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Geology of Langmuir and Blackstock Townships

District of Timiskaming

By
D. R. Pyke

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ABSTRACT

This report describes the geology and mineral occurrences in Langmuir and Blackstock Townships which are located 20 miles southeast of Timmins and comprise an area of 72 square miles.

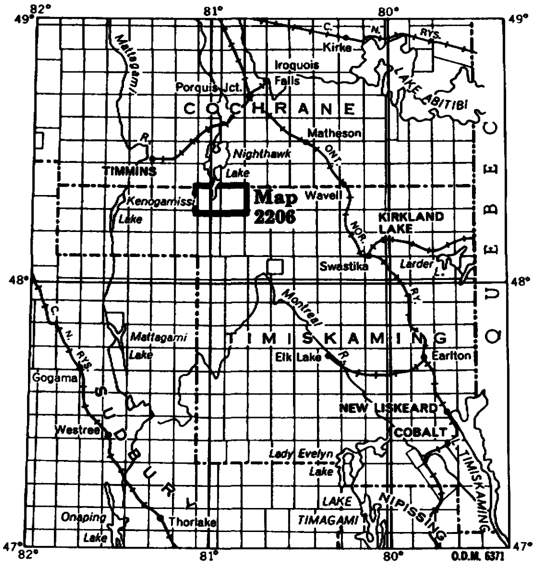

Figure 1–Key map showing location of Langmuir and Blackstock Townships. Scale 1 inch to 50 miles.

All the rocks are of Precambrian age. The oldest rocks in the area consist of metavolcanic flows and pyroclastics, outcrops of which are confined mainly to Langmuir Township. Prior to or during the initial stages of deformation, sill-like bodies of ultramafic rocks were intruded into the volcanics, primarily in the northwestern quadrant of Langmuir Township.

Three bodies of granitic rocks extend into the area from neighbouring townships: a stock of trondhjemite in the northwestern quadrant of Langmuir Township; the northern periphery of a small stock of monzonite along the south boundary of Langmuir Township; and a batholith of granodiorite which underlies most of Blackstock Township.

Diabase dikes are numerous and generally strike in a north or northeast direction.

In the northwestern quadrant of Langmuir Township, the metavolcanic-ultramafic assemblage is folded into an arcuate-shaped syncline. This syncline seems to form the southeast end of an elliptical-dome-shaped structure, the axis of which extends northwest as far as Tisdale Township and the rim of which is intermittently outlined by ultramafic intrusions.

The major fault directions are north, northeast, and northwest. The most prominent break is the Montreal River Fault which extends northwest across Langmuir Township.

Mineral production consists of minor barite which was mined intermittently from 1911 to 1948.

Nickel mineralization, associated with serpentinized dunites, is the prime exploration target in the area. At least two disseminated nickel deposits have been outlined, but are too small to warrant production.

Geology

of

Langmuir and Blackstock Townships

District of Timiskaming

By

D. R. Pyke[1]

INTRODUCTION

LOCATION AND ACCESSIBILITY

The townships of Langmuir and Blackstock cover 72 square miles and are about 20 miles southeast of the town of Timmins, in the District of Timiskaming. The area is bounded approximately by longitudes 80°49′ to 81°04′ west and latitudes 48°17′ to 48°22′ north.

Both townships are readily accessible by water. Langmuir is situated at the south end of Night Hawk Lake and, for those not familiar with that part of the lake, the main channel is, at first, elusive and difficult to follow because of numerous weed banks. The Whitefish River is readily navigable throughout its entire length across Blackstock Township and farther north through Thomas Township where it joins Night Hawk Lake.

Access to either township is available also via helicopter from Timmins. Fixed wing aircraft are not as useful because of a paucity of suitable lakes for landing.

An all weather road extends from the town of South Porcupine to within 1.5 miles of the northwestern corner of Langmuir Township. Numerous tractor roads extend throughout the western half of Langmuir; east of Blackstock Township, good all weather lumber roads extend to within 1 mile of the map-area.

PHYSIOGRAPHY

The area is one of low relief, rarely exceeding 50 feet, and rising to a maximum of approximately 150 feet. Most of the area is covered by a thick mantle of proglacial lacustrine clay, silt, and to a smaller extent, sand. Drainage is very poor. Extensive areas of wet muskeg characterize large parts of the townships, particularly in the centre of Langmuir.

[1]Geologist, Ontario Department of Mines, Toronto. Manuscript accepted for publication by Director, Geological Branch, 13 February 1969.

Pleistocene and Recent alluvium mantles more than 90 percent of the map-area. Drill records indicate that the drift in the central part of Langmuir Township is up to 100 feet thick, and commonly about 35 to 45 feet thick.

Three main rivers, the Forks, Night Hawk, and Whitefish, drain the area northward into James Bay via Night Hawk Lake and the Abitibi River.

PREVIOUS WORK

Geological features in the area were first described by E. M. Burwash (1896) in his report on the geology along the Algoma-Nipissing boundary line which included the west boundary of Langmuir Township.

A. G. Burrows in his report on the Porcupine area referred to the Cobalt group (Burrows 1911, p. 18) in the southwestern part of Langmuir Township, and on his accompanying map illustrated these as well as other outcrops in Langmuir and Blackstock Townships. The following year Burrows made particular reference to the granite in Blackstock Township (Burrows 1912, p. 217-218), to the Colbalt Group (Burrows 1912, p. 221), and to the barite veins near the southern boundary of Langmuir Township. The map accompanying his report also shows a few more outcrops than the previous edition.

In 1939, L. G. Berry (1940) mapped the townships of Carman, Thomas, Sheraton, Timmins, Langmuir, and Blackstock at a scale of 1 inch to 1 mile. Until the present survey, the mapping by Berry gave the most comprehensive coverage available on Langmuir and Blackstock Townships.

Other geological studies have been made in townships bordering the map-area. The first of these was by D. G. H. Wright (1922) who in 1921 mapped the Watabeag Lake area which includes Timmins Township on the east side of Blackstock Township.

P. E. Hopkins' report (Hopkins 1924) includes a sketch map showing the geology of a few outcrops in Fallon and Fasken Townships south of the map-area.

In 1937, W. D. Harding and L. G. Berry (1938) mapped the Keefer-Eldorado area to the west of Langmuir Township.

In 1965 and 1966, E. J. Leahy mapped the adjacent townships of Carman (Leahy 1966) and Thomas (Leahy 1969) at scales of 1 inch to ¼ mile.

FIELD WORK

The field work for this report was done during the summer of 1967. Vertical aerial photographs at a scale of 1 inch to ¼ mile, supplied by the Ontario Department of Lands and Forests, provided mapping control. The base map was prepared by the Cartography Section, Ontario Department of Mines, from map-sheets of the Forest Resources Inventory of the Ontario Department of Lands and Forests. Traverses by pace-and-compass were not spaced at regular intervals, rather only those outcrops or potential outcrop areas that were identified from the aerial photographs were visited. It is believed that very few outcrops were missed. The geology in the report is not tied to surveyed lines.

ACKNOWLEDGMENTS

The writer was assisted in the field by R. M. Stesky, senior assistant, and S. C. Barron, A. W. Garson, and D. R. Sharpe junior assistants.

Thanks are extended to Mr. P. T. George, Resident Geologist at Timmins, and Mr. J. Hill, of Nighthawk Marina, for their help during the field season.

Mr. M. Zurowski is gratefully acknowledged for making available to the writer numerous maps, drill logs, and assays for the property of McWatters Gold Mines Limited (24) and Peerless Canadian Explorations Limited (35).

GENERAL GEOLOGY

The rocks underlying the area are of Precambrian age. The oldest rocks are confined mainly to Langmuir Township and consist of mafic to felsic metavolcanics and minor associated metasediments.

Early sill-like intrusions of ultramafic rocks probably were emplaced before or during the first stages of deformation. These have been folded along with the volcanics, the main structure being an arcuate-shaped syncline in the northwestern part of Langmuir Township. Regional metamorphism is of the greenschist grade.

A small stock of trondhjemite in the northwestern part of Langmuir Township seems to have preceded the intrusion of a monzonite stock adjacent to the southern boundary of Langmuir Township and to have preceded the intrusion of a granodiorite batholith underlying most of Blackstock Township. Foliations within the adjacent volcanic and ultramafic rocks are generally parallel to the contacts of the intrusions.

Posttectonic northeast- and north-trending diabase dikes are numerous and intrusive into the above rocks.

Minor flat-lying sediments of the Cobalt Group outcrop in the southwestern part of Langmuir Township.

Faults in a north, northeast, and northwest direction are common, and there does not seem to be any rigid age relationship among them, probably as a result of recurring movements. The Montreal River Fault, extending northwest across Langmuir Township, is the major fault in the area.

ARCHEAN

Metavolcanics and Metasediments

The metavolcanics in the area are subdivided into two main groups on the accompanying map: (1) mafic to intermediate, composed almost entirely of metamorphosed basalts and andesites; (2) felsic to intermediate, composed in part of volcanics of dacitic to andesitic composition, and in part of distinctly more siliceous varieties of dacite and rhyodacite.

MAFIC TO INTERMEDIATE METAVOLCANICS

A wide variety in mineralogy, texture, and structure exists among the various basalts and andesites, mostly because of the different conditions under which they were metamorphosed. Near intrusions of granodiorite and monzonite, the volcanics underwent contact

Table 1 TABLE OF LITHOLOGIC UNITS

CENOZOIC

RECENT
Swamp and stream deposits

PLEISTOCENE
Till, clay, sand, gravel

Unconformity

PRECAMBRIAN

PROTEROZOIC

Late Mafic Intrusive Rocks
Diabase

Intrusive Contact

HURONIAN
Cobalt Group
Conglomerate, argillite

Unconformity

ARCHEAN

FELSIC INTRUSIVE ROCKS
Trondhjemite, granodiorite, monzonite, feldspar porphyry

Intrusive Contact

ULTRAMAFIC AND MAFIC INTRUSIVE ROCKS
Serpentinized dunite, related gabbro and diorite; serpentinized peridotite-pyroxenite.

Intrusive Contact

FELSIC TO INTERMEDIATE METAVOLCANICS
Dacite-andesite, dacite (quartz and (or) feldspar porphyry), rhyodacite, tuffs and agglomerate.

METASEDIMENTS
Iron formation
Hornblende gneiss

MAFIC TO INTERMEDIATE METAVOLCANICS
Basalt-andesite, andesite porphyry, pillowed basalt-andesite, carbonatized basalt-andesite, epidote-layered amphibolite.

metamorphism; elsewhere they underwent regional metamorphism to the greenschist facies. Therefore the basaltic and andesitic rocks have been divided into two groups: (1) contact metamorphosed mafic volcanics; (2) regionally metamorphosed mafic volcanics.

Contact Metamorphosed Mafic[1] Volcanics

Many of the outcrops of mafic volcanic rocks in the area are in close proximity to either the monzonite (6b) or granodiorite (6d) and have been subjected to contact metamorphism. Most of these rocks are fine to medium grained, moderately foliated, and characterized by discontinuous, alternating light to medium green epidote-rich layers, lenses, and pods, and dark green to black hornblende-rich layers. The green epidote layers range in width from approximately 0.05 to 4.0 inches, average about 0.3 inches, and commonly constitute 10 to 20 percent of the rock. In some locations, the epidote lenses or pods show a zonal structure with the epidote concentrated at the outer margins and the quartz and feldspar in the central part. At first impression, the rock appears to be well layered as shown in Photo 1. However in many exposures the epidote layers are discontinuous, lenticular, and rarely traceable over lengths greater than 4 to 6 feet. In a few outcrops, especially those closest to the monzonite, flow folding has resulted in the epidote lenses becoming highly contorted. Some weathered surfaces of these rocks have a fragmental appearance because the more resistant epidote lenses form protrusions on the outcrop surface. Convincing evidence of the origin of these banded volcanics was seen in a few outcrops, particularly in those just south of the south-central

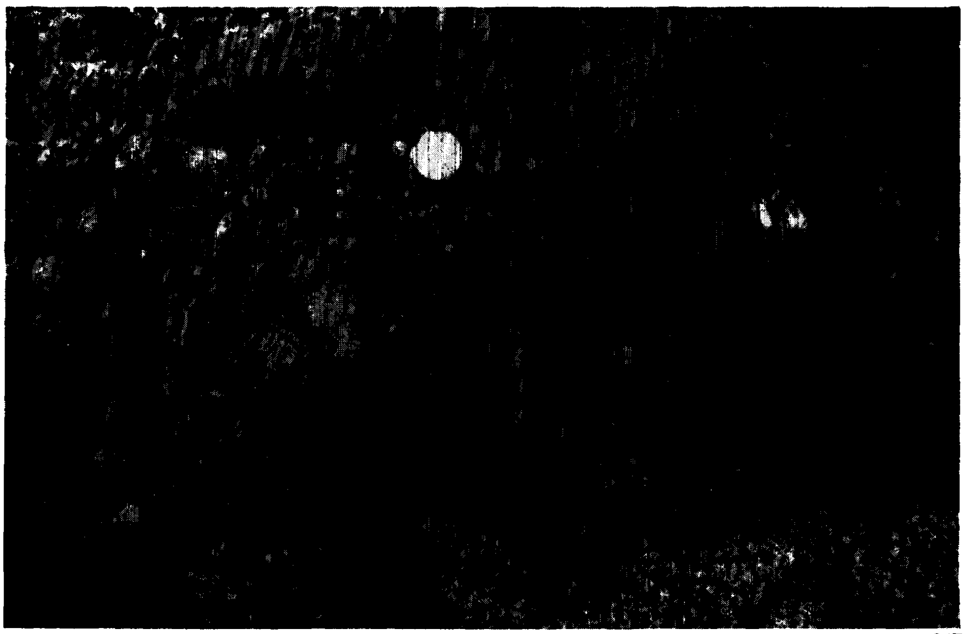

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Photo 1—Epidote-layered amphibolite near south-central boundary of Langmuir Township.

[1]Unless otherwise specified, mafic volcanic implies mafic to intermediate throughout remainder of report.

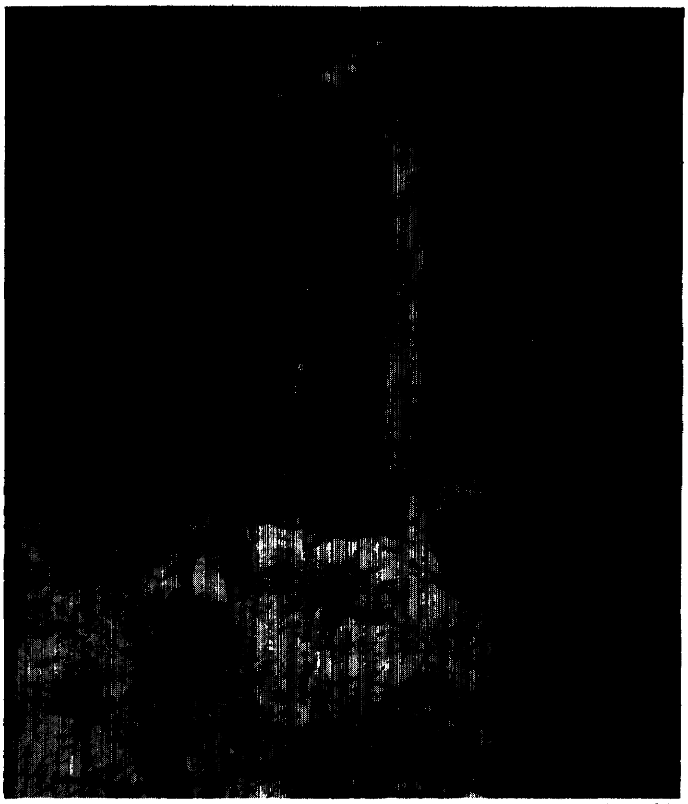

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Photo 2–Dacite (quartz porphyry) cutting diabase on property of E. Galata (12)

boundary of Langmuir Township (this forms the southwestern extension of the epidote-layered unit exposed at the old barite mine on the "Peerless Canadian Explorations Limited," property 35); and in the isolated outcrop of mafic volcanics near the north-central boundary of Blackstock Township. In both locations, the epidote layering formed in pillow lavas.

Three thin sections were examined of rocks of the epidote-layered metavolcanics taken from outcrops near the south-central boundary of Langmuir Township. These contain mineral assemblages typical of the albite-epidote- and hornblende-hornfels grade of metamorphism.

The hornblende-rich layers are composed mainly of a mosaic of hornblende and plagioclase, with a uniform grain size of approximately 0.03 mm. The hornblende is medium green, strongly pleochroic, and locally exhibits a weak foliation. The plagioclase is generally untwinned, ranges in composition from albite to calcic oligoclase, and forms from 4 to 60 percent of the layers. Disseminated granules of epidote and clinozoisite average 10 to 12 percent. One thin section contains 8 percent biotite. Other constituents generally present in minor amounts include quartz, magnetite, leucoxene, and muscovite.

The epidote-rich layers are 70 to 90 percent epidote and clinozoisite; the remainder being quartz and a few grains of hornblende.

In addition to the fine- to medium-grained layered amphibolitic volcanics described above, a medium- to coarse-grained massive amphibolite forms part of a contaminated zone (6c) bordering the monzonite near the south-central boundary of Langmuir Township. This contaminated zone is thought to have resulted from the assimilation of the adjacent volcanics by the monzonite and will, therefore, be discussed in the section on the monzonite.

Regionally Metamorphosed Mafic Volcanics

The majority of the regionally metamorphosed mafic volcanics are exposed in the northeastern quadrant of Langmuir Township, although two outcrops straddling the central part of the Langmuir-Fallon boundary display only minor contact metamorphic effects. Typically, the regionally metamorphosed volcanics are fine grained, chloritized, weakly to moderately schistose, weathered medium to dark grey, and are a dull medium grey to dark green on fresh surfaces. Very few flow contacts were recognized and, therefore, no information is available on flow thicknesses. Amygdules of calcite and colourless to black quartz are the most commonly recognized primary structures and are particularly abundant in those outcrops in the extreme northwestern part of the map-area. Well-preserved pillows occur in the two outcrops of mafic volcanics which straddle the south-central boundary of Langmuir Township, but elsewhere pillow structures are rare. Some varieties, herein termed andesite porphyry, contain numerous light grey-weathering plagioclase phenocrysts averaging approximately 0.05 to 0.10 inches in length. Generally these porphyritic volcanics are less mafic-rich than the nonporphyritic varieties and, in the two thin sections of andesite porphyry examined, each contains approximately 30 percent mafic minerals compared to a range of 35 to 65 percent in thin sections examined from nonporphyritic mafic volcanics.

Microscopically, the regionally metamorphosed mafic volcanics display varying degrees of alteration to a variety of secondary minerals, although in some thin sections an original basaltic texture is recognizable. Average grain size is about 0.1 to 0.2 mm.

Original plagioclase alters to albite-sodic oligoclase, sericite, epidote, clinozoisite, and minor chlorite and calcite. In a few thin sections, laths of plagioclase ranging from 0.1 to 0.5 mm in length are common and impart an ophitic texture to the rock. In one of the porphyritic varieties, phenocrysts of equant plagioclase average 1.2 mm in size, compose 10 percent by volume of the rock, and tend to be more highly saussuritized than the finer laths of plagioclase in the groundmass. In many grains, a faint twinning is still recognizable.

Pale green, weakly pleochroic, shreddy to fibrous actinolite is the dominant ferromagnesium mineral and may or may not display a weak foliation. Minor alteration to chlorite is common.

Quartz, with smaller amounts of calcite, chlorite, and actinolite are the common amygdule minerals.

Minor magnetite and leucoxene are invariably present, and generally traces of apatite.

METASEDIMENTS

With the exception of iron formation, the only rocks thought to be of possible sedimentary origin are the few scattered outcrops in the southeastern part of Blackstock Township adjacent to the granodiorite contact. These are shown as hornblende gneiss (unit 2) on the accompanying Geological Map 2206 (back pocket).

Siliceous Iron Formation

Extensive weathering of the iron formation obscures much of the original layering and renders most of the rock very crumbly or friable. Generally, the only visible minerals are a sugary or granular quartz and red to yellowish red hematite and limonite. Where the rock is unweathered or in drill core, it is seen to consist mainly of thin layers of white, grey, and dull orange to red ferruginous chert and dark grey, red, or black argillite. Most of the iron formation contains sulphide-bearing zones in which pyrite is commonly in excess of pyrrhotite. Only minor magnetite was observed. One-half mile west of Carman Bay, the iron formation contains a thick (up to 4 feet) layer of closely packed spherulitic concretions of pyrite with minor chert. The concretions average approximately 0.4 inches in diameter and display a concentric as well as a radial structure. The concretions are similar to those described by R. S. Woolverton (1960) in the Lumby Lake area.

Drilling has shown that many of the coincident magnetic and electromagnetic anomalies in the area are caused by relatively massive pyrite-pyrrhotite zones, up to 10 feet thick, in siliceous iron formations. About one third of an iron formation unit may contain layers of 30 percent or more pyrite-pyrrhotite. The remainder is dominantly layers of chert and of minor argillite and magnetite-rich material.

Hornblende Gneiss

A finely layered hornblende gneiss is exposed near the southeastern corner of Blackstock Township. Individual layers are medium grey, pink or green weathering, range in width from a fraction of 1 inch to 0.15 inches, and are continuous across the outcrops. It is this continuity of layering which suggests the layers are primary rather than the result of metamorphic differentiation (although metamorphism has undoubtedly accentuated the layering). These rocks are mapped as metasediments. However it is recognized that they could just as conceivably be of a tuffaceous origin. Within a distance of 10 to 25 feet from the contact with the granodiorite, the metasediments become highly contorted, veined by granodiorite in a *lit-par-lit* fashion, and locally have more of a pinkish hue.

One thin section was examined and contains approximately 60 percent plagioclase, 10 percent quartz, 15 percent hornblende, 8 percent epidote, 5 percent perthitic K-feldspar, and minor magnetite, sphene, and apatite.

FELSIC TO INTERMEDIATE METAVOLCANICS

Outcrops of felsic volcanics are confined mainly to the west-central and northwestern part of Langmuir Township. A few small outcrops occur west of St. Peter Bay and could indicate that felsic volcanics underlie a large part of the area immediately west of the bay.

Two main types of felsic volcanic rocks, exclusive of fragmental varieties, are in the area: (1) dacite (unit 4b) which is light to medium grey-green, fine grained, massive to well foliated, light grey to white weathering, and usually porphyritic containing numerous (up to 10 to 15 percent) phenocrysts of quartz and (or) feldspar; (2) rhyodacite (unit 4c) which is massive, fine grained, light grey, very hard, and siliceous. A few of the volcanic outcrops are intermediate (unit 4a) between an andesite and a dacite.

The porphyritic dacite (4b) is similar to the quartz-feldspar porphyries described elsewhere in the Timmins area (Burrows 1924; Evans 1944; Griffis 1962; to mention a few) and presents the same problems of origin (i.e., extrusive flow or fragmental vs. intrusive) and age relationships. That the porphyry is, at least, in part intrusive and postdates the mafic volcanics is illustrated at one exposure on the property of McWatters Gold Mines Limited (24). Here a dike of quartz porphyry cuts the schistosity of the mafic volcanics at a low angle. Moreover on the property of E. Galata (12), a dike of porphyritic dacite cuts across a north-trending diabase dike (Photo 2). This suggests either that some of the dacite porphyry is much younger than thought or that there is more than one age of north-trending diabase dikes. For the purpose of this report, all the dacitic porphyries are shown on the map as unit 4b.

Three thin sections of dacite were examined. Phenocrysts of quartz range in size from 0.3 to 2.0 mm, average about 1.0 mm, and are either oval or subhedral to euhedral in outline (Photo 3). Strain extinction is common and a few of the phenocrysts are either crushed along the margins or fractured irregularly, however, the majority do not display any strong cataclastic effects. The matrix consists of a fine-grained (0.02 mm) mosaic of quartz and feldspar with subordinate foliated sericite which is usually wrapped around quartz phenocrysts and imparts an anastomozing structure. One of the thin sections, in addition to the quartz phenocrysts, consists of 20 percent subhedral, twinned plagioclase phenocrysts ranging in size from 0.2 to 2.5 mm and averaging 1.2 mm. The composition of the plagioclase in the three slides ranges from An_9 to An_{14}. The ratio of quartz to plagioclase in the groundmass is approximately 4 to 3; sericite averages approximately 10 to 15 percent. One or more of the following accessory minerals are present in minor or trace amounts; epidote, clinozoisite, leucoxene, apatite, zircon, calcite, and opaque minerals (commonly pyrite).

Two thin sections of dacite, which macroscopically appears to be massive, contain 10 percent corroded, twinned, plagioclase phenocrysts averaging approximately 0.2 mm in grain size. This suggests that most, if not all, of the felsic volcanics are porphyritic.

Two thin sections of rhyodacite were examined and contain the following minerals; equant (1.5 mm grain size) plagioclase phenocrysts, 10 to 20 percent (An_{20} to An_{27}); epidote 1 to 4 percent; pyrite 1 to 3 percent; feldspar-quartz groundmass with traces of calcite, sericite, chlorite, and biotite, 75 to 80 percent.

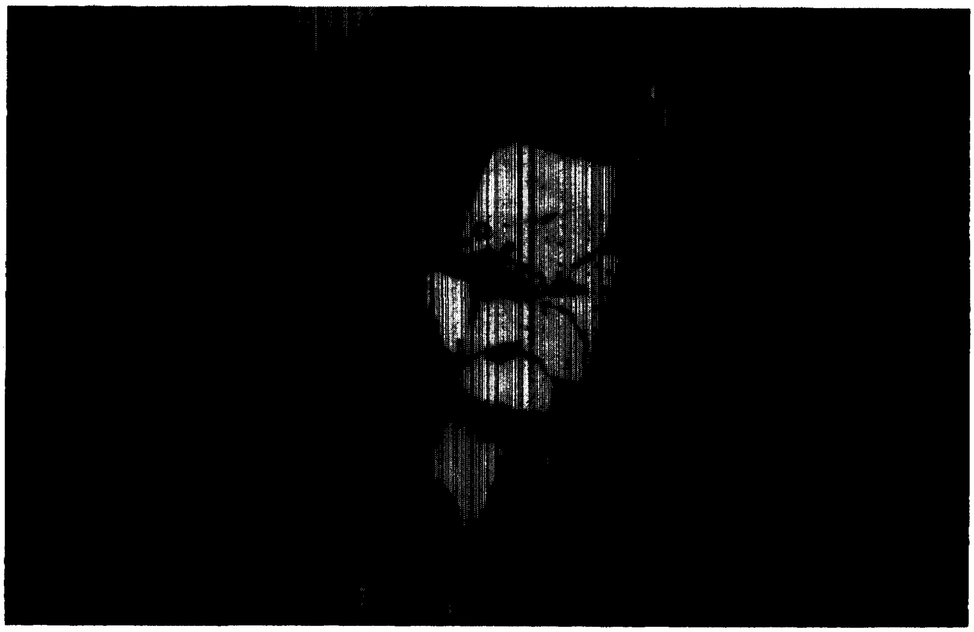

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Photo 3–Microphotograph of dacite (quartz porphyry) (x17). Specimen P-86-67; X-nicols.

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Photo 4–Highly crenulated felsic tuffs from outcrop near eastern boundary of property of Larchmont Mines Limited (19).

Pyroclastic Rocks

Only minor felsic to intermediate fragmental rocks were recognized and nearly all of these are confined to a large outcrop in the northwestern quadrant of Langmuir Township near the property of Larchmont Mines Limited (19).

The outcrop is composed primarily of agglomerate which is typically buff weathering, medium to dark green on fresh surfaces, non-layered, and strongly schistose. Fragments are numerous, generally of a lighter colour than the matrix, range from a fraction of an inch to 12 inches in maximum dimension, and average about ¼ inch to 1 inch. The fragments tend to be flattened in the plane of schistosity, and a few are lineated in a southerly direction. One exceptionally coarse boulder agglomerate layer 2 feet thick and with fragments averaging approximately 6 inches in diameter is exposed for a few feet at the northeastern edge of the outcrop. Minor highly crenulated white-weathering tuffaceous rocks are also present (Photo 4).

Ultramafic and Related Mafic Intrusive Rocks

The ultramafic rocks in the area are subdivided into two main groups: (1) serpentinized peridotite-pyroxenite, which is confined to the southern part of Langmuir Township; (2) serpentinized dunite, which occurs in the northwestern part of the area.

Serpentinized Peridotite-Pyroxenite

The limits of this unit are fairly well outlined on Aeromagnetic Maps 293G and 294G of the Geological Survey of Canada (Geol. Surv. Canada 1956a and b), and the unit forms a lens-shaped body up to approximately 4 miles long and ¾ mile wide. The writer (Pyke 1968) originally mapped these rocks as extrusive and it is by no means unequivocal that they do not represent, at least in part, ultramafic flows. Relationships suggesting a volcanic origin will be presented in the ensuing discussion.

Outcrops are typically well rounded and weather dirty grey to orange-brown. Fresh rock surfaces generally have a very dark bluish black hue indicative of serpentinization, although there are lighter green varieties present. Narrow veinlets of asbestos occur at a few localities and carbonatization is especially common at the southwestern end of the unit. In many respects, the weathered and fresh surfaces are similar to some of the serpentinized dunites to the northwest.

A structure characteristic of many of the outcrops consists of irregularly shaped polygons, generally with a maximum dimension of 8 to 10 inches, but ranging from about 3 to 30 inches (Photo 5). Typically each polygon has a slightly raised rim at the margin and is separated from its neighbour by a narrow cleft, thereby, resembling cooling cracks. Even so, they seem to be just as extensive in a vertical direction as they are in plan. Locally, extensive carbonatization at the margins of the polygons has given the rock a fragmental appearance. The development of the polygons is probably best explained as being related to the processes of serpentinization and representing a multitude of minor fractures or slip surfaces formed during volume adjustments to serpentinization. In a few outcrops, the polygonal structure seems to represent the broken shell

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Photo 5–Polygonal-type structure in serpentinized peridotite-pyroxenite, from large outcrop on property of Acme Gas and Oil Company Limited (2).

of a pillow (Photo 6), suggesting another mode of origin. This could explain the absence of many recognizable pillow outlines as well as the persistence of the polygons in three dimensions.

In thin sections of the serpentinites, the only recognizable primary mineral is olivine, the relic grains of which form about 10 to 15 percent by volume. A few sections suggest that olivine originally constituted up to 50 percent or more by volume of some of the rocks, and commonly about 25 to 40 percent. No pyroxene or plagioclase pseudomorphs were recognized, although presumably at least pyroxene was present originally. Secondary minerals consist dominantly of varying proportions of tremolite, serpentine, chlorite, and magnetite. Table 2 gives an estimate of the volume percentage of minerals in five thin sections as well as an estimate of the original olivine content of the rock.

Table 2 VOLUME PERCENTAGE* OF MINERALS PRESENT IN THE SERPENTINIZED PERIDOTITE-PYROXENITE

Specimen	P-2 -67	R-1 -67	S-1 -67	S-7 -67	S-16 -67
Olivine	11	10	5	18	10
Serpentine	5	37	40	70	53
Chlorite	20	26	18	5	10
Tremolite	60	23	34	5	17
Magnetite	5	3	3	2	10
Hematite	x	...	...	...	...
Leucoxene	x	...	...	...	...
Original Olivine	25-30	45+	50	50+	40+

*x denotes less than 1 percent of mineral present in this and all succeeding tables.

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Photo 6—Polygonal-type structure resembling broken pillows. Photograph from same outcrop as Photo 5.

On the basis of the estimates of primary olivine, these ultramafic rocks were probably of a composition between an olivine pyroxenite and olivine peridotite (i.e., between 30 to 65 percent olivine, the remainder being wholly or dominantly pyroxene).

A peculiar structure referred to by Berry (1940, p. 5) as a feathery or fern-like pattern is common in these ultramafic rocks. This structure seems to be similar to what other geologists have referred to as "chicken-track" or "bird-track" rock found in the Timmins area. One of the first to describe this structure was E. L. Bruce (1926, p. 44) in McArthur Township, and later V. K. Prest (1950, p. 8; 1951, p. 9) in Keith and Guibord Townships respectively, and E. M. Abraham (1953, p. 8) in Sothman Township. Interestingly enough, all the above authors, including Berry in his report on Langmuir Township, originally mapped the rocks in which these structures occur as volcanic rocks. Abraham and Prest suggested they were the result of metamorphism caused by nearby ultamafic intrusions. More recently, some of these rocks have been reinterpreted as being ultramafic intrusions as shown in some of the above-mentioned townships on the Ontario Department of Mines Compilation Map 2046 (Ginn *et al.* 1964).

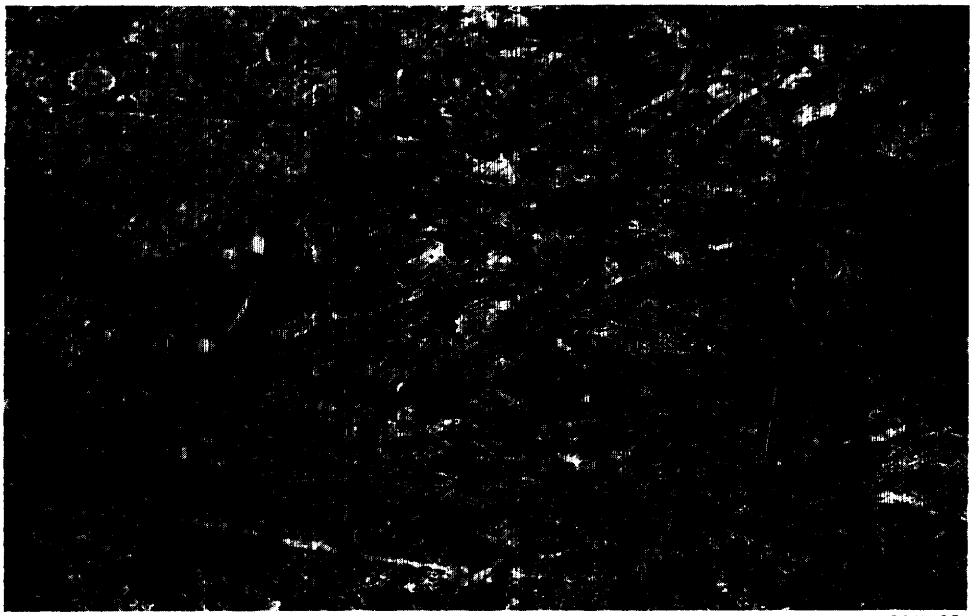

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Photo 7–"Laths in serpentinized peridotite-pyroxenite. Outcrop near northeastern corner of claims held by Maybrun Mines (25).

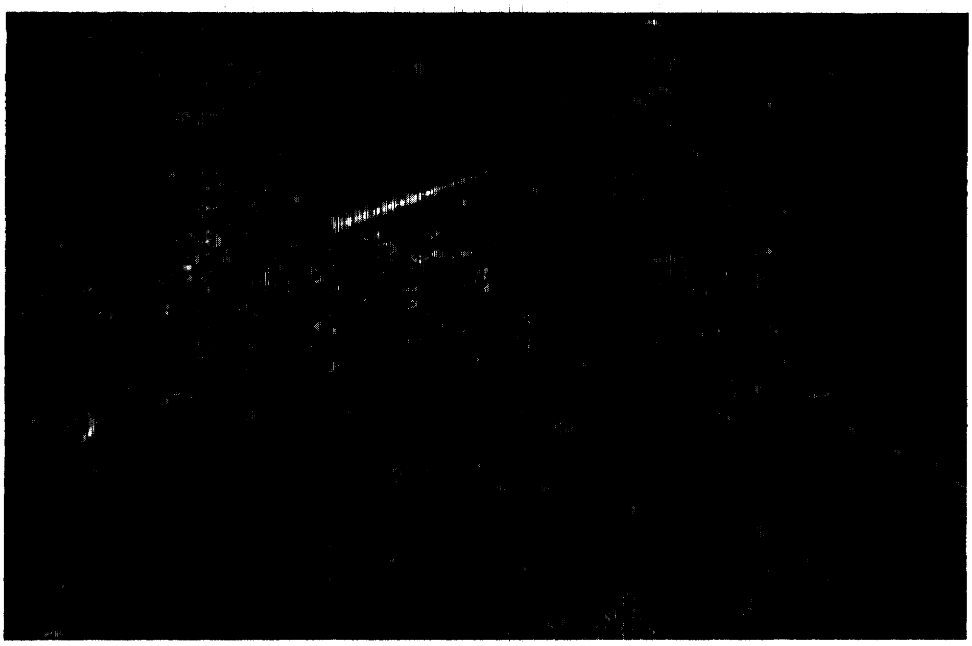

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Photo 8–Sills of "laths" (light coloured) in serpentinized peridotite-pyroxenite. From large outcrop in southeastern part of Langmuir Township.

In Langmuir Township, the "feathery", "fern-like", or "chicken-track" rock is characterized by numerous, randomly oriented, crisscrossing "laths". Macroscopically, the "laths" (Photo 7) are up to 3 feet long and 4 inches wide; a common size being ½ to 4 inches long and ¼ to ½ inch wide. Individual "laths" are composed of very narrow differentially weathered parallel bands.

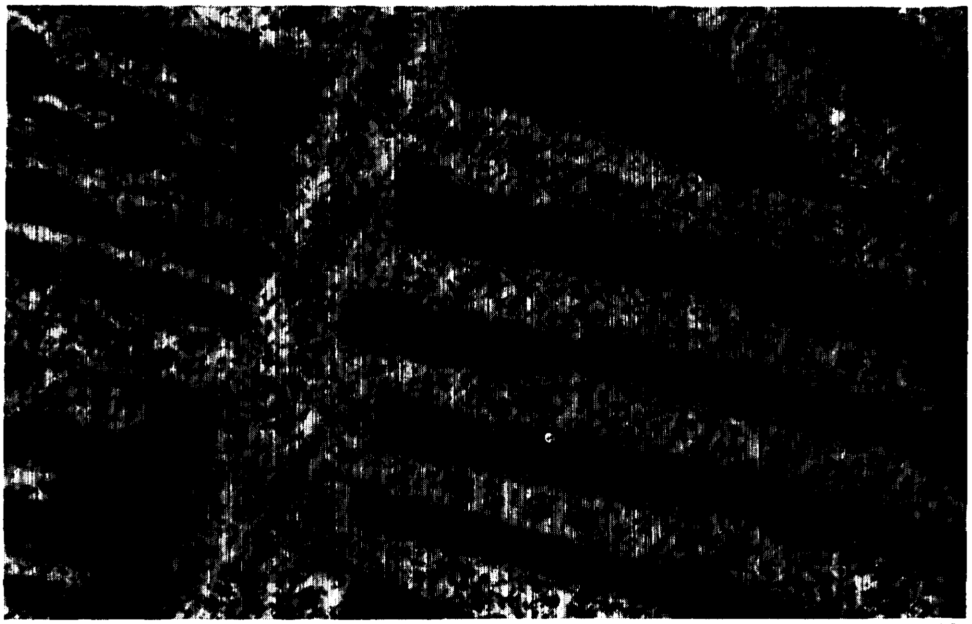
The "laths" occur in a variety of ways, one of the most common appearing to be as "sills" within the serpentinite (Photo 8). Individual "sills" range from approximately 0.5 inches to 10 feet wide, are generally but not everywhere parallel to foliation in the serpentinite, may bifurcate into two or more narrow "dikes", may abruptly change strike, or rapidly pinch out. Virtually all the "sills" have an overall northeast strike, and dip steeply to the southeast. Many relationships are obscured by lichen on the outcrops and it is difficult to trace individual "sills" for more than 50 feet. Both contacts are generally well defined in "sills" about 0.5 inches to 12 inches in width. When the lath-bearing zone is wider, the southeasterly contact invariably grades imperceptibly over a short distance into the adjacent serpentinite with a decrease in the size of the "laths". In a few exposures a definite sequence exists on passing from a northwest to southeast direction: (1) a very fine-grained layer approximately ¼ to 1 inch wide in sharp contact with (2) coarse "laths" about 1 to 8 inches long that grade into finer "laths" over a distance of approximately 2 to 5 feet, and are followed by (3) a polygonal zone, as previously described, which in turn grades into (4) a faintly foliated layer which within a few feet becomes intensely "foliated" due to similarly oriented rather than crisscrossing "laths". The sequence is then repeated beginning with the fine-grained layer. Each of these zones from the coarse "laths" to the intensely foliated part ranges from about 5 to 40 feet.

One characteristic common to all "lath" layers examined is that, where a variation in size of the "laths" is present, the coarsest "laths" invariably are toward the northwest.

Pillow top determinations in the volcanics immediately south of these ultramafic rocks indicate that tops are to the southeast and, therefore, the variation from coarse to fine laths is from bottom to top.

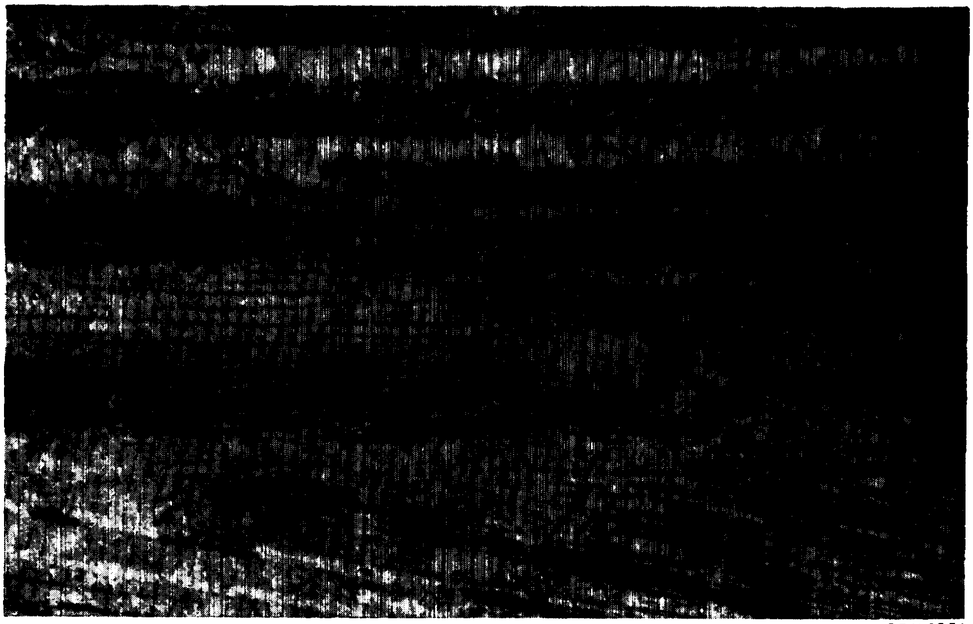
Two thin sections of the "laths" were examined, and consist of alternating bands of fine-grained chlorite and tremolite in one slide (Photo 9), and alternating bands of serpentine and mainly relic olivine plus minor tremolite in the other (Photo 10). Individual "laths" are formed from numerous bands which range in width from 0.1 mm to 0.7 mm and average about 0.4 to 0.5 mm. The largest continuous "laths" observed in the sections were 2 cm in length. An interfingering of "laths" on a microscopic scale can give the macroscopic impression that they are continuous over much greater lengths, as is undoubtedly true with some of the more extreme sizes that were observed.

The parallel growth of elongate crystals of olivine has been discussed in some detail by H. I. Drever and R. Johnston (1957), who concluded that rapid cooling is the prime factor in its development. More recently, A. J. Naldrett (1964) and A. J. Naldrett and G. D. Mason (1968) have discussed the development of the "chicken-track" rock in the Timmins area. They have shown that, at the margins of some ultramafic lenses in Dundonald Township, there is a decrease in the relative amount of olivine to pyroxene and, in those marginal rocks containing less than 50 percent olivine, the formation of parallel growths of tabular or skeletal olivine was numerous. Naldrett and Mason tentatively concluded that the rapid chilling occurred when the ultramafic magma was injected into a submarine volcanic pile at a shallow level. Therefore the two most important prerequisites necessary for the formation of the "laths" in ultramafic rocks seems to be: (1) rapid chilling; (2) an olivine content of less than 50 percent.



ODM 8355

Photo 9–Microphotograph of "laths". Alternating tremolite-rich (light) and chlorite-rich (dark) bands (x17). Specimen P-36-67, x-nicols.



ODM 8356

Photo 10–Microphotograph of "laths". Darker bands composed of tremolite, chlorite, relic olivine, and minor magnetite. Lighter bands composed mainly of serpentine (x17). Specimen P-349-67, X-nicols.

In Langmuir Township, the formation of the "laths" could be accounted for by rapid chilling since they are found in narrow sills and dikes. However the occurrence of "laths" as part of the sequence, as mentioned above, suggests the possibility of the "laths" being part of a surface flow, for which a possible explanation may be: upon extrusion, chilling occurred both along the basal and upper portions of the flow, resulting in the formation of "laths" in contrast to the central slower cooling portion. Continued lamellar viscous flow at the top relative to the bottom of the flow, after rapid chilling, caused the "laths" along the upper portion of the flow to be oriented parallel to one another, thus accounting for the foliated portion. Further work would be necessary, however, before any flow origin could be substantiated.

Serpentinized Dunite

Alpine-type intrusions of serpentinized dunites form extensive sill-like masses within the volcanic rocks in the northwestern part of Langmuir Township. Undoubtedly these ultramafic rocks are not as uniform as depicted on the accompanying Geological Map 2206 (back pocket), because intrusions of this type are commonly characterized by their irregularity. However scarcity of outcrops and lack of extensive drilling precludes, at this time, any detailed interpretation of the contacts. Some of the contacts, therefore, are best considered as incorporating zones consisting dominantly of ultramafic rocks.

The conformity of these serpentinites indicates they were intruded prior to or during the early stages of deformation.

The outcrops typically weather a light greyish white to a medium brownish orange; fresh surfaces are a very dark blue to green, or, more rarely, a light green. The outline of former oval-shaped olivine grains, commonly about 0.5 mm in diameter, is visible on many of the weathered and fresh surfaces and imparts a decided granular appearance to the rock. Some weathered surfaces have a honeycomb aspect. Outcrops are massive and are characterized by numerous fractures which do not seem to form any consistent patterns The fracture planes are commonly slickensided and some contain laths of brittle tremolite up to 5 inches in length.

Narrow veinlets of fibrous asbestos, rarely exceeding 0.10 inches in width, are common in some of the outcrops. Fractures filled with calcite and talc are present locally.

In thin section, the ultramafic rocks are completely altered to serpentine with minor amounts of magnetite, calcite, talc, and chlorite, although in one thin section talc is the dominant constituent. The serpentine has a variety of habits, being either flaky, fibrous, or felt-like and may locally have an hourglass-type structure (Photo 11) as described by W. A. Deer, R. A. Howie, and J. Zussman (1962). No relic pyroxene was found and from the shape of the replaced grains most, if not all, of the serpentinites were derived from rocks consisting entirely of olivine grains (Photo 12). Opaque minerals average about 2 to 3 percent by volume. Magnetite is the most common and occurs either as irregular grains disseminated along the margins or cracks within former olivine grains, or as discontinuous veinlets extending across any given slide. Sparsely disseminated grains of sulphide are commonly present. Two polished thin sections of serpentinite were examined: one has traces of millerite; the other has traces of heazelwoodite.[1]

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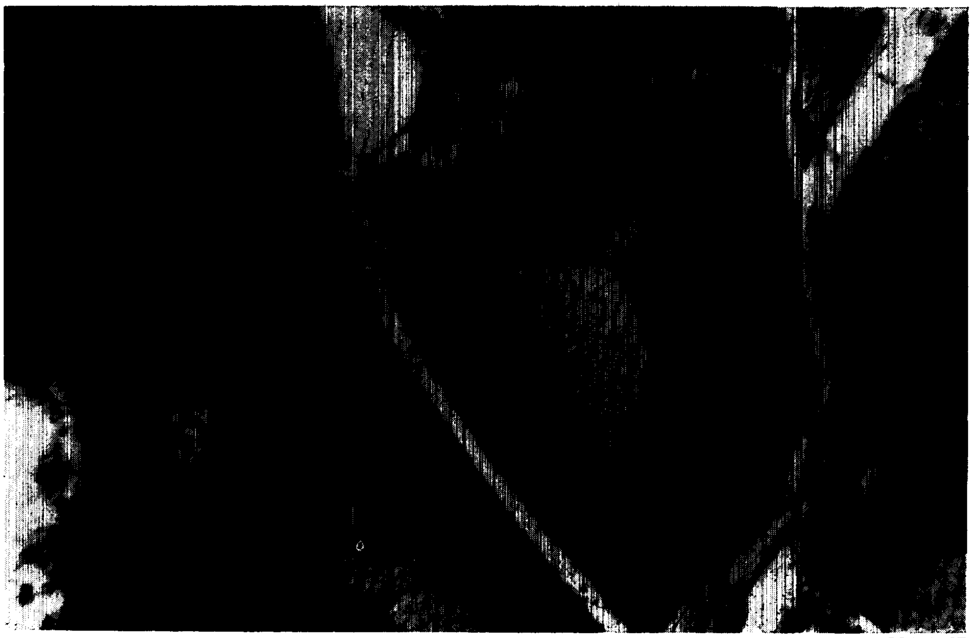
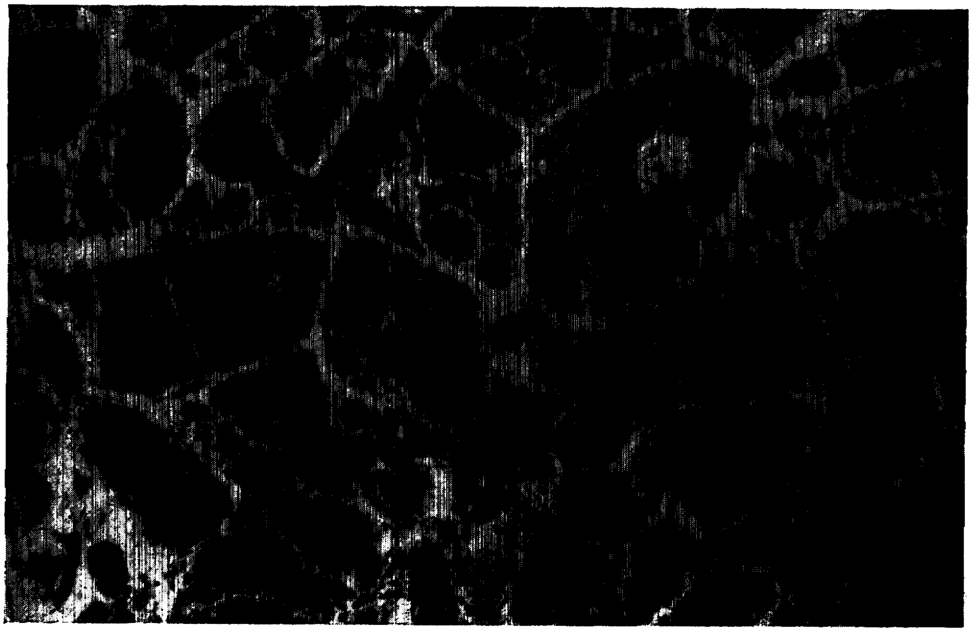
[1]Identified by the Laboratory and Research Branch of the Ontario Department of Mines.



ODM 8357

Photo 11–Microphotograph of hourglass-type structure in serpentinized dunite (x150). Specimen S-36-67, X-nicols.



ODM 8358

Photo 12–Microphotograph of serpentine pseudomorph after olivine in serpentinized dunite (x17). Specimen P-117-67, X-nicols.

A few outcrops of massive, fine- to medium-grained, medium grey-green diorite occur in Langmuir Township near the west-central boundary and north boundary west of Carman Bay. The contacts with the adjacent serpentinites were not observed, but, on the basis of the spatial relationships to the serpentinites and their petrographic characteristics, the diorite is probably the same age. Similarly one outcrop of gabbro near the southeastern corner of the patented claims of Clark Porcupine Mining Syndicate (5) is included with the serpentinite on the same basis as the diorite. Both the diorite and gabbro contain numerous inclusions of the volcanics.

In thin section, the diorite and gabbro consist almost entirely of completely saussuritized plagioclase (42 to 45 percent) and actinolitic hornblende (44 to 60 percent). This suggests that these mafic rocks are older than the diabase rocks and the granitic rocks in the area, both of which have undergone less alteration. It is, therefore, concluded that the diorite and gabbro were probably intruded at the same time as the serpentinite.

Only one exposure was found to contain what may be a rock-type intermediate between the serpentinite and gabbro. This rock was confined to a narrow zone in sharp contact with the serpentinite on the property of E. Galata (12), and in thin section consists of 20 percent actinolite-tremolite (pseudomorph after pyroxene), 70 percent antigorite, 7 percent chlorite, and 3 percent magnetite.

Felsic Intrusive Rocks

Three spatially and compositionally distinct felsic intrusive bodies composed of trondhjemite, granodiorite, and monzonite, respectively, extend into the Langmuir-Blackstock area from adjacent townships. The age relationships among the three plutons is not definitely known, but indirect evidence based on the presence or absence of a contact metamorphic aureole suggests that the trondhjemite is older than the granodiorite and monzonite.

All three intrusions are pre-diabase and undoubtedly post-serpentinite, although intrusive relationships with the serpentinite were not observed. It is, therefore, tentatively concluded that the trondhjemite was intruded sometime prior to the maximum temperature and pressure conditions of regional metamorphism (in this case the greenschist facies), so that any contact metamorphic effect would be masked by the later regional metamorphism. The granodiorite and monzonite were probably intruded during or after the waning stages of regional metamorphism, thereby accounting for the preservation of their contact aureoles.

Modal analyses of the trondhjemite, granodiorite, and monzonite are given in Tables 3, 4, and 5 respectively. The volume percent of quartz, plagioclase, and potassic feldspar recalculated to 100 percent is shown in Figure 2 for the three plutons.

Trondhjemite

The trondhjemite extends from Eldorado Township into the northwestern quadrant of Langmuir Township; it is massive, medium grained, light grey on weathered and fresh surfaces, and, macroscopically, appears to be extremely uniform in composition.

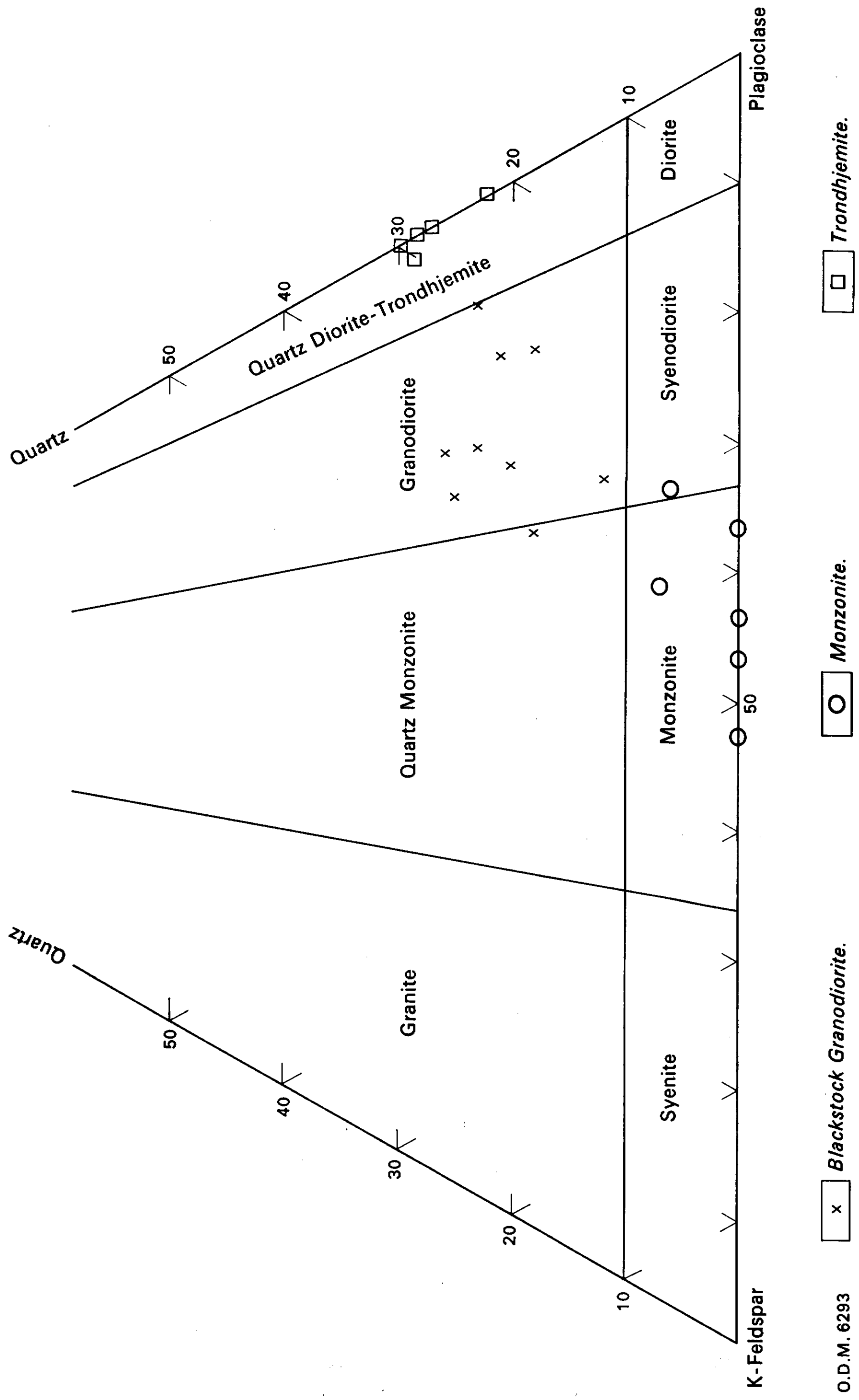


Figure 2—Volume percent of quartz, potassic feldspar, and plagioclase in felsic intrusive rocks of Langmuir and Blackstock Townships. Percentages were determined by modal analyses and recalculated to 100 percent.

Table 3 VOLUME PERCENTAGE OF MINERALS IN THE TRONDHJEMITE

Specimen	P-138 -67	P-149 -67	P-152 -67	P-155 -67	P-209 -67
Plagioclase	62	63	65	64	69
Potassic Feldspar	x	1	...	x	...
Quartz	25	26	25	23	20
Hornblende	5	2	3	2	2
Biotite	...	5	1	5	4
Magnetite	...	x	...	x	x
Sphene	x	x	x	1	x
Apatite	x	x	x	x	x
Allanite	...	x	...	....	...
Zircon	...	...	...	x	...
Epidote	4	3	5	3	3
Pyrite	...	...	...	x	x
Rutile	...	...	....	x	x
Chlorite	4	x	x	x	3
Calcite	x	....	...	x	...
Plagioclase composition (percent An)	9	16	5	11	13

Northeast- and southwest-striking joint sets (not shown on map) are characteristic of most outcrops. Near the southern contact of the trondhjemite, inclusions of felsic volcanics are common.

From an examination of five thin sections of trondhjemite, the average composition is 65 percent plagioclase, 24 percent quartz, 3 percent each of hornblende, biotite, and epidote, and minor amounts of sphene, chlorite, sericite, and apatite. Traces of magnetite, pyrite, calcite, zircon, and rutile are in a few of the sections. The texture is hypidiomorphic granular with an average grain size of 1.5 to 2.0 mm.

Plagioclase shows moderate alteration to epidote and sericite, is invariably twinned, albitic in composition, and a few grains display oscillatory zoning. Narrow rims of secondary unaltered albite enclose many of the grains. The quartz is strained, irregular in outline, and averages approximately 0.8 mm in grain size. The hornblende is pleochroic from medium to light green and alters to biotite, epidote, chlorite, calcite, and quartz. Most, if not all, of the biotite is thought to be secondary after hornblende, and is usually intergrown with subhedral to euhedral crystals of epidote.

Granodiorite

Outcrops of granodiorite are confined almost wholly to the extreme south-central part of Blackstock Township, although Aeromagnetic Map 294G of the Geological Survey of Canada (Geol. Surv. Canada 1956b) suggests the pluton underlies most of the township. Typically, the granodiorite is medium grained, light grey-pink on weathered and fresh surfaces, massive to weakly foliated and almost invariably contains phenocrysts of potassic feldspar ranging in size from 0.1 to 1.0 inches and averaging about 0.3 inches.

Eight thin sections were examined and gave an average composition of 56 percent plagioclase, 17 percent potassic feldspar, 20 percent quartz, and 5 percent hornblende.

The plagioclase is albite to sodic oligoclase in composition and forms subhedral grains ranging in size from 0.3 to 5.5 mm and averaging 2.0 mm. A dusty brown coloration is common due to fine saussuritization and sericitization.

The potassic feldspar occurs either as subhedral to euhedral phenocrysts or as fine-grained irregular, interstitial grains. The phenocrysts are either untwinned, or twinned according to the Carlsbad law. A few phenocrysts display the grid-twinning characteristic of microcline, but it is very patchy and irregular throughout the crystal. A few Carlsbad-twinned phenocrysts, which, as evidenced by the twinning, are of monoclinic symmetry, contain irregular patches or domains which have grid twinning and are, therefore, triclinic. String- and vein-type perthitic lamellae are common and generally parallel the 001 plane. All the interstitial potassic feldspar grains are uniformly grid twinned.

The quartz shows marked undulatory extinction, has very irregular boundaries, and commonly contains a few extremely fine particles or bubbles, some of which are strung out in trains extending all or part way across a grain.

The hornblende is pleochroic from medium green to light greenish brown, and is generally in part altered to chlorite.

Other minerals which may be present in minor or trace amounts are biotite, magnetite, sphene, apatite, calcite, allanite, pyrite, zircon, myrmekite, and leucoxene.

Superimposed on the porphyritic texture of the granodiorite is a weak protoclastic-type texture due to incipient crushing and recrystallization around many of the feldspar phenocrysts.

Table 4 | VOLUME PERCENTAGE OF MINERALS IN THE BLACKSTOCK GRANODIORITE

Specimen	S-102 -67	S-110 -67	S-124 -67	S-134 -67	S-137 -67	S-126 -67	P-332 -67	P-339 -67
Plagioclase	51	49	49	64	54	63	63	53
Potassic Feldspar	17	20	25	8	21	12	13	17
Quartz	21	23	16	21	19	20	17	24
Hornblende	8	7	8	...	6	3	7	4
Biotite	1	x	1	x	x	...	1	1
Magnetite	x	x	x	x	x	x	x	x
Sphene	x	x	x	x	x	x	x	x
Apatite	x	x	x	...	x	x	x	x
Allanite	x	x	x	...	x	x	...	...
Zircon	x	...	...	...	...	...	...	...
Epidote	x	x	x	...	x	1	x	...
Chlorite	1	1	x	6	x	2	1	1
Leucoxene	...	...	...	...	...	...	x	...
Myrmekite	...	x	...	...	x	x	x	x
Calcite	...	...	...	1	...	...	...	...
Pyrite	...	...	...	x	...	...	...	...
Plagioclase composition (percent An)	6	10	8	17	5	8	9	...

Monzonite

The northern periphery of a small stock of monzonite extends from Fallon Township into the southern part of Langmuir Township. Many of the rocks are in what is mapped as a contaminated border zone and are mostly of a hybrid nature due to assimilation of the adjacent volcanics by the monzonite. In uncontaminated outcrops, the monzonite is medium grained, light pink, generally weakly foliated, and locally porphyritic with potassic feldspar phenocrysts up to 0.3 inches in size.

Six thin sections were examined. Three came from outcrops very close to the contact with the border zone and are slightly contaminated (P-299, S-211, G-8). The plagioclase has a bulk composition of albite to sodic oligoclase and is either relatively fresh or highly altered to epidote and sericite. The potassic feldspar is weakly perthitic and is invariably grid-twinned microcline with the exception of a small portion adjacent to the border zone facies. Green pleochroic hornblende, commonly shreddy in appearance and partly altered to chlorite and biotite, is the dominant mafic mineral. Close to the contact with the border zone, the monzonite contains clinopyroxene mostly replaced by hornblende. Other minerals present in minor or trace amounts are magnetite, sphene, apatite, leucoxene, allanite, and calcite.

Rocks in the contaminated border zone are very heterogeneous and range in composition from massive coarse-grained pyroxene amphibolite to mafic monzonite. Cross-cutting dikes of leucocratic monzonite are common. The contact of the monzonite and border zone as shown on the Geological Map 2206 (back pocket) is drawn at the southernmost exposures of massive pyroxene amphibolite. Dikes of pyroxene amphibolite and mafic gabbro intrude the adjacent volcanics.

Three thin sections of massive pyroxene amphibolite (P-306, P-310, D-21) were examined and have an average composition of 43 percent hornblende, 33 percent clinopyroxene, 11 percent oligoclase, 5 percent chlorite, 3 percent magnetite, 2 percent apatite, and minor sphene, epidote, calcite, and quartz.

Table 5 VOLUME PERCENTAGE OF MINERALS IN THE MONZONITE

Specimen	P-299 -67	P-306 -67	P-310 -67	S-211 -67	G-8 -67	D-21 -67
Plagioclase	36	42	56	44	43	48
Potassic Feldspar	28	48	33	39	21	33
Quartz	...	...	x	...	4	6
Hornblende	22	5	6	9	25	8
Clinopyroxene	4	x	...	3	x	x
Biotite	3	...	...	2	...	...
Magnetite	3	1	1	1	1	x
Sphene	...	1	1	...	2	3
Apatite	1	x	x	x	x	x
Allanite	...	...	...	...	x	...
Epidote	x	x	x	x	4	3
Chlorite	3	2	2	...	1	x
Leucoxene	x	...	...	...	...	...
Calcite	...	...	...	x	...	...

PROTEROZOIC

Huronian

COBALT GROUP

Outcrops of the Cobalt Group are confined to the extreme southwestern part of Langmuir Township and constitute one of the most northerly outliers of the Lower Huronian known to date. The two outcrops on the Langmuir-Fallon boundary are primarily a pebble conglomerate, although boulders up to 2 feet in diameter do occur. No layering or sorting is evident. The pebbles form up to 70 per cent of the rock, averaging approximately 20 percent, and are loosely cemented in a greywacke matrix. The pebbles and boulders are rounded to angular and composed of a variety of rock types including granite, granite porphyry, mafic and felsic volcanics, amphibolite, chert, quartz, and diabase. The easternmost Cobalt outcrop is primarily a dark green, buff-weathering, strongly schistose to fissile argillite. Locally, pebbles constitute up to 5 percent of the rock, but one boulder 3 feet by 2 feet was observed.

Late Mafic Intrusive Rocks

DIABASE

Diabase dikes are common in the area and trend either in a north or a northeast direction. In the Timmins area, the north-striking dikes usually are regarded as pre-Cobalt (Matachewan) in age, whereas the northeast-striking dikes are believed to be late Precambrian (Keweenawan). Because the contact relationships between the two sets of dikes were not observed in the Langmuir-Blackstock area and their relationships to the Cobalt Group are not known, all the diabase dikes are tentatively classified as late Proterozoic. The northeast-striking dikes are usually 400 to 500 feet thick, whereas north-trending dikes rarely exceed half this thickness, and are commonly 100 to 150 feet thick. In detail, contacts are rarely straight for any great length, but are step-like in nature.

The dikes are massive, fine to medium grained, dark grey to typically orange-brown weathering and form some of the most prominent outcrops in the area. All the exposed contacts exhibit extremely fine-grained to aphanitic chill margins and generally contain small phenocrysts of pale green plagioclase. Only in north-trending diabase dikes do phenocrysts persist over the entire width. The largest phenocrysts observed were 1 inch in maximum dimension, but average 0.1 to 0.3 inches. In thin section, the phenocrysts are commonly seen to be an aggregate of plagioclase grains and the term glomeroporphyritic is appropriate. In addition to the phenocrysts, there are other notable differences between the northeast- and north-trending dikes. Toward the central portions, the northeast-trending dikes become much coarser grained (0.1 to 0.3 inches), and the fresh surface takes on a light grey, grey-green or pinkish grey colour. The north-trending dikes are dark grey to greenish black. Commonly quartz is visible in the northeast-trending dikes and they do not contain the ubiquitous accessory pyrite of the north-trending dikes.

Microscopically little difference was noted between the two sets of dikes, except that generally in the northeast-trending set both the pyroxene and plagioclase are more highly altered than in the north-trending set. However this seems to be true for only the central sections of the dikes. Modal analyses of diabase from four north-striking and three northeast-striking dikes are given in Table 6.

Table 6 VOLUME PERCENTAGE OF MINERALS IN THE DIABASE DIKES

Specimen	N-S Dikes P-91 -67	P-205 -67	P-208 -67	P-235 -67	NE-SW Dikes P-215 -67	P-218 -67	P-287 -67
Plagioclase	62	58	53	49	49	63	51
Clinopyroxene	25	30	43	44	46	15	26
Hornblende	2	1	...	...	x	6	8
Biotite	1	2	x	1	x	2	...
Quartz	4	2	1	x	x	3	8
Magnetite	4	6	4	4	4	8	1
Pyrite	x	x	x	x	...	x	...
Epidote	...	x	...	...	...	x	x
Apatite	x	x	x	x	x	x	x
Zircon	x	...	...	...	...	...	...
Leucoxene	...	...	...	...	...	...	4
Chlorite	2	2	x	2	3	3	2
Calcite	...	x	x	...	...	...	...
Plagioclase composition (percent An)	24	...	67	...	64	63	63

One thin section was examined of a very fine-grained chill margin of a north-trending dike. In addition to plagioclase phenocrysts, an equal volume (approximately 4 percent) of pyroxene phenocrysts is present. The phenocrysts of plagioclase and pyroxene average approximately 0.5 to 0.8 mm in size and are enclosed in a groundmass of small plagioclase laths (0.15 mm) and partly chloritized fine-grained clinopyroxene.

CENOZOIC

PLEISTOCENE

A thick mantle of proglacial lacustrine clay and sandy clay covers large areas of Langmuir and Blackstock Townships. Drainage is, therefore, very poor and extensive wet swamps are common. The clay was presumably deposited in Lake Ojibway (Knight *et al.* 1919) which covered a vast part of northeastern Ontario during the Pleistocene Epoch.

Toward the eastern boundary of Blackstock Township, sand is the predominant mantling material.

Roches moutonnées, glacial striae, and grooving indicate the ice moved from a near north to south direction.

STRUCTURAL GEOLOGY

Geophysical and diamond drill hole information augment the structural data available for the area, but the paucity of outcrop still precludes any detailed interpretation.

FOLDS

The main structural trend in the area is outlined by a swing of the foliation from a north-northeast direction in the northern part of Langmuir Township to an east-west direction in the west-central part. This same trend shows up very well as a magnetic high on Aeromagnetic Maps 293G and 294G of the Geological Survey of Canada (Geol. Surv. Canada 1956a and b). Regionally, this high forms the southeastern end of an elliptical-dome-shaped structure approximately 14 miles long and 8 miles wide, the rim of which is discontinuously outlined by ultramafic intrusions in Langmuir, Carman, Shaw, Tisdale, Deloro, and Eldorado Townships (Ginn *et al.* 1964). In Langmuir Township, the swing in the foliations is in part exemplified by the ground electromagnetic conductors, many of which were shown from drilling to be caused by sulphide-bearing iron formations. Virtually all the foliations dip in an easterly direction and the swing in the foliation coincides with the trace of the axial plane of a syncline overturned to the northwest. The serpentinite has been especially useful in outlining this fold structure since it forms more or less conformable and fairly continuous zones.

Minor "W"-shaped folds (Photo 4) in finely layered felsic tuffs in the large outcrop of pyroclastics near the property of Larchmont Mines Limited (19) plunge steeply (45° to 65°) to the northeast and are interpreted as plunging in unison with the major fold structure in this vicinity. In the same outcrop a layer of boulder agglomerate (Photo 13) shows a gradation from coarse to fine fragments in a westerly direction, thus supporting the interpretation of a synclinal axis in this vicinity. Contrary to this is the presence of sigmoidal tension fractures (Photo 14) in a gabbroic dike intruding the above-mentioned pyroclastics, signifying a left-lateral movement and suggesting the axis is anticlinal rather than synclinal.

A ground magnetic survey conducted by McWatters Gold Mines Limited (24) suggests the presence of an anticlinal nose along the west boundary approximately 0.5 miles north of the Forks River. The axial trace of this anticline probably extends as far northeast as the Montreal River Fault, i.e., passing through the long axis of the serpentinite lens immediately east of the above-mentioned nose, and trending northeast through the outcrop adjoining the southern boundary of the patented claim of D. Deeks (8).

Mapping by the writer (Pyke 1968) in Fallon Township to the south indicates the presence of a northeast-trending synclinal- to basinal-type structure extending along the axis of the monzonite intrusion. This axis would then extend just within the southeastern corner of Langmuir Township.

FAULTS

There are three main directions of faulting: north, northeast, and northwest. Many of the smaller faults shown on the accompanying Map 2206 (back pocket) are taken from geophysical and geological data provided in assessment reports submitted to the Ontario Department of Mines. On this basis, the criteria most commonly used in this report in the interpretation of a fault is the presence of one or more of the following: (1) a linear of magnetic lows; (2) an electromagnetic anomaly, which drilling has generally confirmed as being due to shearing; (3) an offset or break in magnetic or electromagnetic configurations. Outcrop data such as shearing, alteration, and offsets in conjunction with topographic lineaments have assisted both in locating the extension of the faults interpreted from geophysics and in outlining additional faults.

ODM 8359

Photo 13—Felsic volcanic boulder agglomerate in same outcrop as Photo 14. Pick end of hammerhead in direction of tops.

ODM 3860

Photo 14—Sigmoidal tension fractures within gabbroic dike, in outcrop near western boundary of property of Larchmont Mines (19).

The dominant fault structure in the area is the Montreal River Fault (Ginn *et al.* 1964) which extends in a northwest direction across Langmuir Township, displaying a left-hand strike separation varying from approximately ¼ to ½ mile. With the exception of the coincidence of the fault with the Night Hawk River, the topographic expression of this structure is weak.

An extensive fault, subparallel to the Montreal River Fault, extends across the southwestern part of Langmuir Township and, at least in part, coincides with the axis of a magnetic low as shown on Aeromagnetic Map 2, compiled by Acme Gas and Oil Company Limited (2).[1] The northern extension of this fault would join with the Croteau Creek Fault in the southeastern part of Shaw Township (Carlson 1967). On the basis of the assessment work filed by Maybrun Mines Limited (25),[2] the southern extension of this fault seems to pass into Fallon Township approximately 1 mile west of the old barite mine.

The apparent right-hand displacement of the north-striking diabase dikes across the Forks River is the basis for the interpretation of a fault coinciding with the river.

The interpretation of the north-south fault along Night Hawk Lake is supported by: the abundance of shearing encountered in the drill hole of Tex-Sol Mines Limited (36) near the centre of the lake; the offset of the large northeast-trending diabase dike in Carman Township[3]; the location of the lake, itself.

The northeast-trending fault coincident with the bay along the northwest side of St. Peter Bay is interpreted in part from a topographic lineament, in addition to a suggested linear and break in the isomagnetic contours.[4]

In Blackstock Township, a north-south fault along the Whitefish River could account for the abrupt termination of the large northeast-trending diabase dike (i.e., the fault having acted as a barrier at the time of intrusion).

On the basis of mapping in Fasken Township (Pyke 1968), a north-south fault is thought to coincide with the Whitefish River in the southwestern part of Blackstock Township.

ECONOMIC GEOLOGY

Economic interest in the area centres mainly around the occurrence of nickel mineralization associated with the serpentinized dunites in the northwestern quadrant of Langmuir Township. This impetus in nickel was prompted by McWatters Gold Mines Limited (24), who in 1964 discovered a small nickel deposit within a narrow layer of serpentinite (approximately 640,000 tons, averaging 1 percent Ni; information from M. Zurowski).

Prior to the initial exploration of McWatters Gold Mines Limited (24) in 1962, the area was prospected primarily for gold in the siliceous iron formations and in granite and quartz veins. Much of this exploration work dates back to the early 1900's,

[1]On file with the Resident Geologist, Ontario Department of Mines, Timmins.

[2]On file with the Resident Geologist, Ontario Department of Mines, Timmins.

[3]This is not a strong point, however, as north-south faulting presumably predates the northeast-trending diabase, although later (post-diabase) recurrence of movement is possible.

[4]Information from Company reports on file with Resident Geologist, Timmins.

following the discovery of precious metals in the Porcupine area. Only traces of gold were uncovered in the Langmuir-Blackstock area.

Mineral production from the area, as of 1967, consisted of 1955 tons of barite (Guillet 1963, p. 14), which was mined intermittently from 1911 to 1948 from two narrow veins in mafic volcanics near the south boundary of Langmuir Township. The property is currently held by Peerless Canadian Explorations Limited (35).

Narrow veinlets of asbestos are common locally in the serpentinized dunites, but from available data they do not seem to be present in sufficient quantity to be of economic value.

In 1967, claims in good standing covered nearly all of Langmuir Township with the exception of the southeastern corner.

Blackstock Township has attracted little exploration interest because of the preponderance of granodiorite underlying the township. In 1967, only two claim groups, near the west-central boundary and southwestern corner of the township, respectively, were in good standing.

A written description is given of properties, deposits, and exploration areas, currently (1967) in good standing, for which assessment work has been filed for all or any part of the property during the period 1951 to 1967. In addition the patented claims of R. LaSalle (20), the former property of Dominion Gulf Company [1951] (9), the patented claims of Peerless Canadian Explorations Limited (35), and a molybdenum deposit (39) (staked in 1968 by L. Hill in Blackstock Township) are described.

All claims that were staked during the period 1951 to 1967 and for which assessment work was filed are listed in Table 7 regardless of whether or not they were in good standing in 1967.

Figure 3 is a sketch map of Langmuir Township showing the approximate position and outline of the unpatented claims to be discussed in the following property descriptions.

DESCRIPTION OF PROPERTIES, DEPOSITS, AND EXPLORATION AREAS

Accra Explorations Limited (1)

In 1967, Accra Explorations Limited held six unpatented claims[1], 78995 to 78997 inclusive and 79003 to 79005 inclusive, near the north-central part of Langmuir Township. Outcrop is very sparse and consists entirely of serpentinite, although drilling indicates that the central part of the claims is underlain mainly by felsic volcanics with narrow horizons of iron formation, locally containing 30 to 40 percent magnetite. In 1965, three diamond drill holes were sunk, totalling 1,145 feet, to test three magnetic and one electromagnetic anomaly. Two intersections over a 1 foot width, one in chert and the other in rhyolite tuff, contain 10 percent pyrrhotite with minor associated chalcopyrite.

[1]All claim numbers are preceded by P. unless otherwise stated.

Table 7

SUMMARY OF EXPLORATION WORK IN LANGMUIR AND BLACKSTOCK TOWNSHIPS (1951-1967)
(FROM FILES OF THE ONTARIO DEPARTMENT OF MINES)

Property Name	Number of Claims	Geophysics			Geological Map	Diamond Drilling		Corresponding Property Number on Map+	Assessment File Number		Township		Year Work Done	Remarks
		MAG.	EM.	IP.		Number of Holes	Total Footage		Timmins	Toronto	Langmuir	Blackstock		
Accra Explorations Limited	6	*	*			3	1,145	1	T- 898	65-1430	*		1965	
Acme Gas and Oil Company Limited	18	*	*					2	T-1250	63-2044	*		1966	The magnetic and electromagnetic survey was flown by Canadian Aero Mineral Surveys.
Canadian Johns-Manville Company Limited	9				*	3	902		T- 657		*		1958	Formerly held 9 claims in area mainly held in 1967 by Maybrun Mines.
Con-Key Mines Limited	9	*	*	*				6	T-1313	63-1980	*		1966	
Con-Shawkey Gold Mines Limited	14	*	*		*	6	2,642	7	T-1292	63-2021	*		1966	
Cravit, H.	7	*	*		*			38	T-1260	63-1792		*	1965	Formerly held an adjacent 3 claims in Langmuir Township. Exploration work done by Kidd Mining Company Limited.
Dominion Gulf Company [1951]	27	*			*			9	T- 122 T- 480	63- 273	*		1951	Formerly held 25 claims covering large outcrop area in southeastern part of Langmuir and 2 claims on north central boundary of Langmuir.
Falconbridge Nickel Mines Limited	4	*	*						T- 696		*		1962	Formerly held 4 claims in area now held by Con-Shawkey (7B) and Larchmont.
First National Uranium Mines Limited	9	*	*			10	3,786	11	T-1194	63-1797	*		1965	Formerly named National Explorations Limited.
Galata, E.	9					12	3,475	12	T-1016		*		1964-65	10 of the holes totalling 2475' drilled by Urban Quebec Mines Limited.
Globe Exploration and Mining Company Limited	7	*	*						T-1142		*		1965	Formerly held 7 claims. In 1967, claims were mainly held by PCE Explorations Limited, 2 claims were open, and westernmost claim was held by G. Lelievre.
Gomar Mines Limited	5	*	*					13	T- 954	63-1429	*		1965	Also did a geochemical soil sampling survey.
Hoffman, C.K.	4							15			*			Property formerly held in part by Newrich Explorations Limited and Silverplace Mines Limited.
International Kenville Gold Mines Limited	7	*	*						T-1205	63-1843 63-2015	*		1965	Formerly held 7 claims in southeastern part of Langmuir adjacent to a much larger block in Fallon Township.
International Nickel Company of Canada Limited, The	82							16	T-1018		*		1966-67	Recorded assessment work done by Mining Corporation of Canada (1964) Limited. Results of International Nickel's Exploration unknown.
Lake Kozac Mines Limited	10	*	*						T-1323	63-1977	*		1966	Formerly held 10 claims in vicinity of large lake in southeastern part of Langmuir Township.
Larchmont Mines Limited	5	*	*	*				19	T- 696	63-1881	*		1966	Falconbridge Nickel Mines formerly held some of the westernmost claims.

Lavigne, J.	6		▼					21			*		*Claims for northernmost part of claim group formerly held by Magoma Mines Limited.*
Lelievar, G.	6	*	*			4	1,769	22	T-1258		*	1966	*Exploration work done by Cantri Mines Limited.*
McWatters Gold Mines Limited	54	*	*		*	52	25,735	24	T- 652	63-1171	*	1962-66	
Magoma Mines Limited	11	*	*						T- 993	63-1493	*	1965	
Maybrun Mines Limited	12	*	*			3	1,498	25	T- 959	63-1484	*	1965	
Mespi Mines Limited	3	*	*					26	T- 787	63-1400	*	1964	*Magnetic and EM. surveys flown by Hunting Survey Corporation.*
Michaud, J.	6							27			*		*Northernmost claim was formerly held by Newrich Explorations Limited.*
Mid–North Engineering Services Limited	13	*	*			2	785	28	T-1312	63-2005	*	1966	*Formerly named Northwest Canalask Nickel Mines Limited.*
Mining Corporation of Canada (1964) Limited	2	*	*		*	1	504	29	T-1018		*	1965	*In 1965 this property consisted of an additional 8 claims along the Forks River.*
Min–Ore Mines Limited	12	*	*					30	T-1167	63-1741	*	1965	
Newrich Explorations Limited	9	*	*						T-1126	63-1715	*	1965	*Formerly held claims to the south and east of First Nat'l Uranium. Includes part of claim groups held in 1967 by First Nat'l Uranium, J. Michaud, C. Hoffman, and G. Lelievar.*
New Rouyn Merger Mines Limited	2					7	709		T- 844		*	1964-65	*Formerly held 2 claims in area now held by Con-Shawkey (7).*
North Crescent Holdings and Explorations Limited	12	*	*					32	T- 994	63-1476	*	1965	
Ourgold Mining Company Limited	6	*	*						T-1328	63-2004	*	1966	*Formerly held 6 claims at north end of St. Peter Bay.*
Paramaque Mines Limited	14	*	*			4	2,420	33	T-1015	63 1645	*	1965	
PCE Explorations Limited	24	*	*			3	1,432	34	T-1298	63-2039	*	1966	
Silverplace Mines Limited	1					2	704		T-1364		*	1966	*Formerly held one claim on property held in 1967 by C. Hoffman.*
Texas Gulf Sulphur Company	29					2	637		T- 451		*	1959-60	*Formerly held 29 claims on property held in 1967 by International Nickel.*
Tex-Sol Explorations Limited	11	*	*			5	1,770	36	T- 961	63-1737	*	1965	
Tinex Development Explorations Limited	10	*	*					37	T-1160	63-1636	*	1965	
United Buffadison Mines Limited	3							40	T-1334		*	1966	*In 1967 held an additional 30 contiguous claims in northwest corner of Fasken Township, where all the exploration work has been concentrated.*
United Porcupine Mines Limited	10	*							T-1221	63-1823	*	1965	
Waco Petroleums Limited	4	*	*			8	4,089		T-1259		*	1966	

+ *If no property number given then claims were not in good standing in 1967, with the exception of Dominion Gulf Company [1951]*

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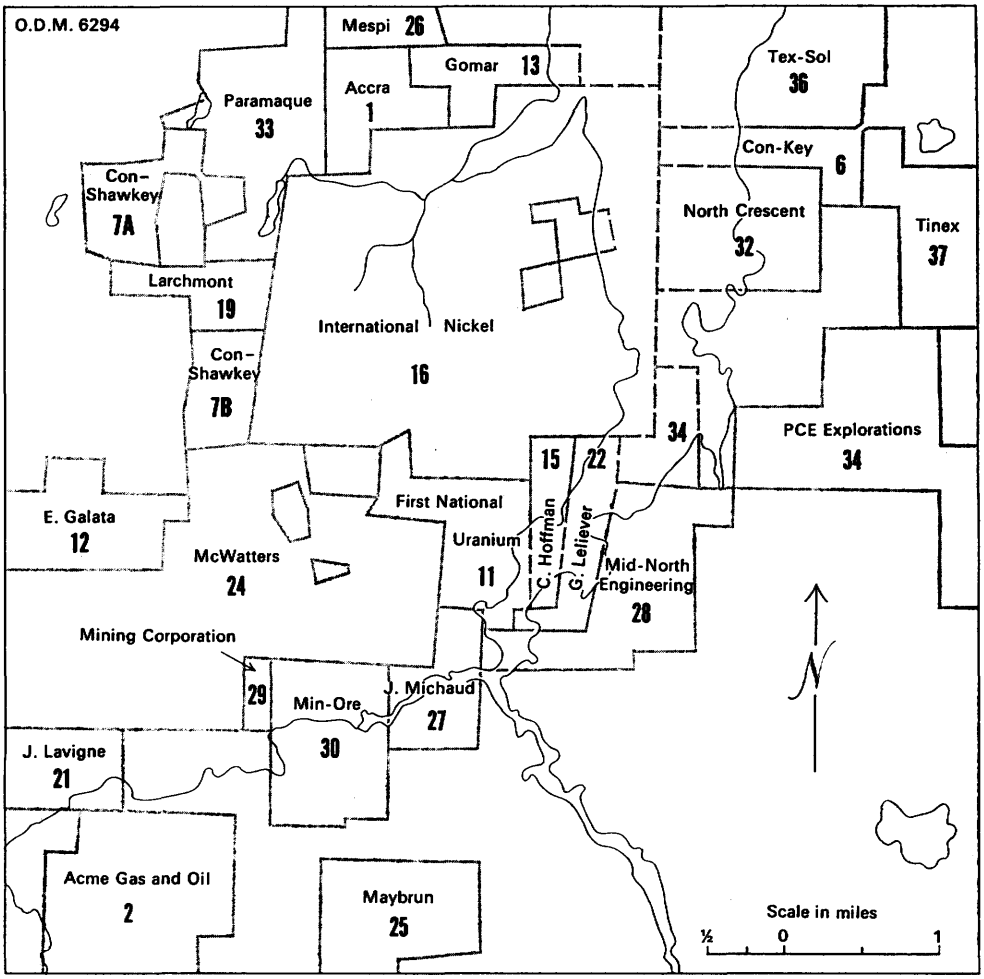

Figure 3–Sketch map of Langmuir Township showing approximate outline and position of unpatented claims in good standing in 1967, for which assessment work has been filed with the Ontario Department of Mines for all or a portion of the claims.

Acme Gas and Oil Company Limited (2)

A group of 18 unpatented claims, 74660 to 74677 inclusive, in the southwestern part of Langmuir Township were held by Acme Gas and Oil Company Limited in 1967. The assessment work for these as well as blocks of claims in adjacent townships, especially Eldorado, consisted of a combined airborne magnetic and electromagnetic survey, flown by Canadian Aero Mineral Surveys Limited, and completed in February 1966. The isomagnetic contour map submitted for assessment work is at a scale of 1 inch to ¼ mile.

The above claims in Langmuir Township include much of what was formerly held by the Porcupine Miracle Mining Company Limited, which Berry (1940, p.16-17) described as follows:

> The claims were staked during the period 1910-14 and included some claims formerly held by the Gray Mining Syndicate of Toronto. The Porcupine Miracle Mining Company Limited, of Toledo, Ohio, was formed in 1911 . . .
>
> . . . Two 2-compartment shafts and several small prospect shafts were sunk on porphyry dikes containing a small amount of disseminated pyrite and a few narrow quartz stringers. Underground operations were carried on from 1912 to 1915. A mill was erected near the southern large shaft, and both amalgamation and cyanidation processes were tried in an attempt to extract gold from the rock. No gold was obtained.

Figure 4 is a sketch map of the geology around the old shafts. The rocks present are serpentinized and, locally, carbonatized peridotite-pyroxenite which is intruded by fine- to medium-grained granite and granite porphyry and dikes of diabase. Many of the ultramafic rocks west of the diabase dikes are carbonatized and, locally, sheared and hematitized. "Laths" were observed at a few localities in the ultramafic rocks as well as the irregular polygonal-type structure discussed in the section on "Serpentinized Peridotite-Pyroxenite".

All the granitic rocks are leucocratic and some contain a preponderance of equant feldspar phenocrysts up to 0.10 inches. Minor disseminated pyrite was the only sulphide mineral observed.

The diabase dikes are massive, have a maximum thickness of 250 feet, and, locally, contain abundant green-weathered epidote. Close to the fault in the northeastern part of Figure 4, the diabase contains narrow veinlets of asbestos.

Con-Key Mines Limited (6)

In 1967, Con-Key Mines Limited held nine unpatented claims, 78893, 78894, 78900, 78905, 79960, 79961, 80627, 80628, and 80631, in the northeastern part of Langmuir Township. The claims seem to be underlain mainly by mafic volcanics converted by contact metamorphism to amphibolite.

Exploration work was done during 1966 and consisted of electromagnetic, magnetic, and induced polarization surveys. No conductive zones were detected. The magnetic survey suggests the presence of a north-trending diabase dike approximately 800 feet west of the small lake on the property. The induced polarization survey indicated one possible anomaly, although the results were inconclusive.

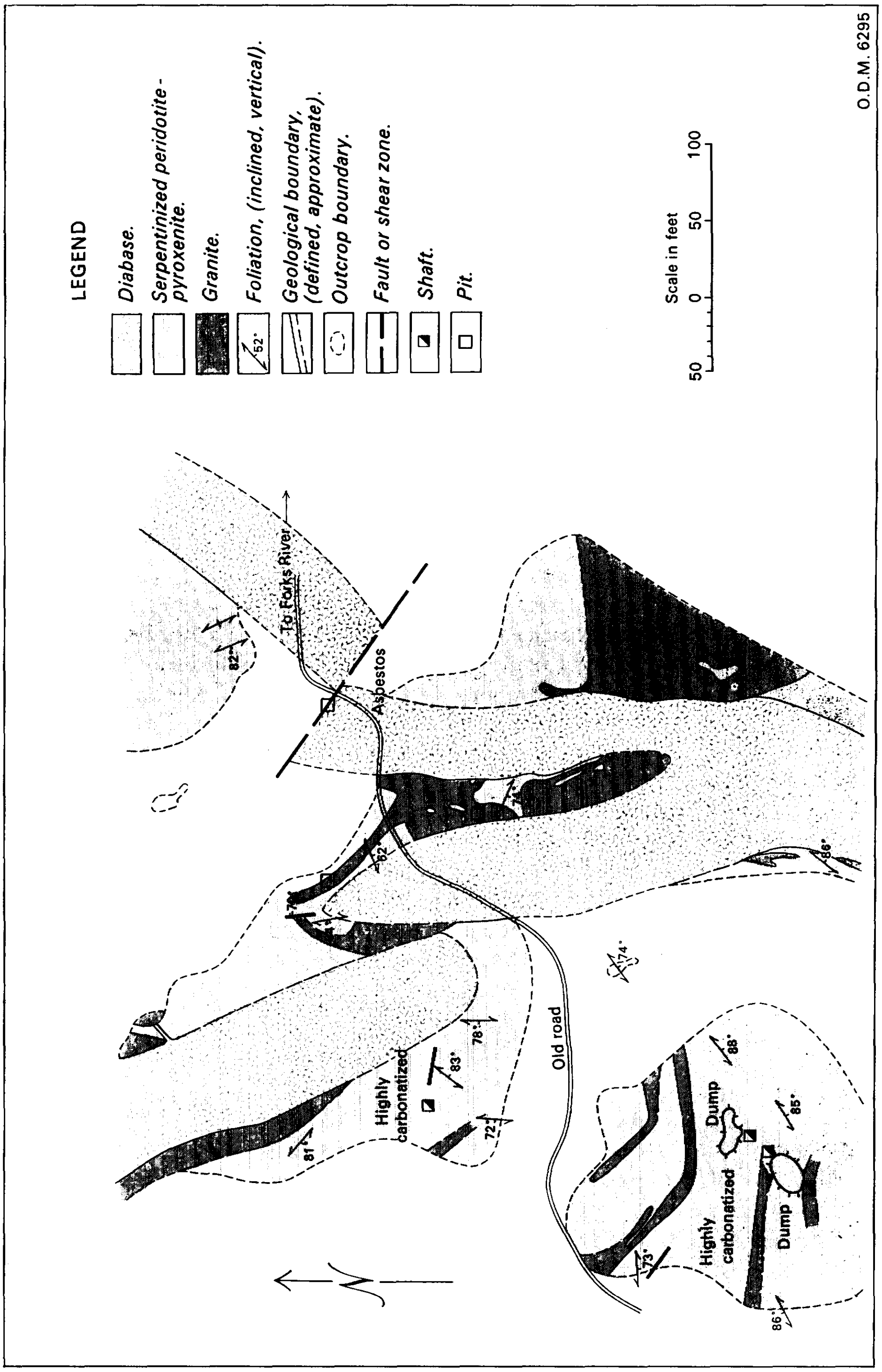

Figure 4—Acme Gas and Oil Company Limited (2) claim group; former gold property of Porcupine Miracle Mining Company Limited.

Con-Shawkey Gold Mines Limited (7A, 7B)

Con-Shawkey Gold Mines Limited held the following two groups of unpatented claims in 1967: eight claims, 64951, 64953, 82189, 83154, 85599, and 84897 to 84899 inclusive, near the northwestern corner of Langmuir Township; six claims, 84085 to 84087 inclusive and 85542 to 85544 inclusive in the west-central part of the township (7B).

NORTHERN CLAIM GROUP (7A)

The northern claim group straddles a part of the trondhjemite-volcanic contact and includes part of the serpentinite and volcanics to the north and east of the adjacent patented claims (18). In 1966, Con-Shawkey did magnetic and electromagnetic surveys on the property.

Some of these claims were formerly held by Falconbridge Nickel Mines Limited and New Rouyn Merger Mines Limited.

In 1962, Falconbridge did magnetic and electromagnetic surveys on four claims adjacent to the west side of the patented claim group (18). No anomalies were found that would be conducive to drilling.

New Rouyn Merger held two claims adjacent to the north and northeast sides, respectively, of the patented claim group (18), which they optioned from R. Allerston. These claims include the sulphide mineralization depicted on the accompanying Map 2206 (back pocket) and shown in detail in Figure 5. Here, a narrow lens of rusty-weathering, cherty, sulphide-bearing iron formation is exposed in a trench for a length of approximately 35 feet. Alternating layers of massive sulphide, up to 1.5 inches wide, and quartz occupy the central part of the trench over a maximum width of approximately 12 inches. The sulphides consist almost entirely of pyrrhotite with minor traces of chalcopyrite and pyrite. Some of the quartz (chert?) has a brecciated or boudinaged appearance and is broken into rectangular fragments, up to 1.5 by 3 inches in size, which are surrounded by pyrrhotite. Elsewhere in the trench, the sulphides are sparsely disseminated. One specimen of the massive sulphide collected by the writer assayed[1] 0.75 percent copper with traces of gold. The surrounding outcrops of dacite are generally massive and, locally, contain quartz phenocrysts.

In 1964 to 1965, New Rouyn Merger drilled seven holes, totalling 709 feet, across the above-mentioned mineralized zone. The best assay was 0.4 percent copper and 0.5 percent nickel across a 5 foot width[2]. The maximum width of the sulphide-bearing zone, as reported in the drill logs, is approximately 45 feet.

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[1]Analysis by the Laboratory and Research Branch, Ontario Department of Mines.

[2]From company report (T-844) on file with the Resident Geologist, Ontario Department of Mines, Timmins.

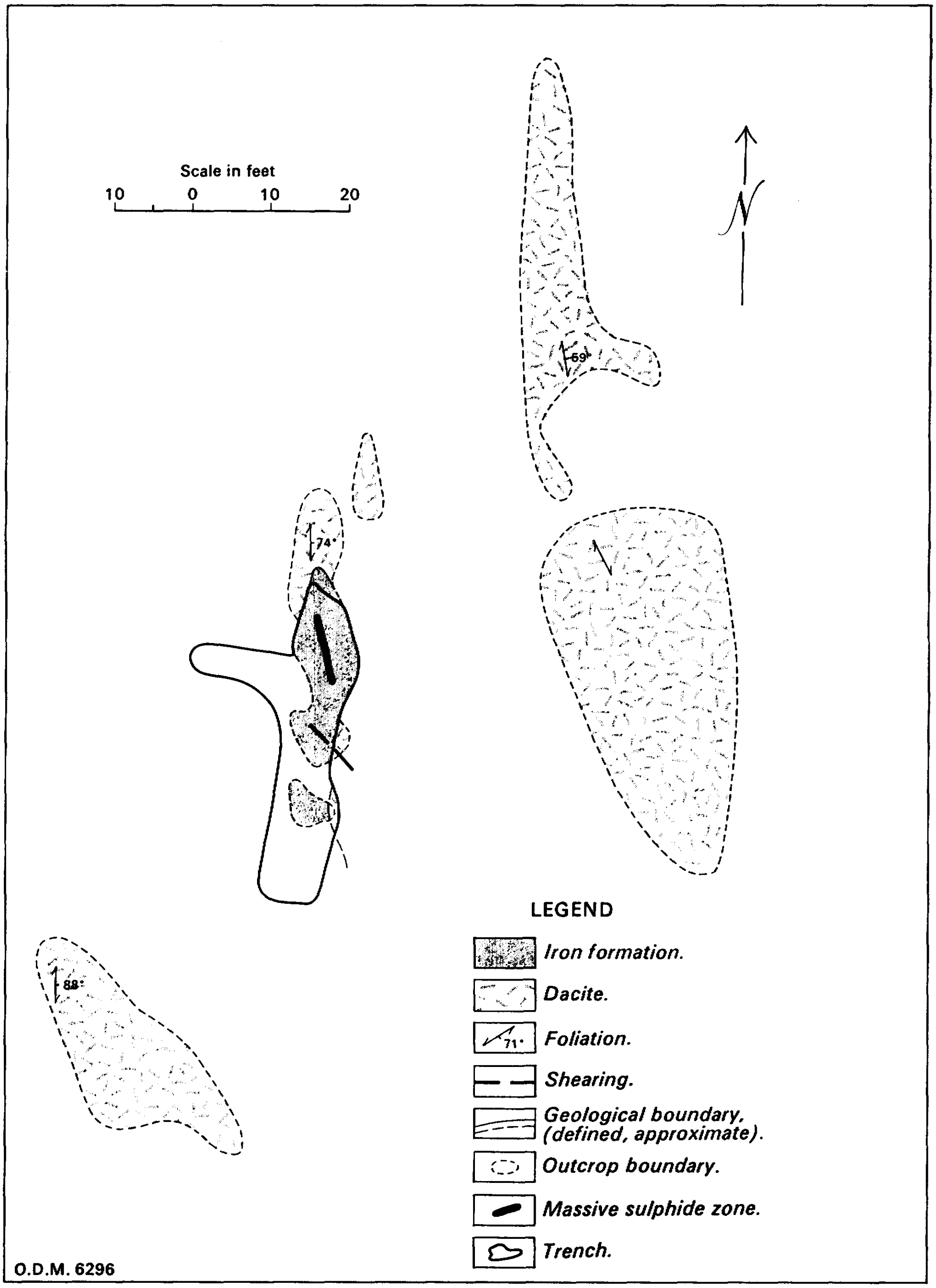

Figure 5—Con-Shawkey Gold Mines Limited (7A) claim group, copper showing.

WEST-CENTRAL CLAIM GROUP (7B)

Most of the exploration work conducted by Con-Shawkey has been concentrated on this west-central group (7B), which is underlain predominantly by felsic volcanics and serpentinite. In addition to magnetic and electromagnetic surveys in 1966, the Company did minor trenching and drilled six holes totalling 2,642 feet. Sulphide mineralization is sparse; the maximum recorded in the drill logs is 2 percent pyrite-pyrrhotite with traces of chalcopyrite, over a width of 5 feet. A geological map at a scale of 1 inch to 200 feet accompanies the recorded assessment work.

H. Cravit (38)

H. Cravit, in 1967, held a group of seven unpatented claims, 79055, 79056, 78972, and 78974 to 78977 inclusive in Blackstock Township, approximately 2.5 to 3 miles north of the southwestern corner of the township. Bedrock is not exposed on the claims, but Aeromagnetic Map 294G of the Geological Survey of Canada (Geol. Surv. Canada 1956b) indicates that the granodiorite-metavolcanic contact trends southeast across the property.

In 1965, Kidd Mining Company Limited did electromagnetic and magnetic surveys on the claims. Numerous weak conductors interpreted mainly as shear zones associated with emplacement of the granodiorite were outlined, but were not considered worth drilling. An interpretation of the underlying bedrock is shown on a map accompanying the report submitted for assessment work.

Dominion Gulf Company [1951] (9)

In 1951, Dominion Gulf Company did magnetic and geological surveys on 25 unpatented claims in the southeastern quadrant of Langmuir Township. The claims have since been allowed to lapse. The claims covered the large outcrop area of serpentinized ultramafic rocks and adjacent volcanics and contaminated border zone of the monzonite east of the Night Hawk River. Minor amounts of asbestos fibre up to ¼ inch in length were reported. Minor sulphide was noted at one locality and all specimens gave a negative nickel reaction when tested with dimethylglyoxine. Spectrographic analyses[1] of the best samples have a nickel and chromium content ranging between 0.05 percent and 0.5 percent.

In the same year, Dominion Gulf held two claims along the north-central boundary of Langmuir Township, but exploration work was confined to four adjacent claims in Carman Township.

[1]From company report (T-122) on file with the Resident Geologist, Ontario Department of Mines, Timmins.

First National Uranium Mines Limited (11)

In 1967, a group of nine unpatented claims, 78885, 78886 and 78874 to 78880 inclusive, in the central part of Langmuir Township approximately ⅓ of a mile north of the junction of the Forks and Night Hawk Rivers were held by the First National Uranium Mines Limited, formerly called National Explorations Limited. The claims are almost entirely drift covered with only two small exposures of a north-south striking diabase dike intruding volcanics. The diabase shows a left-hand strike separation of approximately 800 feet.

Magnetic and electromagnetic surveys were completed in 1965 and 10 holes totalling 3,786 feet were drilled in 1966. The electromagnetic conductors and magnetic highs that were drilled represented shear zones and ultramafic intrusions, respectively.

A lens of serpentinized peridotite intersected by drilling contains up to 3 percent sulphide, although the best recorded assay[1] from the ultramafic body was 0.13 percent nickel. The drill core indicates that the claims are underlain mainly by schistose mafic volcanics with small amounts of serpentinite.

E. Galata (12)

A group of nine unpatented claims, 88707, 91788, 91789, 92219, 92223, and 85328 to 85331 inclusive, near the west-central boundary of Langmuir Township, were held by E. Galata in 1967. The claims, underlain mainly by felsic volcanics and serpentinite, also include part of the southern contact of the trondhjemite. Development work consisted of stripping, trenching, and diamond drilling.

Two trenches have been blasted along a rusty, sheared dacite-serpentinite contact near the north side of the main showing (Figure 6). Massive magnetite with minor associated sulphides are exposed for a length of 9 feet and a maximum width of 6 inches in the most easterly trench. The gossan zone extends approximately 18 to 24 inches into the adjacent serpentinite, where the dominant mineralization is magnetite. The second trench contains only disseminated magnetite and minor sulphides. Two polished thin sections were examined, and the sulphides consist of pyrrhotite, pyrite, and pentlandite. One specimen of the massive magnetite and associated sulphides and one of the mineralized wall-rock, both collected by the writer, assayed[2] 1.77 percent nickel and 1.25 percent nickel, respectively, with traces of zinc, lead, copper, and gold. No platinum was detected.

Two trenches in massive rhyodactite at the south end of the main showing contain only minor pyrite, both as disseminations and concentrations along narrow slip planes. Similar mineralization occurs in another trench southeast of the main showing.

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[1]From company report (T-1194) on file with the Resident Geologist, Ontario Department of Mines, Timmins.

[2]Analyses by the Laboratory and Research Branch, Ontario Department of Mines.

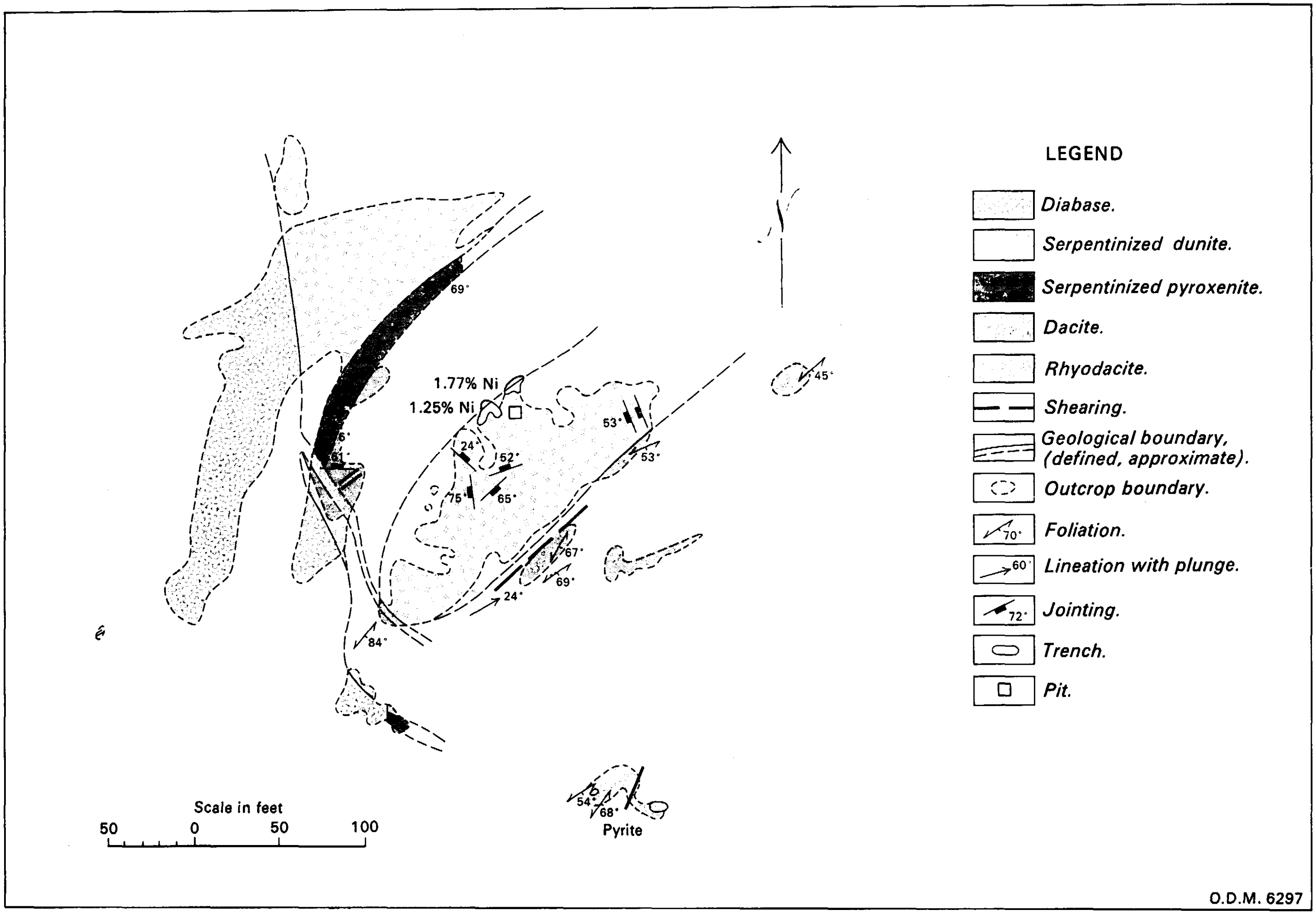

Figure 6–E. Galata (12) nickel showing.

During the latter part of 1964 and early 1965, ten holes, totalling 2,476 feet, were drilled on the property by Urban Quebec Mines Limited, who, at that time, had optioned the property from E. Galata. Six of the holes were drilled on the main showing and, from these, 20 samples of serpentinite core varying in length from 1.5 to 10 feet were assayed for nickel which ranged from 0.03 to 0.99 percent, averaging 0.27 percent[1].

North of the main showing, two pits have been blasted in the serpentinite, the larger (4 x 15 x 3 feet deep) of which, locally, contains numerous narrow seams of fibrous asbestos up to 0.10 inches in length. No attempt was made to estimate the percent of fibre present.

In 1967, E. Galata drilled two holes, totalling 1,000 feet, near the west boundary of his claim group. No mineralization was reported. Some additional stripping and trenching also were done.

Gomar Mines Limited (13)

A group of five unpatented claims, 78998 to 79002 inclusive, near the north-central part of Langmuir Township were held by Gomar Mines Limited in 1967. The claims are entirely drift covered. From the magnetic data, serpentinite appears to underlie the eastern periphery, and volcanics the remainder of the claim group. An electromagnetic survey detected no conductive zones. The exploration work was done during 1965.

A geochemical soil sampling survey was done to determine concentrations of nickel and combined copper, zinc, and lead. Samples were taken at 100-foot intervals along lines spaced at 200 feet. Only anomalous nickel zones were outlined with concentrations up to 60 ppm. No follow-up work was undertaken.

L. Hill (39)

In the southwestern quadrant of Blackstock Township, the granodiorite has been highly fractured and intruded by numerous quartz veins. North of the Whitefish River, a zone of quartz veins strikes southeasterly forming part of a fracture zone ranging in width from approximately 30 to 70 feet. Individual veins range in width from a few inches to 12 feet. Micaceous hematite is common along the surface and in fractures in the veins and to a minor degree in the granodiorite. Locally the granodiorite contains 1 to 2 percent disseminated pyrite. Two specimens of sheared granodiorite and two specimens of the quartz veins collected by the writer were analysed[2] for gold and contain only traces. Of the above specimens, one each of the granodiorite and quartz were analysed for molybdenum and gave negative results.

On the south side of the Whitefish River and 20 feet from shore, a quartz vein with an exposed width of 15 feet is in contact with a strongly foliated granodiorite. The

[1]From company report (T-1016) on file with the Resident Geologist, Ontario Department of Mines, Timmins.

[2]Analyses by the Laboratory and Research Branch, Ontario Department of Mines.

contact strikes northwest, and this is presumably part of the same fracture zone occupied by the quartz veins north of the river. Two specimens collected by the writer were analysed[1] for gold and molybdenum. Both contain only traces of gold; one contains no molybdenum and the other 0.10 percent molybdenum. The molybdenite forms part of a narrow seam in the quartz specimen which, macroscopically, resembles a mixture of fine quartz and either specular hematite or graphite. At best there are only traces of these seams in the quartz vein.

Since the mapping of the area by the writer in 1967, L. Hill staked a group of four claims, on the south side of the Whitefish River, part of which include the above-mentioned quartz vein containing traces of molybdenum.

C. K. Hoffman (15)

In 1967, a group of 4 unpatented claims, 85846, 85847, 85791, and 85793, about ¾ mile north-northeast of the junction of the Forks and Night Hawk Rivers in Langmuir Township, were held by C. K. Hoffman. Two small outcrops of felsic volcanics occur at the north end of the claims: the remainder of the claim group is obscured by drift and the Night Hawk River.

The three southernmost claims were formerly held by Newrich Explorations Limited who, in 1965, did magnetic and electromagnetic surveys on the property. The northernmost claim was formerly held by Silverplace Mines Limited who, in 1966, drilled two holes totalling 704 feet to intersect one magnetic (serpentinite) and two conductors (contact and possible fault zone). Minor pyrite was the only mineralization found. From the exploration work, most of the claim group appears to be underlain by serpentinite and mafic volcanics, the contact of which seems to trend northeast across the claims.

The International Nickel Company of Canada Limited (16)

In 1967, The International Nickel Company of Canada Limited held the following group of 82 unpatented claims in the north-central portion of Langmuir Township: 70568 to 70600 inclusive, 70801 to 70839 inclusive, and 74154 to 74163 inclusive.

The area is mostly drift covered and, with the exception of the few outcrops that do occur on the claims, little detailed information is available. These claims were originally staked by Mining Corporation of Canada (1964) Limited (29) in 1964 who, subsequently in 1965 to 1966, did a geophysical survey and drilled 22 holes totalling 12,379 feet. In 1959 to 1960, Texas Gulf Sulphur Company held a group of 29 claims, in what is now International Nickel's claim block. Texas Gulf drilled two holes total ling 637 feet to test two electromagnetic conductors, which proved to be caused by massive pyrite-pyrrhotite zones in iron formation. The best assay was 0.01 ounces of gold per ton. Little information is available on International Nickel's exploration work,

[1]Analyses by the Laboratory and Research Branch, Ontario Department of Mines.

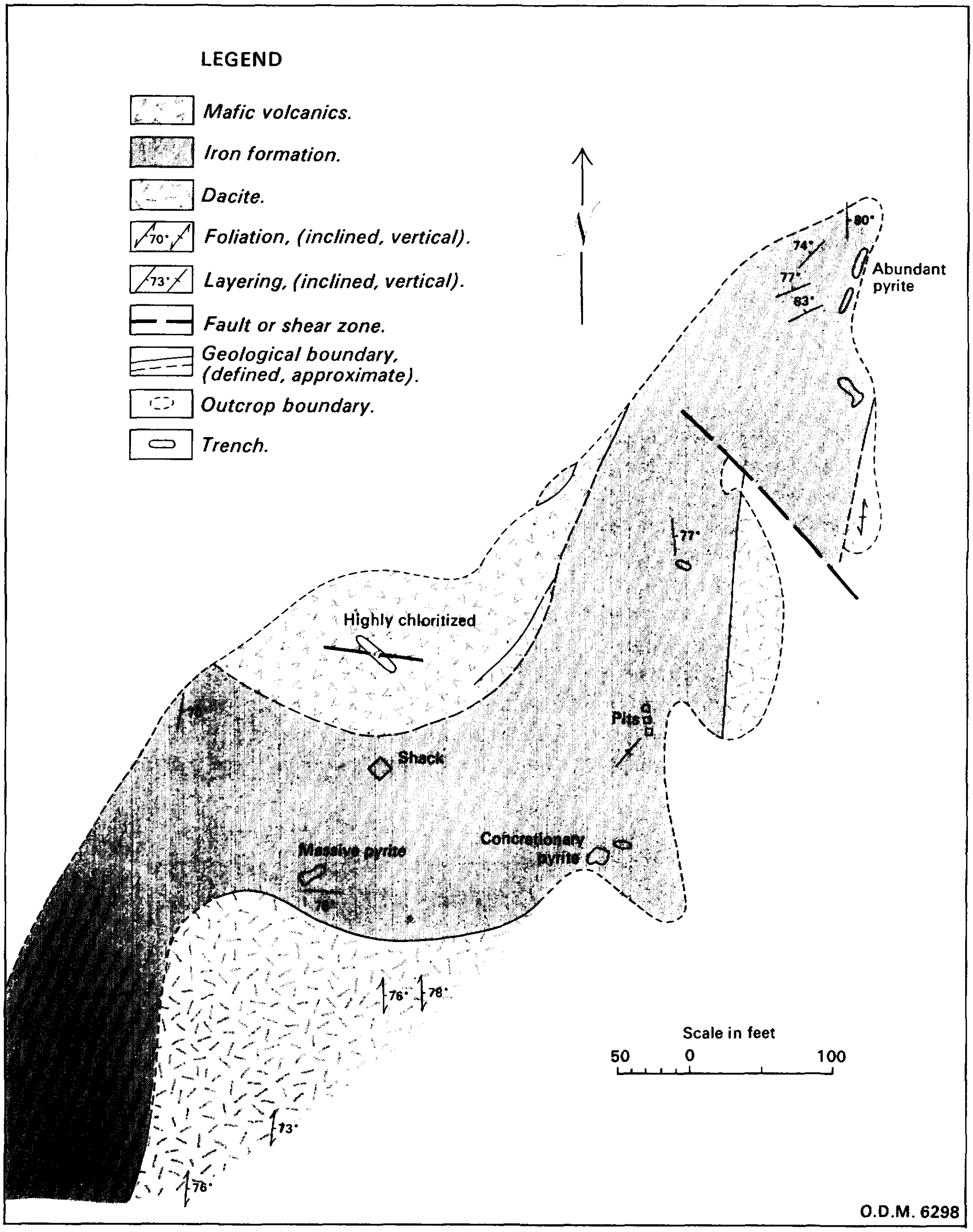

Figure 7–Sulphide-bearing iron formation on the property of The International Nickel Company of Canada Limited (16).

other than at least one small lens (information kindly supplied to writer by M. Zurowski) of nickel mineralization having been located near the southern boundary of the claim group. Much of the drilling, however, has been concentrated in the northeastern quadrant of the claim group, where perhaps similar types of deposits have been outlined.

The area seems to be underlain primarily by serpentinite and felsic volcanics, forming, at least, part of the southeasterly limb of the syncline outlined on the Map 2206 (back pocket). With the exception of iron formation, the volcanic and serpentinite outcrops contain no more than the ordinary complement of sparsely disseminated sulphides.

Old workings in a rusty-weathered iron formation near the northeastern corner of International Nickel's claims were mapped in detail (Figure 7). These workings were described originally by Berry (1940, p. 16) as follows:

> The iron formation has been traced for half a mile along its strike by means of pits and trenches. Massive pyrrhotite replaces the iron formation over a width of 3 to 5 feet. Pyrite and marcasite are also found replacing the chert, and marcasite nodules were observed in the black shaly sediment. A picked sample of massive pyrrhotite was taken by the writer from the largest pit on claim P.7,887. An analysis of the sample by the Provincial Assay office showed no trace of nickel.

The local structure of the iron formation seems to consist of a broad open fold, plunging nearly vertical. Chloritized mafic volcanics flank the north side of the iron formation; schistose dacite is exposed along the south side.

Larchmont Mines Limited (19)

In 1967, Larchmont Mines Limited held a group of five unpatented claims, 79033 to 79037 inclusive, in the northwestern quadrant of Langmuir Township. The western portion of the claims appear to be underlain by the serpentinite-volcanic-trondhjemite contact. The only outcrop is near the eastern side of the claim group and consists primarily of felsic to intermediate pyroclastics intruded by two north-south-trending diabase dikes. Some of the westernmost claims were formerly held by Falconbridge Nickel Mines Limited.

In 1966, Larchmont Mines did electromagnetic, magnetic, and induced polarization surveys. From the results of the exploration work, the claims did not warrant further investigation.

R. LaSalle (20)

Two patented claims 5899½ and 6218, held in 1967 by R. LaSalle, are located in the northwestern quadrant of Langmuir Township. The claims, underlain by trondhjemite, contain a gold showing which was described by Berry (1940, p. 15-16) as follows:

> Stripping and trenching have uncovered a north-south shear zone for a length of 400 feet along an inclusion of greenstone in the granite. This is probably close to the east edge of the granite. An irregular vein of quartz and pyrite with a maximum width of 6 feet occurs in the shear zone and dips 80°W. The pyrite is of two types, coarse- and fine-grained. Gold values, thought to be associated with the fine pyrite, are reported to be present. A 25-foot shaft was sunk by the owners at the widest part of the quartz vein. Gold values are reported to be lower

at the bottom of the shaft, although the quartz maintains its width and pyrite content. During the winter of 1939-40 several shallow diamond-drill holes were put down by The Consolidated Mining and Smelting Company Limited. It is reported that the drill-holes went through the shear zone at depth but did not reach the granite-greenstone contact to the east. No further information is available on the results of this work.

In 1967, R. LaSalle also held in north-central Langmuir Township patented claims 7867 and 7467 for which there is no recorded exploration work.

J. Lavigne (21)

In 1967, J. Lavigne held a group of six unpatented claims, 93676 to 93681 inclusive, adjacent to the west boundary of Langmuir Township and partially straddling the Forks River. The claims are entirely drift covered. No assessment work has been filed by J. Lavigne.

This claim group forms the northern part of a group of claims formerly held by Magoma Mines Limited, who, in 1965, conducted electromagnetic and magnetic surveys on the claims. No area worthy of further exploration work was found and the claims were allowed to lapse.

G. Leliever (22)

A group of six unpatented claims, 85792, 85794, 85845, 85848, 85851 and 85852, near the south end of St. Peter Bay, were held by G. Leliever in 1967. Exploration work on the claims was done by Cantri Mines Limited, who, in 1966, did magnetic and electromagnetic surveys and drilled four holes totalling 1,769 feet. Drilling was confined to the northernmost claim and mainly intersected serpentinized peridotite with smaller amounts of rhyolite porphyry. The best assay[1] reported was 0.13 percent nickel. Locally, the rhyolite porphyry contains up to 4 percent disseminated pyrite.

McWatters Gold Mines Limited[2] (24)

HISTORY

In 1967, McWatters Gold Mines Limited held a group of 54 unpatented claims, 50838 to 50891 inclusive, in west-central Langmuir Township. The claims were originally staked in 1961. The same year the Company completed magnetic, electromagnetic, and geological surveys on the property, the results of which are compiled on three plans at a scale of 1 inch to 400 feet. Diamond drilling commenced early in 1962 to check several geophysical anomalies. Thirteen holes, totalling 3,502 feet, were drilled. Ten of the holes were drilled to test coincident magnetic and electromagnetic anomalies, which subsequently proved to be the result of sulphide-bearing iron formations containing no concentrations of base or precious metals. The other three holes were drilled to investigate various magnetic anomalies, one of which was drilled across the central

[1]From company report (T-1258) on file with the Resident Geologist, Ontario Department of Mines, Timmins.

[2]Quebec Manitou Mines Limited holds a 17½ percent interest in this claim group.

part of an anomaly, approximately 3,400 feet long and 200 to 300 feet wide. This latter hole, mostly in serpentinized dunite, gave an average assay of 0.428 percent nickel for the entire 199 feet of the core with a value of 0.65 percent nickel for a 51.8-foot section[1]. Macroscopically, the core contains only traces of disseminated sulphides locally up to 2 to 3 percent. It was this drill hole which gave the initial spark for much of the subsequent exploration work in the township. Later in the year, an additional 11 holes, most of which were spaced along the above-mentioned anomaly, were drilled for a total of 5,192 feet. Assay results were not too encouraging, although one hole (Northern Miner 1962, p. 771) was reported to have 0.63 percent nickel for a 36-foot section and 0.74 percent nickel for a 45-foot section. This magnetic anomaly as well as many others on the claim group proved to be caused by serpentinized dunite-peridotite.

Drilling was resumed in 1964 to 1965 during which time 24 vertical holes, totalling 15,028 feet, were drilled near the central part of the above-mentioned anomaly. Assay results obtained from a few drill holes were encouraging with some values greater than 1 percent nickel for lengths of 100 to 300 feet. One 10-foot section gave more than 5 percent nickel (Northern Miner 1964, p.1113), and another 9.71 percent nickel (Northern Miner 1965, p. 297). In addition, one inclined hole of 715 feet was drilled to test another magnetic anomaly on the claim group.

In 1967, three drill holes, totalling 1,298 feet, were completed, thereby fulfilling sufficient assessment work to bring the claims to lease. These holes were not drilled on the main mineralized serpentinite and minor pyrite was the only sulphide found.

MAIN DEPOSIT

On the basis of the vertical drilling conducted during 1964 to 1965, McWatters was able to outline within the serpentinite a small irregular deposit, 300 feet in length, averaging approximately 50 feet in width, and extending to a vertical depth of 300 feet (Figures 8, 9, and 10)[2]. The sulphide mineralization occurs either as irregular veinlets, pods, and disseminations, or less commonly, as massive or near massive zones from 2 to 10 feet in width. Nine polished sections (mostly of massive or near massive sulphides) were examined for their sulphide content by the Laboratory and Research Branch of the Department of Mines. Pyrite was observed to be by far the most common sulphide, followed in decreasing abundance by pentlandite, millerite, and very minor chalcopyrite. Typically, the pyrite has a coarse-grained (1 to 2 mm) granular texture, although the grain size ranges from 0.1 to 2.0 mm; pentlandite is interstitial to the pyrite; millerite is either of a similar occurrence to the pentlandite or occurs as coarse irregular poikilitic grains with inclusions of pyrite and pentlandite. The abundance of pyrite to the exclusion of pyrrhotite indicates a high sulphur pressure, thereby, being a particular favourable environment for the formation of an economic nickel deposit (i.e., Chamberlain 1968).

[1]Assays from Company report (T-652) on file with the Resident Geologist, Ontario Department of Mines, Timmins.

[2]From information kindly supplied to the writer by M. Zurowski.

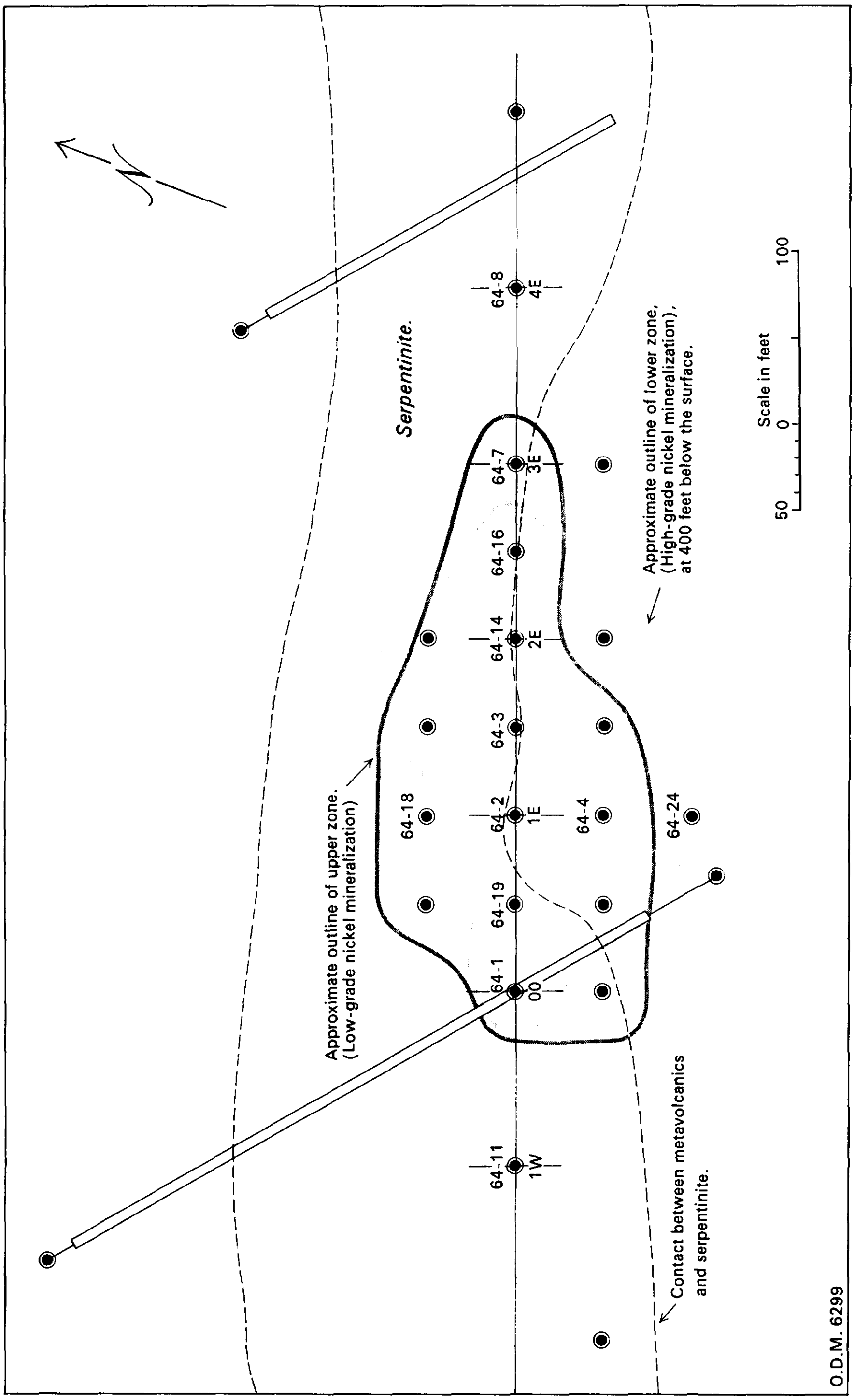

Figure 8—McWatters Gold Mines Limited (24), surface projection of main mineralized zone. Modified after plan by M. Zurowski, prepared for McWatters Gold Mines Limited.

From the few thin sections examined from the serpentinite in the mineralized zones, the disseminated sulphides are generally enclosed within, or adjacent to, pods and veinlets of carbonate and minor talc-carbonate; and the host rock, predominantly serpentinized dunite, seems to become pyroxenitic toward the lower part of the mineralized zone.

The deposit has been subdivided by McWatters into an upper and lower zone (Figures 8, 9, and 10), the latter containing more mineralization. A discordant intrusion of rhyodacite porphyry marks the lower limit of mineralization and, therefore, seems to act as a control for the sulphides. The following quotation[1] adeptly describes this situation.

> The better grade nickel mineralization localized along the upper contact of the acid intrusive is enveloped by a halo of disseminated mineralization.

Table 8 TONNAGES AND GRADES OF THE MCWATTERS NICKEL DEPOSIT, LANGMUIR TOWNSHIP (MODIFIED AFTER INFORMATION OBTAINED FROM M. ZUROWSKI, AND CANADIAN MINES HANDBOOK 1968, P. 218)

	Zone	Tonnage	Grade
Undiluted	Upper	415,450 tons	0.850% Ni
	Lower	144,165 tons	2.170% Ni
	Total	559,615 tons	1.19 % Ni
Diluted	Upper	477,768 tons	0.73 % Ni
	Lower	165,790 tons	1.92 % Ni
	Total	643,558 tons	1.04 % Ni

Table 8, compiled from information obtained from M. Zurowski and Canadian Mines Handbook (1968, p. 218), gives the undiluted and diluted (15 percent at 0.25 percent nickel) tonnages for the upper and lower zones.

ORIGIN

Naldrett (1964; 1966) has shown that sulphurization is the most likely process to explain the formation of the nickel orebody at the Alexo Mine 20 miles east of Timmins. In the same treatise, he briefly discusses many other nickel occurrences in the Porcupine area, one of which is the McWatters discovery. Here he concluded on the basis of sulphur isotope ratios and the distribution of mineralization that sulphurization also seems to be the most likely explanation (i.e., being characterized by nonuniform isotope ratios and ill-defined zones of mineralization).

If the mineralization is the result of sulphurization as suggested by Naldrett, then the source of the sulphur was probably the rhyodacite porphyry at the base of the lower zone of mineralization. However the structural and(or) chemical control necessary to localize the nickel sulphides within this mineralized zone is not apparent.

[1]From report of McWatters claim group by M. Zurowski.

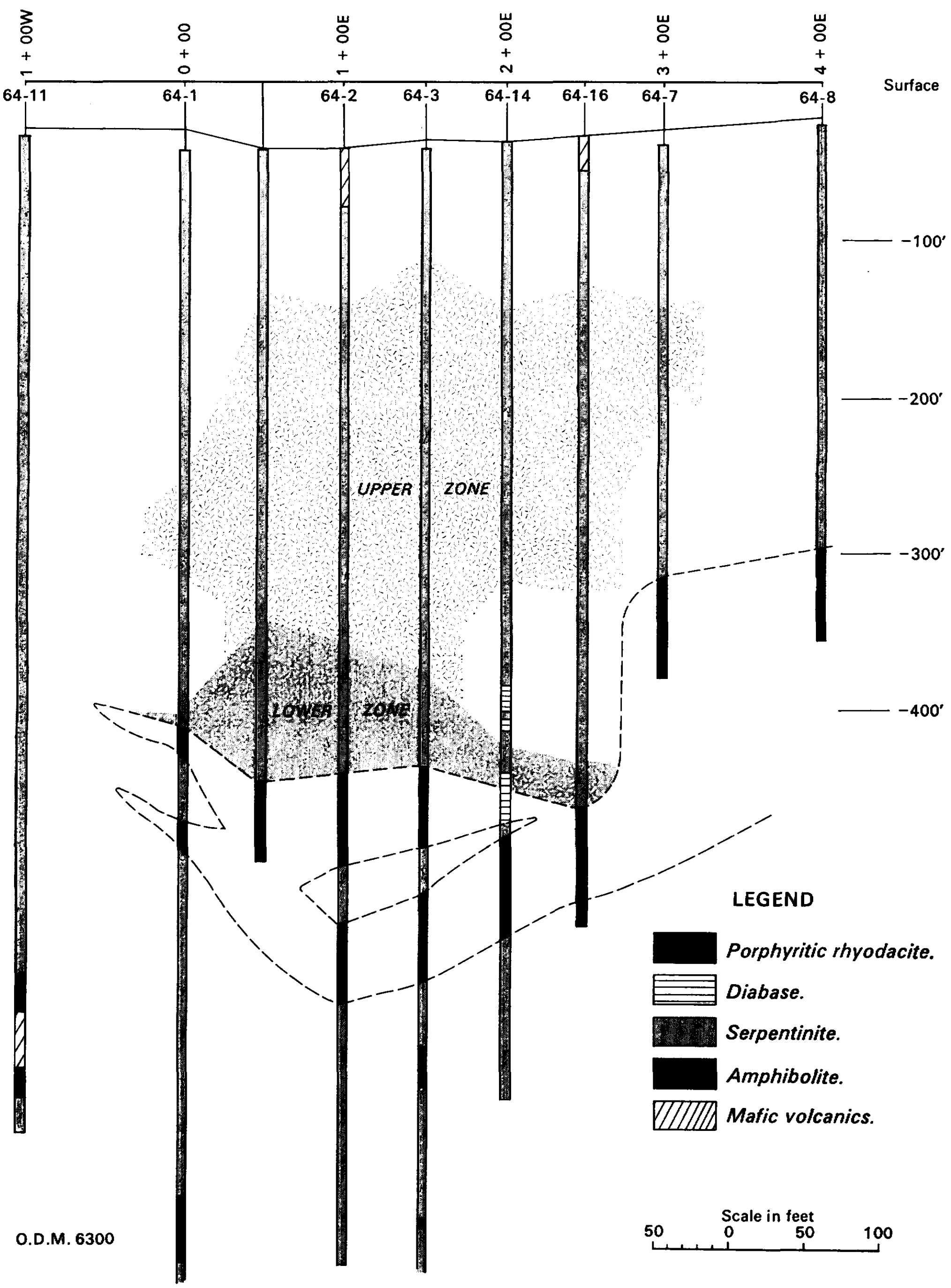

Figure 9–McWatters Gold Mines Limited (24), longitudinal section. Modified after section by M. Zurowski, prepared for McWatters Gold Mines Limited.

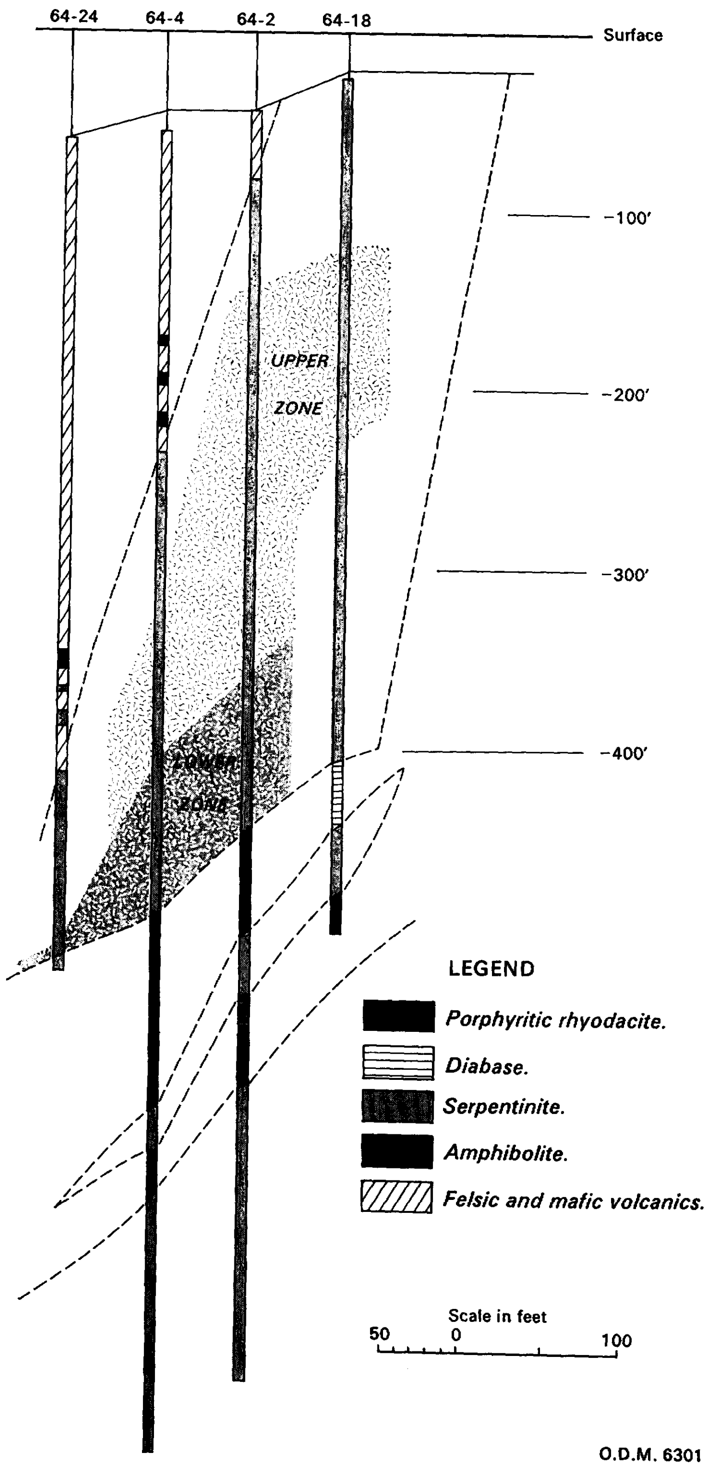

Figure 10—McWatters Gold Mines Limited (24), cross-section 1+00E. Modified after section by M. Zurowski, prepared for McWatters Gold Mines Limited.

Four drill core samples, collected by the writer, of unmineralized serpentinized dunite from the McWatters claim group gave on assay[1] an average background nickel content of 0.26 percent. This is approximately 25 to 40 percent higher than the average ultramafic rock as given by G. G. Goles (1967), although Goles points out that it is difficult to decide on a meaningful average from present data. Nevertheless a relatively high nickel background would be favourable to sulphurization.

Maybrun Mines Limited (25)

A group of 12 unpatented claims, 65297 to 65299 inclusive and 78906 to 78914 inclusive, located along the south-central boundary of Langmuir Township was held by Maybrun Mines Limited in 1967. The claims are underlain by serpentinite in the northern half and basalt-andesite in the southern part.

In 1965, the Company did magnetic and electromagnetic surveys and drilled three holes, totalling 1,498 feet, to test electromagnetic anomalies. No mineralization was encountered and the anomalies seem to be caused by shear zones.

In 1958, Canadian Johns-Manville Company Limited held nine claims covering much of what is currently (1967) the southern half of the Maybrun Mines claim block. Exploration work consisted of trenching and the drilling of three holes for a total of 902 feet, in the serpentinized peridotite-pyroxenite. The best 10-foot core section contains approximately 1 percent asbestos fibre. The length of the fibre ranges from 1/16 to 3/16 inch. A geological plan of the claims at a scale of 1 inch to 200 feet accompanies the assessment report.

Mespi Mines Limited (26)

Three unpatented claims, 76036, 76037, and 76042, along the north-central boundary of Langmuir Township were held by Mespi Mines Limited in 1967. This is the southern part of a claim block extending into Carman Township. Assessment work consists of a combined airborne magnetic and electromagnetic survey, flown by Hunting Survey Corporation in 1964, over parts of Langmuir, Eldorado, Carman, and Douglas Townships. An isomagnetic contour map at a scale of 1 inch to ¼ mile accompanies the assessment report.[2]

J. Michaud (27)

In 1967, J. Michaud held a group of 6 unpatented claims, 93136 to 93141 inclusive, immediately west of the junction of the Forks and Night Hawk Rivers in Langmuir Township. There is no outcrop on the claims and they are possibly underlain mainly by mafic volcanic rocks. The northernmost claim was formerly held by Newrich Explorations Limited. No exploration work has been done on the claim group by J. Michaud.

[1]Analysis by the Laboratory and Research Branch, Ontario Department of Mines.
[2]Company Report (T-787), on file with the Resident Geologist, Ontario Department of Mines, Timmins.

Mid-North Engineering Services Limited (28)

In 1967, Mid-North Engineering Services Limited (formerly named Northwest Canalask Nickel Mines Limited) held a group of 13 unpatented claims, 85642, 85618 to 85624 inclusive, and 85636 to 85640 inclusive, south of St. Peter Bay. Only two small outcrops, both of felsic volcanics, occur on the claims. Two drill holes, totalling 785 feet, encountered only minor pyrite and a trace of chalcopyrite. Magnetic and electromagnetic surveys were done on the claims.

Mining Corporation of Canada (1964) Limited (29)

In 1967, Mining Corporation of Canada (1964) Limited held 2 unpatented claims, 75853 and 75854, north of the Forks River. Formerly (1965), the claim group consisted of 8 additional claims immediately to the south and west, flanking the Forks River. Magnetic and electromagnetic surveys were done in 1965. One hole was drilled to a depth of 504 feet. Rock outcrop is virtually nonexistent and the claims seem to be underlain by both volcanics and serpentinite.

Min-Ore Mines Limited (30)

In 1967, Min-Ore Mines Limited held a group of 12 unpatented claims, 78954, 78955, 78957, 78958, 78946, 78947, 79225, 79226, and 78949 to 78952 inclusive, which straddle the Forks River in the central part of Langmuir Township. The claims seem to be underlain mainly by mafic to intermediate volcanics.

In 1965, Min-Ore did electromagnetic and magnetic surveys on the claims. An electromagnetic conductor, whose axis trends northwest across the claims, was outlined. This conductor is coincident with a magnetic low and probably indicates a fault or shear zone.

North Crescent Holdings and Explorations Ltd. (32)

A group of 12 unpatented claims, 79123 to 79134 inclusive, between Carman and St. Peter Bays in Langmuir Township was held in 1967 by North Crescent Holdings and Explorations Limited. No outcrop occurs on the claims.

Magnetic and electromagnetic surveys were done in 1965. One weak conductor was outlined, but not drilled.

Paramaque Mines Limited (33)

A group of 14 unpatented claims, 72798 to 72811 inclusive, in the northwestern quadrant of Langmuir Township was held by Paramaque Mines Limited in 1967. The claims straddle the contact between serpentinite and andesitic-dacitic volcanics. In 1965, magnetic and electromagnetic surveys were carried out and four holes, totalling 2,420 feet, were drilled to test one electromagnetic and three magnetic anomalies.

The electromagnetic anomaly is caused by iron formation locally containing abundant pyrrhotite, pyrite, and minor chalcopyrite. The best assay[1] result gave 0.12 percent copper and 0.005 ounces per ton gold, over a width of 5 feet. The magnetic anomalies are caused by the serpentinized peridotite.

Numerous narrow veinlets of fibrous asbestos occur in both of the large outcrops of serpentinite on the property. On the basis of the surface exposures, these outcrops seem to be the most promising for asbestos in the area. The best intersection reported from Paramaque's drilling was one 7-foot section which contains 10 percent fibre, 1/32 inch in length. Most of the core from this as well as the two other holes contains no fibre.

In 1951, Dominion Gulf did considerable trenching on the northern extension of these serpentinite outcrops in Carman Township and reported asbestos fibre, ranging in length from 1/16 to 1/4 inch and constituting 2 to 3 percent of the rock.

Peerless Canadian Explorations Limited (35)

In 1967, a group of seven patented claims, RSC215 to RSC220 inclusive and 7079, along the southern boundary of Langmuir Township were held by Peerless Canadian Explorations Limited. These claims contain an old barite deposit originally staked in 1910, which subsequently underwent intermittent and very limited mining until 1948. A brief summation of the history is best given by the following quotation from Guillet (1963, p. 18):

> Between 1911 and 1922, Premier Langmuir Mines Limited actively developed the property. An adit (see photo) was driven on the main vein for 160 feet, and a vertical shaft was sunk at its entrance to a depth of 130 feet. A level was established at 60 feet, and 80 feet of drifting was carried out. A second shaft was sunk to 75 feet on a small adjacent vein. In 1918, a 30-ton mill was constructed and 60 tons of barite were shipped. From 1923 to 1937, intermittent operations were carried on by Canada Nighthawk [Night Hawk] Mines Limited. In 1933, 160 tons were mined from the floor of the adit, and 70 tons were milled. In 1938, Canada Baryte Mines Limited took over the property and, the following year, advanced the adit 20 feet, withdrawing 335 tons of barite of which 181 tons were shipped. Woodhall Mines Limited operated the property from 1943 to 1949, and mined 150 tons in 1945, 1,200 tons in 1946, and 40 tons in 1947. Trial shipments of 40 and 47 tons were made in 1947, and 1948 respectively. Reorganization of the company in 1949 resulted in the formation of Norbarite Mines Limited. Whitby Ore Mills Limited was formed to take over the company's grinding plant at Whitby. In 1962, the property was controlled by Northern Barite Development Company Limited.

Peerless Canadian Explorations Limited apparently gained control of the property in 1964.

There are two barite veins (Figure 11), both of which are on the north slope of a high (150 feet) ridge of contact metamorphosed mafic volcanics and monzonite. The mafic volcanics (unit 1e), as mentioned in the general geology section, contain numerous discontinuous medium to light green-weathering epidote-rich layers ranging from a fraction of 1 inch to 4 inches in width. The schistosity and layering strike east-southeast and dip nearly vertical to steeply south. Rodding and small-scale folding are prominent in many of the epidote layers and impart a steep, generally west-plunging

[1]From company report (T-1015) on file with the Resident Geologist, Ontario Department of Mines, Timmins.

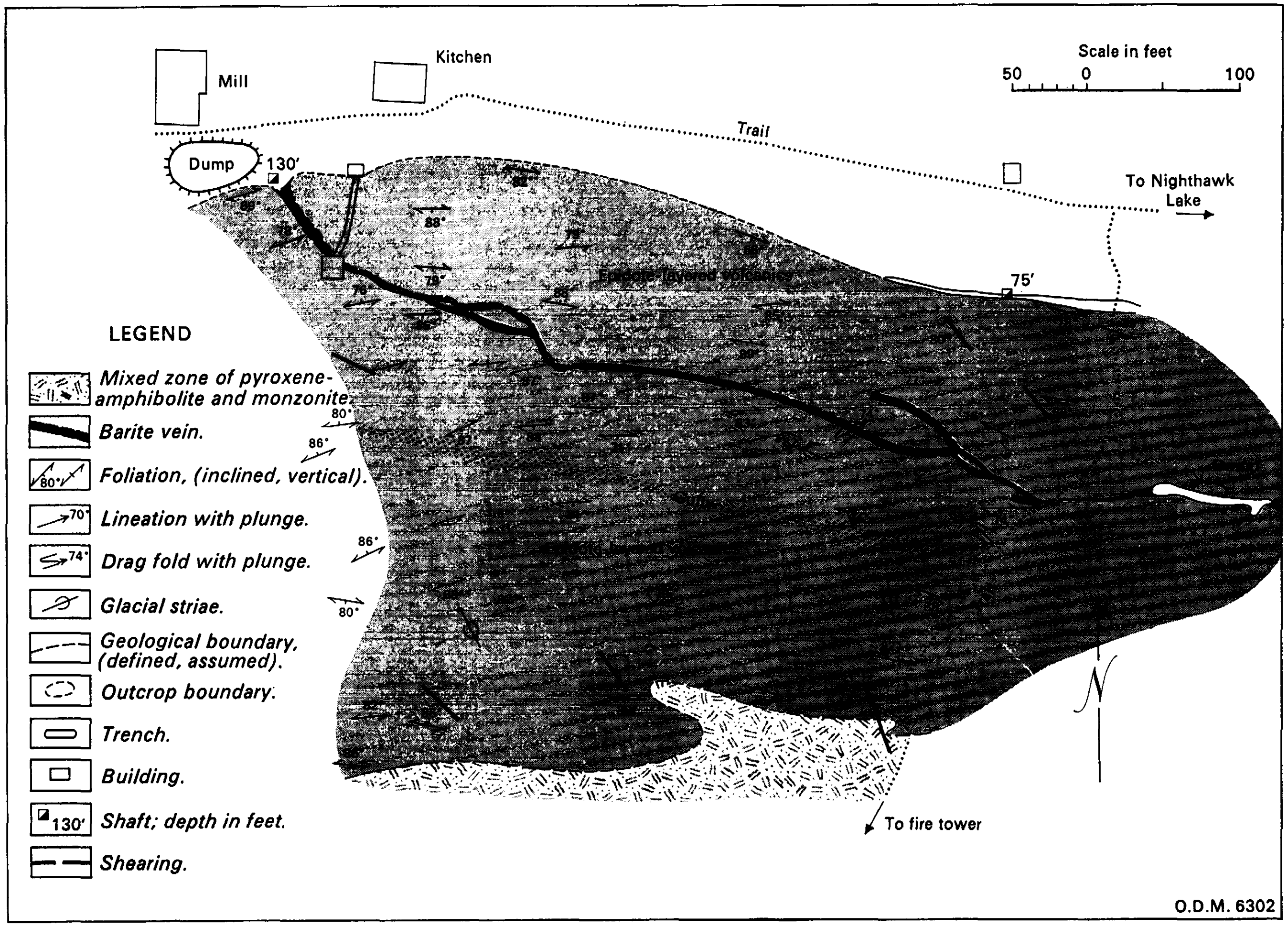

Figure 11–Peerless Canadian Explorations Limited (35) barite property.

ODM 8361

Photo 15–Adit to main barite vein on property of Peerless Canadian Explorations Limited (35).

lineation. Most drag folds display a left-lateral movement. Numerous monzonite dikes, up to 10 feet wide, many of which occupy a minor southeast-striking fracture system, have not been included in Figure 11. Numerous small-scale faults and shears also have a southeasterly strike. A less prominent set of joints strike east-southeasterly and parallels the barite veins. The epidote-layered volcanics are exposed for a width of approximately 300 to 350 feet and are bordered on the south by a heterogeneous zone, grading in composition from monzonite to pyroxene amphibolite.

The southern vein can be traced in an east-southeast direction for approximately 700 feet, but is poorly and sporadically exposed and, locally, pinches out or narrows to a small seam. The average width is about 2 to 2.5 feet. The maximum width, 6 feet, is at the entrance of the adit (Photo 15) at the face of the cliff and the vein narrows to the southeast. Inclusions of the adjacent volcanics and dismembered dikes of monzonite are common locally.

The second vein occurs along the face of the cliff approximately 400 feet east of the adit in the main vein. Exposures of this second vein are confined mainly to narrow selvages along the face of the cliff; the remainder of the vein being obscured by a deep, water-filled trench. According to Hogg (1964), this vein has a width of 2.5 to 5 feet over a length of 80 feet in the vicinity of the shaft. It narrows and pinches out at both ends, however, with a maximum traceable length of no more than approximately 250 to 300 feet.

The barite-filled fractures and parallel shear and joint planes within the volcanics are possibly related to movement along the Montreal River Fault. The apparent left-hand strike slip movement of the Montreal River Fault, would account for the near east-west-trending tension fractures in the adjacent rocks. Alternatively, the barite-filled fractures could be release-type tension joints related to the intrusion of the nearby monzonite.

The barite veins weather white and are in sharp contact with the volcanics. The barite may either form subhedral crystals, up to 2.5 inches in length, or occur as a fine-grained crystalline aggregate. Polysynthetic-twinned crystals are common. Quartz and buff-coloured calcite are the most common gangue minerals. Other minerals include minor fluorite and epidote, and traces of galena, pyrite, sphalerite, chalcopyrite, and native silver.

The analyses of four barite samples are recorded in Table 9.

Spence (1922, p. 46) also reports that a representative sample of the barite mineralization, ground to minus 200 mesh, unbleached, and tested for colour against a standard sample of prime white, exhibited a faint blue-grey shade.

In 1966, Peerless Canadian Explorations Limited undertook a re-evaluation of the barite veins. The following information is taken from a report prepared by M. Zurowski for Peerless Canadian.

Table 9 ANALYSES OF FOUR BARITE SAMPLES RECORDED BY H. S. SPENCE (SPENCE 1922, P. 46) FROM THE BARITE VEINS LOCATED ON THE PROPERTY OF THE PEERLESS CANADIAN EXPLORATIONS LIMITED

	1	2	3	4
Silica	0.10	....	3.95	3.08
Calcium carbonate	3.81	21.80	9.20	8.10
Barium carbonate	....	1.97	....	0.62
Calcium sulphate	3.52	....	....	....
Strontium sulphate	3.40	....	....	....
Barium sulphate	86.60	76.50	86.90	88.45
Oxides of iron and alumina	....	....	0.20	0.10

1—Samples from the rock face at the end of adit: analysis by E. A. Thompson, Mines Branch.
2—Selected sample: analysis by Titanium Pigment Company, Niagara Falls.
3—Samples of mill product from Company's mill: analysis by R. J. Trail, Mines Branch.
4—Average sample of ore from adit: analysis by A. Salder, Mines Branch.

The only record of deep drilling on the property is of two holes drilled by Woodhall Mines Limited in 1943. One hole intersected the main vein at a vertical depth of 500 feet; the other at a vertical depth of 420 feet. True widths for these intersections are approximately 5.0 feet and 4.5 feet, respectively.

The main vein was partially sampled by Peerless Canadian for a length of 112 feet (Figure 12) and gave an average grade of 68.9 percent barite across a width of 3.72 feet. Assuming a minimum mining width of 5 feet and a length of 600 feet, this vein could conceivably produce 336 tons per vertical foot of barite-bearing material

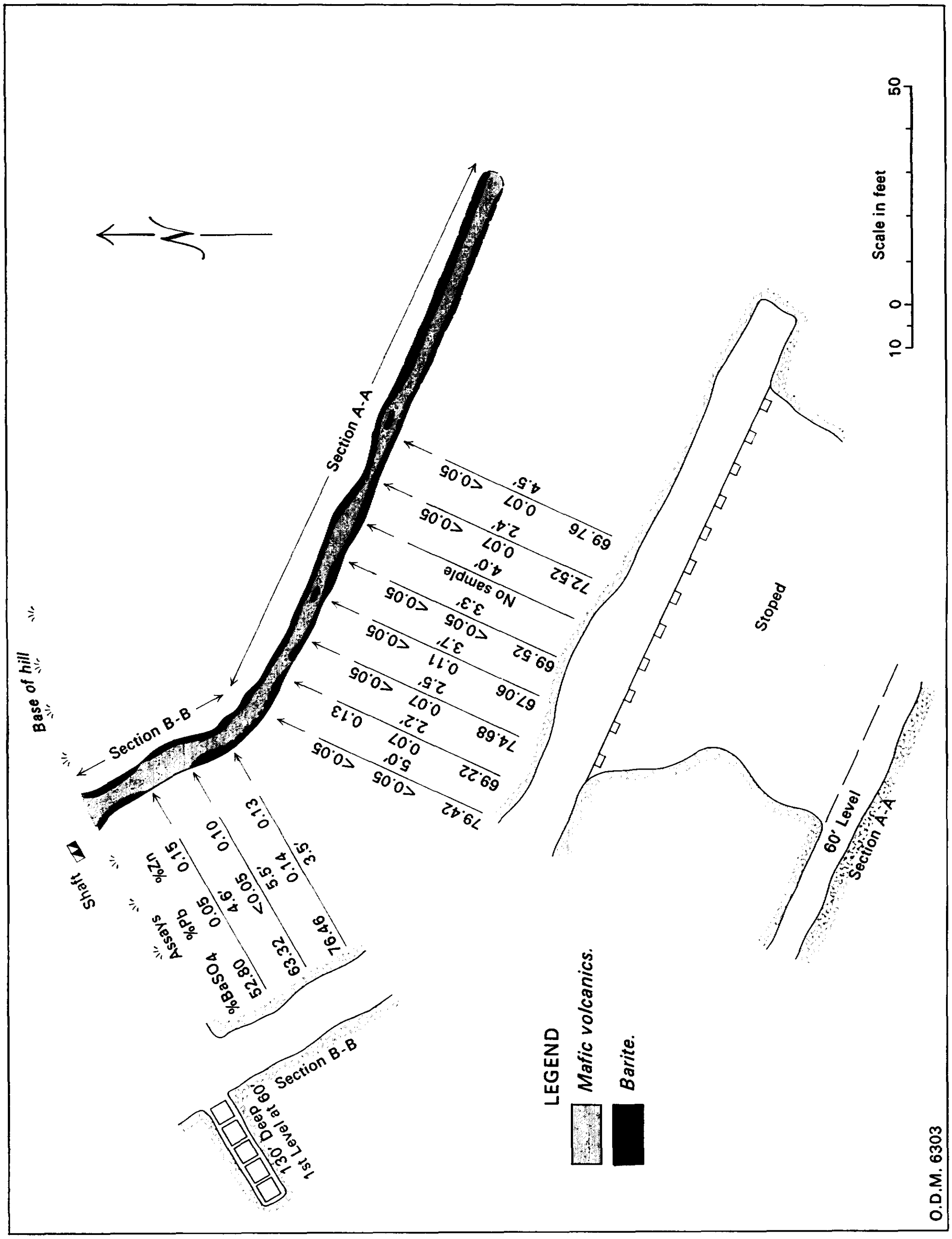

Figure 12–Peerless Canadian Explorations Limited (35), plan of adit level of main barite vein, and partial sections. Plan, section, and assays taken from report prepared by M. Zurowski for Peerless Canadian Explorations Limited.

at a grade of 55.7 percent. For the second or smaller barite vein, an optimistic yield of 250 tons per vertical foot of 55.7 percent barite across a mining width of 5 feet and a length of 450 feet was calculated. Assuming that the barite material could be upgraded to 90 percent $BaSO_4$ and that a 90 percent milling recovery could be obtained, it was calculated that the operating costs would far exceed the value of the mined material.

On the basis of the above evaluation by Peerless Canadian, there can be no doubt that the barite is far from being of economic value under present market conditions.

In 1965, Peerless Canadian conducted an exploration program to investigate the possibility of there being any nickel mineralization associated with the ultramafic rocks. On the basis of electromagnetic and magnetic surveys,[1] five holes, totalling 2,100 feet, were drilled. Four of these holes were drilled in the ultramafic rocks and gave nickel concentrations ranging from 0.3 to 0.17 percent. One hole was drilled to test an electromagnetic anomaly which was found to be caused by a graphitic shear in the serpentinite. Minor disseminations and stringers of pyrrhotite were also in the core.

Five samples (two of which are adjacent to the property of Peerless Canadian) of serpentinized peridotite-pyroxenite were collected by the writer and analysed[2] for nickel. The samples gave an average value of 0.17 percent nickel, which is close to the average for ultramafic rocks as given by Goles (1967, p. 354).

Tex-Sol Explorations Limited (36)

In 1967, Tex-Sol Explorations Limited held a group of 17 unpatented claims, 79653, 79654, and 79286 to 79300 inclusive, adjacent to the north boundary of Langmuir Township near the east side of Carman Bay. The claims are entirely drift covered, but are inferred from the magnetic survey to be underlain dominantly by mafic volcanics with a possible tongue of serpentinite extending into the southwestern corner. A narrow linear north-south-trending magnetic high near the west boundary of the claims probably outlines a diabase dike.

In 1965, five holes, totalling 1,770 feet, were drilled to test three electromagnetic and two magnetic anomalies. Many of the rocks intersected, mainly andesite, were highly sheared, resulting in poor core recovered for some of the holes. No mineralization was reported.

Tinex Development Exploration Limited (37)

A group of 10 unpatented claims, 78890 to 78892 inclusive, 78896 to 78898 inclusive, and 78901 to 78904 inclusive in the northeastern quadrant of Langmuir Township adjacent to Blackstock Township, was held by Tinex Development Exploration Limited in 1967. The claims are mainly within the contact aureole of the Blackstock granodiorite and are underlain predominantly by contact metamorphosed mafic volcanics. Magnetic and electromagnetic surveys were done in 1965. No conductive zones were detected.

[1]Information obtained from M. Zurowski.

[2]Analyses by the Laboratory and Research Branch, Ontario Department of Mines.

United Buffadison Mines Limited (40)

In 1967, United Buffadison Mines Limited held a group of three unpatented claims, 93142 to 93144 inclusive, in the extreme southwestern part of Blackstock Township. All the exploration work has been confined to 30 adjoining claims in the northwestern corner of Fasken Township. This consisted of the following: electromagnetic and magnetic surveys; geochemical soil sampling surveys for copper, lead, zinc, mainly within areas of anomalous geophysical conditions; five diamond drill holes, totalling 1,305 feet; and spectrographic analysis of nine samples of drill core for 14 trace elements. This exploration program and its results will be discussed in more detail in the writer's report on the Townships of Fallon and Fasken. However the outcome of the program did not warrant further exploration at this time.

SUMMARY OF MINERAL POTENTIAL

From the available data in Langmuir and Blackstock Townships, the mineral potential of the area is directly related to the nickel mineralization associated with the serpentinized dunites in the northwestern part of Langmuir Township. Up to 1967, McWatters Gold Mines (24) had outlined a deposit of approximately 640,000 tons grading 1 percent nickel. International Nickel (16) has presumably delineated at least one deposit of similar size.

Chemical analyses indicate that the average or background nickel in the serpentinized dunites is approximately 0.26 percent (see section on "McWatters Gold Mines Limited"). This is 25 to 40 percent higher than the average for ultramafic rocks reported by Goles (1967, p. 354). In contrast the serpentinized peridotite-pyroxenite near the south boundary of Langmuir Township has a nickel concentration (see section on "Peerless Canadian Explorations Limited," property 35) closer to the average given by Goles.

Information pertaining to the genesis of the nickel mineralization in Langmuir Township is scanty. Nevertheless the sulphurization theory appears to be more likely. Naldrett (1966) has outlined a number of factors that should be considered when prospecting for deposits formed by sulphurization and these are briefly listed in Table 10, along with their applicability to Langmuir Township.

The above summation (Table 10) indicates that particularly favourable conditions for nickel concentrations exist at: (1) serpentinite-iron formation contacts; (2) the noses of folds or drag structures due to folding or faulting; (3) a combination of either of the above two factors in conjunction with proximity to granitic intrusions.

The structure, background nickel, and availability of sulphur in the host rocks are factors which favour the serpentinized dunite as opposed to the serpentinized peridotite-pyroxenite. The intensity of contact metamorphism adjacent to the monzonite would favour the serpentinized peridotite-pyroxenite.

It should also be noted that there is no apparent reason why all the ultramafic intrusions delineating the dome-shaped structure extending northwest from Langmuir to Tisdale Townships (see section on "Folds" under "Structural Geology") should not be of equal importance to the serpentinized dunites in Langmuir Township, for exploration for nickel mineralization.

Table 10 SULPHURIZATION AS RELATED TO LANGMUIR TOWNSHIP

Factors Pertaining to Sulphurization (Summarized from Naldrett, 1966, p. 9)	Factors Pertaining to Sulphurization as Related to Langmuir Township
(1) Availability of sulphur in the host rock	(1) Pyrite is a fairly ubiquitous accessory mineral in most of the felsic volcanic rocks intruded by serpentinized dunites. (2) Sulphide-bearing iron formation is common in close proximity to the serpentinized dunites and could have supplied abundant sulphur for the sulphurization process.
(2) Peridotites that have undergone regional metamorphism subsequent to intrusion or that occurs in the metamorphic aureole of late intrusions have a better chance to react with sulphur than those which have not.	(1) All the ultramafic rocks in Langmuir Township have apparently been subjected to greenschist facies regional metamorphism subsequent to emplacement. (2) A stock of trondhjemite intrudes the serpentinized dunites. (3) A stock of monzonite extends to within ¼ mile of the serpentinized peridotite-pyroxenite.
(3) Availability of dilatant structures for the concentration of sulphides formed by sulphurization.	(1) Numerous possibilities exist in the synclinal structure in the northwestern quadrant of Langmuir. (2) Any of the warps or irregularities in the serpentinite-volcanic contact near the south boundary of Langmuir (for example, bend on southern contact ¼ mile east of Night Hawk River).
(4) Presence of very small amounts of high-nickel sulphides such as heazelwoodite, millerite, and pentlandite.	(1) Two specimens of unmineralized ultramafic rocks, one from McWatters' claim group (24), one from Paramaque's (33) claim group, were examined for high-nickel sulphides. McWatters' specimen contains traces of millerite, and Paramaque's has traces of heazelwoodite. Detailed examination of all the serpentinites could outline favourable areas.

Langmuir-Blackstock Townships

The barite-filled fractures on the property of Peerless Canadian Explorations Limited (35) are possibly related to movements along the Montreal River Fault (see section on "Peerless Canadian Explorations Limited"). Minor precious and base metals were introduced with the barite (see section on "Peerless Canadian Explorations Limited"), thereby indicating the availability of these metals for possible economic concentrations at suitable locations along or adjacent to the Montreal River Fault. Moreover there are numerous mineral occurrences, including the barite in Cairo Township, in close proximity to the Montreal River Fault as shown on the Compilation Map 2046 (Ginn *et al.* 1964) for the Timmins-Kirkland Lake area. This suggests that mineralized solutions migrating along the Montreal River Fault and subsidiary fractures have played a major role in the concentration of these metals. Indeed, the projection of the Montreal River Fault to the northwest intersects the Porcupine-Destor fault zone in the vicinity of the Timmins gold camp.

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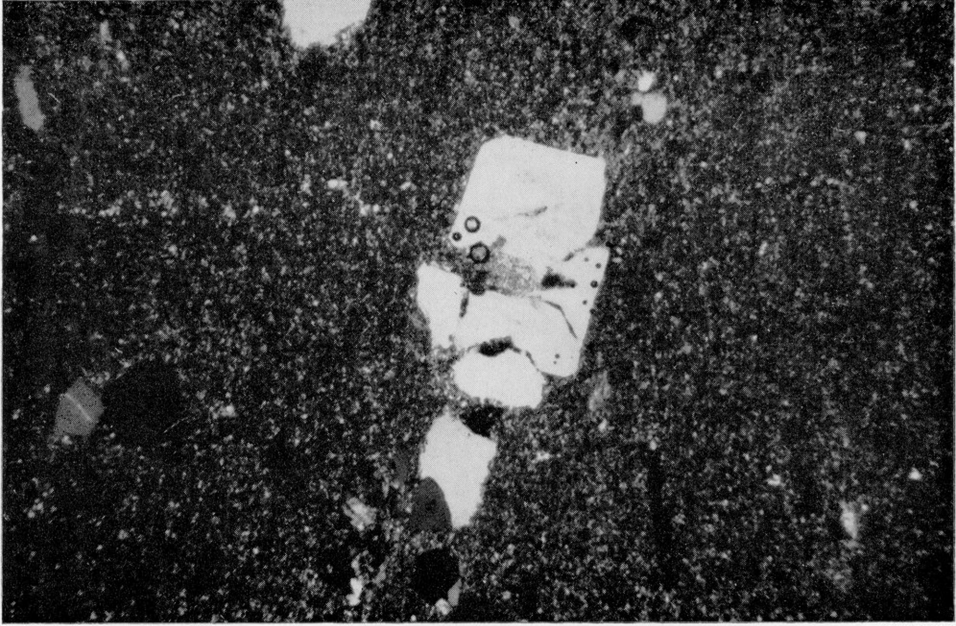

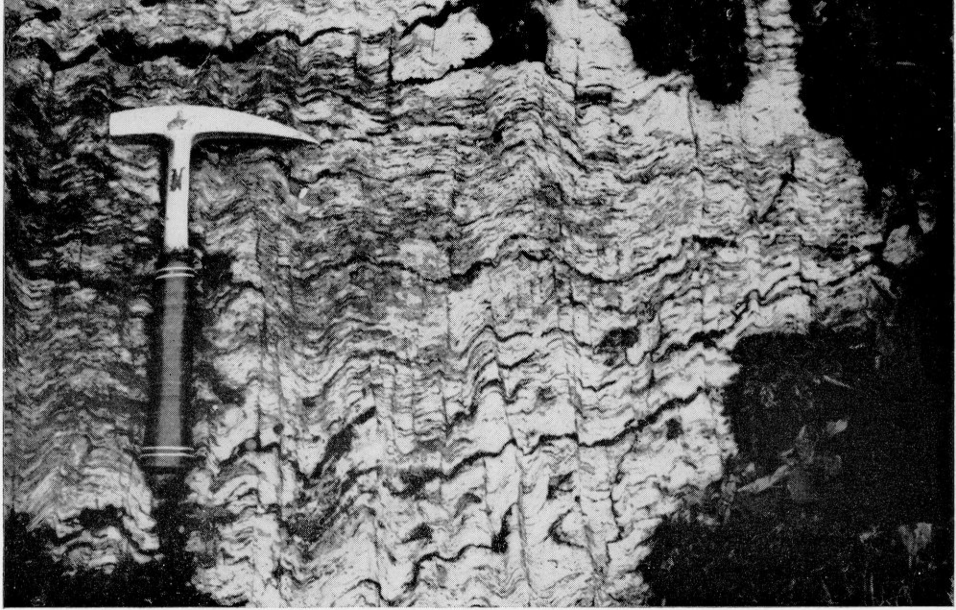

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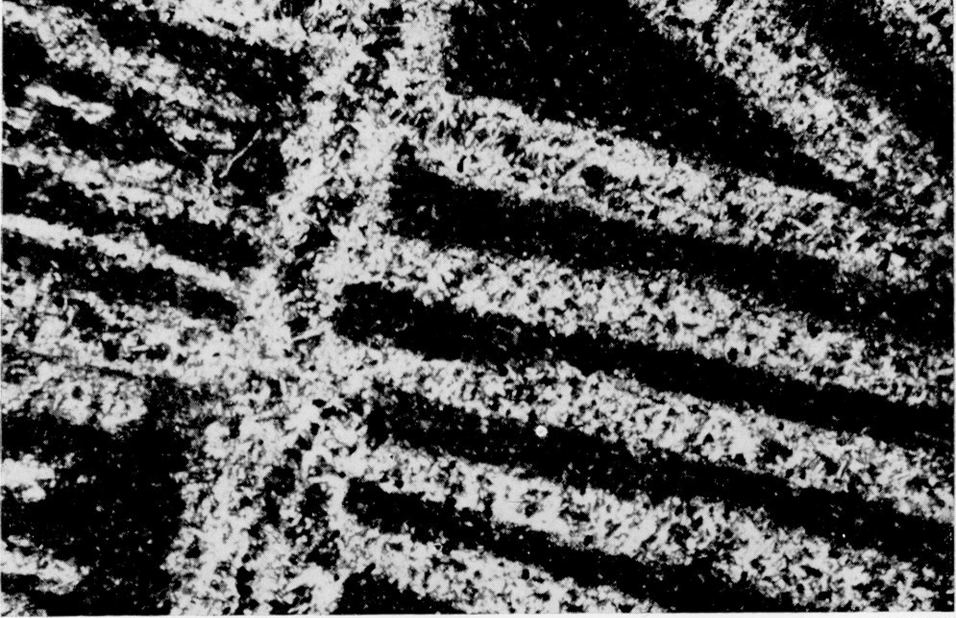

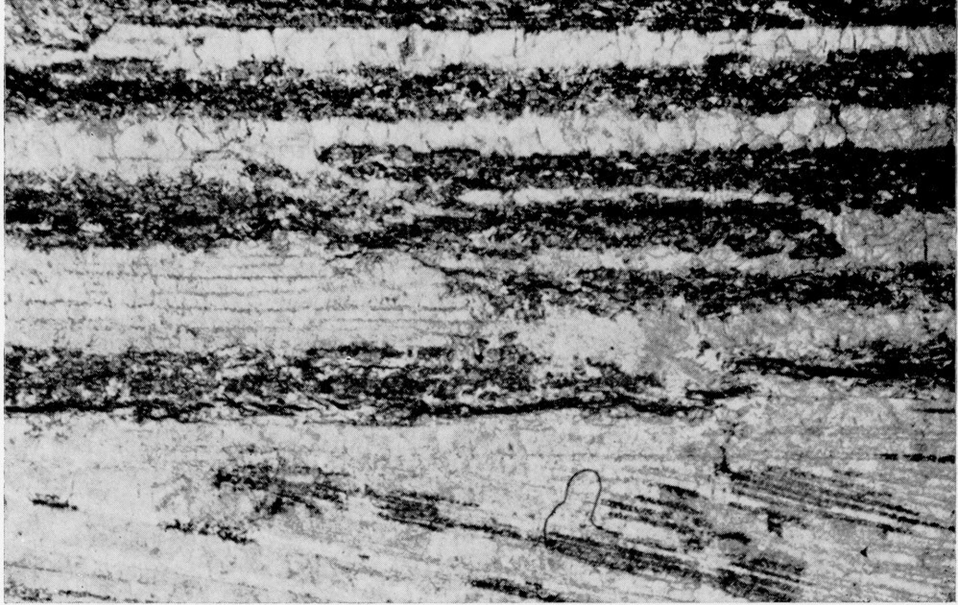

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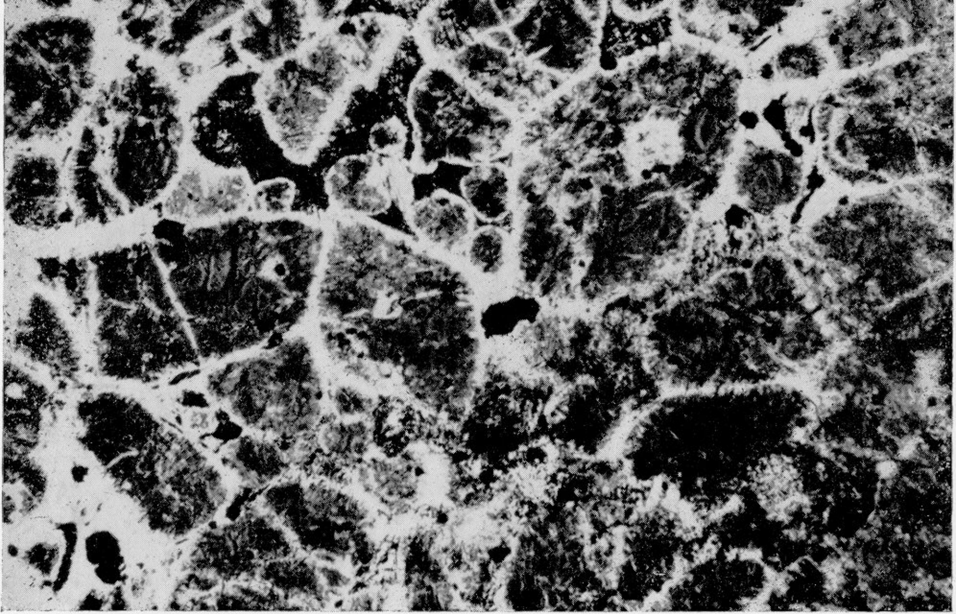

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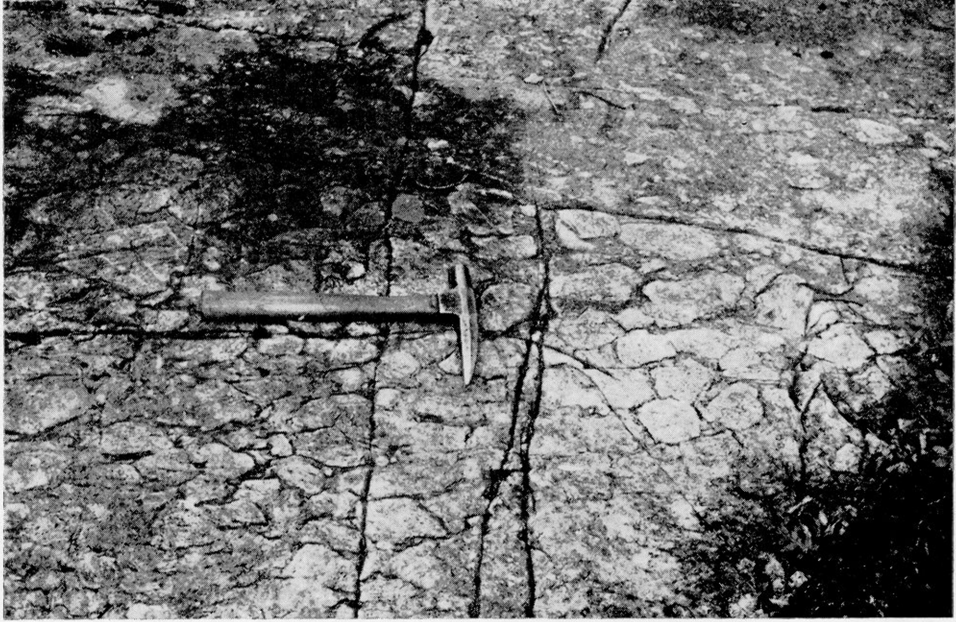

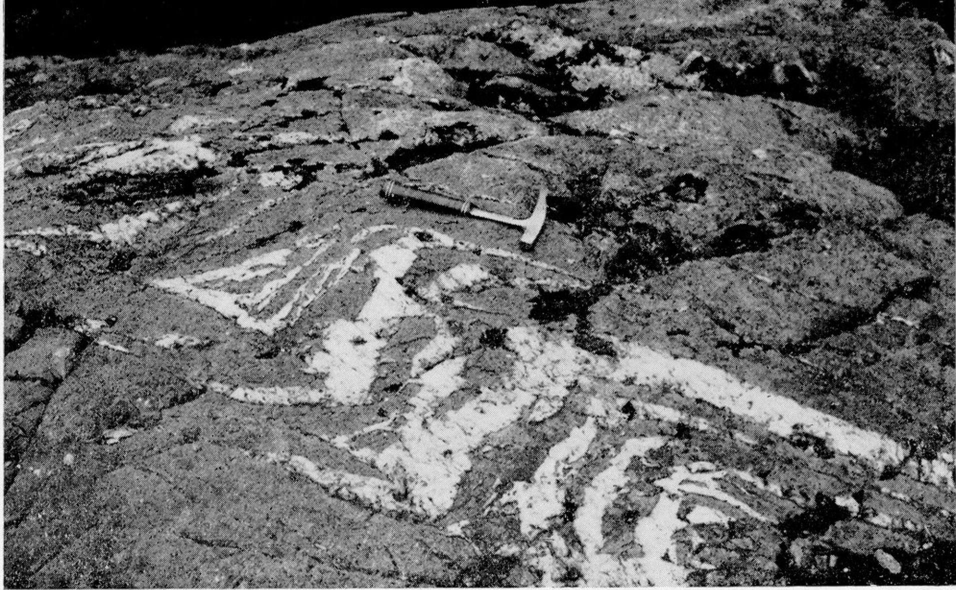

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ODM 8347

ONTARIO
DEPARTMENT OF MINES
HON. ALLAN F. LAWRENCE, *Minister of Mines*
D. P. Douglass, *Deputy Minister* J. E. Thomson, *Director, Geological Branch*

Map 2206
Langmuir and Blackstock Townships

SYMBOLS

- *Glacial striae.*
- *Esker.*
- *Small bedrock outcrop.*
- *Area of bedrock outcrop.*
- *Bedding, top unknown; (inclined, vertical).*
- *Lava flow; top in direction of arrow.*
- *Foliation; (dip unknown, inclined, vertical).*
- *Lineation with plunge.*
- *Geological boundary, observed.*
- *Geological boundary, position interpreted.*
- *Geological boundary, deduced from geophysics.*
- *Fault; (observed, assumed). Arrows indicate horizontal movement.*
- *Drag folds with plunge.*
- *Anticline, syncline, with plunge.*
- *Drill hole; (vertical, inclined).*
- Ni *Orebody projected to surface.*
- *Shaft; depth in feet.*
- *Swamp or muskeg.*
- *Trail, portage, winter road.*
- *Building.*
- *District boundary, approximate position only.*
- *Township boundary with mile posts, approximate position only.*
- *Property boundary, approximate position only.*
- *Claim line, surveyed, approximate position only.*
- 6 *Location of mining property, surveyed. (See "List of Properties").*
- (27) *Location of mining property, unsurveyed. (See "List of Properties").*

LIST OF PROPERTIES

(As of October 20, 1967)

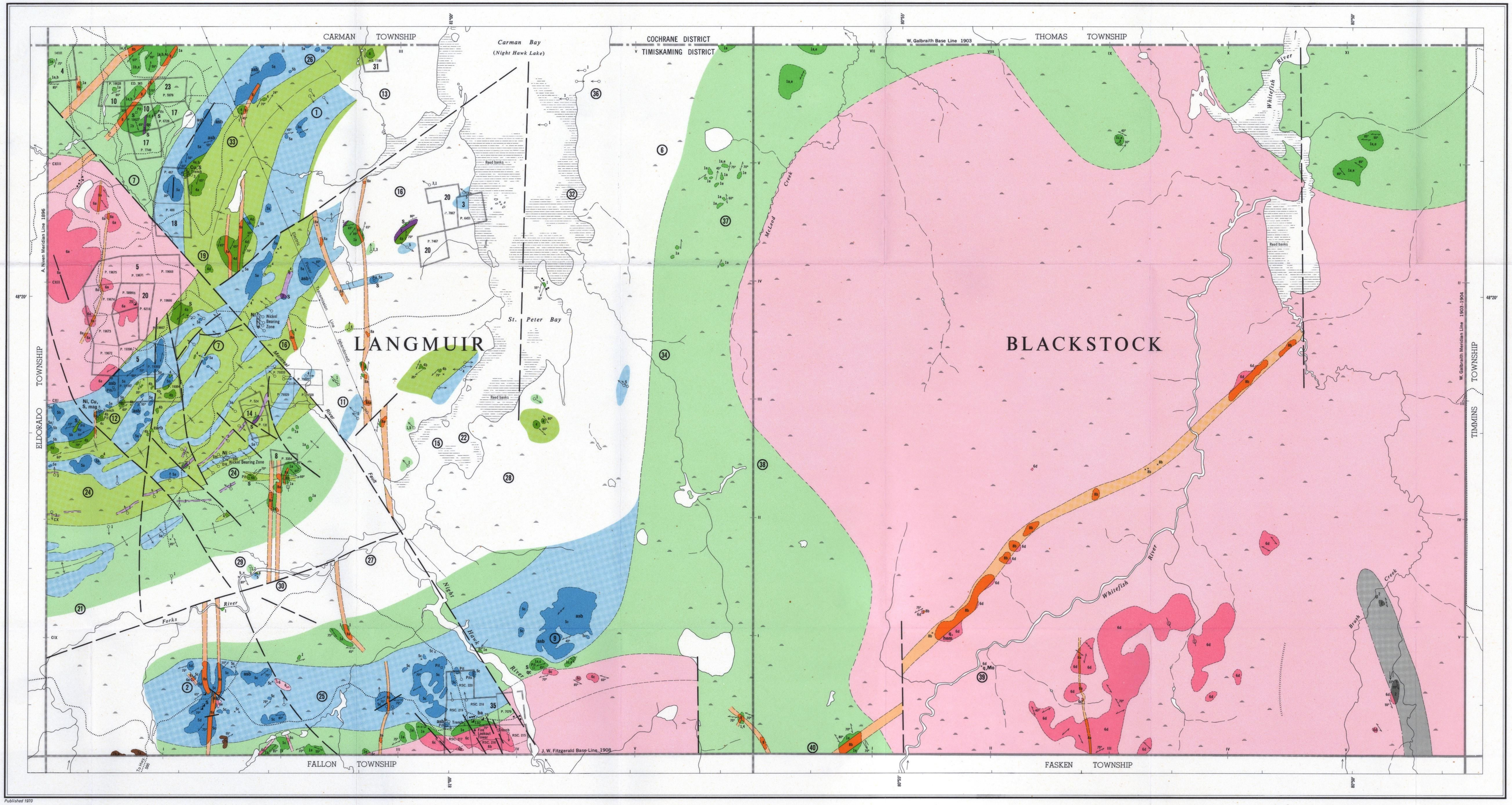
LANGMUIR TOWNSHIP

1. *Accra Explorations Limited.*
2. *Acme Gas and Oil Company Limited.*
3. *Bishop, J. H.*
4. *Booker, A.*
5. *Clark Porcupine Mining Syndicate.*
6. *Con-Key Mines Limited.*
7. *Con-Shawkey Gold Mines Limited.*
8. *Deeks, D.*
9. *Dominion Gulf Company. [1951].*
10. *Fairley, D. C.*
11. *First National Uranium Mines Limited.*
12. *Galata, E.*
13. *Gomar Mines Limited.*
14. *Hennessy, J. W.*
15. *Hoffman, C. K.*
16. *International Nickel Company of Canada Limited, The*
17. *Jones, M. M.*
18. *Keefe, C.*
19. *Larchmont Mines Limited.*
20. *LaSalle, Rev. R.*
21. *Lavigne, J. C.*
22. *Leliever, G.*
23. *McCloskey, H. C., Estate.*
24. *McWatters Gold Mines Limited.*
25. *Maybrun Mines Limited.*
26. *Mespi Mines Limited.*
27. *Michaud, J.*
28. *Mid-North Engineering Services Limited.*
29. *Mining Corporation of Canada (1964) Limited.*
30. *Min-Ore Mines Limited.*
31. *Minthorn, Dr. H. L., Estate.*
32. *North Crescent Holdings and Explorations Limited.*
33. *Paramaque Mines Limited.*
34. *PCE Explorations Limited.*
35. *Peerless Canadian Explorations Limited.*
36. *Tex-Sol Explorations Limited.*
37. *Tinex Development Explorations Limited.*

BLACKSTOCK TOWNSHIP

38. *Cravit, H.*
39. *Hill, L.*
40. *United Buffadison Mines Limited.*

Date in square brackets indicates year of last major work.



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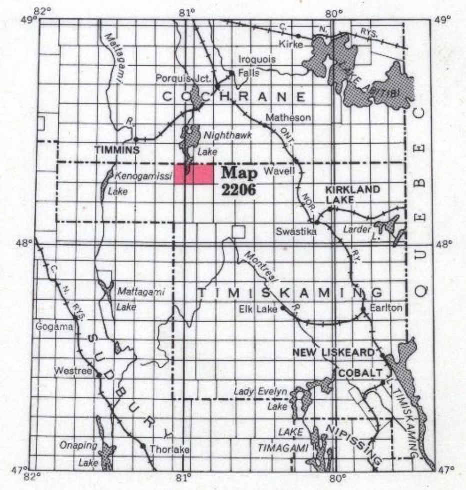

Scale 1 inch to 50 miles

N.T.S. reference 42A/6, 42A/7

LEGEND

CENOZOIC[a]

PLEISTOCENE AND RECENT
Clay, sand, and gravel.

UNCONFORMITY

PRECAMBRIAN[b]

PROTEROZOIC

LATE MAFIC INTRUSIVE ROCKS
- 8 *Diabase (Undifferentiated).*
- 8a *Diabase (Matachewan-type).*
- 8b *Diabase (Abitibi-type).*

INTRUSIVE CONTACT

HURONIAN

COBALT GROUP
- 7a *Conglomerate.*
- 7b *Argillite.*

UNCONFORMITY

ARCHEAN

FELSIC INTRUSIVE ROCKS
- 6 *Undifferentiated.*
- 6a *Trondhjemite.*
- 6b *Monzonite.*
- 6c *Contaminated border zone related to 6b.*
- 6d *Granodiorite.*
- 6e *Feldspar porphyry.*

INTRUSIVE CONTACT

ULTRAMAFIC AND MAFIC INTRUSIVE ROCKS
- 5 *Undifferentiated.*
- 5a *Serpentinized dunite.*
- 5b *Gabbro and diorite related to 5a.*
- 5c *Serpentinized peridotite-pyroxenite.*
- 5d *Carbonatized peridotite-pyroxenite.*

INTRUSIVE CONTACT

FELSIC TO INTERMEDIATE METAVOLCANICS
- 4 *Undifferentiated.*
- 4a *Dacite-andesite.*
- 4b *Dacite (quartz and (or) feldspar porphyry).*
- 4c *Rhyodacite.*
- 4d *Tuffs and agglomerate.*

METASEDIMENTS
- 3 *Iron formation.*
- 2 *Hornblende gneiss.*

MAFIC TO INTERMEDIATE METAVOLCANICS
- 1 *Undifferentiated.*
- 1a *Basalt-andesite.*
- 1b *Andesite porphyry.*
- 1c *Pillowed basalt-andesite.*
- 1d *Carbonatized basalt-andesite.*
- 1e *Layered amphibolite.*

asb	*Asbestos.*
ba	*Barite.*
carb	*Carbonate.*
Cu	*Copper.*
hem	*Hematite.*
mag	*Magnetite.*
Mo	*Molybdenum.*
Ni	*Nickel.*
q	*Quartz.*
qc	*Quartz-carbonate.*
S	*Sulphide mineralization.*

[a] *Unconsolidated deposits. Cenozoic deposits are represented by the lighter coloured and uncoloured parts of the map.*

[b] *Bedrock geology. Outcrops and inferred extensions of each rock map-unit are shown respectively, in deep and light tones of the same colour. Where in places a formation is too narrow to show colour and must be represented in black, a short black bar appears in the appropriate block.*

SOURCES OF INFORMATION

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Geology is not tied to surveyed lines.

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Base map derived from the Forest Resources Inventory maps, Ontario Department of Lands and Forests, with additional information by D. R. Pyke.

Magnetic declination in the area was 9°30′ West, 1967.

Map 2206
LANGMUIR AND BLACKSTOCK TOWNSHIPS
TIMISKAMING DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

Chains 80 60 40 20 0 1 2 Miles
Metres 1000 0 1 2 3 Kilometres
Feet 1000 0 5,000 10,000 Feet