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Frontispiece–Mesa formed by diabase outlier. Looking northeast from vicinity of Namewaminikan River, Sandra Township.

Ontario
Division of Mines

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Geology of Dorothea, Sandra, and Irwin Townships District of Thunder Bay

By

W.O. Mackasey

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(back pocket)

ABSTRACT

Dorothea, Sandra, and Irwin Townships form a 15 by 6 mile (24 by 10 km) area on the east shore of Lake Nipigon and are about 110 miles (180 km) northeast of Thunder Bay. The report and accompanying map outline the lithology, structural geology, mineral deposits, and exploration history of the map-area.

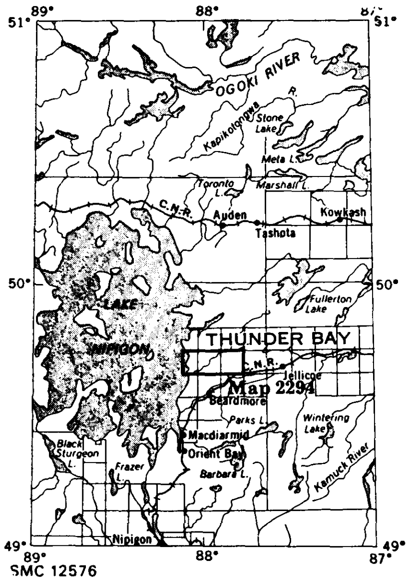

Figure 1–Key map showing location of Dorothea, Sandra, and Irwin Townships. Scale 1 inch to 50 miles (1:3,168,000).

The area is underlain by Precambrian igneous and metamorphic rocks. The oldest rocks are Archean metavolcanics and metasediments, and are intruded by small lenses and dikes of granodiorite, diorite, and related igneous rocks. The metavolcanics range in composition from mafic to felsic. Mafic metavolcanics are dominantly massive types, but zones of amygdules, pillows, and breccia are extensive. The intermediate to felsic metavolcanics consist of tuff-breccia, pyroclastic breccia, thin-bedded tuffs and porphyritic flows. Metasediments are made up of conglomerate, feldspathic sandstone, greywacke, siltstone, argillite, iron formation, and minor limestone. Keweenawan diabase dikes and sheets cut all rock types in the map-area. Pleistocene sand and gravel, and Recent swamp deposits cover much of the bedrock.

The map-area forms part of the Wabigoon Belt of the Superior Province and the Archean rocks have been tightly folded along an east-west axis. Well preserved primary sedimentary and volcanic features were used to determine the superposition of strata. Several prominent post-diabase, east-striking faults were recognized and a total right-handed displacement of 4 miles is indicated in the map-area by a faulted north-south diabase dike.

Gold, silver, iron, copper, molybdenum, sand, and gravel are present. Gold, and associated silver, occur in quartz veins, carbonate zones, and sulphide deposits. Genetic relationship of mineralization to intrusion, volcanism, iron formation, and faulting is considered. Copper is present in sulphide veins and is disseminated along shears in volcanic rocks. Molybdenite is present in quartz veins, and in disseminated form, along with chalcopyrite, in altered granodiorite. Iron is of sedimentary origin and forms both hematite and magnetite deposits.

Dorothea, Sandra, and Irwin Townships

Transportation, communications, and energy resources are available for rapid development of mineral deposits. Exploration for disseminated sulphide deposits related to granitic intrusions is recommended for the region in general. Copper mineralization related to Late Precambrian north-south faults, such as in the Barbara Lake area to the south, should be considered. Examination of sheared tuffaceous rocks for copper is recommended in the north part of the map-area. Gold, iron, and the continuity of volcanic rocks across Lake Nipigon are also discussed.

The iron deposits have been examined repeatedly since the turn of the century. Gold was first discovered in the region in 1925 and provided the main interest in exploration. The Sturgeon River Gold Mine produced 73,438 ounces of gold and 15,922 ounces of silver between 1937 and 1942. Exploration for sulphide deposits has become increasingly active in more recent years. Details of individual properties and mineral deposits are described.

Geology

of

Dorothea, Sandra, and Irwin Townships

District of Thunder Bay

By

W.O. Mackasey[1]

INTRODUCTION

Dorothea, Sandra, and Irwin Townships in the District of Thunder Bay comprise a 6 by 15 mile (10 by 24 km) strip on the east shore of Lake Nipigon and form part of the 'Sturgeon River Gold Belt'. The town of Beardmore, approximately 4 miles (6 km) to the south of the map-area, is the closest centre.

Mineral Exploration

Gold was first discovered in the region in 1925 and has since provided the main interest in exploration. The Sturgeon River gold mine was in production from 1937 to 1942 and yielded a total of 73,438 ounces of gold and 15,922 ounces of silver worth $2,728,905 (Statistical Files, Ontario Division of Mines). A 223-foot (68 m) pilot shaft (Casey Contact Mine) was sunk in 1935 on the present Brenbar Mines Limited property. Extensive stripping and trenching projects accompanied by diamond drilling have been carried out in several parts of the map-area.

Molybdenite has been located on two properties in Dorothea Township. Trenching and diamond drilling has been undertaken on what was formerly known as the Amorada property. This occurrance was again investigated in the 1950s and B.C. Lamble (1959) reports that the deposit contains a total of 7,500 tons grading at least 1.5 percent MoS_2 to a depth of 40 feet (12 m).

Diamond drilling of copper zones south of Patter Lake (Irwin Township) on the former W. Sutherland property and west of Pirum Lake (Sandra Township) on the Witwer property was undertaken as recently as 1960 and 1966 respectively.

Three bands of iron formation within the map-area have been examined repeatedly since the turn of the century. The Algoma Steel Corporation Limited drilled three holes in 1966 to test iron values on the south shore of Still Lake.

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines. Manuscript approved for publication by the Chief Geologist, 1 November 1971.

Present Geological Survey

The present geological survey was undertaken during the summer of 1967 to study the geology and mineral deposits in detail. Additional work was done during the summer of 1968. Mapping was by pace-and-compass traverses spaced approximately ¼ mile (0.4 km) apart in areas of metavolcanics and metasediments, and ½ mile (0.8 km) apart in areas underlain by diabase. Shoreline traverses were run on most of the lakes in the map-area.

Traverses were tied into recognizable features such as roads, streams, and lakes. Surveyed lines such as township boundaries and surveyed claim lines were not useful because they were overgrown or obliterated by slash from logging operations.

Additional geological data were obtained from air photographs on scales of ¼ mile and 1 mile to the inch, ODM-GSC aeromagnetic maps and reports, and geological and geophysical maps of various mining companies.

The geological map of the area was prepared at a scale of 1 inch to ¼ mile (1:15,840) for publication at a scale of 1 inch to ½ mile (1:31,680), using base maps of the Forest Resources Inventory, Ontario Ministry of Natural Resources.

Uncoloured preliminary geological maps P.479, P.480, and P.481, covering the area described in this report at a scale of 1 inch to ¼ mile (1:15,840), were issued in 1968 by the Ontario Division of Mines.

Acknowledgments

The author was assisted in the field by M.A. Bakarr, R.M. Callander, E.R. Owen, and W.T. Fleming. Mr. Bakarr as senior assistant mapped about half the area. Messrs. Callander, Owen, and Fleming ran independent traverses during the later part of the field season.

R. Teal assisted the author in the field for a few days in 1968. A.J. Andrews and A.W. Garson helped with the office work.

Storage facilities and information concerning the area were generously given by J.P. King, former Chief Forest Ranger, Ontario Department of Lands and Forests, and his staff at Macdiarmid.

Means of Access

Highway 11, the Trans Canada Northern Route, skirts the southern part of the map-area and provides excellent access by means of secondary Highways 801 and 580 and branch roads.

Timber operations were numerous in recent years with the result that many bush roads and trails were built throughout the map-area. Some of these roads have since been overgrown by alders. Others pass through swamp and muskeg and consequently can only be used during winter months. Many of these roads and trails are shown on Map 2294 (back pocket). Several haulage roads north of McCambly Lake, Irwin Township, are not shown.

The Canadian National Railway line and Trans-Canada natural gas pipeline are parallel to Highway 11 south of the map-area. An airport having a 3,000-foot (900 m) long, compacted gravel runway is located near the settlement of Jellicoe some 10 miles (16 km) east of Irwin Township.

The Namewaminikan (Sturgeon) River was not used to a great extent as a means of access during the 1967 field season. River drives from logging operations usually kept the waterway closed to navigation. Later in the field season, booms, to allow for storage of logs, blocked off the river. Lake Nipigon is noted for its rough water and transport by canoe or similar light water craft is not advisable.

Previous Geological Work

According to Laird (1936, p.63) Robert Bell of the Geological Survey of Canada, and his assistant Peter McKellar, undertook the first recorded geological work in the region in 1869. Other early workers of the GSC were W. McInnes in 1894, D.B. Dowling in 1898, and W.A. Parks in 1901. The Ontario Bureau of Mines conducted studies of the iron deposits in the region in 1906 and 1907, (Coleman 1907; Moore 1907). A.W.G. Wilson, in 1908, completed the field work started by the Federal government, the results of which form Memoir 1 of the Geological Survey of Canada published in 1910.

A.G. Burrows examined the geology along the railway line in the Beardmore-Nezah area in 1916 for the Ontario Bureau of Mines (Burrows 1917).

The Windigokan Lake area and the railway to the south were mapped in 1917 by the Geological Survey of Canada (Tanton 1921). G.B. Langford mapped this area in greater detail in 1927 (Langford 1929).

Volume 45, Part II, 1936, of the Ontario Department of Mines, by E.L. Bruce (p.1-59) and H.C. Laird (p.60-117) forms a comprehensive report on the geology and mineral deposits of the area. Recent workers in the region were Horwood and Pye (1955), Peach (1951), and Pye (1951). A geological compilation map (Map 2102) of the Tashota-Geraldton area was published by the Ontario Department of Mines (Pye *et al.* 1966).

Table 3 lists assessment work data on file with the Ontario Department of Mines as of December 1967.

Topography

The major part of the map-area is drained by the Namewaminikan (Sturgeon) River (Photo 1) and its tributaries, and flows into Lake Nipigon which is approximately 855 feet (310 m) above sea level.

The map-area can be physiographically divided into three separate regions. The most prominent is a west-dipping diabase cuesta which transects the area. East of this feature, outcrop is abundant and the area consists of east-trending steep-sided ridges and deep troughs and valleys. West of the cuesta relief is moderate to low, and drift covered and swampy areas are extensive.

Many troughs and ridges, as well as lakes and rivers, are the result of east-trending folds and faults in the metavolcanics and metasediments. Erosion along post-diabase faults has produced wind gaps in the cuesta in several locations.

ODM8976

Photo 1–35-foot falls on the Namewaminikan River, Sandra Township. Caused by resistant non-foliated metasediments.

Much of the area has been harvested for pulp logs in recent years and wide areas of slash are present. This, along with a section in the northern part of Sandra and Irwin Townships that was burned over in 1956, makes cross-country traversing difficult in some parts of the map-area.

Tourism and Natural History

The east shore of Lake Nipigon provides a well-exposed section across one of the widest volcanic-sedimentary belts in Ontario and exhibits well-preserved volcanic and sedimentary features such as pillow lavas, volcanic breccia, and graded bedding.

Sections of the Lake Nipigon shoreline in Dorothea Township (as well as the shoreline to the north and south) will prove to be of value in the future, both as an attraction for tourists and as a field study area for educational and recreational groups. Any land-use planning for this area should take into account the historical value of the geological features present.

GENERAL GEOLOGY

The map-area is underlain by east-trending, metamorphosed, folded and faulted Archean volcanic and sedimentary rocks. The metavolcanics range from massive and

Table 1 | TABLE OF LITHOLOGIC UNITS FOR DOROTHEA, SANDRA, AND IRWIN TOWNSHIPS

CENOZOIC

Quaternary

RECENT
Swamp, lake, and stream deposits

PLEISTOCENE
Sand, gravel, and clay

Unconformity

PRECAMBRIAN

LATE PRECAMBRIAN (PROTEROZOIC)

MAFIC INTRUSIVE ROCKS
Diabase

Intrusive Contact

Porphyritic diabase

Intrusive Contact

EARLY PRECAMBRIAN (ARCHEAN)

MAFIC INTRUSIVE ROCKS
Diorite, gabbro, pyroxene porphyry, lamprophyre, serpentinized peridotite

INTERMEDIATE TO FELSIC INTRUSIVE ROCKS
Granodiorite, quartz diorite, quartz-feldspar porphyry, feldspar porphyry

Intrusive Contact

METAVOLCANICS AND METASEDIMENTS

MAFIC METAVOLCANICS
Massive lava, amygdaloidal lava, pillow lava, flow breccia and volcanic breccia, tuff and tuffaceous schist

INTERMEDIATE TO FELSIC METAVOLCANICS
Tuff-breccia, pyroclastic breccia, tuff and tuffaceous schist, massive lava, feldspar porphyry, quartz-feldspar porphyry

METASEDIMENTS
Feldspathic sandstone, greywacke, siltstone, argillite, polymictic conglomerate, iron formation, limestone

pillowed mafic lavas to intermediate and felsic pyroclastics. The metasediments consist of conglomerate, sandstone, siltstone, argillite, and minor iron formation. Stratigraphic relationships are not certain.

The metasediments and metavolcanics are intruded by east-trending mafic dikes and lenticular bodies of intermediate rocks. Feldspar and quartz-feldspar porphyry dikes cut the metavolcanics.

Diabase, probably of Keweenawan age, is present as north-trending dikes and as a thick west-dipping sheet.

The Precambrian rocks are covered in part by Pleistocene deposits of sand, gravel, and clay, as well as by Recent lake, stream, and swamp deposits. The geological history is summarized in Table 1.

Early Precambrian (Archean)

METAVOLCANICS

Mafic Metavolcanics

Mafic volcanic rocks form two main east-trending belts that are composed dominantly of andesitic and basaltic types. Zones of amygdules, pillows, and breccia are extensive. Chemical compositions of three samples of mafic lava are shown in Table 2.

The lavas south of a line drawn from McCambly Lake, Irwin Township, west to the south shore of West Bay, Lake Nipigon, are considered to be dominantly mafic in composition. These flows are separated by two bands of sedimentary rocks in Irwin Township, and by a single band of sedimentary rocks in Dorothea and Sandra Townships. A unit of intermediate to felsic volcanic breccia and related flows extends from Poplar Point east to the Namewaminikan River, Sandra Township.

The lavas vary from dark green to greyish green and are generally fine grained. Individual flows could not be delineated but the presence of amygdaloidal and pillowed zones indicate that the volcanic pile is composite.

Primary features such as pillows and amygdules generally have been moderately deformed. In contrast, tuffaceous units and scoria zones have been highly sheared. Moss, lichen, and other vegetal material quite easily conceal these primary features. The best exposures are along the Lake Nipigon shoreline and on some bulldozed logging roads.

The mafic volcanic rocks, along with intermediate to felsic volcanic and sedimentary rocks, have been metamorphosed under greenschist facies conditions. The mafic volcanic rocks contain abundant chlorite and saussuritized plagioclase, as well as epidote, quartz, amphibole, pyroxene, calcite, and minor amounts of magnetite. The plagioclase occurs in the form of phenocrysts and tiny laths. Relict pilotaxitic texture can be observed in some thin sections.

Table 2 COMPLETE ROCK AND TRACE ELEMENT ANALYSES OF ROCKS FROM DOROTHEA, SANDRA AND IRWIN TOWNSHIPS.[1] CHEMICAL ANALYSES BY THE MINERAL RESEARCH BRANCH OF THE ONTARIO DIVISION OF MINES

	1	2	3	4	5	6	7
MAJOR COMPONENTS IN PERCENT							
SiO_2	59.6	44.9	43.1	58.0	62.5	13.3	61.30
Al_2O_3	13.0	15.1	14.2	14.6	15.4	0.46	16.78
Fe_2O_3	2.27	3.05	1.92	2.12	2.01	1.34	1.37
FeO	5.08	8.60	10.8	6.80	4.55	4.14	3.78
MgO	6.45	12.6	5.88	2.95	1.97	2.35	2.98
CaO	3.83	8.28	11.9	5.05	2.18	41.8	4.25
Na_2O	3.29	1.73	2.64	3.29	3.98	0.11	3.52
K_2O	0.22	0.06	0.22	0.87	1.98	nil	0.80
H_2O^+	3.42	4.63	2.71	2.47	2.00	0.15	
H_2O^-	0.59	0.25	0.21	0.41	0.20	0.10	2.53
CO_2	2.90	0.19	4.60	3.20	0.80	35.6	1.92
TiO_2	0.59	0.65	0.62	0.89	0.46	<0.01	0.64
P_2O_5	0.16	0.24	0.07	0.19	0.08	0.02	0.11
S	0.02	0.01	0.03	0.06	0.97	0.06	nil
MnO	0.12	0.20	0.24	0.17	0.06	0.11	0.11
Total	101.5	100.5	99.1	101.1	99.1	99.5	100.1
Specific Gravity	2.73	2.98	3.01	2.98	2.76	2.76	2.76
TRACE ELEMENTS IN PPM							
Ag	<1	<1	<1	<1	<1	1	
As	—	5	—	—	4	—	
Ba	—	—	—	150	500	—	
Co	30	60	40	20	20	—	
Cr	400	600	200	100	30	—	
Cu	50	—	120	100	340	40	
Ga	30	20	40	40	20	—	
Li	—	20	—	20	—	—	
Ni	200	380	120	40	40	15	
Pb	<10	—	—	<10	30	<10	
Sb	8	6	8	8	<1	6	
Sc	40	40	40	20	—	—	
Sr	150	200	100	150	200	500	
V	150	150	200	150	80	—	
Y	30	<20	30	50	—	—	
Zn	90	120	100	120	110	14	
Zr	150	100	60	200	100	<20	

Sample 1. Sample M-68-11-226, pillow lava, north of Nordic Lake, Irwin township.
2. Sample M-68-11-203, massive basalt, south shore of Bish Bay, Lake Nipigon.
3. Sample M-68-11-201, pillow lava, small island between West and Bish Bays, Lake Nipigon.
4. Sample M-68-11-202, volcanic breccia, south of Bish Bay, Lake Nipigon.
5. Sample M-70-3-111, feldspar porphyry, Zmudzinski property, west of Pirum Lake, Sandra township.
6. Sample M-67-15-122, cherty limestone, north-central Irwin township.
7. Sample No. 3, granodiorite from crosscut north of shaft, Sturgeon River Gold mine. (Taken from Bruce, 1936, p. 24, Table 1).

[1]Be, Mo, and Sn were looked for but not detected in any of the samples.

MASSIVE LAVA

Massive mafic lava is considered to be the dominant type, however, this impression may be due to the lack of good exposure. The massive lava is included in the unsubdivided mafic metavolcanics (Map 2294, back pocket).

Massive lava varies in texture from medium to coarse grained and in general composition from basalt to andesite. Much of the massive lava contains up to 5 percent dark green specks of chlorite which are believed to be altered amphibole and pyroxene phenocrysts.

Coarse-grained mafic rocks associated with the massive lava are thought to be the central parts of flows. Laird (1936, p.70) believed that some of the coarser grained parts may be intrusive. Colcleugh (1946), in central Irwin Township, found bodies of diorite to be intrusive into the lavas but stated (p.7) that they are difficult to recognize. He also stated (p.7) that "The diorites are strongly suggestive of sills in their lineal east-west distribution between andesite flows".

Colcleugh (1946, p.23-28) considered several problems in the recognition of dioritic rocks that are intrusive into mafic lava. In central Irwin Township he found (p.23) that "Exposures of bare rock were not plentiful, and nowhere on surface was an unquestioned intrusive relationship seen. As mapping progressed, the field evidence indicated diorite rather than andesite, but such evidence was never quite conclusive. Diamond drilling results helped somewhat to clarify the picture". He noted, for example, that small tongues of mafic lava appeared to project into the coarse-grained rocks and he considers the fine-grained rocks to be part of pre-existing lava flows. The coarse-grained rocks in places occur as sharply defined layers about 10 feet (3 m) thick and as isolated patches which may represent sills and related offshoots. Another factor according to Colcleugh is that the coarse-grained rocks contain ilmenite and leucoxene, whereas none was observed in the finer grained rocks. Difference in grain size may, however, account for the apparent lack of these minerals in the fine-grained lavas.

Although the author recognized these coarser grained rocks in the mafic lava succession, they were considered to be the interior parts of thick flows. In view of the detailed work by Colcleugh (1946), especially with his studies of diamond drill core, it should be conceded that some sills of dioritic rock are present. Whether or not they are related to the volcanic pile or to later intrusive activity is a matter still to be resolved.

An analysis of a coarse-grained portion of a mafic flow on the south shore of Bish Bay is shown in Table 2.

AMYGDALOIDAL LAVA

Zones of amygdules are abundant throughout the mafic lava succession and are present in both pillowed and massive flows. A few scoria zones were also noted.

Amygdules in the lava flows are irregularly distributed and randomly oriented. Although amygdaloidal zones probably correspond to the tops of flows, no evidence was found to confirm such.

Most of the amygdules are undeformed and the original well-rounded spheroidal shape is intact. Quartz, carbonate, and chlorite are the most abundant mineral fillings.

ODM8977

Photo 2–Giant pillows near road east of Nordic Lake, Irwin Township. Thin patches of tuffaceous material fill spaces between pillows.

In describing the zone of mafic lavas that extends from south of the Namewaminikan River in Sandra Township, east to Tallon Lake, Irwin Township, Laird (1936, p.71) stated that "...The amygdules are elongated, suboval structures ranging up to 3 inches (8 cm) in length, the common fillings being quartz, calcite, a chlorite mineral, chalcedony, and pyrite, in the same order of decreasing abundance. Quartz invariably fills the openings greater than ½ inch (1.3 cm) in diameter. The deposition of chalcedonic quartz in small openings gives rise to bluish agate, and in places pink rather than white calcite was observed. Chlorite fillings are commonly replaced wholly or in part by pyrite. Seldom were more than two of the above-named amygdaloidal types seen in any one outcrop, a notable exception being on the Lak-Teck property, southwest of Windigokan Lake, where amygdules filled with quartz, calcite, chlorite, and pyrite occur together in the same outcrop...".

PILLOW LAVA

Zones of pillow lava are common and in a few places form mappable units. They range from a few tens of feet to a few hundreds of feet in thickness and parallel the regional strike.

Most pillows are 1 foot to 2 feet (0.3 to 0.6 m) in diameter, but some pillows larger than 4 feet (1.2 m) across were observed. Most pillows are closely packed and show slight to moderate deformation; their longest axis being parallel to foliation. Selvages are dark green and aphanitic, and are generally 1 inch to 2 inches (2.5-5 cm) thick. The use of pillows in structural top determinations was rare due to deformation as well as the absence of well defined cusps.

Large, well exposed balloon-type pillows were observed along the road north of Nordic Lake, Irwin Township (Photo 2).

Amygdules generally are present in the pillows and are concentrated near the rims. South of West Bay, Lake Nipigon, amygdules were observed that form a radial pattern around the pillow margins.

In a small bay 1,200 feet (360 m) north of Bish Bay, Lake Nipigon, there is a small exposure of pillow breccia that consists of several ellipsoidal and pancake-shaped pillows, with carbonate amygdule rims, suspended in a fine-grained breccia matrix.

The chemical compositions of two samples of pillow lava are shown in Table 2.

VOLCANIC BRECCIA

In the south-central part of Sandra Township breccia is composed of 1- to 2-inch (2.5-5 cm) angular to sub-rounded volcanic fragments suspended in a dark green fine-grained pyroclastic matrix. This unit can be traced for over 1 mile (1.6 km) along strike. The position of the south contact of this zone could not be determined and the breccia may be more extensive than indicated on the map. Where exposed on rarely preserved glacially polished surfaces, some rocks which elsewhere appear to be massive were found to have a brecciated aspect. Similar breccia was observed near the west end of Tallon Lake. Most of this breccia is interpreted to be of flow top origin. Laird (1936, p.73) mentions the presence of flow breccia in the northeast section of Gooseneck Lake.

TUFF AND TUFFACEOUS SCHIST

Tuffaceous rocks are rare in the mafic lava succession. Thinly bedded and laminated rocks and sheared chlorite-sericite schist of probable tuffaceous origin outcrop along the Lake Nipigon shoreline in the vicinity of the north shore of Bish Bay. Similar rocks occur east along strike on the bush road in Dorothea Township north of the Tyson property. Minor amounts of hematitic schist talus and rubble were found associated with the tuffaceous rocks.

Microscopic studies of laminated tuff collected along the Lake Nipigon shoreline midway between Bish and West Bays show the rock to be composed of 10 to 15 percent sheared quartz and feldspar clasts suspended in a fine-grained cloudy saussuritic groundmass. No definite evidence of pyroclastic origin was observed and it is conceivable that these rocks may be of sedimentary origin.

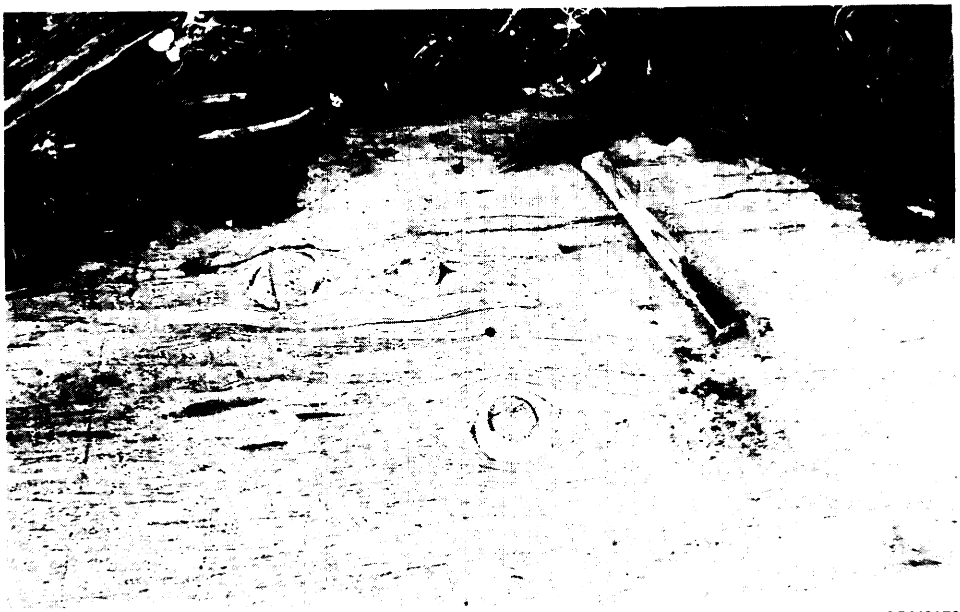
Intermediate to Felsic Metavolcanics

Intermediate to felsic volcanic rocks underlie most of the map-area north of the Paint Lake Fault with the exception of those areas underlain by diabase. A second band extends from the southern part of Long Rapids, Sandra Township, west to Poplar Point.

The most important rock types are tuff-breccia, pyroclastic breccia, and tuff. Excellent exposures occur on ridges along the north boundaries of Sandra and Irwin Townships. Chloritic intermediate lava, massive and laminated rhyolite, and porphyritic felsic rocks

ODM6978

Photo 3–Tuff-breccia, Brenbar Property, Irwin Township.



ODM8979

Photo 4–Tuff-breccia with pancake-type bombs. Note wrap-around structures that may be of primary origin. Northeast corner, Sandra Township.

ODM8980

Photo 5–Pyroclastic breccia, Hopkins Property, northwest corner of Irwin Township. Note left hand displacement of faulted blocks, and glacial striations.

ODM8981

Photo 6–Tuff-breccia with layering, Brenbar Property, Irwin Township.

are common. Numerous fine- to medium-grained gabbroic dikes and sills, too small to be shown on the map, occur within this unit.

These volcanic rocks vary from shades of light green to greyish green on fresh surfaces. For the most part they exhibit a characteristic, rough, weathered surface having a bleached or faded green colour.

A well foliated aspect is prominent throughout most of the succession and in places, especially in the Twin Falls area, a distinct lineation due to stretching of clasts can be readily observed.

PYROCLASTIC ROCKS

Pyroclastic rocks are distributed throughout the entire intermediate to felsic volcanic rock succession. Excellent exposures of pyroclastic breccia occur along the northern boundaries of Sandra and Irwin Townships and are interbedded with tuff and tuff-breccia as well as with massive and laminated felsic flows. Blocks and bombs in the pyroclastic breccia range from 2½ inches up to 2 feet (6 cm-0.6 m) across, the average size being between 4 and 6 inches (10-15 cm). Most bombs are elongated or 'cigar-shaped' parallel to regional foliation (Photos 3,4,5).

There is some evidence to indicate that the elongate shape of the bombs may be, in part, a primary feature. Photo 4 shows that although the majority of bombs are elongate, a few are round. These bombs, which appear elongate in section, may be of the pancake variety. In other exposures, angular blocks and bombs are mixed with the elongate clasts.

Excellent exposures of pyroclastic rocks can also be found in the northern part of the Brenbar property, Irwin Township. Here, tuff-breccia is interlayered with finer grained pyroclastic rocks as shown in Photo 6.

The pyroclastic rocks are generally composed of fine, sericitic, quartzofeldspathic material with variable amounts of quartz and feldspar phenocrysts. Pyroclastic breccia found in the vicinity of Twin Falls, Irwin Township, consists of moderately well packed porphyritic bombs in a matrix of fine-grained feldspar porphyry. The only apparent difference between the bombs and matrix is a higher concentration of phenocrysts in the latter. In some localities, several types of fragment were observed in the same outcrop. The variation, however, exists only in grain size, phenocryst content, and difference in competence. All are of intermediate to felsic volcanic composition.

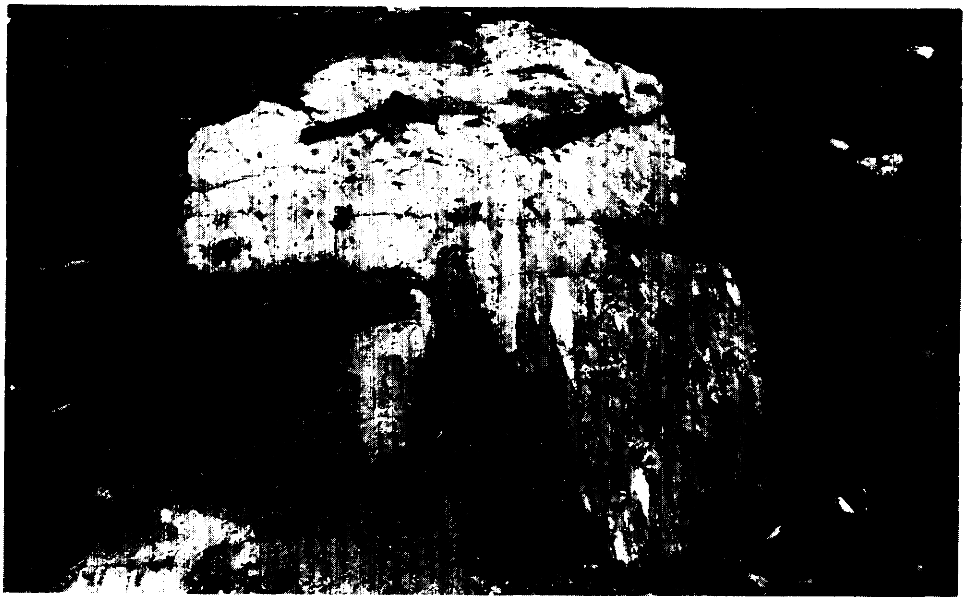
Many of the rocks classified as intermediate to felsic volcanic rocks are sericite and sericite-chlorite schists with little evidence of mode of origin remaining. In several exposures, especially near the boundary between Irwin and Sandra Townships, 'ghost' outlines of bombs and lapilli were found in the schistose rocks (Photo 7). A recent forest fire in this area destroyed the vegetal cover leaving large clean outcrop surfaces. The actual extent of the pyroclastic rocks may be much greater than is evident beyond the burn.

Even though metamorphism and shearing are cited as the causes for destruction of the pyroclastic texture (Photo 8) other processes, such as intense welding of fragmental material as described by Ross and Smith (1961) should also be considered.

A large body of volcanic breccia outcrops over an extensive area on the Lake Nipigon shoreline between Bish Bay and Poplar Point. Laird (1936, p.73) gives the following description: "...It consists of numerous angular and blocky fragments of greenish materials showing considerable variety and ranging in size from mere particles to four-

ODM8982

Photo 7–Tuff-breccia and tuffaceous schist, Brenbar Property, Irwin Township. Note gradual disappearance of fragmental texture.



ODM8983

Photo 8–Tuff-breccia, northeastern Irwin Township. Flame-like shape of fragments may be due to shear deformation.

sided blocks 2 feet (0.6 m) or more in width. The fragments are generally crowded together and show no special orientation. The interstitial material is a dark chloritic substance. In places near the water's edge, surfaces polished by glaciation and wave-action exhibit a very pleasing mosaic of velvety green fragments, this rock being almost in the ornamental class . . ."

The fragments contain feldspar phenocryst 'ghosts' embedded in a very fine-grained matrix of quartz, plagioclase, and chlorite, with minor amounts of muscovite and epidote. Calcite is present as a coating around fragments and as seams filling fractures in the fragments. A chemical analysis of the breccia is given in Table 2.

The origin of this breccia is not clear but angularity of the fragments, poor sorting, lack of bedding, and wide areal extent suggests an Aa lava flow.

MASSIVE AND PORPHYRITIC LAVAS

Massive and porphyritic lavas make up the great bulk of the intermediate to felsic volcanic succession. Most of these rocks have been sheared to varying degrees, leaving little evidence of primary features. In a few places, laminations, possibly representing flow bands, were observed.

Well foliated, grey weathering, fine-grained intermediate to felsic rocks with 5 to 20 percent euhedral feldspar phenocrysts, 2 to 3 mm in length, are common. In some areas, these rocks are distinctly fissile; they may have originally been thin bedded tuff.

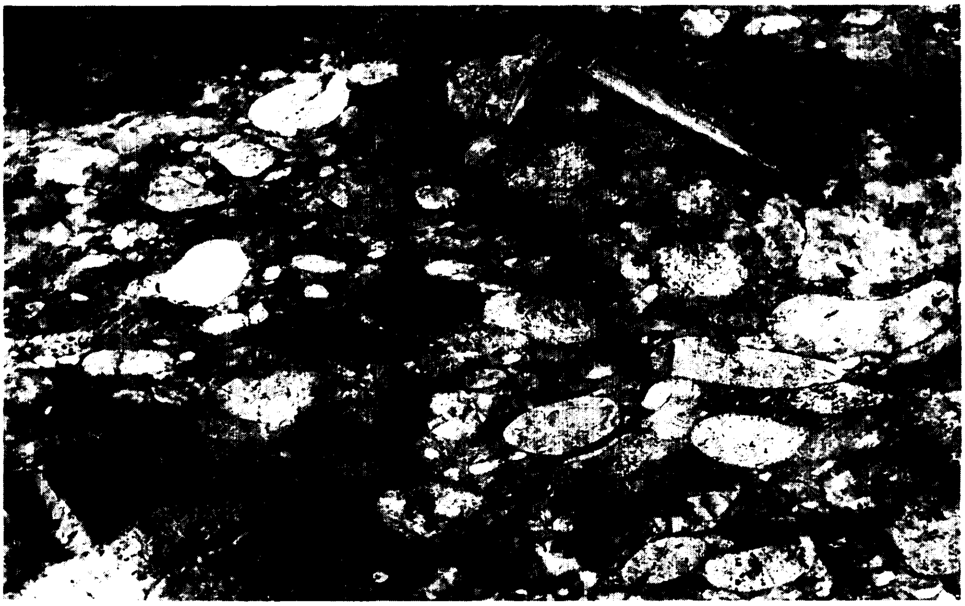
Some of the more massive porphyritic rocks are brittle, being well fractured rather than sheared, and are probably of flow origin. Feldspar porphyry, believed to represent an altered dacite flow west of Pirum Lake, Sandra Township, is composed of altered plagioclase phenocrysts in a matrix of fine-grained quartz, plagioclase, and chlorite along with minor amounts of calcite and pyrrhotite. A chemical analysis of this rock is shown in Table 2.

Grey weathering, brittle, massive to foliated quartz-feldspar porphyry occurs in Irwin Township south of the Sturgeon River Gold Mine and in the northern part of the Brenbar property. The rock is composed of 15 percent quartz phenocrysts, 1 to 3 mm in diameter, in a silicious aphanitic groundmass. Some of the quartz phenocrysts may be of metamorphic origin. Plagioclase phenocrysts are euhedral, average 2 mm in size, and make up more than 15 percent of the rock in some places.

Several 2- to 3-foot (0.6-0.9 m) wide bands of a distinctive feldspar porphyry, with subhedral to euhedral phenocrysts up to 1 inch (2.5 cm) in diameter, were found in the intermediate to felsic lava succession. Contact relationships have been obscured by shearing and they may either be dikes or thin flows. A sample collected near the east border of Sandra Township is dark green and is made up of equal portions of altered feldspar and chlorite with 15 percent light grey plagioclase phenocrysts. The rock has a salt-and-pepper texture with the plagioclase phenocrysts standing out in relief on the weathered surface.

METASEDIMENTS

The metasediments form three prominent bands striking east across the map-area. The northernmost band, in the Patter-Knox Lake area is dominantly polymictic con-



ODM8984

Photo 9–Polymictic conglomerate with pebble of chert iron formation (photo centre), Corrigan Creek, Sandra Township.

glomerate. The central and most extensive belt is composed of polymictic conglomerate, feldspathic and quartzose sandstone, siltstone, minor argillite, and hematitic iron formation. An apparent decrease in grain size was found to exist south across the central band. The southernmost belt is present in the southeast corner of Irwin Township and consists dominantly of greywacke sandstone, siltstone, and argillite with minor magnetite-bearing iron formation and conglomerate.

The metasediments were originally termed the Windigokan series by Tanton in 1917. Pye (1968, p.12) notes that rocks similar in character occur along the projected strike west of Lake Nipigon.

Conglomerate

The best exposures of conglomerate are in the Corrigan Lake-Patter Lake areas of Irwin and Sandra Townships. Here large outcrops and cliffs of polymictic conglomerate are composed of pebbles and boulders of granitic and dioritic rock, mafic and intermediate volcanic material, and less abundant argillite, quartz, jasper, and iron formation.

The clasts generally show a high degree of rounding and are closely packed as shown in Photo 9. The matrix varies from medium- to coarse-grained feldspathic sandstone that in some places has been transformed to chloritic schist. One- to two-foot (0.3-0.6 m) thick feldspathic 'arkosic' sandstone layers, as shown in Photo 10, are present in a few localities. Compaction and folding has caused flowage of the less competent clasts, and primary features such as imbrication have been destroyed.

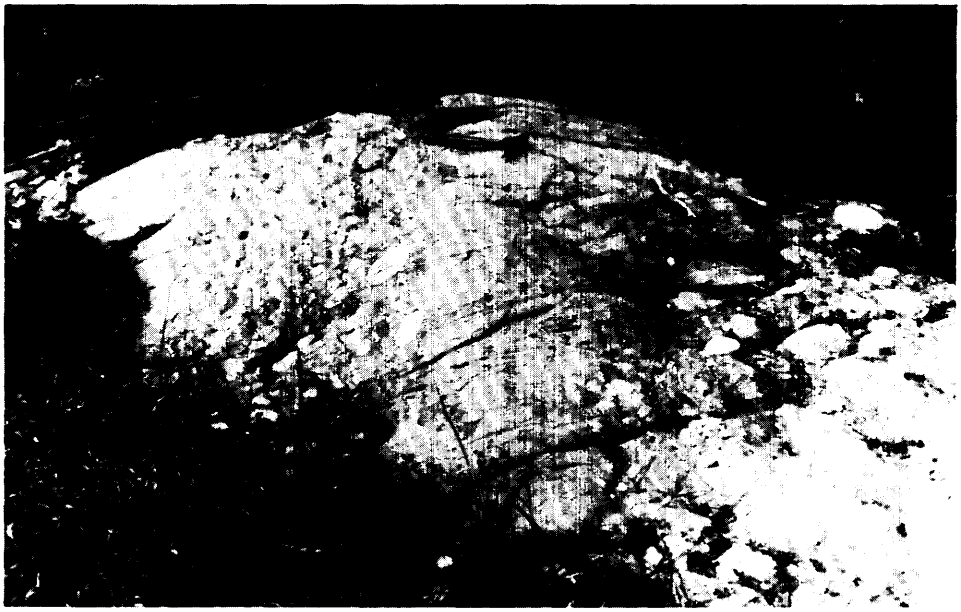


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Photo 10–Interbedded polymictic conglomerate and feldspathic sandstone, Corrigan Creek, Sandra Township.

Large outcrop areas of similar polymictic conglomerate occur in the sedimentary unit extending across the southern part of Sandra and Dorothea Townships.

A close spatial relationship between conglomerate and iron formation was observed in two locations. A thin bed of polymictic conglomerate was found to overlie a succession of lean iron formation in claim AL403, Dorothea Township. Sandstone and pebble conglomerate are interbedded with thin layers of magnetite-bearing iron formation (Photo 11) just north of the road at the east end of Watson Lake, Irwin Township.

In a study of conglomerate in the Beardmore region, Callander (1970, p.50) concludes that the majority of the clasts are volcanic in origin with granitoid material making up as much as 35 percent of the remainder. One notable feature about clast composition is the almost complete lack of material of metamorphic origin. Most of the conglomerate is composed of material that is probably of local origin.

Sandstone, Siltstone, Argillite, and Slate

The fine-grained metasediments in the map-area may be classified as two types. The first type consists of medium- to coarse-grained feldspathic sandstone and minor related finer grained rocks associated with the conglomerates and is confined to the central sedimentary belt. The second type consists of a greywacke or turbidite sequence and is dominant in the southern sedimentary belt.

The first type is characterized by massive medium grey feldspathic to quartzose sandstone that is fairly resistant to erosion and forms large smooth outcrops and out-

ODM8986

Photo 11—Magnetite layers (dark) interbedded with conglomerate and greywacke. North side of road at the east end of Watson Lake, Irwin Township.

crop ridges. This sandstone occurs with the conglomerate and has thin, pebbly layers throughout. Tiny angular chips of jasper can commonly be recognized in hand specimen. In thin section the sandstone is seen to consist of angular to subrounded, moderately coarse sand-size clasts and is composed mainly of quartz and plagioclase along with lesser amounts of chert and lithic fragments of volcanic origin and minor amounts of biotite. The matrix makes up 5 to 10 percent of the rock and is mainly a fine-grained mixture of sericite and other clay minerals. The best exposures are in the central part of Sandra Township. Crossbedding and graded bedding were observed near the base of the 35-foot (11 m) falls on the Namewaminikan River, Sandra Township. Medium to dark grey siltstone and argillite associated with the feldspathic sandstone is most abundant along the southern margin of the central belt. In some outcrops a prominent slaty cleavage cuts across the thin bedded and laminated sedimentary rocks.

The greywacke or turbidite sequence consists of dark grey thin bedded greywacke interlayered with silt, slate, and argillite with graded bedding as a dominant feature. Many examples of channeling and rafted argillite chips were also observed on clean outcrop surfaces. This greywacke or turbidite assemblage is well exposed in the Watson Lake area, Irwin Township as well as north of Spawn and Tallon Lakes.

The sandstone and greywacke sequence in the central belt appear to have an interfingering relationship with each other that is interpreted as a facies change.

A small wedge of thinly bedded greywacke sandstone, siltstone, and argillite similar to the sediments at Watson Lake occurs along the Namewaminikan River west of the Long Rapids in Sandra Township. A small window of greywacke sandstone and argillite occurs in the diabase sheet to the west of Long Rapids. Thin section study shows that here the greywacke and argillite have been cut by tiny stringers and seams of clinopyroxene and biotite that are probably offshoots from the diabase.

ODM8987

Photo 12–Hematitic iron formation (dark layers) at Spawn Lake, Irwin Township. Folding may be due to penecontemporaneous deformation.

Iron Formation

Iron formation and related ferruginous rocks in the map-area were studied by A.P. Coleman and E.S. Moore in 1906 and 1907 (Moore 1907; Coleman 1908). Detailed descriptions are given in their reports.

Four main localities in which iron formation is associated with other sedimentary rocks have been recognized. One locality is in Dorothea Township north of the Namewaminikan River. The other three are in Irwin Township at the west end of Windigokan Lake, along the south shores of Spawn and Still Lakes, and in the Watson Lake-Doris Lake area.

In Dorothea Township, a thin band of well bedded lean iron formation can be traced in outcrop for approximately 1 mile and has a well defined aeromagnetic trend as shown on ODM-GSC map 2128G. The unit consists of thin-bedded, alternating red and green ferruginous cherty layers with minor amounts of visible magnetite and jasper. Laird (1936, p.76) estimates that the total thickness exceeds 40 feet (12 m) in only a few places. These beds dip approximately 45NW and are overlain by conglomerate.

Both hematite and magnetite iron formation deposits can be found in Irwin Township. The hematite iron formation is well exposed on the south shore of Spawn Lake and near Still Lake just west of Tallon Creek. Here thin beds of hematite are inter-

ODM8988

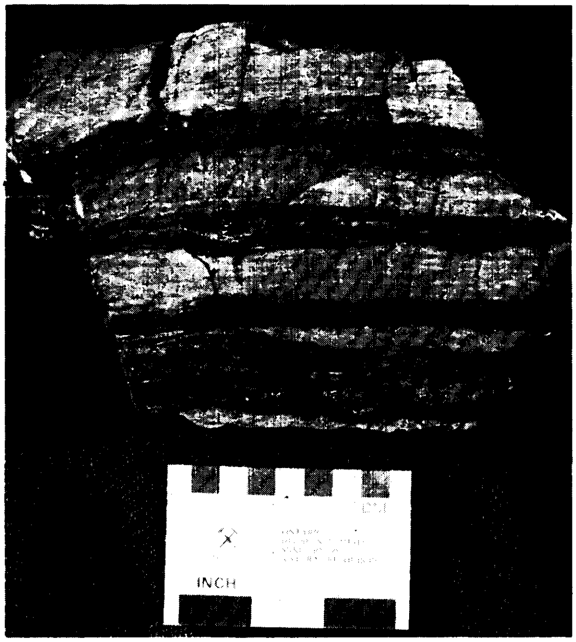
Photo 13–Hematitic iron formation from same location as shown in Photo 12 but of higher grade.

calated with light grey weathered argillite and siltstone and minor chert and jasper as shown in Photos 12 and 13. Minor folds with amplitudes ranging from a few inches up to 10 feet (3 m) are present and are well exposed near Still Lake. Deposits at the west end of Windigokan Lake have a low iron content.

Magnetite is the main iron mineral in the band extending from the north shore of Watson Lake eastward to Doris Lake and beyond. Here, thin discontinuous layers, ¼ inch to 6 inches (0.6 cm-15 cm) thick, of magnetite are interbedded with fine-grained clastic rocks, chert, jasper, and conglomerate across known widths up to about 40 feet (12 m). This iron formation band is well delineated on ODM-GSC aeromagnetic map 2135C.

It is significant that there is a southward change from dominantly hematitic iron formation to the magnetitic variety which may represent a facies change.

Because of the well preserved laminated structure and the presence of jasper, the Spawn Lake-Still Lake deposits are thought to be of chemical precipitate origin. The interbedded nature of conglomerate and magnetite at Watson Lake (Photo 11) is difficult to explain as a result of chemical precipitation. In describing iron formation of the same type in Errington Township, Pye (1951, p.20-21) notes that ". . . The nature of the iron formation, varying from bands made up largely of laminae of iron oxides to bands made up almost entirely of greywacke, strongly suggest a sedimentary origin. For the most part, it probably represents beds of black sand laid down with the other rock formations, though the local occurrence of dull red layers of either jasper or dense, grey silica in place of the typical greywacke suggests that at least some of the silica and iron formed as chemical precipitates".



ODM8989

Photo 14–Specimen of limestone, from Irwin Township occurrence, showing beds of rusty weathering chert (dark).

Limestone

Two occurrences of light brown to medium grey weathering, fine-grained, banded limestone with minor amounts of chert were found in the intermediate to felsic volcanic succession in the northern part of Irwin Township.

The main occurrence, south of the mouth of Crooked Green Creek is about 50 feet (15 m) thick and was traced for over 1,000 feet (300 m) along strike. In places it forms a narrow flat ridge standing about 5 feet (1.5 m) high that resembles a railroad embankment.

This rock is characterized by a very smooth weathered surface interrupted by rusty weathering chert layers and pods up to 2 inches (5 cm) in thickness (Photo 14) and has a sharp contact with the enclosing volcanic rocks. Thin section examination shows the limestone to be an equigranular rock composed of interlocking twinned carbonate grains ranging between 0.05 and 0.1 mm in size. X-ray studies show that calcite is the dominant mineral with dolomite, chlorite, and quartz present in minor quantities. A sprinkling of fine-grained specularite was observed in some hand specimens. Results of a chemical analysis are shown in Table 2.

The second occurrence is relatively small and is located in porphyritic felsic volcanic rocks near the east border of Irwin Township approximately 1 mile (1.6 km) south of the Sturgeon River Gold Mine.

These limestone deposits occur within a thick succession of intermediate to felsic pyroclastic rocks and are probably the result of related fumarolic or hot-spring activity. The equigranular texture, presence of chert layers, and absence of inclusions of country rock and carbonate porphyroblasts do not favour a carbonate shear zone (metasomatic) origin.

INTRUSIVE ROCKS

Intermediate to Felsic Intrusive Rocks

GRANODIORITE AND QUARTZ DIORITE

Three relatively small bodies of plutonic rock cut the Archean metavolcanics in the map-area. The easternmost occurrence is in the northeast corner of Irwin Township and is a tongue or offshoot of the plutons in Elmhirst and Walters Townships (Bruce 1936) that are composed of granodiorite and quartz diorite. Bruce (1936) indicates that the workings of the Sturgeon River gold mine pass through granodiorite. Although underground geological plans are not available, the large amount of granodiorite in the waste-rock pile near the shaft indicates that this rock type was intersected in the mine workings.

Outcrops are of limited extent and consist of greenish grey, medium-grained, granitoid rock with interlocking cloudy feldspar, quartz, and chlorite. In thin section, the rock was seen to be made up of greater than 60 percent feldspar that has been completely saussuritized. Some relict albite twinning can be recognized and approximately 5 percent myrmekite is present, along with up to 20 percent quartz. Carbonate, chlorite, and leucoxene make up the remainder of the rock. A chemical analysis of a sample taken from a crosscut in the Sturgeon River Gold Mine has been reported by Bruce (1936, p.24) and is included in Table 2.

The granodiorite in the southern part of Dorothea Township is a light to medium pinkish grey, medium- to fine-grained granitoid rock consisting essentially of altered feldspar with 30 to 35 percent quartz, and less than 5 percent femic minerals. Thin section study shows the feldspar to be a plagioclase that has been almost completely replaced by fine-grained sericite and epidote. Albite twinning is recognizable around the rims of the plagioclase which has been identified as oligoclase. Light brown weakly pleochroic biotite is present in minor amounts. Pyrite, chalcopyrite, and molybdenite occur as fine disseminations and thin films along fractures and in quartz stringers that cut the granodiorite.

A small lens of pink, medium-grained leucocratic rock, containing approximately 40 percent quartz and 55 percent albite, as well as minor sericite and chlorite, cuts the metavolcanics near the northwest end of Windigokan Lake. The albite is relatively unaltered and displays fine chessboard twinning under crossed nicols.

QUARTZ-FELDSPAR AND FELDSPAR PORPHYRY DIKES

Quartz-feldspar and feldspar porphyry dikes with variable amounts of hornblende and pyrite, and averaging 2 to 3 feet (0.6-0.9 m) in width, cut both the metasediments and metavolcanics. In general the phenocrysts are euhedral and are less than 5 mm in longest dimension, and occur in a fine-grained to aphanitic groundmass. Most dikes parallel regional foliation.

A thin section of a sample collected from a quartz-feldspar porphyry dike on Lake Nipigon shoreline near Poplar Point consists of 15 to 20 percent subhedral quartz phenocrysts and less than 10 percent plagioclase feldspar phenocrysts that are almost completely altered to a mixture of carbonate, sericite, and saussurite, and which are suspended in a fine-grained quartzofeldspathic groundmass. Using high power magnification the groundmass can be seen to consist of interlocking quartz and albite grains. Sericite and carbonate are the most common alteration products and together make up about 20 percent of the rock. Pyrite, chlorite, leucoxene, biotite, and apatite are also present, but in minor amounts.

Mafic Intrusive Rocks

QUARTZ DIORITE, DIORITE, AND GABBRO

Quartz diorite along with minor amounts of associated diorite and gabbro make up the most extensive bodies of Archean intrusive rocks in the map-area.

Dark greenish grey fine-grained quartz diorite lenses form narrow ridges where they cut metasediments in Dorothea and Irwin Townships. The intrusive contact was well established east of Murray Lake, Irwin Township. Here the quartz diorite was found to be in sharp contact with the metasediments. Chilling of the quartz diorite and the effects of contact metamorphism on the sedimentary rocks is evident. In thin section the rock can be seen to consist dominantly of saussuritized plagioclase of undetermined composition along with 15 to 20 percent pleochroic hornblende, 10 percent quartz, as well as biotite, chlorite, carbonate, apatite, and zircon. A minor amount of polysynthetically twinned magnetite and leucoxene was detected using shaded light.

A sill-like body of dark green granitoid rock varying from quartz diorite to diorite in composition is present in the mafic metavolcanics in the central part of Dorothea Township. This body differs from the other quartz diorite in its higher chlorite content, and in the presence of up to 20 percent myrmekitic quartz-feldspar intergrowths. This unit may be genetically related to the volcanic pile itself either as a sill intruded during volcanism, or as the coarse-grained interior of a flow.

The quartz diorite lens east of Bish Bay is fine-grained and highly altered. A well-defined intrusive contact is exposed in Sandra Township at the east end of the quartz diorite lens.

A small lens of poryhyritic gabbro intrudes mafic volcanic rocks south of Dead Lake, Irwin Township. Pyroxene phenocrysts have been altered to a fine-grained mixture of talc and chlorite but still display a relict prismatic structure. The groundmass is composed of fine-grained plagioclase feldspar along with minor pyroxene and chlorite. Quartz, although not evident in thin section, was detected by X-ray diffraction.

MAFIC DIKES

Mafic dikes ranging in composition from diorite to peridotite cut the metavolcanics and metasediments of the map-area. The majority of the dikes are dark green, fine-

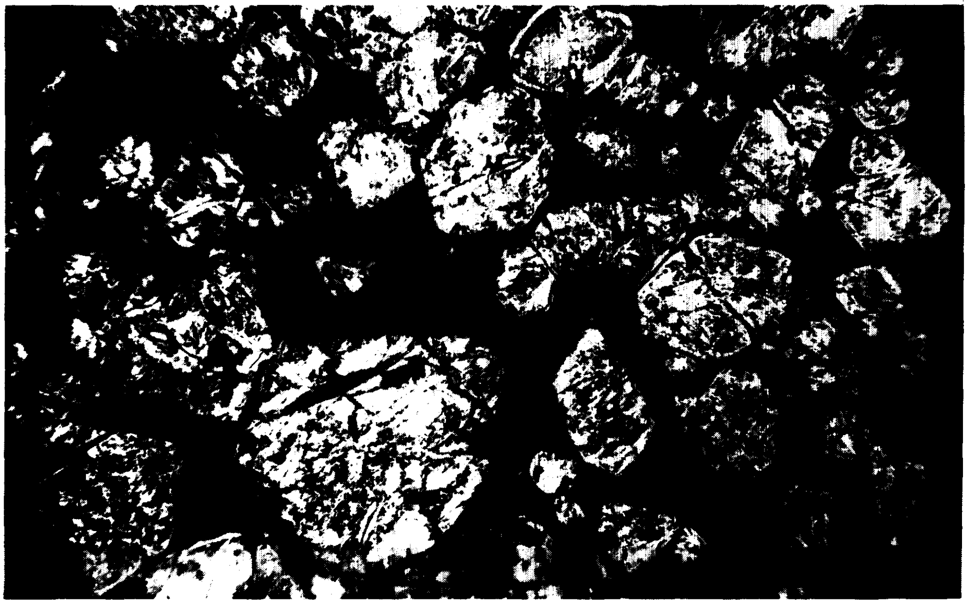


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Photo 15–Photomicrograph of olivine pseudomorphs in a serpentinized peridotite dike, Lake Nipigon shoreline. Crossed nicols.

grained chloritic types that range from 1 foot to 3 feet (0.3-0.9 m) wide and can be traced only a few feet or few tens of feet along strike.

One such dike cuts the metasediments above the 35-foot (11 m) falls on the Namewaminikan River in Sandra Township. Here the dike is a dark green, fine-grained chlorite-carbonate rock that, in thin section, is seen to have 5 percent tiny euhedral phenocrysts that have been completely altered to carbonate. Some phenocrysts have chlorite-rich zones parallel to crystal faces.

North of Bish Bay on Lake Nipigon, a 20-foot (6 m) wide serpentinized peridotite body, with an abundance of asbestiform fibres, lies along the south contact of a quartz diorite body. In thin section, the rock is seen to consist of olivine pseudomorphs suspended in an extremely fine fibrous serpentine matrix as shown in Photo 15. The asbestiform fibres, which are mainly concentrated along shear planes and fractures, have been identified as tremolite by X-ray analysis. Although shown on map 2294 (back pocket) as a dike, contact relationships are not clear and it is possible that the body may be a mafic segregation in the quartz diorite body.

A medium-grained gabbro dike parallels the north contact of the small granodiorite lens near Windigokan Lake. Narrow, irregular chlorite-rich sheared gabbro dikes, not shown on Map 2294 (back pocket), are present in the intermediate to felsic volcanics in the northern part of the map-area. Some of the gabbro bodies may actually be recrystallized tuff layers and thus be of metamorphic rather than intrusive origin.

Bruce (1936, p.27, 38) mentions the presence of lamprophyre dikes in the vicinity of the Sturgeon River Gold Mine.

ABSOLUTE AGE OF ARCHEAN ROCKS

The assignment of the metasediments, metavolcanics, and intrustive rocks other than diabase in the map-area to the Archean is based on their being pre-diabase in age and on their radiometric dates.

A potassium-argon date on biotite from a sample of metasediments in the Geraldton area is given by Wanless (1970) to be 2,555 million years which indicates an Archean age. Rocks in Dorothea, Sandra, and Irwin Townships are probably of the same age. No information is available on the Archean intrusive rocks in the map-area other than the fact they are cut by diabase dikes.

Wanless (1970) found that the diabase dikes in the region, analyzed by the potassium-argon method, are of two ages. Two specimens analyzed by the whole rock method gave age dates of 1,545 and 1,560 million years. Biotite from a third dike gave an age date of 1,125 million years.

DuBois (1962, p.56) on the basis of palaeomagnetic studies, states that the diabase sills in the Nipigon region are of the same age as sills near Thunder Bay and are definitely younger than Keweenawan strata.

Middle to Late Precambrian (Proterozoic)

DIABASE SHEETS AND DIKES

Porphyritic Diabase

A distinctive porphyritic diabase, locally termed 'Greenspar' porphyry, is present as north-trending dikes ranging up to 200 feet (60 m) wide and cutting both the metasediments and metavolcanics in the area. This diabase (Photo 16), which is considered by Laird (1936, p.80) to be similar to the Matachewan diabase of northeast Ontario, contains variable amounts of saussuritized green feldspar phenocrysts ranging from 0.5 to 2 inches (1.3-5 cm) in diameter. The matrix is a medium-grained diabase consisting of labradorite laths, interstitial pyroxene and minor amounts of biotite, hornblende, myrmekite, apatite, ilmenite, and pyrite.

A zoning of phenocrysts was observed in a large outcrop area east of Twin Falls on the north side of the Namewaminikan River. Here, the feldspar phenocrysts are concentrated near and form bands parallel to the walls of the dike. Well developed epidote rosettes occur along joint planes in this locality.

The termination of several of these dikes coincides with east-west faults, which gives rise to the interpretation that the dikes represent faulted segments of a once continuous, single north-striking dike. An aggregate right-handed displacement of about 4 miles (6 km) is thus recorded within the map-area. The porphyritic diabase can be traced north and south into the adjacent townships.

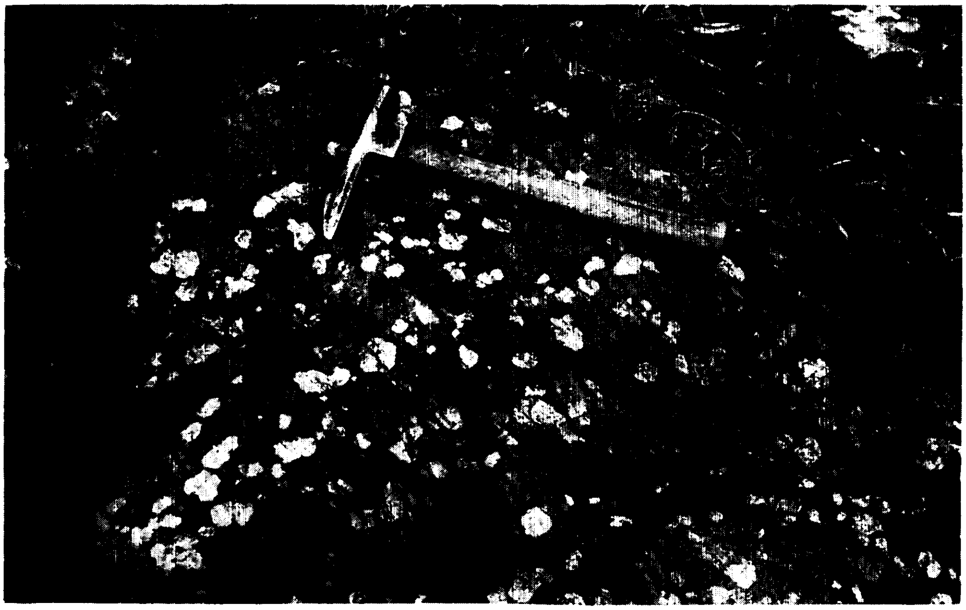

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Photo 16—Porphyritic diabase ('Greenspar') dike, Irwin Township.

Diabase Sheets

A thick, massive, diabase sheet covers an extensive part of the map-area and forms distinctive scarps as can be seen in Photo 17. Two small diabase outliers form mesas in Sandra Township (Photo 17 and Frontispiece) and are remnants left from the erosion of a once larger sheet.

Prominent steep cliffs over 100 feet (30 m) high commonly display columnar jointing. Well developed flat jointing gives rise to large bedrock platforms and, in a few places, overhanging ledges.

The diabase is a brown weathering, dark grey equigranular medium- to fine-grained rock with a well developed diabasic texture consisting of a 'logjam' arrangement of labradorite laths enclosing interstitial clinopyroxene (Photo 18). Biotite, olivine, magnetite, myrmekite, and quartz are also present.

Some pegmatitic sections with feldspar laths over 10 mm long were observed. A primary foliation produced by the apparent horizontal alignment of femic minerals is conspicuous on lichen-free, differentially weathered diabase exposures along the Lake Nipigon shoreline.

Laird (1936, p.81) considers the diabase sheet to be a flow. Recent workers (Benedict and Titcombe 1948; Pye 1965) show that the diabase in this region is of intrusive origin. The sheet, which has a gentle dip to the west, cuts across steeply dipping Archean rocks and, as pointed out by Benedict and Titcombe (1948), technically the diabase sheet is a flat lying dike. In Eva and Summers Townships the sheet has been found to vary from 400 to 650 feet (120-200 m) in thickness. (Mackasey 1970b, p.74).

ODM8992

Photo 17–Air photograph of north-trending diabase cuesta (A) in parts of Irwin, McComber, Sandra, and Summers Townships. Note diabase outliers in Sandra Township (B) and displacements of the diabase sheet by faulting. Scale approximately 1 inch to 1 mile.

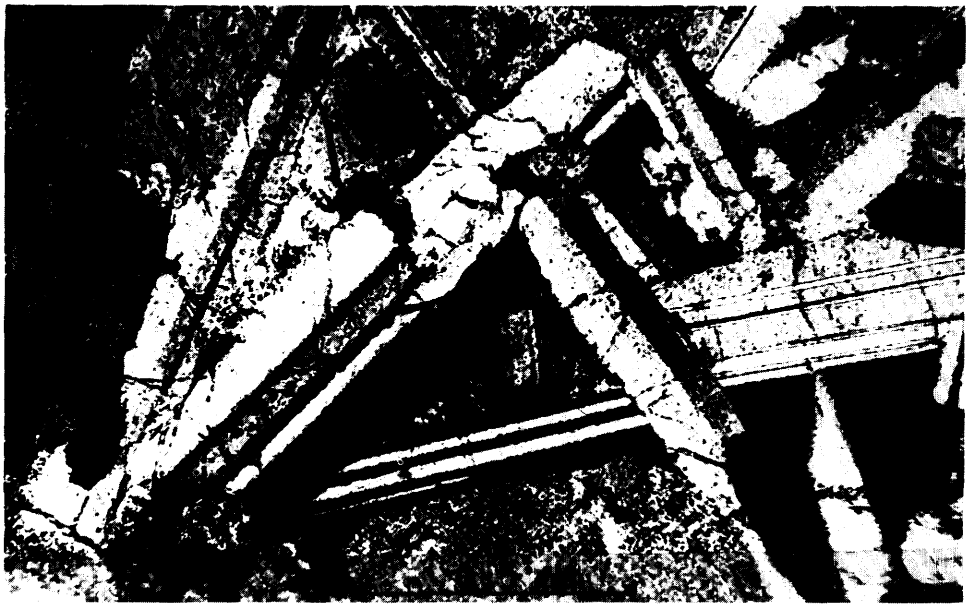

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Photo 18–Photomicrograph showing typical diabasic ('logjam') arrangement of labradorite laths enclosing pyroxene. Diabase sheet, Sandra Township. Crossed nicols.

In Sandra and Irwin Townships closely spaced flat joints have been developed in the country rocks adjacent to the contacts.

The diabase sheet appears to overlie the porphyritic diabase dike at Murray Lake, Irwin Township, and in Summers Township cuts the porphyritic diabase (Mackasey 1970a). The sheet must therefore be considered younger than the porphyritic diabase dikes. The age span is open to question and consideration should be given to assigning the porphyritic diabase to a pre-Keweenawan age, which is the age cited for the Matachewan dikes in the District of Timiskaming (Lovell 1967).

Diabase Dikes

North-striking, equigranular diabase dikes only a few feet wide are abundant in the region and, because of traverse direction and spacing, are probably more numerous than shown on Map 2294 (back pocket). The dikes are unaltered and of the same composition as the diabase sheets.

Cenozoic

QUATERNARY

Pleistocene and Recent

The map-area is covered by extensive deposits of ground moraine of silty to sandy till; lacustrine deposits of clay, silt and sand; and valley train deposits of sand and gravel in the vicinity of the Namewaminikan River (Zoltai 1965).

Areas of sand plains are most abundant in Sandra and Dorothea Townships on the west side of the diabase cuesta. Eskers occur along the Namewaminikan River and a raised beach is preserved on the Lake Nipigon shoreline near the mouth of the Littlelake River. Well polished and striated outcrop ridges are plentiful.

Laird (1936, p.82) mentions the presence of high sand flats that are separated by 30-foot (9 m) high terraces on either side of the Namewaminikan River, especially in the vicinity of the 35-foot (11 m) falls. These are composed of thick deposits of stratified silt, sand, and gravel that, near the river water level, have been found to overlie boulder clay. Coleman (1907, p.135), using a hand level, measured a thickness of 98 feet (30 m) of silt overlain by 14 feet (4 m) of sand and gravel near the 35-foot (11 m) falls.

Several meanders, meander scars, and oxbow lakes are present along the Namewaminikan River and are especially well developed in the region of Crooked Green Creek. The course of the Namewaminikan River may have once followed the Paint Lake Fault trough west to Lake Nipigon rather than flowing south through Long Rapids. The presence of the deep trough east from Littlelake River in Dorothea Township through Big and Little Dawson Lakes to the present course would seem to be a much shorter and more direct route. The abrupt 90 degree turn through Long Rapids may be the result of stream capture.

STRUCTURAL GEOLOGY

Regional Structural Setting

The metavolcanics and metasediments in the map-area form part of the Early Precambrian Superior Province of the Canadian Shield and occur along the boundary between two major east-trending, lithologic and structural units of the Superior Province. These are the Wabigoon Belt, which is composed predominantly of metavolcanic and granitic rocks (Goodwin 1970) and a metasedimentary-granitic complex to the south, termed the Quetico Belt (Stockwell 1964).

The rocks north of the Quetico Belt form a fold belt that can be traced from the Little Long Lac area (Geraldton) west to Lake Nipigon. Pye (1968, p.32) has shown that this belt extends to the Lac des Iles area west of Lake Nipigon.

The rocks within the Wabigoon Belt in this region have been isoclinally folded along an east-west axis. Horwood and Pye (1951) and Pye (1951) have suggested an isoclinal fold style in the Geraldton area on the basis of surface and subsurface mapping and geophysical data.

Several prominent east-trending faults have been recognized. The Paint Lake Fault is a major structural discontinuity in the Sturgeon River area, marking a change in lithologies and structural style.

Folding

MAJOR STRUCTURES

Evidence for major isoclinal folds, similar to those near Geraldton, is not abundant in Dorothea, Sandra, and Irwin Townships. Tight folding has, however, been recognized just south of the map-area in the vicinity of the Leitch Mine (Ferguson 1967; Mackasey 1970a).

An east-trending anticline and syncline, occurring south of the Paint Lake Fault, have been postulated as the main fold structures in the map-area.

In the central sedimentary belt, top determinations based on graded-bedding, channeling, and crossbedding, show tops to the north. Bedding-cleavage relationships also suggest tops to the north. It is probable therefore that this belt of metasediments occurs in the north limb of an east-trending anticline.

The southern belt of metasediments exposed in the southeastern corner of Irwin Township is believed to occur along the south limb of the anticline. These metasediments appear to have been much less competent than those of the central belt. Top determinations based on graded bedding indicate overturned isoclinal folding. The east-trending magnetic pattern shown on ODM-GSC Map 2135G swings to the southeast near the east end of Watson Lake and may represent a fold in the iron formation which gives further support to the isoclinal folds hypothesis.

Top determinations based on the shape of pillows in the mafic lava unit north of Watson Lake show tops to the south and fit in with the postulated anticline.

The northern and central sedimentary belts are best explained as representing limbs of a broad east-trending syncline. In his study of the geology east of Knox Lake, in the vicinity of the northern sedimentary belt, Colcleugh (1946) found however that bedding dips to the north with graded beds showing tops to be up. A simple fold relationship does not therefore appear to exist. A syncline may be present but there are insufficient bedding features to confirm this interpretation. A more reasonable explanation may be that the northern sedimentary belt is an up-faulted segment of the central sedimentary belt.

Reversals in graded bedding, although not recognized in this region, are not uncommon in sedimentary sequences (Bishop *et al* 1969). The use of graded bedding in structural analysis is thus not always reliable. No mention was made by Colcleugh (1946) of channeling or crossbedding in the Knox Lake area and it is possible therefore that these sediments are overturned to the south and form the north limb of a syncline. This interpretation fits in better with the regional structural setting.

An east-plunging syncline is present in the vicinity of Tallon Lake. This structure lacks top indicators and may therefore be more correctly termed a synform.

MINOR STRUCTURES

Foliation

Foliation has an easterly trend that parallels the regional structural units in the map-area and is developed to varying degrees in all the metasedimentary and metavolcanic rocks.

Schistosity and slaty cleavage are well developed in the metasediments and can be found cutting across bedding in many locations, but especially in the slates and argillites of the central and southern belts. Tuffaceus units within the volcanic rocks also have well-developed schistosity. The massive and pillow lava units are not as severely deformed. In some locations however pillows have been stretched out for several feet parallel to schistosity.

Two intersecting sets of schistosity were found in tuff-breccia east of Piram Lake, Sandra Township.

Minor Folds

Minor folds were found in layered tuffaceous intermediate to felsic volcanic rocks about 1 mile northeast of Twin Falls near the northwest corner of Irwin Township. Lack of good exposure prevented the tracing out of these structures. The axes of crenulations, believed to parallel the axis of a larger fold, plunge at 60 degrees to S65W. Farther east, folded fragments in the tuffaceous rocks have similar orientations.

East-plunging, tight, similar folds with amplitudes ranging from a few inches up to 6 feet were found in the iron formations in the Spawn-Still Lakes region. Photo 19 illustrates microscopic-scale folding that occurs in the iron formation.

Lineation

Three types of lineation were observed in the map-area. Traces of bedding along cleavage planes formed excellent lineations in the fine-grained clastic rocks of the central and southern sedimentary belts. The axes of crenulations, especially in the tuffaceous rocks, provided the second type of lineation. A third type is produced by the stretching out of pyroclastic fragments and pillows. Many lapilli-size fragments, blocks, and bombs in the intermediate to felsic rocks north of the Paint Lake Fault have been stretched and are conspicuously pencil-and-rod shaped.

Faulting

Faults, identified mainly by their topographic expression, appear to be the most significant structural feature in the map-area.

Deep narrow erosional troughs have a prominent east-west trend and, in many locations, separate outcrops of different lithologic units. Most of these troughs form

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Photo 19–Photomicrograph of polished specimen of iron formation showing development of small-scale folding and related cleavage (A). Bedding (B) is marked by chert (dark) and hematite (light) layers. Spawn Lake, Irwin Township.

easily recognizable linear features on air photographs. Narrow lakes, ponds, streams, and muskeg occupy most of the troughs.

PAINT LAKE FAULT

One of the most significant faults in the area extends from the Lake Nipigon shoreline east through Sandra and Irwin Townships and beyond. Tyson (1945) termed this structure the Devil's Walk-Paint Lake Fault, but for brevity the name Paint Lake Fault is used in this report.

The Paint Lake Fault is considered to have been a major zone of weakness which has experienced repeated periods of movement. Two distinct subparallel linear features delineate the zone (Photo 20). Talus slopes, drift, and swamps cover most of the immediate area so that features such as slickensides and fault gouge were not observed by the field party. Primary volcanic features such as pillows and pyroclastic fragments are absent near the fault zone. Schistosity is well developed and outcrops with crenulated rock are present. Pebbles in the conglomerate west of McCambly Lake have been highly deformed.

A net right-hand displacement of ½ mile (0.8 km) is illustrated by the offset of a porphyritic diabase dike in the vicinity of Foxear Creek, Irwin Township.

The Paint Lake Fault marks the line across which an abrupt change in lithology occurs. South of the fault, Temiskaming-type clastic metasediments are abundant, whereas to the north they are absent. Mafic amygdaloidal and pillow lavas are common

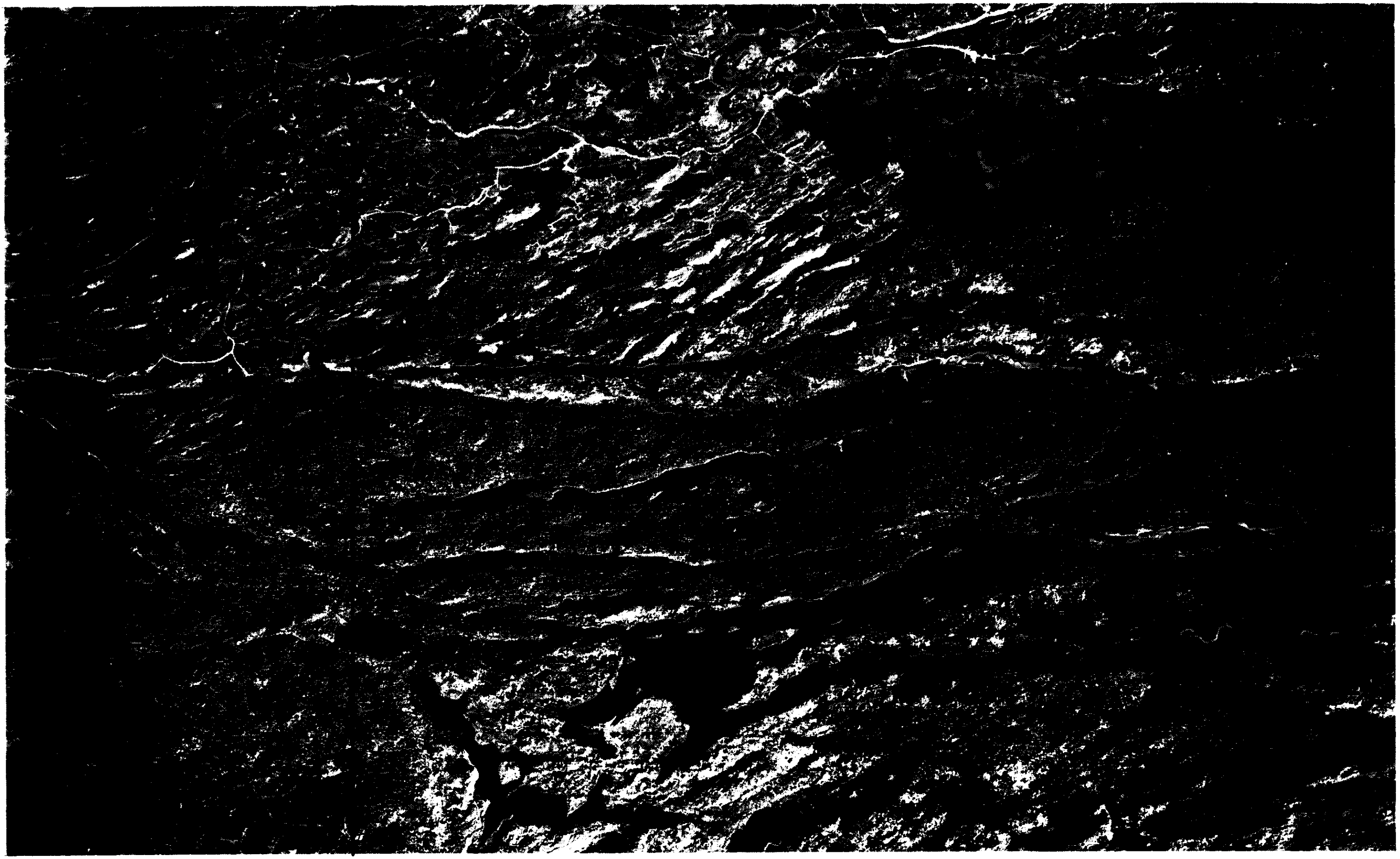

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Photo 20–Air photograph of parts of Irwin and Sandra Townships showing the Paint Lake Fault (A-A). Scale approximately 1 inch to 1 mile.

south of the fault but intermediate to felsic tuffaceous metavolcanics form the predominant rock types to the north.

As portrayed on the Tashota-Geraldton geological compilation map (ODM Map 2102) the volcanic rocks north of the fault do not follow the general east-west trend, but fold around to the northwest.

OTHER FAULTS

Several other faults subparallel to the Paint Lake Fault have been recognized. The Watson Lake and Sandra Lake Faults in the southern part of the map-area have east-northeast trends and cut the diabase sheet. The Musca Lake Fault in the northern part of Irwin and Sandra Townships has been found (Oja 1967) to be an electromagnetic conductor in the vicinity of Musca Lake. A gouge zone was intersected by diamond drilling (Oja 1967) at the west end of Musca Lake. Fracture cleavage related to the fault at Knox Lake, Irwin Township has sliced the conglomerate on the north shore into a series of thin brittle slabs that have broken across the pebbles.

The apparent right-hand displacement of the porphyritic diabase dike in Irwin Township indicates that the rocks in the map-area have undergone appreciable right-hand strike slip movement.

North- and northeast-trending faults occur in Dorothea and Sandra Townships. The abrupt change in direction of the Namewaminikan River south through Long Rapids is interpreted by the author to be the result of capture due to headward erosion along the north-south fault cutting the diabase sheet.

Many less prominent linear features not shown on Map 2294 (back pocket) may also be related to faulting.

AGE OF FAULTS

The Paint Lake, Watson Lake, Sandra Lake, Musca Lake, and several other faults cut the diabase sheet. These faults have been eroded to produce deeply incised wind or water gaps through the cuesta ridge. The diabase sheet has in effect been sliced into several blocks which have undergone displacement and rotation as can be seen when viewed from an aircraft or by studying air photographs (Photo 17). The last movement of many of the faults is thus post-Keweenawan in age, and probably only indicates a rejuvenation of much older faults. For example, the porphyritic diabase dike north of Foxear Creek, Irwin Township, is not displaced by the north segment of the Paint Lake Fault. This relationship indicates that the Paint Lake Fault system, and probably many of the other faults in the map-area, were active prior to Keweenawan time.

ECONOMIC GEOLOGY

Gold, silver, iron, copper, molybdenum, sand, and gravel are present in the map-area. The Sturgeon River Gold Mine produced $2,728,905 worth of gold and silver from 1937 to 1942 (Statistical Files, Ontario Division of Mines). Sand and gravel have been used in the construction of roads within the area.

Gold was first discovered in the region in 1925 and has since provided the main interest in exploration. Three bands of iron formation within the map-area have been examined repeatedly since the turn of the century and exploration for copper and molybdenum has occurred on a sporadic basis.

Gold Deposits

Gold deposits in the map-area have three recognized modes of occurrence which are gold mineralization in quartz veins, carbonate zones, and sulphide deposits. Variable amounts of silver accompany the gold mineralization.

QUARTZ VEINS

Gold-bearing quartz veins are present in every rock type in the map-area with the exception of the Keweenawan diabase. Auriferous quartz veins such as those at the Sturgeon River Gold Mine, Irwin Township, and at the Tyson property, Dorothea Township, vary from a few inches to 1 to 2 feet (0.3-0.6 m) or more in thickness and follow fracture systems in the host rocks. Gold occurs mainly in the free state, but very finely dispersed. Gold tellurides and electrum have been identified in the Sturgeon River Gold Mine (Bruce 1936, p.34, 42). Many of the gold-bearing quartz veins have a 'ribbon' structure formed in a coating of chlorite and sericite on slip planes.

Conventional prospecting by means of stripping, trenching, and diamond drilling was the main method used in past exploration programs for gold.

CARBONATE ZONES

Gold mineralization is associated with a carbonate zone in the Knox Lake area, Irwin Township. Four separate gold zones have been outlined on the Brookbank property. Laird (1936) and Colcleugh (1946) consider the carbonate zone in the Knox Lake area to be the product of shearing and hydrothermal alteration of volcanic rocks. The upper contact of the carbonate zone is marked by a thin layer of cherty iron formation which is in turn overlain stratigraphically by thin bedded greywacke, feldspathic sandstone, and conglomerate.

Ridler (1970, p.39) has proposed that gold-bearing carbonate bodies of the Larder Lake area may be a type of auriferous carbonate facies iron formation. The presence of the cherty iron formation as well as the stratigraphic position of the carbonate zone indicates that the carbonate zone in Irwin Township may be of a type similar to that described by Ridler.

SULPHIDE MINERALIZATION

Gold occurs with chalcopyrite-pyrite veins cutting intermediate to felsic volcanic rocks west of Pirum Lake, Sandra Township. Elsewhere in the district, Horwood and Pye (1951, p.35) describe the occurrence of gold in pyrite and arsenopyrite in lenses, tongues, and irregular masses in fractured and sheared iron formation at the MacLeod-Cockshutt and Hard Rock Mines.

RELATIONSHIP OF GOLD DEPOSITS TO GEOLOGICAL FEATURES

The proximity of the Sturgeon River Gold Mine and the Tyson prospect to granodioritic and quartz-diorite intrusions indicates that there may be a genetic relationship. Laird (1936, p.71) noted that many of the gold occurrences in the Sturgeon River area are situated in the intermediate to felsic tuffaceous volcanic rock unit in the northern part of the map-area. Elsewhere in the region some gold deposits occur in tightly folded sedimentary rocks which may be near or in iron formation.

Tyson (1945) has compared the spatial relationship of gold deposits to major faults such as the Paint Lake Fault. In other gold camps major faults have been postulated to serve as channel-ways that have allowed gold-bearing hydrothermal solutions to permeate into the upper part of the earth's crust.

Many questions remain to be answered in this, as well as other gold districts, and it is quite likely that more than one mode of origin is responsible for the formation of gold deposits in each camp. If the case for auriferous carbonate facies iron formation can be substantiated in the map-area, then the presence of fossil placer gold deposits derived from the erosion of the iron formation may have to be considered. A sample of conglomerate selected at random by the field party to check for this type of gold occurrence was collected north of Knox Lake. Assayed by the Mineral Research Branch, Ontario Division of Mines, this sample contained 0.02 oz. Au/ton and a trace of silver. Although the gold in the conglomerate could be of 'placer' origin, it can be just as easily argued that the mineralization is of hydrothermal origin.

Sulphide Deposits

Chalcopyrite and molybdenite mineralization in the map-area occurs both as vein and disseminated deposits.

VEIN DEPOSITS

Sulphide veins containing copper have been studied in Sandra and Irwin Townships. Narrow veins and stringers containing appreciable amounts of chalcopyrite occur in the intermediate to felsic volcanic rocks in the Witwer property, Pirum-Musca Lakes area, Sandra Township, and in the Brenbar property, Irwin Township. Chalcopyrite also occurs in sheared mafic volcanic rocks on the former Sutherland Occurrence, near the west end of Windigokan Lake, Irwin Township.

A molybdenite-bearing quartz vein some 1,500 feet (460 m) long has been outlined by trenching and drilling on the Tyson property, Dorothea Township. The molybdenite occurs as large irregular 'splashes', some up to 6 inches (15 cm) across, in the quartz vein. Laird (1936, p.90) found minor amounts of pyrite and molybdite associated with the vein.

A pyrite replacement vein, a few inches wide, containing traces of Cu, Pb, Ni, Au, and Ag was found in mafic pillow lava on the shore of a small cove on Lake Nipigon north of Bish Bay.

DISSEMINATED DEPOSITS

A deposit of disseminated chalcopyrite, molybdenite, and pyrite occurs in an altered granodiorite intrusion and the surrounding host rocks in the Hopkins property, Dorothea Township. Mineralization appears to be concentrated as films along tight fractures and in narrow quartz stringers and is believed to be genetically related to the intrusion.

Minor amounts of chalcopyrite are present as small blebs in sheared tuff-breccia in the Brenbar property, Irwin Township, and may be widespread.

RELATIONSHIP OF MINERALIZATION TO GEOLOGICAL FEATURES

Relationship to Igneous Intrusions

The proximity of some of the sulphide deposits in the map-area to intrusive rocks indicates that some mineralization may be related directly to igneous activity.

The molybdenite vein on the Tyson property and the disseminated molybdenum mineralization on the Hopkins property are both associated with west-striking quartz diorite and granodiorite intrusions. The Hopkins property deposit appears to be of the 'porphyry-copper' type, with mineralization following a stockwork of fractures and quartz stringers that was probably formed during the final phase of emplacement of the intrusion. The quartz-molybdenum vein on the Tyson property, 1¼ (2 km) miles to the northeast, may be a genetically related stockwork type of quartz vein.

Copper mineralization and tourmalinization near the Sturgeon River Gold Mine may be of magmatic hydrothermal origin and appears to be spatially related to the large altered felsic intrusions in Walters and Elmhirst Townships.

Relationship to Faulting and Shearing

Sulphide occurrences in the Pirum-Musca Lakes area, Sandra Township, are of the fracture-filling type. The fracture system in this area may be related to the Musca Lake Fault.

Copper mineralization occurs in sheared mafic volcanic rocks at the west end of Windigokan Lake, Irwin Township. Shearing parallels east-west faulting in this area.

Iron Deposits

Exploration for iron deposits in the region has been undertaken sporadically since the early 1900s and, in the map-area, three main occurrences have come under examination. All are considered to be of sedimentary origin, as has been described earlier under General Geology.

In Dorothea Township, ODM-GSC Aeromagnetic Map G2128 outlines a lean unit of chert-hematite-magnetite iron formation north of the Sturgeon River. No recent work has been recorded for this occurrence.

A magnetite-chert deposit on the north shore of Watson Lake, Irwin Township, was tested by diamond drilling of Central Manitoba Mines Limited in the 1950s.

A folded hematite deposit in the Spawn-Still Lakes area, Irwin Township, was tested by stripping and diamond drilling of The Algoma Steel Corporation Limited in the 1960s.

The narrow limestone band in Irwin Township contains variable amounts of specularite. A selected grab sample collected by the field party was found by the Mineral Research Branch, Ontario Division of Mines, to contain 30.8 percent Fe and 3.33 percent MnO, with traces of Cu, Pb, and Zn.

Platinum Group Metals

Finely disseminated pyrite and chalcopyrite were observed in an outcrop of medium-grained diabase along the Littlelake River, Dorothea Township. A representative sample collected by the field party was analyzed by the Mineral Research Branch, Ontario Division of Mines, and found to contain only traces of copper and nickel. Assay results showed that a trace of palladium was present but no platinum was detected. This sample was collected from the diabase sheet in the vicinity of the prominent linear feature that marks the Paint Lake Fault.

Asbestos

Light green asbestiform material along fractures in a serpentinized peridotite dike forms a zone about 20 feet (6 m) wide on a cliff along the Lake Nipigon shoreline midway between Bish and West Bays.

X-ray identification by the Mineral Research Branch, Ontario Division of Mines, shows the fibrous material to be tremolite. Fibres are soft and flexible, and are up to 5 inches long.

Building Stone

Attempts have been made north of the map-area, in Pifher Township, to evaluate the use of porphyritic diabase (locally known as 'Greenspar' porphyry) as a building stone. Steeply dipping dikes, close to 200 feet (60 m) wide, of porphyritic diabase are present in Irwin Township. A soft green spotted appearance on both rough and polished surfaces is due to the presence of green, saussuritized, subhedral feldspar phenocrysts, 0.5 to 2 inches (1.3-5 cm) in length.

A green, tightly cemented volcanic breccia, having a texture on the polished surface not unlike 'chipboard' wooden wallboard, makes up most of the bedrock in the Poplar Point area extending from the mouth of the Sturgeon River north to Bish Bay. This rock along with the 'Greenspar' porphyry may be suitable for facing material. Use for decorative purposes such as lampstands, penholders and bookends merits consideration.

Details on prohibitive features such as pyrite content and abundance of fractures and joints were not investigated by the field party.

Sand and Gravel

Deposits of sand and gravel are abundant throughout the map-area and have been used extensively in the construction of service roads for logging operations.

The most widespread area of sand and gravel appears to be in the northern part of Dorothea Township and the central part of Sandra Township.

Suggestions for Mineral Exploration

The map-area discussed in this report is serviced by a railway, highway, a hydro-electric power line, natural gas pipeline, and a microwave communications system. Thus any commodities of economic value could be rapidly developed.

Several types of base metal deposit occur within the map-area. Disseminated copper-molybdenum mineralization may be much more widespread in Dorothea Township than already known. Consideration should be given to the possibility of a continuation of the copper-molybdenum mineralized stockwork northeast from the vicinity of the Hopkins property to the Tyson property in Dorothea Township. Much of this area is covered with drift which makes prospecting by conventional methods difficult. Biogeochemical prospecting by analyzing trace amounts of molybdenum in plants and trees may be a useful exploration aid for outlining the extent of molybdenum mineralization (W. J. Wolfe, Geochemist, ODM, personal communication). Disseminated sulphide mineralization may be present in similar intrusions throughout the region in general.

Copper mineralization has been found to be related to Late Precambrian north-trending faults in the Barbara Lake and surrounding areas (Pye 1965, p.26; Kustra 1969, p.38; Mackasey 1969; Oja 1970, p.31). Several north-trending faults occur in the Beardmore-Geraldton area. In Sandra Township, a north-south linear feature, believed to represent a Late Precambrian fault, cuts across the flat-lying diabase sheet at Long Rapids.

Special consideration should be given to tracing out the bedded carbonate rocks in Irwin Township. These units could serve as hosts for replacement base metal deposits, especially at their contacts with igneous intrusions.

The intermediate to felsic volcanic unit in the north part of the map-area contains several sulphide occurrences and merits prospecting. Much of the prospecting in this area was for gold, with little attention being paid to sulphide minerals. Disseminated sulphide minerals such as described in the Brenbar property may be present in and around other copper occurrences in the tuff breccia. The area of tourmalinized volcanic rocks west of the Sturgeon River Gold Mine deserves detailed examination for base metals.

The iron formation in the Spawn-Still Lakes area has a low magnetite content making exploration, for extensions along strike, difficult by magnetic methods. For example, the possible extension of these deposits is covered by Spawn and Dead Lakes. Here the contrast in magnetic intensity between the iron formation and enclosing host rocks may be masked. Detailed magnetometer surveys in conjunction with gravity studies may be warranted in exploration for this type of iron deposit within the central sedimentary belt.

When prospecting for gold deposits in the area, consideration should be given to thoroughly examining carbonate zones similar to those of the Brookbank-Sturgeon property, and to searching for possible fossil placer gold deposits in the conglomerates, and possible placer gold deposits in the Recent gravels. Examination of Recent gravels in the valley north of Long Rapids, Sandra Township and west along what may have once been an old route for the Namewaminikan River through the Dawson Lakes area west to Lake Nipigon may be warranted.

The discovery of amygdaloidal and pillow lavas on Preston Island, Lake Nipigon by the field party, indicates that there may only be a thin veneer of diabase on other islands in the lake. Though many of the islands with high relief can readily be seen to have a great thickness of diabase, it may be worthwhile to check some of the low lying islands for sedimentary and volcanic rocks and related mineral occurrences. Differences in the weathering characteristics of metamorphic rocks and diabase can sometimes be seen along shorelines, and serve as an aid to mapping.

Description of Properties

The description of properties is listed alphabetically. The descriptions of properties held on 31st December 1967 are entitled by the full name of the company or person who held the property. Descriptions of properties with showing marked on map 2294, but no longer held, are titled by a name derived from the company or party who carried out exploration work. An unclaimed parcel of explored land in which no mineral showings were located is entitled by the full name of the company or person who held the land and by the date in brackets of last major work.

The field party attempted to visit as many of the properties as possible but was not able to locate them all. Many of the workings were opened up in the 1930s and have since filled in or grown over. Overgrown township lines and surveyed claim lines, combined with slash from logging operations and the large burned-over area in Sandra and Irwin Townships, made the location of several of the older properties difficult to find.

Details on the history of the various properties are taken from company records on file with the Ministry of Natural Resources, as well as from reports and records from the Department of Energy, Mines, and Resources, Ottawa, and the Ontario Division of Mines.

Table 3 INFORMATION ON PROPERTIES IN DOROTHEA, SANDRA AND IRWIN TOWNSHIPS ON FILE WITH THE REGIONAL GEOLOGIST, ONTARIO MINISTRY OF NATURAL RESOURCES, THUNDER BAY, AS OF DECEMBER 31, 1967

FILE NAME	TOWNSHIP	PROPERTY REFERENCE NUMBER	TYPE OF WORK
Algoma Ore Properties Ltd.	Irwin	15,16	DDH
Bonwitha Mining Co.	Irwin	8,17	G,EM,M,R
Brengold Mines Ltd.	Irwin	18	R
Brookbank Mines Ltd.	Irwin	19	DDH,A
Candela Development Co.	Irwin	20	DDH
Canorama Explorations Ltd.	Irwin	21	G,GR
Central Manitoba Mines Ltd.	Irwin	22	DDH
Coleman, Fred	Irwin	3	A
Dajaty Gold Mines Ltd.	Irwin	2	G,R
Hopkins, A. P. E.	Dorothea	2,28	GR,G
Kimberley Copper Mines Ltd.	Dorothea	3	R
Northwind Explorations Ltd.	Dorothea	4	P
Nortoba Mines Ltd.	Dorothea	6,7	P,G,R,EM,ER,DDH
Quebec Sturgeon Gold Mines Ltd.	Irwin	34	R (M)
Springer Sturgeon Gold Mines Ltd.	Irwin	38	R
Sutherland, W.	Irwin	39	DDH
Tyson, A. E.	Dorothea	6,12	GR,DDH,W
Witwer Project	Sandra	13	DDH
Zmudzinski, J.	Sandra	13	R,SP

Abbreviations used
A—Assay plan
DDH—Diamond drill hole
G—Geological map
GR—Geological report
R—Report
M—Magnetometer survey
EM—Electromagnetic survey
ER—Resistivity survey
P—Prospectus
SP—Self potential survey
W—Open cut plans and sections

Table 3 is a list of assessment work and other data on file with the Regional Geologist, Ontario Ministry of Natural Resources, Thunder Bay, as of December 31, 1967. A duplicate file of assessment work is available in the Toronto office of the Ministry.

THE ALGOMA STEEL CORPORATION LIMITED (15, 16)

The Algoma Steel Corporation Limited maintained two properties in Irwin Township in 1967. Patented claim HF11 was held in good standing during the 1967 field season. This claim is in the southwestern corner of Irwin Township, near Schnob Lake, and is reported to contain a small occurrence of jasper and magnetite (Harris *et al.* 1924, p.185).

The option agreement between the Algoma Steel Corporation Limited and Mrs. Emma Rentz, E. B. Rentz, and G. P. Boldue covered claims TB116754 to TB116759, TB120243 and TB120244, and TB123214 to TB123217. This property has two main exposures of iron formation, one at the east end of Spawn Lake and the other at the

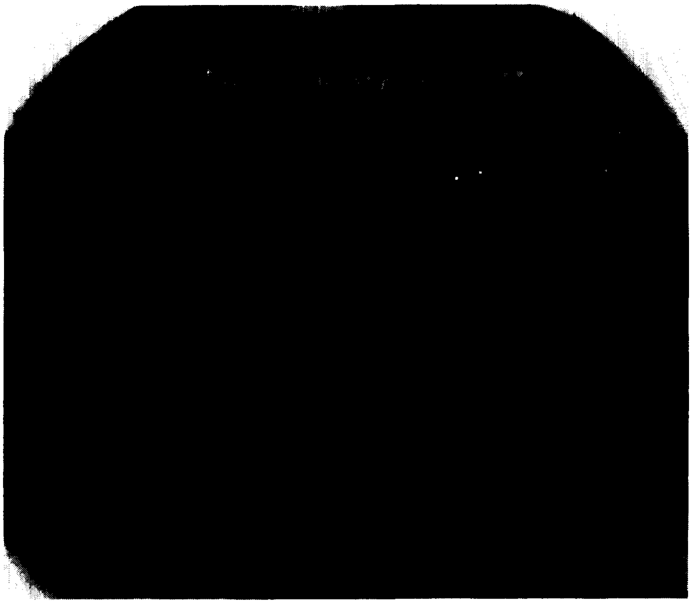

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Photo 21–Close-up of polished specimen of iron formation showing well preserved lamellar structure. Hematite beds are light, argillite beds are dark. Spawn Lake, Irwin Township.

Table 4 ANALYTICAL RESULTS OF TWO IRON FORMATION SAMPLES FROM THE ALGOMA STEEL CORPORATION LTD. (OPTION), PROPERTY (16.) ANALYSES BY MINERAL RESEARCH BRANCH, ONTARIO DIVISION OF MINES

	CHIP SAMPLE (over 10 ft.) (percent)	SELECTED GRAB SAMPLE (percent)
Silica (SiO_2)	45.4	34.7
Alumina (Al_2O_3)	6.07	4.26
Iron Oxide (Fe_2O_3)	36.0	50.8
Iron Oxide (FeO)	6.15	5.24
Magnesia (MgO)	0.93	0.90
Lime (CaO)	0.32	0.81
Phosphorus Pentoxide (P_2O_5)	0.10	0.07
Sulphur (S)	0.02	0.02
Manganese (Mn)	Trace	Trace
Moisture (H_2O^-)	0.36	0.10
Loss on Ignition	2.85	2.41

ODM8997

Photo 22–Hematitic iron formation with chert and jasper layers, and cut by quartz stringers that parallel regional foliation. Still Lake, Irwin Township.

west end of Still Lake. The iron formation consists of several iron-rich units about 1 foot to 10 feet (0.3-3 m) thick that are composed of thin beds of argillite, fine-grained sandstone, hematite, and minor amounts of chert and jasper. Little or no magnetite is present. The iron-rich units are interstratified with grey weathered argillite and fine-grained sandstone. Both exposures are bounded by swampy ground and water to the north, and by swamp and outcrops of massive, medium-grained sandstone to the south.

A 30- to 40-foot (9-12 m) wide strip of the Spawn Lake exposure has been bulldozed off for a distance of approximately 700 feet (200 m) along strike. Here bedding (Photo 13) strikes N80W and dips 75 degrees north and is cut by vertical-dipping slaty cleavage striking N80E. Delicate laminations are well preserved in the iron-rich beds (Photo 21). Results of analyses by the Mineral Research Branch, Ontario Division of Mines, of a selected grab sample collected from a test pit and a chip sample taken over a 10-foot (3 m) width, both collected by the field party, are given in Table 4.

The Still Lake exposure indicates that here the iron formation has a strike length of 3,000 feet (900 m). Here the rocks strike due east and dip 75 degrees north. Photo 22 shows one of the higher grade sections.

Three diamond drill holes with a total footage of 1,045 feet (320 m) were completed by the Algoma Steel Corporation Limited in 1966 (ODM files, Toronto). One hole was drilled to the south at a location just northeast of the Spawn Lake exposure and intersected over 200 feet (60 m) of iron formation along with thin layers of interbedded argillaceous sedimentary rocks. The remaining two holes were drilled on the Still Lake exposure in a northerly direction. Analytical results for the drilling program were not reported to the Division.

BONWITHA MINING COMPANY LIMITED [1960] (8, 17)

In June 1960, the Bonwitha Mining Company Limited optioned a group of 21 claims, in the northwest part of Irwin Township and the adjoining part of Sandra Township, from Nicholas Dzuba. Geological and geophysical surveys followed by trenching and stripping were undertaken to locate gold-bearing quartz veins or shear zones. According to a company report by J. C. Grady, assays of 0.02 oz. Au/ton and a trace of Cu were obtained from the best mineralized occurrences.[1] The option was terminated at the end of the exploration program.

BRENBAR MINES LIMITED (18)

The Brenbar Mines Limited property in 1967 consisted of 12 leased claims, TB13561 to TB13569, and TB14001 to TB14003, located in the northeastern corner of Irwin Township. The area is underlain by east-trending, deformed tuff-breccia, pyroclastic breccia, and fine-grained flows and tuffs of intermediate to felsic composition. Photo 6 shows some of the tuff-breccia found on the property. Tourmalinization has occurred in some of the volcanic rocks. Quartz feldspar porphyry outcrops in the northeastern part of the claim group.

The original discovery was in 1934 by the Brennan and Kenty Bros. Prospecting Company who later sold the property to Casey Contact Mines Limited. In 1936, the company was reorganized under the name of Brengold Mines Limited.

Laird (1937, p. 92) states that:

> . . . When the Casey Contact company assumed control it extended the programme of surface exploration and initiated a campaign of underground development near the original discovery. In all, close to 5,700 feet [1700 m] of stripping and trenching has been completed and 15 quartz veins of varying importance have been systematically examined. In the spring of 1935, the main showings were probed to shallow depths by diamond drilling, 16 holes being drilled for a total of 2,604 feet [794 m].

The Statistical Files, Ontario Division of Mines, show that some gold was produced from this property in 1941; details, however, are not available. Brenbar Mines Limited acquired the Brengold assets in 1946 and between September 1st and December 31st, 1949, the mine shaft was dewatered and the surface plant reconditioned. During this time a total of 46 tons of material was sent for treatment to the mill of Magnet Consolidated Mines Limited near Geraldton.

In 1967, the main showing (claim TB13566) was completely overgrown. All trenches had caved in and stripped areas were grown over with moss and lichen. All of the buildings had been removed and the headframe collapsed, leaving the shaft uncapped. A description of the gold occurrences is therefore taken from Laird (1937, p.93-97) who states that:

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[1]Assessment work files, Regional Geologist's office, Ontario Ministry of Natural Resources, Thunder Bay.

The more important showings are located along an east-west ridge that extends over parts of three claims, T.B. 13,563, 13,566, and 13,569. They occur in a highly chloritic tuff, which has been strongly sheared at N.80°E. In places the rock becomes quite agglomeratic, but shearing commonly tends to destroy the usual fragmental appearance. The fine-grained tuff in places shows faint bedding parallel to the schistosity, and in one outcrop near the west boundary of claim T.B. 13,568, excellent bedding was observed. The veins are more or less parallel to the schisting, but in some cases they cut across it.

The discovery vein, No. 2, is located near the east boundary of claim T.B. 13,566 and is exposed for a length of 200 feet along the contact between a "green" dike and highly altered tuff. It is lens-like in character, ranging from 12 to 50 inches in width. It strikes in an easterly direction, but toward the east end it turns sharply southward, more or less folding back on itself. Rather severe faulting complicates the vein system. The quartz is rusty and much fractured, and it contains moderate quantities of pyrite, chalcopyrite, and visible gold, and a little carbonate.

About 60 feet southeast of the discovery vein is No. 7 vein, which is exposed in a cribbed trench and on surface for about 65 feet. It strikes N.75°E. and dips 80°S. It has a maximum width of 30 inches, but the average width is probably not more than 10 inches. The quartz is moderately mineralized with pyrite, chalcopyrite, galena, zinc blende, and visible gold, and contains appreciable quantities of carbonate (ankerite) and sericite. The immediate wall rock is a rusty, bleached sericite schist carrying no gold values. As a result of the diamond-drilling of this vein, it was decided to proceed with underground development and a shaft was sunk 20 feet to the south.

Next in importance is No. 5 vein, which is located in the extreme northeast corner of claim T.B. 13,563 and is exposed over a length of 275 feet. It strikes N.25°E. and dips steeply to the west. It has a maximum width of 33 inches, but narrows down in places to a mere stringer. The quartz is milky and well-fractured and carries moderate quantities of pyrite, chalcopyrite, and visible gold. In one place near the road, where the vein narrows to not more than an inch in width, specks of visible gold are plentiful. The country rock is a tuffaceous greenstone.

No. 6 vein, a little more than 200 feet southeast of the shaft, occurs in a highly sheared sericitic tuff, arkose-like in appearance. It strikes N.75°., dips 80°S., and pinches and swells over an exposed distance of 225 feet. Its maximum width is 18 inches, but the average width is probably less than 6 inches. The quartz carries a little pyrite and visible gold.

No. 8 vein, 200 feet north of the cookery, has been uncovered for 200 feet. It strikes N.60°W. and stands vertical. It pinches and swells in characteristic fashion, the width of quartz ranging from 2 to 24 inches. The mineralization consists of pyrite, ankerite, and visible gold. Visible gold was also observed in a similar vein, No. 17, about 100 feet east of the cookery.

Vein No. 15, on the boundary between claims T.B. 13,562 and 13,565 has been traced for 300 feet. It strikes N.80°E. and stands vertical. In places it widens to 45 inches, but the average width is 12 inches. The quartz is milky and contains pyrite and sphalerite, but no gold was observed. Vein No. 14, on the same claim but east of No. 15, has been uncovered for nearly 500 feet. It has an average width of 12 inches and carries pyrite, chalcopyrite, and visible gold, as well as ankerite and sericite.

He also states (p.95) that:

All but three of the veins thus far uncovered have a general easterly trend and seem to follow a definite fracture system, which continues on to the Macjoe Sturgeon and Sturgeon River properties lying to the east. Veins No. 3, 4, and 5 strike north, a fact suggesting that there may be two sets of vertical fractures in the pattern. There is some evidence, however, of folding, and it may be assumed that these northerly veins occur in drag folds. If this is true, there may not be

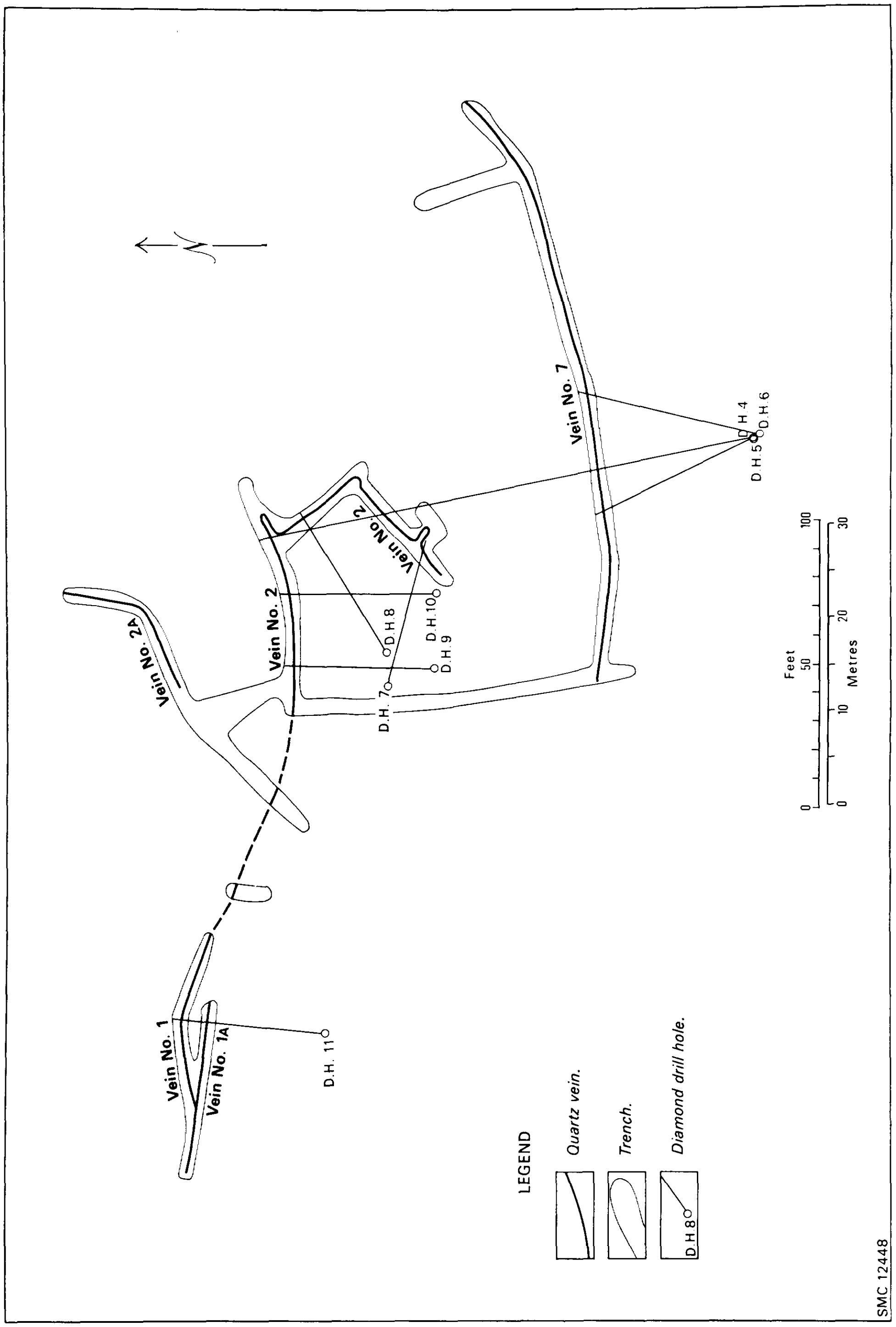

Figure 2–Surface plan of the vein system and diamond drilling in the vicinity of the Casey Contact shaft, Brenbar Property; after Laird (1936, p.94).

as many veins as at first supposed. What are known as veins Nos. 1, 2, 7, and 4 may be one and the same vein; and veins Nos. 6 and 3 may likewise be a single vein. Further work may establish similar relationships between other widely separated veins on this property.

Most of the beins have features in common. They are narrow and lens-like in habit, follow curved fractures, and pinch and swell in characteristic manner along both the strike and dip. They usually develop a characteristic banded or ribboned appearance due to the presence of chlorite or sericite along fractures and slip planes parallel to the walls. Alteration of the wall rocks is not strong but results mainly in the addition of silica, carbonate, pyrite, and sericite. The quartz is rather milky, well-fractured, and finely granular. The mineralization is rather sparse and confined largely to the quartz. It consists of pyrite, galena, sphalerite, native gold, and a little chalcopyrite. The gold is a pale variety occurring as tiny specks, almost invisible without a lens, and also in coarse blobs of a spectacular nature. The gold is found in several associations. Galena and sphalerite appear to be favoured, since the presence of either of these minerals commonly indicates gold in greater quantities than ordinary. It has also been observed in tiny fractures in grains and cubes of pyrite, in association with chlorite and sericite in the fractures and various slip planes in the quartz, and far out into what appears to be otherwise barren and unfractured quartz.

"During the summer of 1935 the northern half of the group was further prospected, but the main interest was centred largely on underground development in the vicinity of veins Nos. 2 and 7. A crew of 21 men under the management of H. M. Parrington was engaged in this work. On July 13 a pilot shaft was completed to a depth of 223 feet and a 200-foot level established. Crosscuts on the 125-foot level failed to locate important vein matter, although the shaft had been located to intersect the southward-dipping No. 7 vein above this level. At first, success did not attend lateral work on the lower level, but early in September a drive to the west encountered a vein on the 200-foot level at a point 115 feet almost directly west of the shaft and directly below No. 7 vein as exposed on surface. When the property was visited in September the relationship between this vein and those on surface had not been established. It had been drifted on for 60 feet. The face in the west drift showed a 42-inch width of excellent-looking vein matter, consisting of well-fractured quartz carrying considerable pyrite, chalcopyrite, galena, and visible gold. The face in the east drift showed a 28-inch width of similar vein matter. The average width of quartz over drift length is estimated to be about 19 inches.

The company suspended operations at the property on September 25, reportedly on account of financial difficulties. The property has since been idle pending reorganization of the company.

Figures 2 and 3 are taken from Laird (1937) and show the surface and underground workings in the vicinity of the Casey Contact shaft.

The Statistical Files, Ontario Division of Mines, indicate that a total of 134 oz. of gold, worth $5,160, was produced between 1941 and 1949. A sample of pyritic quartz collected by the field party from a supply stored near the shaft assayed 6.24 oz. Au per ton (analysis by the Mineral Research Branch, Ontario Division of Mines).

Chalcopyrite mineralization was found by the field party on the south side of a large outcrop area in the central part of claim TB13568. Here the mineralization follows the foliation in sheared intermediate to felsic volcanic rock. A more significant copper occurrence in the same locality is shown on a geological sketch map by Laird (1937, p.93), and the following account is taken from page 95 of his report:

A type of vein matter entirely differing from that commonly observed on this property was encountered on the east line of claim T.B.13,568 about 3 chains north of No. 2 post. It consists of a strongly mineralized shear zone in a volcanic

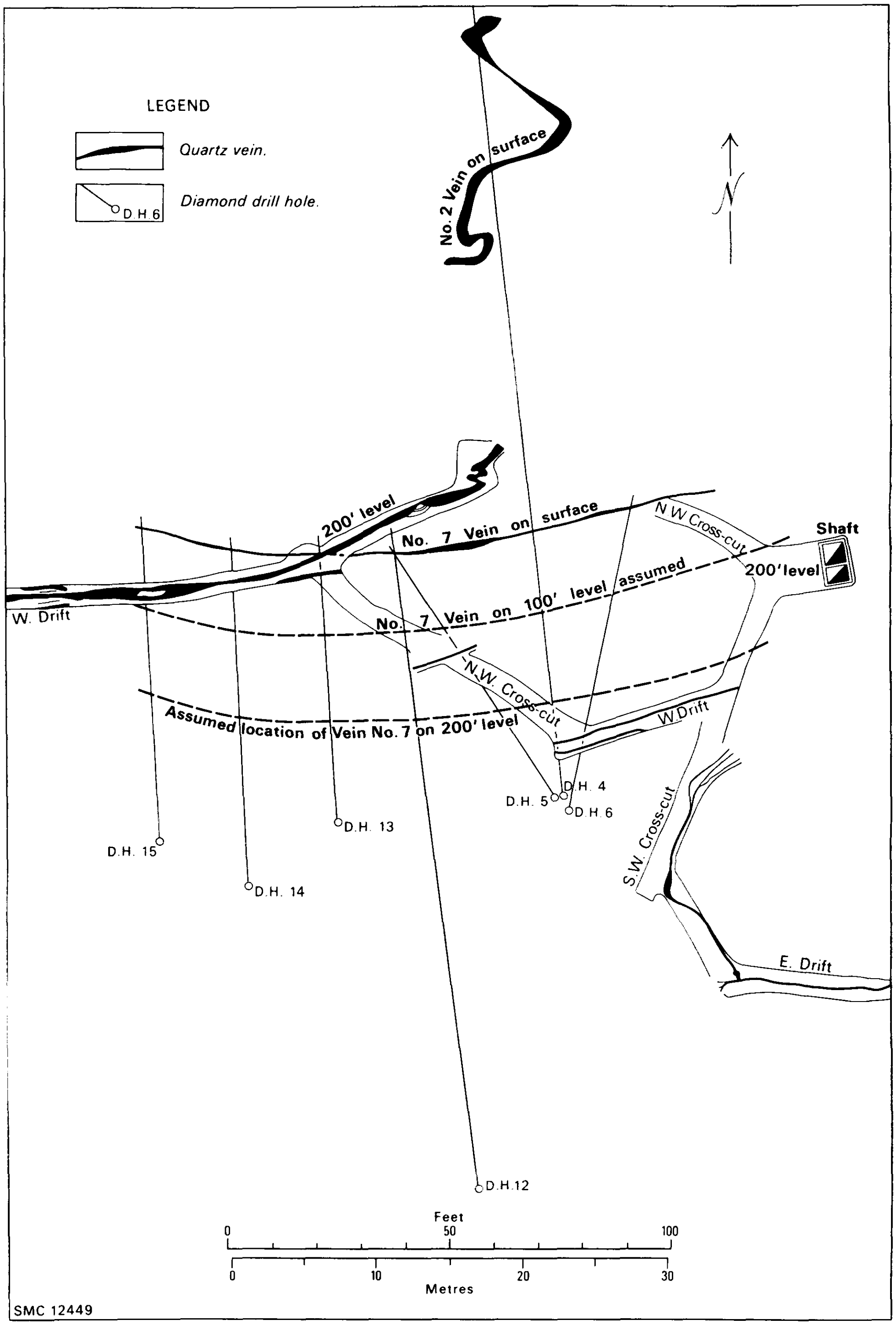

Figure 3—Plan of the vein system and underground workings, 200-foot level, shown in relationship to vein numbers 2 and 7, as exposed on surface, Casey Contact shaft, Brenbar Property; from Laird (1936, p.96).

tuff. The shear zone is 4 feet (1.2 m) wide, strikes east, and dips 85°S. The mineralization consists of abundant chalcopyrite and a little azurite; there is no vein quartz.

The approximate location of this copper occurrence is shown on Map 2294 (back pocket).

BROOKBANK-STURGEON MINES LIMITED (19)

History

In 1967, Brookbank-Sturgeon Mines Limited held a block of 18 claims, TB29025 to TB29042, between Foxear Creek and Windigokan Lake in the central part of Irwin Township.

Exploration for gold on this property has been concentrated along a pyritic carbonate zone marking the contact between mafic metavolcanics and overlying metasediments.

The first recorded account of exploration on this property is given by Laird (1936, p.97). In 1934, Connell Mining and Exploration Company Limited carried out a surface exploration program and diamond drilling on a group of 24 unsurveyed claims called the Brookbank group. A series of 17 cross-trenches and several test pits traced out a mineralized zone about 1,300 feet (400 m) along strike. Laird (1936, p.98) reports that only low and erratic gold values were encountered and that development work was suspended in 1935. No information on the 1934 diamond drilling program is given.

Colcleugh (1946) undertook geological mapping of the present Brookbank group for Noranda Mines Limited in 1944. A diamond drill program ran concurrently and a total of 6,091.5 feet (1850.3 m) was completed. Location of most of the drill holes is shown on Figure 4 and data on gold values intersected are shown on Table 5.

In 1950, ownership passed to Brookbank-Sturgeon Mines Limited. No further work has been reported.

Geology

The results of detailed mapping by Colcleugh (1946) were incorporated into a thesis study. In doing this work Colcleugh was able to make use of diamond drill information.

The mineralized zone consists of a pyritized and silicified carbonate unit that extends some 2,000 feet (600 m) along the contact between mafic metavolcanic and overlying metasedimentary rocks. Average width of the zone is about 100 feet (30 m) (Figure 4). Both Laird (1936) and Colcleugh (1946) consider the carbonate zone to be a replacement or alteration of the metavolcanics.

Colcleugh (1946, p.6) determined the stratigraphic sequence within the claim group to be mafic lava and diorite at the base followed by the pyritic carbonate zone, altered iron formation, arkose, slate, mudstone, greywacke, conglomerate, and greywacke. Graded bedding in the greywacke indicates the metasediments have tops to the north. Pillow outlines in the underlying rock indicate the metavolcanics also face north. With the

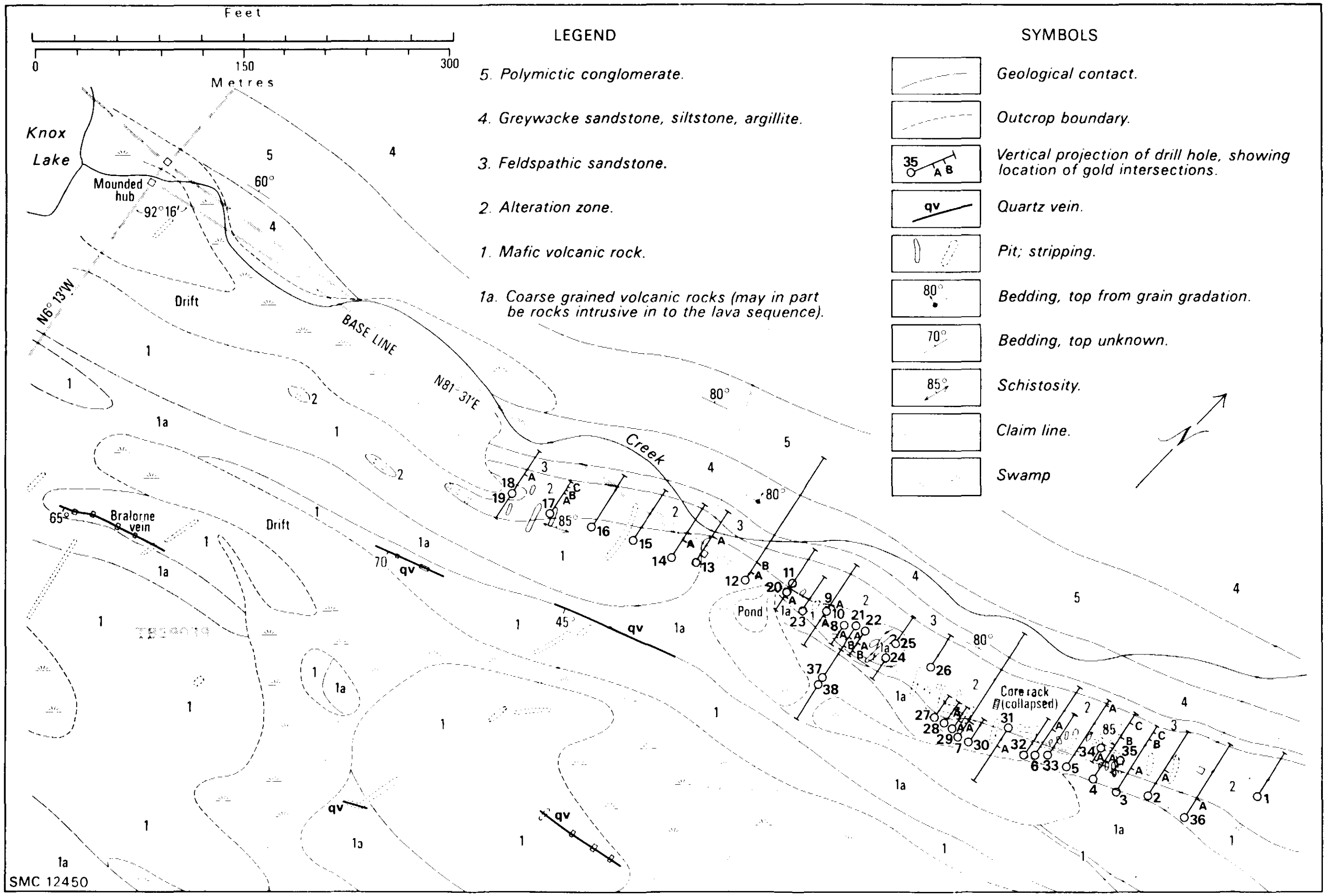

Figure 4–Geological plan of the property of Brookbank-Sturgeon Mines Limited, showing the location of diamond drill holes. Each unit on the foot scale is 100 feet. After Colclough (1946).

Table 5 BROOKBANK PROPERTY DIAMOND DRILLING RESULTS.* (CORRESPONDS TO DRILL PLAN IN FIGURE 4)

DRILL HOLE	ANGLE	INTERSECTION (oz. Au/ton)	LENGTH OF HOLE
1	44°	NIL	168.0′
2	40°	A) 8.5′ @ 0.16	235.0′
3	35°	A) 2.8′ @ 0.14	233.0′
		B) 8.2′ @ 0.15	
		C) 4.1′ @ 0.10	
4	30°	A) 3.5′ @ 0.41	211.0′
		B) 2.9′ @ 0.13	
		C) 4.4′ @ 0.10	
5	30°	A) 4.4′ @ 0.14	212.0′
6	30°	A)14.7′ @ 0.143	233.0·
7	33°	A)10.9′ @ 0.195	346.0′
8	45°	A)17.7′ @ 0.288	81.0′
9	40°	A) 3.8′ @ 0.11	171.0′
10	47°	A) 3.8′ @ 0.135	145.0′
11 N	40°	NIL	152.0′
12	33°	A) 5.8′ @ 0.20	372.0′
		B) 2.8′ @ 0.105	
13	42°	A) 3.7′ @ 0.10	186.0′
14	35°	A) 2.0′ @ 0.68	185.0′
15	42°	NIL	186.0′
16	37°	NIL	180.0′
17	35°	A) 2.5′ @ 0.10	103.0′
		B) 2.5′ @ 0.12	
		C) 2.0′ @ 0.18	
18	45°	A) 1.6′ @ 0.10	179.0′
19	45°	A) 2.5′ @ 0.32	99.5′
20 S	45°	A) 2.4′ @ 0.10	99.0
21	45°	A) 6.4′ @ 0.634	99.5′
		B) 4.3′ @ 0.10	
22	45°	A) 2.8′ @ 0.14	97.0′
		B)16.3′ @ 0.126	
23	45°	NIL	127.0′
24	45°	NIL	83.0′
25	45°	NIL	115.0′
26	40°	NIL	122.0′
27	45°	NIL	83.0′
28	45°	A)11.3′ @ 0.118	81.0′
29	45°	A) 3.5′ @ 0.11	82.5′
30	45°	NIL	85.0′
31	35°	A) 6.2′ @ 0.107	180.0′
32	35°	NIL	126.0′
33	45°	NIL	114.5′
34	45°	A) 3.6′ @ 0.18	52.5′
35	45°	A) 4.1′ @ 0.12	48.0′
36	35°	A) 8.2′ @ 0.126	253.0′
37	45°	A) 4.3′ @ 0.12	226.0′
38	45°	NIL	159.0′
39	45°	No Information Recorded	81.0′
40	45°	,, ,, ,,	100.0′

*Taken from drill hole plan on file with Regional Geologist, Ontario Ministry of Natural Resources, Thunder Bay.

possible exception of the carbonate zone, all rocks in this succession are similar to those found elsewhere in the map-area. The arkose as described by Colcleugh (1946) is probably closer in composition to the feldspathic sandstone described earlier in this report. Colcleugh (1946) believes the dioritic rocks to be intrusive into the volcanic sequence. The writer however feels that they might, in part, be the coarser grained section of flows or preserved remnants of feeders in the volcanic pile.

Colcleugh (1946, p.12) describes the alteration zone as follows:

> The usual sequence of material in the main ore zone from south to north is as follows:—First, there is a well fractured greenstone containing occasional small stringers of hard, reddish, silicious material, with slight pyritization. A few narrow lenticular bands of schistose greenstone are present. The rock changes northward into a highly brecciated dark brown to buff coloured material largely composed of iron carbonate and finely dispersed quartz and a fine network of quartz and carbonate veinlets is commonly seen. Narrow irregular areas of pink to reddish fine grained silicious material are a consistent feature of the zone and seem confined largely to the greenstone side. Rather fine grained pyrite is liberally distributed throughout the whole zone, but concentrated only in certain narrow bands, usually in the more silicious phases. When the north margin of the zone is approached, the first evidence of a change is the appearance of a narrow band of dense black cherty material in places less than one inch in thickness. Preceding or following it for a few inches, there is usually a dark cherty phase of the alteration. This cherty horizon is interpreted as being originally a narrow band of iron formation. Following this northward is a highly schistose, sericitic phase which grades into a light cream coloured schistified arkose. The arkose within variable distances usually changes into a fine grained dark slaty (mudstone) phase, and thence into greywacke.

Sulphide mineralization in the 'alteration zone' consists mainly of fine disseminated pyrite. Specularite, chalcopyrite, and molybdenite are also present, the latter two being rare. Colcleugh (1946, p.10) states that "visible gold is quite rare." He also states (p.30) that "gold and chalcopyrite particles of extremely small size occur in fractures in pyrite, and sometimes appear completely enclosed in pyrite grains or in gangue".

The presence of cherty 'iron formation' layers in the hangingwall of the 'alteration zone' together with Colcleugh's (1946, p.8) observation that this unit persists intermittently along the contact between the metavolcanics and metasediments may possibly allow the interpretation that the 'alteration zone' is of primary sedimentary origin. Ridler's (1970, p.37-38) descriptions of the auriferous carbonate facies of the Boston Iron Formation in the Kirkland Lake area has many similarities with the carbonate rocks of the Brookbank group.

CANDELA OCCURRENCE (20)

Laird (1936, p.114) reports the following:

> The Boylen group consists of 6 claims surveyed in 1935 (T.B. 15,259 to 15,264) and located between Windigokan and Gooseneck lakes, Irwin township. Near the north boundary of claim T.B. 15,259 a prospect pit was sunk on a rusty shear zone in a rather acid lava. A narrow quartz-carbonate veinlet traversing the schist is reported to carry gold.

In September 1952, Candela Development Company drilled a 324-foot (99 m) hole to test for gold in volcanic rocks with disseminated sulphide minerals. No values were intersected.

CANORAMA EXPLORATIONS LIMITED [1961] (21)

In 1961, Canorama Exploration Limited held a block of 23 claims on the east border of Irwin Township, with an additional 6 claims forming the eastern end of the group in Walters Township.

A preliminary geological survey was undertaken on 17 of the above mentioned claims in the fall of 1960. This was followed by detailed geological mapping program in the summer of 1961 and a geological map was prepared at a scale of 1 inch to 200 feet (1:2400).

The area is underlain by intermediate to felsic flows and pyroclastic rocks. Many of the quartz veins cutting the volcanic rocks were sampled by the company and found to contain no gold. Two quartz veins located close to milepost 4 on the boundary between Irwin and Walters Townships contain minor amounts of pyrite, galena, and chalcopyrite. Laird (1936, p.114) describes work done by the Devanney-Smith group in an area covered by the southwestern part of this claim block. Six cross trenches, on the north shore of the east end of McCambley Lake, exposed a northeast-striking, rusty shear zone 40 to 50 feet (12-15 m) wide which contains minor pyrite. Other shear zones were located ½ mile (0.8 km) to the north.

CENTRAL MANITOBA MINES LIMITED [1957] (22)

In 1957, Central Manitoba Mines Limited held three groups of claims in the Watson Lake area, Irwin Township. Iron formation made up of chert laminae alternating with magnetite-hematite laminae occurs along the contact between Archean metavolcanics and metasediments. The iron formation is represented by distinct northeast-trending anomalies on regional aeromagnetic maps (ODM-GSC Maps 2128G, 2135G).

According to Shklanka (1968, p.385), International Mining Development Company undertook trenching and sank a 36-foot (11 m) shaft in 1917.

In 1957, Central Manitoba Mines Limited reported the completion of four diamond drill holes aggregating 1,012 feet (308 m) in length. One of the best intersections averaged 23.41 percent Fe over a drill core length of 43 feet (13 m).

Shklanka (1968, p.385) states that "A selected grab sample assayed 48.9% Fe but the estimated apparent grade is 32% Fe".

Central Manitoba Mines Limited have since allowed their claims to lapse but a group of six leased claims. TR2415, TR2416, TR2417, TR2418, TR2419, TR35819, was held in the central part of Watson Lake by S. Cowan in 1967.

CHERBOURG GOLD MINES LIMITED (23)

In 1967, Cherbourg Gold Mines Limited held a group of 15 leased claims, TB19945, TB19947, TB19949; TB21111, TB21112, TB21113; TB24846, TB24847, TB24848; TB27243, TB27244, TB27245, TB27246, TB27247; and TB27416, situated between Knox and Windigokan Lakes in Irwin Township.

Work in the vicinity of the south shore of Knox Lake is reported by Laird (1936, p.99-100) to have been done in the summer of 1935 by K.L. Exploration Company Limited who, at that time, held a group of 16 claims. Three main showings were examined: the 'Galena vein', just south of the bay in the central part of Knox Lake; a possible extension of the Brookbank 'break' located less than 1/4 mile (0.4 km) from the east end of Knox Lake; and a southern vein located approximately 1/4 mile (0.4 km) south of Knox Lake.

According to Laird (1936, p.100) the 'Galena vein'

> . . . strikes N.33°E., dips 70°W., and is exposed for 200 feet. It pinches and swells in characteristic manner, attaining a maximum width of 30 inches but in places narrowing to less than an inch. The enclosing rock is a soft-weathering, highly chloritized greenstone, slightly sheared at N.60°W. The quartz is well-mineralized with pyrite and galena, and pink calcite is plentiful. Two character samples taken by the writer from the north and south ends of the exposed vein yielded 0.20 and 0.16 uonces of gold per ton.

The zone believed to be an extension of the 'break' on the Brookbank property to the east has been described by Laird (1936, p.100). He states:

> . . . It has been exposed in a series of 6 cross-trenches over a length of 200 feet. A quartz vein in the most easterly pit is 28 inches wide, strikes east, and dips slightly south. The mineralization consists of pyrite and carbonate. The country rock is a rusty, pyritized greenstone, and a small body of coarse quartz diorite is exposed near by. At the west end of the workings the vein matter is spread over a width of 32 feet and consists of a sort of stockwork of quartz veins ranging from a quarter of an inch to 3 inches in width. The wall rock is altered to a reddish and greenish material, being strongly silicified and feldspathized, similar to that at the Brookbank showing. The mineralization consists of fine-grained pyrite and specular hematite, both of which occur mainly in the altered wall rock. Channel assays are reported to have yielded no gold values.

The southern quartz vein (p.100)

> . . . strikes N.50°-75°E., dips slightly south, and has been exposed by trenching and test-pitting over a length of a quarter of a mile or more. The quartz itself is usually not more than 12 inches in width, but the accompanying shear zone carrying quartz stringers widens to 5 feet in places. Both the quartz and schist are well mineralized with pyrite, and chalcopyrite and galena occur sparingly in the quartz; carbonate is a common constituent of the vein matter. A well-mineralized character sample taken by the writer from the best-looking section near the east end yielded 0.03 ounces gold per ton.

During 1967, the field party examined some of the trenches just south of Knox Lake. The 'southern' quartz vein was not located.

A trench along the boundary between claim TB27245 and TB27246 exposed an 8-inch (20 cm) wide quartz vein with traces of pyrite and chalcopyrite. A chip sample taken by the field party across the vein and submitted to the Mineral Research Branch, Ontario Division of Mines, assayed 0.02 oz. Au/ton and 0.32 oz. Ag/ton. A 5-foot (1.5 m) wide quartz vein with traces of pyrite and galena was located along the south shoreline of a bay in claim TB27245. A grab sample collected by the field party was found by the Mineral Research Branch, Ontario Division of Mines, to assay .01 oz. Au/ton with a trace of silver.

A sample plan covering parts of claims TB24848 and TB21111 is listed under Fred Coleman in the files of the Regional Geologist, Ontario Ministry of Natural Resources, Thunder Bay.

S. COWAN (24)

In 1967, S. Cowan held a group of six leased claims, TB2415, TB2416, TB2417, TB2418, TB2419, and TB35819 in the central part of Watson Lake, Irwin Township.

Although no work has been reported, this property is underlain by the same unit of iron formation that has been tested by diamond drilling by Central Manitoba Mines Limited on both the east and west boundaries of the claim group.

C.L. CRAIG (1, 9)

In 1967, Mrs. C.L. Craig held six patented claims, AL402 to AL407, in Dorothea Township and one patented claim, AL418, in Sandra Township.

The claims in Dorothea Township are underlain by a thin band of ferruginous metasediments that can be traced on ODM-GSC aeromagnetic map 2128G.

Shklanka (1968, p.375) summarizes the Dorothea occurrence as "NE-trending, magnetite-hematite-quartz (chert, jasper) iron formation with some interbedded greywacke, usually less than 50 but up to 240 feet (15-73 m) in width, and 1¼ miles (2 km) in length".

CYRIL KNIGHT PROSPECTING COMPANY LIMITED (10, 26)

This company undertook exploration of two groups of claims in 1934 and 1935. An 'East' group of six claims was located near the mouth of Crooked Green Creek in Irwin Township.

According to Laird (1936, p.38) the 'East' group,

> . . . is underlain by schistose tuffs and agglomerates resembling arkose, but Keewatin in age. The schisting of these rocks is east-west, and their attitude more or less vertical. A massive outcrop of rhyolite or quartz porphyry occurs near the northeast corner of claim T.B. 14,866, and a porphyritic diabase dike, about 150 feet in width, strikes north across claim T.B. 14,861 only a few feet west of the main showing. Several small quartz veins have been uncovered near the middle of claim T.B. 14,861, but the only one containing gold is No. 1 vein. This vein has been stripped for 70 feet. It strikes east, dips 70°S., and has an average width of 5 inches. The quartz is well-fractured and milky-white and carries a little pyrite in addition to the gold. Channel-sampling disclosed no commercial gold values; the best sample is said to have yielded 0.64 ounces gold over a channel width of 9 inches. The showing is reached by a trail leading from the middle of the ox-bow stream just west of the mouth of Crooked Green creek.

The 'West' group, approximately ½ mile (0.8 km) southwest of Musca Lake in Sandra Township, is largely covered by timber slash and was not located by the field party. Laird (1936, p.98-99) reports that:

> . . . The main showings occur on claim T.B. 14,853. Near the middle of this claim a quartz vein or series of lenses has been traced for 657 feet. Near the trail this vein attains a maximum width of 17 feet but narrows considerably in either direction. It strikes N.45°W. and dips from the vertical to 55°N. The quartz is well-fractured and milky white, and on the whole is rather sparsely mineralized with pyrite, chalcopyrite, and gold; in one pit near the west end rather massive chal-

> copyrite was encountered. The gold is confined largely to the main quartz lens, which is crossed by the trail leading from Musca lake. This lens is 45 feet long and has a maximum width of 17 feet. In channel-campling, it was found that the highest gold content occurs where the lens is widest. One small 'pay streak' is said to have yielded 1.90 ounces of gold over a width of 7 inches, but the streak is only 2 feet long.
>
> On the north boundary of claim T.B. 14,853, just west of the trail, a rusty carbonate shear zone carrying a few quartz stringers was stripped. Neither the schist nor the quartz carries any important mineralization.

To the author's knowledge no additional work has been done on these showings.

DAJATY MINES LIMITED [1947] (27)

In 1947, Dajaty Mines Limited held four claim groups in Irwin Township. Three of these groups were along the Paint Lake Fault and the fourth just south of the Watson Lake Fault stradling the boundary between Irwin and Walters Townships. A limited amount of trenching and stripping was done in search of gold mineralization.

C. FORTIER (28)

Two mining claims, TB129738 and TB129739, were held by Claude Fortier in 1967 and are situated on the east boundary of Irwin Township just south of the Sturgeon River Gold Mine. No work has been reported for this property.

ALBERT P.E. HOPKINS (2, 29)

Albert P.E. Hopkins, in 1967, held three groups of leased claims in the map-area.

A group of four claims, TB10501, TB10502, TB10504, and TB10505, just north of Twin Falls, in Irwin and Pifher Townships, were originally staked by J.J. Green in 1932 following a gold discovery by Green and G. Brennan the preceding year. This group was held by P.E. Hopkins in 1935(Laird 1936, p.85).

In Laird's (1936, p.99) description of the property, mention is made of the country rock being arkosic tuffs and agglomerate. He also stated that:

> . . . The main showings are located in the northwest quadrant of claim T.B. 10,502 and may be reached by a good trail branching off from the Maloney Sturgeon trail at a point 20 chains north of Twin falls. Most of the work has been done on the east slope of a steep north-south ridge. Here a few quartz stringers, well-mineralized with pyrite, intersect a somewhat indefinite east-west shear zone in light-weathering, arkose-like tuff, which is interbedded with agglomerate. Farther along the trail in the southern part of claim T.B. 10,505 are large, irregular, lens-like masses of quartz in schistose arkosic tuff. This quartz is rusty in places but appears to carry no mineralization other than a little pyrite. In the central part of the same claim an east-west vein of white milky quartz, 3 feet wide, has been traced up the east side of a steep hill and exposed for about 80 feet. No important mineralization was observed.
>
> No further surface exploration was carried out on this group of claims during the summer of 1935.

A group of six claims, TB28881 to TB28886, is located some 2½ miles (4 km) to the east of the Twin Falls group, and adjoins the west boundary of the Brenbar Mines Limited property. No record of exploration work on these claims is on file with the Ontario Division of Mines. Minor sulphide minerals were found by the field party in a test pit near the Namewaminikan River.

The third group consists of nine claims; TB20190 to TB20191, TB20193 to TB20194, TB20196 to TB20197, and TB20199 to TB20201, in the southern part of Dorothea Township. This area is underlain by intermediate to felsic volcanic breccia and flows which have been intruded by a granodiorite lens and diabase dikes.

According to a report by Hopkins (1959, p.2), Tom Montgomery discovered gold in this area during the 1930s. Laird (1936, p.115-116) reports that several quartz veins were located by prospecting during 1935 on what was then known as the H.A. Montgomery group, and states ". . . One narrow vein near the extreme northeast corner of the property carries appreciable quantities of pyrite and chalcopyrite; this material is reported to carry low values in gold".

This property was held by Albert P.E. Hopkins in 1939, during which time a limited amount of diamond drilling was completed. Drilling was again undertaken over short periods during the fall of 1958 and the spring of 1959, but with little success because of difficult ground conditions. A geological survey was conducted by Albert P.E. Hopkins in November 1958.

Disseminated chalcopyrite, molybdenite, and pyrite were found by the field party in a small lens of granodiorite that strikes west through the central part of the claim group. At first glance, the sulphide minerals appear to be randomly distributed throughout the host rock but close examination reveals that the chalcopyrite and molybdenite mineralization is localized along hairline fractures. Quartz stringers with related sulphide minerals occupy some of the fractures.

Chalcopyrite and molybdenite generally appear to be smeared out along the fractures. Individual grains are in the order of 1 to 2 mm and some flakes of molybdenite up to 5 mm long were found in quartz stringers usually at the intersection of two or more stringers.

The best occurrence known is in the northeast corner of claim TB20190. It must be pointed out, though, that at the time of the visit by the field party, most outcrops had a thick moss covering and the actual extent or poential grade of mineralization was not determined. Disseminated chalcopyrite has been found east of the claim group both in the intrusive rock and in the surrounding country rocks.

This pluton has been described by various workers as granite porphyry, granodiorite, quartz diorite, and diorite. In general, the rocks are pink weathered with an abundance of quartz showing on clean surfaces. A thin section of a specimen collected near the north contact was found to be equigranular, medium grained, and containing a dominant amount of altered feldspar, up to 35 percent quartz, along with lesser amounts of epidote, carbonate, and biotite. The feldspar is almost completely saussuritized plagioclase having preserved oligoclase rims. The rock may be classified as either a trondhjemite or granodiorite but the latter is preferred. Several petrographic phases and alteration types probably exist in the pluton. Copper and molybdenum mineralization appears to be directly related to the intrusion with concentration being controlled by fracturing.

KIMBERLEY COPPER MINES LIMITED [1958] (3)

In 1958, Kimberley Copper Mines Limited held a group of 18 unsurveyed claims located in Dorothea Township near the north shore of Bish Bay on Lake Nipigon.

A property examination was made for the company in 1958 in search of gold- and molybdenum-bearing quartz veins. Old workings located along the Lake Nipigon shoreline expose quartz veins and stringers. No significant mineralization was encountered.

KARL SPRINGER EXPLORATION COMPANY LIMITED [1935] (29)

A block of 18 unsurveyed claims in Irwin Township, extending from Knox to Corrigan Lakes, was held by the Karl Springer Exploration Company Limited in 1935. Laird (1936) reports that work was done at two locations in the claim group. The first is situated near a pond midway between Patter Lake and Foxear Creek. Laird (1936, p.112) states:

> . . . A rusty shear zone has been exposed in a series of 9 north-south trenches over a distance of 600 feet. The zone strikes in an easterly direction and has a maximum width of 40 feet. The immediate country rock is a coarse, massive, dioritic greenstone. Quartz is not abundant, but in places the schist carries considerable pyrite and arsenopyrite. A grab sample of this material yielded 0.07 ounces gold per ton.

The second area of interest is described under Springer Sturgeon Gold Mines Limited.

K.L. EXPLORATION COMPANY LIMITED

Laird (1936, p.99) reports that this company, in 1935, held five groups of claims in Irwin Township. Some work was done in the vicinity of Tallon Lake early in the 1935 field season. Work done later the same summer is listed in the report under Cherbourg Gold Mines Limited.

LAC-TECK GOLD MINES LIMITED [1935] (30)

A description of the Lac-Teck property in 1935 is given by Laird (1936, p.100-101):

> The property of Lac-Teck Gold Mines Limited consists of a group of 18 unsurveyed claims (T.B. 15,500 to 15,505, 15,484 to 15,492, and 15,497 to 15,499) centred about Schnob lake south of the west end of Windigokan lake, Irwin township, and the old surveyed iron claims H.F. 16 and H.F. 17.
>
> Interesting mineralization was uncovered on the east slope and top of a high hill just south of Schnob lake. The main showing, near the northeast corner of claim T.B. 15,502, is exposed in a trench 100 feet long. It consists of a heavy gossan zone, which appears to be a replacement of an amygdaloidal flow by silica, pyrite, and carbonate; specular hematite is abundant in places. Two well-mineralized character samples yielded no gold values. Samples taken by company officials likewise indicate that the deposit is not auriferous.

MINERALS DEVELOPMENT LIMITED [1935] (31)

According to Laird (1936, p.115), Minerals Development Limited held, in 1935, a group of seven unsurveyed claims on the south side of the Namewaminikan River about 1 mile (1.6 km) east of Twin Falls, Irwin Township. He reports (p.115) that ". . . The showings consist of rusty carbonate shear zones with irregular quartz veinlets. Although interesting mineralization was encountered, the gold values are said to have been low".

NORDIC STURGEON GOLD MINES LIMITED [1935] (32)

This property was visited by Laird in 1935 and the following is taken from his report (Laird 1936, p.116):

> Nordic Sturgeon Gold Mines, Limited, holds a group of 9 unsurveyed claims (T.B. 16,091 to 16,099) located about half a mile west of Tallon lake, Irwin township. The main showings are located near the middle of the east side of Nordic lake. Test pits and 6 cross-trenches expose a strong shear zone in greenstone, 6 feet wide and about 200 feet long. It strikes N.15°W. and dips 70°S. In places the schist carries abundant pyrite and is intersected by quartz veins up to 18 inches in width. In one trench there is much massive pink calcite in vugs and unusual quantities of massive graphite developed along shear planes. A short quartz lens in the most easterly pit carries considerable pyrite, chalcopyrite, and carbonate. No gold was obtained in two representative specimens taken by the writer.

NORTHWIND EXPLORATIONS LIMITED [1957] (4)

In 1957, Northwind Explorations Limited held a group of 18 claims, known as the George Elliot Property, located in the Poplar Point area along the southern boundary of Dorothea Township and parts of Eva Township.

According to a report by B.C. Lamble (1957, p.9) these claims were staked early in September 1957 by Messrs. Montgomery and Elliot. Parts of this group had been staked at an earlier date but no reports on previous work done are available.

The only work reported for Dorothea Township was panning for gold from a 5-foot-wide (1.5 m) milky quartz vein exposed in an old trench. Pyrite and specularite were found to occur in minor amounts.

Additional activities of this company are described under the heading of Tyson Properties.

ONTARIO-QUEBEC PROSPECTORS (TRUST) [1935] (33)

In 1935, Ontario-Quebec Prospectors (Trust) held a group of six unsurveyed claims in Irwin Township situated along Foxear Creek between Bearskin and Windigokan Lakes. Laird (1936, p.116) reports:

> . . . A considerable amount of stripping and trenching has been done along a high east-west ridge, just north of Foxear creek on claim T.B. 15,240. The showings occur along the contact between highly schistose amygdaloidal lavas, conglomerate, and iron formation. The schists along this contact are rusty and impregnated with pyrite. Very little quartz occurs. No important mineralization is indicated.

QUEBEC STURGEON RIVER MINES LIMITED (34)

Introduction

In 1967, Quebec Sturgeon River Mines Limited held a block of 24 leased claims located in the northeastern corner of Irwin Township and consisting of TB13394, TB13403, TB13641 to TB13647, TB16726 to TB16734, and TB25967 to TB25972. This claim block was transferred to the Coniagus Mines Limited in 1968.

The Sturgeon River Gold Mine, which is situated on this property, produced a total of 73,438 oz. Au and 15,922 oz. Ag worth $2,728,905 between 1937 and 1942 (Statistical Files, Ontario Division of Mines). The deposit is situated near the west periphery of a granodiorite stock. Production came from quartz veins that cut both volcanic and intrusive rocks.

History and Production

Claims TB13641 to TB13647 were originally staked in 1934 by J.M. Wood and W.T. Brown. Work was concentrated on claim TB13642, the site of the original discovery, and was mainly confined to the "No.3 Vein".

Sturgeon River Gold Mines Limited was incorporated in August 1934 and a three compartment shaft was begun on May 9, 1935. During 1935, the shaft was completed to a depth of 523 feet (160 m) with levels being established at 125, 250, 375, and 500 feet (38, 75, 113, and 150 m). A total of 3,200 feet (980 m) of surface diamond drilling was completed in the same year.

In 1936, production came from shrinkage stopes in the No.3 Vein on the 250- and 375-foot (75 and 113 m) levels. The shaft was deepened to 774 feet (227 m) and 625- and 750-foot (188 and 225 m) levels were established. A 30-ton amalgamation mill was installed and operated from June to August, treating 1,290 tons of ore. Operations were suspended, however, because of a high loss in tailings, and the cost of wood-generated steam power. Claims TB13394 and TB13403 were acquired from Agaura Exploration Limited (Bruce 1936, p.45-48) sometime after 1936.

Hydro-electric power was supplied to the minesite early in 1937 and a 50-ton amalgamation cyanide mill was installed and began operation in March. The first gold brick was poured April 23, 1937. Cut and fill stoping by the resuing method was introduced with the ore being hand sorted in the stopes and on a picking belt in the crusher house.

Shaft sinking resumed in 1938 and reached 966 feet (294 m) by year end. Underground operations were confined to the No.3 Vein.

In 1939, the shaft was deepened to 1,274 feet (386 m) with the lowest production level being established at 1,250 feet (380 m). The No.3 Vein, which had followed the shaft from below the 500-foot (150 m) level to the 875-foot (260 m) level, now changed dip to 75 degrees east and was cut by a flat dike at the 1,125-foot (340 m) level. Stopes on the 875-foot (260 m) level had a total length of 900 feet (270 m), and 700 feet (215 m) on the 1,000-foot (300 m) level. Forty percent of the ore was now being taken from below the 750-foot (225 m) level. Fire destroyed the hoist house and equipment in the spring of 1939 causing a four-month slowdown in production. The mill averaged 72.4 tons daily and yielded a total of 26,280 tons in 1939.

The shaft was deepened to 1,780 feet (550 m) in August 1940 and new levels were established at 1,415, 1,580, and 1,750 feet (431, 480, 520 m). The discovery of

ODM8998

Photo 23–Site of the Sturgeon River Gold Mine taken from top of the waste-rock pile, looking east. The vault can be seen in the background centre.

the No.10 Vein was made east of the shaft on the 1,580-foot level and drifted on for 411 feet (124 m) in 1940. Three stopes were started on the No.10 Vein which had an average width of 8.3 inches (21 cm) over a total length of 286 feet (87 m). Grade was estimated at 0.30 oz. Au/ton over 30 inches (76 cm) (Tower *et al.* 1941, p.125-126). In 1940, there were 46 houses and a 30-pupil school on the property. The total population was 221.

By 1947 the No.10 Vein was found to be erratic and generally of low grade. A narrow but high grade vein ('M' Vein) was developed on the 1,415-, 1,580-, and 1,750-foot (431, 480, 520 m) levels. The No.3 Vein was found to continue north into the granodiorite on the 1,415- and 1,580-foot (431, 480 m) levels.

Eighteen additional claims were obtained from the adjoining Macjoe Sturgeon Gold Mines Limited in 1942. The shaft was sunk another 328 feet (100 m) to a total depth of 2,108 feet (640 m) and new levels were established at 1,915 and 2,080 feet (584, 634 m). The mining method was changed in several stopes so that the waste was first blasted out and then the vein material removed. This resulted in a higher grade millfeed. Following the entry of the United States into World War II, gold mining in Canada became classed as a non-war industry and the mine closed in October 1942. At the time of closing, crosscuts on the two lower levels had exposed the 'M' Vein, No.3, Vein and a new 'No.11' Vein. These veins were normal in appearance and contained some visible gold (Tower *et al.* 1943, p.183).

Total production for the Sturgeon River Gold Mine was 73,438 oz. Au and 15,922 oz. Ag, worth $2,728,905 (Statistical Files, Ontario Division of Mines). Much of the equipment was taken to the Nama Creek Mines Limited lithium property south of Beardmore in the mid-1950's (E.G. Pye, personal communication) and the shaft capped.

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Photo 24—No. 3 vein (south of shaft), Sturgeon River Gold Mine, Irwin Township.

A magnetometer survey of the property was completed during the winter of 1944-1945. Some surface diamond drilling was undertaken in the adjoining property in Walters Township during 1953 but no gold values were reported.

A view of the property in its present state (Photo 23) was taken from the top of the waste pile looking east. A surface exposure of the No.3 Vein (Photo 24) was located by the field party and a chip sample collected across a width of 26 inches (66 cm) was found by the Mineral Research Branch, Ontario Division of Mines, to assay 2.94 oz. Au/ton and 0.86 oz. Ag/ton.

Geology

The area is underlain by intermediate to felsic metavolcanics that have been intruded by granodiorite, mafic dikes, quartz veins, and diabase dikes. The metavolcanics are medium grey to dark green and vary from massive to foliated. Fine-grained 'quartz-eye' porphyry is present in the vicinity of the mine and may be the result of silicification related to the intrusion of the granodiorite stock to the east. Tuffaceous volcanic rocks are minor tuff-breccia outcrop along the north half of the western boundary of the property. Tourmalinized metavolcanics similar to those described by Laird (1936, p.72-73) were found in claim TB16730.

Granodiorite and quartz diorite stocks lie to the north and east of the mine. Irregular tongues and porphyritic, hybrid zones of these bodies can be found in the vicinity of the minesite. Massive equigranular granodiorite was found underground and this rock type is present over a large part of the waste dump. A chemical analysis of the granodiorite collected by Bruce (1936) from the underground workings is shown in Table 2. Bruce (1936, p.28) describes a large lamprophyre dike cutting granodiorite northeast of the shaft. This dike is equigranular and contains pyroxene, magnetite, quartz, and an untwinned feldspar.

The gold-bearing quartz veins cut all rocks in the mine area with the single exception of a flat dike on the 1,125-foot (343 m) level (believed by the writer to probably be diabase). According to Bruce (1936, p.38) there are two or three sets of quartz veins. One set strikes northeast and a second set (containing the No.3 Vein) slightly east of north. The No.3 Vein itself strikes N13E and dips 70 degrees west. As the No.3 Vein changes to an easterly dip underground Bruce (1936, p.39) concludes that there may be a third set of fractures.

The following account of the mine geology is taken from Bruce (1936, p.39-44). No other detailed account of the geology is available to the author. The reader should refer to the original text for photographs of the mine workings and ore textures.

> The course of No.3 vein is remarkably straight and is unaffected by the kind of rock in which it lies; it cuts across contacts without any deviation whatever. The width varies considerably. At the widest part there is 3 feet of quartz. At other places the vein narrows to 2 or 3 inches (see photographs on pages 39 and 40). In the 700 feet it has been traced on the surface the average width is 9 inches. South of the shaft, No.3 vein passes through a tongue of granodiorite, and the vein is narrower in that part than it is in the lavas. To the north of the shaft, the vein lies in places along the contact between granodiorite and lava; apparently the latter is included between salients of the intrusive. Underground the rocks are distinguishable by a blocky, polygonal jointing in the granodiorite, as contrasted with a more or less marked schistosity in the lavas. No doubt these structures are responsible for the different character of the vein where it crosses from one rock into the other.
>
> Although in general remarkably straight, the vein is offset in a few places for distances of 2 to 4 feet. The offsets are not faults but merely the ending of the vein along one fracture and the beginning of another vein along a parallel fracture. In all cases observed the offsets are to the right hand. Commonly the end of the vein is rather blunt, but narrow veinlets of quartz stream off for a few inches along the direction of the vein zone. On the 625-foot level a fold offsetting the vein to the right has a short arm amplitude of several feet. The lenticular character is well shown in the drifts, the appearance of the faces of which changes with every round removed. Thus a single vein appears a few feet farther along as two, and these a little farther again unite (see photographs on pages 41 and 42). In addition to the gold-bearing quartz veins, there are lenses of barren quartz, most of which are only an inch or so in width and a few feet in length. Commonly these are parallel to the vein. Small veinlets of calcite intersected by the quartz veins form reticulating patterns in the wall rocks (see photographs on page 42).
>
> The veins have a roughly banded structure (see photograph on page 39), due to the presence of zones, parallel to the walls, containing considerable chlorite and sericite. These are probably remnants of sheared wall rocks almost completely replaced. Quartz is the most abundant mineral in the vein. It is of two generations. The older is milky to faint pinkish in colour and appears fractured. The younger is in tiny, water-clear veinlets traversing the older quartz.
>
> A thin section shows that the older quartz is rather coarsely crystalline, and that the grains form a closely interlocking mosaic. In places there are areas of finer texture, possibly crush zones, since foils of sericite, in roughly parallel arrangement, lie between the grains. Vein material from the 250-foot level has a streaked appearance. A section cut normal to the banding is found, under the

microscope, to consist of alternate zones of quartz and calcite. The quartz appears to be younger than the calcite. There is as well a very marked difference in the grain size of the quartz, which may be due to brecciation. If so, there are two generations of quartz, and it is not certain that both are younger than the calcite. Sericite is apparently later than both the quartz and calcite. It occurs in narrow, irregular veinlets. Metallic minerals form a very small part of the vein filling. In order of abundance these are pyrite, chalcopyrite, sphalerite, gold, and gold telluride. Some of the pyrite shows fairly good crystal outlines; some of it is in irregular grains. Chalcopyrite is found within apparently unfractured pyrite but generally occurs in fractures in it. Intergrowths of chalcopyrite and sphalerite are thought to be due to replacement of the former, since the rounded grains of it have a regular pattern (see photomicrograph on page 43) and have the same orientation as neighbouring grains when examined under polarized light. [N.B. The presence of chalcopyrite blebs is probably best described as their being a product of exsolution from sphalerite.] A telluride, probably petzite, occurs within apparently unfractured pyrite crystals (see photomicrograph on page 44). In nearly every polished section examined in which gold is present there is clear evidence that the pyrite had been fractured and the fractures filled with gold. Gold also occurs lying between pyrite and gangue. Much of the gold, however, is in fractures in the quartz (see photomicrograph on page 45), and a considerable amount lies in the zones of chlorite and sericite, probably because, subsequent to consolidation of the quartz, movements were localized along the chlorite-sericite zones.

Gold is relatively abundant in some parts of No.3 vein. Most of it is in very fine particles and is very pale in colour. Hence, it is not always easily recognizable in hand specimens, especially where it is along highly sericitic slip planes. Very high assays have been obtained from some sections of the vein. The average gold content over a width of 9 inches for the total length exposed is said to be more than an ounce per ton. There is comparatively little in the wall rocks, even where they are somewhat altered. It will be necessary to mine as narrow widths as possible in order to avoid undue dilution.

A number of specimens were taken from the vein walls in order to study the alterations undergone during vein formation. Where the walls are andesite, the rock at some distance from the vein consists of secondary minerals: chlorite, quartz, sericite, and some altered feldspars. Chlorite makes up about 50 per cent of the whole. A specimen of rock included in the vein consists of chlorite, sericite, quartz, and pyrite. Quartz, however, forms a much larger proportion than in the previously described section. It occurs as angular to subangular grains, which look not unlike fragments. This characteristic is probably due to replacement of the somewhat schistose country rock. The pyrite is certainly introduced.

In one locality where the wall rocks are granodiorite, a specimen 2 feet from the vein consists of quartz, plagioclase, sericite, chlorite, and a considerable amount of pyrite. The greater part of the rock was originally imperfectly formed plagioclase crystals now altered to sericite, with which quartz forms a micrographic intergrowth. Two inches from the vein the rock is in most respects similar to that farther away except that there is a considerably larger proportion of sericite.

The wall rock alteration, therefore, is merely an addition of quartz and some sulphur and possibly some sericitization of the already altered andesite or granodiorite.

No.1 vein belongs to the first fracture system mentioned above. It strikes nearly northeast-southwest and dips 70° to 75°N.W. Its intersection with No.3 vein is concealed by drift, but it should be about 60 feet north of the shaft. On the 250-foot level at a point 300 feet north of the shaft, a shear zone containing quartz stringers cuts through No.3 vein. On the 500-foot level a vein similar in apearance to No.1 vein cuts through No.3 vein. At that point the younger vein has a dip to the southeast, however, and the line of intersection of the two rakes downward to the south at an angle of approximately 5 degrees. On the 375-foot level what seems to be No.1 vein intersects No.3 at a point 433 feet north of the shaft.

Where exposed by trenches west of the shaft, No.1 vein lies wholly in granodiorite. It should, however, cross the contact into the lavas in the low ground immediately north of the shaft, about 40 feet southwest of the junction with No.3 vein. The northeasterly extension of No.1 vein lies in low ground, but test pits show that the rock in that part is a narrow tongue of lava of rather acidic type but not a quartz porphyry. It appears to be a trachyte.

No.1 vein is wider than No.3. At the test pit 130 feet southwest of the shaft it has a width of 3 feet. The quartz is similar to that in No.3 vein. There is some pyrite, but the content of gold is low; no sections of ore grade have been indicated by trenching and diamond-drilling.

. . . . . .

A few small faults have been found in the underground workings. One of the 625-foot level dips 45°N. Others have dips of 45 degrees or less. All are post-ore, but none offsets the vein more than a few inches. A considerable amount of water enters along these faults in the upper levels.

RAYNER-TYSON SYNDICATE [1935] (35)

Laird (1936, p.116) reports the following:

> In the fall of 1935 the Rayner-Tyson Syndicate was engaged in prospecting a group of 12 unsurveyed claims (T.B. 17,017 to 17,025 and 16,007 to 16,009) located north of Watson lake, Irwin township. On claim T.B. 17,025 a prospect pit has been sunk on a band of what appears to be a brecciated cherty iron formation. The band at this point is 5½ feet wide and exposed over a length of 60 feet. Both the fragments and matrix are heavily impregnated with very fine pyrite. No gold is reported. Further work has been done farther west along the north line of claim T.B. 17,021 on what may be the same or a similar band of rusty breccia.

Z. RENSHAW (5)

Mr. Z. Renshaw, in 1967, held a group of four leased claims; TB17318 and TB17319, TB17430 and TB17431, adjacent to Lake Nipigon, north of Poplar Point and the mouth of the Namewaminikan (Sturgeon) River.

The property was optioned in 1934 by Tom Johnson-Nipigon Mines Limited and in 1935 considerable work was done on claim TB17430, about four chains from the Lake Nipigon shoreline. Laird (1936, p.117) states that "...A quartz vein ranging from 4 to 12 inches (10-30 cm) in width has been exposed in a trench over a length of 340 feet (104 m), it strikes N70°E. The vein appears to follow a shear zone in greyish amygdaloidal lava and at one point intersects a 30-foot (10 m) granite dike. The quartz carries pyrite and specular hematite, but no gold is reported".

The files of the Mineral Resources Branch, Department of Energy, Mines, and Resources, Ottawa, show that additional work was done subsequent to Laird's visit to the property and gold values ranging from a trace of 0.90 oz. Au/ton over narrow widths were found. A total of 3,400 feet (1040 m) of diamond drilling was completed during 1935 but results were apparently disappointing and the option was dropped.

EDWARD SABOURIN (12)

In 1967, E. Sabourin held two claims: TB128671 and TB128672 in Sandra Township. These claims were located south of Pirum Lake on the southern boundary of the Witwer group. No information is on file for these claims.

SPRINGER STURGEON GOLD MINES LIMITED [1946] (38)

The main area of interest is located just south of Knox Lake and trends in a southwesterly direction. According to Laird (1936, p.112-113) this mineralized zone

> . . . has been explored in a series of 21 cross-trenches and rock cuts over a distance of more than a mile. The zone lies in the greenstone close to or at the contact with the conglomerate, in this respect resembling conditions on the Brookbank property a mile to the east. In places the showings consist of rusty shear zones ranging from a fraction of an inch to 20 feet or more in width and carrying quartz stringers. In other places the mineralization is associated mainly with narrow quartz lenses as much as 30 inches in width and 150 feet in length. The average strike of the break is N.80°E. The schist is commonly silicified and heavily pyritized but contains no gold. In places the quartz is mineralized with pyrite and galena, and calcite, and ankerite are common constituents of the vein matter. On the whole the gold content is low and the values erratic.

In 1946, four surveyed claims, TB13766 and TB13767, TB13769 and TB13770 covering the Knox Lake occurrence, belonged to Springer Sturgeon Gold Mines Limited. A report on file with the Ontario Division of Mines (Hough 1946) indicates that work on this claim in 1934 showed "average low values across narrow widths in quartz veins. 70% of the assays run from trace to .10 [oz. Au/ton] and most of the balance are less than .30 [oz. Au/ton] with a very few between .3 and .5 [oz. Au/ton]".

SUTHERLAND OCCURRENCE (39)

In 1960, two unsurveyed claims, TB84289 and TB84290 in Irwin Township, known as the W. Sutherland Group, were tested by 3 diamond drill holes having an aggregate length of 996.9 feet (304 m).

The area drilled consisted of north-dipping conglomerate and related sedimentary rocks which are overlain by chloritic mafic flows and minor gabbro. Chalcopyrite mineralization is confined to several silicified zones in the volcanic rocks, occurring as fine disseminations, blebs, and seams up to 4 inches (10 cm) thick. Pyrite, pyrrhotite, and magnetite accompany the copper mineralization. Analytical results for the drilling have not been recorded.

Two test pits with chalcopyrite and pyrite mineralization were found by the field party and are located about 1,000 feet (300 m) apart, just north of a narrow bay at the west end of Windigokan Lake.

TYSON PROPERTIES (6, 7, 13)

Introduction

In 1967, two adjoining groups of claims located in the southern part of Dorothea and Sandra Townships, east of Bish Bay, were held by A.E. Tyson and Mrs. V.W. Tyson. Together these properties form a block of 36 claims in which exploration for gold and molybdenum has been undertaken.

Mrs. V.W. Tyson held the westerly block comprising 20 claims, TB107787 and TB107788, TB107794 to TB107796, TB107994 to TB108004, TB108007 to TB108011, and A.E. Tyson held 16 claims forming the easterly block; TB107781 to TB107786, TB107789 to TB107793, TB107795, TB107797 and TB107798, TB108005, and TB19675.

History

The exploration history in the area of the block of claims is complex and dates back to 1935, when an exploration program was undertaken by Amorada Gold Mines Ltd. The following account is taken from Laird (1936, p.88):

> Amorada Gold Mines, Limited, was incorporated early in 1935 to develop two adjacent groups consisting of 20 unsurveyed claims and 4 surveyed claims, in Sandra and Dorothea townships, about a mile north of Sturgeon river and two miles east of Lake Nipigon. The west group, known as the Sellars group, was formerly held by Springer Sturgeon Gold Mines, Limited. The east group, known as the Brennan-Kenty group, was originally staked for the Brennan and Kenty Bros. Prospecting Company, Limited, later optioned by the Mid-Canada Exploration Company, Limited, and still later incorporated as Kenbro Sturgeon Gold Mines, Limited.

The work at this time consisted of trenching and sampling several gold-quartz veins and a molybdenite-bearing quartz vein.

In 1936, The Consolidated Mining and Smelting Company of Canada Limited sampled the No.3 (Molybdenite) Vein. This vein was again sampled in 1942 by the Department of Mines and Resources, Ottawa. According to their files, by 1940, a total of 1,737 feet (530 m) of diamond drilling had been completed and the No.3 Vein had been traced to a depth of 380 feet (115 m). A second molybdenite-bearing quartz vein of similar grade and width was cut by three holes 75 feet (23 m) to the south (Mineral Resources Branch Files, Dept. Energy, Mines, and Resources).

The lease on the four surveyed claims expired in June 1957, and in September of the same year, G. Elliot and N.V. Montgomery staked a group of 52 claims covering the former Amorada property. In November, Northwind Explorations Limited was formed to explore these claims. Nortoba Nickel Explorations Limited, however, acquired the property in June 1958. In August 1958, this company was renamed Nortoba Mines Limited.

During 1958 and 1959, Nortoba Mines Limited conducted geophysical surveys on the property which were followed by stripping, trenching, and diamond drilling. A new

ODM9000

Photo 25—Open cut and ore chute at the Tyson Property (1A Vein), Dorothea Township.

sulphide zone ranging from 50 to 70 feet (15-21 m) wide over a length of 400 feet (120 m) and containing copper and gold values was located ½ mile southwest of the No.1 Vein.

Plans were drawn up to mine the molybdenum-bearing vein by means of a decline, and in 1959 a mill with a capacity of 75 to 100 tons per day was purchased. Lack of funds however prevented the commencement of development work and the company disposed of its assets in 1960.

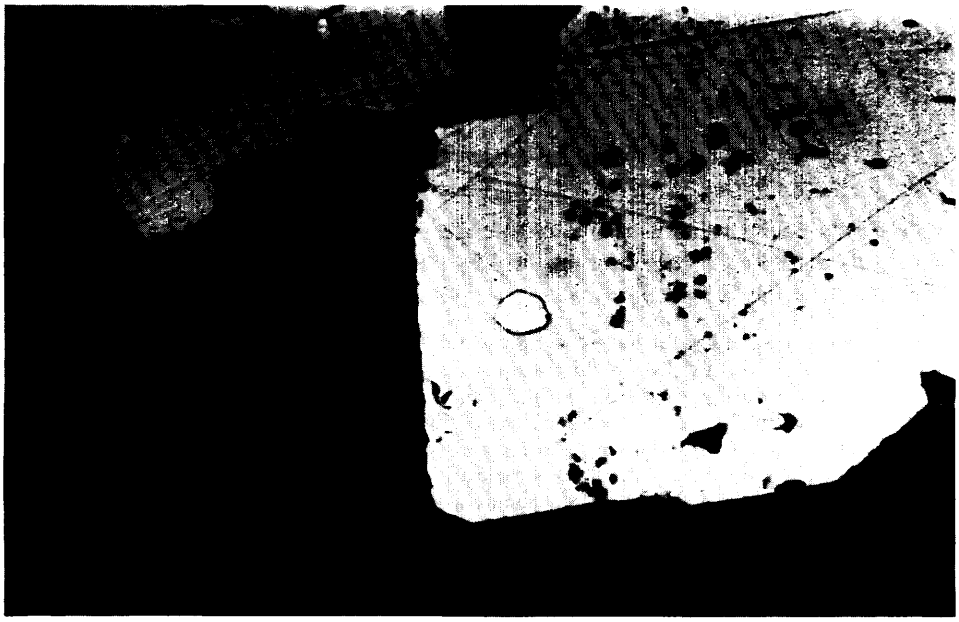
In January and February 1962, Mead Mining Corporation Limited completed 7 drill holes for a total length of 3,018 feet (920 m), south of the four mile post near the eastern boundary of Dorothea Township.

W.T. Woods and A.E. Tyson acquired the property in 1963 and undertook a bulk sampling program of two gold quartz veins. This was then optioned to Candore Explorations Limited in 1965.

Candore Explorations Limited undertook geological mapping, trenching, and stripping, and completed 17 diamond drill holes totalling 3,927 feet (1200 m), to further investigate the molybdenite deposit.

B.C. Lamble (1969) has reported that the molybdenite (No.3) vein deposit contains a total of 7,500 tons grading at least 1.5 percent MoS_2, calculated to a depth of 40 feet (12 m).

A total of 147.5 tons of material assaying over $35.00 a ton was taken from the No.1 and 1A gold quartz veins during the bulk sampling program in 1964. This material was trucked to the mills of Leitch Gold Mines Limited near Beardmore and MacLeod-Cockshutt Gold Mines Limited near Geraldton (Tyson 1967).



ODM9001

Photo 26–Photomicrograph of polished specimen showing gold bleb (centre) in pyrite. Dark material is quartz with minor inclusions. No.1A Vein, Tyson Property, Dorothea Township.

Geology

This claim group is underlain by strong to weakly foliated metavolcanics including amygdaloidal and porphyritic intermediate to mafic flows and intermediate to felsic tuffs, tuff-breccia and flows. The metavolcanics are intruded by a fine- to medium-grained, altered quartz diorite lens. Mineralized quartz veins cut all rock types.

The bulk of the work has been along, and on the flanks of, a prominent east-west ridge. The main gold quartz vein (1A Vein) is on the north side of the ridge.

Approximately 147 tons of vein material have been removed from an open cut. An ore chute and bin (Photo 25) and two buildings were on the property in 1967, and a road provides access to the immediate area.

The molybdenite-bearing quartz vein (No.3 Vein) can be reached by trails as shown on the accompanying geological map and is adjacent to and about 40 to 50 feet (12-15 m) above flat swampy ground to the south. In 1967, the field party was able to trace out test pits in the vein for a distance of more than 1,000 feet (300 m) along strike. The vein cuts metavolcanics which include an intermediate to felsic volcanic breccia with well-preserved angular fragments that was found in a clean exposure a few feet north of the vein.

Mineralization

GOLD QUARTZ VEINS

The gold quartz veins, as shown on the accompanying geological map, were worked on as early as 1935 and have been exposed by stripping, test-pitting, and crosstrenching. Descriptions of the individual veins are taken from Laird (1936, p.88-89):

> No. 1 vein has been traced along the north side of a high east-west ridge for about 1,200 feet, showing widths ranging from 7 to 31 inches. It strikes N.80°W. and dips vertically to steeply south. The vein appears to follow a fault along which a somewhat rusty shear zone has developed. The country rock is coarse- to fine-grained andesite. The vein pinches and swells and in places seems to be more or less scattered into a number of parallel stringers. Visible gold was observed here and there, but the results of channel assaying are said to indicate only erratic gold values. About 300 feet from the west end the vein is faulted south. At this point a parallel vein lying a few feet to the south has likewise been intersected by the same fault. This vein, known as No.1A, has been exposed for 60 feet west of the fault, has an average width of 15 inches, and is reported to have yielded channel assays ranging from 0.05 to 1.60 ounces gold per ton. A grab sample taken by the writer from a 10-foot pit yielded 3.18 ounces gold per ton. The quartz here is much brecciated and carries considerable galena and shattered pyrite cubes.

Approximately 145 tons was mined from the 1 and 1A Veins, the bulk taken from the 1A Vein by means of an open cut. Polished specimen studies of the 1A Vein indicated the gold to be associated with pyrite as shown in Photo 26.

The Mines Branch, Department of Energy, Mines and Resources, Ottawa, analyzed a 5-pound selected composite sample collected from the 1A Vein which gave assays of 11.99 oz. Au/ton and 3.52 oz. Ag/ton (Department of Energy, Mines and Resources files, Ottawa). A grab sample of fractured quartz with minor pyrite collected from the open cut by the field party was tested by the Mineral Research Branch, Ontario Division of Mines, and found to contain 1.62 oz. Au/ton and 0.38 oz. Ag/ton.

Laird (1936, p.89) describes two other veins:

> No. 2 vein has been traced about 1,600 feet. It is 475 feet south of No. 1 vein and parallel to it. In low ground toward the west end it consists of a rusty shear zone up to 40 inches in width and carrying numerous quartz stringers. Farther east the shear zone persists, but the quartz becomes more or less concentrated into a single vein with a maximum width of 13 inches. Visible gold occurs in several places along this vein, but no ore sections have been delimited. A grab sample of well-pyritized quartz from a pit near the west end yielded 2.32 ounces gold per ton.
>
> No. 7 vein is located about 250 feet south of No. 2 and just south of the winter road. It consists of an irregular network of quartz stringers in a strongly carbonatized shear zone, which strikes east and has a maximum width of 12 feet. The schist contains a little pyrite and negligible quantities of gold. The immediate country rock is altered andesite, but a parallel dike of quartz diorite occurs a few feet to the north.

MOLYBDENUM QUARTZ VEINS

The main molybdenite occurrence is in the No.3 Vein as shown on Map 2294 (back pocket). Many of the trenches and test pits were still clear of debris when visited by the field party in 1967.

The molybdenite occurs as large irregular patches in the quartz. In describing the No.3 Vein, Lamble (1957, p.6) states that "the maximum concentration of vein material appears to be about three feet [1 m], but in places the vein splits into a number of parallel veins extending over widths up to six feet [2 m]. The molybdenite occurs as thin films in the fractured quartz, and as massive concentrations up to about 15% of vein material".

Lamble (1958, p.8) further states, "About 100 pounds of mineralized quartz was blasted out of the westerly of those latter two pits [in the No.3 Vein] and from the material I selected a piece of quartz containing about between 10% and 15% mineral for assay purposes. The assay result was 7.40% molybdenum. The material from this pit is rather spectacular and obviously of too high a mineral content to be assayed in an over-all assessment of this vein's economic importance. Pieces of quartz weighing 15 pounds to 20 pounds carry solid molybdenite mineral up to 10 inches [25 cm] and more in length and 6 inches to 8 inches [15-20 cm] in width."

This vein has a strike of approximately N80E with close to vertical dip. Lamble (1959) has traced the vein some 1,500 feet (460 m) and found it to have an average width of 18 inches (46 cm). An *en echelon* structure appears to be present but Lamble (1957, p.6), who examined the deposit when trenching was being done, states that "The vein is broken into many short sections by a series of cross faults, but the horizontal displacements are in most cases only a few feet with the greatest of these about twenty-five feet [7.5 m]".

Laird (1936, p.90) states that "... the quartz carries a little pyrite and molybdenite, but the gold content is negligible...."

The vein was tested by diamond drilling to a depth of 385 feet (117 m) (Department of Energy, Mines and Resources files, Ottawa). It should be pointed out that molybdenite mineralization is not restricted solely to quartz veins as is revealed by Lamble's (1959) description of drill hole E-101. Lamble stated that this drill hole ". . . intersected 1.3 feet [0.4 m] of fine grained altered diorite containing approximately 2% molybdenite by visual inspection".

WITWER OPTIONS (11, 14)

H.M. Holm and J. Zmudzinski Properties

History

According to a report by Oja (1967), Mr. S. Witwer acquired a group of unsurveyed claims in the Pirum-Musca Lakes area, Sandra and Meader Townships, during the summers of 1965 and 1966. A total of 22 claims were optioned from Mr. Jan Zmudzinski and 7 from Mrs. H.M. Holm. The deposits described under this section have since been acquired by Mrs. H.M. Holm.

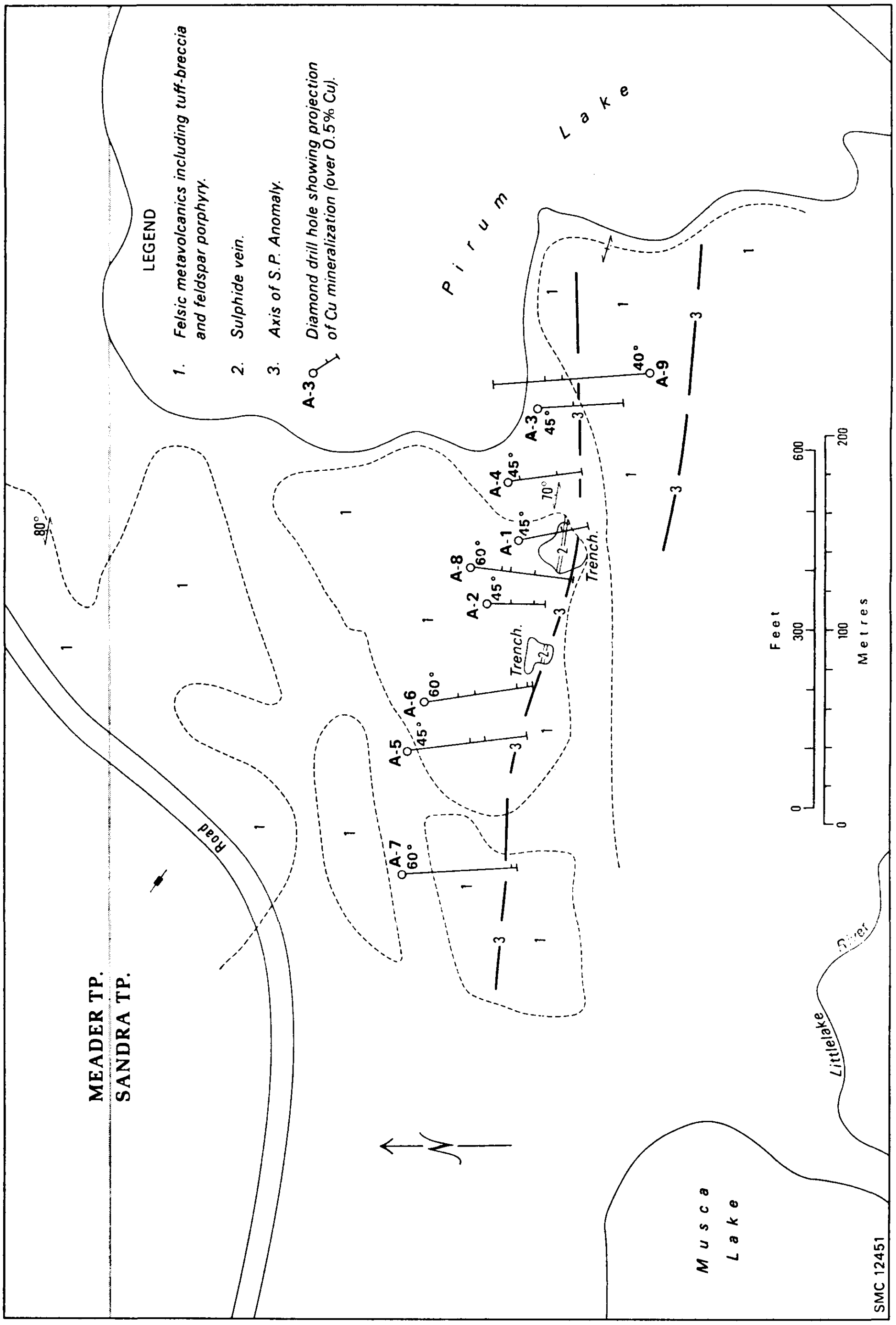


Figure 5–Diamond drill plan of the A Zone, Witwer Option. After Oja (1967).

Previous work in this area dates back to 1935 (Laird 1936, p.91) when trenching and test pitting was done by Brennan and Kenty Bros. Prospecting Company Limited along the boundary between Sandra and Meader Townships north of the west end of Musca Lake. Jan Zmudzinski completed a self-potential survey of 5 claims located north of Pirum Lake in August 1963.

Oja (1967) reports that the Witwer Project was originated following the discovery of copper-gold mineralization on the Zmudzinski claims. Geological examination of the area in 1965 was followed by electromagnetic and self-potential surveys. A total of 3,449 feet (1051 m) of diamond drilling was then completed.

Geology and Mineral Deposits

Rocks in the Pirum-Musca Lakes area are intermediate to felsic volcanic pyroclastics and flows that form part of a belt lying north of the Paint Lake Fault and extending east several miles from Lake Nipigon. The pyroclastic rocks consist of tuff, tuff-breccia, and pyroclastic breccia. Commonly the fragmental nature of these rocks can only be seen on clean, smooth weathered surfaces. Many of the flow rocks are porphyritic. A chemical analysis of feldspar porphyry from the A zone is shown in Table 2.

The property under the Witwer option is comprised of four separate zones as shown on the accompanying map. Of these, only the A and C Zones are in Sandra Township. The other two are on, and just north of, the boundary between Sandra and Meader Townships.

A ZONE

The A Zone is situated on the west shore of Pirum Lake as shown on Figure 5. Sulphide mineralization has been well exposed by two trenches. Examination of the easterly trench by the field party found a vein to consist of chalcopyrite and pyrite with minor amounts of subrounded quartz fragments. Minor amounts of chloritic material and carbonate are also present. The vein varies between 3 and 4 inches (8-10 cm) wide and is exposed over a distance of about 50 feet (15 m). Strike of the vein was found to be N80W with a dip of 70 degrees north.

A channel sample, taken across the vein at a width of 4 inches (10 cm) was collected by the field party from a face in the east trench and was found on analysis by the Mineral Research Branch, Ontario Division of Mines, to contain 16.8 percent Cu, 0.09 oz. Au/ton, 3.55 oz. Ag/ton, and traces of Co, Pb, Mo, Ni, and Zn. No pyrrhotite was found by the field party although its presence is indicated in the diamond drill logs. Inclusions of sphalerite were found within chalcopyrite blebs as shown in Photo 27.

Drilling of the A Zone consisted of 9 holes (Figure 5) over a strike length of 800 feet (240 m) for a total of 2,377 feet (725 m). Copper mineralization along with minor amounts of gold and silver were intersected in all 9 holes. Oja's (1967, p.13) interpretation is that the drilling has extended mineralization of the main A Zone showing for at least 600 feet (180 m). Values range from 0.99 percent Cu, 0.005 oz. Au/ton, 0.09 oz. Ag/ton over 0.5 feet (0.2 m) in drill hole A-6, to 4.70 percent Cu, 0.06 oz. Au/ton, 0.09 oz. Ag/ton over 2.3 feet (0.7 m) in drill hole A-9. (Oja 1967). No drilling has been done to test the possible eastward extension of the A Zone into Pirum Lake.

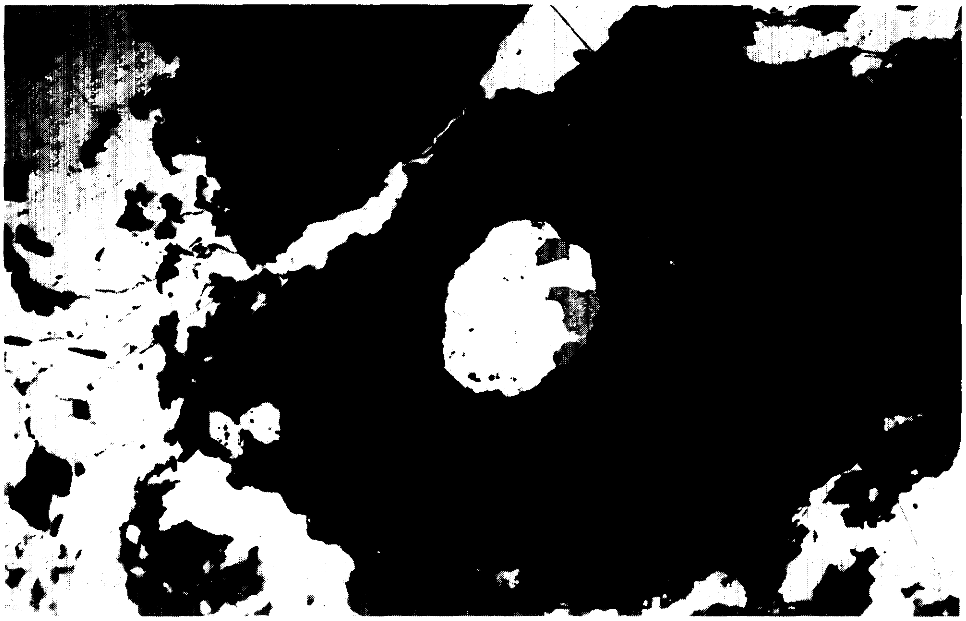


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Photo 27–Photomicrograph of polished specimen from sulphide vein in the A Zone, Witwer Option, Sandra Township. Rounded bleb of chalcopyrite (light) in quartz-carbonate gangue (dark) has inclusions of sphalerite (medium grey).

B ZONE

The B Zone is located about 600 feet (180 m) north of Pirum Lake and is underlain by intermediate to felsic metavolcanics.

Oja (1967, p.5-6) states that there are several trenches and a 6-inch (15 cm) chalcopyrite vein has been traced for about 300 feet (90 m), paralleling the axis of a self-potential anomaly. He reports an assay of 18.82 percent Cu, 0.10 oz. Au/ton, and 6.80 oz. Ag/ton for a selected grab sample. Three drill holes totalling 723 feet (221 m) were put down to test the B Zone. Two of the drill holes intersected sulphide mineralization similar to that on surface. The best mineralization located by drilling was 2 feet (0.6 m) of 2.32 percent Cu, 0.47 oz. Au/ton and 1.13 oz. Ag/ton.

C ZONE

One diamond drill hole was put down at the west end of Musca Lake to test an electromagnetic conductor that extends along the centre of the lake for a surveyed distance of 5,000 feet (1500 m). According to Oja (1967, p.7) an 8-inch wide zone of finely ground and pulverized rock was intersected by the drill hole. The conductor is thus interpreted as being related to the Musca Lake Fault.

D ZONE

The D Zone is a discontinuous shear zone with pyrite, chalcopyrite, and patches of azurite and malachite, located on or just north of the township line near the west end of Musca Lake. Work here was originally done by the Brennan and Kenty Bros. Prospecting Company Limited in 1935 (Laird 1936, p.91-92).

The mineralized shear zone in fractured and massive porphyritic lava has been traced for over 1,000 feet (300 m) and coincides with a self-potential anomaly. According to Oja (1967, p.9) the drill holes to test this shear zone were short and not well located. No encouraging results were intersected.

A chip sample collected by the field party across a width of 6 feet (1.8 m) in one of the central trenches was tested by the Mineral Research Branch, Ontario Division of Mines, and found to contain 0.33 percent Cu, 0.06 oz. Au/ton, and a trace of silver. A grab sample collected by the field party from the rubble in the old Brennan and Kenty workings contained 2.53 percent Cu, 0.26 oz. Au/ton, and 0.64 oz. Ag/ton.

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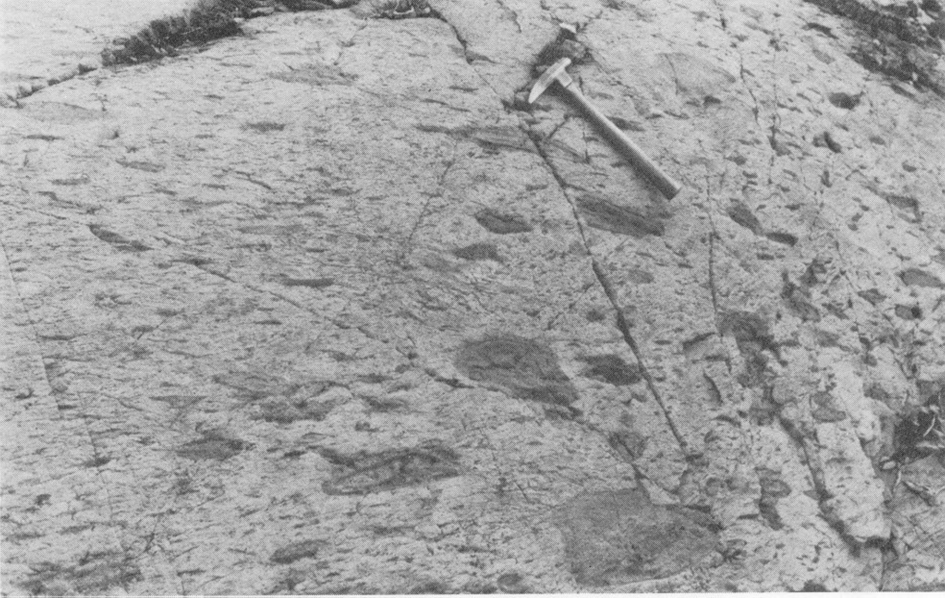
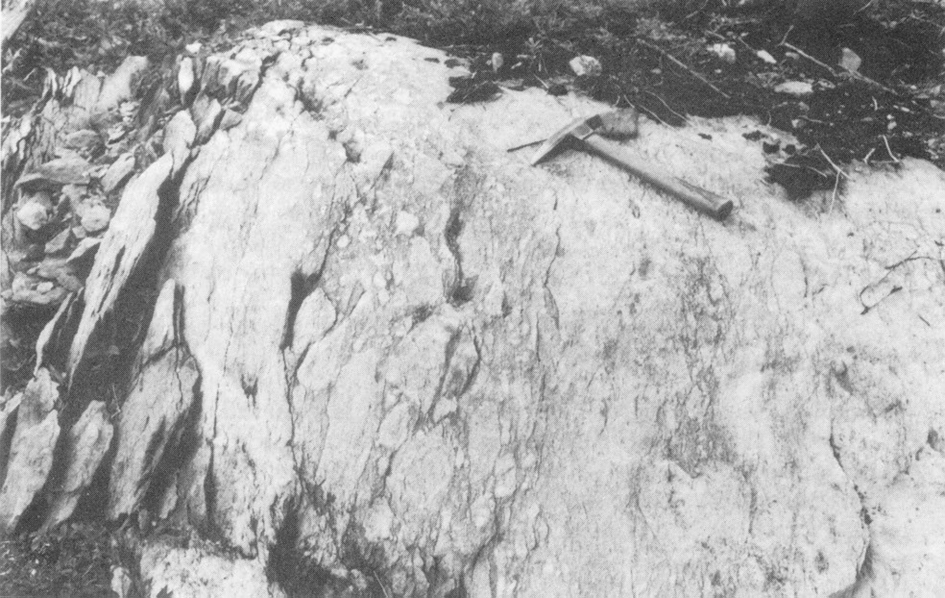
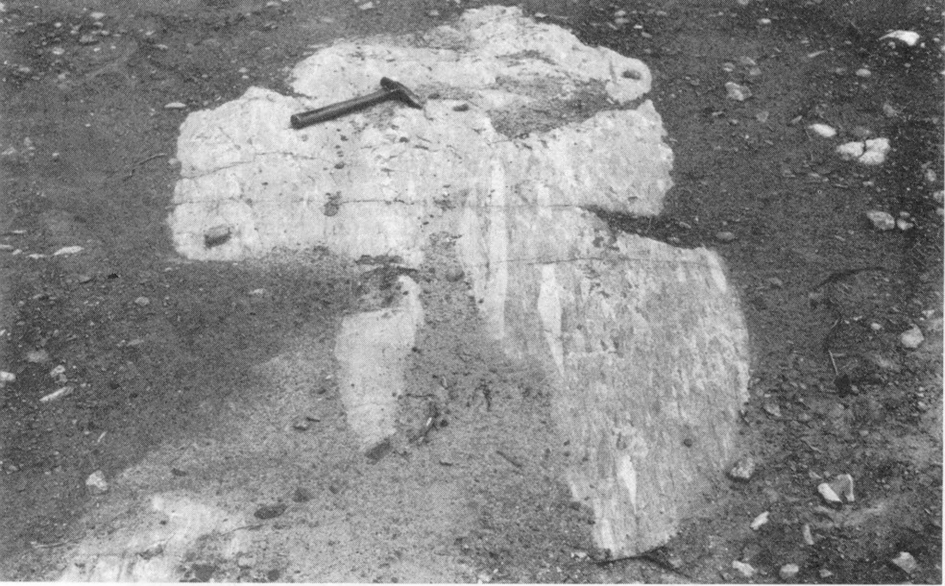
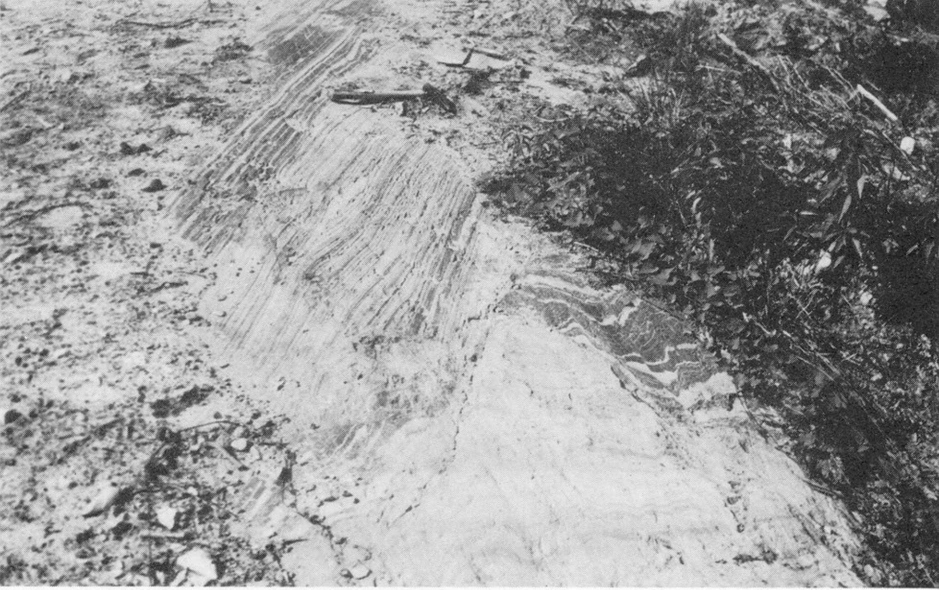
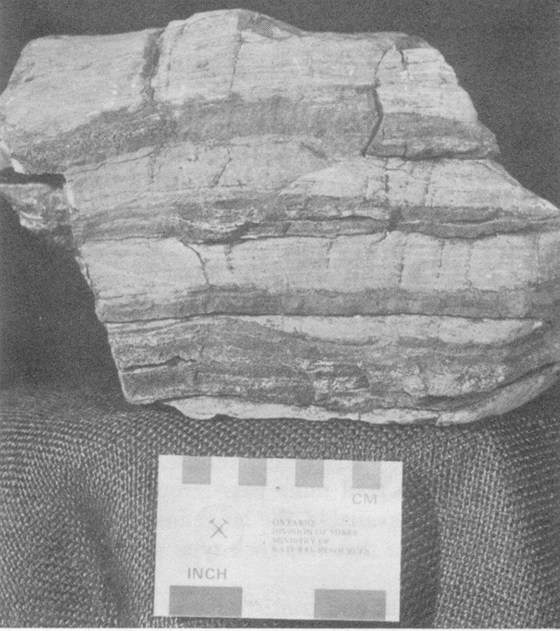
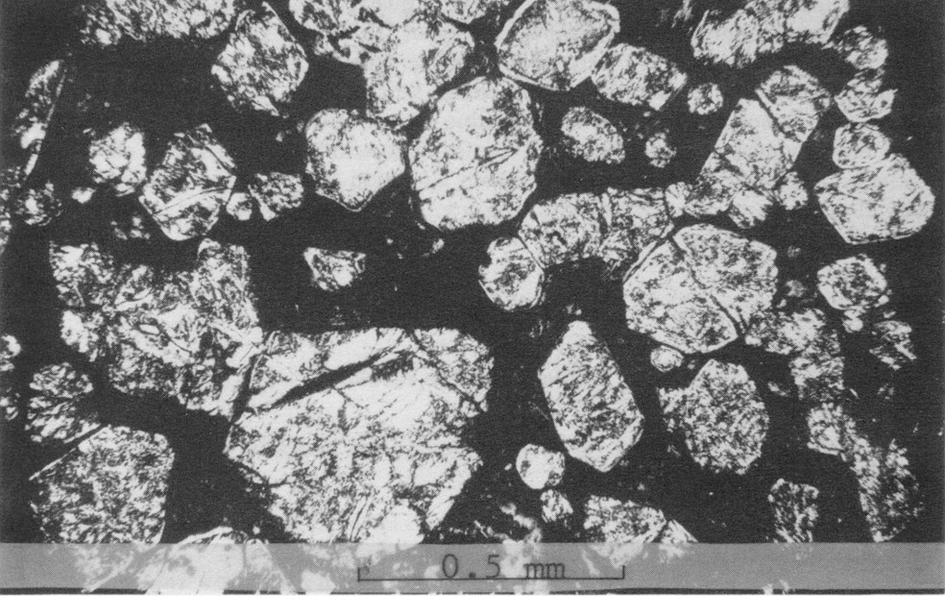









CM
INCH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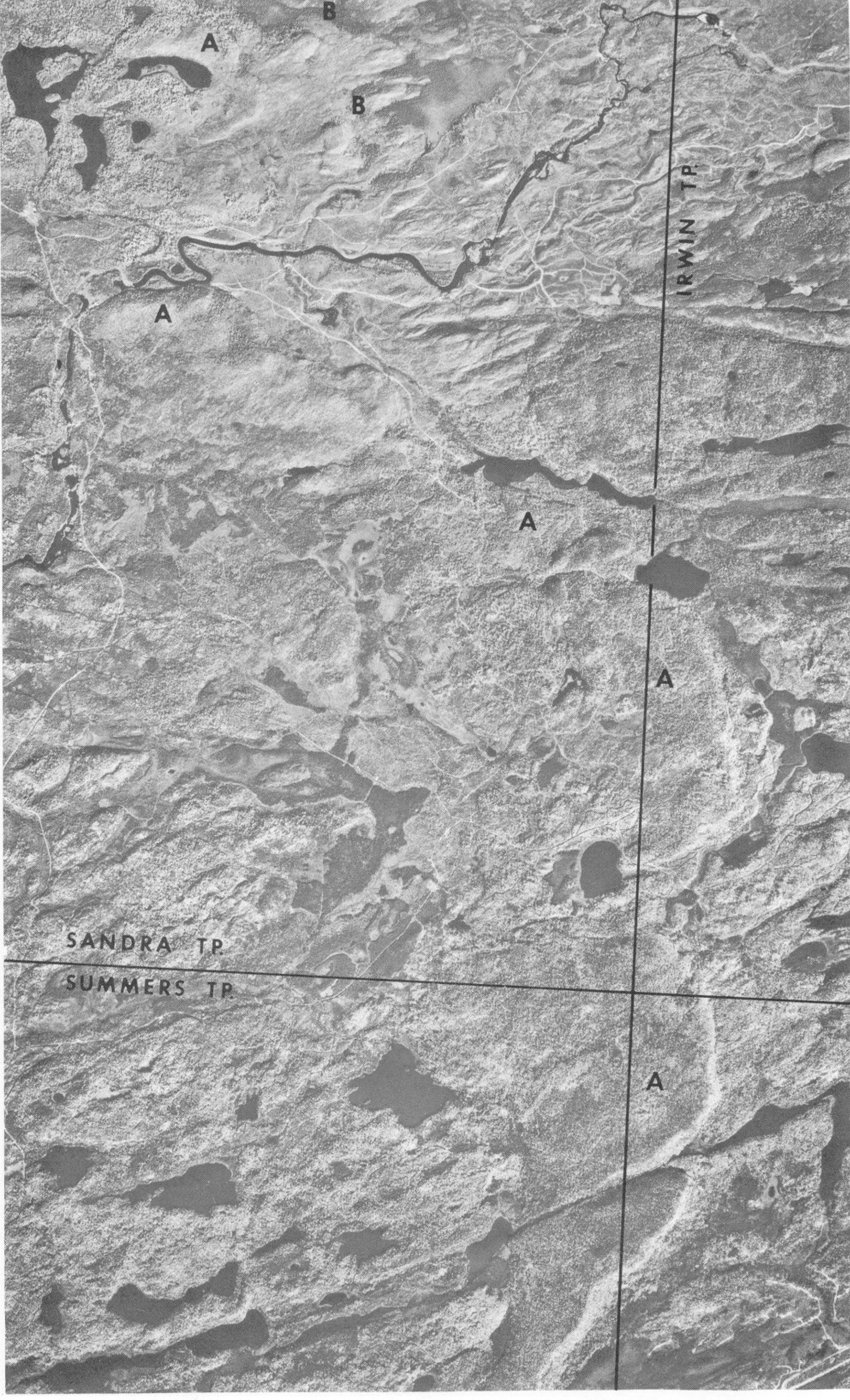
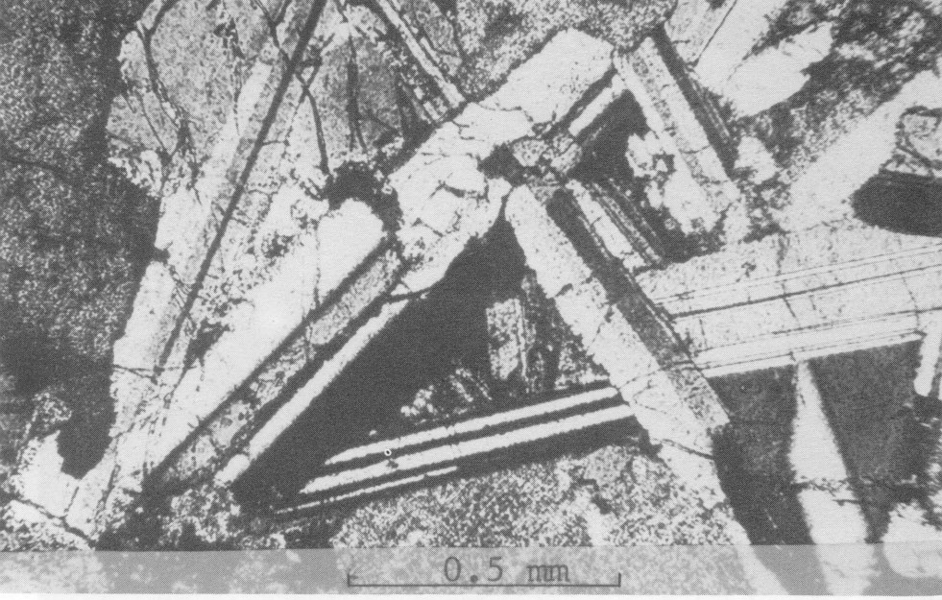

B
A
B
IRWIN TP.
A
A
A
SANDRA TP.
SUMMERS TP.
A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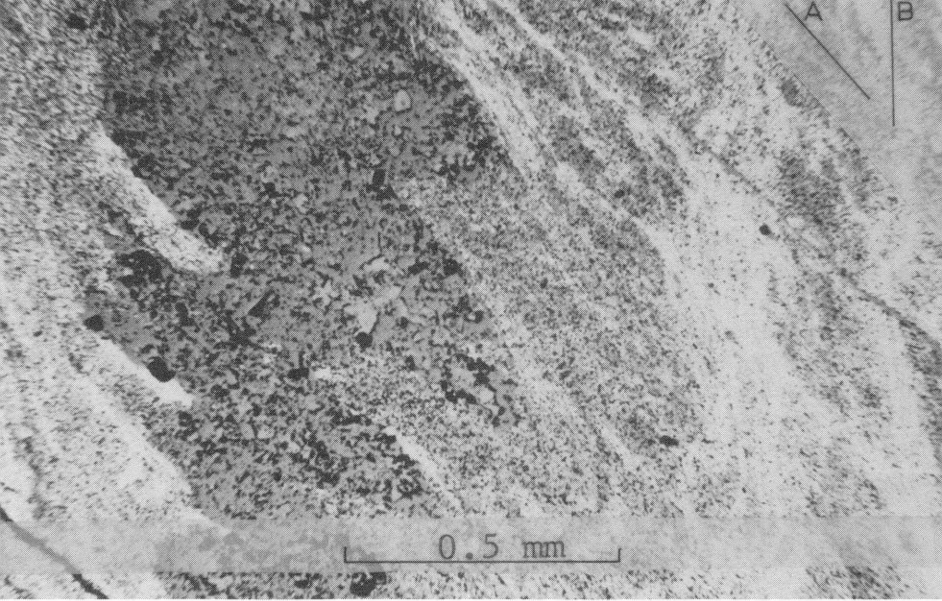
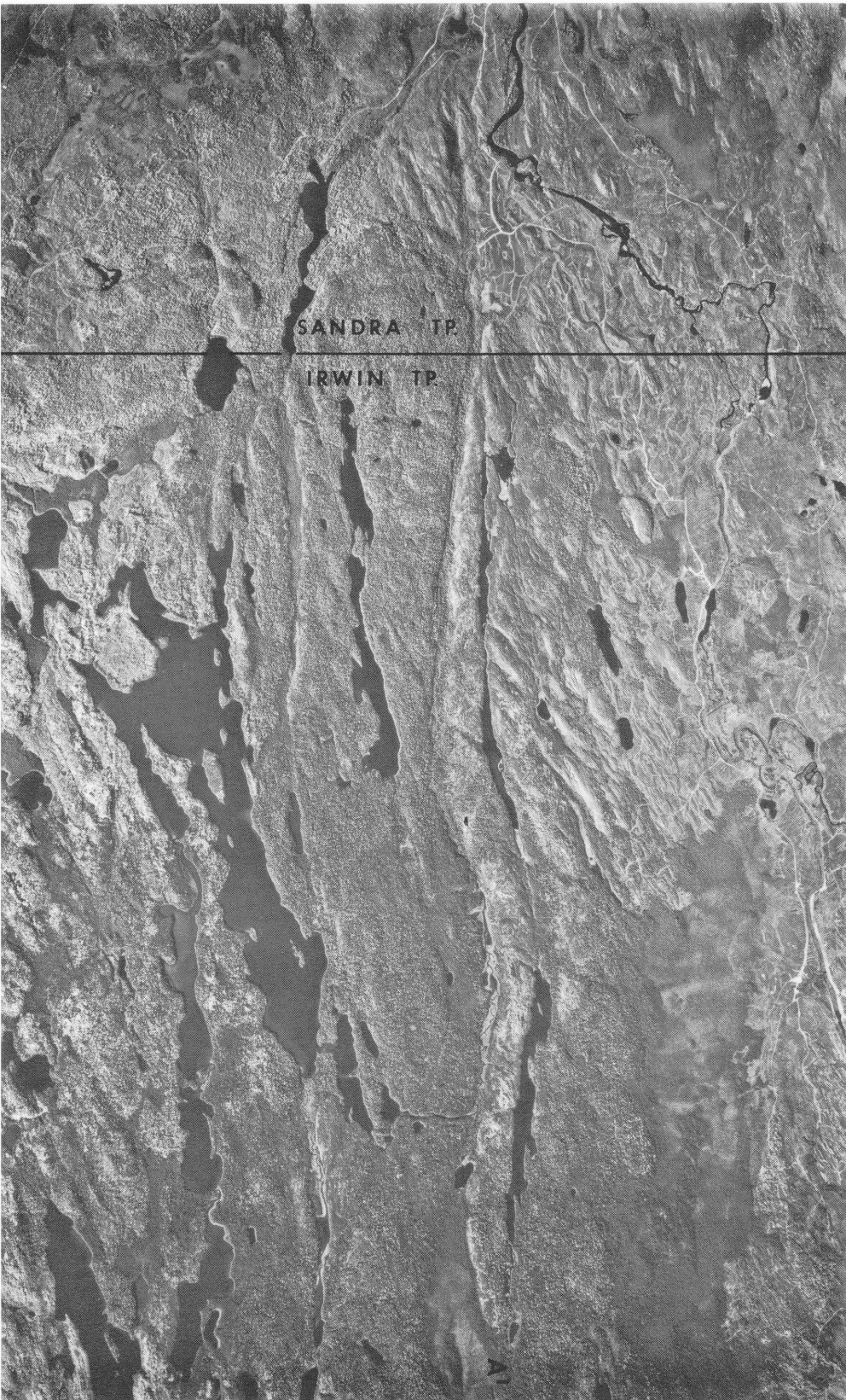
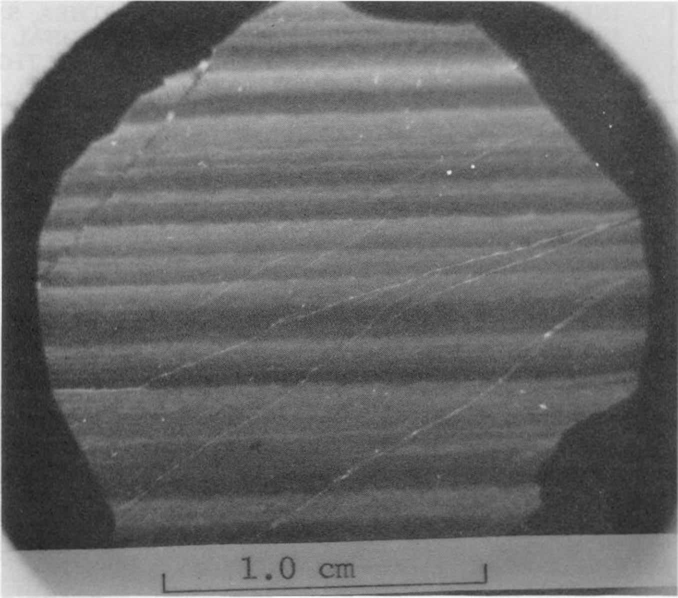
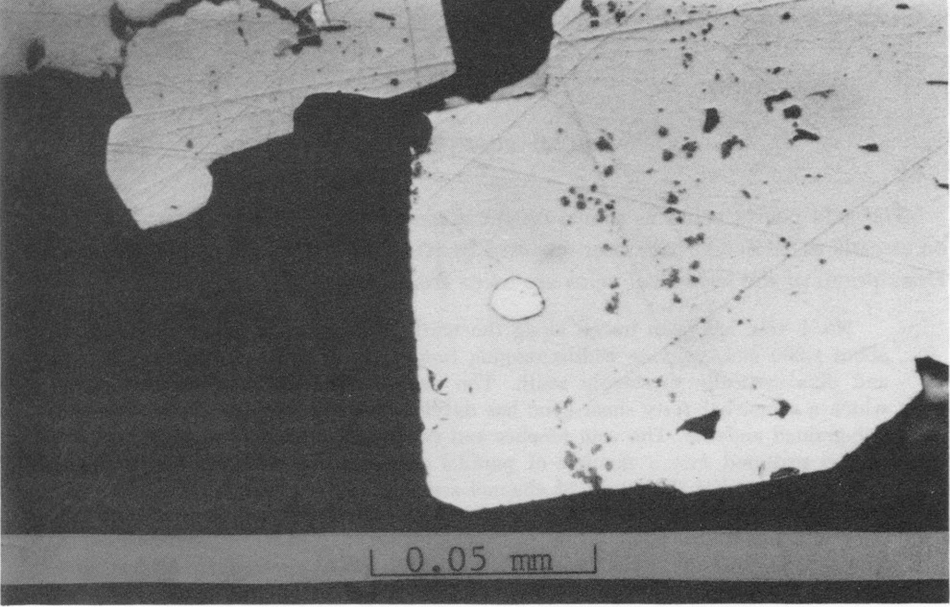
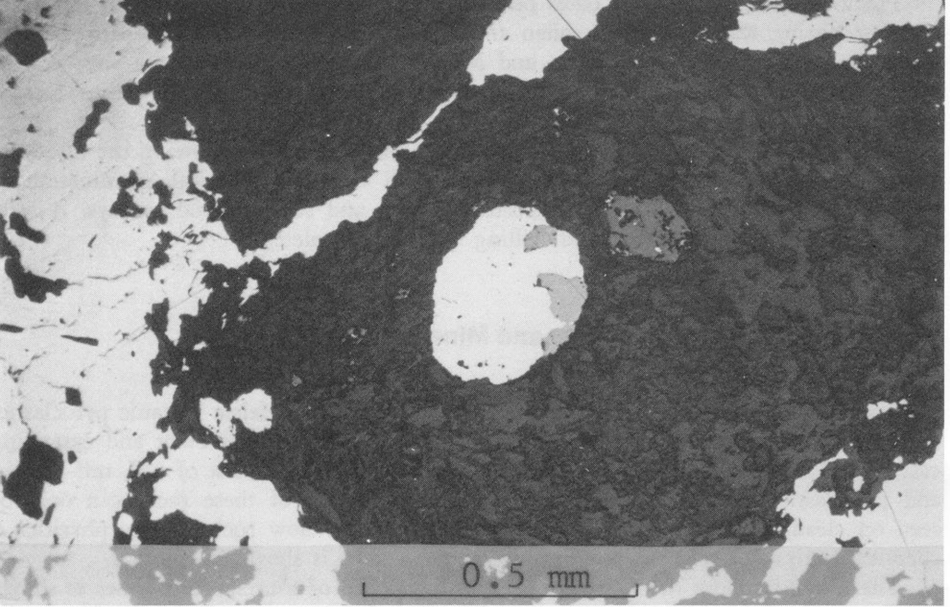


A
B
0.5 mm


SANDRA TP.
IRWIN TP.
A'


1.0 cm


0.05 mm


0.5 mm

ONTARIO
DIVISION OF MINES
HONOURABLE LEO BERNIER, *Minister of Natural Resources*
W. Q. MACNEE, *Deputy Minister of Natural Resources*
G. A. Jewett, *Executive Director, Division of Mines* E. G. Pye, *Director, Geological Branch*

Map 2294
Dorothea, Sandra and Irwin Townships

SYMBOLS

- *Glacial striae.*
- *Esker.*
- *Small bedrock outcrop.*
- *Area of bedrock outcrop.*
- *Bedding, top unknown; (inclined, vertical).*
- *Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).*
- *Bedding, top (arrow) from crossbedding; (inclined, vertical, overturned).*
- *Lava flow; top (arrow) from pillows shape and packing.*
- *Schistosity; (horizontal, inclined, vertical).*
- *Foliation; (horizontal, inclined, vertical).*
- *Lineation with plunge.*
- *Geological boundary, observed.*
- *Geological boundary, position interpreted.*
- *Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.*
- *Jointing; (horizontal, inclined, vertical).*
- *Drag folds with plunge.*
- *Anticline, syncline, with plunge.*
- *Drill hole; (vertical, inclined).*
- *Drill hole; (projected vertically, projected up dip).*
- *Vein.*
- *Swamp.*
- *Motor road. Provincial highway number encircled where applicable.*
- *Other road.*
- *Trail, portage, winter road.*
- *Building.*
- *Township boundary, base or meridian line, with mileposts, approximate position only.*
- *Property boundary, approximate position only.*
- *Survey line, approximate position only.*
- 5 (4) *Location of mining property; (Surveyed, unsurveyed). See list of properties.*

PROPERTIES, MINERAL DEPOSITS

DOROTHEA TOWNSHIP

1. *Craig, C. L.*
2. *Hopkins, A. P. E.*
3. *Kimberley Copper Mines Ltd. [1958]*
4. *Northwind Explorations Ltd. [1957]*
5. *Renshaw Z.*
6. *Tyson, A. E.*
7. *Tyson, V. W.*

SANDRA TOWNSHIP

8. *Bonwitha Mining Co., Ltd. [1960]*
9. *Craig, C. L.*
10. *Cyril Knight Prospecting Co., Ltd. [1935]*
11. *Holm, H. M. (Witwer Option)*
12. *Sabourin, E.*
13. *Tyson, A. E.*
14. *Zmudzinski. J. (Witwer Option)*

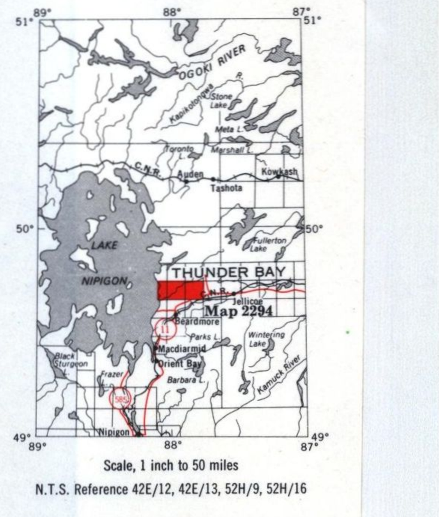
IRWIN TOWNSHIP

15. *Algoma Steel Corporation Ltd., The.*
16. *Boldue, G. P. (Algoma Steel Option)*
17. *Bonwitha Mining Co., Ltd. [1960]*
18. *Brenbar Mines Ltd.*
19. *Brookbank-Sturgeon Mines Ltd.*
20. *Candela occurrence.*
21. *Canorama Explorations Ltd. [1961]*
22. *Central Manitoba Mines Ltd. [1957]*
23. *Cherbourg Gold Mines Ltd.*
24. *Cowan, S.*
25. *Karl Springer Exploration Co. Ltd. [1935]*
26. *Knight occurrence.*
27. *Dajaty Mines Ltd. [1947]*
28. *Fortier, C.*
29. *Hopkins, A. P. E.*
30. *Lak-Teck Gold Mines Ltd. [1935]*
31. *Minerals Development Ltd. [1935]*
32. *Nordic Sturgeon Gold Mines Ltd. [1935]*
33. *Ontario-Quebec Prospectors (Trust). [1935]*
34. *Quebec Sturgeon River Mines Ltd.*
35. *Rayner-Tyson Syndicate. [1935]*
36. *Rentz, E. (Algoma Steel Option)*
37. *Rentz, E. B. (Algoma Steel Option)*
38. *Springer Sturgeon Gold Mines Ltd. [1946]*
39. *Sutherland occurrence.*

Information current to December 31st, 1967. Only current and defunct properties for which geological or related information is available are listed and located on the map-face, a date in square brackets indicates last year of unencouraging exploration activity. For further information see report.

The designating letters "TB" have been omitted on this map from the numbers marking the mining claims recorded at the office of the Thunder Bay Mining Division.

Published 1974



Scale, 1 inch to 50 miles
N.T.S. Reference 42E/12, 42E/13, 52H/9, 52H/16

LEGEND

CENOZOIC[a]

QUATERNARY
RECENT
Lake, stream, and swamp deposits.

PLEISTOCENE
Sand, gravel, clay.

UNCONFORMITY

PRECAMBRIAN[b]

LATE PRECAMBRIAN (PROTEROZOIC)

MAFIC INTRUSIVE ROCKS

7 *Diabase.*

INTRUSIVE CONTACT

6 *Porphyritic diabase.*

INTRUSIVE CONTACT

EARLY PRECAMBRIAN (ARCHEAN)

MAFIC INTRUSIVE ROCKS

5 *Unsubdivided.*
5a *Diorite, quartz diorite.*
5b *Gabbro.*
5c *Mafic dikes.*

INTERMEDIATE TO FELSIC INTRUSIVE ROCKS

4a *Granodiorite, quartz diorite.*
4b *Quartz-feldspar porphyry.*
4c *Feldspar porphyry.*

INTRUSIVE CONTACT

METAVOLCANIC AND METASEDIMENTARY ROCKS[c]

MAFIC METAVOLCANICS

3 *Unsubdivided.*
3a *Amygdaloidal lava.*
3b *Pillow lava.*
3c *Volcanic breccia.*
3d *Tuff and tuffaceous schists.*

INTERMEDIATE TO FELSIC METAVOLCANICS

2 *Unsubdivided.*
2a *Tuff-breccia, pyroclastic breccia, and derived schists.*
2b *Massive and laminated lavas and tuffs associated with 2a.*
2c *Quartz-feldspar porphyry.*
2d *Feldspar porphyry.*

METASEDIMENTS

1a *Polymictic conglomerate.*
1b *Feldspathic sandstone.*
1c *Quartzose and feldspathic sandstone, siltstone.*
1d *Greywacke.*
1e *Fissile stiltstone, argillite, and slate.*
1g *Limestone.*

IF *Iron formation.*

Ag	*Silver*	**Pd**	*Palladium*
asb	*Asbestos*	**q**	*Quartz*
Au	*Gold*	**S**	*Sulphide mineralization*
Cu	*Copper*	**spec**	*Specularite*
mo	*Molybdenite*		

[a] *Unconsolidated deposits. Cenozoic deposits are represented by the lighter coloured 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.*

[c] *Rocks in these groups are subdivided lithologically and the order does not imply age relationships within or among groups.*

The letter "G" preceding a rock unit code, for example "GIF" indicates interpretation from geophysical data in drift-covered areas.

Map 2294
DOROTHEA, SANDRA AND IRWIN TOWNSHIPS
THUNDER BAY 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

SOURCES OF INFORMATION

Geology by W. O. Mackasey and assistants, Geological Branch, 1967.
Geology is not tied to surveyed lines.

Aeromagnetic maps 2128G, 2129G, 2135G, 2136G, O.D.M.-G.S.C.

Laird, H. C.: The western part of the Sturgeon River area, Vol. 45, pt. 2, p. 60-117, Ontario Department of Mines, 1936.

Ministry of Natural Resources:
Map 45a, Sturgeon River Gold Area, scale 1 inch to 1 mile, 1936.
Map 2102, Tashota-Geraldon Sheet, scale 1 inch to 4 miles, 1966.

Preliminary maps P.479, Dorothea Township; P.480, Sandra Township; P.481, Irwin Township, scale 1 inch to ¼ mile, 1968.

Cartography by M.G. Sefton and assistants, Surveys and Mapping Branch, 1973.

Base map derived from maps of the Forest Resources Inventory, Surveys and Mapping Branch, with additional information by W. O. Mackasey.

Magnetic declination in the area was approximately 2° West, 1967.