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GEOLOGICAL REPORT No. 4

LÉPINE LAKE AREA

DESTOR TOWNSHIP, ABITIBI COUNTY

by

H. M. Bannerman

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1940

LÉPINE LAKE AREA

DESTOR TOWNSHIP, ABITIBI COUNTY

by H. M. Bannerman

TABLE OF CONTENTS

MAP AND ILLUSTRATIONS

PLATES

(After page 14)

LÉPINE LAKE AREA

DESTOR TOWNSHIP, ABITIBI COUNTY

by H. M. Bannerman

INTRODUCTION

During the summer of 1938, the writer was engaged in a geological examination of a small area about the central part of Destor township, Abitibi county. Field work, commenced on June 21st, was continued until the middle of September. During that time, the greater part of that portion of the township lying to the east of the Macamic highway as far as lot 40 in ranges III to VII was examined in some detail. The general mapping in the field was on a scale of 1,000 feet to one inch. Outcrops were located by pace-and-compass traverses run at various intervals, usually 600 to 800 feet apart, controlled by reference to the lot-posts on the range-lines, and the compilation made on a base-map furnished by the Bureau of Mines.

Acknowledgments

The writer was assisted in the field by Irenée Marsalais, François Grenier, D. Kearney Walsh and Art. Martineau, each of whom discharged the duties assigned him in a satisfactory manner. Thanks are due to various settlers in the neighbourhood for courtesies extended, and the writer is under deep obligation to certain geologists and engineers for much information and valuable discussion concerning the geological problems extant in the region. In particular, he would acknowledge indebtedness, in this respect, to A. S. Banfield, of Beattie Gold Mines; Wm. C. Martin, of Mining Corporation; C. A. McIntosh, of Duquesne Mines; C. W. Gordon, of Eclipse Gold Mines; J. W. Ambrose, Wm. C. Gussow, and H. C. Gunning, of the Geological Survey, Department of Mines and Resources; and to A. L. Lee and B. S. W. Buffam, consulting geological engineers. To C. W. Gordon and the management of Eclipse Gold Mines, additional thanks are due for the use of the camp on the Company's property at Lépine lake and for the loan of a geological map of the property, which had been prepared by Mr. Gordon.

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SURFACE FEATURES

Destor township and the adjoining country has been well described by Buffam and others, to whose reports the reader is referred for extended discussions of the surface features. The portion of the township specifically under consideration in the present report is characterized for the most part by high, rocky, elongate ridges and narrow intervening valleys, often with precipitous walls. The topographic grain trends east-northeast, paralleling the general structure and local shearing in the underlying rocks, but several very persistent and remarkably straight north and northwest trending valleys break across the grain. Indeed, the main streams in the area have accommodated themselves in a large degree to this latter system of valleys as they drain the waters southward to join those of Dufresnoy river; these valleys are pretty generally parallel to the major jointing in the more massive rocks, and they probably owe their origin to etching along joints and small-scale faults.

The higher valley floors are covered by drift or by muskeg, clothed in many instances by stands of spruce. The valley of Destor river and the greater part of those of its tributaries in ranges III, IV, and V, are clogged by sand and silt deposits, covered by tall grass, clumps of alder, and other shrubs. The uplands are for the most part bare, having been completely stripped of trees and much of the soil by the ravages of forest fires. Rocky upland country predominates over the entire area, with the exception of the southern half of range III. Here, along a line striking generally west-northwest, the topography breaks suddenly from rocky highlands on the north to a low-lying sand- and clay-covered farm-land, punctuated only here and there by outcrops of bed-rock, on the south. This topographic break marks in a general way the trend of a wide shear-zone along which there appear to have been major fault movements. The rocks along the walls of this valley are schistose, sometimes fissile, drag-folded, and greatly carbonatized. The structure has been traced eastward into the Clericy quadrangle by officers of the Geological Survey of Canada (1). For convenience, the writer plans, in this report, to refer to this zone of sheared rocks as the *Destor Break*.

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(1) AMBROSE, J. W., and GUSSOW, WM., oral communication.

GENERAL GEOLOGY

The rocks of the area may be conveniently subdivided and tabulated as follows:

TABLE OF FORMATIONS

PLEISTOCENE AND RECENT		Flood-plain and lake deposits; muskeg and forest loam Sand, silt, clay, till
Great unconformity		
PRECAMBRIAN	POST-DUPARQUET (?) INTRUSIVES	Lamprophyre dykes Feldspar porphyry dykes
		Intrusive contact
		Quartz-gabbro, pyroxenite, peridotite (and serpentine)
	TEMISCAMIAN-TYPE (DUPARQUET) SEDIMENTS	Conglomerate, arkose, quartzite
	Unconformity	
	OLDER PORPHYRY	Quartz porphyry, quartz-feldspar porphyry
	Intrusive contact	
	KEEWATIN-TYPE	Andesite, dacite and basalt flows, with gabbro-diorite (in part intrusive) Porphyritic andesite Rhyolite and rhyolite porphyry (in part intrusive); tuff, agglomerate and some beds of argillite and greywacke Chlorite, talc and sericitic schists *Cléricy Sediments* (age relations in doubt); greywacke, argillite, conglomerate

KEEWATIN-TYPE

By far the greater part of the area is underlain by lava flows and what seem to be correlative intrusives. The lavas are mainly of intermediate to basic composition—andesite and basalt—but dacite, and, locally, rhyolite flows are also represented. In places, beds of tuff are interbanded with the

lavas, and, in the extreme southeast of the map-area, sedimentary rocks (Cléricy sediments) are closely associated with them. On published maps, the several members of this assemblage have been designated 'Keewatin', but doubt as to their correlation, and particularly in regard to the stratigraphic position of the Cléricy sediments, emphasizes the necessity for more data of a structural nature before a geological time term can be applied to these rocks with assurance.

Andesite, Dacite, Basalt

Typically, the andesites and dacites are drab greenish-grey on weathered surface, whereas the basaltic flows are brownish. In the northern part of the area, all these rocks are remarkably fresh-looking, and except in the section about Lépine lake, where they are intricately cut by quartz porphyry and feldspar porphyry, and in zones of local shearing, they show no foliation. A well developed pillow structure is characteristic of the andesite and dacite flows, and ropy flowage structures, with blocky, scoriaceous margins, are fairly typical of the lavas over a great part of the area. This is particularly true of the flows which underlie so much of ranges VI and VII. Elsewhere, and especially in ranges III and IV, the lavas exposed are massive, coarse grained aggregates, often strongly jointed or blocky, with well developed diabasic structure, similar in composition, and in textural and structural features, to the numerous diorite and gabbro intrusive bodies found in association with the volcanics. Indeed, certain of these coarse grained, massive rocks, which can be traced through continuous transitions to typical pillowed andesite, so entirely resemble many of the diorite-gabbro intrusive bodies that, in the time available, it was not possible to distinguish them for purposes of mapping. Consequently, since it is believed that all these rocks are of common age and origin, the accompanying map simply separates the coarse grained, more or less massive, types from those which exhibit fairly definite flow characteristics.

A number of thin sections of the intermediate to basic flow rocks were examined. Most of them show well developed crystals of fresh augite, or less commonly diopside, and usually also laths of plagioclase, much of it completely saussuritized. Many of the slides show some quartz and some contain hornblende. Ilmenite and leucoxene are present in fair amount, and common secondary minerals include chlorite, serpentine, epidote and carbonate. In the fine grained types, the groundmass is a mosaic of devitrified glass.

Porphyritic Andesite

Two parallel bands of highly porphyritic pillowed andesite, striking N.75°E. and about 3,000 feet apart, occur in range VII. One of them outcrops on the east side of the Macamic highway near the north boundary of lot 60 East Macamic Road range and can be traced more or less continuously for a mile and a quarter to lot 21, range VII, where it disappears beneath swamp. It is very irregular in width, varying from 160 feet to upwards of 400 feet. The other band outcrops on lot 56 East Macamic Road range and has been traced brokenly as far as lot 36, range VII, a distance of about three and a half miles. The northern band has been

described by both Buffam (1) and Lang (2), who state that it has a total length of 12 to 14 miles.

As exposed within the map-area, the bands are similar in appearance. Pillows are strikingly developed throughout the greater part of the flows. Phenocrysts range in size from a quarter of an inch up to two and a half inches. Generally, they are more abundant near the north side (bottom) of the flows. They have a greasy lustre and a buff-grey to light olive colour, and at first sight they might be mistaken for inclusions of felsitic material. However, although some have corroded edges, many display a sharp crystal outline, strongly suggestive of feldspar. They are present both in the massive portions of the flow and within the pillows, and in the latter they may be concentrated near the centre of the pillow, or near its rim, where they are sometimes embedded in the glassy margin (Plate 1-A).

Examined in thin section, the phenocrysts are found to be completely replaced by a fine grained aggregate having the characteristics of saussurite, together with a considerable amount of fibrous serpentine. In none of the slides examined was any relic of the original material of the crystals seen. The groundmass is very fine grained and consists of augite, plagioclase, and a little quartz in a mesh of secondary chlorite, epidote, serpentine, and carbonate. Thus, the only essential difference between these bands and the typical andesite flows of the area is their highly porphyritic character, but this feature renders them distinctive, easily recognized and excellent horizon markers among the monotonous succession of flows with which they are associated.

Rhyolite and Tuff

Bands of rhyolite and tuff occur at a number of places between flows of more basic composition, but their total distribution within the area is relatively small. In general, the rhyolite bands are very erratic in thickness, pinching and swelling along their strike, and their margins are in places brecciated. Commonly, the bands are traceable for one to two miles and then wedge out.

Typically, the rhyolite is buff coloured on weathered surfaces, and greenish-olive with waxy lustre when freshly broken, but in some places, as on lot 35, range-line IV-V, it has a mauve tint, due to disseminated spangles of hematite. Thin sections of the rock show small phenocrysts of quartz in a groundmass of quartz, sericite, and pale chlorite.

Usually, the rhyolite is accompanied by well bedded tuff, which is often agglomeratic, but the beds have a thickness of the order of a few feet only. In most exposures, the tuffs are quite schistose, in contrast to the blocky, massive rhyolite.

Near the adjacent boundaries of lot 23, range IV, and lot 29, range east of Macamic highway, a thickness of several feet of quartzite is associated with the rhyolite, and along the slope immediately north of Lépine creek, on range V, a thin band of meta-argillite is interstratified with rhyolitic material.

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(1) BUFFAM, B. S. W., *Destor Area, Abitibi County, Quebec;* Geol. Surv. Can., Summ. Rept., Part *C*, 1925, p. 89.

(2) LANG, A. H., *Palmarolle and Taschereau Map-Areas, Abitibi County, Quebec;* Geol. Surv. Can., Summ. Rept., Part *D*, 1932, p. 26.

Many of the rhyolite occurrences within the area are sill-like, or less commonly dyke-like, intrusives. In hand specimen, these rocks closely resemble those of the rhyolite flows. Two intrusive types may be distinguished. In one, the rock has a sugary grain, with well developed phenocrysts of quartz and oligoclase set in a greasy-looking groundmass of quartz, feldspar, sericite, and chlorite. The other type is much finer grained, and on a freshly-broken surface it often shows minute brecciation. Rock of this type often occurs along the boundaries of dacitic and andesitic flows, sometimes permeating the scoriaceous portions of the flow and fingering out around pillows in most irregular fashion. In hand specimen, this type has much the appearance of a cherty sediment, but in thin section it is seen to be a minutely porphyritic rhyolite similar in composition to, though more siliceous than, the sugary-grained variety described above, of which it is probably a fine grained equivalent. Their structural relations, however, and their high quartz content, suggest that they may be products of hydrothermal solutions which permeated the porous parts of the flows about the time the lavas were accumulating. That circulating solutions of this character were active is well attested by the abundance of amygdules that occur in the lavas, and by the numerous small veins and irregular blotches of quartz, epidote and mauve-coloured axinite that appear in the basic lavas throughout the area.

Chlorite, Talc, and Sericite Schists

Over a great part of the area, and particularly in the section north of Lépine lake, the lavas are remarkably free from deformation for rocks of presumably early Precambrian age. Along the trace of the Destor 'break', however, and in local shear-zones throughout the area, the lavas and associated intrusives have been converted into fine grained, sometimes fissile, schists—the basic types into chlorite or talc schists, and the rhyolitic types into sericite or quartz-sericite schists. To these changes have been added a considerable amount of carbonatization and silicification, and locally pyritization and chloritization, such that in many instances the original character of the rock can be recognized only by virtue of the fact it is traceable into less altered phases.

Clericy Sediments

A few small outcrops of sedimentary rocks, mainly greywacke, with some thin bands of meta-argillite, occur in the extreme southeast of the area, on lots 29 to 32, and lot 40, range III, just north of the Davangus highway, and beyond the south boundary of the map-area, on lot 40, range II, bands of conglomerate are interbedded with a coarse phase of the greywacke.

The strike of the beds is somewhat erratic, but the general trend is S.70°-75°E., with dip varying between vertical and 80 degrees south. Cutting the sediments are small, sill-like bodies of rhyolite, and on lot 33, range III, just north of the road, is an outcrop of diorite which presumably intrudes the sediments, although no contact is exposed. All these rocks are much sheared, with schistosity striking approximately east-west and dipping vertical or at a high angle (70°) to the south.

These sedimentary rocks are the northwestward extension of the band that is so prominently developed in Cléricy and Lapause townships to the southeast (1). Although nowhere seen in contact with the Keewatin-type volcanics, within the Lépine Lake area most of the evidence at hand indicates that the flows outcropping to the south of them have their tops facing south, which suggests that the sediments lie stratigraphically beneath them.

In the Cléricy area immediately southeast of here, where the sedimentary band widens appreciably, it is said to show parallelism to the volcanic rocks (2). Moreover, it appears probable that the volcanic rocks of the Lépine Lake area are equivalent to those, in the regions to the southeast, which Gunning has termed the Blake River Volcanics (3) and that the Cléricy sediments are an extension of the Kewagama Series, hence stratigraphically below the volcanics. If this be so, it follows that the Cléricy band is considerably older than the members of the Duparquet sediments, described below, which can be shown to rest unconformably on top of the volcanics.

Older Porphyry

Considerable bodies of quartz porphyry and quartz-feldspar porphyry occur in the area about Lépine lake. Large outcrops may be seen both east and west of the Macamic highway, from lot 36 northward to lot 40. Similar rocks underlie the ridge south of Lépine lake. They bound the southeast shore of the lake, and poorly exposed outcrops of similar character were encountered along the valley of Lépine creek as far east as lot 28, range V. Less extensive bodies and many small dykes of this nature were observed in various parts of the area.

Generally, the porphyry is a fine to medium grained rock which weathers light grey, usually with a pinkish tinge, and on fresh surface has a drab olive colour and waxy lustre. In most of the outcrops seen, it is massive. However, the rock exposed in the vicinity of Lépine lake and along the valley east of the lake is brecciated and schistose.

The porphyry invariably carries phenocrysts of both quartz and feldspar, the former of opalescent appearance and the latter greasy or dull, but there is wide variation in the relative proportions of these two constituents. Some varieties are exceedingly rich in quartz, with phenocrysts ranging up to half an inch in diameter, and feldspar scarcely noticeable. In others, feldspar phenocrysts greatly predominate over quartz, and one variety of the rock is characterized by 'books' of muscovite up to three-eighths of an inch wide by one-eighth of an inch thick.

In the outcrops of brecciated and altered porphyry on lots 39 and 40, East Macamic Road range, bright green mica is an abundant constituent of the rock; there carbonate is also common.

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(1) *See* Geol. Surv. Can., Map No. 328A, Memoir 166.

(2) Geol. Surv. Can., Memoir 166, p. 90; Ambrose, J. W., and Gussow, W., oral communication; also Gunning, H. C., and Ambrose J. W., *The Temiskaming-Keewatin Problem in Rouyn-Harricanaw Area, Quebec;* Roy Soc. Can., Trans., Vol. XXXIII, Sect. IV, 1939, pp. 23-26.

(3) Gunning, H. C., *Cadillac Area, Quebec;* Geol. Surv. Can., Memoir 206, 1937; also, with Ambrose, J. W., *op. cit.*

Examination in thin section shows that the larger quartz phenocrysts are usually crushed, and some are granulated. The feldspar phenocrysts have the composition of oligoclase (about Ab85) and are more or less fogged by sericite. Muscovite flakes of fair size occur in most of the slides, and a sprinkling of pyrite grains and some euhedral crystals of carbonate are usually present. The groundmass is a fine grained meshwork of quartz, feldspar and sericite, with varying amounts of chlorite and carbonate.

Age Relationships:

There can be little, if any, doubt that the several types of porphyry discussed above are of common origin and essentially the same age. Evidence supporting this view may be seen, for example, on the low ridge just west of the Macamic highway, on lot 35, where the quartz-rich type grades northward into one containing abundant feldspar phenocrysts.

These porphyry bodies are definitely younger than the Keewatin-type volcanics, and older than the Duparquet sediments. As dykes, they cross-cut andesite and diorite in the vicinity of Lépine lake; outcrops near the Macamic highway carry inclusions of the lavas, some of which have been converted into an amphibolitic rock composed mainly of greenish hornblende; and on lot 23, near range-line V-VI, a porphyry dyke intrudes acidic tuff. That they are older than the Duparquet sediments is evident from the occurrence of boulders of all the various facies of the porphyry in the basal conglomerate of that series.

Temiscamian-Type

Duparquet Sediments

Several patches of sedimentary rock outcrop in the country north and east of Lépine lake that are similar lithologically and structurally to the more extensive band occurring farther west of the map-area, along the east-west centre-line of Destor and Duparquet townships (1). They consist mainly of beds of coarse conglomerate, quartzite, and arkose, and differ from one another only in the relative amounts of the various sedimentary materials of which they are composed.

The largest band, near the northern edge of range VI, has an outcrop width of a quarter of a mile. It extends eastward, from lot 35, beyond the eastern margin of the map. It is composed in large part of well bedded quartzite and arkose, interlayered by lenses and bands of conglomerate in which up to 80 per cent of the rock is made up of well rounded pebbles (Plate II-A). The pebbles are mainly andesite, but include 'older' porphyry, diorite, granite, and jaspilite. The matrix is arkose. The layers are crudely cross-bedded (Plate II-B) and several irregular scour-channels occur in which a thickness of as much as 6 to 8 feet of quartzite beds are missing over lengths of 20 to 30 feet, the cavities being filled in by conglomeratic material.

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(1) O'Neill, J. J., *The Beattie-Galatea Mines Map-Area;* Que. Bur. Mines, Ann. Rept., 1933, Part *C*, pp. 86-87, 94.

The boundaries of the body are not exposed and its relationship to the surrounding members of the volcanic complex could not be definitely determined. The general strike of the bedding is about east-west and the dip for the most part is at a high angle toward the south. Such attitude determinations as have been made on the basis of cross-bedding and scour-and-fill channels all suggest that the tops of the beds face southward. As these determinations were all made on outcrops near the centre of the band, however, it does not follow that the body is a southward-facing monocline. The matrix of the conglomerate is schistose. The foliation strikes 60 to 65 degrees east of north and dips southeastward at about 70 degrees.

The narrow band of sediments outcropping on lots 23 to 26, range VI, is mainly conglomerate made up in large part of andesite and grey porphyry pebbles set in a greenish quartzitic matrix. This band is poorly exposed. Its eastward extension is pretty well precluded by outcrops of gabbro-diorite, but it is possible that it continues westward beneath the swamp, to join the band which underlies lot 49, east of Macamic highway. The latter band is irregular in outline. Its maximum width is about a quarter of a mile. It is composed mainly of arkose and quartzite, with interbedded conglomerate bands. The beds appear to stand on edge, and no definite data is at hand as to their true attitude. On lot 50, just east of Macamic highway, the northern portion of this band includes beds of meta-argillite, the succession, from north to south, being relatively fine grained conglomerate, argillite, arkose. Here, the relationship of the flow cleavage to the bedding planes in the meta-argillite suggests that these beds face north and plunge at about 30 degrees toward the east.

The body of conglomerate that lies across range-line V-VI, just north of Lépine lake, is not well exposed except on lot 23, where a few fairly large outcrops appear and extensive trenching has laid bare some good cross-sections of the conglomerate and associated rocks. Typically, the beds are coarse boulder conglomerate, composed in large part of quartz-feldspar porphyry, rhyolite, and andesite pebbles. The matrix is arkosic and quite schistose. The rock shows no distinct bedding except in the exposures along the north boundary of the band where, just north of the range-line near the east boundary of lot 23, a small trench exposes poorly bedded greywacke interlayered with argillaceous beds and thin, sandy bands of conglomerate. Here the greywacke layers are cross-bedded and the tops face south. The general strike of the bedding is east-west, or a few degrees south of east, and the dip is steeply toward the south. The southward limit of this conglomerate band is concealed by swamp, but trenches and outcrops immediately east of the conglomerate outcrops reveal the presence of a series of interbedded acidic tuffs, thin flows of silicified and carbonatized quartz andesite, fine grained dacite, and a thin band of black schist, the latter presumably developed from carbonaceous argillite. The abnormally stained, silicified and sericitized nature of these underlying rocks suggests that they represent a pre-conglomerate weathered surface. They strike around N.65°E., so that an angular unconformity of some 25 to 30 degrees is indicated between them and the overlying conglomerate.

Another outcrop of conglomerate occurs just south of Lépine creek, on lots 25 and 26, range V, and still another small exposure was observed

at the south bend of the creek, on lot 27, range V. These bodies are similar petrographically and, as far as could be determined, they too are in contact with acidic tuffs and lavas similar to those found adjacent to the conglomerate that occurs near the range line. They may be a continuation of the southeast fork of the latter band, but the writer is inclined to believe them separate patches, fortuitously preserved, and resting on the acidic lava-tuff complex which appears to constitute a fairly wide band in this part of the area.

The patch of sedimentary rocks that occurs south of Lépine lake, on lot 40, East Macamic Road range, is likewise poorly exposed. For the most part it is conglomerate, composed of quartz porphyry and quartz-feldspar porphyry boulders set in a sericite schist matrix. Many of the pebbles are angular. The contact with the underlying porphyry is indeterminate. The conglomerate appears to grade downward through a mauve-coloured, nondescript rock, which looks like a non-bedded, sericitic quartzite containing vague boulders of porphyry, to fairly fresh-looking quartz-feldspar porphyry. Similar contact relations were noted about the large outcrop of conglomerate that occurs just west of the Macamic highway, on lot 42. Here, the underlying rock is altered, pale grey andesite and, near the conglomerate contact, this appears as angular blocks cemented by sandy, schistose material which, in thin section, is seen to consist mainly of quartz, sericite, chlorite, and carbonate. As a whole, this body of conglomerate is an aggregation of pebbles and boulders of quartz porphyry, quartz-feldspar porphyry, diorite, dacite, rhyolite, banded tuff, quartz, and carbonatized greenstone. Locally, the rock contains nodules of pyrite and fragments of cherty quartz. The lower part of the conglomerate is made up very largely of angular to sub-rounded boulders of coarse quartz-porphyry and quartz-feldspar porphyry, diorite, and andesite set in a granular-looking matrix entirely similar to that appearing as a cement in the upper, disintegrated part of the underlying andesite. Some of the porphyry boulders are upwards of three feet in diameter, and they are so strikingly similar, lithologically, to the nearby porphyry intrusives, that there can be little doubt of their local origin. Every facies of the older porphyry is represented, even to the unusually coarse quartz porphyry with relatively large 'books' of muscovite. Some of the porphyry fragments contain bright green mica similar to that observed in the brecciated porphyry on lots 39 and 40, east of Macamic highway, and blotches of the same mica appear in places in the matrix of the conglomerate. Indeed, the presence of this mica is a feature common to many of the conglomerate outcrops.

Age Relationships:

The various bodies of sedimentary rock grouped as the Duparquet sediments are believed to be younger than the Keewatin-type volcanics and younger also than the 'older' porphyry. Moreover, they seem to rest unconformably on a weathered surface of these older rocks, and to be made up in large part of fragments derived from them. Whether or not this stratigraphic break is of widespread importance cannot be determined from the data at hand. It is not impossible that it is of purely local extent, the result of weathering, stream action and, in some cases, of landsliding, coincidental with the period of volcanism that produced the great lava

A.—Porphyritic pillow lava, lot 61, east of Macamic highway. Note the general distribution of the phenocrysts and their presence in the glassy margin of the pillows.

B.—Amygdaloidal lava, lot 42, range IV, Destor township.

A.—Duparquet conglomerate, lot 38, range VI.

B.—Cross-bedding in Duparquet conglomerate, lot 38, range VI.

A.—Abrupt banding of pyroxenite (dark) and peridotite (light), lot 39, range V.

B.—The same, showing block faulting of the bands.

A.—Porphyritic peridotite, lot 37, range V. The black spots are poikilitic crystals of pyroxene.

B.—Veinlets of magnetite and chrysotile in serpentinized peridotite, lot 38, range V.

field existent in the region. Such seems to be the surface and sedimentary history of the more modern lava fields (1), and it may well be that similar events typified such regions in early Precambrian time. However that may be, the relationships observed warrant the assumption that the Duparquet sediments are considerably younger than those of the Clériey band.

Post-Duparquet (?) Intrusives

Peridotite, Pyroxenite, Gabbro

Distribution:

Some comparatively large bodies, and a number of dykes, of gabbro and related ultrabasic rocks occur within the area, mainly in ranges V and VI, that are definitely younger than the Keewatin-type complex, and probably younger than the Duparquet sediments.

The most extensive, and in many respects the most interesting, of these is a warped sill-like body that extends diagonally across range V from the southern part of lot 22 to the eastern boundary of the map-area, where it passes into range VI, on lots 40 and 41. Gabbro, pyroxenite, and peridotite are all represented in this body, either sharply interbanded or showing gradational transition one to the other. The gradational type is particularly well developed on lots 37 and 38, range V, where a section across the body from south to north shows a transition from peridotite to pyroxenite to gabbro and quartz-gabbro (in the central part) and again through pyroxenite to peridotite. Excellent examples of sharp interbanding of pyroxenite and peridotite are to be seen in outcrops near the centre of the mass, on lot 39, where the succession of alternating bands of the two types of rock is so regular as to simulate the bedding of a sedimentary formation (plate III-A). The banding parallels in a general way the boundaries of the body, with the bands dipping north. Hence it is concluded that the intrusive mass as a whole is a folded sill, inclined toward the north, and the widening of the peridotite toward the east, together with the abrupt termination of the entire body on lot 22, suggest that the structure plunges westward.

A fairly large body of gabbro-diabase is exposed along range-line VI-VII, to the north of the band of Duparquet conglomerate. It is perhaps much more extensive, particularly toward the east, than shown on the map. The rock is medium to coarse grained and generally massive, but locally it shows the effects of much crushing and, as in some outcrops near the north boundary, has a mylonitic character. There is a gradual change in the colour of the rock from light to dark greenish-grey as it is followed across the body from north to south, and this is due to a gradual change in composition from a quartz-bearing type in the north to a quartzless, more basic type in the south.

Several other occurrences of these basic and ultrabasic rocks are indicated on the map. A rather extensive body of irregular outline, composed mainly of gabbro, is exposed east of Lépine lake, on lots 24 to 26, range V, and gabbro and pyroxenite again outcrop farther east, from lots 28 and 29 to lot 34. All these occurrences are to the north of the sill-like

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(1) *See* Stearns, Harold T., and Vaksvik, K. N., *Geology and Ground Water Resources of the Island of Oahu, Hawaii;* U.S. Geol. Surv., Div. of Hydrography, Bull. No. 1, 1938.

body that extends eastward from lot 22 and they appear to be separated from it by a band of Keewatin-type volcanics.

Dykes of serpentinized peridotite were observed on lots 23, 25, 38, and 40, range V, and small bodies of pyroxenite on lots 29, 30, and 31, range VI.

As has been noted on a previous page, many of the coarser, massive types of the volcanic complex are strikingly similar to the gabbroic members of this younger group of intrusives, and in doubtful cases such rocks have been mapped as Keewatin-type. It is entirely possible, therefore, that gabbro intrusives belonging to this sub-division are more widespread than is indicated on the map.

Although the descriptions that follow refer particularly to the several rock types represented in the main body first described, they are applicable in a general way to the other occurrences of these basic and ultrabasic intrusive rocks within the map-area,

Peridotite:

The peridotite is dark bluish-grey, weathering light to brownish-buff. The coarser grained facies of the rock are distinctly poikilitic, with crystals of shiny black pyroxene, up to half an inch in length, enclosing grains of serpentine, doubtless representing original olivine crystals. Such rock has a characteristically spotted appearance on the weathered surface, the dark pyroxene contrasting strongly against the lighter coloured serpentine that forms the body of the rock (plate IV-A).

Examined in thin section, it is found that practically the whole of the olivine has been converted into an aggregate of serpentine and magnetite, which in many cases retains the outline of the original olivine crystal. Pyroxene is present in varying amount. Usually, it is the diallage variety of diopside (with $Z \wedge 010$ measuring 38° to 42°), and on the whole it is remarkably fresh, even in rock containing as much as 60 per cent serpentine. Where alteration has taken place, it has given rise to pale amphibole (actinolite) or, less commonly, a marginal development of serpentine. Magnetite is abundant, both in euhedral grains and as fine aggregate filling fractures in the serpentine and along cleavage and parting planes in the pyroxene. The tendency for the magnetite to fill fractures in the serpentinized portions of the rock is well shown macroscopically in outcrops on lots 38 and 39, range V, which, crossed by a veritable network of magnetite veins, have the appearance of rough masonry (plate IV-B). Such rock is so magnetic as to cause serious deflections of the compass needle.

Some of the thin sections of peridotite examined contain a subordinate amount of reddish, dust-like material of high refractive index which resembles picotite or some other chrome-bearing spinel.

Pyroxenite:

Pyroxenite makes up by far the greater part of the ultrabasic portion of the sill-like body, except at its eastern end, on lots 38 to 40 where, as already noted, the peridotite widens appreciably. On fresh surface, it is a pale to moss-green rock, often with a silky to resinous lustre. The weathered

surface is dark green to brownish-green. The grain is generally even, and certain of the very fine grained types of the rock have much the appearance of dunite.

In some of the thin sections examined, the rock is composed almost entirely of pyroxene; in others, the serpentine (altered olivine) content amounts to 10 per cent or more, and the rock might be termed a wehrlite. As in the peridotite, the pyroxene is diallage (diopside), at least for the most part, and generally it is remarkably fresh. Where the rock has suffered shearing, however, or has been subjected to the action of hydrothermal solutions, anthophyllite, tremolite, and sometimes pale chlorite, talc, or brucite, have been developed at the expense of the pyroxene. This is particularly the case in the pyroxenite adjacent to a feldspar porphyry dyke on lot 22, range V. The diallage-rich pyroxenite contains very little magnetite, ilmenite, or leucoxene, but these constituents are present in increasing amount in the rock toward the upper (north) part of the sill. At the same time, plagioclase (An 67-73) begins to make its appearance, augite predominates over diopside, and the rock takes on the character of a gabbro or diabase.

Narrow dykes with coarse grain and a pale buff colour cut the peridotite here and there, particularly on lots 38 and 39. In hand specimen, these dykes look like feldspar-rich pegmatite, but in thin section they are found to consist almost entirely of bleached diallage, pale chlorite, serpentine, brucite, and tremolite. They contain no feldspar and there is no indication of this mineral, unless it be that some of the pale chlorite replaces former feldspar. The dykes are apparently pyroxenite pegmatite that have suffered bleaching and alteration during the serpentinization of the main body of the rock.

Gabbro and Diabase:

The gabbroic facies of the sill is a mottled rock of diabasic appearance, which weathers brownish-green to greenish-black. Generally, the grain size is about 2.5 mm. but it varies sporadically up to 5 mm. or larger. The coarser types are lighter in colour and contain appreciably more feldspar. In many places, the gabbro is traversed by a multitude of tiny fractures, lined by dark green serpentine and chlorite, a feature which is particularly noticeable on the weathered surface, and in the rock exposed on lots 35 and 36, range V, these fractures assume a peculiar radial pattern. Presumably, the fractures are a result of volume changes during serpentinization.

Thin sections of the gabbro outcropping near the southern margin of the gabbroic facies of the sill in range V consist essentially of augite (up to 65 per cent) and basic, almost completely saussuritized, labradorite. The rock apparently contains no primary quartz. Other constituents noted are an abundance of ilmenite and leucoxene, and varying amounts of carbonate, chlorite, serpentine, and secondary quartz. Near the northern margin of this body the gabbro is a more acidic type. It contains a fair amount of primary quartz, and the plagioclase is not only less abundant but is less calcic (An 54) than in the type described above. The rock also contains much less ilmenite and leucoxene.

The slides examined did not represent a complete cross-section of the gabbro; but, so far as they go, they tend to support the view that the

several types of gabbro met with are genetically related, perhaps all differentiation products of a single irruption of magma.

Age Relationships:

The pronounced tendency of the pyroxenite to fade gradually into gabbro near the north-central part of the body, on lot 37, range V, the variation in composition of the gabbro, as for example on lot 35, from a relatively basic to a quartz-bearing variety, and the presence within the pyroxenite-peridotite portion of the body of numerous coarse grained gabbroic dykes, all warrant the assumption that the several rock types in the main body of these basic and ultrabasic rocks originated from a common source, perhaps a single magmatic intrusion. The rocks met with in the other occurrences referred to and indicated on the map are so similar to those of the main body, and to one another, that there can be little, if any, doubt that all of them are of the same age and genetically related.

Considerable doubt remains, however, as to their age relationship to other rocks of the area. They distinctly transgress the lavas and tuffs in range V, and a peridotite dyke just east of the Macamic highway, on lot 38, is chilled against pillow lava and quartz porphyry. A similar relationship was observed between peridotite and quartz-feldspar porphyry on lot 23, range V.

No positive evidence was obtained to establish the age relation of these intrusives to the Duparquet sediments. Negative evidence that they are younger is the fact that no pebbles or boulders of the intrusives were observed in the conglomerate. Also, in Poulariès township, which adjoins Destor on the north, a dyke-like body of peridotite, resembling the ultrabasic rocks of this area, cuts the Palmarolle granodiorite (1). In the writer's opinion, therefore, these various occurrences of basic and ultrabasic intrusive rocks are all of the same age and origin, and are probably younger than the Duparquet sediments.

That these basic intrusives have suffered considerably by crustal disturbances is evident, however, from the mylonitized and sheared nature of many of the outcrops; and it is noteworthy, also, that a general parallelism obtains between the shear patterns in them and in the adjoining rocks, including the Duparquet sediments.

Feldspar Porphyry

Small dykes and irregular bodies of fine grained feldspar porphyry occur here and there throughout the area. On lots 22 and 23, range V, a seven-foot-wide dyke of this type cuts pyroxenite, and a similar feldspar porphyry intrudes the gabbro body on lots 24 and 25. A number of such dykes occur in the sheared and faulted section along the Beattie railway, and have been involved in the shearing.

In hand specimen, this rock closely resembles some of the fine grained, intrusive rhyolites described on page 10. It is usually pale olive-green to grey on fresh surface, weathering a light buff. The texture appears aphanitic, but close inspection seldom fails to reveal tiny lath-like or platy phenocrysts of pale greenish-grey feldspar.

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(1) Geol. Surv. Can., Memoir 166, p. 139.

The feldspar phenocrysts have the composition of oligoclase (about Ab 77), and usually they are in more or less parallel alignment. The groundmass is a dense matte of feldspar, chlorite, and sericite, with a minor amount of carbonate. Spots of chlorite, apparently representing original hornblende, were noted in a thin section made from a dyke of the porphyry which cuts silicified rhyolite tuff exposed in a trench on lot 38, East Macamic Road range.

The feldspar porphyry is clearly intrusive into the rocks of the Keewatin-type complex, and also into the basic intrusives described in the preceding section. Its age relationship to the Duparquet sediments has not been determined. In many respects, this porphyry resembles the bostonite porphyry of the Beattie-Galatea area immediately to the west (1), and in all probability the two are closely related in age and origin.

Lamprophyre Dykes

Two lamprophyric dykes were observed in the map-area. One, on lot 22, range III, just south of the Beattie railway, intrudes pillow lava; the other, exposed in a trench near the west end of lot 27, East Macamic Road range, cuts quartz porphyry. Both are dark grey rocks with a distinctly purplish cast. They contain shiny black phenocrysts of biotite, and some of altered plagioclase (determined as albite) in a medium grained groundmass of highly altered feldspar, chlorite, carbonate, and minor quartz.

Beyond the fact that one at least of these dykes is younger than the 'older' porphyry, their age relations are not known, but their shattered condition suggests that they are pre-faulting.

STRUCTURAL GEOLOGY

Folding

The major structural features of the map-area are comparatively simple. A broad synclinal fold dominates the structure of the main part of the Keewatin-type complex. The main axis of this fold passes just north of Lépine lake, crosses the east-west centre line of the township in the vicinity of lots 21-22, and persists eastward across the area with a trend of about N.75°E. The pitch of the fold appears to be low and toward the west, but the data on this point are scanty. The criteria upon which the fold interpretation is based are very largely derived from a study of the attitude of pillows, and of the scoriaceous margins, of lava flows. North of the axial line, indicated above, exposures are exceptionally good, the lavas are quite fresh, and they have unusually well developed pillow structure. A great number of attitude determinations were possible in this part of the area, and the constancy with which vesicles fan out and individual pillows maintain a convex surface toward the south, while their flatter surfaces and the triangular, pod-like inter-spaces between them are on the north, lend strong support to the belief that the tops of these flows face toward the south. Determinations of dip have not been satisfactory, but such as they are they indicate that the dip of the flows is south, and that

(1) O'Neill, J. J., *Beattie-Galatea Mines Map-Area;* Que. Bur. Mines, Ann. Rept., 1933, Part *C*, pp. 90-92.

the angle of dip is usually not over 60 degrees. South of the axial line of the fold, the number of determinations of attitude are not so many or so convincing. Nevertheless, good determinations were obtained in the lavas on lots 33 and 34, range VI, and at various places on range V, south of the body of ultrabasic intrusives. In each of these, the evidence indicates that here the flows face northward. On range IV, only a few determinations were obtained. A large part of this range is underlain by rocks similar in composition to the pillow lavas but which do not display pillow structure. This may in part be due to a change in attitude of the rocks, to a flatter dip. Some of them, however, seem to be sill-like intrusives; others are massive flows. In any case, the majority of the dip determinations indicate that here, too, the rocks face northward, but the distribution of tuff bands, and also of rhyolite flows near the western boundary of the map-area, suggests that minor folds are here superimposed on the larger structure. In a similar way, there is some evidence that a minor fold affects the pillow lava in the eastern section of the area, on range III, where there is a wide divergence in strike. The details of these minor folds, if such they be, have not been worked out in sufficient detail, however, to warrant further discussion of them.

Along the ridge north of the Beattie railway, on lots 25 and 26, and lots 38 and 39, fairly satisfactory determinations indicate that the lavas face northward. On the other hand, with the exception of one observation —made on an outcrop of sheared lava occurring some three hundred feet north of Davangus highway on lot 27, range III, where pillows that strike northwest appear to face northeast—all the data derived from a study of the lavas outcropping in the vicinity of lots 19 to 24 on the Macamic highway and along the southern part of range III, suggest that here the flows strike west-northwest and face southward. Moreover, such inferences as may be drawn from the attitude of secondary structures imposed upon the banded greywacke of the Cléricy meta-sediments all indicate that the beds face southward and plunge west-northwest. Thus the bulk of the evidence at hand, based on attitude determinations alone, suggests that the trend of the Cléricy sediments delineates in a general way an anticlinal axis. Between the outcrops of sediments and the northward facing lavas on the ridge north of Beattie railway, however, is the wide zone of heavily sheared rocks referred to in this report as the Destor 'break.' This zone crosses Macamic highway on lot 27, persists across range III in a direction approximately S.70°E., and passes into range II about at the boundary between lots 41 and 42. It is marked topographically by a persistent swamp, and is evidently a fault-zone of considerable importance. It is believed, then, that the reversal in attitude of the lavas and associated rocks from a northward-facing complex along the northern portion of range III, to a southward- and southwestward-facing group in the southern part of that range, is not due to folding alone, but is complicated by faulting, the fault-zone in this part of the region breaking diagonally across the southern limb of the Lépine Lake syncline.

Shearing and Faulting

The schistosity in the rocks within the zone most affected by the Destor 'break' is approximately parallel to the trend of the zone itself. Locally, however, the foliation is drag-folded in a manner that indicates

a late movement westward and upward on the southerly block, while the dip of the schistosity and of fracture-cleavage suggests that the main fault-plane dips toward the south at an angle up to 70 degrees. A goodly number of seemingly related subsidiary shear-zones fan out in a general direction N.65°E. These smaller features are marked by local, and usually narrow, schistose bands in the otherwise massive volcanic rocks, and often by a moderate amount of carbonatization and other accompanying forms of hydrothermal alteration. The locations of some of these are shown on the map by conventional symbols. They show a marked tendency to consistency in strike. They dip southeastward, at angles not usually over 60 degrees and, traced along their strike in a direction away from the main fault, they tend to disappear in the course of a mile or so. Other sheared zones of wider extent and greater lateral persistence occur here and there in the area north of the main 'break'. These, too, are marked by bands of schistose rocks of various petrographic types, and they may mark east-northeasterly trending faults of some importance. A notable example occurs in the valley of Lépine lake, where a fairly wide zone of porphyry, andesite, and rhyolite tuff has been converted by shearing movements into schists of varying fissility and mineralogical composition. The zone passes through the swamp area on lot 41, east of the Macamic highway, and persists in a direction N.75°-80°E. through Lépine lake to lot 28, range V. Beyond that, it seems to have split, or to have swung northward along the valley of Lépine creek into range VI. Locally, the rocks in this schistose zone have been silicified; in some places they are talcose and impregnated by carbonate and a little pyrite.

Another shear-zone, less prominent but with similar characteristics, parallels the south boundary of the southern body of ultrabasic rock on range V, and persists southwestward across the area. Still others, with the same strike but narrower and less well marked, occur in ranges VI and VII. Subsidiary shears trending N.50°-55°E. occur here and there along the margins of each of these east-northeasterly zones. Associated with the shearing in many places is a fairly prominent system of tension fractures with north-northeasterly to north-northwesterly strike. Faulting of small order is common along these tensional breaks, and in every case observed the eastern block is displaced, relatively, southward. Occasionally, these fractures are filled by quartz and other vein-forming materials of hydrothermal origin.

The extent or importance of the faulting movements along these shears is not known. The pattern of the shearing and faulting, when plotted on the map, suggests that the entire system may be related to the strains which produced the east-southeasterly trending Destor 'break', though local variations in the structure and strength of the rocks involved have complicated the picture to some extent.

It has not been possible from the available data to establish a definite age for the shearing. It distinctly post-dates the folding, and each of the consolidated rock formations, including the Duparquet sediments and the feldspar porphyry, has been involved in it. Certain of the hydrothermal products, however, such as siliceous, carbonate, and metalliferous replacements and vein deposits, are clearly later than the greater part of the shearing. Indeed, most of the deposits of this nature observed in the area by the writer occur as replacements in shear-zones, or as vein fillings in fractures that are clearly related to the shearing.

Structure of Clericy Sediments

The structural disposition of the Clericy sediments cannot be determined from the data at hand. As has been noted, only a few small outcrops of these rocks occur within the area. Their dip is either vertical or at a high angle to the south. To the north of them is the persistent swamp and drift-covered depression through which passes the wide shear-zone of the Destor 'break', and beyond this are ridges composed of Keewatin-type lavas which face northward.

The greater part of the evidence derived from a study of the lavas that outcrop immediately south and southwest of these sediments, on the other hand, indicates that here the tops face south, and from this it might be inferred that the sediments underlie them. In one outcrop, near the southwest contact of the Clericy band, however, a band of pillows was observed which apparently faces northeast. Whether this reversal in attitude is due to drag-folding of the formations in the vicinity of the Destor 'break', or to some other cause, is not known. In any event, it would seem that the Clericy sediments (and the lavas immediately south and west of them) owe their present position, relative to lavas that occupy the area north of Beattie railway, to an upthrust along a fault following the Destor 'break', and the movement in this zone may have been considerable.

Structure of Duparquet Sediments

As noted on an earlier page, the Duparquet sediments in the map-area have been found to rest unconformably on the lavas and associated rocks of the Keewatin-type complex or on the 'older' porphyry. The beds have a steep dip (sometimes steeper than the underlying flows), and in every observed occurrence, except one, their tops face southward. There is no evidence, however, that might indicate that any of the bands of these rocks are in-pinched folds. Cross-sections of most of the larger bodies show a change in character of the sediment, but with no repetition of beds.

The steeply inclined attitude of the beds is in all probability due to the warping of strata that were originally highly inclined—a condition not unusual in coarse, cross-bedded sediments such as form much of the Duparquet formation in this area. In the writer's opinion, the several bands of these rocks, with their distribution somewhat *en échelon*, do not owe their present position and attitude to folding, though faulting may in part be responsible. The facts at hand seem best explained by assuming either (1) that the sediments represent fillings of depressions or local valleys on an old erosion surface, fortuitously preserved near the bottom of the westward-pitching, broad synclinal structure; or (2) that they owe their preservation and present location to a series of faults, diverging in a northeasterly direction. Of the two hypotheses, the writer favours the first as the more probable, though it seems not unlikely, in view of the fault pattern extant in the area, that faulting also has played a part.

ECONOMIC GEOLOGY

A considerable amount of money and effort has been expended in the area during the past ten years in the search for mineable ore-bodies. To date, however, no deposits of commercial grade have been discovered.

Metalliferous Deposits

Typically, the metalliferous deposits in this area are fine-grained siliceous bodies mineralized with pyrite, chalcopyrite, arsenopyrite, and a little gold. They occur as replacements in sheared zones in the volcanic complex, and in, and along the boundaries of, fine grained porphyry dykes. In a few places, quartz veins, carrying a sprinkling of pyrite and chalcopyrite and said to contain some gold, were observed to occupy north-south trending fractures; but these are exceptional and, so far as observed, small. The mineralization, even in the larger bodies, is light and exceedingly fine grained. Usually, the sulphides are barely distinguishable to the naked eye, though they can be readily detected by the aid of a hand lens. The heaviest and most persistent sulphides, so far as observed, occur in the more siliceous-looking portions of sheared rock. Often the material has the appearance of greenish-olive pyritized chert; in other cases it has a pinkish cast and closely resembles the mauve-coloured rhyolite. In thin section, this latter material appears to be altered feldspar porphyry or, in some instances, rhyolite. The rock has been crushed and silicified, and a goodly amount of fine grained carbonate has been added along with some tiny grains of pyrite, but some feldspar phenocrysts remain and the outlines of many others are still discernible.

Eclipse Gold Mining Company, Limited

A group of claims about the shores of Lépine lake, and extending eastward beyond the north-south centre line of the township, are controlled by the Eclipse Gold Mining Company, Limited. Stripping operations have been carried on in various parts of the property, and a geophysical survey was made in 1937, followed by a moderate amount of diamond drilling. The locations of the drill holes and of most of the trenches are shown on the map.

The geology of this part of the area is complex. The claims are located almost in the trough of the Lépine Lake syncline. Andesitic flows, intrusives, and associated tuffs are intricately cut by bodies of quartz-feldspar porphyry and, east of the lake, by large bodies of basic gabbro. A heavily faulted zone passes through the southern part of the lake, persisting eastward through the valley of Lépine creek. It involves rocks of various character, all of which are now converted into schistose aggregates of varying fissility. Typically, they show carbonatization, and locally they have been highly silicified and carry small amounts of pyrite and specks of chalcopyrite. Some of the acidic tuffs and portions of the sheared porphyry have been converted into a fine grained aggregate of greenish talc, carbonate, sericite, and silica. This shows up particularly well in portions of the drill core taken from the holes drilled along, and north of, the creek.

Lots 37 and 38, East Macamic Road Range

South of Lépine lake, near the east end of lots 37 and 38, East Macamic Road range, trenching has exposed a body of mineralized silicified rock on ground previously covered by claim R-16016. The showing is easily reached by way of a trail which leads southward across the swamp at the east end of the lake. The mineralization is in a schistose band of what seems originally to have been a succession of andesite, rhyolite, and

rhyolite tuff beds. The bedding in the tuff strikes about N.80°E., and the band ends abruptly on the east against the margin of a body of ultrabasic intrusive rock. The line of contact between the mineralized rock and the intrusive trends approximately S.40°E. The true relationships are obscure, but it seems probable that the contact between the basic body and the members of the volcanic complex is intrusive, with a pitch toward the west, and that the mineralization along the contact was an event of considerably later date than the intrusion.

Generally speaking, the sheared andesite within the mineralized zone has been converted to rusty, siliceous, carbonate rock, while the acidic and tuffaceous bands are changed to a fine grained, almost cherty-looking aggregate, composed mainly of quartz, carbonate, and talc. A sprinkling of bright green mica appears throughout. An irregular dyke of fine grained feldspar porphyry breaks through the tuffaceous beds and follows the contact between the volcanics and the basic intrusive for a short distance. This fine grained porphyry is strikingly similar to the younger porphyry that cuts the basic intrusive some two hundred feet east of here, and it is likely that the two are genetically related. The dyke is mineralized and has undergone considerable silicification, together with the tuffaceous rocks along its southern border. The sulphides, mainly pyrite with specks of chalcopyrite, are disseminated throughout the more silicified portions of these rocks, and are exceedingly fine grained. Low values in gold are reported, over widths of as much as 10 feet, from the more mineralized sections along the southern margin of the dyke. Stringers of white quartz fill tension fractures here and there in the silicified portions of the rocks. They trend about N.45°E. and appear to be barren. Three drill holes, inclined at 60 degrees in a direction N.60°E., were put down from a line approximately 125 feet southwest of the contact between the mineralized zone and the basic intrusive. Each of these holes intersected mineralization but bottomed at rather shallow depth in the basic intrusive.

W. C. Martin Claims

The small triangular section that lies between the Macamic highway and Beattie railway, including part of lots 27 to 31, East Macamic Road range, is structurally one of the most complicated portions of the map-area. It displays considerable evidence of mineralization, and in years past it has been accorded much attention by prospectors and mining companies. A large amount of stripping, some trenching, and considerable diamond drilling has been carried out at various times, particularly on lots 27 and 28. The greater part of the ground is now held by W. C. Martin of Noranda.

The rocks underlying these properties consist of a complex of altered andesite flows, diorite, serpentinized gabbro, rhyolite, and, on lot 27, a thin band of tuffaceous sediments, all of which have been intruded by quartz-feldspar porphyry and feldspar porphyry. Structurally, they seem a part of a crumpled anticlinal fold, complementary to the Lépine Lake syncline, but the data are scant, and the complexity of the rocks involved, coupled with the excessive amount of shearing they have undergone, renders interpretation doubtful. The wide shear-zone of the Destor 'break' passes through lot 27, and is reflected in the fissile and crumpled nature of the schists exposed in trenches on the northern margin of the

swamp which lies across that lot. Numerous smaller shears, with strike N.55°-60°E. and a southeastward dip, break across the outcrops, and here and there small north-south trending faults occur, along which the eastern blocks have moved, relatively, southward.

The andesitic rocks and the tuffs have been converted in large part into chlorite schists and, locally, these have been carbonatized, serpentinized, and silicified. Likewise, the basic gabbros are now, in part, fissile chlorite schists, usually with a considerable content of carbonate and serpentine. The rhyolites and porphyries, where sheared, are dominantly quartz-sericite schists containing more or less carbonate, pale yellowish serpentine, bright green mica, and sometimes talc.

The mineralization is mainly in the form of fine grained pyrite, through which tiny specks of chalcopyrite, and sometimes of arsenopyrite, are disseminated. Low values in gold are reported. The sulphides are largely restricted to the silicified and carbonatized shear-zones, and are particularly apt to follow the margin of a porphyry or rhyolite band. Several such mineral-bearing lenses appear in trenches on claims R.12824, 13696, and 13697.

On lot 31, a few feet west of the Macamic highway, a quartz vein occurs filling a north-south fissure in andesite. It is traceable for about 125 feet on the surface and has a width ranging up to 18 inches. The vein is of white quartz, carrying small amounts of pyrite and chalcopyrite, and such secondary minerals as malachite and limonite. Parallel stringers of quartz in a shattered zone marginal to the vein increase the width of the system to as much as 3½ feet, but the mineralization in these stringers is very light. Presumably the vein is a tension filling, related structurally to the shear pattern that dominates the area.

Descar Corporation, Limited

This Company holds a block of 26 claims adjacent to the village of Destor, on lots 36 to 47, range II, and lots 37 to 47, range III. The writer is indebted to Dr. W. C. Gussow, of the Geological Survey of Canada, for information regarding the property. It straddles the Destor 'break', which passes beneath the swamp and drift area just north of the Davangus highway.

The claims north of the swamp are underlain by massive and pillowed andesite flows which are cut by small dykes of quartz-feldspar porphyry. The lavas strike east-northeast and appear to face northward. The scoriaceous flow margins are sheared erratically, along a general strike N.60°-70°E. The shearing dips steeply southward and, locally, the sheared rocks are carbonatized. On the claims south of the highway, the rocks outcropping are Cléricy sediments, schistose conglomerate, and greywacke. These beds strike about S.70°E. and dip steeply southward.

The main showings are on claim R.25136, lots 41 and 42, range III, where sheared andesite is impregnated by fine grained sulphides, chiefly pyrite. Some values in gold are reported. The mineralized zones follow the shearing and vary in width up to 50 feet. Over thirteen thousand feet of diamond drilling has been done on these claims, the greater part of it on claim R.25136. Four holes drilled under the drift-covered area near the highway, on lots 41 and 42, intersected heavily sheared rocks, with prominent mud seams, in the zone of the main 'break'.

Paquin Property

Gold-bearing veins were discovered during the summer of 1938 on lot 42, range IV. The claim on which the veins occur is one of a group held by A. Paquin, of Noranda. The writer made a brief visit to the property in September, and he is indebted to W. B. Maxwell, manager, and A. S. Banfield, geologist, of Beattie Gold Mines, to whom the claims are optioned, for information derived from development work carried on since that date.

The veins occur in tension fractures in a massive, fresh-looking quartz diabase which forms a prominent ridge along the south margin of a persistent east-northeast trending drift- and swamp-covered depression. The diabase is medium to coarse grained, locally with micropegmatitic texture. A short distance south of the discovery, it holds inclusions of rhyolite, and dykes of similar diabase penetrate an amygdaloidal andesite nearby. In appearance, the diabase is very similar to that of the coarse, sill-like bodies and massive flows that occur here and there in the lavas throughout the area to the west.

Three veins had been uncovered at the time of the writer's visit. The most westerly, and largest, vein strikes about N.26°W. and has been traced by stripping over a length of 200 feet. It is composed mainly of glassy-looking quartz. It varies in width from mere stringers that finger into or criss-cross the shattered diabase, to a well defined vein up to 15 inches wide. East of this 325 feet, a similar vein has been exposed over a length of 90 feet. The third vein is about 272 feet still farther east and strikes N.20°E. over an exposed length of 45 feet. It is essentially a fractured zone carrying stringers of mineralized vein-quartz. The veins all dip westerly, at 55 to 60 degrees.

The quartz of these veins tends to be coarse grained, vuggy, and in places euhedral along the margins of the veins. It is mineralized throughout with pyrite and a little chalcopyrite, and locally with galena and sphalerite. The sulphides occur in lesser amount in the shattered walls, in places for a width of as much as two or three feet from the vein. Interesting and fairly consistent values in gold are reported from both the vein matter and the mineralized wall-rock, the highest values appearing in the sections that carry the lead and zinc sulphides. The veins tend to branch and pinch out southward, but diamond drilling has demonstrated a continuation of the two westerly ones beneath the drift-covered depression to the north for over 300 feet. In their northward extension, however, the veins remain small, and the indications are that gold values, though persistent, tend to decrease.

Asbestos Deposits

Bouchard Property

In the serpentinized portions of the ultrabasic intrusives in various parts of the area there is commonly a small development of asbestos (chrysotile) fibre, and on lots 37, 38 and 39, range V, the wide body of serpentinized peridotite was being explored for commercial fibre during the summer of 1938. The property is held by J. G. Bouchard, of Montreal, and the development work, carried on during July and August, was under his direction. The prospect is approximately 2¾ miles north of the

Davangus highway and may be reached by way of a winter road which leads northward from the highway at lot-post 37-38.

The asbestos occurs both as cross-fibre and slip-fibre. The wall-rock is the bluish-grey serpentinite, with rusty buff weathering, so typical of the altered portions of the peridotite in this area. The best development of fibre is on the south side of a shear-zone that strikes N.65°E. across the coarse grained central part of the peridotite body, on lots 38 and 39, where, for a width of about 400 feet and a length of 1,000 feet, there is a fairly general distribution of fibre. Adjacent to the shear-zone, the rock is greatly fractured and criss-crossed by a multitude of veinlets of silky chrysotile, black shiny magnetite, and greasy brown material, mainly magnesite and brucite, which contrast strongly with the rusty, buff colour of the weathered surface of the main body of the rock.

As seen in the veins, the chrysotile has a bluish-grey to olive colour, but milled or fluffed the fibre is white. On the whole, the cross-fibre is short. The maximum observed length was five-eighths of an inch, and generally it is less than one-eighth of an inch long. Occasional veins having a width of seven-eighths of an inch were seen, but in every such instance observed these were made up of broken fibre. Slip-fibre measuring up to 2¼ inches was seen at various points, particularly in and near the shear-zone.

No reliable estimate can be made, from the data at hand, as to the percentage of fibre in the deposit as a whole. The face of one small pit, which might be taken as fairly representative of the material exposed at the time of the writer's visit, showed 19 veins of cross-fibre. Of these, seven were one-eighth of an inch in width, three were wider than this, but less than five-eighths, and ten were less than one-eighth inch wide. The entire width of the pit face was 43 inches; the combined widths of the veins add up to 2.16 inches. From this it may be calculated that the rock exposed in the face contained approximately 5 per cent of fibre. In some of the other pits, veins with a width greater than one-eighth of an inch were relatively more abundant, but in these pits the veins were more widely spaced, and it is probable that the rock exposed in them contains somewhat less than 5 per cent of fibre.

ALPHABETICAL INDEX