Ontario Geological Survey

Report 182

Geology of

Conant, Jutten, and Smye Townships (Savant Lake Area)

District of Thunder Bay

By

W.D. Bond

1979

Ontario

Ministry of Natural Resources

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Queen's Park, Toronto, Ontario
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Orders for publications should be accompanied by cheque,
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ISSN 0704-2582
ISBN 0-7743-3623-4

Bond, W.D.
1979: Geology of Conant, Jutten, and Smye Townships (Savant Lake Area), District of Thunder Bay; Ontario Geological Survey Report 182, 113p. Acompanied by Map 2398, scale 1:31 680 or 1 inch to ½ mile.

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(back pocket)

MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

All the measurements in this report are given in the units used in the source materials or in the original measuring. If the reader wishes to convert Imperial Units to Metric or SI Units or SI Units to Imperial Units the following multipliers should be used:

Unit	*Multiplied by*	*Gives*	*Unit*	*Multiplied by*	*Gives*
		LENGTH			
1 mm	0.039	inches	1 inch	25.4	mm
1 cm	0.394	inches	1 inch	2.54	cm
1 m	3.281	feet	1 foot	0.3048	m
1 km	0.621	miles (statute)	1 mile (statute)	1.609	km
		AREA			
1 cm^2	0.155	square inches	1 square inch	6.452	cm^2
1 m^2	10.764	square feet	1 square foot	0.093	m^2
1 km^2	0.386	square miles	1 square mile	2.590	km^2
1 m^2	0.000247	acres	1 acre	4046.686	m^2
1 h	2.471	acres	1 acre	0.405	h
		VOLUME			
1 cm^3	0.061	cubic inches	1 cubic inch	16.387	cm^3
1 m^3	35.315	cubic feet	1 cubic foot	0.028	m^3
		CAPACITY			
1 l	1.760	pints	1 pint	0.568	l
1 l	0.880	quarts	1 quart	1.137	l
1 l	0.220	gallons	1 gallon	4.546	l
		MASS			
1 g	0.035	ounces (avdp)	1 ounce (avdp)	28.350	g
1 g	0.032	ounces (troy)	1 ounce (troy)	31.103	g
1 kg	2.205	pounds (avdp)	1 pound (avdp)	0.454	kg
1 kg	0.0011	tons (short)	1 ton (short)	907.185	kg
1 t	1.102	tons (short)	1 ton (short)	0.907	t
1 kg	0.000984	tons (long)	1 ton (long)	1016.047	kg
1 t	0.984	tons (long)	1 ton (long)	1.016	t
		CONCENTRATION			
1 gm/t	0.029	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.292	gm/t
1 gm/t	0.583	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.715	gm/t
1 ounce (troy)/ ton (short)	20.0	pennyweights/ ton (short)	1 pennyweight/ ton (short)	0.05	ounce (troy)/ ton (short)

Suggestion: Although the above conversion factors are given to several decimal places for your convenience, do not attempt to convert an approximate measurement to a precise measurement. For example, "about 1000 feet" should be converted to "about 300 m" rather than "304.8 m".

ABSTRACT

Conant, Jutten, and Smye Townships are situated in the Savant Lake area approximately 230 km (145 miles) north-northwest of Thunder Bay. The three townships form part of the Wabigoon Belt, a part of the Superior Province in the Precambrian Shield. All the bedrock in the map-area is Early Precambrian (Archean) in age. The map-area is underlain by two different metavolcanic sequences and associated metasediments; these rocks have been intruded by mafic to felsic plutons of various ages.

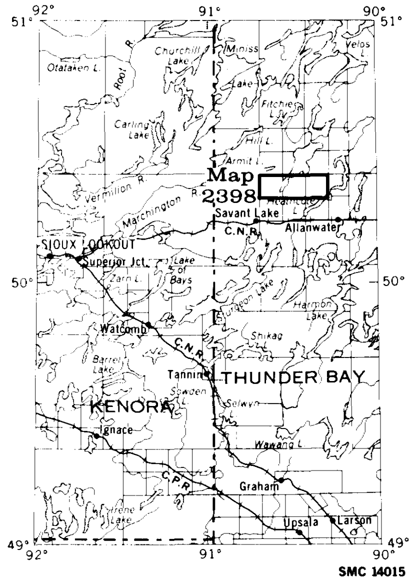

Figure 1–Key map showing locations of Conant, Jutten, and Smye Townships. Scale 1:3 168 000.

The first sequence is located east of the South Arm of Savant Lake and comprises a thick, uniform, succession of pillowed and massive predominantly mafic metavolcanics, and is typical of a lower volcanic cycle in the standard Archean volcanic sequence. These mafic volcanic rocks accumulated in a fairly quiet, subaqueous, environment. The second sequence lies west of the South Arm of Savant Lake, and is a thick predominantly metavolcanic succession marked by sharply contrasting, interlayered, and interfingering felsic, intermediate, and mafic volcanic rocks. Most of the felsic to intermediate metavolcanics are pyroclastic rocks.

Several thin units of clastic and ferruginous metasediments mark minor quiescent periods within this more complex metavolcanic succession. The metavolcanics are folded, and stratigraphic top determinations indicate that these two contrasting sequences have opposing facing directions across a fault extending along the South Arm of Savant Lake. Owing to their opposing facing directions, it is not known if these two (lower and upper) volcanic sequences are genetically related.

Metaconglomerate, exposed along the eastern shore of the South Arm of Savant Lake, was unconformably deposited on top of the lower mafic metavolcanic sequence, and was succeeded conformably by arenaceous and ferruginous metasediments. Metasediments, underlying the northern part of

Jutten Township, were derived in part from the complex felsic to mafic metavolcanic sequence lying to the south. Ferruginous metasediments were deposited with the arenaceous metasediments.

Felsic to intermediate quartz and/or feldspar porphyritic intrusive rocks are spatially associated with highly metamorphosed felsic plutonic rocks, and these rocks are intruded into the felsic to mafic metavolcanic sequence. A small stock ranging in composition from gabbro to diorite intruded the same felsic to mafic metavolcanic sequence in Conant Township. Several gabbro sills also intruded the metasedimentary sequence in northeastern Conant Township. Granitic rocks ranging in composition from trondhjemite to granodiorite and to quartz monzonite were intruded into, and form a large batholith to the southeast of the South Arm of Savant Lake. Several younger, more potassic-rich, leucocratic granitic stocks were subsequently intruded along structurally weak, contact zones between major lithologic units.

The lower volcanic sequence east of the South Arm of Savant Lake forms a continuous sequence that faces northwest. The upper volcanic sequence west of the South Arm of Savant Lake has been complexly folded about a northeasterly-trending vertical fold axis, and forms an anticlinal structure. Longitudinal faulting between the two sequences along the South Arm of Savant Lake is probably coincident with, and is a result of, this folding event. Several minor transverse faults that are probably younger than the longitudinal faulting, displace the fold structure and may be a result of the emplacement of a granite batholith nearby. The regional metamorphic event appears to have outlasted, or to postdate the folding and the coincident, longitudinal, faulting.

Within the map-area, gold has been the most important economic mineral since prospecting began in the area at about the turn of the century. The gold is invariably associated with quartz veins and silicified zones in the sheared mafic metavolcanic sequence east of the South Arm of Savant Lake. Copper-, lead-, and zinc-bearing sulphide minerals, as well as silver are commonly associated with the quartz veins, but the discontinuous nature and low quality of most of these mineralized zones have prevented any mineral production in the map-area to date. These deposits are found mostly in mafic metavolcanics; they appear to be epigenetic intrusives into their volcanic host rocks. Iron associated with chert-magnetite iron formation mainly occurs in the northwestern part of Conant Township, and could be of recoverable grade.

Geology of

Conant, Jutten, and Smye Townships (Savant Lake Area)

by

W.D. Bond[1]

INTRODUCTION

Conant, Jutten, and Smye Townships are situated approximately 232 km (145 miles) north-northwest of Thunder Bay and are bounded by Latitudes 50°24′40″N and 50°19′30″N and by Longitudes 90°17′05″W and 90°41′33″W. These townships cover an area of approximately 280 km^2 (108 square miles). The three contiguous townships lie in an east-west direction, across the South Arm of Savant Lake in the District of Thunder Bay. The present survey was carried out during the field season of 1972.

Savant Lake forms part of a navigation route linking the southern part of northwestern Ontario to the Albany River which drains eastward into James Bay. The route was used extensively by the early explorers and fur traders, and is still travelled by vacationing campers. Intermittent prospecting has been going on in the map-area throughout the mining history of the Savant Lake Area. The Savant Lake Greenstone Belt is continuous with the Sturgeon Lake Greenstone Belt to the south. In 1968, the discovery of a Cu-Pb-Zn-Ag sulphide ore body by Mattagami Lake Mines Limited Exploration Division in the Sturgeon Lake area has generated new interest in the Savant Lake area.

Field Mapping Procedure

Mapping was done by pace and compass traverses at 0.4 km (¼ mile) intervals, supplemented by the use of vertical air photos at a scale of 1:15 840 (1 inch to ¼ mile). Based upon prior examination of air photos, traverses were designed

[1]Geologist, Precambrian Geology Section, Ontario Geological Survey. Manuscript accepted for publication by the Chief Geologist, 30 November 1976.
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for optimum outcrop coverage, and where possible, at or near right angles to the known trend of the lithological formations as indicated by existing geological maps and ODM-GSC Aeromagnetic Maps (ODM-GSC 1961a, and b). Where outcrop areas were readily apparent on the air photos, these were mapped directly on the photo overlay. Outcrops that were not visible on the air photographs were tied to recognizable topographic features by pace and compass traverse lines wherever feasible. In addition all shorelines of lakes and rivers and all roads were investigated for outcrops. Over areas underlain by iron formation, standard compasses were found to be useless, and trends of linear structures in these areas were approximated using the sun in conjunction with recognizable topographic features, such as the shape of an exposure if it was observable on the accompanying air photo. Emphasis was placed on mapping the metavolcanic areas; a minimal amount of time was spent on the areas underlain by granitic-type rocks. Smye Township was mapped in a two week period. Geological data were plotted on transparent overlays attached to the air photographs and were subsequently transferred to a base map prepared from the Forest Resources Inventory, Ontario Ministry of Natural Resources, Division of Forests.

Preliminary uncoloured geological maps (Bond 1973a, b, c) supplemented with marginal notes were published at a scale of 1:15 840 (1 inch to ¼ mile) in 1973. The final maps accompanying this report are a reduction of the preliminary maps, and are at a scale of 1:31 680 (1 inch to ½ mile).

Acknowledgments

The author acknowledges the assistance of G.R. Edwards, F.R. Ploeger, E. Sawitzky, G.C. Sharpe, B. Hachkowski, and J. Kirkpatrick during the 1972 field season. G.R. Edwards, as senior assistant, was responsible for about 40 percent of the mapping, and the author would like to thank him for numerous discussions and suggestions. The following were junior assistants; F.R. Ploeger, E. Sawitzky, and G.C. Sharpe. F.R. Ploeger performed independent mapping in 10 to 15 percent of the map-area. B. Hachkowski and J. Kirkpatrick joined the field party during the last two weeks of the field season, and their assistance is appreciated.

Special thanks are due John Donner, Prospector, and to Roger Mercier of Mid-North Engineering Services Limited for the cooperation they extended to the author during tours of their respective properties, and for kindly supplying the author with geophysical plans and diamond drilling information.

Dr. R.T. Bell, then a staff member of the Department of Geology, Brock University at St. Catherines in Ontario, is gratefully acknowledged for his data, suggestions, and several stimulating discussions. G.H. Funk, also of Brock University, supplied the author with a copy of his B.Sc. thesis (Funk 1973) on the Savant Lake Conglomerate.

Mr. Moede, owner of the tourist lodge (Wildewood Resort) on the South Arm of Savant Lake, permitted the field party to pass through his property.

Means of Access

The town of Savant Lake is situated at the junction of the Canadian National Railways and Highway 599, about 10.4 km (6.5 miles) south of the southwestern corner of Conant Township. Highway 599 originates at a point 1.6 km (1 mile) east of the town of Ignace which is 240 km (150 miles) west of Thunder Bay on the Trans-Canada Highway. From Ignace, Highway 599, runs northeasterly to the town of Savant Lake 129.6 km (81 miles) to the north, and continues northward, passing through the western part of Conant Township. Several minor logging roads are situated west of Grebe Lake and extend from Highway 599 in northwestern Conant Township.

Access into the South Arm of Savant Lake is by fixed-wing aircraft from the town of Savant Lake or by all-terrain vehicle along a poor quality road that adjoins Highway 599 at a position about 26 km (16 miles) north of the town of Savant Lake in McCubbin Township (Bond 1972a). This road leads into the tourist lodge (Wildewood Resort) located on the northern part of the township boundary between Conant and Jutten Township.

The numerous lakes and rivers within the area afford easy access into most parts of the map-area by fixed-wing aircraft and canoe. Numerous well-cut portages exist between most of the lakes. A brief description of the access routes follows. Grebe Lake and Staunton Lake are easily accessible from Highway 599, the local residents in the area often refer to Staunton Lake as "Pickerel Lake". Two very small portages (the largest is 76 m (250 feet) long) link Staunton Lake to Conant Lake. The portage from Conant Lake to Handy Lake, although not used a great deal, is still fairly well preserved and is 1070 m (3,500 feet) in length. The portage from Harold Lake to Savant Lake was part of the main canoe route used by the early explorers to the area, and was used by Moore (1928) to gain access into Savant Lake. This portage is approximately 1300 m (4,300 feet) long, is still used frequently, and is very well cut. Two portages, 150 m (500 feet) and 460 m (1,500 feet) in length respectively, and one small portage, approximately 30 m (100 feet) in length, are required to portage a canoe from Savant Lake to Handy Lake. The portage into Jutten Lake is well maintained by the (Wildewood) tourist lodge, and is 450 m (1,480 feet) in length. A small portage, about 30 m (100 feet long), provides access into Hackett Lake (in Jutten Township), and another small portage is required to gain access to the lake system south of Hackett Lake. The tourist traffic also results in two well kept portages leading into Silver Lake and Pride Lake that are 320 m (1,050 feet) and 221 m (725 feet) in length respectively. Most of Smye Township is readily accessible from Smye Lake.

Previous Geological Mapping

According to E.S. Moore (1928), the first reference to Savant Lake in the literature was by G.W. McInnes (1901) who reported traces of gold occurring on one of the islands in Savant Lake. T.W. Gibson (1902, p.18) also reported gold-bearing quartz veins in the area. W.G. Miller (1903) visited the area, and examined some placer gold deposits on a large island north of the narrows, and just outside the map-area. W.H. Collins (1910) was the first to conduct a geological reconnaissance of the area, and published a map (Map 993) at a scale of 1:253 440 (1 inch to 4 miles). E.S. Moore (1910), visited the area in 1909 to evaluate the iron deposits, and published a map at a scale of 1:126 720 (1 inch to 2 miles). The Savant Lake area was brought into prominence by a major gold rush in 1925. As a consequence, the following year, Moore (1928), carried out a geological study of the entire Savant Lake area, and published a map (Map 37j) at a scale of 1:126 720 (1 inch to 2 miles). Most of the rocks in the western part of the present map-area were grouped together by Moore under the heading "Timiskaming". The contact between the mafic metavolcanics and granitic rocks in Jutten and Smye Townships was defined at this time. A more detailed study was done by Rittenhouse (1936) for his Ph.D. Thesis when he mapped Conant and Jutten Townships and the neighbouring townships of McCubbin and Poisson lying to the north (Bond 1972a,b). The mapping was done at a scale of 1:31 680 (1 inch to ½ mile) but essentially very little was added to Moore's (1928) original interpretation of the present map-area. J.C. Davies *et al.* (1970) published a compilation map (Map 2169) at a scale of 1:253 440 (1 inch to 4 miles) that included the present map-area. More recently, R. Skinner (1969) mapped the area at a reconnaissance scale 1:253 440 (1 inch to 4 miles) in order to correlate the surrounding greenstone belts. The three adjoining townships to the north of the present map-area, McCubbin, Poisson, and McGillis Townships, were mapped in detail at a scale of 1:15 840 (1 inch to ¼ mile), (Map 2357 *in* Bond 1977) during the 1971 field season.

Mineral Exploration

The Savant Lake region has been prospected for minerals since the turn of the century. During the very early part of the twentieth century, extensive iron deposits were discovered west of the main part of Savant Lake. The iron deposits are in the form of iron formation intimately intercalated with arenaceous metasediments. The iron deposits are mainly concentrated towards, and outside, the extreme northwestern corner of Conant Township, and were described in the report of the Ontario Iron Ore Committee (1923, p.182-183) and by Moore (1910) who regarded them as having a fairly low quality.

In 1926, the first significant gold discovery was made by a group of prospectors on a small island in Savant Lake to the north of the present map-area. During that period, the area around Stillar Bay in northern Jutten Township was heavily staked and explored by Savant Mines Limited, and is described by Moore (1928, p.73-75). Two decades later in 1946, Northern Canada Mines Limited obtained favourable gold assays from several showings in the centre of Jutten Township and staked four patented claims which were still held by the company during the 1972 field season. The gold showings appear to be fairly limited in their extent, and to date are considered to be uneconomic.

Since the mid 1950s, emphasis in exploration has shifted from precious metals to base-metal deposits. The discovery of the Mattabi Mine on nearby Sturgeon Lake in 1968 reactivitated interest in the area, and exploration activity intensified from 1969 to about 1973.

Topography and Drainage

Savant Lake has an elevation between 396 m (1,300 feet) and 430 m (1,400 feet) above sea level. Annual fluctuations of the lake level are generally less than 0.9 m (3 feet). The surrounding terrain is 15 to 30 m (50 to 100 feet) above the lake level, and rises locally up to just over 460 m (1,500 feet) above sea level in: a) the southwestern corner of Conant Township; b) in the southeastern corner of Jutten Township and; c) in the area between the South Arm of Savant Lake and Staunton Lake.

The map-area was extensively glaciated, only minor topographic features resulting from the denudation are observed. Although some of the lakes trend subparallel to the direction of ice movement, most tend to roughly reflect the nature of the underlying bedrock. Outcrop density is uniform throughout the area; locally in Jutten Township exposure is good. The shorelines of Savant Lake and the numerous smaller lakes also have good rock exposures. The mafic metavolcanics in Jutten Township form large, well rounded exposures of moderate relief that are often covered by thick blankets of moss. By comparison, the felsic to intermediate metavolcanics and metasediments underlying the area west of the South Arm of Savant Lake are smaller in extent, and more flat lying. The granitic rocks, and the porphyritic subvolcanic rocks near Handy Lake, tend to form outcrops of moderate relief similar to the mafic metavolcanics, except that they are neither as extensive nor as abundant.

The map-area is well drained by the numerous lakes and rivers. Areas of low relief with poor drainage and poor exposure are found in only three parts of the map-area: a) between Staunton Lake and Hough Lake; b) west of Grebe Lake; and c) immediately west of Jutten Lake.

A watershed separating two major drainage basins runs through Conant Township. West of Handy Lake, all the lakes in the map-area including Conant, Staunton, Grebe, and Hough Lakes drain westward into the English River and are part of the English River Drainage Basin which drains westward to Lake Winnipeg. All rivers and lakes in the map-area east of, and including Handy Lake, drain into the Albany River which eventually flows into James Bay; these lakes and rivers are part of the Albany River Drainage Basin. Both of these drainage basins are part of the Arctic watershed. Rapids occur along the Savant River which drains Jutten Lake, and at several places along the Marchington River that flows out of Conant Lake into Grebe Lake, but in general, the gradients are gentle, and controlled in many areas by beaver dams. Most of the small rivers are too small to be navigable by canoe, and many of their courses are blocked by overhanging and fallen trees.

Natural Resources

A dense, mixed growth of spruce, pine, poplar, and balsam dominates the vegetation. Deciduous trees are generally more prolific than other types of tree to the west of the South Arm of Savant Lake, and are associated with the more sandy till of Conant Township. Spruce is the most plentiful tree in the area, and reaches its greatest height in the area east of the South Arm of Savant Lake. In addition, birch, elm, mountain ash, alder, and occasional maple are found. Alder is often found associated with small wet patches. Red pine and mostly jackpine are found associated with the well-drained, sandy hills. Cedar is found locally concentrated in very wet areas, and is peculiar to the sheared, rocky slopes along the western shore of, and on the islands of, the South Arm of Savant Lake.

Logging operations are confined to areas in Conant Township that are accessible from Highway 599. Locally, as in the extreme southwestern corner of Conant Township, logging operations occurred before 1968, as evidenced by the date of the air photographs used in the field work. From 1970 to 1971, the Great Lakes Pulp and Paper Company cut over much of the area immediately west of Highway 599 beside Grebe Lake. The timbering operations extend to a maximum of 900 m (3,000 feet) from the road. Several logging roads traverse this area, but are not shown on Map 2398 (back pocket).

Game fishing attracts many tourists to Savant Lake every year. Pike and pickerel thrive in all areas of the lake, but are particularly abundant by "The Narrows" that lead north into the main part of Savant Lake just east of the forest fire tower. According to the depth gauges of several local fishermen, the South Arm of Savant Lake is almost 90 m (300 feet) feet deep just southeast of the peninsula separating the forest fire lookout tower from Wildewood tourist lodge, and large lake trout have been taken there.

Moose are abundant throughout the Savant Lake area, and attract many hunters in the autumn. Bear, muskrat, beaver, otter, rabbit, ground hogs, squirrel, and smaller rodents are also present. A family of wolves was observed during the 1972 field season on the northeastern shore of the small lake that is south of and drains into Conant Lake.

GENERAL GEOLOGY

Precambrian

EARLY PRECAMBRIAN (ARCHEAN)

All the rocks underlying Conant, Jutten, and Smye Townships are of Early Precambrian (Archean) age. In the map-area, there are two volcanic sequences situated east and west of the South Arm of Savant Lake, respectively.

Mafic metavolcanics are apparently the oldest rocks in the map-area, and are found to the east of the South Arm of Savant Lake. These rocks are similar to, and continuous with, metavolcanics mapped by Bond (1972b, c) in Poisson and McGillis Townships. The maximum apparent thickness measured in a line extending northwest from the contact with the granite in Smye Township, south of Silver Lake, to the northwestern tip of Girard Island in Poisson Township (Bond 1972b) indicates that this lower mafic metavolcanic sequence may be as much as 7600 m (25,000 feet) thick. This estimate may be slightly exaggerated because a minor synclinal fold axis is thought to be present north of Pride Lake (Bond 1977, p.52), and the sequence may actually be 6400 m (21,000 feet) thick.

TABLE 1 TABLE OF LITHOLOGIC UNITS FOR CONANT, JUTTEN, AND SMYE TOWNSHIPS.

PHANEROZOIC
CENOZOIC
RECENT
Swamp and stream deposits, lake deposits
PLEISTOCENE
Glacial drift: sand, silt, gravel and boulders

Unconformity

PRECAMBRIAN
EARLY PRECAMBRIAN (ARCHEAN)
FELSIC INTRUSIVE ROCKS
MASSIVE FELSIC INTRUSIVE ROCKS
Grebe Lake Stock
Granodiorite; quartz monzonite; pink aplite; white aplite; hornblende-bearing granitic rocks

Intrusive Contact

METAMORPHOSED FELSIC TO INTERMEDIATE INTRUSIVE ROCKS
Conant Lake Intrusive
Trondhjemite; granodiorite; porphyritic granodiorite

Jutten Batholith
White biotite trondhjemite; biotite granodiorite; pink biotite granodiorite; quartz monzonite; porphyritic granodiorite; white biotite trondhjemite with blue quartz crystals; hornblendic and biotite-hornblendic granitic rocks; quartz diorite

Intrusive Contact

Handy Lake Porphyritic Sills
Quartz-feldspar porphyry; quartz porphyry, feldspar quartz porphyry; feldspar porphyry; xenolithic porphyritic intrusive rocks

Intrusive Contact

METAMORPHOSED MAFIC INTRUSIVE ROCKS
Biotite diorite; biotite-hornblende diorite; gabbro; fine-grained gabbro; leucocratic diorite

Intrusive Contact

METASEDIMENTS
ARENACEOUS METASEDIMENTS
Greywacke, subgreywacke; sandstone; siltstone to mudstone; tuffaceous metasediments; siliceous siltstone, cherty metasediments

FERRUGINOUS METASEDIMENTS
Chert-magnetite iron formation; chert-magnetite iron formation with greywacke, subgreywacke; chert-magnetite iron formation with siltstone; chert-magnetite iron formation with tuffaceous metasediments

CONGLOMERATIC METASEDIMENTS
Volcanic conglomerate, conglomerate

Unconformity

METAVOLCANICS
FELSIC TO INTERMEDIATE METAVOLCANICS
Quartz and quartz feldspar porphyry; tuff; lapilli-tuff; tuff-breccia; crystal tuff; lahar; reworked pyroclastic rocks; autoclastic flow breccia; fine- to medium-grained flows; porphyritic (feldspar) flow, intermediate metavolcanics with mafic segregations; garnetiferous-magnetite horizons; volcanic sandstone

INTERMEDIATE TO MAFIC METAVOLCANICS
Pillow lavas; fine- to medium-grained flows; derived amphibolites; medium- to coarse-grained flows, derived amphibolites; porphyritic flows; tuff, lapilli-tuff, tuff-breccia; metavolcanic rocks with chlorite (biotite) clots; sheared, gneissic metavolcanic rocks; metavolcanic rocks with blue quartz crystals

The mafic metavolcanics have been deformed by the intrusion of granitic batholiths, and the true thickness has thus been obscured. Abundant pillow lavas throughout this sequence indicate that these rocks were primarily deposited in a subaqueous environment.

A volanic conglomerate, overlain by a conglomerate, was unconformably deposited upon the mafic metavolcanics to the east of the South Arm of Savant Lake. This metaconglomerate sequence is overlain by arenaceous and ferruginous metasediments.

A second volcanic sequence consisting of felsic to intermediate metavolcanics with intercalated metasediments and mafic to intermediate flows is exposed west of the South Arm of Savant Lake. The area is structurally complex, and exhibits frequent lateral and vertical facies changes. The felsic to intermediate metavolcanics are primarily of pyroclastic origin. Porphyritic felsic to intermediate intrusive rocks form a thick sill within this complex sequence, and appear to be associated with a metamorphosed granitic intrusive at Conant Lake. A small dioritic to gabbroic stock, the Staunton Lake Stock, has also intruded the above sequence.

Metasediments overlie the complex sequence of felsic to intermediate metavolcanics. Metasediments occur mainly in the northern part of Conant Township, and are part of the metasedimentary sequence exposed to the north of the map-area in McCubbin and Poisson Townships (Bond 1972a, b). In northeastern Conant Township, this metasedimentary sequence contains abundant siliceous siltstones that appear similar in composition to the felsic to intermediate metavolcanics to the south, suggesting these metasediments were derived from the latter rocks.

Structure and metamorphism indicate that several ages of granitic emplacement are present in the map-area. East of the South Arm of Savant Lake, a large, trondhjemitic to quartz monzonitic batholith intrudes the lower mafic metavolcanic sequence, and underlies almost fifty percent of the map-area. Two possibly younger, massive, more potassium-rich bodies were emplaced at Grebe Lake (Conant Township) and in northwestern Smye Township.

There is a marked contrast in structural trends across the South Arm of Savant Lake. The mafic to intermediate metavolcanics to the east of the South Arm of Savant Lake form a continuous sequence that faces northwest. The felsic to intermediate metavolcanics to the west of the South Arm of Savant Lake oppose this northwest-facing direction, and have been complexly folded about a northeasterly-trending vertical fold axis. These rocks form an anticlinal structure that faces east to northeast towards the mafic to intermediate metavolcanic sequence. The fold axis is faulted and curvilinear, a feature possibly caused by the emplacement of the large granitic batholith to the east. Extensive shearing in the area between the above two opposing structural domains is believed by the author to be caused by major faulting which was probably coincident with the folding event. The transverse faults that locally displace the anticlinal fold structure, are believed to have developed at a later stage than the major fault.

The metavolcanics and metasediments have been metamorphosed under lower to middle greenschist facies conditions; lower amphibolite facies metamorphism was reached in areas adjacent to felsic intrusive rocks. Thermal metamorphic overprinting on this regional metamorphism is associated with the dioritic to gabbroic stock in Conant Township. The regional metamorphism is believed to have outlasted, or postdated both of the folding and coincident faulting deformation events.

The Table of Lithologic Units is given in Table I. Previous workers (Moore 1928; Rittenhouse 1936; Skinner 1969) established the main geological units, and devised their own nomenclature for the various lithologic units. Table 2 summarizes each of their main sequences and the corresponding terminology.

Metavolcanics

In the field, the metavolcanics were subdivided into two main groups based primarily on colour index, corresponding to mafic mineral content. The two groups are: 1) mafic to intermediate metavolcanics having a basaltic to locally andesitic composition, and 2) felsic to intermediate metavolcanics having an andesitic to rhyolitic composition. The latter rocks were subdivided further in the field into two categories: i) metavolcanics of dacitic to rhyolitic composition and ii) metavolcanics of dacitic to andesitic composition.

INTERMEDIATE TO MAFIC METAVOLCANICS

The intermediate to mafic metavolcanics, summarized in Table 2, were formerly classified as part of the "Savant Group" by Moore (1928). Rittenhouse (1936) remapped the area, and further subdivided the rocks applying the name "Jutten Volcanics" to the mafic to intermediate metavolcanics because of their excellent exposure in Jutten Township. Skinner (1969) classified them simply as "Greenstone".

The intermediate to mafic metavolcanics are well exposed immediately east of the South Arm of Savant Lake in northern Jutten Township, extend east into the northern part of Smye Township, and are continuous with similar rocks in Poisson and McGillis Townships (Bond 1972b and c). These rocks are the oldest in the map-area, and comprise a gently curvilinear succession bounded by granitic intrusive rocks to the south. The metavolcanics pinch out against these granitic rocks near Jutten Lake in the southwestern corner of Jutten Township, and reappear to the south of Harold Lake in Conant Township. Based on reconnaissance mapping (Sage *et al.* 1974), the mafic metavolcanics in the northeastern part of Smye Township extend about another 2.4 km (1.5 miles) east of the township boundary where they were probably engulfed by the granitic intrusive rocks. Intermediate to mafic metavolcanics also occur as thin flows within the metasediments in northeastern Conant Township, and probably occur as composite flows forming concordant layers in the felsic to intermediate metavolcanics in the southern part of Conant Township.

Pillow lava is the most common flow unit present throughout the sequence in Jutten Township. Subsidiary fine- to coarse-grained flow units are spatially associated with the pillowed units, but are more common in the northwestern part of Smye Township. Porphyritic flows and a few porphyritic pillowed flows occur locally within the above relatively homogeneous succession, but are gener-

TABLE 2 HISTORY OF STRATIGRAPHIC NOMENCLATURE USED FOR SAVANT LAKE AREA.

Moore, E.S. (1928)	Rittenhouse (1939)	Skinner (1969)	Present Survey
PRECAMBRIAN:			
KEWEENAWAN: Diabase dikes	KEWEENAWAN(?) - Diabase dikes	KEWEENAWAN(?) - Diabase dikes	
ALGOMAN: Granitic Intrusives	Granitic Intrusives	Granitic Intrusives, gneisses	FELSIC INTRUSIVE ROCKS
	BASIC INTRUSIVES		MAFIC INTRUSIVE ROCKS
	HANDY LAKE VOLCANICS Felsic to Intermediate Metavolcanics unconformity	HANDY LAKE VOLCANICS	METASEDIMENTS (West of Savant Lake Fault Arenaceous Metasediment Ferruginous Metasediment
SAVANT GROUP TIMISKAMING: Complex series of interbanded acid, intermediate and basic lava flows, agglomerate, tuffs arkoses, greywacke, banded iron formation and conglomerate and derived gneisses.	SAVANT SERIES UPPER Upper Greywacke member Upper Iron-bearing member Lower Greywacke member Lower Iron-bearing member LOWER Upper Conglomerate member Lower Conglomerate member	SAVANT GROUP TIMISKAMING(?) Metasediments Pyroclastics	EAST OF SAVANT L. FAULT Conglomerate and related arenaceous & ferruginous metasediments WEST OF SAVANT L. FAULT FELSIC TO INTERMEDIATE METAVOLCANICS (with intercalated mafic metavolcanics)
KEEWATIN: Greenstones, intermediate to mafic metavolcanics	JUTTEN VOLCANICS: Mafic to intermediate metavolcanics	GREENSTONE: Mafic to intermediate metavolcanics	MAFIC TO INTERMEDIATE METAVOLCANICS (Jutten Sequence)

ally laterally discontinuous. Several medium-grained flows and minor related crystal tuffs are found interlayered within the metasediments in northeastern Jutten Township.

In thin section, the intermediate to mafic metavolcanics are recrystallized to varying extents. A few sections show relict primary textures. The most common mineral assemblage is plagioclase, amphibole, chlorite, epidote, quartz, carbonate, and biotite. Magnetite, associated leucoxene and minor disseminated sulphide minerals are accessories. Grain size in the rocks averages 0.1 to 0.5 mm.

Plagioclase was mostly altered to granules of albite that in thin section are often hard to distinguish from quartz. The plagioclase phenocrysts in the porphyritic flows are often completely saussuritized. In several thin sections, the original pilotaxitic texture is preserved with elongated laths of skeletal-like plagioclase as much as 0.7 mm in length, but averaging 0.25 mm. Some of these needle-like plagioclase crystals are similar in habit to the quench plagioclase described by Gelinas and Brooks (1974), because some appear to have the hollow cores characteristic of quench plagioclase. Some of the embayed material appears to be mostly saussurite, and these hollow zones may just be a more altered calcic core of an albite twin. Only a few show the required swallow-tail cross-section, but all the laths are elongate, and have probably been rapidly chilled. In thin section, this rapidly chilled plagioclase is randomly oriented to locally lineated in a trachytic texture.

Shredded, radiating, aggregates of pale green to colourless tremolite is the most common ferromagnesian mineral present. Actinolite commonly forms subhedral, equant crystals, is dark green, and is more common in the medium- to coarse-grained interflows in Conant Township, and in proximity to the batholithic intrusive rocks in southern Jutten and Smye Townships. In places, the amphibole is uralitized, and near the granitic contacts, the actinolite is locally changed to blue-green hornblende.

Associated with tremolite, chlorite (probably prochlorite) commonly occurs as minute anomalous brown birefringent, fan-shaped crystal aggregates. Locally, chlorite, where it is intergrown with biotite, displays an anomalous blue birefringence colour.

Epidote occurs as an alteration product of plagioclase, and occurs as anhedral granular masses and as single euhedral crystals. Carbonate is present as subhedral to anhedral grains; it is often associated with plagioclase, but is also found in secondary pockets and veinlets.

The intermediate to mafic metavolcanics are the metamorphosed equivalent of extrusive rocks of basaltic to andesitic composition. In the field, these rocks were classified on the basis of their mafic content. The percentage of ferromagnesian minerals varies from 35 to 50 percent, but averages about 40 percent.

These rocks exhibit a wide variation in colour which is attributed to various mineral assemblages formed under different intensities of metamorphism and alteration. The majority of the mafic to intermediate metavolcanics away from the granitic intrusions have been regionally metamorphosed to lower to middle greenschist facies, and primary features are well preserved. Amphibolitic metavolcanics of lower amphibolite facies metamorphic rank form a zone varying from approximately 300 to 600 m (1,000 to 2,000 feet) wide adjacent to the granitic contact in Jutten Township. Further east in northwestern Smye Township, the greater part of the sequence was extensively amphibolitized when the nearby felsic intrusive rocks were intruded. Except for the common development of metamorphic amphibole (amphibolitization) near felsic intrusive rocks, there is no apparent systematic pattern to most of these differences. The development of amphibole in the contact aureole results in a darkening of the rock from light green to dark green. Weathered surfaces vary from dark green to light yellow-green in more carbonatized and epidotized varieties. In places, the development of chlorite accompanies shearing, and also tends to give the rock a darker green hue.

The pillow lavas commonly weather a lighter colour than the more massive flows, and locally display a light yellow-green weathered surface along the southern shore of Stillar Bay in Jutten Township, and on the northern shore of the peninsula separating Stillar Bay from the main part of Savant Lake near the northern boundary of Poisson Township. Where surfaces are lichen free, the pillows are light green, and on partly lichened surfaces they are green-brown. Fresh surfaces are generally darker in hue than the corresponding weathered surface, and vary from light grey-green to dark green to almost black.

The colour is related to the metamorphic mineralogy, a relation similar to that noted in the adjacent map-area to the north (Bond 1977). The lighter green colour is characteristic of chlorite-tremolite assemblages; the darker green colour is associated with more actinolite-hornblende assemblages. These predominantly massive, fine- to medium-grained, to locally coarse-grained amphibolitic metavolcanics are interpreted to have been derived from mafic flows. Variation in grain size within these metamorphosed rocks may partly reflect the original grain size of composite flows.

Chemistry

Samples exhibiting the entire array of fresh surface colours were analyzed for SiO_2 content by the Mineral Research Branch, Division of Mines. The results showed no obvious relationships between samples. Six of the samples submitted to the Mineral Research Branch, Division of Mines, were completely analyzed, and the resulting whole rock analyses with accompanying molecular normative calculations (after Irvine and Baragar 1971) are given in Table 3. The samples represented by Analyses Numbers 4 and 5 were termed andesites in the field on the basis of colour, but on the basis of chemistry are classified as basalts (Irvine and Baragar 1971). These samples are similar to the analyses (1,2,3, and 6) of basaltic samples considered by the author to be representative of the "Jutten" intermediate to mafic metavolcanic sequence. The results show no obvious trend between colour and silica content. The rocks analysed within the "Jutten" metavolcanic sequence are all classified as tholeiitic basalts after Irvine and Baragar (1971). Most, if not all, of the intermediate to mafic metavolcanic sequence to the east of the South Arm of Savant Lake may be basaltic in composition. Samples l, 2, and 3 (Table 3) were taken in the lower part of the mafic metavolcanic sequence less than 11800 m (6,000 feet) away from the exposed lower contact with the Jutten Batholith. Samples 4, 5, and 6 (Table 3) were taken higher in the sequence at distances of 1800 to 4990 m (6,000 to 16,370 feet) from the contact of the Jutten Batholith. The chemical analyses indicate a general

TABLE 3 CHEMICAL ANALYSES OF MAFIC TO INTERMEDIATE METAVOLCANICS FROM THE JUTTEN METAVOLCANIC SEQUENCE, CHEMICAL ANALYSES BY MINERAL RESEARCH BRANCH, DIVISION OF MINES.

Chemical Analyses, Major Components in Percent

Analysis Number	1	2	3	4	5	6
Sample No.	561	565	746	F.20	749	750
SiO_2	46.00	51.10	51.50	52.00	53.80	52.10
Al_2O_3	14.90	13.50	13.30	14.50	15.40	14.90
Fe_2O_3	2.35	2.00	2.40	1.78	2.46	2.04
FeO	12.10	9.08	8.71	9.74	6.57	8.41
MgO	7.05	7.50	7.22	5.78	4.19	4.42
CaO	11.70	10.90	11.00	8.57	9.42	8.58
Na_2O	1.21	1.54	1.89	3.18	2.24	2.00
K_2O	0.12	0.12	0.05	0.39	0.17	0.02
H_2O^+	2.61	2.39	2.58	2.67	2.69	3.88
H_2O^-	0.18	0.14	0.14	0.16	0.18	0.22
CO_2	0.05	0.28	0.19	0.24	1.09	2.10
TiO_2	0.80	0.68	0.82	1.07	0.92	0.81
P_2O_5	0.06	0.08	0.08	0.10	0.06	0.05
S	0.15	0.08	0.11	0.10	0.03	0.03
MnO	0.37	0.26	0.22	0.21	0.26	0.29
Total	99.65	99.65	100.21	100.49	99.48	99.85

Trace Element Analyses in Parts Per Million (ppm)

Ag	—	2	—	<1	—	—
Ba	70	90	50	110	60	50
Co	55	50	50	45	60	55
Cr	220	250	150	180	220	250
Cu	85	130	95	130	160	140
Ga	15	15	15	20	15	15
Li	20	10	8	9	8	10
Mo	—	—	--	10	—	—
Ni	120	120	120	85	170	190
Pb	<10	<10	<10	<10	—	<10
Sc	45	40	40	40	45	45
Sn	—	15	—	<10	—	—
Sr	80	80	150	100	150	150
V	220	220	200	260	220	200
Y	20	20	30	25	30	25
Zn	120	100	100	110	90	90
Zr	60	50	55	70	55	45
Distance from contact of Jutten Batholith in feet	1,190	4,200	5,675	6,865	15,700	16,370

Metrication; to convert feet to metres multiply by 0.3048.

Table 3 — continued on next page

TABLE 3 — continued

Molecular Norms of Mafic to Intermediate Metavolcanic Rocks from the Jutten Metavolcanic Sequence

Analyses Numbers	1	2	3	4	5	6
Sample Numbers	561	565	746	F.20	749	750
Quartz	—	5.97	5.86	2.38	12.83	12.14
Orthoclase	0.75	0.74	0.31	2.39	1.07	0.13
Albite	11.43	14.49	17.68	29.55	21.45	19.61
Anorthosite	36.69	30.99	28.83	24.99	33.57	34.54
Mg Pyroxene	14.58	15.30	13.64	12.38	8.50	10.87
Fe Pyroxene	12.10	8.76	7.40	9.57	5.56	9.65
Diopside	10.48	12.78	14.27	8.28	7.67	4.92
Hedenbergite	8.68	7.32	7.74	6.40	5.02	4.36
Forsterite	0.50	—	—	—	—	—
Fayalite	0.41	—	—	—	—	—
Ilmenite	1.17	0.99	1.19	1.54	1.37	1.23
Magnetite	2.53	2.19	2.53	1.93	2.70	2.33
Apatite	0.13	0.18	0.18	0.22	0.13	0.11
Chromite	—	—	—	0.03	—	—
Pyrrhotite	0.55	0.29	0.40	0.36	0.11	0.11
Normative Plagioclase Composition	76.00	68.00	62.00	45.80	61.00	63.80

Description and Location of Analysed Samples of Mafic to Intermediate Metavolcanics

Analyses Number	Sample Number	Rock Description	Location: Latitude Degrees	Location: Longitude Degrees
1	561	Green-grey fine-grained flow	50°22′27″	90°28′58″
2	565	Dark green medium-grained basaltic flow	50°23′00″	90°27′45″
3	746	Green, fine-to medium-grained basaltic flow	50°22′05″	90°31′00″
4	F.20	Green, pillow lava	50°23′50″	90°27′46″
5	749	Very light green, fine-grained andesitic flow	50°24′40″	90°29′52″
6	750	Light-to medium green, fine-grained flow	50°24′35″	90°29′52″

Table 3 — continued on next page

Table 3 — continued

1. From exposure located 400 m (1,300 feet) north of the granitic contact and 800 m (2,600 feet) south-southeast of Hackett Lake.

2. From exposure 1400 m (4,500 feet) directly east of northern portion of Hackett Lake.

3. From exposure 200 m (650 feet) east of the east central shoreline of the South Arm of Savant Lake and 1400 m (4,500 feet) north-northeast of the main test pit on the "John Donner Property".

4. From exposure 800 m (2,600 feet) east of the "Narrows" on the south shore of the main part of Savant Lake near the north boundary of Poisson Township.

5. From exposure 1190 m (3,900 feet) east of the "Narrows" on the south shore of main part of Savant Lake near the north boundary of Poisson Township.

6. From shoreline exposure on east-southeast end of Stillar Bay.

decrease in iron content with increase in height in the sequence. There appears to be an accompanying decrease in the magnesium content from a fairly consistent 7 percent in the lower part of the sequence, to a fairly consistent 4 percent in the upper part. Magnesium appears to remain constant for approximately the first 1800 m (6,000 feet) of the exposed mafic metavolcanic succession (samples 1, 2, and 3), but drops off sharply to 5.78 percent (sample 4) over a sampling interval of approximately 360 m (1,200 feet).

Silica analyses of samples from the sheared grey metavolcanics exposed along both the western shore, and the southeastern shore of the South Arm of Savant Lake vary from approximately 49 to 57 percent, and possibly indicate a variation from basaltic to andesitic composition. The variation, however, may also be related to effects associated with shearing.

Pillowed Flows

Pillow lavas are most abundant in Jutten Township, and are locally present in the mafic sequence in northeastern Smye Township. In Jutten Township these rocks are estimated to constitute about 60 percent of the succession. The pillows are best exposed on Hackett Lake where they form an uninterrupted sequence at least 900 m (3,000 feet) thick, but are also well exposed along the southern shore of Stillar Bay, and on the shoreline of the small lake situated about 1200 m (4,000 feet) west of Hackett Lake.

Typically, the pillows are light green, accentuated by a dark green to green-brown interstitial matrix. Although many show no variation in colour, individual pillows frequently were observed to have light green margins adjacent to selvages that become progressively darker green towards the interior. The selvage margins are commonly light yellow-green, resist weathering, and form ridges higher than the rest of the pillow.

The pillows are similar to the individual variety (described in Bond 1977, p.11) observed in Poisson and McGillis Townships that lie to the north of Jutten and Smye Townships respectively, and are composed of pillows entirely separated from each other by matrix material. The pillows vary in size and form; the majority are closely packed with a minimum of interstitial material. Locally, the volume of intervening material increases substantially and forms small patches up to 25 cm (10 inches) in size between the pillows. In places, this interstitial material has weathered out leaving a pitted surface, or elsewhere was filled with secondary quartz. Individual pillows average 0.9 to 1.5 m (3 to 5 feet) in size, and are 0.3 to 0.6 m (1 to 2 feet) thick in cross-section. Length to thickness ratios average from 1:1 to about 5:1 on a plan surface; in general, the pillows are elongated in the vertical direction. On any given exposure there is no regularity in the size distribution of the individual pillows; very large pillows are often present with very small pillows.

The pillows are mainly distorted plastically; many show re-entrant selvaged edges possibly caused by initial rolling. As a result, top determinations were not always possible, but where taken, were all observed to face northwest. The pillows are fine to medium grained. The pillows are locally porphyritic containing plagioclase laths up to 2 mm long. Porphyritic pillows are present at the two small lakes located about 460 m (1,500 feet) east of the metaconglomerate opposite Hackett Lake. The porphyritic plagioclase is randomly oriented, and decreases in size towards the outer margin of the pillow. The outer 5 cm (2 inches) of the pillow is lacking in feldspar phenocrysts because of rapid chilling. These porphyritic pillows were observed on a very clean, lichen free surface. This porphyritic feature is probably more common in the map-area, but is obscured by vegetation on many exposures. The pillows are mostly non vesicular, although in some of the pillows, a narrow, typically brown weathered-out zone adjacent to the more resistant outer skin of the pillow may represent a more easily weathered-out vesicular zone. Although Engel and Engel (1966) reported that the vesicularity of lavas is dependent upon magma type and probably several other factors, the general lack of vesicles in the pillow lavas may indicate that the pillow lavas of Savant Lake were formed in fairly deep water (Moore 1965; Jones 1969).

Massive Flows

Massive to subfoliated to highly sheared flows are associated with the pillow lavas. These subsidiary flows are generally darker in colour, slightly coarser, and are more homogeneous in texture and grain size than their pillowed counterparts; they are relatively featureless rocks. In the field, where possible, areas dominated by massive flows were mapped separately from areas composed mainly of pillow lavas, but, because of the limited exposure, these areas are probably not entirely exclusive of pillow lavas. No contacts between individual flows or between massive and pillowed flow units were observed in the field, although most of the flows are undoubtedly composite. The massive flows may grade into pillowed flows, or were protected from contact with water by an outer pillowed carapace as suggested by MacDonald (1967, p.28) and Melson *et al.* (1968). Some of the coarse-grained rocks in the mafic to intermediate metavolcanics in the "Jutten" sequence form sheets and irregular masses that probably intrude the intermediate to mafic metavolcanics, and may possibly represent feeder zones that were coeval with the extrusion of the basaltic flows.

Intermediate to mafic metavolcanic flows are interlayered with the more felsic sequence to the west of the South Arm of Savant Lake. Locally these flows are coarse-grained, and are composed of equant amphibole crystals in a matrix composed of amphibole and plagioclase. These amphibole phenocrysts are single actinolite crystals that may be pseudomorphs of olivine. They range in size up to 1.25 cm (½ inch) and protrude up to 0.6 cm (¼ inch) above the surface of the rock giving a "knobby texture". Locally, amphibole is sub-lineated and drawn out along shear planes. Coarse-grained amphibolite is also common in the extreme northeastern corner of Smye Township. In the southwestern corner of Conant Township, the intermediate to mafic metavolcanics become gneissic in character, and are carbonatized and injected by quartz veins near the contact with the granitic intrusive rocks. The intermediate to mafic rocks near the axial fold trace on the northeast shore of the small lake approximately 1.6 km (1 mile) south of Conant Lake are medium to coarse grained, and locally contain "blue quartz" pods (2 mm across). In the field, the quartz appears to consist of single crystals that may be primary in origin, but in thin section the crystals appear to be thin, secondary, recrystallized veinlets possibly related to the nearby fault. The coarse-grained mafic metavolcanics in the nose of the fold are believed to be dominantly extrusive, but may be partly intrusive. The presence of the "quartz eyes" and a gneissic structure with associated quartz-carbonate veins (not shown on map) gives these rocks a heterogeneous character; the mafic content also tends to vary, but averages 40 percent.

A few small flow units of a dioritic-appearing rock are present in places within the intermediate to mafic metavolcanics in Jutten Township. These flows weather white, and are spotted with green, porphyritic actinolite crystals 2 mm in size, forming 30 to 40 percent of the rock. Thin section examination reveals that the light part of the rock is saussuritized plagioclase along with some patches of secondary carbonate. Chlorite and poikiloblastic uralitic actinolite constitute the main ferromagnesian minerals.

Shearing is often restricted to planes spaced from several cm to 3 to 4.6 m (10 to 15 feet) apart. North of Stillar Bay though, and along the south part of the South Arm of Savant Lake, the shearing is intensive over extensive widths; these areas have been distinguished by shading on the preliminary series of maps (Bond 1973a, b, c). The large shear zone north of Stillar Bay which runs eastward into the Southeast Bay of Savant Lake averages 300 m (1,000 feet) in width and can be traced for about 4 km (3 miles). The rocks within this zone are all schistose. Numerous quartz veins with associated sulphide mineralization have accompanied the shearing. The economic significance of this major shear zone was recognized by Moore (1928, p.58-73). Euhedral cubes of pyrite are commonly present within the sheared rocks. In other areas, metamorphism has severely recrystallized and sheared the mafic metavolcanics. On the south side of Harold Lake, a gneissic, amphibolitic zone of mafic metavolcanics (map unit 1

m) straddles the metasediments on the east shore. The zone is characterized by discontinuous, lensoidal, parallel, mafic and felsic laminae approximately 1 to 2 mm in width. These laminae are sheared and exhibit small crenulation folds throughout. In thin section, three different bands are apparent; siliceous bands, mafic bands, and biotitic siliceous bands. The siliceous bands are ellipsoidal lenses 1.3-1.9 cm (0.5 to 0.75 inch) in length, composed of a microcrystalline mosaic of granular quartz and albite. These siliceous bands are coarser grained (0.5 mm) than the other bands. In hand specimen, the siliceous bands form ridges and appear similar to lapilli fragments. Mafic bands are composed of an aggregate of quartz, feldspar, and biotite with poikiloblastic radiating aggregates of dark green partly uralitic actinolite up to 3 mm in size. Locally poikiloblastic garnets (1 mm in size), and accessory magnetite are present. Some of the biotite is intergrown with chlorite. Kink bands, readily apparent in the field, are visible in thin section and cross-cut actinolite. Biotite is oriented parallel to the gneissic layering and to a cross-cutting cleavage. The biotitic siliceous bands are similar to these mafic bands, except that they contain no actinolite. On the weathered surface the bands containing no actinolite form grooves. This gneissic texture is believed by the author to be the result of extensive recrystallization of sheared mafic volcanic rocks, and indicates that the metamorphic event outlasted the fault deformation event. Gneissic texture is also seen locally along the margins and in the central part of the interlayered intermediate to mafic metavolcanic flow unit in southwest Conant Township 1.6 km (1 mile) west of Harold Lake. Some of the more leucocratic parts form bands that are continuous over several metres, and it is possible that these might represent original tuff or metasedimentary horizons. The banded texture is probably not metamorphic in origin, but could be caused partly by the mixing of mafic flows and metasedimentary or tuffaceous horizons. This layering could have been deformed during later shearing, folding, and metamorphism, giving the rock a heterolithologic appearance.

Porphyritic Massive and Pillowed Flows

Most of the massive flows are fine to medium grained, and are similar in texture and composition to the pillow lavas. Several flows are, however, distinctly porphyritic. Porphyritic intermediate to mafic flows, characterized by sparse to concentrated phenocrysts of single and rare doubly twinned plagioclase feldspar crystals, are found at the following localities:

i) East of the metaconglomerate at the entrance to Stillar Bay;

ii) Locally on the south shore of Silver Lake and near the outlet that drains Silver Lake into Pride Lake;

iii) Locally on the north shore of the landmass separating Stillar Bay from the main part of Savant Lake situated to the north; and

iv) Locally on the southeast shore of Stillar Bay.

These porphyritic zones are mainly limited in size, 1.5 to 3.0 m (5 to 10 feet) thick, and do not extend laterally for any great distances. The most noteworthy occurrence is the first which appears to occur as a sill up to 67 m (250 feet) thick, and is traceable discontinuously for about 670 m (2,200 feet). Plagioclase feldspar phenocrysts are euhedral to subhedral, and are often subrounded, possibly due to abrasion by the contact with their neighbours, or to resorption. The phenocrysts average 1.9 to 2.5 cm (¾ inch to 1 inch) in size, and are set in a medium- to coarse-grained basaltic matrix. In thin section, plagioclase appears to form single crystals that are completely saussuritized. A few granulated microfractures cut the phenocrysts; rarely are fragments of the porphyritic plagioclase suspended in the matrix. All of the porphyritic rocks appear to form sills surrounded by massive flows. Porphyritic rocks similar to these were noted to occur in McGillis Township (Bond 1977, p.17-19). Baragar (1960), who described rocks of similar texture in Labrador, appealed to a flow differentiation mechanism, where the plagioclase aggregates were concentrated into the faster flowing, central regime of a flowing magma when the magma is injected into a narrow restricted conduit. The process was later shown by Bhattacharjii (1967) to be reproduceable in experiments.

Between the northern end of Handy Lake and the South Arm of Savant Lake there is a thin lens of intermediate to mafic volcanic rock with porphyritic mafic clots (map unit 1k, Map 2398, back pocket). The clots are augen shaped, and are up to 4 mm in length. A thin section revealed the clots to be composed mostly of aggregates of chlorite, and lesser amounts of biotite, carbonate, and minor epidote. Several of the clots are formed of almost single crystals of chlorite. The epidote is locally found as a rim on the outer margin of the clots. The matrix is completely recrystallized, and it is hard to tell if this rock is a flow or a tuff. The majority of the clots do appear to be crystal aggregates with inclusions of biotite and carbonate suggesting that they are metamorphic in origin.

The intermediate to mafic metavolcanic flows interlayered within the metasediments in northeastern Conant Township and northwestern Jutten Township are fine grained. These flows are generally slightly finer grained than the gabbroic sills in the same metasediments in northeastern Conant Township, but the former may also be partly intrusive. Intermediate to mafic crystal tuff indicated by map unit 1j (Map 2398, back pocket), forms a small discontinuous lens with the same metasedimentary sequence in northeast Conant Township. The crystal tuff is characterized by fragmental to euhedral laths of albite (An_7) up to 3.5 mm in size that are locally aligned in a matrix composed of anomalous blue chlorite (penninite), biotite, minor granulated quartz "trains," and carbonate.

Summary

The accumulation of the intermediate to mafic metavolcanics in Jutten Township probably took place under uniformly quiet, relatively deep, subaqueous conditions, because of their uniformity, lack of significant deposits of intervening metasedimentary-metatuffaceous horizons, and the abundance of pillow lavas. The nature of the volcanism is typical of a "lower" mafic volcanic cycle that is observed in many Archean greenstone belts.

FELSIC TO INTERMEDIATE METAVOLCANICS

Felsic to intermediate metavolcanics are restricted to the area west of the South Arm of Savant Lake, and underlie about 65 percent of Conant Township. Moore (1928), the first to recognize the felsic to intermediate metavolcanics in this area as part of a complex series of interbedded metavolcanics and metasediments, incorporated these rocks into his "Savant Group" (Table 2). Rittenhouse (1936) renamed the felsic to intermediate metavolcanics the "Handy Lake Volcanics" but Skinner (1969) retained Moore's (1928) original term: the "Savant Group". The felsic to intermediate metavolcanics have remained largely unsubdivided until the present mapping programme.

The felsic to intermediate metavolcanics are separated from the intermediate to mafic metavolcanics in Jutten Township by a major north-northeast-trending fault zone. These rocks are in contact with and disconformably overlain by arenaceous metasediments exposed in northern Conant Township and northwestern Jutten Township. The felsic to intermediate metavolcanic sequence has been folded about a curvilinear, east northeast- to north-northeast-trending axis; top indicators show that this feature is an anticlinal fold structure. The felsic to intermediate metavolcanic sequence extends south of the area, and this, along with the fact that these rocks have been tightly folded, renders any estimate of their true thickness speculative.

In the field, where possible, the rocks of this category were subdivided on the basis of mafic content into: 1) dacitic to rhyolitic metavolcanics (Map Unit 2a, Map 2398, back pocket); and 2) dacitic to andesitic metavolcanics (Map Unit 2b). This subdivision was not always possible to make in the field, and contacts could not be placed on the map immediately southwest of Grebe Lake and east of Handy Lake. The dacitic to rhyolitic metavolcanics contain up to 20 percent mafic minerals but the dacitic to andesitic varieties contain 20 to 35 percent mafic minerals.

The more felsic varieties (Map Unit 2a, Map 2398, back pocket) generally are white to light grey with pink patches on the surface (northwest of Harold Lake), and are typically dark grey, locally pink, and siliceous on fresh surfaces. Felsic to intermediate metavolcanics (Map Unit 2b) are more diversified in colour, and weather light grey to light green to buff-brown, and vary from grey to light green on the fresh surface. Weathering affects rock surfaces and forms a rind from 0.3 to 1.3 cm (⅛ to ½ inch) deep.

The felsic to intermediate metavolcanics are composed predominantly of pyroclastic rocks and massive, commonly porphyritic, flows. Towards the southwest corner of Conant Township, mafic (amphibolitic) lenses and loosely aggregated amphibole clots are found within intermediate metavolcanics. These intermediate metavolcanics with mafic clots have been metamorphosed under amphibolite facies conditions.

Most of the felsic to intermediate metavolcanics have been metamorphosed under greenschist facies conditions. The most common mineral assemblage is: quartz, albite, white mica, biotite, chlorite, carbonate, muscovite, and epidote. The composition of the plagioclase could not be determined in most sections because of its fine-grain size. Biotite, by far the most common mafic mineral present, is often seen concentrated along discontinuous shear planes which envelop the fragments. Locally, it is associated with anomalous blue, or brown radiating prochlorite aggregates that form discontinuous lenses approximately 1 cm (0.4 inch) in length. Epidote and sericite are alteration products, and appear mostly as single individuals. Magnetite is a common accessory.

Pyroclastic Rocks

These rocks are complex because they are characterized by different textures, compositions, and colour across small 6 m (20 feet) exposures. Individual, metamorphosed pyroclastic deposits, made recognizable by similarities in composition, and colour, generally cannot be used for stratigraphic purposes at the present mapping scale because many of these deposits are limited in extent. Generally, tuff, crystal tuff, lapilli-tuff and tuff-breccia are interlayered within intervals of less than 15 m (50 feet). In places, however, pyroclastic rocks do form distinctive deposits which locally form mappable units. The following rocks are encountered immediately northwest of Harold Lake: i) 460 m (1,500 feet) of dominantly dacitic to andesitic crystal tuff with sparse lapilli fragments; ii) 460 m (1,500 feet) of dacitic to rhyolitic tuff-breccia, lapilli-tuff; and iii) 300 m (1,000 feet) of dacitic to rhyolitic tuff. Elsewhere, for example between Handy Lake and the South Arm of Savant Lake, no detail of the stratigraphy could be made, partly due to the poor exposure. The terms tuff, lapilli-tuff, and tuff-breccia were assigned to agree with Fisher's (1961) classification.

Tuff

Tuff deposits generally form massive relatively homogeneous fine-grained interlayers, but are usually found forming the matrix of the coarser pyroclastic deposits. The more intermediate tuff deposits are easily deformed becoming increasingly darker with shearing, and are not easily distinguishable from the intermediate flows.

Crystal Tuff

Crystal tuff is prevalent throughout the sequence, and is composed of varying proportions of plagioclase crystals, crystal fragments and lesser amounts of quartz crystal fragments. The fragmented plagioclase crystals mainly occur in a buff-brown to green matrix that is andesitic to dacitic in composition. On the west shore of Harold Lake it forms a distinctly mappable horizon about 460 m (1,500 feet) thick, that is traceable for 900 m (3,000 feet) and may extend further south out of the map-area. Lapilli fragments are present within this deposit, but are sparse. Randomly oriented plagioclase feldspar crystals (2 mm) with minor quartz crystals and crystal fragments are present, and vary in volume from approximately 10 to 35 percent. Locally, crystal tuffs display a crude bedding defined by the concentration of crystal fragments; local alignment of the feldspar laths is possibly caused by ash flowage. Crystal tuff also commonly forms the matrix of coarser pyroclastic deposits, and this relation is most notably observed east of Staunton Lake. There, both plagioclase and quartz form the crystal clast component, but the former are more abundant. Plagioclase crystal clasts constitute from 10 to 20 percent by volume of the matrix, and quartz forms up to 10 percent by volume in places. Where the crystal tuff is associated with the coarse fragments, the bedding is obscure.

Crystal tuff is easily confused with porphyritic intrusive and extrusive rocks. The crystal tuffs are generally characterized by a much greater density of crystals than the porphyritic rocks; the packing density of the crystals is much more chaotic within the crystal tuffs than in the porphyritic flows where the phenocryst population is generally sparser and more uniformly distributed. A few uncommon lapilli-size fragments are present within the crystal tuffs and locally aid in the identification of these rocks.

Lapilli-Tuff and Tuff-Breccia

Lapilli-tuff and tuff-breccia are the most abundant rock types present in the felsic to intermediate metavolcanics. The composition of the matrix determines whether these pyroclastic rocks were classified as dacitic (Map Unit 2b) or rhyolitic (Map Unit 2a, Map 2398, back pocket). The coarsest fragmental rocks are generally andesitic to dacitic in composition, and are found: i) west of the dioritic stock at Staunton Lake; ii) east and northwest of Staunton Lake; and iii) at the northern part of Harold Lake. The fragments are generally poorly sorted. Generally, the fragments are more felsic than the matrix and are distinct. Locally, northeast of Harold Lake, the composition of the fragments and matrix approximate one another and the margins of the fragments are indefinite (Photo 1). There, many of the indistinct bomb-sized fragments contain feldspar phenocrysts and lesser amounts of quartz phenocrysts and many of the exposures can be easily mistaken for porphyritic flows or crystal tuffs.

The fragments in most exposures consist predominantly of only one rock type although minor amounts of other types of lithic clasts are present. The variation in lithology of the fragments between exposures is such that correlation and mapping of individual pyroclastic deposits was not possible. Distinct, black, rhyolite fragments occur along the base of the coarse pyroclastic unit (Unit ii, above) situated 600 m (2,000 feet) northwest of Harold Lake. Only two or three of the black fragments occur in each exposure. The fact that these fragments were only observed in exposures along the northern margin (base) of this coarse pyroclastic sequence (Units 2a, f, and g on Map 2398) suggests that a continuous mappable horizon exists in this location. On the east shore of Harold Lake, a few thin, mafic lenses (Photo 2) are intercalated in the felsic to intermediate pyroclastic sequence. The mafic layers which are as much as 0.3 m (1 foot) thick, are composed of amphibole, magnetite, and garnet. Two of these mafic layers appear to be at the same stratigraphic level, and may be laterally continuous over a distance of 760 m (2,500 feet). In the Manitouwadge area, Pye (1957) found that quartz-magnetite iron formation tended to grade into a garnet-amphibole-rich rock; he stated, page 24:

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Photo 1–Felsic tuff-breccia, northwest of Harold Lake. The fragments are dominantly felsic in composition, are rounded to subangular, and are partly obscured by a slightly less felsic matrix. The fragments are stretched parallel to the foliation. Pen is approximately 13 cm (5 inches) long.

As the quartz content of the iron formation decreases, the dark layers increase in importance relative to the light ones, and with the disappearance of the quartz-rich layers, the rock grades into garnet-amphibole- (biotite) schist. The iron formation is not everywhere associated with the schist, but only in a very few places is the schist found without some iron formation.

At the time, Pye (1957) felt that such a mineral assemblage could be produced by metamorphism. The garnet-magnetite mafic lenses at Harold Lake are possibly a form of sedimentary iron formation, but may also be of exhalative origin.

The fragments vary in shape, and are often stretched. The mafic fragments were apparently less competent than the felsic fragments, and are more highly stretched. The elongated fragments are tightly packed, and the rock appears to be similar to sheared flows at two localities: i) near the northern part of Handy Lake, and ii) on the outcrop located at the southern junction of the loop in Highway 599 situated southwest of Grebe Lake. Most of the lapilli-tuff and tuff-breccia fragments are subrounded to subangular, and are approximately elliptical in form. The shape of the fragments is due to a combination of forces including pyroclastic flowage, impact spatter followed by cooling, and adjustment to solidification, and later secondary tectonic forces such as folding.

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Photo 2–Small amphibole-garnet-magnetite lens within intermediate to felsic interbedded tuff-breccia (just below the dark mafic lens), lapilli-tuff (top of photo), and tuff (lower part of photo). The sequence is overlain and underlain by crystal tuffs to the north and south. A small sinistral northeast-trending fault has offset the sequence.

Thin section examination reveals that the fine-grained tuffs and the matrix of the coarser pyroclastic deposits differ only slightly in mineralogy and texture. Textural and compositional differences are, however, widely apparent between the fragments and the supporting matrix in the coarser-grained pyroclastic rocks. The felsic fragments are sharply contrasted from the matrix by differences in mafic content and grain size due to recrystallization. Felsic fragments are composed of an indistinguishable granular mosaic of quartz and feldspar with minor (commonly foliated) biotite. Carbonate, probably an accessory mineral, is randomly concentrated in patches in some of the fragments. Quartz phenocrysts and less commonly, plagioclase phenocrysts, are often observed in the fragments. The more intermediate fragments are fewer in number, and tend to blend into the matrix.

Epiclastic and Pyroclastic Volcanic Deposits

Some of the pyroclastic rocks show evidence of sedimentary processes such as rounding of fragments and bedding; this is substantiated by the presence of mappable interlayered epiclastic sedimentary units within the felsic to intermediate metavolcanic sequence. Pettijohn *et al.* (1973, p.149, 261) grouped these rocks under volcaniclastic rocks (clastic rocks rich in volcanic material), and stated that these rocks can be divided into two types based on mode of deposition:

i) Pyroclastic type: pyroclastic sands that are produced by explosive ejection from volcanic vents;

ii) Epiclastic type: rocks derived by normal erosion from a previously deposited volcanic source.

The first type originated during initial explosive igneous activity, and sedimentary deposition took place during the initial formation of the volcaniclastic deposit. The second type of deposit is formed by subsequent erosion of previously deposited volcanic flows, or pyroclastic rocks, and except for their obvious volcanic provenance, are comparable to the epiclastic rocks classified as metasediments in this report. In the map-area, the sedimentary volcanic deposits differ from rocks classified as metasediments in the following ways:

i) Repetitive bedding in the sedimentary volcanic deposits is only locally developed, and where present is neither extensive or laterally continuous over thousands of metres, but individual bedding units in the metasediments in the area are traceable over long distances;

ii) Pelitic units are generally absent in the sedimentary volcanic sequences;

iii) Bedding planes, where present in the sedimentary volcanic deposit rocks, tend to be diffuse and not sharply defined; and

iv) The beds in volcanic sedimentary deposits are more massive and ungraded than in other sedimentary rocks.

The sedimentary volcanic rocks are distinguished from pyroclastic rocks by the following:

i) The fragments in sedimentary volcanic rocks are well rounded and are often uniform in size range;

ii) The matrix of the sedimentary volcanic deposits is well sorted, and is composed of well-rounded clastic grains; the composition of the matrix also tends to be more uniform, but in pyroclastic rocks the matrix is more heterolithologic.

Sedimentary and pyroclastic rocks overlap because reworked volcanogenic deposits can grade into either true sedimentary or pyroclastic sequences. Some of the rocks in this category may actually be sedimentary in origin, but because of their close spatial relationship with the felsic to intermediate metavolcanics, these rocks have been described under the volcaniclastics.

Locally, in the vicinity of the loop in Highway 599, just south of Grebe Lake, a few thin (5 to 10 cm; 2 to 4 inches), very fine grained tuff beds interrupt the metavolcanic sequence indicating a time lapse between successive coarser pyroclastic deposits. These beds probably are ash fall deposits (Type i), and mark the end of a cycle of formation of pyroclastic rocks. These thin tuff horizons could not be traced along strike due to lack of continuous exposures.

On the western shore of Savant Lake, and at several localities northeast of Harold Lake, the direction of elongation of fragments is, in places, highly discordant to the bedding planes. This discordance could be representative of the trend of the particular unit, the result of local reworking or slumping, or, caused by later tectonic deformation.

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Photo 3–Reworked lapilli-tuff from small lake just west of the quartz-feldspar porphyry sill on the Handy River system leading into the South Arm of Savant Lake. The angular to subrounded fragments are hosted by a volcanic greywacke to sandstone (gritty) appearing matrix. A discordant lens (dike?) of fine-grained tuffaceous sandstone is present towards the right margin of the photo. Pencil is 16.5 cm (6.5 inches) in length.

Between the north end of Handy Lake and the South Arm of Savant Lake, several pyroclastic deposits and tuffaceous metasediments are interlayered with lapilli-tuff and tuff-breccia units. Characteristically, these rocks consists of well-rounded to subangular felsic, lapilli fragments that form a disrupted framework, and are situated in a well-sorted, well-rounded volcanic sandstone matrix (Photo 3). These volcaniclastic rocks form lenses bordering the quartz-feldspar porphyry sill located midway along the Handy River System that drains into the South Arm of Savant Lake. The volcaniclastic lenses are parallel to the trend of the surrounding metavolcanics, and are traceable for 900 to 1200 m (3,000 to 4,000 feet) where they probably pinch out against felsic to intermediate pyroclastic rocks. The more easterly unit is characterized by angular to subrounded cherty (rhyolite) fragments averaging 5 to 7.6 cm (2 to 3 inches) in size set in a gritty matrix. The associated fragments are dominantly felsic in composition. The matrix characteristically weathers buff-brown, is equigranular, composed of subangular to rounded plagioclase grains, and lesser amounts of quartz grains (2 to 3 mm) and lithic fragments. Grain size in the matrix averages 0.3 to 0.5 mm.

A discordant, fine- to medium-grained gritty volcanic sandstone (Map Unit 2s, Map 2398, back pocket) dike (Photo 3) within the more westerly reworked lapilli-tuff unit is exposed on a small island situated just east of the dammed outlet

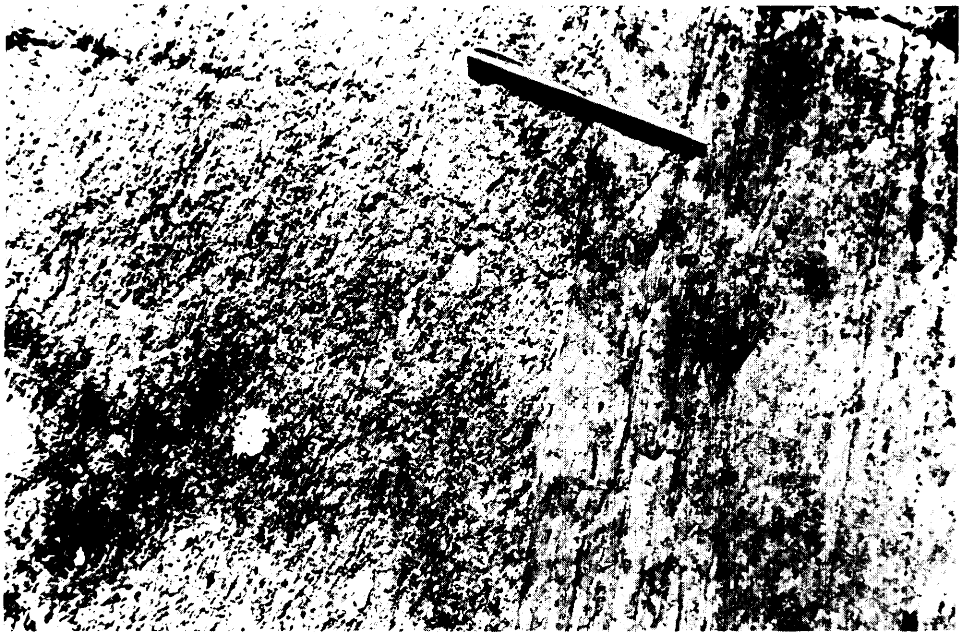

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Photo 4—Fine-grained laminated siltstone deposited on top of reworked lapilli-tuff. Pen is about 14 cm (5.5 inches) in length. From exposure on Highway 599, just south of Grebe Lake.

of Handy Lake. The sandstone dike is similar in texture to the matrix of the associated reworked lapilli-tuff, and also to the matrix of the more easterly unit already described. Field evidence indicates that this volcanic sandstone dike is discontinuous, appears to cut sharply across the trend of the reworked lapilli-tuff, and is similar in nature to the sandstone dikes that are present towards the base of the sedimentary section in Poisson Township (Bond 1977, p.33) to the north of Jutten Township.

The following features such as the lack of sedimentary stratification, the uniformity of the well-rounded, well-sorted, clastic matrix, and the heterogeneous nature of the volcanic fragment population suggest that this lapilli-tuff is a volcanic, pyroclastic deposit (Type i), and is possibly a shallow water deposit.

Lapilli-tuff interlayered with metasediments (Photo 4) just south of the west end of Grebe Lake on Highway 599, is characterized by densely populated fairly well rounded felsic fragments in an intermediate to felsic, gritty tuffaceous matrix. At this location, several of these pyroclastic units each averaging 0.9 to 1.5 m (3 to 5 feet) thick are interlayered with interbedded fine-grained metasiltstone and metamorphosed iron formation. The well-rounded fragments and close proximity of these reworked lapilli-tuff units to true metasediments suggest that they have been eroded from a nearby source area, and deposited along with the sediments as a Type ii volcaniclastic deposit. The lack of stratification and grading in these units indicate that they have not been transported too far.

Between the two metasedimentary units in the southwest corner of Conant Township, a siliceous, tuffaceous, appearing unit that is about 270 m (900 feet) thick is exposed. Bedding is generally absent, but where observed, is not at all obvious. The bedding, where present, averages 2.5 to 7.6 cm (1 to 3 inches) thick. This unit of locally reworked felsic tuff is aphanitic to fine-grained and massive; exposures weather white-grey to light brown, and exhibit grey to dark grey fresh surfaces. The overall discontinuous nature of the bedding in this unit suggests that it is a reworked tuff.

Lahar

West and southwest of the mafic intrusive stock at Staunton Lake, a massive lahar (MacDonald 1972) is exposed. Slumping of a previously consolidated volcanic sequence, which is the accepted way lahars are formed, is regarded by the author as a process of reworking similar to the Type ii volcaniclastic deposits. The lahar deposit (Photo 5) is best exposed on a small, flat-lying outcrop situated on the east side of Highway 599 midway along the length of Staunton Lake and on the shoreline of the small peninsula jutting out of the east shore of Staunton Lake south of the Staunton Lake Stock. Lack of exposure prevented any determination of the true thickness or extent of this deposit. Locally, on the western shore of Hough Lake located just west of the west boundary of Conant Township, the pyroclastic deposits appear in part similar to, and may be continuous with the lahar on Staunton Lake.

The lahar is characterized by the following:

i) Extremely poor sorting;

ii) Equally abundant rounded and subangular fragments in which the long axis of the fragments are completely randomly oriented (Photo 5);

iii) An assortment of fragments in order of decreasing abundance: felsic to intermediate metavolcanics, rare mafic volcanic and rare distinct green (epidotic) siliceous fragments;

iv) A highly variable, but abundant volume of matrix material (Photo 5).

The green siliceous fragments, 2.5 to 5 cm (1 to 2 inches) in size, although rare (1 or 2 per outcrop), are always present, and are characteristic of this particular lahar. If the lahar is trending sub-parallel to the nearby east-trending lithologic trends, then the limited exposure indicates it may be up to 1070 m (3,500 feet) thick. The coarsest fragments up to 0.8 m (2.5 feet) in size are exposed on the eastern shore of Staunton Lake where they also achieve their greatest abundance (Photo 5). Northwards from there, at the exposure on Highway 599, a dramatic increase in volume of matrix accompanied by a decrease in size and abundance of the fragments (Photo 5) occurs. The matrix is completely devoid of any sedimentary structures, is massive, and locally contains crystal fragments in a tuffaceous-like matrix. Randomly oriented amphibole crystals are present in the matrix, and are the result of thermal metamorphism related to the nearby mafic intrusive stock.

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Photo 5–Lahar on southeast peninsula of Staunton Lake just south of mafic intrusive stock. The fragments which are ill-sorted, hetrogeneous in character, randomly suspended and angular to subrounded, are supported in a massive tuffaceous matrix. Pen is about 12 cm (4.7 inches) long.

The large fragments could possibly be ejecta from a volcanic vent, but the lack of stratification, the compositional variation shown by the fragments, and the lack of spiral (rotated) forms that are so typical of hot magma projectiles, indicate that this interpretation is incorrect. The poor sorting and the massive nature of the matrix are more indicative of a lahar (MacDonald 1972, p.171). The increase in concentration and size of the fragments in the south, possibly caused by initial gravity settling and subsequent displacement of the water saturated matrix, may indicate that the tops are to the north. If so, this facing direction is compatible with the other structural data which indicated that the felsic to intermediate metavolcanics form part of a north-facing anticline.

MacDonald (1972, p.171, 178) listed several possible causes of a volcanic mudflow or lahar formation, but eventually concluded (p.178):

> By far the commonest cause of subaerial mudflows during the last century of scientific observation has been simply heavy rain on the flank of the volcano.

Fine- to Medium-Grained Massive Flows and Porphyritic Flows

The felsic to intermediate metavolcanic flows are difficult to distinguish from fine-grained tuffaceous rocks in hand specimen and in thin section. The flows often contain plagioclase phenocrysts, and appear similar to the porphyritic subvolcanic intrusive rocks discussed later in the report, except that the matrix of the flows is generally fine-grained, almost aphanitic, and is fairly well foliated. Also, quartz phenocrysts tend to be fairly abundant in the subvolcanic intrusive rocks, but are only rarely observed in the porphyritic flows where they are often a conspicuous irridescent blue. Some of the flows near Handy Lake are spatially associated with the porphyritic subvolcanic intrusive rocks, and may be extrusive equivalents.

Fine- to medium-grained, andesitic to dacitic flows are intercalated with andesitic to dacitic pyroclastic rocks north-northeast of Handy Lake, but poor exposure has prevented delimiting them elsewhere. A porphyritic intermediate to dacitic flow with pink-weathering (hematitized) randomly oriented, plagioclase feldspar laths (average 2 to 3 mm) occurs south of the Handy River System (Map Code 2db, Map 2398, back pocket) which drains eastward into the South Arm of Savant Lake. The dimensions of this unit are not known, although it seems to be exposed for about 900 m (3,000 feet) in a northerly direction. The rock weathers grey-green, and is grey to dark grey on the fresh surface. Subhedral to euhedral plagioclase grains are extensively sericitized, partly recrystallized, and tend to blend into the matrix. Foliation is pervasive, and envelops feldspar. Pressure shadows formed near plagioclase grains are marked by distinctly coarser textures and lower biotite content relative to the nearby matrix. The matrix is composed of microcrystalline quartz and plagioclase, carbonate, sericite, and biotite. Up to 5 percent disseminated magnetite is also characteristic of this unit. Locally, coarse grains of plagioclase are fragmented; this feature, as well as inhomogeneities in the texture and composition of the matrix, indicate that this rock may be partly pyroclastic in origin.

The most noteable flows outcrop east of the Grebe Lake Pluton, and appear to be siliceous (a sample analysed for SiO_2 by the Mineral Research Branch, Division of Mines returned 71.9 percent SiO_2). This unit is extremely massive, weathers creamy white, and contains evenly distributed, sparse, randomly oriented plagioclase laths up to 2.5 mm in length. The plagioclase phenocrysts are subhedral, slightly sericitized, uniform in size (1 to 1.5 mm) and exhibit pericline twinning. The matrix is very fine grained, and is composed of a uniform, equigranular mozaic of quartz and albite with 5 to 10 percent biotite. Rare, subhedral plagioclase (albite) microlites in the matrix suggest that the rock is crystalline. Although no flow contacts were found in the field, this massive unit (map code 2m,n,a, Map 2398, back pocket), which appears to be about 600 m (2,000 feet) thick, is probably composed of multiple flow units which originated from the same source of magma. A peculiar flow breccia texture noted within this unit, (Map Unit 2k, Map 2398, back pocket) occurs near the east contact of the Grebe Lake Pluton. This outcrop is characterized by angular to subrounded porphyritic flow fragments set in a matrix with a similar composition. Fragments vary in size from several cm to large blocks of indeterminate size, are homogeneous in composition, and are haphazardly arranged. The structure that the fragments present is unique in the area because many of the fragments have bound-

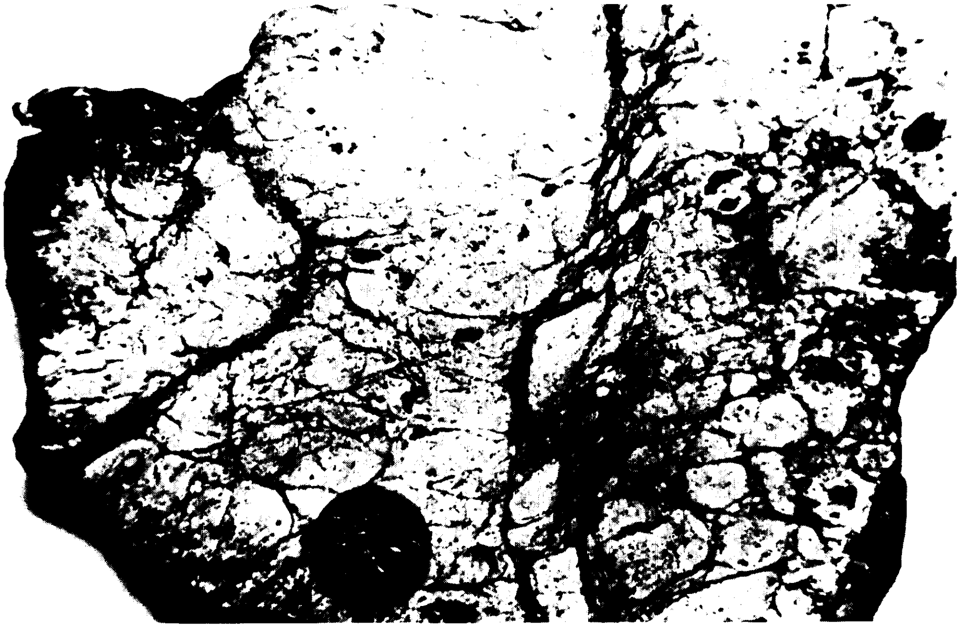

Photo 6–Brecciated felsic flow from exposure just east of Grebe Lake Pluton, note the left-hand part which appears to be a large fractured fragment, but on the right the fragments, although disrupted, appear to relate to one another.

aries which match the form of the boundaries of adjacent fragments but are separated by a small amount of matrix (Photo 6). Some of the large fragments exhibit internal fracture patterns which do not contain matrix material. These features suggest that the fragments have formed through *in situ* breakdown of larger blocks which could result from the following:

i) Disruption of the initially solidified outer crust of a flowing magma, either by the tectonic forces involved during flowage, or by the sudden explosive action of volatiles steaming up through the thin solidified cover of a flow;

ii) Collapse of a partly solidified dome or vent of a volcano.

It is interesting that the brecciated part of the massive flow is roughly equidimensional, about 92.9 m^2 (1,000 square feet) in area, and could well be the source vent for the rest of this massive porphyritic felsic flow. The lack of any alignment of the fragments and the random texture of the brecciation make it highly improbable that this feature is caused by the later intrusion of the nearby Grebe Lake Pluton.

Porphyritic flows containing 10 to 15 percent quartz and feldspar phenocrysts occur in the centre of Conant Township just south of the small lake situated approximately 1.6 km (1 mile) south of Conant Lake. There, the amount of quartz phenocrysts is approximately equal to that of the feldspar phenocrysts;

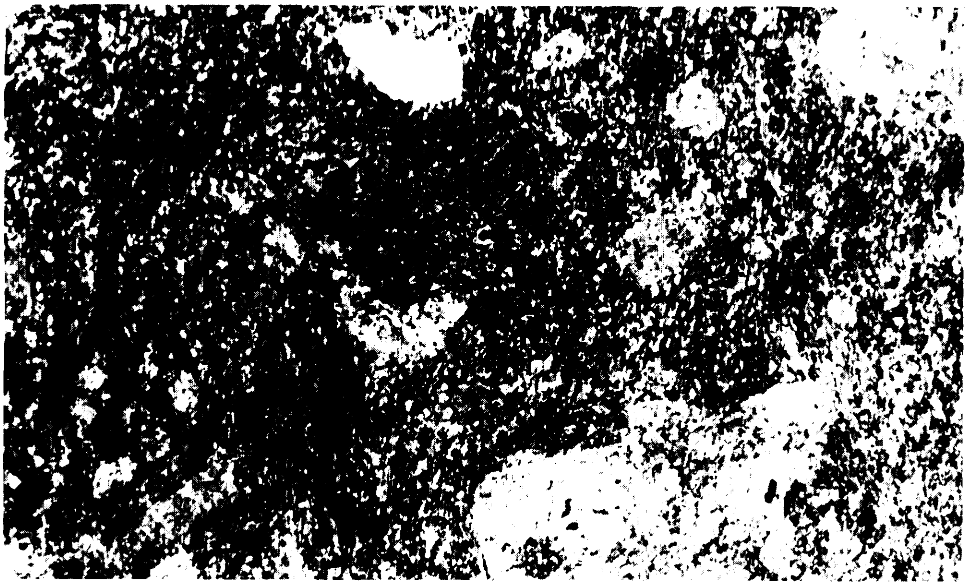

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Photo 7–Photomicrograph of felsic to intermediate porphyritic flow. The plagioclase crystals are altered and tend to blend into the recrystallized matrix, but quartz has remained relatively unaffected by the metamorphism. The light grey quartz crystal at the top of the photomicrograph is 1.1 mm in length. Crossed Nicols. Field of view approximately 8 mm wide.

the ratio of these two components does not vary greatly. Felsic to intermediate porphyritic flows containing mainly quartz phenocrysts form a lens just north of Harold Lake that extends northward to Handy Lake. This lens may be stratigraphically the equivalent of a lens of porphyritic subvolcanic intrusive rocks which strike the length of Handy Lake. The quartz phenocrysts are irridescent blue, and set in a siliceous, aphanitic, pink matrix and form from 5 to 10 percent by volume of the rock.

North-northeast of Harold Lake, between the South Arm of Savant Lake and Handy Lake, the felsic to intermediate metavolcanic flows contain sparsely distributed quartz and feldspar phenocrysts forming from 1 to 3 percent of the rock. No fragments were observed in the field, or in thin section. Thin section examination reveals that these rocks are highly recrystallized. The plagioclase phenocrysts are anhedral to euhedral, locally fractured, and exhibit some twinning (mostly the albite or pericline laws). Zoning in the feldspars is rare. Sericitic alteration commonly affects the plagioclase phenocrysts, and many are almost indistinguishable from the matrix (Photo 7). On the other hand, the quartz crystals are visually rounded, are slightly polygonized along the margins, and are generally unaltered. The quartz phenocrysts often attain sizes up to 4 or 5 mm.

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Photo 8–Photomicrograph of embayed rounded quartz crystal in recrystallized intermediate to felsic porphyritic flow situated 760 m (2,500 feet) east of the fork in the southern part of Handy Lake. The large embayed quartz crystal is approximately 2 mm in diameter. Crossed Nicols.

Many of the quartz crystals are embayed by the matrix. This may be caused by resorption which occurred when the magma moved along fractures during primary erruptive activity (Photo 8).

Intermediate Metavolcanics with Mafic Clots

Conspicuous mafic clots range in size from a few cm up to 4 or 5 m (13.1 or 16.4 feet) in length, and are present in the felsic to intermediate metavolcanics in the extreme southwest corner of Conant Township. These mafic clots do not appear to be simply mafic fragments. They vary in amount forming 10 to 70 percent by volume of the exposures. The clots are composed of varying amounts of hornblende, actinolite, and biotite. The clots form small pods and lenses that are generally aligned subparallel to the trend of the felsic intermediate metavolcanic unit. Locally the mafic minerals do not form discrete, sharply defined masses, but instead form diffuse concentrations that grade with a decline in the amount of mafic minerals into the host intermediate metavolcanics. Vague banding, probably indicating the presence of original bedding is present, but most of the unit appears to be composed of intermediate flows or tuff deposits. Quartz veins commonly cut the mafic-rich zones. The origin of the clots is not entirely understood by the author, but these possibilities exist:

i) The clots could be hydrothermal segregations having developed as a consequence of the quartz veining. The heat involved during the injection of the quartz-rich fluids would probably not be sufficient to cause reconstitution of the mafic mineral component of the host intermediate metavolcanics;

ii) The clots could be metamorphic in origin, the mafic minerals having segregated out. There appears to be no accompanying leucocratic mineral segregation associated with these mafic accumulations, although the latter could have been remobilized out of the intermediate metavolcanic unit. In this case, the quartz veins may in fact represent some of the remobilized leucocratic material;

iii) The intermediate metavolcanics with mafic clots could be the result of the mixing of two compositionally different andesite and basalt magmas.

The author does not know the exact origin of the mafic clots. Subsequent mapping (Bond 1974) of this unit to the southwest indicates that a combination of all three possibilites existed.

Summary

The intermediate to felsic metavolcanic sequence to the west of the South Arm of Savant Lake is composed predominantly of felsic to intermediate pyroclastic rocks and less abundant fine- to medium-grained flows of similar composition. Eruption of mafic flows has locally interrupted the felsic to intermediate volcanism. The intermediate to felsic pyroclastic deposits have been locally reworked during pauses in the volcanic activity. At two separate intervals this activity has ceased long enough to allow the accumulation of significant amounts of sedimentary material.

The wide diversity in composition of the numerous volcanic units and the presence of interlayered metasedimentary units in the metavolcanic sequence to the west of the Savant Lake Fault, indicate that the diversity is typical of an "upper" volcanic cycle in the standard Archean volcanic sequence. Owing to their opposing structural styles, it is not known if this "upper" volcanic sequence is genetically related to the lower volcanic sequence, the intermediate to mafic metavolcanic (Jutten) sequence east of the South Arm of Savant Lake. More recent mapping by Trowell (personal communication, 1975) in the Sturgeon Lake area indicates that this "upper" volcanic sequence is continuous with an east-facing metavolcanic sequence situated west of Sturgeon Lake, south of the present map-area.

Metasediments

Metasediments are found in three different associations in the map-area:

i) Exposed along the east shore of the South Arm of Savant Lake, coarse clastic and fine-grained arenaceous and ferruginous metasediments appear to unconformably overlie the "Jutten" metavolcanics;

ii) The accumulation of the dominantly pyroclastic sequence west of the South Arm of Savant Lake has been significantly interrupted at least twice by deposition of substantial volumes of sediments that form conformable interlayered sequences;

iii) North of the felsic to intermediate metavolcanics, a thick sequence of metasediments is found in northern Conant and Jutten Townships, and these rocks are part of the main metasedimentary belt exposed in western Poisson Township and the southern part of McCubbin Township as delineated by Bond (1972a, b).

The relationship between the felsic to intermediate metavolcanics and the neighbouring metasediments to the north remains obscure, but appears to be a conformable one in northeast Conant Township.

All the metasediments (Table 2) were formerly classified with the felsic to intermediate and intermediate to mafic metavolcanics in the "Savant Group" by Moore (1928) which essentially included (Moore 1928, p.56) "all rocks older than the granitic intrusives". Rittenhouse (1936) subdivided all of the metasediments from the felsic to intermediate metavolcanics (Handy Lake Volcanics), and termed them the "Savant Series". He did not include the metasediments interlayered within the felsic to intermediate metavolcanics (association ii above) which were grouped with the "Handy Lake Volcanics". Skinner (1969) revised the classification further and combined the metasediments and the "Handy Lake Volcanics" under the heading originally used by Moore (1928) excluding the intermediate to mafic metavolcanics. In the present survey, the metasediments have been subdivided into conglomeratic, ferruginous, and arenaceous metasediments.

In general, where ferruginous and arenaceous metasediments are associated together, a relatively consistent sequence of clastic sedimentary rocks overlain by ferruginous metasediments seems to occur throughout the map-area.

CONGLOMERATIC METASEDIMENTS

Metaconglomerate has long been recognized as the most distinctive unit in the map-area, and was accurately delineated by all of the previous workers (Moore 1928; Rittenhouse 1936; and Skinner 1969). Exposed along, or near the entire eastern shore of the South Arm of Savant Lake for a distance of 9.6 km (6 miles), the metaconglomerate lies unconformably on top of the mafic metavolcanics that underlie most of the northern part of Jutten Township. Evidence for the unconformity lies mainly in the discordance (up to 35°) observed between the trend of the metaconglomerate and the trend of the pillowed flows in the underlying mafic to intermediate "Jutten" metavolcanics. Field mapping showed the metaconglomerate to be divisible into two distinct parts based on the composition of the clasts as follows:

i) Polymictic conglomerate with granitoid clasts (Map Unit 3b, Map 2398, back pocket) equivalent to the lower conglomerate of Rittenhouse (1936); and

ii) Polymictic volcanic conglomerate with rounded volcanic clasts (Map Unit 3a, Map 2398, back pocket) equivalent to the upper conglomerate of (Rittenhouse 1936).

The relationship of the two subdivisions is best revealed on the south shore of the entrance into Stillar Bay where the granitoid conglomerate appears to underlie the volcanic conglomerate. There, the contact is abrupt and marked by shearing, but north of Stillar Bay, and in the southern reaches of the South Arm of Savant Lake, the contact appears to be gradational. The nature and relation of the two conglomerates was first documented by Rittenhouse (1936) who termed them the upper and lower conglomerate members (map units 3b and 3a respectively Map 2398, back pocket).

The conglomerate achieves its greatest thickness on the south shoreline of the entrance into Stillar Bay where the lower conglomerate is approximately 200 m (700 feet) thick, and the upper conglomerate is 400 m (1,300 feet) thick for a total of 600 m (2,000 feet). Southward from Stillar Bay, the unit thins, gradually at first, but rapidly near Jutten Lake, until it is terminated by faulting. Its abrupt termination north of Stillar Bay can also probably be attributed to faulting.

The best exposure of the polymictic conglomerate with granitoid clasts in the Savant Lake area is on the south shore of the entrance to Stillar Bay. It is similar to the polymictic conglomerate with the granitoid clasts noted to occur in McCubbin and Poisson Townships (Bond 1972a, b). Besides the granitoid clasts, in order of decreasing abundance, the metaconglomerate is visually estimated to be populated by felsic volcanic, mafic volcanic, and intermediate volcanic, porphyritic felsic volcanic, quartzose to cherty, and medium-grained dioritic to gabbroic clasts which are present in a distinctly green (chloritic) matrix. On the east shore of the South Arm of Savant Lake, just south of Stillar Bay, bedding, marked by lack of coarse clasts, (Photo 9) is sub-parallel to the trend of the conglomerate. These clasts are poorly sorted, have a variable lithology, and form 50 to 60 percent by volume of the rock.

Two, texturally distinct granitoid clast types are present at the exposure south of the entrance into Stillar Bay. Coarse-grained, partly porphyritic trondhjemitic clasts are present as well as less abundant finer grained, equigranular trondhjemitic clasts. In this location, most of the granitoid clasts appear to have retained their primary, well-rounded form, through subsequent regional deformation and metamorphism (Photo 9). Funk (1973, p.32) who studied this conglomerate, found the coarser grained granitoid clasts to be most abundant near the base of the conclomerate, but this distribution is not apparent to the author. The clasts range from 15 cm (6 inches) up to a maximum of 0.6 m (2 feet) in largest diameter, and average about 25 cm (10 inches). The largest of the granitoid clasts are present on the exposure at the entrance to Stillar Bay; the size of these granitoid clasts and some of the other clast types diminishes gradually to the south. The coarse-grained granitoid boulders are composed essentially of plagioclase, quartz, and minor ferromagnesium minerals. Plagioclase (albite-oligoclase) forms subhedral laths up to 5 or 6 mm in length that are moderately altered to sericite and epidote. Quartz is anhedral to locally euhedral; on the weathered surface, it is distinctive because it weathers higher than the plagioclase. Anomalous blue chlorite and muscovite form interlocking masses which have partly replaced biotite. Secondary carbonate is locally present. Funk (1973), also found the mineralogy of the granitoid clasts to essentially consist of quartz, plagioclase,

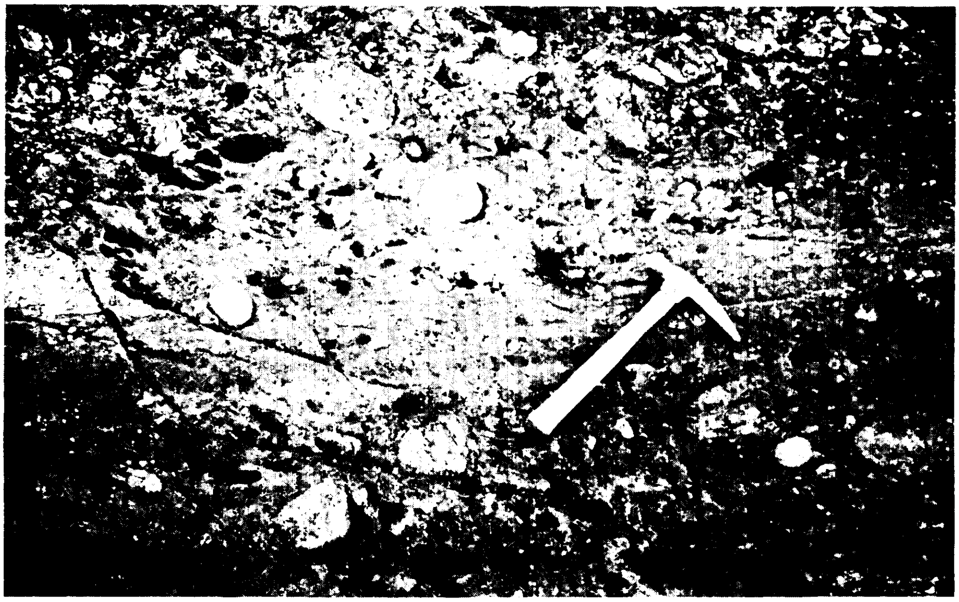

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Photo 9–Crude bedding in lower conglomerate unit with well-rounded granitoid clasts. East shore of the South Arm of Savant Lake, just south of the entrance into Stillar Bay.

and chlorite, but noted some variation in their relative proportions. As presented in Table 4, Funk (1973) found the quartz to vary volumetrically from 26.2 to 41.2 percent, and the associated plagioclase to vary from 48.0 to 59.8 percent. The granitoid clasts are distinctive, and stand in relief above the matrix. They constitute from 30 to 50 percent of the total population of clasts.

Felsic volcanic fragments in the polymictic conglomerate with granitoid clasts are also fairly well rounded; they range from 1.3 cm (½ inch) up to 0.6 m (1.5 feet) in size, and average 10 cm (4 inches). The felsic volcanic clasts are generally fine grained, and are extensively recrystallized. Mafic to intermediate clasts are typically green and weather lower than or flush with the matrix. Least competent of all the clasts, these clasts are commonly highly stretched and wrap around the more competent felsic clasts. Near Jutten Lake, where even the granitoid clasts are stretched and exhibit length to width ratios of up to 4:1, some of the mafic clasts were noted to be elongated with length to width ratios of as much as 20:1. Less common are smaller cobbles of diorite and gabbro, cherty- to quartz-rich clasts and, fine-grained quartz porphyry (felsic volcanic rock) clasts. Each of the felsic and mafic to intermediate volcanic clasts forms about 20 percent of the total clast population.

The matrix of the lower conglomerate is green, whereas the upper conglomerate matrix is grey. Grain size of the matrix averages about 1 mm. The matrix is greywacke-like in texture with coarse, subangular to subrounded quartz

TABLE 4 MODAL ANALYSES OF GRANITOID CLASTS FROM CONGLOMERATE EXPOSURE ON SOUTH SHORE OF ENTRANCE INTO STILLAR BAY. FROM FUNK (1973, APPENDIX I).

Sample Number	A-4	A-8	A-10	A-12	C-2	C-6
Quartz	29.8	41.2	32.2	35.0	39.8	26.2
Plagioclase	56.0	50.0	59.8	48.0	55.4	59.8
Biotite	0.6	Tr	0.6	0.4	—	—
Muscovite	—	2.2	—	2.6	—	—
Chlorite	11.6	4.6	1.4	11.2	3.0	7.6
Epidote	1.6	0.4	Tr	1.0	—	0.8
Zoisite	Tr	—	6.2	0.4	0.8	1.6
Zircon	Tr	—	—	0.4	0.2	1.2
Sphene	0.2	0.4	—	0.4	0.2	0.4
Opaque	0.2	—	Tr	—	0.2	0.6
Carbonate	Tr	0.6	Tr	0.6	0.4	1.2
Total	100.0	99.4	100.2	100.0	100.0	99.4

"A Series" — medium-grained trondhjemite clasts from the upper part of the conglomerate.
"C Series" — coarse-grained trondhjemite clasts from the lower part of the conglomerate.

and feldspar grains set in a granular matrix of quartz, feldspar, and rock fragments with associated biotite and chlorite.

Polymictic volcanic conglomerate (Map Unit 3a, Map 2398, back pocket) is similar to the granitoid boulder-bearing metaconglomerate, except that it lacks the granitoid clasts. The clasts contained in the volcanic conglomerate are similar in lithology and abundance, but on the whole, average slightly smaller in grain size than those of the lower conglomerate. Quartz-rich clasts, although still not abundant, are more numerous as are the felsic volcanic clasts in the volcanic conglomerate. The cherty clasts vary from 2.5 to 20 cm (1 to 8 inches), and are often quite dark relative to what appears to be ghost quartz. The density of clasts varies with some zones, 0.37 to 0.46 m^2 (4 to 5 square feet) in size, being sparsely populated to having almost no clasts.

FERRUGINOUS AND ARENACEOUS METASEDIMENTS

For field mapping, the finer grained metasediments were subdivided into two categories: i) arenaceous metasediments, and ii) ferruginous metasediments with interbedded iron formation, arenaceous metasediments, and magnetite-bearing arenaceous metasediments. Metasediments were classified into the latter category on the basis of the presence or absence of iron formation. These two types form easily mappable units (see Map 2398, back pocket). The presence of iron formation in the Savant Lake area was noted at the beginning of the twentieth century and was first documented by Moore (1910). Rittenhouse (1936) delineated the iron formation-bearing metasediments quite accurately in the metasedimentary sequence in the northern parts of Conant and Jutten Townships, but several thin metasedimentary bands which had not previously been delineated within the felsic to intermediate metavolcanic sequence were located during the present mapping program. The ferruginous and arenaceous metasediments form stratigraphic units that are located as follows:

i) A unit deposited with apparent concordance on top of the metaconglomerate which is exposed along up the east shore of the South Arm of Savant Lake;

ii) A unit interbedded with felsic to intermediate tuffaceous rocks in southwest Conant Township;

iii) A unit interbedded with felsic to intermediate tuffaceous rocks just south of Grebe Lake;

iv) Units exposed in the northern part of Conant Township and the northwest corner of Jutten Township are part of the main metasedimentary sequence underlying part of McCubbin and Poisson Townships (Bond 1972a,b) directly to the north.

If the intermediate to felsic metavolcanic sequence is a simple anticlinal structure as suggested by the few top determinations, then, stratigraphically, the age of the metasediments decreases from unit (ii) to unit (iv). The relationship of the metasediments (unit i) deposited on top of the conglomerate to the other three units is not known, because the relationship of the two contrasting metavolcanic sequences east and west of the South Arm of Savant Lake is not known. If the metasediments of unit (i) stratigraphically overlie the conglomerate which caps the mafic to intermediate metavolcanic sequence east of the South Arm of Savant Lake, then unit (i) metasediments may be the oldest ferruginous and arenaceous metasediments in the map-area.

The metasediments are composed mainly of interbedded greywacke, siltstone to mudstone, cherty (felsic tuffaceous) metasediments, tuffaceous metasediments including reworked pyroclastic deposits, and iron formation. The iron formation is oxide facies, and composed of thinly laminated chert and magnetite horizons. The majority of the metasediments are regularly bedded and average 2.5 to 6.4 cm (1 to 4 inches) in thickness.

Unit (i)

The metasediments east of the South Arm of Savant Lake have a maximum thickness of 260 m (850 feet). These metasediments thin southwards to about a thickness of 60 m (200 feet). To the north the metasediments are only exposed on one or two islands north of the "John Donner" property, but probably continue northward as far as "The Narrows". Most of these metasediments are fine- to medium-grained greywackes interbedded with less abundant siltstone. The bedding thickness averages 1.25 to 5 cm (½ to 2 inches) thick. The beds are massive, appear to be ungraded, and exhibit few, if any, minor sedimentary structures. These sediments appear to lie conformably on top of the conglomerate, and their depositional history is probably similar to that of the conglomerate. The mineralogy of the metasediments commonly consists of quartz, albite, biotite, sericite/muscovite, epidote, and magnetite; locally the relative percentages of some of these minerals vary and feldspathic, quartzose, and biotite-rich layers are present. Disseminated (5 to 10 percent) magnetite is present throughout the arenaceous part of the metasediments; magnetite also forms thin concentrated layers. The magnetite ranges from 0.05 to 0.07 mm in grain size. Tiny quartz-carbonate veinlets cut the bedding in the metasediments at a high angle.

Unit (ii)

Metasediments in the southwest part of Conant Township average about 600 to 760 m (2,000 to 2,500 feet) in thickness. This metasedimentary unit is folded, and is faulted. West of Highway 599 this unit of metasediments is characterized by arenaceous metasediments, and by iron formation-bearing metasediments. The latter appear to be truncated by faulting to the east, and do not reappear in the southern limb of the fold except possibly in places indicated by locally encountered magnetic anomalies. The metasediments in this area are well bedded, and average 2.5 to 5 cm (1 to 2 inches) in thickness. Most of the beds appear to be massive and ungraded, but crude grain gradation is observed in one or two localities in this unit, and in its west extension (Bond 1974). This grading indicates that the sequence faces north, and that the arenaceous metasediments are overlain by the iron formation-bearing metasediments. In the southern extension of these metasediments near the southern boundary of Conant Township, the arenaceous metasediments are separated by a layer of reworked felsic tuffs (described previously under "Epiclastic and Pyroclastic Volcanic Deposits"). The two marginal sedimentary sequences are similar to those described from the northwest extension of these metasediments, except that they are more highly metamorphosed.

The metasediments in unit (ii) are visually estimated to be composed of 50 to 60 percent plagioclase, 20 to 30 percent quartz with the remainder being composed of biotite, epidote, muscovite, sericite, and carbonate, and in the ferruginous varieties, magnetite. Most of the sediments are fine- to medium-grained, well bedded, greywackes to subgreywackes as defined by Pettijohn *et al* (1973). Rock fragments, rarely observed, are not easily distinguished from the matrix. In thin section, biotite is generally crudely foliated in greywacke, but is often found to form randomly oriented clots adhering to magnetite grains. The clots themselves are crudely foliated. Biotite is also found along fracture cleavage planes that cut the bedding planes at a high angle. Locally, biotite and sericite are randomly oriented.

Near the southern boundary of Conant Township, these metasediments are recrystallized to lower amphibolite facies assemblages, and the major mineral assemblage is plagioclase (oligoclase), quartz, biotite, and muscovite. Hornblende is sparsely distributed in the rock. Near the margin of the medium- to coarse-grained mafic flow in south-central Conant Township, the metasediments are revealed to be weakly gneissose in thin section, biotite tends to be concentrated into diffuse bands. In the field, the gneissic structure is highly contorted and its trend could not be indicated on the map (Map 2398, back pocket). This gneissic structure may have resulted from the intrusion of the nearby granitic rocks, or may also be the result of mixing of mafic tuffs, or the mafic flow unit and the sedimentary material.

Unit (iii)

Just south of Grebe Lake, a metasedimentary unit extends eastward from the northwest boundary of Conant Township to within 900 m (3,000 feet) of the South Arm of Savant Lake, then curves southward and pinches out just south of the Handy River System. The ferruginous metasedimentary segment of this unit disappears east of Staunton Lake, and this is probably because of a facies change.

In several places magnetic anomalies located south of the Handy River System are on strike with this metasedimentary unit. These anomalies suggest that magnetite-rich facies stratigraphically equivalent to these metasediments may extend southward all the way to Harold Lake. South of Grebe Lake, the metasediments in this unit are composed of finely bedded to laminated siltstone to mudstone and lesser volumes of fine-grained arkosic greywacke which are commonly interbedded with reworked pyroclastic rocks (Photo 4). The siltstone is very delicately laminated, and in places shows crude crossbedding. In Photo 10, finely interlaminated to interbedded siltstone and iron formation are interrupted by a lensoid, concordant tongue of coarser grained, partly crossbedded, greywacke. The delicate laminations of most of these metasediments near Highway 599 imply that they accumulated under quiet conditions well below wave base. Further east, the metasediments of this band are still finely bedded with bedding averaging 2.5 to 3.8 cm (1 to 1.5 inches).

Unit (iv)

In the northwest corner of Conant Township the metasediments are poorly exposed, and their relationship to the felsic to intermediate metavolcanic sequence to the south is obscure. The companies who have worked in this area previously (The Algoma Steel Corporation Limited and Pershland Gold Mines Limited, see Bond 1977, p.60-66) have indicated, on the basis of magnetic surveys, that the proportion of iron formation-bearing metasediments is much smaller in volume than is shown by Map 2398 (back pocket). The iron formation present in most exposures in this area is quite low relative to the area embraced by high magnetic anomalies to the northwest, and which is outlined by company data (Files 63.909 and 63A.529 *in* Assessment Files Research Office, Division of Mines, Toronto). The iron formation appears to form an isoclinally folded syncline which plunges steeply to the west-northwest. The highest concentration of iron formation lies to the north of Conant Township, and is described in a magnetometer survey by Pershland Gold Mines Limited given in Bond (1977, p.62). Most of the iron formation observed in northwest Conant Township is thinly bedded, discontinuous owing to facies change, and estimated to constitute from 2 to 10 percent of the exposures with the remainder consisting of buff-brown weathering, fine-grained greywacke, and lesser amounts of siltstone. Some of the greywacke beds have a spotted appearance in the field because of randomly oriented poikiloblastic biotite crystals and aggregates that average 0.2 mm in diameter. These biotite crystals occur in a subgreywacke estimated to consist of approximately 40 to 55 percent plagioclase and 30 to 35 percent quartz. The biotite

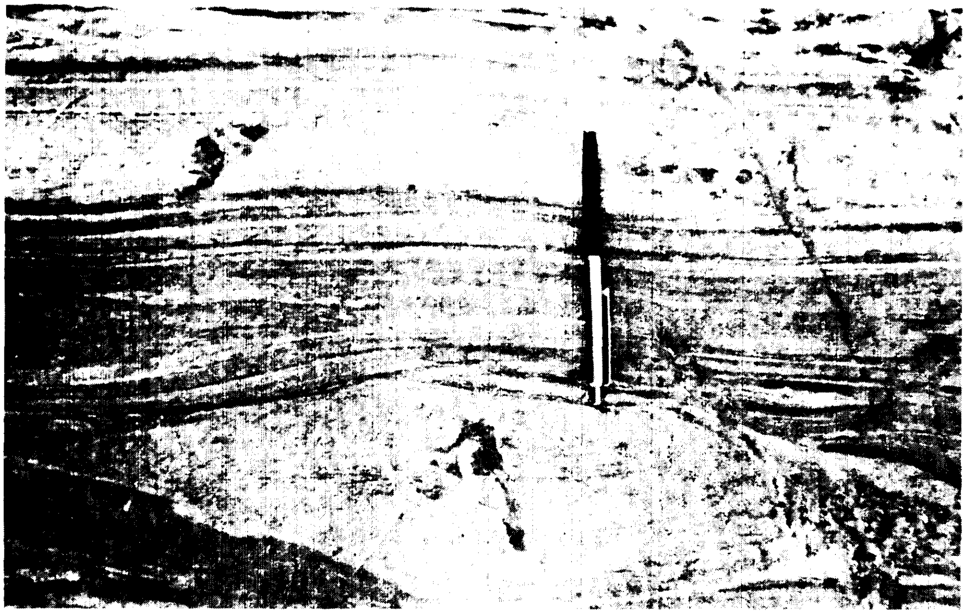

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Photo 10–Thinly interbedded siltstone (light coloured) and iron formation (dark). The augen-like structure is composed of coarse-grained greywacke and represents the end view of a small channelway in the finer grained interbedded iron formation and siltstone. From the exposure on the east side of Highway 599, in the metasedimentary unit 300 m (1,000 feet) south of the southwest end of Grebe Lake. Pen is about 13 cm (5 inches) in length. Tops are to the top of the photograph.

is crudely to randomly oriented, and is a result of a thermal metamorphic overprinting on the regional metamorphism. The biotite poikiloblasts occur in the arenaceous metasediments which outcrop south of the folded ferruginous metasediments approximately 2.4 km (1.5 miles) directly west of the western extension of the Grebe Lake Pluton. Biotite was not detected within the metasedimentary unit just south of Grebe Lake, and the origin of the poikiloblastic biotite at such a distance from the Grebe Lake Pluton remains unknown.

North of the tourist lodge in northeastern Conant Township, the metasediments are composed of interbedded, massive fine-grained greywackes and siliceous siltstone to mudstone. The greywackes weather light grey, while the latter, more siliceous variety, weather creamy white. Both types are regularly interbedded 2.5 to 5.0 cm (1 to 2 inches), are very fine grained, and are similar to the metasediments in the vicinity of Snowbird Lake to the north described by Bond (1977, p.32). The siliceous siltstone beds appear to be similar in composition to the felsic flow unit in the felsic to intermediate metavolcanic sequence to the south; this suggests the latter was derived from the former.

The metasediments underlying the peninsula separating the tourist lodge and the forest fire control tower just west of The Narrows in Jutten Township weather light green and bedding averages 2.5 to 7.6 cm (1 to 3 inches) in thickness. Many of the beds in the vicinity of the small lake within the peninsula are contorted, and in this area, it is difficult to determine the true trend of the metasediments. Most of the beds are massive and fine-grained, but local grain gradations do give some top directions that indicate the metasediments have been isoclinally folded about a north-south axis. The areas of contorted metasediments are near this fold axis.

Summary

The metasediments generally tend to be thinly bedded 2.5 to 7.5 cm (1 to 3 inches) thick, massive, and ungraded. The lack of current formed structures in most of these metasediments suggests they were deposited well below wave base. The presence of the two metasedimentary marker horizons within the felsic to intermediate metavolcanics indicates that the felsic volcanism diminished, or was quiescent during two intervals to allow the accumulation of clastics.

Metamorphosed Mafic Intrusive Rocks

Mafic intrusive rocks form a few small sills within the metasedimentary sequence in the northeastern corner of Conant Township, a few minor dikes within the felsic to intermediate metavolcanics in the northeastern corner of Conant Township, and a stock in the centre of Conant Township at Staunton Lake. The contacts of the sills and dikes in northeast Conant Township are not exposed, and the interpretation of these rocks as being intrusive is tentative.

STAUNTON LAKE STOCK

The Staunton Lake Stock appears to be composed of two separate bodies with a smaller, satellite offshoot from the main stock at Staunton Lake occurring on the northeast shore of Conant Lake. This smaller satellite body may also be a faulted off segment of the main mafic intrusive body. The main part of the stock at Staunton Lake is circular to lensoidal, and like the small satellite body at Conant Lake, is predominantly concordant with the surrounding felsic to intermediate metavolcanic hosts. The western boundary of the main part of the stock is discordant with the trend of the host rocks. Numerous inclusions of intermediate lapilli-tuff and tuff-breccia are common along the western margin of the stock at Staunton Lake, and testify to its intrusive origin. The stock is essentially a diorite in composition with both biotite and biotite-hornblende phases being developed; gabbroic and rare leucocratic dioritic phases are present. Texturally, these rocks are similar to the coarser phases of the mafic extrusive rocks associated with the mafic metavolcanics.

The dioritic to gabbroic rocks are massive to locally weakly foliated and are generally of medium-grain size. Grain size does vary in places; patches of both fine- and coarse-grained varieties are visible on many of the exposures. The rocks weather light grey to dark grey and are light to dark grey, to dark green on the fresh surface. Biotite is the dominant ferromagnesian phase developed. Secondary hornblende-bearing phases are randomly distributed throughout the stock. The percentage of hornblende to biotite varies randomly. These two minerals are hard to distinguish in the field partly because of their fine grain size and the hornblende-bearing phase may be more abundant than indicated. Gabbro is more uniform in its distribution than diorite and forms a layer approximately 300 m (1,000 feet) thick along the southern margin of the stock. Gabbro was distinguished from the diorite in the field on the basis of mafic content. Rocks containing greater than 40 percent combined biotite and hornblende were classified as gabbro. Diorite phases are composed of 20 to 40 percent combined mafic minerals. The diorite and gabbro vary in texture with distinct amphibole forming equant crystals (0.5 mm in thin section) supported in a brownish white matrix composed of granular plagioclase, epidote, and clinozoisite. Locally, a leucocratic diorite phase (less than 20 percent combined mafic mineralogy) forms irregular-shaped pods within the stock.

Plagioclase forms anhedral to subhedral grains (2 to 5 mm) that are equant to lath shaped. The plagioclase is generally sodic andesine (An_{34}) and forms 50 to 60 percent of the diorite and 40 to 50 percent of the gabbro. Some of the plagioclase has retained its albite and pericline twins, but most grains are clouded by a sericitic and granular epidote alteration; a few appear to be vaguely zoned. Deformation fractures with accompanying granulation and/or influx of finer grained (recrystallized) feldspathic material are present. The margins of many of the coarser grains of plagioclase are irregular, and are not sharply defined against the more finely recrystallized mafic-rich surrounding material. Biotite is present as tabular crystals that commonly form composite patches, and single thin prismatic crystals that are often concentrated into "aggregated trains", especially along shear planes. Biotite is aligned along parallel planes to produce a weak foliation in the rock. The green-brown to olive green biotite is crudely aligned in most of the examined thin sections. With an increase in hornblende content the percentage of biotite declines. Amphibole is present as anhedral crystals (2 to 3 mm) of poikiloblastic hornblende. These grains are both subparallel to, and cut across the foliation trend of the biotite. Some of the amphibole is mottled, and is partly uralitized. In the more hornblende-rich varieties, the amphibole forms randomly oriented radiating aggregates, and stubby prismatic, locally poikilitic crystals that are pleochroic from light yellow-green to green-blue. The amphibole in the hornblende phases can form from 40 to 90 percent of the mafic minerals. Quartz, where present, is a minor constituent (up to 5 percent by volume of the rock), is interstitial, and occurs as small granular patches that may be secondary. In addition, minor chlorite, epidote, apatite, magnetite, and sphene are common accessories. Secondary carbonate in the form of loosely connected patches of calcite grains is prevalent along the margins of the stock, and constitutes up to 5 percent by volume of the rock. Quartz veins, one of which is mineralized with pyrite and minor chalcopyrite, are generally small in stature, and are discontinuous. Pyrite and pyrrhotite are disseminated randomly throughout the stock, but are common in the border zones.

The leucodiorite is composed of approximately 70 percent plagioclase, 20 percent biotite, 5 percent quartz, and accessories.

The relationship of the poikiloblastic amphibole to the biotite implies that this mafic stock has been subjected to at least one metamorphic event. The foliation marked by biotite could represent an intrusive structure or a regional metamorphic feature; a subsequent contact metamorphic event would appear to be responsible for the overprinting of the poikiloblastic amphibole on the weak foliation marked by biotite. The intrusion of the mafic stock produced a contact biotite metamorphic aureole that can be observed on the exposure of the lahar on Highway 599 approximately 670 m (2,200 feet) to the west of the margin of the stock. This metamorphic aureole is not as evident around much of the remainder of the stock.

MAFIC SILLS AND DIKES

A few small mafic sills are interlayered within the metasediments in the extreme northeast corner of Conant Township. These sills appear to be continuous with those observed in the southeast corner of McCubbin Township (Map 2357 in Bond 1977) to the north of Conant Township. No contacts were found in the field, and their classification as sills is somewhat tentative. These rocks are frequently documented in other greenstone belts, and are texturally similar to the medium to coarse-grained metavolcanic flows; it is possible that these sills are extrusive in part. These rocks are generally massive, medium grained, and weather light to dark green to dark grey with dark green fresh surfaces. They form discontinuous concordant sills that average 76 m (250 feet) thick, and are traceable for only a few hundred feet. These mafic intrusive rocks are gabbroic in composition, consisting of roughly equal proportions of amphibole and plagioclase.

A few fine- to medium-grained gabbroic dikes intrude the felsic to intermediate metavolcanics just east of the Grebe Lake Stock. These dikes are similar in composition and texture to the gabbroic sills described above.

Felsic Intrusive Rocks

Felsic intrusive rocks were subdivided into: i) massive felsic intrusive rocks; and ii) metamorphosed felsic to intermediate intrusive rocks. This subdivision was based largely on the degree of metamorphic alteration and the overall form of the intrusion. Estimation of the degree of alteration present can be accomplished partly in the field by closely examining the nature and crystal form of the individual crystal boundaries which tend to be more ill-defined and diffuse in the metamophosed felsic to intermediate intrusive rocks. The massive felsic intrusive rocks tend to be more massive in texture while the metamorphosed felsic to intermediate intrusive rocks are commonly foliated. In some cases, these latter intrusions were massive and this relation should not be used as the sole criteria for the identification classification of these rocks. According to Burwash and Krupicka (1969, p.1, and 383), quartz is one of the most easily recrystallized minerals, and if the quartz crystals are large enough, it is possible to tell if they are undeformed, fractured, or recrystallized in hand specimen.

The metamorphosed felsic to intermediate intrusive rocks in the map-area tend to be intruded passively, forming sheet-like bodies such as at Conant Lake, that are concordant to the trend of the host rocks. These early "granitic intrusive rocks" also tend to be impoverished in potassium feldspar in comparison to the later massive intrusive rocks. Crystal boundaries tend to be poorly defined on the weathered surface. Metamorphosed felsic to intermediate intrusive rocks generally display a foliation. East of the South Arm of Savant Lake, these earlier felsic intrusive rocks form a mass of batholithic size.

The massive felsic intrusive rocks compared with the earlier group, form round, nearly equidimensional plugs that are generally small in area (less than 25.89 km^2 or 10 square miles). These rocks are massive, unmetamorphosed, are compositionally richer in potassic feldspar and have been generally forcefully intruded along zones of weakness, such as contacts between major lithological units causing the surrounding lithologies to be deflected around them.

METAMORPHOSED FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Handy Lake Porphyritic Sills

Intercalated with the felsic to intermediate metavolcanics near Handy Lake west of the South Arm of Savant Lake are metamorphosed felsic to intermediate rocks characterized by the presence of quartz and/or feldspar phenocrysts. These porphyritic rocks occur primarily as large masses or sill-like layers, and less commonly as narrow sills that are locally observed within the host rocks near the large masses. The porphyritic rocks are associated with granitic intrusive rocks in the vicinity of Conant Lake. East of Conant Lake, toward Handy Lake, and especially between Handy Lake and the South Arm of Savant Lake, they become progressively finer grained, and are more extrusive in appearance.

In the field, the porphyritic intrusive rocks appear similar to intermediate to felsic crystal tuffs and porphyritic flows. The porphyritic intrusive rocks are distinguished by their more massive nature. In general, the density of concentration and crystal size of the phenocrysts within the intrusive porphyritic rocks is more variable than in the extrusive crystal tuffs and porphyritic flows. Crystal tuffs generally have a greater concentration of crystals and crystal fragments (40 percent by volume) whereas porphyritic flows generally have a much lower concentration of phenocrysts (approximately 15 percent by volume). The porphyritic intrusive rocks have a phenocryst population that averages approximately 20 to 30 percent by volume of the rock. Most of these rocks weather pure white to light grey to light green-white, but grey, buff-brown and pink tones are locally observed. The matrix is typically grey to dark grey on the fresh surface; feldspar phenocrysts are generally white to grey, and where feldspar is in abundance, it tends to lighten the colour of the rock on both the fresh surface and the weathered surface. The feldspar phenocrysts are quite evident in many of the samples, while in others the mineral is not nearly so distinct. This is a function of increasing intensity of metamorphism. On the other hand, quartz phenocrysts, although not as abundant a component, are almost always readily distinguishable in hand specimen, especially when it exhibits an irridescent blue colour. Generally, these subvolcanic rocks form massive, relatively featureless exposures.

Although these porphyritic rocks appear at a glance to be uniform in character, they are heterogeneous in texture and grain size. Their dissimilarities arise from:

i) Abundant changes in size of phenocryst components over single exposures;

ii) The phenocrysts are commonly fractured and the amount of fracturing is variable over single exposures;

iii) Abundant changes in the concentration and abundance of the phenocrysts in single exposures;

iv) Change in grain size of the matrix (aphanitic to fine grained), and in the ratio of volume of matrix to volume taken up by the phenocryst population;

v) Variation in ratio of types of phenocryst (quartz versus feldspar) present;

vi) Changes in weathering properties largely in response to variations in the intensity of alteration.

Based on the above criteria, several types or varieties of porphyritic subvolcanic rocks were noted in the field. Some of these types can be assigned crude spatial limits, but most warrant further investigation before being accurately defined. Some of these probably represent separate, compositionally different intrusive phases, but they are all probably genetically related with their respective differences resulting from differences in their cooling history or depth of the observed eroded surface. This is supported by their close proximal association to one another, and by the fact that many appear to grade into one another the gradation being in most cases over tens of feet.

Most workers have placed some importance on the degree of crystallinity and grain size exhibited by the matrix in determining whether these subvolcanic rocks are intrusive or extrusive in origin. Most of the porphyritic rocks to the west and north of Handy Lake have a fine- to medium-grained matrix that appears to be more crystalline in character than the majority of the porphyritic appearing rocks northeast of Handy Lake. The latter mentioned rocks are characterized by an aphanitic to fine-grained matrix which appears to be extrusive in character. The coarser matrix characteristic of these subvolcanics to the west of Handy Lake may be a function of metamorphic recrystallization.

Typical Quartz-Feldspar Porphyry Phase

West of Handy Lake, most of the subvolcanic rocks contain from 10 to 60 percent quartz and/or feldspar phenocrysts which form on average 30 percent of the rock. These characteristic components weather from flush with the matrix, or 0.2 to 0.32 cm ($^1/_{16}$ to ⅛ inches), above the matrix, and are distinctive in the field. The feldspar component is nearly always greater in quantity than the quartz component, and the ratio of the two is estimated to average about 3:1.

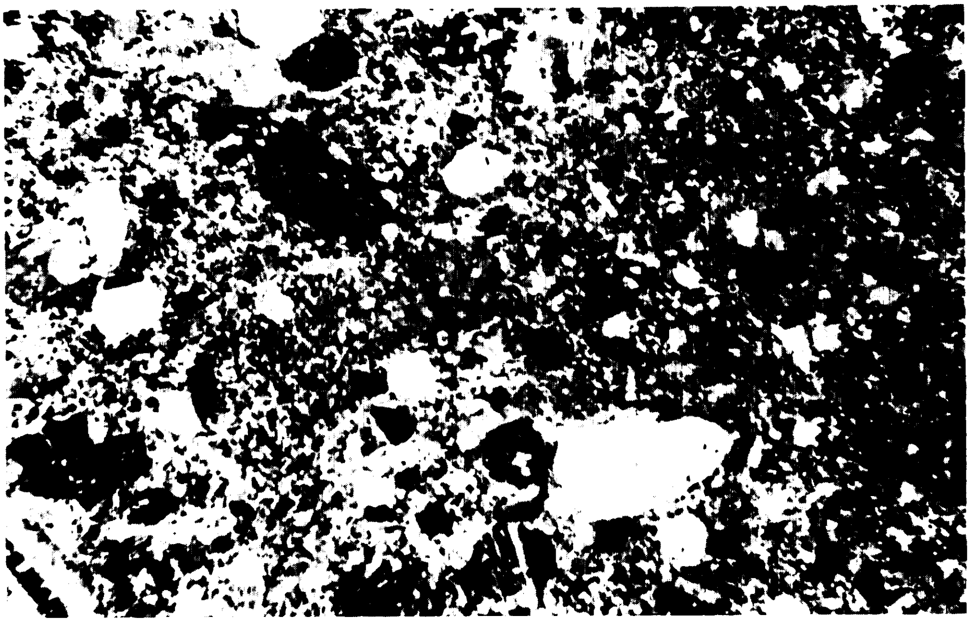

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Photo 11–Photomicrograph of metamorphosed felsic to intermediate porphyritic intrusive rock with quartz and feldspar phenocrysts. From exposure on southwest shore of Conant Lake.

Thin section examination of the porphyritic rocks near Conant Lake reveals that the feldspars are generally subrounded to rounded, locally fractured with subordinate, subangular, subhedral to euhedral forms (Photo 11). The feldspar is randomly oriented plagioclase (albite), although locally rare potassium feldspar is present. Quartz commonly forms rounded, single anhedral forms up to 3.0 mm, but a few are subangular. The quartz is strained, generally free of inclusions, and is not polygonized or recrystallized. A few are fractured; granulation in places accompanies the fracturing and also occurs along some of the margins of the phenocrysts. The matrix is typically composed of granular albitic plagioclase and quartz. Sericite, biotite, epidote, carbonate, and locally accessory magnetite and sphene form the matrix. Sericite occurs as randomly oriented crystals that are often concentrated into masses, but are also concentrated along fractures. Biotite is variable in abundance, but often forms a crude foliation that, because of its fine grain size, is visible only in thin sections. Near Handy Lake biotite is concentrated into discontinuous "trains" of crystals along a fracture cleavage that generally intersects the above foliation at an angle. This fracture cleavage is locally evident in the field. Carbonate is locally abundant, and forms isolated patches.

Approximately 1100 m (3,600 feet) north of the junction where Handy Lake splits into two arms in its southern reaches, on the west shore, there are inclusions in the subvolcanic rocks. These inclusions weather lower than their host, and are easily visible on the weathered surface. This unit is exposed for about 15 m (50 feet) but its overall dimensions are not known. In thin sections, the inclusions are composed of mainly sericitic muscovite, lesser amounts of biotite, granular quartz, plagioclase (albite), and carbonate. The sericite is aligned parallel to the trend of the fragments, while the biotite is randomly oriented transverse to this direction. Other more felsic inclusions composed of granular quartz and feldspar, and are distinctly poorer in biotite in relation to the host porphyritic rocks. A few of these more siliceous inclusions also contain coarse, porphyritic quartz and/or feldspar anhedral crystals. The matrix is similar to the subvolcanic rocks discussed above, except that quartz is more abundant than the feldspar. The quartz is anhedral to subhedral; euhedral forms are rare, and ranges in size from 0.1 mm to 1.5 mm. The feldspar is mainly composed of anhedral plagioclase that is locally fractured; it tends to be more altered than the other subvolcanic rocks, and blends into the matrix. Fragmented feldspars are slightly more prevalent in the matrix than the other subvolcanic rocks. The matrix is a mosaic of quartzofeldspathic granules with patches of epidote and carbonate. Sericite and more often biotite are generally aligned parallel to each other.

Coarse-Grained Feldspar Porphyry Phase

Coarse-grained feldspar porphyry is found locally at the following places:

i) On the northwest shore of Handy Lake;

ii) Within the subvolcanic mass immediately south of Conant Lake;

iii) Near the north shore of Conant Lake just west of the outlet from Staunton Lake.

The dimensions and trends of these units can only be approximated due to lack of exposure, but appear to be in the order of 30 to 90 m (100 to 300 feet) thick. The most extensive coarse-grained unit is located 76 m (250 feet) west of the South Arm of Savant Lake; it is about 90 m (300 feet) wide and extends for at least 900 m (3,000 feet). Quartz phenocrysts, although present in these rocks, form only a minor (5 percent) component. The feldspars which range from 1 or 2 mm up to 2 cm (0.8 inch), are mainly albitic plagioclase; potassic feldspars are found locally associated in the subvolcanic intrusive phases near the south shore of the first small lake adjoining the western part of Conant Lake. Most of the feldspars tend to form subhedral to euhedral crystals suspended in a quartzofeldspathic matrix; a few of the feldspar phenocrysts are fragmented. The volume of the intervening matrix material of the feldspar porphyries varies from 60 percent of the rock in the phase near the north shore of Conant Lake, to 5 percent of the rock in the feldspar porphyry phase on the northwest shore of Handy Lake.

Porphyritic Sills

Near Handy Lake, sills that are similar in texture to the subvolcanic rocks are observed. Their extent is limited partly by lack of exposure, but they tend to be less than 15 m (50 feet) in width, and can be traced for a maximum of 300 m

(1,000 feet). The intrusive origin of these sills is not certain because no contacts were observed in the field.

A felsic porphyritic rock occurs on the east shore of the South Arm of Savant Lake, and directly opposite the outlet of the Handy River system. Because of its anomalous association with mafic lavas and pillow lavas, this unit is thought to be intrusive. In the field, the rock weathers white, and contains quartz crystals in an aphanitic matrix. Feldspar crystals are present, but are only evident in thin section because of a lack of contrast between them and the surrounding matrix. The feldspars are generally euhedral, up to 3.5 mm in size, and exhibit complex oscillatory zoning (Photo 12), a feature which was never observed in any of the other subvolcanic rocks. Sericite is concentrated around the margins of the crystals and may be a late hydrothermal product. The quartz is subhedral, locally angular, up to 2 mm in size, and is markedly strained. The matrix is composed of a recrystallized mosaic of quartz, feldspar, sericite, biotite, carbonate, and epidote. Zircon and sphene are accessories.

Summary

The general aphanitic to fine-grained nature of the matrix suggests that these rocks may be partly extrusive. The form of the fragmented and rounded phenocrysts could have been accomplished by the explosive forces present during pyroclastic accumulation, or could also be related to the interaction of crystals within the motion of a volcanic flow or a subvolcanic intrusion. However, the association of these subvolcanic rocks with other granitic intrusions near Conant Lake, the lack of bedding features or alignment of feldspars due to possible extrusive flow, their overall massive relatively homogeneous nature, the presence of mostly euhedral crystal forms and minor inclusions, all indicate these rocks are intrusive in origin.

Jutten Batholith

The area south of the mafic metavolcanic sequence in northern Jutten and Smye Townships and the area south of the quartz monzonite stock in northwestern Smye Township has been intruded by early granitic rocks herein termed the Jutten Batholith. These rocks range in composition from trondhjemite near the margin of the granitic intrusive in Jutten Township to granodiorite and quartz monzonite further to the southeast. In the field, this change in composition is gradual, and is generally not readily apparent from the weathering properties of these rocks. Except for the change in composition, the intrusive appears to be fairly homogeneous, medium grained, white to whitish pink, and commonly displays a foliation. The contacts of the various granitic phases were not sharply defined, and as a result their relative age relationships of the units are not known.

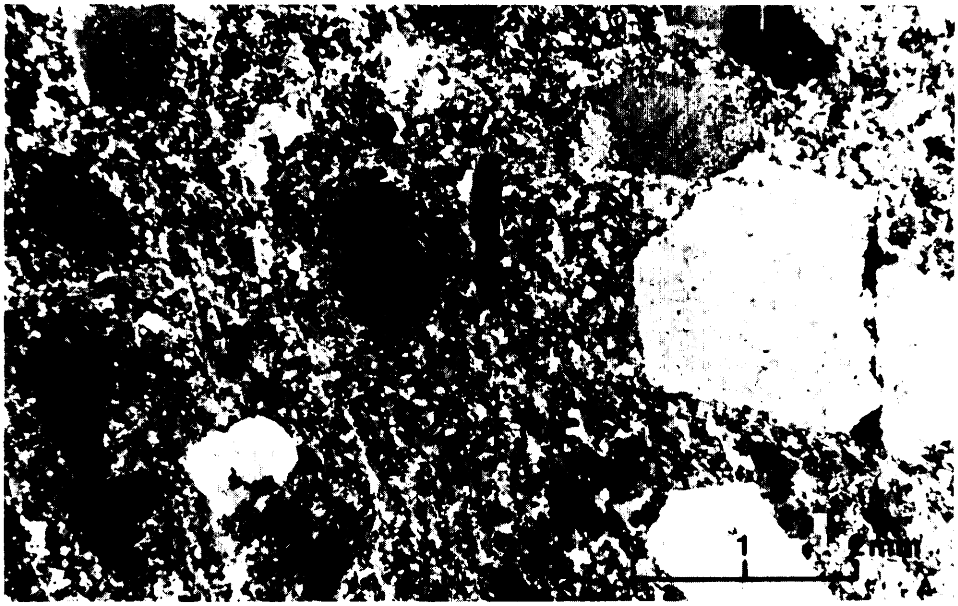

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Photo 12–Photomicrograph of quartz-feldspar porphyry intrusive showing zoning in feldspar phenocryst near right margin of photo. From exposure on the east shore of the South Arm of Savant Lake near the west central boundary of Jutten Township. Crossed-Nicols, field of view is approximately 8 mm.

Biotite Trondhjemite

In Jutten Township, the mafic metavolcanics are intruded by a medium- to locally coarse-grained white-weathering, trondhjemite. Biotite forms clots 6.35 to 12.7 mm (¼ to ½ inch) in length that are aligned and impart a distinct foliation to this rock. The margin of the trondhjemitic intrusion is further marked by the presence of 3 to 5 percent iridescent blue quartz crystals that locally form crystal aggregates. The biotite clots, and blue quartz are the most distinctive properties of this trondhjemite. Besides the blue quartz, there is also grey quartz visible in the hand specimen. On the fresh surface the rock is grey. Shearing is locally found as sinuous shear planes near the margin of the granitic body, but is most prevalent in the exposures located on the west shore of Jutten Lake just south of the portage into the South Arm of Savant Lake in southeast Conant Township. Several of the early mappers (Moore 1928, and Rittenhouse 1926) interpreted this exposure to be conglomerate. The confusion arises from the presence of sinuous shear planes several cm wide along which granulation has occurred. Adjacent to these fine-grained shear zones, which are nearly concordant to the nearby contact, are medium-grained massive, more competent parts giving an overall conglomeratic appearance to the exposure. Several small mafic metavolcanic inclusions are also present, and these add to the overall confusion. The contact between the trondhjemite and the metavolcanics to the north is approximately concordant to the contacts of the pillowed and massive flow units, and is fairly sharp, straight, and dips steeply to the north. A few aplite dikes and sills occur in the adjacent metavolcanics near the centre of Jutten Township, but there are no extensive apophyses of granitic material extending into the country rocks. The foliation is also subparallel to the contact of the granitic intrusive.

A visual estimate of the one thin section observed, showed the trondhjemite to be composed of about 50 percent plagioclase, 20 to 30 percent quartz, and 15 percent biotite with chlorite, muscovite, carbonate, magnetite, sphene, minor zircon, and minor rutile constituting the remainder. Plagioclase occurs as subhedral to anhedral lath-shaped crystals up to 5 mm in length. Most are twinned, but the twinning is strained and complicated by the fact that many crystals appear to have oscillatory zoning. Most of the plagioclase crystals are slightly altered to sericite. Quartz occurs as anhedral, interstitial grains that are fractured; the quartz is polygonized along the margins and along the fractures, but generally is not extensively recrystallized. There were no inclusions observed in the quartz and the origin of the iridescent blue quartz that is visible in hand specimen is not known. Biotite forms anhedral plates and locally contains sagenitic inclusions of a mineral that is probably rutile. The remainder of the rock is a recrystallized matrix (15 percent of the rock) composed of a mosaic of mostly quartz, plagioclase, biotite, magnetite, sphene, minor chlorite, and minor apatite.

Thin section examination reveals that the pink aplite dikes in the adjacent mafic metavolcanics are composed of quartz and feldspar. Anomalous blue-birefringent chlorite aggregates form clots and constitute about 5 percent of the rock. Near the contact of the aplite dike, chlorite is more abundant.

South and east of the white biotite trondhjemite a steady increase in the potassic feldspar content takes place in the granitic batholith. Most of the rocks south of an arbitrary line joining Smye Lake and Jutten Lake are quartz monzonitic to locally granodioritic in composition; north of this line the rocks are granodioritic in composition. Except for a very small decrease in grain size to the south, the rocks generally appear very similar in texture, and are not easily distinguished in the field.

Biotite Granodiorite, Hornblende-Biotite Granodiorite, Porphyritic Granodiorite

Most of these rocks weather white to locally pink with grey fresh surfaces, and appear similar to the trondhjemite. Parts of the granodiorite, noteably in the area just west of the west arm of Smye Lake, are hornblende-bearing. On the east shore of the long lake situated about 0.8 km (½ mile) west of Smye Lake, there are several mafic lenses which give the rock a banded appearance. The bands (several cm wide) are discontinuous, and are concordant to the foliation in the surrounding rocks. The contacts of the individual bands are diffuse suggesting the bands may be partly assimilated, mafic inclusions possibly related to the mafic metavolcanics.

Pink porphyritic granodiorite with microcline phenocrysts occupies a large area to the east of Smye Lake. The phenocrysts average 1.3 cm (½ inch) in size towards the north part of this porphyritic phase. Near the contact with the mafic metavolcanics in the eastern part of Smye Township, the microcline phenocrysts are augen-shaped and enveloped by a fairly strong foliation.

One exposure of fine- to medium-grained quartz diorite was found 600 m (2,000 feet) north of Smye Lake at the south end of the lineament situated between Silver Lake and Smye Lake.

Thin section examination of three rock specimens reveals that the medium-grained granodiorite consists of 40 to 50 percent subhedral plagioclase, 25 to 30 percent anhedral quartz, 5 to 15 percent interstitial microcline, and 5 percent biotite with sphene, magnetite, epidote, sericite-muscovite and epidote as accessory minerals.

The plagioclase generally forms subhedral, equant to lath-shaped crystals that are often conspicuous in hand specimen. Albite twinning has largely been obliterated by metamorphism and sericitic alteration. Nearly half of the plagioclase crystals examined in thin section show a complex zoning revealed by selective sericitic alteration. Several of the crystals are granulated along the margins. Quartz is nearly always polygonized, and is an interstitial mineral. Microcline is subhedral to anhedral, and is also interstitial. Microcline is undeformed, and occurs as plates that commonly contain euhedral to subhedral laths of plagioclase. Discontinuous string- to flame-like perthite textures are commonly developed originating near the margins of the crystals. Biotite with minor associated muscovite is present as subhedral crystals; inclusions of quartz and epidote are common along the cleavage planes of the biotite. One of the samples taken approximately 600 m (2,000 feet) north of the west arm of Smye Lake contained a few crystals of monazite 1 mm in size. In thin section, monazite is characteristically metamict, colourless, biaxial with a low 2V angle, and has high relief. Fractures radiating away from the monazite crystal are present in the surrounding minerals. The metamict nature of the crystal and the radiating fractures indicate that it is radioactive.

Biotite Quartz Monzonite to Granodiorite

Pink biotite quartz monzonite to granodiorite outcrops in the southeast part of Jutten Township, and in the southern part of Smye Township. The rock is foliated, fine to medium grained, and biotitic. In thin section, it is similar to the previously mentioned granodiorite, except there is a greater percentage (15 to 25 percent) of interstitial microcline feldspar. Sphene is a common accessory mineral and forms euhedral crystals. Quartz is polygonized but no granulation occurs along the boundaries of the individual polygonal units.

Conant Lake Intrusion

An intrusive sill of granodiorite to trondhjemite is split into two parts by, and closely associated with, the Handy Lake Porphyritic Sills. The more southern arm is about 760 m (2,500 feet) wide, and appears to terminate abruptly, although exposure is very poor to the east of Conant Lake. The intrusive varies in composition from trondhjemite to granodiorite. In the field, the rock is light grey on both the weathered surface and the fresh surface, and varies from fine to medium grained. The rock is generally massive to locally weakly foliated, especially in the southern part, but, partly because of the fine grain size, foliation is generally not readily apparent in the field. The texture and composition of this intrusive rock vary considerably. Generally, the rock is equigranular and trondhjemitic south of Conant Lake; potassic feldspar is present, but is not abundant (4 to 5 percent). The northern part of the intrusive is weakly porphyritic, characterized by 5 to 10 percent randomly oriented potassic feldspar crystals (2 to 5 mm in length) situated in a matrix averaging 2 to 3 mm in size.

Based on an examination of five thin sections, the south part of the intrusive is estimated to consist of 50 percent plagioclase, 25 to 30 percent quartz, 5 percent microcline, 5 percent biotite, and 3 to 4 percent matrix material including carbonate, quartz, epidote, apatite, zircon, sphene, and opaque minerals. This rock locally appears weakly porphyritic in thin section; plagioclase phenocrysts and, to a lesser degree, quartz crystals 2 to 3 mm in size are situated in a finer grained (0.1 mm) recrystallized matrix. Plagioclase forms subhedral to euhedral, 2 to 3 mm grains that are partly lath-shaped. Plagioclase twinning includes the albite, pericline, and Carlsbad laws, and is only slightly visible because the plagioclase is heavily altered to muscovite and minor amounts of sericite and epidote. Albite twinning in the plagioclase locally shows kink banding. In places the plagioclase has a patchy birefringence caused by: i) growth of secondary albite which is generally free of the muscovite alteration, and ii) replacement by microcline feldspar. Quartz, generally rounded, is subhedral to anhedral to rarely euhedral. It is generally free of inclusions, is only locally fractured, and except for the margins of the individual grains, appears to be primary. The borders of the quartz crystals are generally discontinuously granulated; some of the granulated parts are recrystallized. In the south part of the intrusive, potassic feldspar forms mostly anhedral, interstitial grains in the matrix, but rarely forms euhedral lath-shaped grains. In the north part of the intrusion, the potassic feldspar is more abundant (about 10 percent), and nearly always forms euhedral grains with irregular boundaries that are coarser in texture than the matrix. The microcline invariably shows polysynthetic twinning. Approximately half of the potassic feldspar grains examined in the thin sections appears to contain irregularly distributed patches of plagioclase (albite) material (Photo 13). The contact between the plagioclase and the potassic feldspar in these grains is generally diffuse, suggesting that the latter mentioned feldspar replaced the former. One observed potassic feldspar crystal contained several randomly oriented plagioclase feldspar crystals that seemed to be situated around the same growth plane of the potassic feldspar crystal. The contact between the plagioclase crystals and the potassic feldspar host crystal is sharp, and the former appear to be inclusions. Biotite is the sole mafic mineral present; it forms single subhedral plates that locally aggregate to form clots. The matrix, which generally constitutes 5 to 15

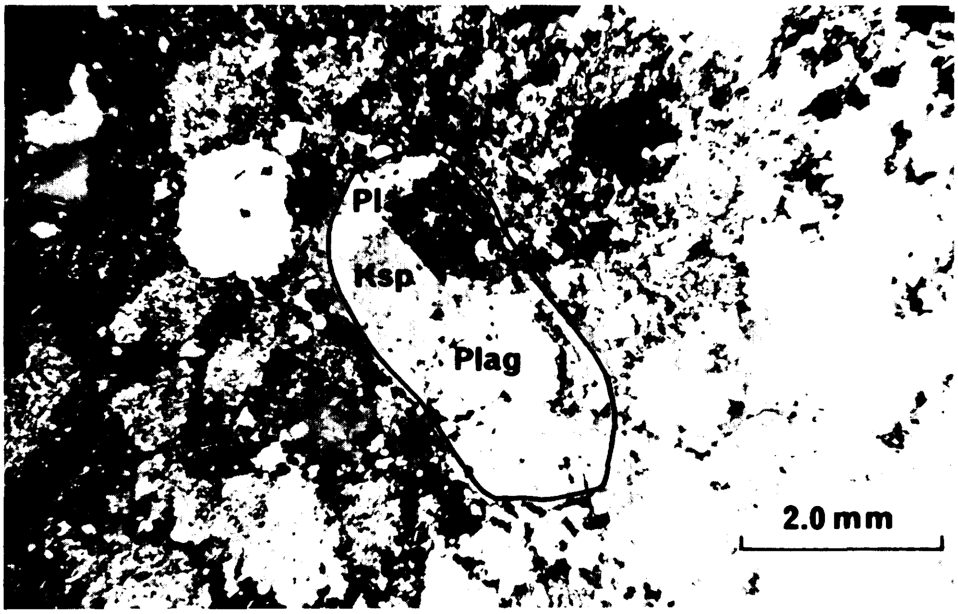

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Photo 13–Photomicrograph of altered, weakly porphyritic trondhjemite-granodiorite from exposure near the contact of the metamorphosed Handy Lake Porphyritic Sills by the first portage north out of Conant Lake to Staunton Lake. The section has been stained for potassic-feldspar, and plagioclase (centre of crystal) has been largely replaced by microcline feldspar (darker part of crystal).

percent of the volume of the rock, is in part derived from the crystallization of the coarser minerals. It consists of a granular quartzofeldspathic mosaic, carbonate, epidote, and minor apatite, zircon, sphene, and opaque minerals. Locally traversing the thin sections there are a few intensely deformed shear planes along which the matrix and coarser mineral components are extensively granulated.

The fracturing of the plagioclase, the presence of local intense shear planes along which mortar textures are commonly developed, and the peripheral granulation of the quartz suggest that this felsic intrusive rock has been physically deformed after crystallization had ceased. Most of the potassic feldspar present is probably a replacement of the plagioclase feldspar, and indicates that potassium metasomatism has been active. The problem of "granitization" or "potassium feldspathization" has been reviewed by various workers (Marmo 1971), but these processes are still disputed. Burwash and Krupicka (1969) believe there is a close relationship and dependence between potassium enrichment and postcrystalline deformation. Whether the potassium has originated from within the intrusive rock and is a late stage phenomenon, or whether it originated from some external source such as the more potassic Grebe Lake Pluton is not known by the author. The potassium enrichment is confined to plagioclase crystals; no evidence of the mobility of potassium, such as along the structurally weaker shear planes, is evident in thin section.

Locally, this intrusive rock looks similar in texture to that of the Handy Lake Porphyritic Sills because the coarse-grained plagioclase and quartz crystals locally appear to be in a finer grained recrystallized matrix. The close spatial relationship and similar trondhjemitic composition of these two intrusive rocks suggest the two may have originated from the same parent magma. The intrusive is essentially trondhjemitic in composition, if the potassic feldspar present has been formed by potassium metasomatism from an external source. Although no field evidence was found to indicate this, the Handy Lake Porphyritic Sills described previously may be a fine-grained marginal and roof phase of the Conant Lake Intrusive.

MASSIVE FELSIC INTRUSIVE ROCKS

Grebe Lake Stock

The Grebe Lake Stock is located in the north-central part of Conant Township. A small part of the stock lies outside the present map-area in McCubbin Township to the north and was mapped by Bond (1972a). The generally circular to elliptical outline of the stock is interrupted by a small lobe jutting out on its southern margin and gives the stock a rotated appearance. The long axis of the stock, measured in an east-southeast direction, is 3 km (2.5 miles) in length, while the axis measured at near right-angles to this, just east of the Marchington River is 3.3 km (2 miles) in length.

The emplacement of the Grebe Lake Stock has taken place along the contact of metasediments to the north and felsic to intermediate metavolcanics to the south. Both of these sequences have been displaced by, and wrap around the intrusion.

In the field, the rock is mainly massive, but foliated parts are locally found near the southeast margin. Weathered surfaces are pink to white with the pink tones reflecting the amount of hematite dust that is associated with the quartz. Contacts are sharply defined with the country rock. Inclusions of intermediate pyroclastic rocks and rarer mafic metavolcanics are common along the border of the stock. Thin pink aplite dikes are also common near the margins of the stock. Granodiorite dikes of the Grebe Lake Stock locally intrude the country rocks. The marginal rocks are slightly finer grained than rocks in the remainder of the stock.

The stock is a granodiorite in composition with locally more silicic, quartz monzonite zones. Plagioclase (An_{27}), quartz, microcline, and biotite constitute the major minerals while epidote, chlorite, sphene, and minor zircon are accessories. Thin section study showed the rock to be only slightly altered. Plagioclase, which weathers white in the field, forms subhedral to euhedral laths up to 4 mm, but averages 2 mm. Although most appear unzoned, a few show oscillatory zoning with the zoning being marked by minor selective sericitic alteration. Albite and pericline twinning are the most common forms of twins observed. The margins of a few of the laths are slightly granulated. Plagioclase forms 30 to 45 percent of the rock, and quartz forms 25 to 35 percent. Quartz is fresh, and lacks inclusions; it is fractured, locally polygonized, and mostly anhedral in habit.

Commonly, quartz forms aggregates up to 6 mm across. A few of the quartz grains appear to be nearly euhedral in form. Microcline constitutes from 10 to 20 percent of the rock, and forms anhedral crystals, interstitial to the plagioclase. Microcline commonly weathers pink, but does weather white. Microcline is often seen growing around, and enclosing smaller quartz and plagioclase crystals. Most of the microcline is slightly perthitic, and is characterized by the typical cross-hatched microcline twinning. Biotite forms broad equant plates some of which are bent; the plates of biotite are up to 2.5 mm across. Biotite locally forms discrete clots that are aligned parallel. In places, it is intergrown with chlorite. Hornblende is also locally present. The total percentage of ferromagnesian minerals varies from 3 to 10 percent, but averages from 5 to 7 percent. A single zone containing hornblende was found to occur on the western shore of Grebe Lake. Granular epidote, euhedral sphene, and zircon are accessory minerals.

Both pink-weathering and white-weathering aplite are associated with the Grebe Lake Stock. Pink aplite forms thin (5 to 15.9 cm) dikes that are most prevalent along and trend perpendicular to the peripheral part of the stock. The pink aplite is leucocratic, composed predominantly of a mosaic of granular quartz and feldspar, the two being largely indistinguishable in thin section.

Along the southern margin of the stock there is a white-weathering leucocratic rock (map code 9e, map 2398, back pocket) that is aphanitic to fine-grained. The fine grain size prevented making any hypothesis about the origin of this unit in the field although layers or inclusions of mafic to intermediate metavolcanics were observed in one exposure. In thin section, this white aplitic rock varies from a weakly porphyritic quartz-feldspar porphyry to an equigranular fine-grained quartz monzonite to granite. The quartz-feldspar porphyry is leucocratic (less than 2 percent biotite), and contains scarce porphyritic zoned plagioclase (2 to 3 mm) and quartz situated in a fine-grained matrix of mostly quartz and feldspar (granular microcline and plagioclase) with accessory epidote, biotite, magnetite, and sphene. The plagioclase phenocrysts are altered and recrystallized; in most cases the margins are not easily distinguished from the matrix. The quartz forms large aggregates in patches that appear to be polygonized, single, euhedral crystals up to 4.0 mm across. Microcline is present in the matrix, but is not as abundant as plagioclase. Both of these minerals are granular and are not easily distinguished from the quartz which is also granular. In other places, this rock is a fine-grained quartz monzonite to granite in composition. Here, it consists of an equigranular mosaic of microcline, quartz, and plagioclase.The first two minerals form anhedral grains, while the latter forms subhedral to anhedral grains. The white aplite is characterized by spectacular symplectic intergrowths of microcline and quartz. According to Spry (1969, p.103) these intergrowths:

> ...result from simultaneous co-nucleation and interdependent growth of the two phases by discontinous precipitation.

The nearly euhedral outline of the quartz crystals and the micrographic intergrowths are similar to the criteria used by Hughes (1971) in postulating an epizonal origin for such rocks. According to Hughes (1971), the euhedral quartz owes its existence to slowly crystallizing, trapped volatiles that could only be retained in high-level intrusions.

Late Felsic Stock in Northwest Smye Township

A massive felsic quartz monzonitic stock has been emplaced between the Jutten Batholith, and the mafic to intermediate metavolcanics that underlie the map-area east of the South Arm of Savant Lake. The centre of the stock is located approximately 2 km (1.2 miles) due south of the portage linking Pride Lake to the southeast bay of Savant Lake. The stock is grossly elliptical to triangular, and extends into the western part of Jutten Township. The margin is smoothly irregular in places. A bulge from the granitic batholith in southern Smye and Jutten Township is shown on the compilation map of the area by Davies *et al.* (1970), and indicates the presence of this granitic stock. The contact of this late stock is sharply defined against the mafic to intermediate metavolcanics to the north, but in the south and southwest where it is in contact with the granitic batholith, the contact is partly gradational over a 300 m (1,000 foot) wide zone possibly due to assimilation of the earlier batholithic felsic intrusive rocks. South from this contact, there is a gradual decrease in quartz content (35 percent to 25 percent) and a concomitant increase in biotite content (5 up to 15 percent) in the felsic plutonic rocks. It is possible that this is an entirely different phase separate from both of the felsic intrusive rocks. The mafic metavolcanics were largely displaced by this intrusion, while the margin of the batholith to the south remained mostly unaffected except for the assimilation.

This intrusive body weathers a vivid orange-pink resulting from the presence of abundant pink-weathering microcline feldspar and hematized quartz. Exposures are medium to locally coarse grained, and quite massive in character. Surfaces of this rock are often pitted in the field due to weathering out of biotite books. The quartz commonly tends to weather high and forms an interconnecting string-like texture. Large inclusions of mafic to intermediate metavolcanics and of the batholithic rocks to the south are fairly common in the southeast part of the stock. Proceeding southwards out of this late stock into the Jutten Batholith, the gradational contact is marked by decrease in quartz content and concomitant increase in the biotite content. In two locations near the centre of the stock, quartz veins and veinlets are abundant and commonly trend from S20°E to S30°E and dip vertically 85° west. The percentage of biotite and quartz varies from 2 to 5 percent throughout the stock. Quartz locally forms blue, irridescent pods, but is generally a smoky grey colour.

In thin section, the rock contains nearly equal proportions of plagioclase, microcline, and quartz. Biotite varies from less than 1 percent up to 8 percent, but averages about 5 percent. This stock differs from the Grebe Lake Stock because it is more leucocratic, contains more quartz, and is richer in potassic feldspar. Plagioclase (oligoclase) varies from 20 percent up to 35 percent in the more potassium-rich rocks. It forms euhedral to subhedral laths that are only a slightly altered to sericite. The laths are mainly twinned after the albite laws; a few appear to be zoned. The twins are commonly bent and cut by cross-cutting microfractures. The margins of the plagioclase crystals are irregular and some of the crystals are quite rounded. Interstitial quartz is estimated to form from 30 to 40 percent of the rock. Quartz is present as aggregates that form patches or connecting lenticular zones as much as 3 cm (1.2 inches) long. The margins of the quartz vary from smoothly curvilinear, to sutured, and are not granulated. Microcline feldspar averages 30 to 35 percent by volume of the rock, but locally in the southwestern flanks of the stock, is concentrated in patches where it forms nearly 50 to 60 percent by volume of the rock. Microcline is slightly perthitic and contains inclusions of plagioclase and quartz. Biotite, minor muscovite, titaniferous magnetite, and minor epidote are accessories. Compositionally, the rock is a quartz monzonite, but near the southwestern flank of the pluton it locally attains the composition of a granite.

Phanerozoic

CENOZOIC

Quaternary

PLEISTOCENE

A fairly thin blanket of Pleistocene deposits covers the bedrock in the map-area. Locally, east of Savant Lake, the Pleistocene deposits are thick. Diamond drilling by several mining companies intersected from 1.2 m (4 feet) to 15 m (50 feet) of overburden, but generally it averages 3 to 6 m (10 to 20 feet) in thickness. Where the bedrock is fairly well exposed, the trend of the underlying lithologies is evident from air photo examination. For the most part, especially west of Savant Lake, the Pleistocene deposits are thick enough to obscure the trend of the underlying lithologic units. The majority of the lakes do conform to the trend of the underlying rocks, although this trend also conforms in part to the direction of the last ice advance.

During Pleistocene time, the map-area was covered by several ice masses, the last being the Wisconsinan Sheet which began retreating between 14,000 and 13,000 years ago (Prest 1970). According to Prest (1970), the margin of the ice had retreated to a position just north of the map-area sometime between 10,600 and 10,300 years ago, and at that time, the map-area was covered by glacial Lake Agassiz. Following this, a minor readvance of the ice front occurred between 10,300 and 10,000 years ago, any evidence for the existence of the previous glacial lake was removed. No varved clays were observed during the present mapping program. Subsequently, from 10,000 to 9,500 years ago, the ice retreated for the last time to reveal the present physiography.

Glacial striae are present on many outcrop exposures, but are mostly prominent on shoreline exposures. They indicate that the last direction of ice movement was S28°W.

Recognizable geomorphological forms resulting from the glaciation are rare in the map-area; much of the present surface relief is featureless. Fluting is locally present west of Highway 599 in the west part of Conant Township. Fluting is marked by adjacent ridges of low relief 3 to 6 m (10 to 20 feet), regularly spaced at approximately 180 m (800 feet) intervals that are conspicuous on air photos by the association of deciduous trees to them. The adjacent, gouged out, flutes are characterized by a much greater proportion of coniferous trees.

RECENT

Redistribution of the Pleistocene deposits is locally evident in the map-area. Sand, silt, gravel deposited locally by streams, and organic mud deposits associated with muskegs, constitute the recent material. Sand and silt deposits generally form beach accumulations along lake shores, and have been concentrated by wave action. Gravel is locally present in higher energy environments such as fast-flowing rivers. Large, wet, partially open muskegs form in only three areas of the map-area, and these are located:

i) West of the south arm of Staunton Lake; in the west-central part of Conant Township;

ii) West of Grebe Lake in northwest Conant Township;

iii) Just northeast of Jutten Lake in south-central Jutten Township.

These muskegs, which are poorly drained, are characterized by thick moss accumulations on top of dark organic muds; black spruce spaced at 1 m to 1.2 m (3 to 4 feet) intervals occur in these recent muskeg deposits.

CORRELATION OF GEOLOGY WITH AEROMAGNETIC DATA

The aeromagnetic expression of the map-area is shown on aeromagnetic maps published jointly by the Ontario Department of Mines and the Geological Survey of Canada in 1961. The maps, which are published at a scale of 1:63,360 (1 inch to 1 mile), are numbered 1119G and 1109G (ODM-GSC 1961a, b).

Some of the magnetic features in the map-area, such as the outline of the Grebe Lake Stock, are masked by the presence of two large anomalous zones of high intensity (up to 80,000 gammas) that reflect the presence of underlying iron formation. The zone bearing the highest magnetic intensity (80,000 gammas) is partly situated in the extreme northwestern corner of Conant Township. The other anomalous zone, which also reflects iron formation, is largely outside the map-area, and is situated north of Jutten Township in Poisson Township (Bond 1972b). The more closely spaced gamma contour interval, as well as the higher maximum intensity value given by the anomalous zone in northwest Conant Township, suggest that the iron formation is of better quality there, and it may be more economic in comparison to that found in Poisson Township. Company work (Bond 1977, p.60-66) and field observations by the author support this interpretation. Several other linear positive anomalous zones in the map-area also reflect the presence of iron formation. The presence of iron formation-bearing metasediments situated between Grebe Lake and Staunton Lake is readily illustrated by the presence of a positive anomalous zone rising approximately 1,000 to 2,000 gammas above a background value of approximately 60,500 gammas. The abrupt termination of the iron formation band in southwest Conant Township south of Conant Lake is also reflected by the abrupt termination of the associated anomalous zone. The presence of the faulted iron formation-bearing metasediments in the extreme south part of the South Arm of Savant Lake in southeast Conant Township is also apparent on the aeromagnetic maps. All of these zones have substantially lower maximum intensities than the two extreme anomalous zones in the north. This is consistent with the diluted nature of this iron formation which is intermixed with substantial amounts of arenaceous metasediments, and forms only about 5 percent by volume of the metasediments.

A positive magnetic anomaly also occurs over the folded, southwest-trending sill-like, coarse-grained, metavolcanic band in south-central Conant Township. The mafic intrusion at Staunton Lake has an associated negative anomaly; generally, gabbroic rocks would be expected to have associated positive anomalies, and the reason for this negative anomaly is not known. Magnetic lows overlie the granitic intrusive rocks at both Conant Lake and Grebe Lake . The metavolcanic-granitic contact in Jutten Township is approximated on the aeromagnetic maps by an abrupt change in spacing of the gamma contour interval, the contour lines being more widely spaced in the felsic plutonic rocks. A magnetic low marks the position of the unmetamorphosed quartz-monzonite stock in northwest Smye Township. Several other lows (as low as 60,300 gammas) are present over the granitic rocks in Smye Township, but there does not seem to be any related change in lithology of the associated rocks. Most of the remainder of southern Smye Township is aeromagnetically featureless.

STRUCTURAL GEOLOGY

Foliation, Schistosity, and Cleavage

The majority of the metavolcanics and metasediments have a prominent secondary foliation arising from the subparallel alignment of amphibole, biotite, or chlorite during regional metamorphism. On plan surface, fragments of pyroclastic rocks, and clasts of conglomerate and pillow lavas are generally elongated parallel to the foliation. Foliation is also well developed in the metamorphosed granitic rocks. The relatively unmetamorphosed granitic stocks in the map-area are generally massive, but locally display a weak foliation which may or may not be primary. Metagabbros and coarse-grained flows are often massive, and are devoid of any foliation.

Schistosity is locally developed on a small scale in places within the metavolcanics; it is intensely developed in three main areas:

i) Along the north shore of Stillar Bay;

ii) Along parts of the eastern and western shores of the South Arm of Savant Lake in Jutten Township;
iii) As an extension of locality (ii) between the extreme southern extension of the South Arm of Savant Lake and Harold Lake in southeast Conant Township.

These areas are distinguished by light shading on the preliminary maps of the area (Bond 1973a, b, c). The most intensely sheared of the above three areas occurs at the first locality. There, the shearing is continuous over a width varying from 300 to 430 m (1,000 to 1,400 feet) and is concentrated along a zone that is about 3700 m (12,000 feet) long. Towards the eastern extremities of this zone the shearing is not continuous, and contains wedges of massive rock. The reasons for the abrupt termination of this zone in the west is not known. Numerous, concordant quartz veins with minor associated carbonate are present in this shear zone, and attracted some of the first mineral exploration activity in the map-area. The shearing along the shores of the South Arm of Savant Lake is not as continuously developed as at that along the north shore of Stillar Bay, but is just as intensely deformed in places. The shear zones near Harold Lake are highly kinked and appear to be recrystallized suggesting the metamorphic event either outlasted or postdated the faulting event. The mafic to intermediate metavolcanics appear to be the most intensely deformed rocks in the map-area. Near Jutten Lake portage, the intrusion of the Jutten Batholith has also caused extensive shearing and elongation of the clasts contained within the conglomerate. Here, the competent granitoid boulders are highly stretched and have size ratios of about 8:1.

West of the South Arm of Savant Lake, in the vicinity of Handy Lake, foliation is subparallel to the fold axis, and is possibly an axial planar cleavage. This cleavage was only weakly developed and, although not apparent elsewhere, it probably is weakly developed throughout the map-area.

Lineations

Only a few lineations were observed during the mapping. Lineations, whether caused by preferred mineral orientation or by stretching of clasts in the conglomerate, were not distinguished on the map (Map 2398, back pocket). On the south shore of Stillar Bay, the boulders in the conglomerate plunge 60 to 65° to the east-northeast. This plunge changes direction abruptly in northeastern Jutten Township east of the "Narrows" where the boulders in the conglomerate plunge 40 to 60 degrees to the east-southeast. The abrupt change in lineation of the clasts may be caused by rotation related to faulting.

Lineations from mineral orientations of some of the amphibole-rich metamorphic segregations in the rocks in the extreme southwest corner of McCubbin Township plunge fairly shallowly at 35 to 40 degrees to the east. Within the metasedimentary sequence to the north of Conant Township, (in McCubbin and Poisson Townships, Bond 1972a, b), plunges on minor folds are much steeper (70 to 80°), and the plunge of the megafold structure west of Savant Lake appears to be increasing from south to north. The shallow plunges in the southern part of the folded succession may be caused by the upwelling of underlying granitic plutons.

Kinking and locally conjugate box kinking are present in some of the intensely sheared rocks previously mentioned. These are linear features but are not shown on the map.

Folding

The effect of folding on the gross configuration of the metavolcanic-metasedimentary sequence west of the South Arm of Savant Lake is clearly shown on Map 2398 (back pocket). Moore (1928), Rittenhouse (1936), and Skinner (1969) were of the opinion that the dominantly felsic to intermediate metavolcanic sequence west of the South Arm of Savant Lake was a syncline, but field evidence from the present mapping program indicates that this structure is anticlinal and plunges to the northeast.

Pillow lavas east of the South Arm of Savant Lake, indicate that the lower, dominantly mafic, metavolcanic sequence faces northwest, and is continuous with that mapped in Poisson and McGillis Townships (Bond 1972a, b) to the north of Jutten and Smye Townships respectively. No fold axis is apparent and this sequence appears to be a continuous succession.

Graded bedding within the metasediments in the folded metasedimentary-metavolcanic upper volcanic sequence in Conant Township indicates that this sequence faces north and southeast, and forms an anticlinal structure that plunges to the northeast. The graded bedding where observed in the field, is fairly obvious, and is a reliable indicator that the fold structure is an anticline. Subsequent mapping to the west (Bond 1974) of the iron formation-bearing unit just south of Grebe Lake, and the direction of crossbedding on Shoehorn Lake, located 1.6 km (one mile) west of the west boundary of Conant Township, yield data which agree with the north-facing graded bedding found in the map-area. Within the mafic to intermediate metavolcanics along the west shore of Savant Lake, one locality of poorly exposed pillow lavas appears to face east. This top determination however, is not completely reliable because of the extensive deformation in this area and is not indicated on the map. If this does face east, possibly a few minor fold axes do occur within the upper volcanic sequence near the Savant Lake Fault. These minor fold axes could result from movement along the fault zone. Minor apparent secondary folding of the metamorphosed porphyritic felsic intrusive rocks northeast of the nose of Handy Lake may be a result of this folding, but could be cross-cutting dikes or sills. Small crenulations (not shown on Map 2398, back pocket) are present within felsic to intermediate metavolcanics near the axis of the anticlinal fold where it crosses Highway 599. Helicitic garnets averaging 0.63 to 1.2 cm (0.25 to 0.5 inch) in length have grown along these crenulation planes (Photo 14).

In thin section, the helicitic garnets appear to be crystal aggregates that have grown along the earlier formed crenulation planes. The origin of the garnet is in doubt because the mineral is far removed from any granitic intrusive rock. According to Spry (1969, p.299), the helicitic structure is only rarely preserved during any later polymetamorphic phase, and it is quite likely that these helicitic garnets grew during the main regional metamorphic event; if this is the case, then the regional metamorphism may post date or has at least outlasted the folding event.

ODM9768

Photo 14–Crenulation folding with complimentary helicitic garnets; in axial zone of the folded metasedimentary-metavolcanic sequence in Conant Township. The helicitic texture of the garnets is post-tectonic or syntectonic because garnet aggregates have grown along pre-existing, preserved crenulation fold planes. From exposure of felsic to intermediate metavolcanics on east side of Highway 599 near the trace of the axial plane in southwest Conant Township.

The relationship of the metasediments in northern Conant Township to the metasedimentary-metavolcanic sequence to the south is not completely known. In northeast Conant Township, the metasediments face north, and appear to be lying conformably on top of the metasedimentary-metavolcanic sequence. Further west, the contact is poorly exposed, but the metasediments to the north appear to be more complexly folded as shown by the pattern of the iron formation-bearing metasediments. The iron formation-bearing metasediments in northwest Conant Township have been isoclinally folded; no plunges could be measured, but from the trend and dips of the individual sedimentary units they appear to form a syncline plunging steeply to the west-northwest. Whether the surrounding arenaceous metasediments have been as tightly folded is not known because of poor exposure and lack of marker units.

The metasedimentary sequence in McCubbin and Poisson Township (Bond 1972a, b) situated to the north of the present map-area, is more complexly folded on the whole than the surrounding metavolcanic sequences (Bond 1977, p.52,53). The complex fold pattern of the metasedimentary sequence in the map-area, and in McCubbin and Poisson Townships, is probably a function of the metasedimentary sequence being wedged between the two (upper and lower) volcanic sequences during the regional deformation.

Faulting

Faulting has caused minor displacement of the rock units in the map-area. Lithologic units are abruptly offset or terminated in several parts of the area, and faulting is thought to be the cause of such displacements. The faulting appears to generally trend northwest; sinistral and dextral displacements have occurred.

The most extensive fault is the Savant Lake Fault which can be traced along the length of the main part of Savant Lake between the mafic metavolcanic and metasedimentary sequences in Poisson Township (Bond 1972b) to the north of the area, and continues down the South Arm of Savant Lake to Harold Lake. This is a longitudinal fault, and the amount of displacement involved is not readily apparent. The basis for placing the fault in this location is the facing direction of the rock units on either side of the proposed fault. East of the fault, the mafic metavolcanic sequence faces northwest, while to the west of the fault, the felsic to intermediate metavolcanics and metasediments face east. This facing relation cannot be explained by a synclinal fold because the two opposing sequences on either side are entirely different in character. That is, there is no repetition of units across this location as would be expected if folding had occurred. Intense shearing of the rocks along the shores of the South Arm of Savant Lake support the faulting hypothesis. This fault is believed to be a strike-slip fault coincident with, and a direct result of the folding event that formed the anticlinal structure to the west. At Harold Lake, the Savant Lake Fault has been recrystallized suggesting its development occurred early in the regional tectonic history of the area.

Some of the faulting appears to post date the folding. For instance, the nose of the fold south of Conant Lake is offset by a west-northwest-trending transverse, dextral fault. No shearing was found to accompany this fault, although locally it is accentuated by a lineament of substantial relief. To the northwest, the fault becomes longitudinal, and parallels the pre-existing planes of weakness (here these planes are represented by both bedding planes and the contact between two major lithologic units). The mafic flows near the nose of the fold are offset approximately 430 m (1,400 feet) on plan surface.

The abrupt termination of the conglomerate north of the mouth of Stillar Bay is thought by the author to be caused by faulting. A small change in the direction of lineation of the granitoid boulders from east-northeast 150 m (500 feet) southwest of the fault to east-southeast at the fault, a change of approximately 30 degrees, is thought to be due to the faulting.

A minor north-trending transverse fault in the metasedimentary sequence in northeast Conant Township is marked by minor offsets in the mafic intrusive sills.

Complex faulting occurs in the southeast corner of Conant Township where minor northwest-trending faults have caused minor offsets at the mafic metavolcanic-granitic rock contact.

Extensive shear zones at Stillar Bay exist on the east contact of the conglomerate exposed north of Stillar Bay. Faulting is thought to exist along these shear zones.

The Savant Lake Fault is a longitudinal fault, and is believed to be coincident with the folding event that produced the anticlinal sequence west of the South Arm of Savant Lake. This fault probably developed as a consequence of folding when the upper volcanic sequence was deformed against the lower volcanic sequence east of the South Arm of Savant Lake. The latter sequence, unaffected by the folding event, remained as a rigid block; movement along the boundary of this rigid block during folding of the upper volcanic sequence produced the intensely sheared fault zone. Subsequently, intrusion of the Jutten Batholith during regional metamorphism caused recrystallization of this early fault zone, and produced the minor transverse faulting detected in Conant Township. The growth of helicitic garnets, and the recrystallization of the Savant Lake Fault at Harold Lake, indicate that regional metamorphism outlasted these events. The development of the transverse faults observed in the margin of the Jutten Batholith in southeastern Conant Township possibly represents the last tectonic event in the map-area.

ECONOMIC GEOLOGY

Gold- silver- iron- and copper-, lead-, and zinc-bearing sulphide minerals are found in the map-area. Other sulphide minerals such as pyrite, pyrrhotite, and minor arsenopyrite also occur in the area. No ore deposits have been found in the map-area to date although some of the showings have been extensively investigated by prospectors. Iron, in the form of chert-magnetite iron formation, is concentrated in the metasedimentary sequence in the northwest corner of Conant Township and may become exploitable in the future.

The map-area has been intermittently prospected since the beginning of the twentieth century. In the early years, emphasis was placed on gold and the extensive iron deposits. More recently, base-metal sulphide minerals have become the main target for exploration companies. Interest in the area has been greatly intensified by the recent discovery of several base-metal deposits in the Sturgeon Lake area about 64 km (40 miles) to the south of the map-area.

Except for the iron deposits, all of the mineralized showings observed in the map-area by the author are associated with quartz veins and silicified country rocks. Most of the more prominent veins were injected into shear zones, but some veins were hosted by massive rocks. The veins are generally concordant to the trend in the host rocks. Although some good values of gold, silver, copper, lead, and zinc have been obtained, these mineralized quartz veins have remained uneconomic because of their lateral and vertical discontinuity. Assays from four mineralized quartz veins within the Jutten mafic to intermediate metavolcanic sequence have indicated the presence of gold, silver, copper, lead, and zinc sulphide minerals. The silver appears to be most prominent in those zones containing substantial amounts of galena. More detailed descriptions of the main mineralized showings are given in the Section "Property Descriptions". Several showings found in the map-area are not held at the present time, and are described below.

Near the tip of the most easterly peninsula in Staunton Lake, there is a minor quartz vug 0.5 m by 1.5 m (1.6 by 4.9 feet) with a pod of chalcopyrite. The south-trending quartz vein was quite contorted, and terminated over a distance of 1.5 m (5 feet). A sample of the quartz vein with visible chalcopyrite, taken by the author and assayed by the Mineral Research Branch of the Division of Mines, assayed 0.01 ounce of gold per ton and contained 0.17 percent copper. Several thin (0.3 m; 1 foot), discontinuous small quartz veins were found approximately 6 m (20 feet) south of this mineralized vug, but only minor amounts of associated carbonate and pyrite were found there.

Disseminated pyrite varying from 2 to 10 percent by volume was found in the matrix of one exposure of felsic tuff-breccia situated on the east side of the loop in Highway 599, just south of the southwest tip of Grebe Lake in Conant Township. The fragments are similar in composition to, but are easily distinguished from, the rusty weathered matrix.

A trench was found approximately 400 m (1,300 feet) south of the small bay on the southeast side of Conant Lake in Conant Township. The trench was excavated by an unknown party over a shear zone with a trend approximately N80°W and a nearly vertical dip. The shear zone is partly silicified, and occurs in an intermediate tuff. Minor pyrite, pyrrhotite, and chalcopyrite are associated with the sheared intermediate metavolcanic host, and younger thin quartz and carbonate veinlets also intrude the mineralized zone. The shear zone is approximately 9 m (30 feet) in width. A grab sample of the mineralized zone, taken by a member of the field party, and assayed by the Mineral Research Branch of the Division of Mines was found to contain traces of gold and silver and 0.20 percent copper.

Between Handy Lake and the South Arm of Savant Lake, two small test pits and one trench have been excavated by an unknown party. The excavations which are largely caved-in and overgrown are located 1280 m (4,200 feet) northeast of the portage from Handy Lake into Harold Lake. Strong magnetic attraction, probably in response to iron formation, was found to occur immediately east of the test area. The test pits are located in a fine-grained felsic metavolcanic rock that is partly silicified, and strikes approximately N30°E and dips 80° to the west-northwest. The zone, about 12 m (40 feet) wide and traceable for 120 m (400 feet), contains approximately 5 percent disseminated pyrite and pyrrhotite, although the mineralization was not evenly disseminated throughout. A very minor amount of malachite staining was locally apparent.

Further east, near the east boundary of Smye Township and just south of the mafic metavolcanic-granitic rock contact, several highly altered, partly assimilated mafic metavolcanic inclusions occur within the margins of the granitic batholith. The inclusions trend N85°W, dip 80°N, are injected by a few thin quartz-carbonate veinlets, and are marked by rusty weathering. A grab sample of the quartz veins associated with the inclusions taken by a member of the field party and assayed by the Mineral Research Branch of the Division of Mines contained 0.01 ounce of gold. The showing probably does not warrant any further investigation because of the discontinuous nature of the inclusions.

Description of Properties and Occurrences

A brief summary of the assessment work on file with the Ontario Ministry of Natural Resources, submitted by the various companies and individuals who worked in Conant, Jutten, and Smye Townships, is given in Table 5. The locations of the various properties held by the companies and/or individuals working in the map-area are illustrated by Figures 2, 3, and 4.

A brief description of the significant mineralization encountered in the diamond drilling by these companies is given in Table 6. Only three diamond-drill holes were located in the field, and these three holes, all put down by the Canadian Nickel Company Limited, are the only drill hole sites shown on the accompanying map (Map 2398, back pocket). The approximate locations of the other drill holes are given by latitude and longitude in Table 6. These locations are based on the plan locations submitted as part of the assessment report to the Assessment Files Research Office, Division of Mines, Toronto, and are only approximate.

A.P. BEST (14)[1]

During the 1972 field season, A.P. Best of Savant Lake, Ontario, held nine claims located approximately 1.6 km (one mile) north-northwest of Smye Lake in Smye Township (Figure 4). The claims are numbered: PA310205; PA310210 to 310212 inclusive; PA310214, PA310215; and PA310722 to 310724 inclusive.

The claims are underlain by felsic intrusive rocks. No work has been recorded on the claim group which was in good standing as of December, 1972.

CAM MINES LIMITED (2)

On May 6th, 1971 Cam Mines Limited optioned 116 claims in the Savant Lake area from E.W. Hadley. During exploration for base-metal deposits, Cam Mines Limited staked 29 claims in Conant Township (Figure 2) between Handy Lake and Harold Lake, and their staking included the following unpatented claims: PA287602 to 287624 inclusive and PA287839 to 287844 inclusive.

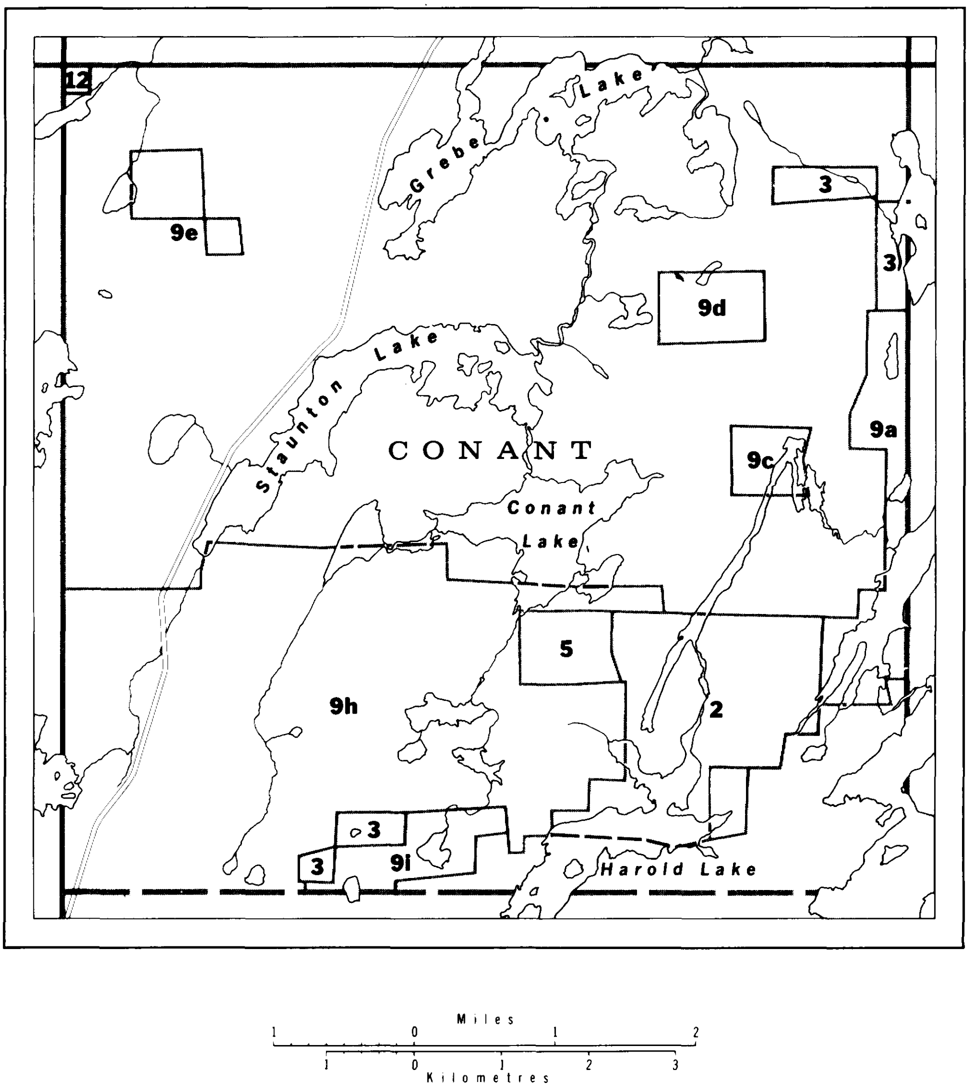
The claims are underlain by intermediate to felsic tuff and tuff-breccia. From January to March 1972, the company conducted a combined electromagnetic and magnetic survey over the claims on grid lines spaced at 120 m (400 feet) intervals. The electromagnetic survey showed there to be no conductive zones present, but the magnetic survey disclosed a northeast-trending anomaly with readings as high as 60,000 gammas. The anomalous zone is traceable for about 1200 m (4,000 feet) and was interpreted to be caused by iron formation (File 2.800, Assessment Files Research Office, Division of Mines, Toronto). The magnetic attraction is on strike with a band of metasediments that does contain

[1]Number in parentheses refers to property number shown on Map 2398, back pocket.

TABLE 5 ASSESSMENT WORK DATA ON FILE WITH THE DIVISION OF MINES ON MARCH 30, 1974 FOR CONANT, JUTTEN, AND SMYE TOWNSHIPS.

Name of Company or Individual	Township	Toronto Files	Type of Work					
			GC	DD	GP	GL	TR	ST
A.P. Best	J	No work recorded	—	—	—	—	—	—
Cam Mines Limited	C	63.2892, 2.800	—	—	x	—	—	—
John Donner	J	2.461, 2.1195	x	x	x	—	—	—
Dome Exploration Canada Ltd.	S		—	x	—	—	—	—
Falconbridge Nickel Mines Ltd.	C	2.622	—	x	x	—	—	—
The Canadian Nickel Co. Ltd.	C, J		—	x	—	—	—	—
Mid-North Engineering Services Limited:								
Amalgamated Rare Earth Mines Ltd. Property	S	63.2922, 2.614	x	x	x	—	x	x
Langis Silver & Cobalt Mining Company Ltd. Property	S	2.381	—	—	x	—	—	—
New Kelore Mines Limited Property	J	2.613	—	—	x	—	—	—
Nickel Rim Mines Limited Property	J, S	2.834	—	—	—	—	—	—
United Macfie Mines Limited Property	J	63.2993, 2.611 2.613	x	x	x	—	—	x
Noranda Exploration Company Limited	C, J	2.475	—	x	x	—	—	—
	J	2.526, 2.553	—	x	x	—	—	—
		2.555	—	—	x	—	—	—
	C	2.535, 2.538	—	—	x	—	—	—
		2.541, 2.558	—	x	x	—	—	—
		2.792, 2.768	—	x	x	—	—	—
Northern Canada Mines Limited	J	Assessment Files Sioux Lookout	—	x	—	x	x	x
Quebec Sturgeon Mines Limited	J	63.3008 63.2159	—	—	—	—	—	—
Ray Ramsay	C	2.838	—	—	—	—	—	—

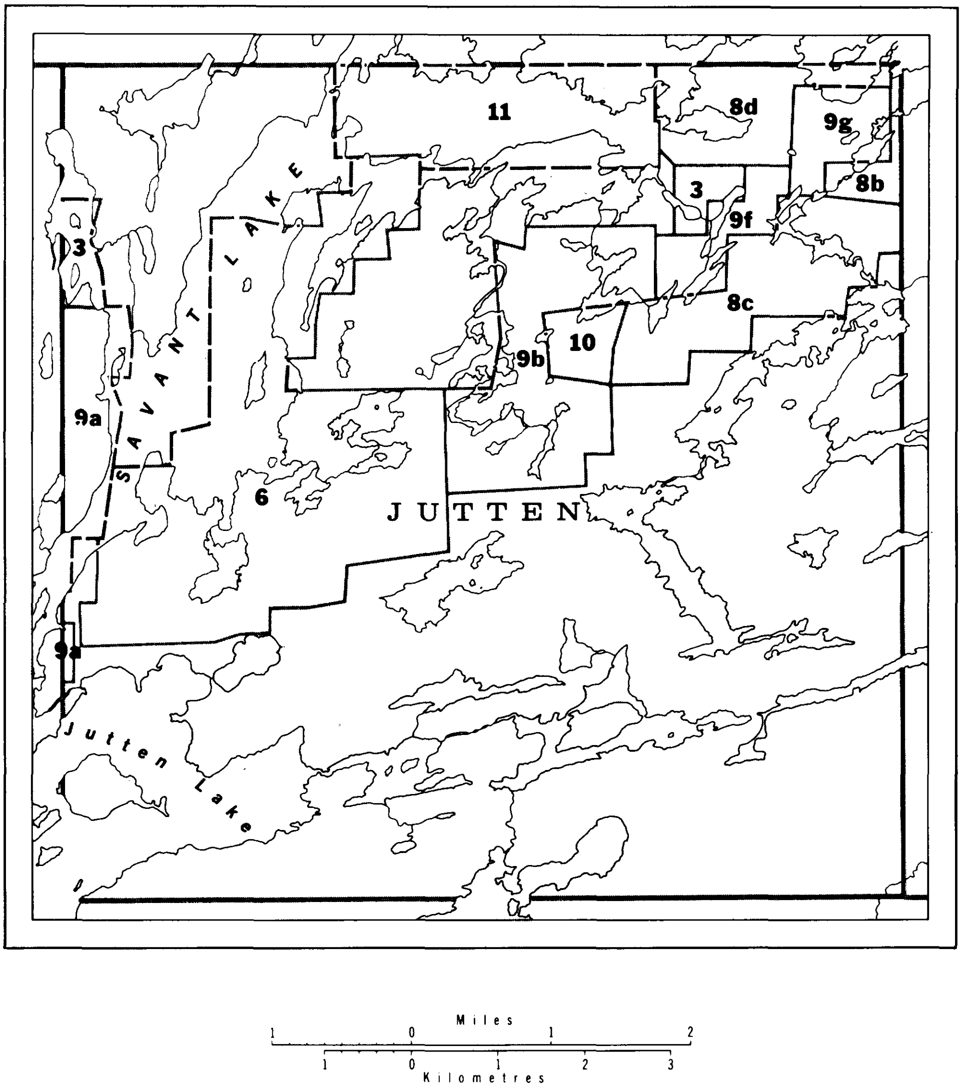
Abbreviations:
GC — Geochemical sampling
DD — Diamond drilling
GP — Geophysical
GL — Geological
TR — Trenching
ST — Stripping
x — Work done
C — Conant Township
J — Jutten Township
S — Smye Township



2. *Cam Mines Ltd.*
3. *Canadian Nickel Co. Ltd.*
5. *Falconbridge Nickel Mines Ltd.*
9. *Noranda Exploration Co. Ltd.*
  a *Area I.*
  c *Area III.*
  d *Area IV.*
  e *Area V.*
  h *Area VIII.*
  i *Area IX.*
12. *Ray Ramsay.*

SMC 13803

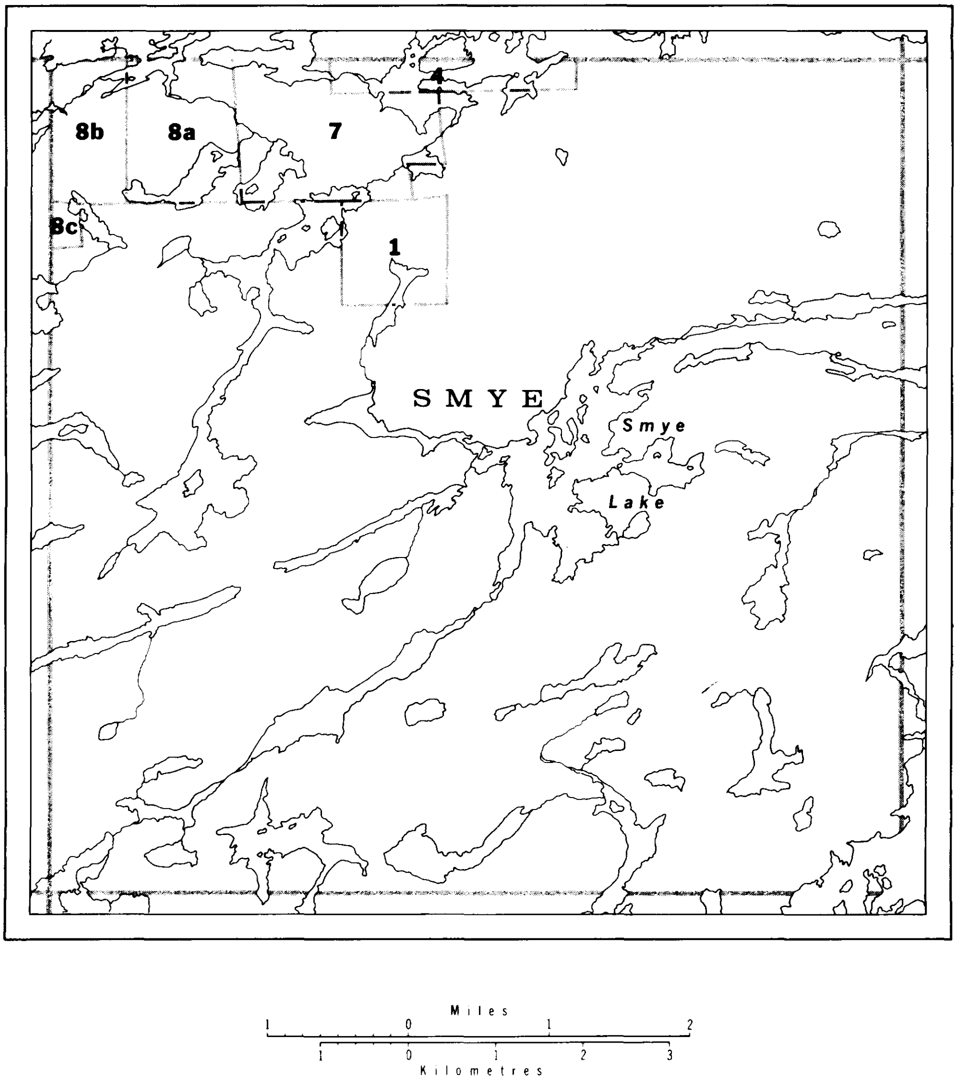
Figure 2–Sketch map of Conant Township showing approximate outline and position of properties held on December 31st, 1972.



3. *Canadian Nickel Co. Ltd.*
6. *John Donner.*
8. *Mid-Northern Engineering Services Ltd.*
b *New Kelore Mines Ltd.*
c *Nickel Rim Mines Ltd.*
d *United MacFie Mines Ltd.*
9. *Noranda Exploration Co. Ltd.*
a *Area I.*
b *Area II.*
f *Area VI.*
g *Area VII.*
10. *Northern Canada Mines Ltd.*
11. *Quebec Sturgeon Mines Ltd.*

SMC 13804

Figure 3–Sketch map of Jutten Township showing approximate outline and position of properties held on December 31st, 1972.



1. *A. Best.*
4. *Dome Exploration (Canada) Ltd.*
7. *Langis, Silver, and Cobalt Mining Co. Ltd.—Amalgamated Rare Earth Mines Ltd. Property.*
8. *Mid-North Engineering Services Ltd.*
  a *Amalgamated Rare Earth Mines Ltd. Property.*
  b *New Kelore Mines Ltd. Property.*
  c *Nickel Rim Mines Ltd. Property.*

SMC 13805

Figure 4–Sketch map of Smye Township showing outline and position of properties held on December 31st, 1972.

iron-formation units along its western extension. This band is traceable within the folded metavolcanic sequence until just north of the Handy River System but cannot be traced further south, mainly owing to poor exposure. The magnetic attraction outlined on the Cam Mines Limited Property is probably an extension of this same metasedimentary band. The claims were still held by the company on December 31, 1972.

CANADIAN NICKEL COMPANY LIMITED (1, 6)

The Canadian Nickel Company Limited conducted a fairly extensive exploration programme that covered most of the Savant Lake area between May 1967 to May 1971. Within Conant Township (Figure 2), and Jutten Township (Figure 3), the company held four widely spaced claim groups totalling 17 claims. The claims are numbered as follows:
PA39408, PA39411, PA39412, PA39475, PA39476 (Conant Township); PA44715 to 44717 inclusive (Conant Township); PA44720 to 44722 inclusive (Jutten Township); PA44226 to 44231 inclusive (Conant Township); PA259671 to 259676 inclusive (Conant and Jutten Townships); and PA271221 to 271222 (Conant Township).

Claims PA44715 to 44717 inclusive (located on the southwest border of Conant Township see Figure 2) and PA44720 to 44722 inclusive are underlain by mafic metavolcanics, while the remainder of the claims are underlain primarily by intermediate to felsic metavolcanics. Eleven diamond-drill holes were sunk for a total length of 920 m (2,363 feet) and these were submitted as assessment credits to the Assessment Files Research Library, Division of Mines, Toronto. The holes were drilled during the period May 1967 to May 1971, and are summarized in Table 6. Three of the holes were located in Conant Township during the field mapping, and are shown on Map 2398 (back pocket). These three holes were drilled on claims PA44715 to 44717 inclusive (Assessment Files Research Library, Division of Mines, Toronto, Assessment File 12). The drill hole on claim PA44231 just southeast of the east end of Harold Lake intersected both amphibolite and metasediments (Assessment Files Research Library, Division of Mines, Toronto, Assessment File No.11). The drill logs indicate that disseminated pyrite and pyrrhotite constitute the main form of mineralization found over small widths. Traces of chalcopyrite were also present locally, but were of minor importance.

Claims PA39408, PA39411, PA39412, PA39475, PA39476 are part of a large block of claims owned by the company in McGillis Township (to the north of Conant Township) and are described in an open file manuscript by the author (Bond 1973, p.121-122). By the spring of 1974, these claims had expired along with claims PA259671 to 259676 inclusive, PA44226 and PA44231. The remainder of the claims are still in good standing.

TABLE 6 DIAMOND-DRILL HOLE DATA FOR CONANT, JUTTEN, AND SMYE TOWNSHIPS.

Township	Company	Date	Assess. File No. (Tor.)	Assess. Claim No. (Tor.)	Depth (ft.)	Latitude	Longitude	First Rock-Type Intersected	Mineralization & Assays (Footage indicates depth of mineralization encountered)
Conant	Falconbridge Nickel Company Limited	1972	21	PA263003	328.0	50°21′06″	90°36′45″	Intermediate Metavolcanics	230-237 ft. -15-20% py,po, trace cp, 238-259 ft. 5-10% py,po
		1972	21	PA263003	434.0	50°21′06″	90°36′45″	Intermediate Vol.	269-278 ft. -15-20% po + some 1-6 inch long massive po
		1972	21	PA263003	330.0	50°21′06″	90°36′45″	Intermediate Vol.	111.0-116.0 ft. -20% py, trace cp 116-123 ft. 15-50% po, trace
Conant	Canadian Nickel Company Ltd.	1968	10	PA41178	320.0	50°40′55″	90°21′36″	Amphibolite	211-215 ft. 10-80% sulphides
		1968	11	PA44231	133.0	50°19′56″	90°34′52″	Metasediments	83-85, 5-12% py, po
		1968	12	PA44715	209.0	50°19′50″	90°38′15″	Mafic Metavolcanics	185-188 ft. 5-20% py, po
		1968	12	PA44716	149.0	50°19′56″	90°38′30″	Mafic Metavolcanics	81-84 ft. 80% po, py, trace cp 124-127 ft. 10-40% po, py
		1968	12	PA44717	230.0	50°19′40″	90°38′59″	Mafic Metavolcanics	179.2-201.5 ft. disseminated py, po 5-80%
		1970	13	PA236275	284.0	50°23′38″	90°38′31″	Metavolcanics	Minor po, py throughout (<1%) locally more concentrated up to 10%
		1971	15	PA271221	181.0	50°23′54″	90°34′22″	?	1% sulphides 130-139 ft.
Conant	Noranda Exploration Co. Limited	1971	14	PA263042	325.0	50°23′53″	90°40′21″	Metavolcanics	
		1971	14	PA263042	391.0	50°23′50″	90°40′30″	Metavolcanics	216.6 to 305 ft. graphite, disseminated py, po
		1971	16	PA263075	378.0	50°20′27″	90°38′54″	Intermediate Metavolcanics	17-20 ft. disseminated mineralization with carbonate veins; trace Au, 0.16 oz per ton Ag, 0.02 percent Cu, 0.05 percent Zn, trace Pb, 0.01 percent Ni, 317 to 328 ft. carbonate, disseminated po, py, trace Au, Ag, 0.02% Cu, 0.07% Zn, 0.01% Ni, trace Pb
Conant	Noranda Exploration Company Ltd.	1971	16	PA263075	398.0	50°20′22″	90°38′58″	Chlorite Schist	12-15 ft. silicified in part trace Au, Ag, Pb, Ni, 0.02% Cu 0.05% Zn

Table 6 – continued

Township	Company	Date	Assess. File No. (Tor.)	Assess. Claim No. (Tor.)	Depth (ft.)	Latitude	Longitude	First Rock-Type Intersected	Mineralization & Assays (Footage indicates depth of mineralization encountered)
									170-174 ft. similar assays from scattered blebs to massive po, py
		1971	16	PA263075	411.0	50°20′30″	90°38′50″	Intermediate Metavolcanics	9-11 ft. po, py, mineralization trace Au, Ag, Pb, Ni, 0.02% Cu 0.05% Zn 124-126 ft. similar assays values with mineralization associated with quartz veins
		1971	17	PA302194	400.0	50°20′52″	90°37′15″	Intermediate Metavolcanics	minor po, py in blebs and stringers, mainly disseminated up to 15%, locally up to 50-70% po, py
		1971	17	PA261848	280.0	50°20′50″	90°37′50″	Intermediate to Felsic Tuff	disseminated to locally massive py, po
		1971	17	PA261856	271.0	50°20′54″	90°37′14″	Intermediate Metavolcanics	some disseminated py, trace cp, locally some massive po, py
		1971	18	PA310161	297.2	50°20′38″	90°40′21″	Intermediate Metavolcanics	locally minor disseminated py, po, trace cp
		1972	19	PA239104	301.5	50°20′24″	90°37′00″	Amphibolite	disseminated po, py, cp, up to 1% locally; often silicified-carbonate stringers
		1972	19	PA239104	210.0	50°20′16″	90°37′05″	Amphibolite Schist	143-148 ft. disseminated po, py, silicified trace cp
		1972	20 •	PA263044	305.0	50°22′42″	90°33′17″	Chlorite Schist	185.0-187.6 ft. 1% disseminated po, trace cp
		1972	20	PA263047	248.0	50°22′27″	90°33′23″	Chlorite Schist	180-206 ft. graphite 1-5% py 223.5-248 ft. graphite with disseminated py
Jutten	Canadian Nickel Company Ltd.	1968	10	PA44237	183.0	50°21′36″	90°33′12″	Intermediate Mafic Metavolcanics	minor disseminated py
		1968	11	TB44720	204.0	50°24′00″	90°27′23″	Metavolcanics	minor po, py, trace cp
		1968	11	TB44722	125.0	50°23′52″	90°33′15″	Intermediate Metavolcanics	minor disseminated to massive py, po (10-20%)

Table 6 – continued on next page

Table 6 — continued

Township	Company	Date	Assess. File No. (Tor.)	Assess. Claim No. (Tor.)	Depth (ft.)	Latitude	Longitude	First Rock-Type Intersected	Mineralization & Assays (Footage indicates depth of mineralization encountered)
		1971	13	PA259674	162.0	50°23'48"	90°33'15"		minor disseminated sulphides
	Monarch Gold Mines Ltd. (option from "John Donner")	1965	12	PA32080	427.0	50°21'39"	90°32'16"	Intermediate Metavolcanic (Tuff)	1.5 ft. chlorite, carbonate schist with disseminated py, and 0.02 ounce per ton Ag
		1965	12	PA32083	283.0	50°21'40"	90°32'07"	Conglomerate	25.6 foot shear zone in greywacke, carb and chloritic stringers with py and minor cp, 0.03 ounce per ton Ag over 5 foot interval
	Noranda Exploration Company Ltd.	1972	16	PA230327	300.0	50°23'23"	90°28'30"	Intermediate Metavolcanics (Tuff)	locally disseminated to banded po, trace cp -footage 115-120 -5% sulphides, 2 to 3 inch massive zones, po, trace, cp, Pb assayed trace Ag, 0.16 ounce per ton Ag, 0.53 percent Cu, 0.53% Zn, 0.2% Pb, 0.01% Ni. also minor py, po, trace cp associated with local quartz-carbonate stringers
Jutten	Noranda Exploration Limited	1972	17	PA230318	303.0	50°23'00"	90°29'00"	Acid tuff	footage 8-79.5 ft. trace po, cp, -footage 264.8 ft., assay 0.21 ounce per ton Ag, 0.04 percent Cu, 0.45 percent Zn, trace Pb, 0.02% Ni
		1972	18	PA274935	254.0	50°23'47"	90°32'57"	Chlorite Schist	minor py-bearing graphite zones
		1972	18	PA274935	173.0	50°23'46"	90°33'02"	Chlorite Schist	minor py with graphite, carbonate zones. Footage 169-171.2 assayed trace Au, 0.1 oz per ton Ag, 0.03% Cu, 0.04% Zn, trace Pb, 0.01% Ni
	United Macfie Mines Ltd.	1971	14	PA280982	300.0	50°24'21"	90°26'24"	Andesite flow	Footage 97.1-198 mineralized quartz veins (cp, sphal.) - assayed trace to 0.04 ounce per ton Au

Table 6 — continued

Township	Company	Date	Assess. File No. (Tor.)	Assess. Claim No. (Tor.)	Depth (ft.)	Latitude	Longitude	First Rock-Type Intersected	Mineralization & Assays (Footage indicates depth of mineralization encountered)
		1971	14	PA280982	305.0	50°24′21″	90°26′24″	Andesite	Footage 70.7-82.5 silicified andesite, quartz-carbonate veinlets with associated mineralization. Assays yielded trace to 0.22 oz per ton Au, trace Ag. trace to 0.02% Cu, trace to 0.03 % Zn. Footage 82.7-120 py, cp, sphalerite with quartz veins
Smye	Amalgamated Rare Earth Mines Ltd.	1972	11	PA25409	350.0	50°24′11″	90°22′15″	Andesite	minor dissemination and stringers, po, py, trace cp, iron formation at footage 216-285
Smye	Dome Exploration Company Ltd.	1970	10	PA210092	403.0	50°24′37″	90°20′34″	Dacite	Footage 214-216, graphitic disseminated and stringers py, po. Footage 354-365.6, 5-10% py in graphite
Smye	Amalgamated Rare Earth Mines	1971	11	PA254511	300.0	50°24′13″	90°22′40″	Dacite ?	No significant mineralization
	Ltd. (First 5 holes all on same claim) First 6 holes drilled along silicified (test pitted zone).	1972	11	PA254511	300.0	50°24′13″	90°22′40″	Dacite ?	silicified zones with mineralization. Footage: a. 87.5-90.3 b. 96-100 c. 100-103 d. 167-169.2 Assays Au Ag Cu Zn Pb a. Tr. Tr. 0.06 0.18 0.32 b. – Tr. 0.02 0.03 – c. Tr. Tr. 0.04 0.02 – d. – – 0.02 0.01 – po, py-bearing silicified zone, assayed 0.01 to 0.06 percent Cu and trace 0.08 percent Zn

Table 6 — continued on next page

Table 6 — continued

Township	Company	Date	Assess. File No. (Tor.)	Assess. Claim No. (Tor.)	Depth (ft.)	Latitude	Longitude	First Rock-Type Intersected	Mineralization & Assays (Footage indicates depth of mineralization encountered)
		1972	11	PA254511	210.0	50°24'13"	90°22'40"	Andesite	no significant mineralization
		1972	11	PA254511	286.0	50°24'13"	90°22'40"	Andesite	minor py, po. Footage 163-168.2 -cp, sphal., associated with quartz vein, assayed trace Au, 0.06 percent Cu
		1972	11	PA254511	275.0	50°24'13"	90°22'40"	Medium-to coarse-grained andesite	minor pyrite-bearing quartz veins, locally trace cp, sphalerite
		1972	11	PA254516	175.0	50°24'13"	90°22'40"	Tuff	no mineralization
		1972	11	PA25410	300.0	50°24'6"	90°22'38"	Andesite	Footage 87.9-115 minor py cp, Zn, assayed 0.15 percent Cu and 0.10 percent Zn

To Metricate: multiply feet by 0.3048 to obtain metres.

Minerals: py - pyrite, po - pyrrhotite, cp - chalcopyrite, sphal - sphalerite
Elements: Au - gold, Ag - silver, Pb - lead, Zn - zinc, Ni - Nickel

DOME EXPLORATION (CANADA) LIMITED (15)

In 1970, Dome Exploration (Canada) Limited held several groups of claims in McGillis Township to the north of Smye Township (Bond 1972c). One of these claim groups involved 41 claims stretching from Pride Lake east towards Virginian Lake in McGillis Township and is situated partly in Smye Township. Of the 41 unpatented claims, seven claims are situated within Smye Township (Figure 4). The remaining claims are described elsewhere by Bond (1975). The seven unpatented claims are numbered as follows: PA210092 to 210098 inclusive.

The claims are underlain by mafic to intermediate metavolcanic flows.

An electomagnetic survey was carried out to locate conductive zones with possible associated sulphide mineralization. Nine diamond drill holes were sunk, and only one of these was situated in the map-area in the southeast corner of Silver Lake. The drill hole was sunk for 122.8 m (403.0 feet), and encountered mostly mafic to intermediate metavolcanics with local dacitic (silicified) zones. Minor amounts of disseminated pyrite and very minor chalcopyrite were intersected in two holes. The claims were in good standng on December 31, 1972.

JOHN DONNER (7)

In the summer of 1971, John Donner, Director and Property Manager for Bird River Mines Company Limited, staked a block of 75 unpatented claims along the east shore of the South Arm of Savant Lake in Jutten Township (Figure 3). The claims are numbered as follows: PA202292 to 2022297 inclusive; PA202300; PA202301; PA202303; PA202309 to 202311 inclusive; PA238762 to 238764 inclusive; PA247300 to 347302 inclusive; PA247304; PA247305; PA247307; PA247308; PA247329; PA247330; PA247332; PA247333; PA247336; PA247337; PA247341 to 247344 inclusive; PA263050; PA263052; PA263060; PA263063; PA274351 to 374385 inclusive; PA309417 to 309420 inclusive; PA309914 to 309933 inclusive; PA330322 to 330324 inclusive; PA44237; PA44238; PA247345; and PA247347.

The claims are underlain by metamorphosed mafic to intermediate pillowed lavas, subsidiary fine- to medium-grained massive flows, metaconglomerate, and in the south part of the property by felsic plutonic rocks. A test pit containing abundant galena and silver, and lesser amounts of gold and zinc occurs on the property (Table 7) and is shown on the accompanying map (Map 2398, back pocket). The test pit is located on claim PA202293. The property was staked by John Donner in 1958, and at that time he did some sampling of the test pit which had originally been excavated by an unknown party. In 1963, a reconnaissance geophysical survey was done over four of the claims. The geophysical survey showed several conductors trending N20°E and N60°E, and are in the order of 180 to 240 m (600 to 800 feet) long, occurring just east of the small lake situated near the showing. A weak conductor was also picked up near the test pit. These electromagnetic conductors are parallel to the trend of the underlying rocks.

TABLE 7 ASSAY VALUES OF SAMPLES FROM HIGH GRADE TEST PIT ON THE JOHN DONNER PROPERTY. GOLD AND SILVER VALUES IN OUNCE(S) PER TON. LEAD AND ZINC VALUES ARE IN PERCENT.

Series	Sample Number	Au	Ag	Pb	Zn	Widths (inches)
1958	21	0.10	22.0	1.92	2.2	24
	22	0.32	50.4	3.97	2.4	12
	23	0.02	4.2	0.43	0.5	6
	24	0.12	43.4	4.66	1.3	7
	25	0.04	11.2	1.06	0.5	12
	26	0.02	9.0	0.92	Tr	18
	27	Tr	Tr	Tr	Nil	—
	28	0.01	Tr	Tr	Nil	—
	22A	0.50	64.4	7.03	5.6	—
	28A	0.02	Tr	0.45	Tr	—
1969	06216	0.16	11.92	1.17	0.36	—
	06217	0.54	62.36	5.63	1.08	—

To metricate multiply inches by 2.54 to obtain centimetres.

Abbreviations
Tr — Trace amounts
Au — gold
Ag — silver
Pb — lead
Zn — zinc

From December 11, 1964 to December 31, 1966, the property which at that time consisted of 15 contiguous unpatented mining claims, was optioned to Monarch Gold Mines Limited. According to the prospectus (March 1965) of Monarch Gold Mines Limited (Resident Geologist Files, Ontario Ministry of Natural Resources, Sioux Lookout):

> The showing on the claims was probably discovered during the late 1920's when the Patricia District received its most intensive prospecting. Since that time, three pits were put down along the showing (now largely fallen in) and four old x-ray drill set ups can be discerned near the showing. None of the results of this work are filed with the Ontario Department of Mines.

The showing was also described in the same company prospectus:

> The showing is a short sulphide lens in a shear zone. The shear is about 4 feet [1.2 m] wide and strikes N60°E and dips 80° south. The sulphide lens is about 15 feet [4.3 m] in length and from 1 to 3 feet [0.3 to 0.9 m] wide. The mineralization is largely pyrite, with accompanying sphalerite and galena. The pyrite and sphalerite occupy a band along the main shear direction, while the galena occupies fractures transverse to the shear planes. Total sulphide content is about 25 percent.

The company took three chip samples across the central 3 m (10 feet) length of the lens and these assayed as follows (Monarch Gold Mines Limited Prospectus, March 1965 *in* Resident Geologist's files, Ontario Ministry of Natural Resources, Sioux Lookout):

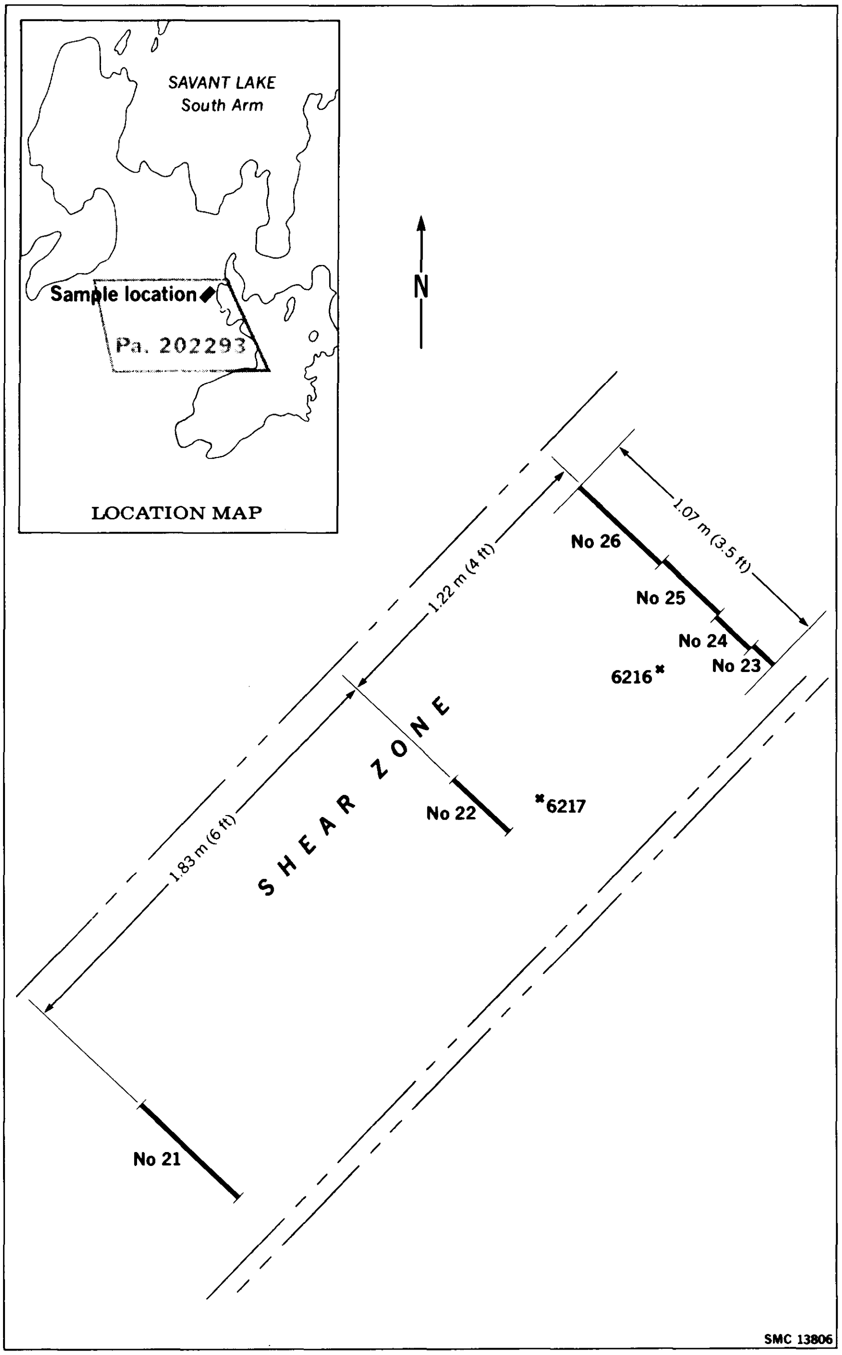


Figure 5–Approximate location of surface samples taken from main test pit on Claim PA202293 by John Donner (from Assessment File 2.46, Assessment Files Research Office, Division of Mines, Toronto).

Sample Number	Width	Silver (oz./ton)	Gold (oz./ton)	Lead (Percent)	Zinc (Percent)
1	0.76 m (2.5 ft.)	19.5	0.06	1.75	2.50
2	0.9 m (3.0 ft.)	9.0	0.10	0.83	1.70
3	0.6 m (2.0 ft.)	26.2	0.02	2.81	0.96

Further geophysical work was recommended by the company. In April, 1965, Monarch Gold Mines Limited, drilled two diamond-drill holes 216.4 m (710 feet) which intersected a few minor shear zones, and gave assays of 0.02 ounce of gold per ton, 0.02 ounce of silver per ton, and minor chalcopyrite over widths varying from 0.46 to 1.6 m (1.5 to 5 feet). A summary of the drill logs are in Table 6. The first diamond-drill hole put down is 149 m (427 feet) in length, and was located on strike with, and southwest of the high grade test pit. The second hole was drilled on PA32083 to the north of the claim PA32080 with the high grade test pit. This second diamond-drill hole was drilled several hundred feet west of the cabin on the shore of the small bay on the east shore of the South Arm of Savant Lake.

Monarch Gold Mines Limited let the property revert back to John Donner in December 1966.

In 1969, John Donner resampled the test pit, and submitted these results along with the results from the 1958 sampling program to the Assessment Files Research Office, Division of Mines, Toronto. These results are listed in Table 7, and the approximate relative spatial locations of the samples are given in Figure 5. Samples 22A and 28A were samples selected from the larger channel samples of 27 and 28 respectively, but the location of the latter two is not indicated in the assessment report (Assessment Files Research Office, Division of Mines, Toronto, Assessment File 2.461).

Further detailed geophysical surveys and geochemical sampling of the overburden were done in 1971 and 1972. The detailed geophysical surveys conducted during this period included magnetometer, very low frequency, electromagnetic (EM-16), and long-wire dip angle electromagnetics. Several new conductors were found, two of which could be extensions of the earlier ones picked up in the 1963 survey. Several of the anomalous zones are approximately in line with the mineralized test pit.

John Donner conducted the author on a tour of the property, including the Au-Ag-Cu-Pb-Zn test pit during the field season. The main test pit is approximately 120 m (400 feet) west of the northern shore of the small lake situated just south of the South Arm of Savant Lake. The mineralization is associated with a silicified shear zone at the contact between conglomerate to the north and mafic metavolcanics to the south. The zone strikes W60°E, and dips vertically to 85° to the southeast. The main silicified zone with which the mineralization is associated is 25 to 30 cm (10 to 12 inches) wide and the accompanying marginal shear zone has an exposed width of 1.5 m (5 feet), but may be up to 4.6 m (15 feet) wide. Based on the sampling by John Donner, the silver appears to be associated with galena which, as well as sphalerite, are present in appreciated quantities. A selected sample of the silicified zone taken by the author assayed 0.27 ounce of gold per ton, 49.13 ounces of silver per ton, 0.06 percent copper, 3.32 percent lead, and 4.77 percent zinc (Mineral Research Branch, Division of Mines). A grab sample taken by the author from the silicified zone, also assayed by the Mineral Research Branch, Division of Mines, contained 0.02 ounce of gold per ton, 4.78 ounces of silver per ton, 0.3 percent lead, and 0.24 percent zinc.

Further diamond drilling was recommended in February 1972 on the property by John Donner in the Bird River Mines Company Limited prospectus dated November 25, 1971, but no records of further drilling were ever submitted to the Assessment Files Research Office, Division of Mines, Toronto. By the spring of 1973, a large part of the claims had been allowed to lapse, leaving only 22 in good standing.

FALCONBRIDGE NICKEL MINES LIMITED (3)

During the 1972 field season, Falconbridge Nickel Mines Limited, held six unpatented claims just south of Conant Lake in Conant Township (Figure 2). The block of six claims was numbered:
PA263003 to 263006 inclusive, PA262614, and PA262615.

A combined (vertical coil) electromagnetic and magnetometer survey was carried out over these claims by Central Geophysics Limited of Winnipeg, Manitoba, over a grid system with grid lines spaced at 30 m (100 feet) intervals (Assessment Files Research Office, Division of Mines, Toronto, Assessment File 2.622). Three electromagnetic anomalous zones were found at the following localities:

a) A short north-trending anomaly in the south part of the claim group that was perhaps caused by graphite;

b) A short east-trending conductor in the southwest corner of the claim group;

c) A larger east-northeast-trending anomaly about 600 m (2,000 feet) in length in the northwestern part of the property.

The additional magnetic survey revealed very little, and showed no correlation with the anomalous zones. Only the third conductor was tested by diamond drilling, in April 1972. Three diamond-drill holes totalling 328 m (1,092 feet) in length were drilled (see Table 6) along the strike of the conductor. The drill holes were closely spaced to one another at invervals of 15 to 30 m (50 to 100 feet) respectively. The most common form of mineralization was 3 to 4.6 m (10 to 15 feet) of disseminated (5 to 20 percent) pyrite and pyrrhotite with associated traces of chalcopyrite. The locations of the drill holes were not found during the field season, and they are not shown on Map 2398 (back pocket).

MID-NORTH ENGINEERING SERVICES LIMITED (8,9,10,16,17,18, and 19)

Mid-North Engineering Services Limited staked and held claims in Jutten and Smye Townships on behalf of the following companies:

i) Amalgamated Rare Earth Mines Limited;
ii) Langis Silver and Cobalt Mining Company Limited;
iii) New Kelore Mines Limited;
iv) Nickel Rim Mines Limited; and
v) United Macfie Mines Limited.

Mid-North Engineering Services Limited was also responsible for conducting the work submitted to the Assessment Files Research Office, Division of Mines, Toronto, but did so on behalf of the companies listed above.

Amalgamated Rare Earth Mines Limited (16)

By an agreement dated March 19, 1971, the company acquired a 90 percent interest in 14 unpatented claims (Figure 4) from Mid-North Engineering Services Limited in Smye and McGillis Townships. The claims are numbered: PA285924 to 285926 inclusive; PA285928 to 285930 inclusive; PA285935 to 285940 inclusive; PA285970; and PA285971.

In a further agreement with Mid-North Engineering Services Limited, the above agreement was amended on August 19, 1971, and the company acquired an additional nine unpatented claims in Smye Township. The nine additional claims are: PA285927; PA285961 to 285967 inclusive; and PA285972.

Mid-North Engineering Services Limited also acquired a 95 percent interest in 14 more unpatented claims in Smye and McGillis Townships: namely PA254506 to 254518 inclusive, and PA261210. The nine claim group and the 14 claim group were originally staked for Langis Silver and Cobalt Mining Company Limited (Figure 4). The 23 additional claims lie east of the original 14 claims. Mid-North Engineering Services Limited conducted a geophysical survey on the Langis Silver and Cobalt Mining Company property, and picked up eleven electromagnetic conductors. The results of this survey are given in this report under the name of the latter mentioned company.

A geophysical survey was done on the western part of the property to correlate with that done on the 14 claims done earlier for Langis Silver and Cobalt Mining Company Limited on the eastern part of the property. The combined electromagnetic and magnetic survey was done during July and August of 1971. Survey readings were taken at 15 m (50 feet) intervals along grid lines spaced 120 m (400 feet) apart. Background magnetic intensity varied from 1,000 to 1,400 gammas. The survey showed a strong magnetic ridge-like feature ranging up to 5,000 gammas which trends northeast from the southwest corner of the property. The ridge is 1650 m (5,400 feet) long, and varies from 15 to 45 m (50 to 150 feet) in width. The extent and strength of this feature indicates that it is caused by iron formation. Numerous local electromagnetically conductive zones were also found, but many could not be correlated from one picket line to another and suggest that (Assessment Files Research Office, Division of Mines, Toronto, File 2.614):

> these conductive zones are *en echelon* rather than long single zones of conductivity which would be suggestive of graphitic shear zones.

Some of these conductive zones are associated with the previously described magnetic ridge, while others are found flanking it. Further investigation of some of the zones of conductivity was recommended in the assessment report (Assessment Files Research Office, Division of Mines, Toronto, File 2.164).

During the fall of 1971, a geochemical survey for copper, lead, and zinc was conducted over nine claims in the eastern part of the property, which included a base metal showing associated with a silicified zone as shown on the enclosed geological map (Map 2398, back pocket). The nine claims were: PA254515 to 254517 inclusive; and PA254506 to 254511 inclusive.

The soil sampling was conducted over the known geophysically anomalous zones. In general, the results obtained from the geochemical survey (Assessment Files Research Office, Division of Mines, Toronto, File 2.854) showed no correlation to those obtained from the geophysical survey, and were found to be inconclusive.

The base-metal showing was visited by the author and Roger Mercier of Mid-North Engineering Services Limited, during August 1972.

The minerals are concentrated in a silicified zone situated 520 m (1,700 feet) south of Pride Lake in northwestern Smye Township; this silicified zone occurs in pillowed lavas of basaltic composition. The zone which is exposed in three test pits, strikes approximately N85°E, and dips from vertical to 80° to the north. The silicified zone is 3 to 4.6 m (10 to 15 feet) wide, and is traceable along strike for approximately 600 m (200 feet). The test pits that delineate the mineralized zone are however, aligned at N65°E and this apparent difference from the strike of the silicified zone (N85°E) might indicate progressive offsetting of the mineralized and silicified zones. Numerous joints and fractures strike N20°E and dip 85° to the northeast. The country rocks in the immediate vicinity are strongly sheared. Pyrite is disseminated throughout the silicified zone. Several samples that appear to have been blasted contained massive sphalerite and galena, and were found near the trenches, but the location of their source was not evident in the exposed trenches. Initial grab samples collected and assayed by a representative of Mid-North Engineering Services Limited assayed as follows (Assessment Files Research Office, Division of Mines, Toronto, File 63.2922):

Sample Number	Copper (Percent)	Zinc (Percent)	Lead (Percent)	Gold (oz./ton)	Silver (oz./ton)
1	0.02	5.92	0.80	0.01	0.46
2	0.07	1.29	0.32	0.15	0.27
3	0.05	0.79	2.32	0.02	1.22
4	0.04	1.57	2.31	0.02	1.34

Randomly collected samples, including two of the massive sphalerite float samples (Samples 1 and 3) taken by the author in 1972, when assayed by the Mineral Research Branch Division of Mines, yielded the values given in Table 8.

The value obtained by Mid-North Engineering Services Limited (Table 8, Sample 1) is similar to the values obtained from the float samples (Table 8, Samples 1 and 3) taken by the author.

Diamond drilling was done on the property by Mid-North Engineering Services Limited from October 1971 through to February 1972. Eight diamond-drill holes were sunk for a total of 654 m (2,146 feet). The footage and accompanying mineralization of the diamond drilling is given in Table 6. Most of the drilling intersected mafic to intermediate metavolcanic extrusive rocks which are injected by secondary quartz veins, or veinlets with some associated carbonate and silicified zones. Mainly disseminated pyrite, pyrrhotite, and traces of chalcopyrite are generally associated with the margins of the secondary quartz injections and the interior of the silicified zones. Two holes contained minor amounts of lead

TABLE 8 ASSAYS OF SAMPLES, AMALGAMATED RARE EARTH MINES LIMITED.

Selected Sample	Visible Mineralization	Gold oz. per ton	Silver oz. per ton	Lead %	Zinc %
1	massive sphalerite and quartz	0.07	0.89	2.60	9.50
2	silicified zone, minor sulphides	0.01	trace	nil	0.23
3	massive sphalerite, silicified zone with some disseminated sulphides	0.27	0.63	0.78	5.78
4	barren silicified zone	0.02	trace	nil	nil

and zinc as indicated in Table 6. Five of the holes were barren, or contained very little mineralization. Six of the holes were drilled across the silicified zone and two of the holes were drilled across the large (1100 m; 3,600 feet) conductive zone (see account for "Langis Silver and Cobalt Mining Company Limited") situated just south of the conductor associated with the silicified zone itself. The best hole was the second diamond-drill hole which intersected the silicified zone from a length of 64.3 to 66.3 m (211.1 to 211.5 feet). Assays were low in gold and silver, but contained 0.06 percent copper and 0.08 percent zinc. Mineralization associated with smaller silicified zones from 26.7 to 76.8 m (87.5 to 169.2 feet) in the same hole gave similar results, except in one 1.7 m (3.5 feet) section which gave slightly higher zinc values (0.18 percent) as well as 0.32 percent lead. Of the two diamond-drill holes that intersected the large conductor to the south only minor pyrite and chalcopyrite associated with quartz veins were located in one hole and iron formation, minor pyrite and pyrrhotite, and traces of chalcopyrite were located in the other hole. The claims were in good standing on December 31, 1972.

Langis Silver and Cobalt Mining Company Limited (17)

These claims became part of the claims held under the jurisdiction of the Amalgamated Rare Earth Mines Limited property on August, 1971.

During January and February 1971, Mid-North Engineering Services Limited held a group of 23 claims (Figure 4) in northwestern Smye Township on behalf of Langis Silver and Cobalt Mining Company Limited. The claims were numbered: PA254506 to 254518 inclusive; PA261210; PA285961 to 285967 inclusive; PA285972; PA285927.

At that time, Mid-North Engineering Services Limited conducted a combined magnetic and electromagnetic survey (EM16) over the claim group. The survey was done on a 120 m (400 feet) grid system of picket lines striking N35°W. Survey readings were taken every 15 m (50 feet).

The claim group is situated on ground underlain by mainly mafic to intermediate metavolcanics in the north, but part of the south-central part is underlain by the granitic plug. The survey delimited several strong magnetic ridges with magnetic intensities above 1,500 gammas (i.e. above a background level of 1,000 to 1,400 gammas). Within these ridges, which are roughly aligned east-west, the magnetic intensities rise up to between 3,000 and 5,000 gammas, and locally are as high as 10,000 gammas.

Eleven electromagnetic conductors were found and nine of these were quoted in the assessment report as being fairly strong (Assessment Files Research Office, Division of Mines, Toronto). All the conductors have an easterly trend, and range in length from 150 to 1100 m (500 to 3,600 feet). A 426 m (1,400 foot) conductor associated with a mineralized, silicified zone shown on the map (Map 2398, back pocket) in northwestern Smye Township within the claim group is perhaps the most significant conductor. This mineralized zone is described under the Amalgamated Rare Earth Mines Limited property of Mid-North Engineering Services Limited. At a small scale, (1:4,800; 1 inch to 400 feet) this appears to be one long conductor. Further detailed work was done on lines spaced at 30 m (100 feet) intervals and indicates that this conductor is a series of *en echelon* conductors. There were no significant magnetic anomalies associated with this conductive zone. Two more extensive anomalies about 1100 m (3,600 feet) in length south of the above mentioned conductor, do however, have an associated magnetic high, and diamond drilling was recommended (Assessment Files Research Office, Division of Mines, Toronto, File 2.381). About one half of the remaining anomalies which are smaller in extent are associated with water or underlain by granite rocks, and these were discarded. The remainder warranted further investigation.

New Kelore Mines Limited (8, 18)

Mid-North Engineering Services Limited held ten claims on behalf of New Kelore Mines Limited situated along the northern part of the boundary separating Jutten and Smye Townships (Figures 3 and 4). The ten claims were numbered: PA285922, 285923; PA285931 to 285934 inclusive; and PA285941 to 285944 inclusive.

The claim group is underlain mostly by mafic metavolcanic flows and pillow lavas; granitic rocks underlie the extreme southern part of the property.

Mid-North Engineering Services Limited conducted a magnetometer and electromagnetic (EM 16) survey over the ground during July and August of 1971 for New Kelore Mines Limited. The survey was conducted over a grid system with picket lines spaced at intervals of 120 m (400 feet). The results (Assessment Files Research Office, Division of Mines, Toronto, File 2.613), of the electromagnetic survey showed numerous isolated zones of conductivity of variable intensity occurring throughout the claim group. Most of the major conductive zones are associated with magnetic anomalies that have a similar northeast trend parallel to the trend of the underlying rocks. Two conductors exposed in the south part of the property appear to be associated with the granitic-volcanic contact and iron formation respectively. Several other conductors that were associated with water drainage courses, are probably caused by graphite, and were not tested. Some of the other smaller, discontinuous conductive zones showed no corresponding magnetic expression, and it was recommended that these warranted further investigation, including prospecting, geochemical soil sampling, and limited diamond drilling (Assessment Files Research Office, Division of Mines, Toronto, File 2.613). A pronounced, northeast-trending magnetic ridge is continuous with a magnetic ridge found to the west. The intensity of the anomalous zone ranges up to 40,000 gammas, and is probably caused by iron formation. Magnetic attraction was also noted in the vicinity by a member of the field party. No further work has been recorded to date.

All the claims originally staked by New Kelore Mines Limited in the map-area were all in good standing on December, 1972.

Nickel Rim Mines Limited (9, 19)

In 1972, Mid-North Engineering Services Limited held on behalf of Nickel Rim Mines Limited, 27 contiguous unpatented mining claims in the northeastern part of Jutten Township and northwest part of Smye Township (Figures 3 and 4). The claims are numbered: PA285945 to 285960 inclusive; PA285973 to 285976 inclusive; PA285392 to 285396 inclusive; and PA285968 to 285969 inclusive.

The claim block adjoins the eastern boundary of the four patented claims indicated on Map 2398 (back pocket) in the centre of Jutten Township, and from there trends northeast straddling the granite-metavolcanic rock contact. Most of the claims are underlain by mafic to intermediate pillow lavas and flows.

A magnetic and electromagnetic survey was done over the property in 1971 by Mid-North Engineering Services Limited. A number of small strongly magnetic zones (ranging up to 13,000 gammas) are present, and are thought to indicate the presence of iron formation (Assessment Files Research Office, Division of Mines Toronto File 2.834). Several other anomalous magnetic readings were noted, but were local in extent. All the magnetic zones were trending northeast in direct consequence to the trend of the associated mafic to intermediate metavolcanic flows and pillow lavas. Most of the conductors show little if any magnetic expression. One conductor may be 1000 m (3,300 feet) in length, but its characteristics vary greatly throughout (Assessment Files Research Office, Division of Mines, Toronto, File 2.834). Several small conductors are correlatable with the magnetics, and further surface examination and geophysical surveying of these has been recommended in the hope of locating some diamond-drill hole targets (Assessment Files Research Office, Division of Mines, Toronto, File 2.834).

United Macfie Mines Limited (10)

Mid-North Engineering Services Limited held on behalf of United Macfie Mines Limited 15 claims situated in the northeast corner of Jutten Township (Figure 3). The claims are numbered: PA280973 to 280982 inclusive; and

PA285917 to 285921 inclusive.

The property is underlain mainly by mafic to intermediate fine- to medium-grained flows and lesser volumes of pillow lavas. There are numerous test pits and stripping located at two different widely spaced locations.

The early history and development of these excavations is obscure, because little of the work has been submitted to the assessment files. According to a file in the Resident Geologist's Files, Ontario Ministry of Natural Resources, at Sioux Lookout submitted by M.W. Bartley, this was originally known as the "M.C. Williams Option." The property was staked by Messrs., E. MacKinnon and H. Hollingsworth for Mr. Williams in 1939. According to this file, written by Bartley, and titled the "M.C. Williams Option", the previous development is shown in Figure 6, and was described as follows:

> In 1927, some $5,000.00 was spent on surface work on claim TB-26640. In the autumn of 1939 Diamond Drill Holes No.l, 1-X, 4,5,6,10,11 and 12, were drilled by Mr. Williams. In the same year surface workings and drill cores were re-sampled by Mr. Samuel. To quote from his private report: "Visible gold was seen in the quartz, and assays from Trenches No.3 and 4 are good, but the lens is only about 32 feet [9.8 m] long, and Drill hole No.14 give an average value of only $1.79 from about 15 feet [4.6 m] to 25 feet [7.6 m] vertically below the surface in similar mineralized quartz and siliceous material to the pit (Tr.No. 3) itself. The other point where a high assay was obtained was Hole No. 5.From this section a piece of quartz showing visible gold was removed, so the assay is probably due to visible gold. Excluding the assays from Trenches No. 3 and 4, and the section in Hole No.5, sixteen other quartz and siliceous vein sections were sampled in trenches and drill holes giving gold values ranging from trace to a maximum of $3.85 (1941 price of gold $38.50/oz), and an arithmetic average of the sixteen sections of $1.53.

Also, the mineralization according to this file was as follows:

> Numerous narrow quartz veins and wider silicified zones were encountered in all drill holes. Many of the veins and zones are barren of mineralization, but others contain coarse and fine-grained pyrite, chalcopyrite, and pyrrhotite. W. Samuel reports the presence of sphalerite, galena, and visible gold in Trenches No.3 and 4, and in Diamond Drill Holes No.1, 1-X, 12 and 5. These minerals were not noted in Holes No. 13 to 17 inclusive. Mr. Samuel states that the high assays obtained in his sampling were probably due to the presence of visible gold.

That diamond-drill programme included 11 diamond-drill holes and numerous excavations, the location of these are shown in Figure 6. Apparently holes 13 and 14 were drilled so as to intersect "any veins or zones lying parallel to the known veins" (Resident Geologist's Files, Ontario Ministry of Natural Resources, Sioux Lookout, M. Bartley File). Holes 1,4,5,6,10, 11,12 were drilled in 1939, and holes 13 to 17 were drilled in 1941. The total footage of all the drill holes was 328.3 m (1,077 feet). No record of the diamond-drill logs for the holes drilled in 1939, is known to exist in the Resident Geologist's Files, Ontario Ministry of Natural Resources, Sioux Lookout), but diamond drilling logs of holes 13 to 16 are recorded there. These latter holes intersected sheared mafic metavolcanics, locally broken by sparsely mineralized silicified zones and quartz veins. Forty-five samples were taken from these last five holes for assay, but only seven returned a gold content with the highest running at 0.05 ounce of gold per ton.

A combined electromagnetic and magnetic survey was conducted over 12 of the claims held by United Macfie Mines Limited in the summer of 1971. The remaining three claims not surveyed are entirely underwater. Picket lines were cut at intervals of 120 m (400 feet) with readings being taken every 15 m (50 feet).

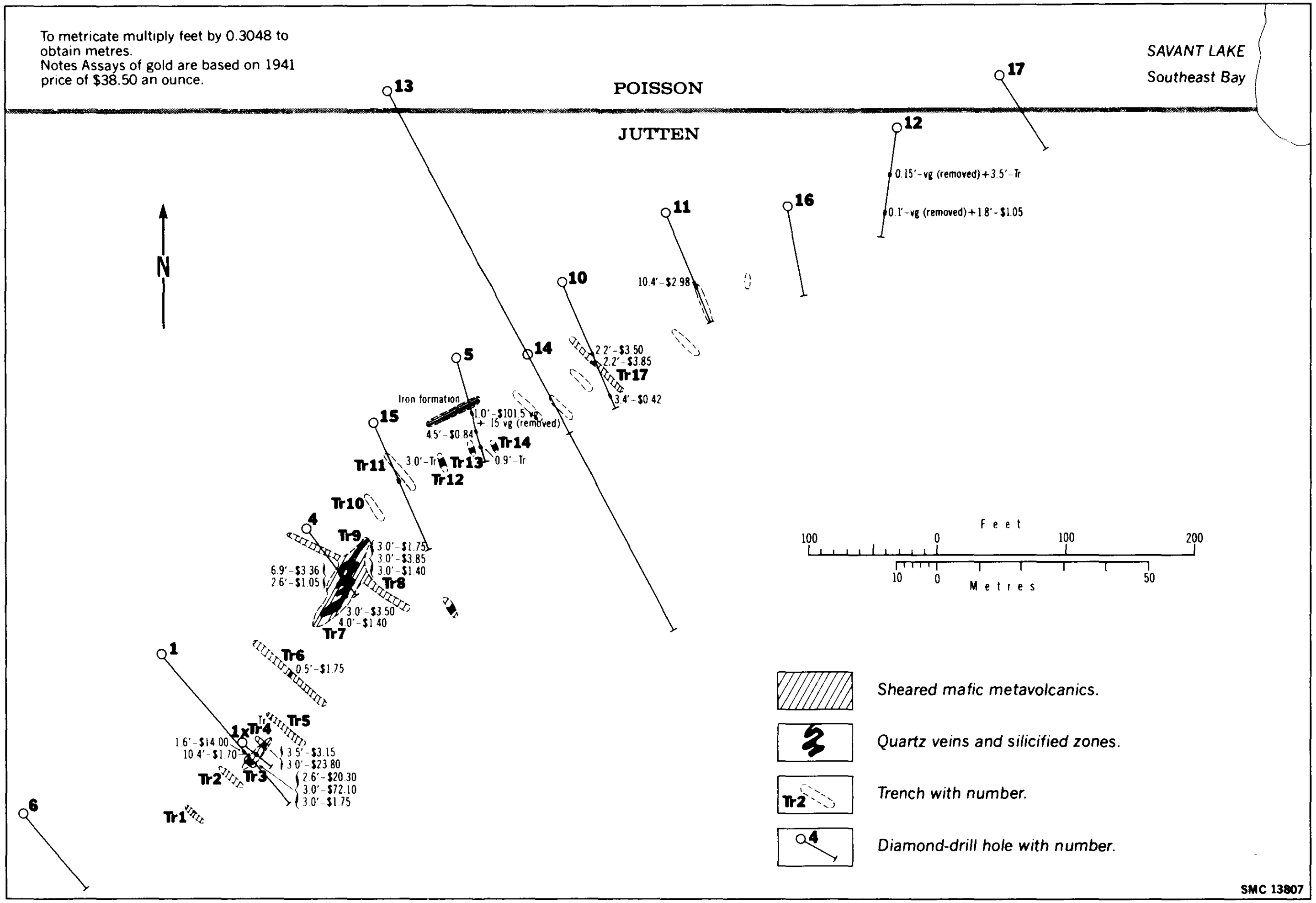


Figure 6–Plan showing the location of excavations and diamond drilling on the "Mid-North Engineering Services Limited Property". Geology by W. Samuel, March 1941. Compiled with minor additions by M.W. Bartley. Plan obtained from Resident Geologist's Files, Ontario Ministry of Nat-

The magnetometer survey disclosed several isolated anomalous zones over 2,000 gammas in intensity above a background that varies from 1,300 to 1,700 gammas. According to the company report (Assessment Files Research Office, Division of Mines, Toronto, File 2.611), only a few high readings were found to be present, and these were generally in the form of small isolated pods that are probably not due to iron formation. Several electromagnetic conductors were found, but most showed little correlation with the anomalous magnetic zones. According to the File 2.611, there are some conductive zones nearby, but these are not directly associated with the old trenchings. The most intense conductor is, in part, associated with a large irregular magnetic anomaly to the north of the trenches.

Roger Mercier of Mid-North Engineering Services, was very helpful in conducting the author on a tour of the main test pit zone during the field season. The large shear zone north of Stillar Bay on the Quebec Sturgeon River Mines property has already been discussed. However, this shear zone can be traced discontinuously all the way into Southeast Bay and is almost 5 km (3 miles) in length. Test pits are spotted throughout but there are three main areas possessing a higher concentration of workings and these occur near the zone's eastern flanks. The two more westerly test pit zones are located 550 m (1,800 feet) and about 1.6 km (1 mile) east of the northwest corner of Stillar Bay, respectively. They are each characterized by three or four test pits and strippings. These workings are mostly overgrown and filled in, but some quartz and silicified veins that are locally mineralized are present in the test pits situated 1.6 km (1 mile) east of Stillar Bay.

The main test pit zone shown in Figure 6 contains over 25 test pits and strippings. These also have been filled in over the years, but during the 1972 field season, Mid-North Engineering Services Limited cleaned and restripped many of the showings. Essentially the test pits are characterized by a series of discontinuous quartz and carbonate veins and silicified volcanic rocks that are locally mineralized, and hosted in a chloritic shear zone located between mafic metavolcanic pillow lavas and flows. The quartz and silicified veins are locally folded and contorted as shown in Figure 6. In trench number 7, the silicified veins average 15 cm (6 inches) in width, but are up to 50 cm (20 inches) across. The widest quartz vein observed was 1 m (3.5 feet) wide. Individual quartz and silicified veins have an observed maximum length of 9 m (30 feet). The shear zone varies in direction from N65°E in the western test pits to N80°E in its eastern flanks, and dips from vertical to 80° north. Locally, the dip varies to 85°S due to the dip of the intruded quartz veins. The main mineralized, silicified zone varies along strike but is up to 4.6 m (15 feet) wide. Mid-North Engineering Services Limited extended the stripping southeast of Trench No.8, and the sheared zone is at least 120 m (400 feet) wide at that point. Iron formation is shown to occur as a band in the long thin test pit to the north of Trenches 12, 13, and 14, but was not observed in the field.

Chalcopyrite, pyrrhotite, pyrite, marcasite, and gold are visible as disseminations, veinlets and small pods. The individual minerals occur singly, in zones that are not traceable for any great distances. A sample of a pod of massive pyrite with minor chalcopyrite from Trench 14 (Figure 6) taken by the author and analysed by the Mineral Research Branch, Division of Mines, was found to contain 0.08 ounce of gold per ton, traces of silver, and 0.52 percent copper. Pyrite and marcasite occur as isolated crystals that are densely concentrated along fairly continuous shear planes. Samples of the quartz, carbonate, and marcasite from sheared zones in Trenches 8 and 9 analysed by the Mineral Research Branch, Division of Mines, yielded the highest gold assays (0.10 ounce of gold per ton) obtained from assays of selected samples taken by the author. A grab sample of the silicified zone taken by the author, and assayed by the Mineral Research Branch gave 0.02 ounce of gold per ton.

In places, this mineralized zone appears to be structurally controlled along the contact of pillow lavas and massive flows. This is an important consideration in any further exploration.

United Macfie Mines Limited sunk three diamond-drill holes for a total length of 284 m (932 feet) in 1971. The holes are not shown on the map (Map 2398, back pocket), but were drilled to intersect the main silicified zone. The mineralogy intersected was similar to that described above, except that sphalerite was also intersected, and assay results are given in with the summary of the diamond drilling given in Table 6. The best assay yielded 0.22 ounce of gold per ton with a trace of silver, 0.02 percent copper, and 0.03 percent zinc over an approximate length of 3.66 m (12 feet).

The 15 claims were still held by the company in December 1972.

NORANDA EXPLORATION COMPANY LIMITED (4, 11)

During 1972, the Noranda Exploration Company Limited held a large number of unpatented claims in both Conant and Jutten Townships that were acquired in 1970. On the two claim maps (Figures 2 and 3), these claims form six individual blocks, and the approximate location with the corresponding claim numbers and assessment file data are given in Table 9.

Areas 8 and 9 adjoin each other as do areas 2, 6, and 7. The company conducted an airborne geophysical survey on the area, and this was followed by combined ground magnetic and electromagnetic surveys done on each claim group. Readings were located along grid lines, and spaced at 120 m (400 feet) intervals.

Area 1

Most of the ten airborne anomalies in the northern part of the claim group occur on the west shore of the South Arm of Savant Lake were located on the ground (Assessment Files Research Office, Division of Mines, Toronto, File 2.475). The ground electromagnetic anomalies trend from generally north to northwest, and coincide with the associated magnetic trend, and have a variation of several hundred gammas above the background. The northern part of this claim group is underlain by sheared intermediate metavolcanic flows or tuffs. The strongest and longest conductor is 800 m (2,600 feet) in length, and is located near the small lake 600 m (2,000 feet) west of the central west shoreline of the South Arm of Savant Lake. The conductor was drilled (Table 5; Assessment

TABLE 9 ASSESSMENT DATA ON FILE, NORANDA EXPLORATION COMPANY LIMITED, ASSESSMENT FILES RESEARCH OFFICE, DIVISION OF MINES, TORONTO.

Location	Claim Numbers	Number of Claims		Toronto Assessment File Number
1. Along the border of Conant and Jutten Townships (see Figure 2, and 3).	PA263043 to 263055 inclusive	13		2.475
	PA263057 to 263065 inclusive	9	28	
	PA274932 to 274935 inclusive	4		
	PA274938 to 274939 inclusive	2		
2. Vicinity of Hackett Lake, Jutten Township (see Figure 3).	PA230306 to 230307	2		
	PA230309 to 230322 inclusive	14		
	PA230324	1	32	2.526
	PA230326 to 230328 inclusive	3		
	PA238759 to 238764 inclusive	6		
	PA238792 to 238794 inclusive	3		
	PA254489 to 254491 inclusive	3		
3. Northend of Handy Lake, Conant Tp. (see Figure 2).	PA263066 to 263069 inclusive	4		2.535
4. 0.8 km (½ mile) east of Marchington R. Conant Tp. (see Figure 2).	PA263070 to 263072 inclusive	6		2.538
	PA285535 to 285537 inclusive			
5. Northwest corner of Conant Tp. (see Figure 2).	PA263039 to 263042 inclusive	5		2.541
	PA285530			
6. 0.8 km (½ mile) east-southeast of Stillar Bay Jutten Township (see Figure 3).	PA263144 to 263150 inclusive	7		2.553
7. Northeast corner of Jutten Township (see Figure 3).	PA263151 to 263157	7		2.555
8. Southern part of Conant Township (see Figure 3).	—	69		2.558 2.768
9. South-central border of Conant Township (see Figure 2).	PA295204 to 295206 inclusive	3		
	PA305389 to 305390 inclusive	3		2.792
	PA309115 to 309118 inclusive	4		

Files Research Office, Division of Mines, Toronto, File 20), but generally only minor disseminated pyrite, traces of chalcopyrite and graphite were encountered.

The southern part of this claim group is located on the east shore of the South Arm of Savant Lake, and is underlain by mainly arenaceous and ferruginous metasediments, metaconglomerate, and intermediate to mafic metavolcanics. Several conductive zones were found, but are associated with a strong magnetic anomaly related to the underlying iron formation-bearing metasediments, and were not diamond-drilled (Assessment Files Research Office, Division of Mines, Toronto, File 2.475).

Area 2

This property was known as the "Ranta Option". Three airborne anomalies were located on the ground in the northern part of the property which is entirely underlain by mafic to intermediate metavolcanic flows and pillow lavas. The conductors trend northeast, and reflect the trend of the underlying lithologies and show a good correlation with the magnetic survey (Assessment Files Research Office, Division of Mines, Toronto, File 2.526). It is possible that the three anomalies are continuous with one another. Two diamond-drill holes were spotted near the conductive zone and the results are given in Table 6. Local zones of sulphide minerals, generally containing small percentages of gold, silver, copper, lead, and zinc were revealed in the drill core. Several weak conductors were found in the southern part of the property but did not correlate with any magnetic anomalous zones. The claims were in good standing in December 1972.

Area 3

A fairly strong electromagnetic airborne anomaly was found to occur on this claim group but follow up geophysical surveys, including electromagnetic and vertical loop surveys, failed to locate it on the ground (Assessment Files Research Office, Division of Mines, Toronto, File 2.535). No magnetic anomalies were located, and as a result these claims have since been dropped by the company. This area is underlain by porphyritic felsic intrusive rocks.

Area 4

This six claim group straddles the boundary of the Grebe Lake Pluton with the felsic to intermediate metavolcanic flows or tuffs. One electromagnetic anomaly trending northwest for 240 m (800 feet) was found but there was no associated magnetic anomaly. Magnetic anomalies in the extreme southern part of the claim group are related to a band of iron formation-bearing metasediments. No diamond drilling was done by Noranda Exploration Company Limited on this claim group which was still held by the company on December 31, 1972.

Area 5

The five (5) claims in Area 5 are underlain by metasediments to the north and by felsic to intermediate pyroclastic rocks to the south. Two drill holes were put down to test one conductor (Assessment Files Research Office, Division of Mines, Toronto, File 14) Table 6, but only disseminated pyrite and pyrrhotite with some graphite was encountered. A highly anomalous magnetic zone on the south of the property in claim PA285530 is probably related to the band of iron formation-bearing metasediments just to the south of the claim group. The claims were still in good standing on December 31, 1972.

Area 6

A northeasterly-trending conductor was found in the southern part of this property and extends for about 240 m (800 feet). According to the Assessment Files Research Office, Division of Mines, Toronto, there is a test pit situated near this conductor; this test pit was not observed during the present mapping program, and is not marked on the accompanying maps. The test pit was reported to contain small amounts of pyrite and pyrrhotite (Assessment Files Research Office, Division of Mines, Toronto, File 2.553). The claim group is underlain by mafic to intermediate metavolcanic flows and pillow lavas. This conductive zone was accompanied by only a slight magnetic anomaly.

In the northern part of the property, another 240 m (800 feet) conductor was found with a strong magnetic expression, but was regarded as being caused by overburden.

All of these seven claims were held by the company on December 31, 1972.

Area 7

Four strong electromagnetic anomalies were picked out by the airborne survey over these claims which are underlain by mafic to intermediate metavolcanic flows and pillow lavas. Only one of these could be located by follow-up ground geophysics and a second vertical loop survey was conducted over the ground (Assessment Files Research Office, Division of Mines, Toronto, File 2.555). A northeast-trending conductive zone was found to extend completely across the property; this zone, according to the above file, may be continuous with the conductor found to the southwest of this property in Area 6. If so, this conductive zone may be up to 2.4 km (1.5 miles) long. Although the magnetic survey disclosed several isolated magnetic anomalies, none of these correlated with the axial trend of the electromagnetic conductor. Additional work was recommended in the same assessment report, but no further work has been submitted to date. The claims were in good standing as of December 31, 1972.

Area 8

The largest group of claims staked by the Noranda Exploration Company Limited covered much of the southern part of Conant Township. During preliminary field investigations, the company resolved that there were two different structural trends indicated from the geophysical surveys. The two trends are due to the underlying folded sequence of mafic, intermediate, and felsic metavolcanic and metasedimentary rocks as shown on Map 2398 (back pocket). Numerous electromagnetic conductive zones were found, and vary in length from 120 m (400 feet) up to 490 m (1,600 feet). These coincided with good correlatable magnetic expressions. When the results of these surveys are superimposed on Map 2398 (back pocket), most of them coincide with the intermediate to mafic metavolcanic flow unit in the centre of the folded sequence of felsic to intermediate metavolcanics to the west of the South Arm of Savant Lake.

Diamond drilling along this mafic zone (File 16, 17, 18, 19, in Table 6) showed the conductors to be due to small graphitic and sulphide zones associated with quartz-carbonate veinlets containing disseminated pyrite and pyrrhotite and minor amounts of copper, zinc, gold, and silver. The sulphide mineralization appears to be associated with the intermediate to mafic flow unit, and is not with the surrounding pyroclastic rocks. Although some of these claims had elapsed, the majority of the claims were still held on December 31, 1972.

Area 9

An interesting airborne electromagnetic response was indicated in claim PA309115. Several parallel electromagnetic anomalous zones were found, all with strong magnetic associations. Several of the conductive zones trend southwest off the claim into the property owned by the International Nickel Company of Canada Limited. The claims are underlain by mafic metavolcanics and the conductors are undoubtedly related to the same type of mineralization noted in the surrounding area (Area 8). This mafic unit was also drilled by the Canadian Nickel Company Limited, and the results are described in the list of properties under the appropriate company name. These claims were still in good standing on December 31, 1972.

NORTHERN CANADA MINES LIMITED (12)

Northern Canada Mines Limited has owned the four patented claims in the centre of Jutten Township (Figure 3) since 1948. These are the only surveyed claims in the map-area, and are numbered: TB37809, TB37812, TB37814, and TB37942.

The earliest information recorded on these claims is to be found in the September 9th, 1948 issue of the Northern Miner (1948a) which described a "strong shear structure" to the east of Savant Lake containing zinc, copper, lead, gold, and silver. At that time, Northern Canada Mines Limited shared 50 percent interest in the four claims (Northern Miner 1959a) with Kirkland Lake Gold Mining Company Limited, but purchased the remaining 50 percent from the latter company in January, 1959 (Northern Miner, 1959b).

According to the year end report on work done (Northern Miner 1948b), 28 claims were staked, and 15 others were optioned in Jutten Township by Northern Canada Mines Limited, and involved showings of zinc, silver, and several gold-bearing quartz veins. A small amount of stripping and x-ray drilling was done towards the close of the season. The "number 6 zone" (which refers to the showing on claim TB37942) shown on Map 2398 (back pocket) was reported as being the most promising (Northern Miner 1948b). There, a quartz vein was exposed for up to 30 m (100 feet) varying in width from 0.6 to 1.8 m (2 to 6 feet), and was found to carry pyrite, galena, and chalcopyrite (Northern Miner 1948b). Two x-ray holes, 3.6 m (12 feet) apart intersected mineralization assaying 2.67 ounces of gold over a length of 1.2 m (4.0 feet) and 0.74 ounce of gold over 2.0 m (6.5 feet) respectively. Another hole, 17.7 m (58 feet) along strike gave an assay of 0.30 ounce of gold over 0.4 m (1.3 feet).

Northern Canada Mines Limited carried out more extensive sampling and used x-ray diamond drilling the following field season. The results are given in the Northern Miner (1949) as follows:

> Surface sampling at 10 foot [3 m] intervals (along strike) gave an average value of 3.13 ounces of gold per ton across 3.7 feet [1.1 m] (assumed average channel sample width) along a strike length of 100 feet [30 m]. If an additional sample in a trench 20 feet [6 m] to the east is included, the quartz vein on surface averaged 2.97 ounces of gold across 3.3 feet [1.0 m] (assumed channel sample width) for a 120 foot [36.6 m] length. A total of 23 holes were drilled through the vein and its projections along a strike length of 590 feet [179.8 m] and to a depth of 120 feet [36.6 m].
>
> The vein, where cut in the holes near the outcrop surface is fairly wide and high grade, while in the deeper holes it is narrow and low grade. In the vicinity of the outcrop along a strike length of 250 feet [760 m], 10 holes to the 50 foot [15 m] horizon returned average values of 1.08 ounces of gold per ton over an average core width of 1.7 feet [0.5 m]; six holes, with 50 to 100 foot [15 to 30 m] horizons returned 0.12 ounce over a core width of 1.2 feet [0.37 m] and the combined 16 holes returned 0.68 ounce over a width of 1.4 feet [0.43 m]. Weighted combined surface and diamond drill results gave values of 1.81 ounces of gold along a strike length of 184 feet [59.4 m] over a width of 2.0 feet [0.6 m].

Geological mapping was also done by the company in the area and as well as diamond-drill logs, was submitted as assessment credits to the "Ontario Bureau of Mines", and is now on file in the Resident Geologist's Files, Ontario Ministry of Natural Resources, Sioux Lookout. Figure 7 shows the geology and location of the diamond-drill holes. Table 10 shows the mineralization encountered in the diamond drilling. Most of the holes intersected intermediate to mafic metavolcanics with pyrite, pyrrhotite, and minor galena, sphalerite, chalcopyrite, and gold; these minerals are nearly always associated within quartz carbonate veins or veinlets. Most of the veins and associated mineralization are less than 5 cm (2 inches) thick. A total of 32 diamond-drill holes (numbered 10-42 in Table 10) were drilled in claims TB37942 and TB37814. Hole numbers 1 to 3 were drilled in TB37855, hole 4 was drilled in TB37967 and holes 5 to 9 were drilled in TB37815.

The test pit zone and stripping was visited by the author during the field season. The stripping is located at the northwest margin of a large outcrop that is indicated as a "scarp" on the company geological map (Figure 7). The quartz vein is recrystallized, it dips vertically and is curvilinear striking from N45°E in the southwest to N25°E in the northeast. It averages 1.2 m (4 feet) in width, and has been stripped laterally for 90 m (300 feet). The best assays are from a se-

TABLE 10 SUMMARY OF NORTHERN CANADA DIAMOND DRILLING IN JUTTEN TOWNSHIP 1948-1949.

HOLE	DEPTH (feet)	AZIMUTH (degrees)	DIP (degrees)	MINERALIZATION
1	61.5	334	53	Small veinlets to massive pockets of pyrite, pyrrhotite.
2	63	140	50	—
3	73.4	130	45	—
4	49	160	45	—
5	56	340	50	One quarter to one half inch stringers sphalerite associated with quartz stringers at foot ages: 12.2, 42.8 and 55.0 (some pyrite also present).
6	22	350	55	—
7	20	155	53	Footage 14.5-16.2 — quartz with 1 inch stringer of sphalerite.
8	44	155	50	—
9	49	320	45	Pyrite stringers from footage 36.0-47.4 including some 2 to 3 inch massive zones.
10	64	130	50	Footage 2.2-6.2 — fine veinlets plus masses of pyrite, pyrrhotite, galena, 3 specks visible gold (no assays reported).
11	15	130	50	Footage 4.2-5.3 — galena and quartz plus 2 specks of visible gold.
12	65	135	45	Footage 15.0-17.0 — pyrite blebs plus galena.
13	96	331	50	—
14	80	145	50	—
15	17	—	—	No bedrock encountered.
16	78.6	142	50	Minor visible gold with quartz vein from footage 39.8-40.5.
17	87	140	50	—
18	127	140	50	One to 2 inches only of massive pyrite, pyrrhotite.
19	128.5	140	50	Minor pyritic seams at footage 39.0-57.0.
20	90	140	50	—
21	141	140	50	Minor pyrite and galena with quartz vein at 127.5 feet.
22	157.1	140	50	Pyrite and pyrrhotite associated with silicified veinlets at footage 96.9-107.9.
23	54	140	50	—
24	167	136	50	Footage 90.8-92.4 quartz stringers with pyrite, pyrrhotite and minor sphalerite. Footage 123.3-134.2 schist with galena, sphalerite, pyrite and quartz veinlets.
25	44	138	50	Minor disseminated galena, pyrite associated with several 2-3 inch quartz veins.

Table 10 — continued on next page

Table 10 — continued

HOLE	DEPTH (feet)	AZIMUTH (degrees)	DIP (degrees)	MINERALIZATION
26	63	?	50	Four inches silicified zone with disseminated pyrite, galena, plus other minor silicified zones.
27	47	148	50	—
28	64	154	50	Two inch quartz, veinlet with sparse, pyrrhotite, pyrite, galena.
29	55	340	55	—
30	61	290	60	—
31	57	334	50	--
32	83	154	50	—
33	96	155	50	Minor quartz seams with specks sphalerite, galena.
34	80	140	50	Minor sphalerite, pyrite with 1-2 inch quartz vein.
35	150	150	50	—
36	155	145	45	Very minor pyrite, sphalerite.
37	120	15	45	Pyrite and pyrrhotite in shear zone, minor chalcopyrite.
38	182	125	50	—
39	165	147	50	Some disseminated pyrrhotite, pyrite with several small silicified zones.
40	100	325	50	Disseminated pyrrhotite with 20 foot silicified zones.
41	70	190	50	Very minor pyrite, chalcopyrite, with quartz veinlet.
42	72	117	50	Some pyrite, pyrrhotite, arsenopyrite, with schist and silicified zone.

To metricate; multiply feet by 0.3048 to obtain metres and inches by 2.5 to obtain centimetres.

lected sample of the mineralized quartz vein taken by the author which yielded 0.44 ounce of gold per ton, 0.36 ounce of silver per ton, 0.04 percent copper, and 0.36 percent lead (assays by Mineral Research Branch, Division of Mines). Galena, chalcopyrite, pyrite, and minor specks of visible gold are visible locally in the zone in the field. Four other test pits situated northeast of the stripping are shown on the company geological map (Figure 7), and these were also examined by the author. These test pits are mostly grown over and the geology is partly obscured by debris. The exposed mafic to intermediate metavolcanics are intensely sheared; the minor quartz veinlets are present, but the silicified zone was not observed.

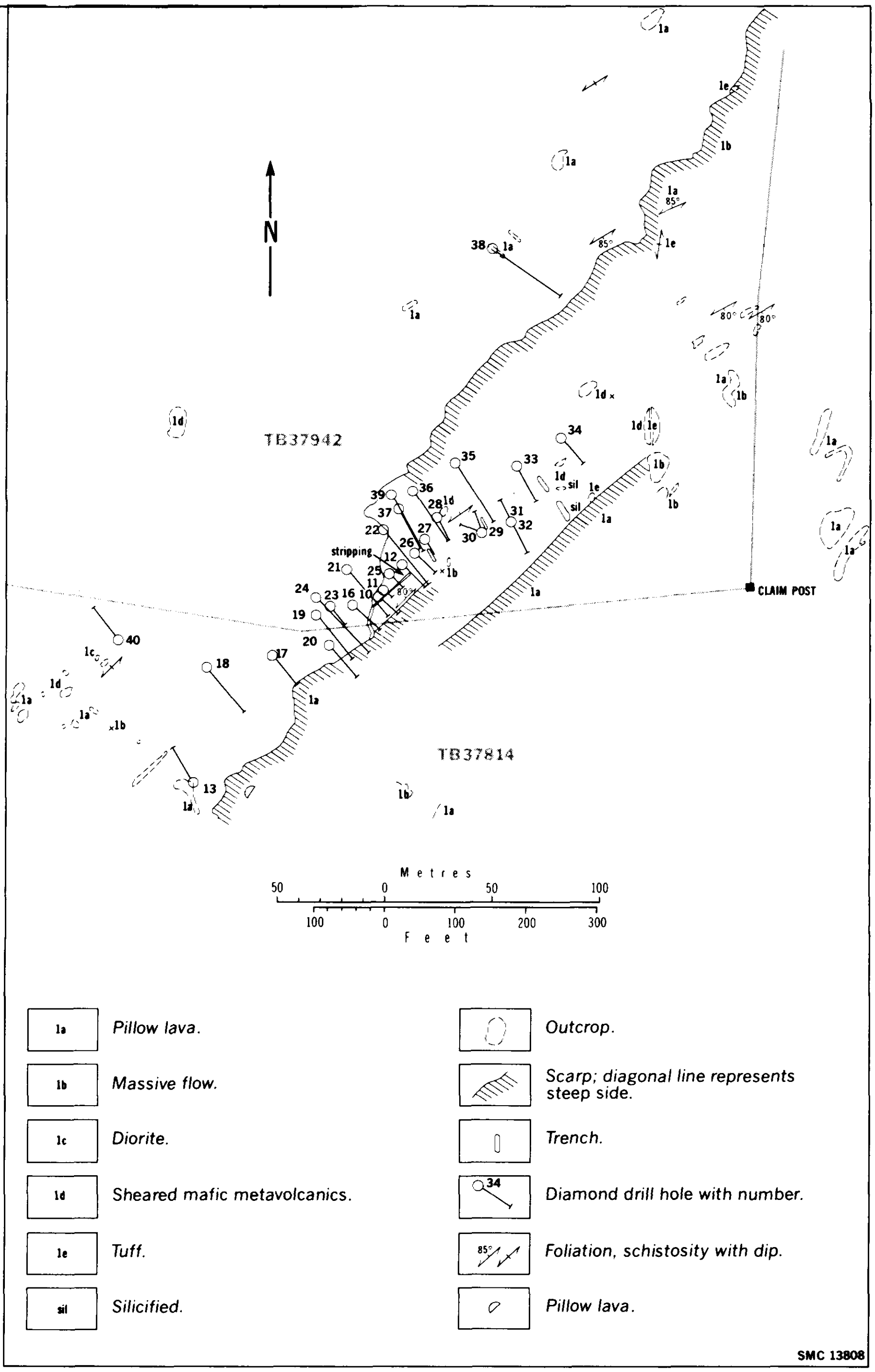


Figure 7–Geological map showing location of diamond-drill holes by Northern Canada Mines Limited. Plan obtained from Resident Geologist's Files, Ontario Ministry of Natural Resources, Sioux Lookout.

No mineralization was observed in the test pit exposures except several float samples obtained from the excavations near the second test pit (to the northeast of the stripping) contained massive pyrite and pyrrhotite.

The claims were still held on December 31st, 1972.

QUEBEC STURGEON MINES LIMITED (13)

Quebec Sturgeon Mines Limited, in a joint venture with Coniagas Mines Limited, staked 27 claims in Jutten Township (Figure 3), north of Stillar Bay during August 1972. The claims held were: PA335214 to 335226 inclusive; and PA336309 to 336320 inclusive. This area centred over the northern part of Stillar Bay, was previously worked by Savant Mines Limited who before, and during 1927, did considerable trenching, test pitting, and stripping and is described by Moore (1928, p.73-75). According to Moore, at that time, the work centred on several east-west trending, gold-bearing quartz veins associated in part with iron formation. He found the quartz to be mineralized with pyrite, chalcopyrite, and arsenopyrite.

Moore stated (1928, p.75):

> ...in no other section of the Savant Lake area are there so many of these zones (i.e. schist zones), and if the assay values were higher, the condition would be more promising.

The present field mapping disclosed that these quartz veins are abundant here, and are in fact associated with a major east-west shear zone north of Stillar Bay. The zone is up to 300 m (1,000 feet) thick and is traceable almost continuously for approximately 4.8 km (3 miles). Approximately ten old test pits, blasted by Savant Mines Limited, were observed during the field season. The mineralization is associated with quartz veins and minor associated quartz-carbonate veins in shear zones. The shearing is generally in an east-west direction, and dips steeply south. Although iron formation was reported to be associated with the mineralized zones by Moore (1928, p.73), none was observed by the author. According to Moore (1928, p.73):

> The veins carry quartz, sericite, carbonate, pyrite, chalcopyrite, arsenopyrite, and in places tourmaline. Native gold is not seen in the quartz veins, but it has been found by panning at many points in the weathered outcrop, and five assays have shown values of a few dollars a ton from several veins.

The author saw only euhedral pyrite, although many of these old excavations are overgrown. Most of the samples of the various test pits collected by the author contained traces of gold as determined by assay. Two of the test pits contain greater amounts of gold, and are indicated as such on the map. Both test pits are about 300 m (1,000 feet) north of the central part of Stillar Bay, and grab samples taken by the author and assayed by the Mineral Research Branch, Division of Mines, yielded from 0.01 to 0.12 ounce of gold per ton. Quebec Sturgeon Mines Limited recommended further evaluation of the property (Assessment Files Research Office, Division of Mines, Toronto, File 63.3008), but no further work has been submitted as assessment credits to date. On December 31, 1972 the claims were in good standing.

RAY RAMSAY (5)

During the 1972 field season, Ray Ramsay held claim PA295107 situated in the extreme northwest corner of Conant Township (Figure 2). The claim is part of a large block of claims owned by Ramsay which is situated to the north of and to the west of this particular claim. These claims are underlain by iron formation-bearing metasediments; the iron formation is abundant here, and has been looked at by several companies. Most of the iron formation is concentrated to the northwest, just outside Conant Township. The history and development of this property dates back to about 1908 and has been previously described by the author (Bond 1977, p.60-66).

The only work reported by Ramsay thus far, is that confined to another nearby claim PA295107 just outside the map-area.

According to the Pershland Gold Mines Prospectus 1957 (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora), the magnetometer survey indicated a potential 500 million ton iron deposit which could be amenable to open pit extraction. A beneficiation test was done on a 600 pound bulk sample extracted from the area by R.G. Ramsay in July 1971. The sample assayed 34.1 to 35.1 percent acid soluble iron (Assessment Files Research Office, Division of Mines, Toronto, File 2.838). Although the magnetic mineralization is very fine grained, preliminary tests showed that an iron super-concentrate with 70 percent Fe, and 2 percent insolubles with greater than 80 percent recovery could be obtained. A full scale test programme has been ordered (Assessment Files Research Office, Division of Mines, Toronto, File 2.838). An estimated 500 million tons is based on a 1957 magnetometer survey, and further detailed examination is required to define tonnage and grade.

SUGGESTIONS FOR FUTURE MINERAL EXPLORATION

Most of the known mineralized showings are situated within the mafic metavolcanic sequence to the east of the South Arm of Savant Lake. These showings generally contain precious minerals (gold and/or silver) and some of the base-metal sulphide minerals (copper, lead, and zinc sulphides). The minerals are associated with highly silicic rocks that appear to be epigenetic, having been injected along pre-existing shear zones. These mineralized fluids may have had their source in the trondhjemitic to granodioritic intrusive body to the south. The gold and silver in some of these zones may have been concentrated by lateral secretion from the volcanic rocks into the quartz veins. From field observations, these zones do not appear to be extensive. The "John Donner" showing is stratigraphically controlled between the metaconglomerate and the mafic metavolcanics. The possible lateral continuity of these zones should be tested by detailed geophysical and geological surveys.

Airborne geophysical surveys have been flown over the Savant Lake area, and the companies involved have done follow-up ground geophysical surveys. The following areas appear to be economically interesting:

i) The felsic, autoclastic, porphyritic flow breccia situated just east of the Grebe Lake Pluton may be a collapse dome breccia, signifying a volcanic centre. If so, the surrounding district would be a favourable area to explore for stratiform, syngenetic base metal deposits.

ii) The felsic tuff-breccia just south of the southwest tip of Grebe Lake containing 2 to 10 percent pyrite in the matrix warrants further examination. A diamond drill hole (Table 6, File 13, Conant Township) located approximately 240 m (800 feet) north of this tuff-breccia encountered concentrations of pyrite, and pyrrhotite as high as 10 percent, indicating that there is mineralization around this area.

iii) The pyrite occurrence situated between Handy Lake and the South Arm of Savant Lake, and just south of the Handy River System was probably initially prospected for gold some time ago, and should be looked at again for its base-metal potential. No diamond drilling has occurred in the vicinity.

The Handy Lake Porphyritic Sills in the vicinity of Conant Lake are spatially associated with felsic plutonic rocks, and may also be younger than the felsic intrusive itself. In considering the economic potential of the Handy Lake Porphyritic Sills, it will be important to determine if the sills are genetically related to the associated plutonic intrusions, or if they are part of the volcanic succession.

The iron formation deposit near the northeast corner of Conant Township may eventually prove to be economic. There, the ferruginous metasediments outlined by the present survey appear to be more voluminous than outlined by company geophysical and geological work (Bond 1977, p.60-66). The iron formation, however, forms only a very small percentage, 5 percent, of the total volume of the metasediments in this area.

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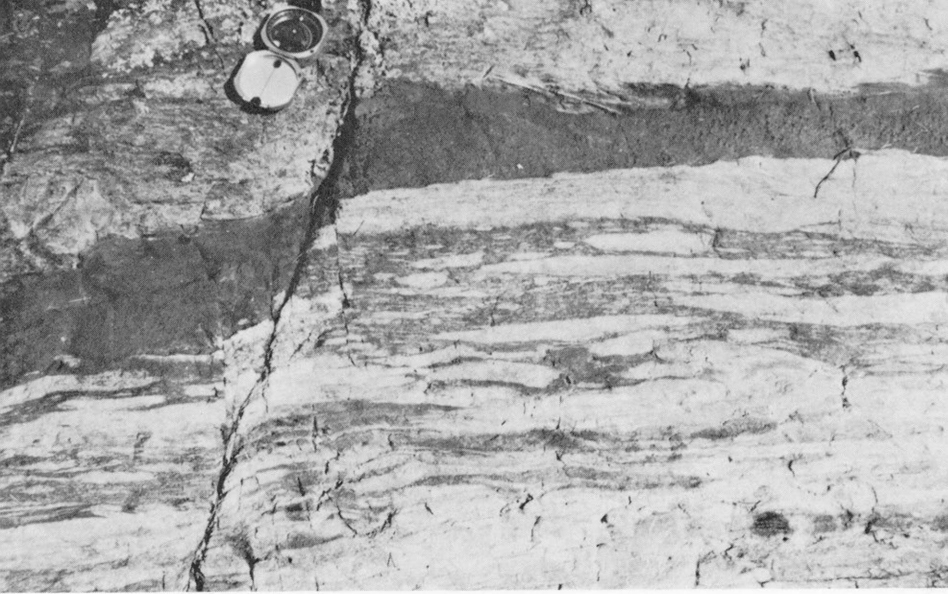

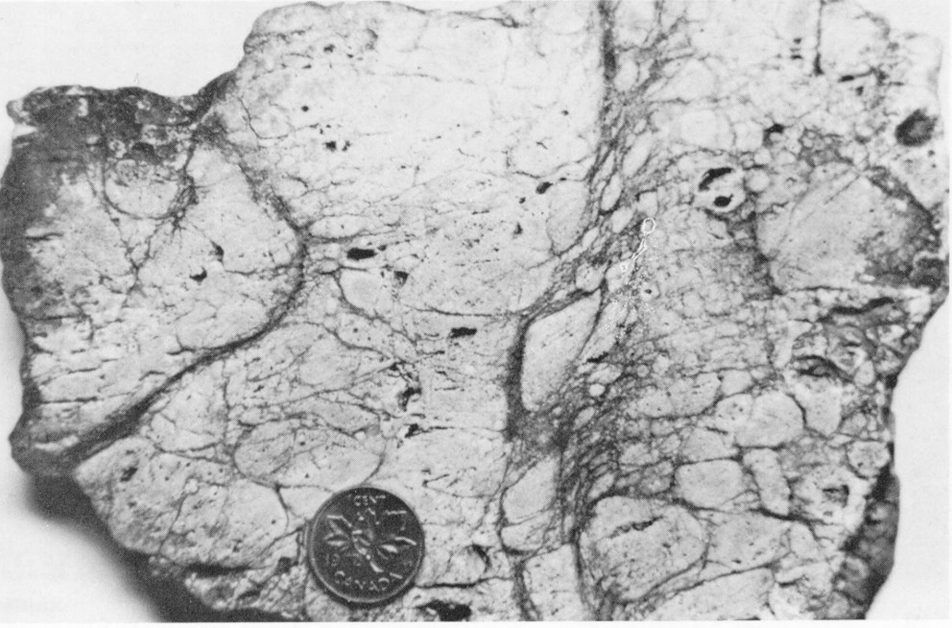
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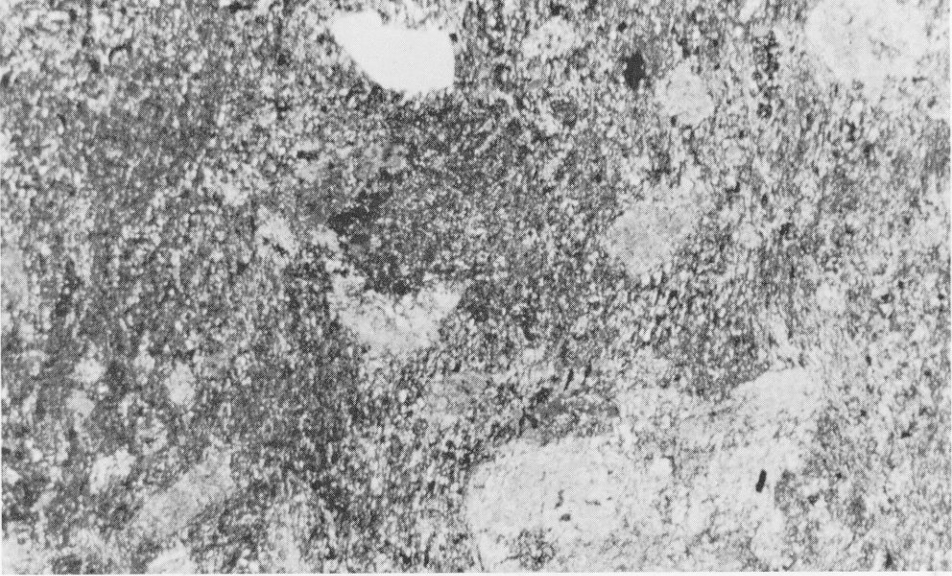

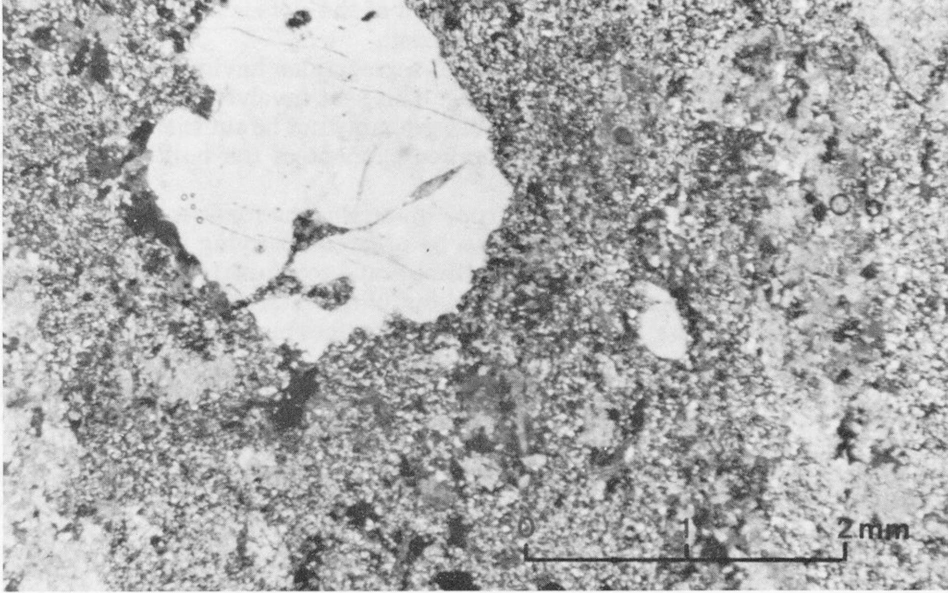
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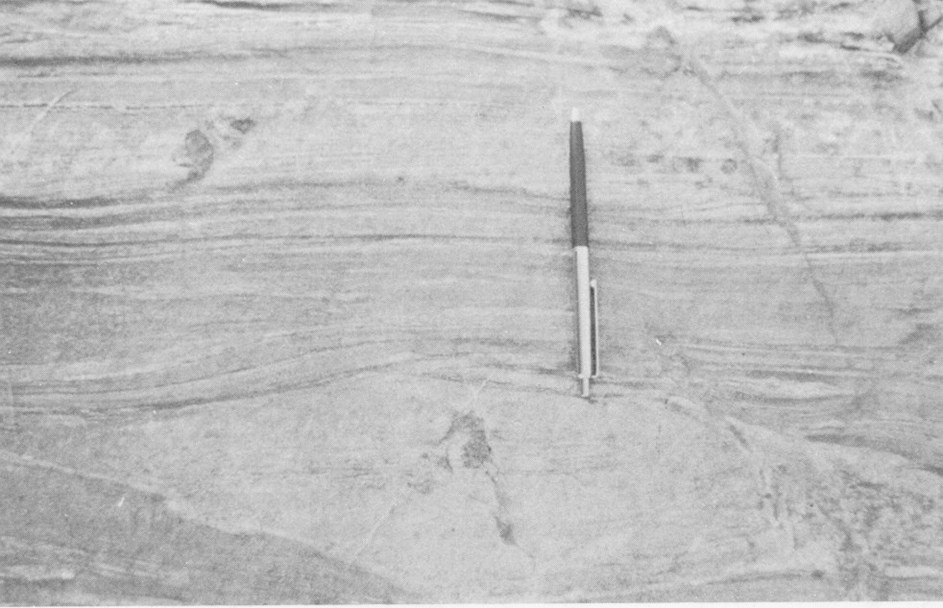

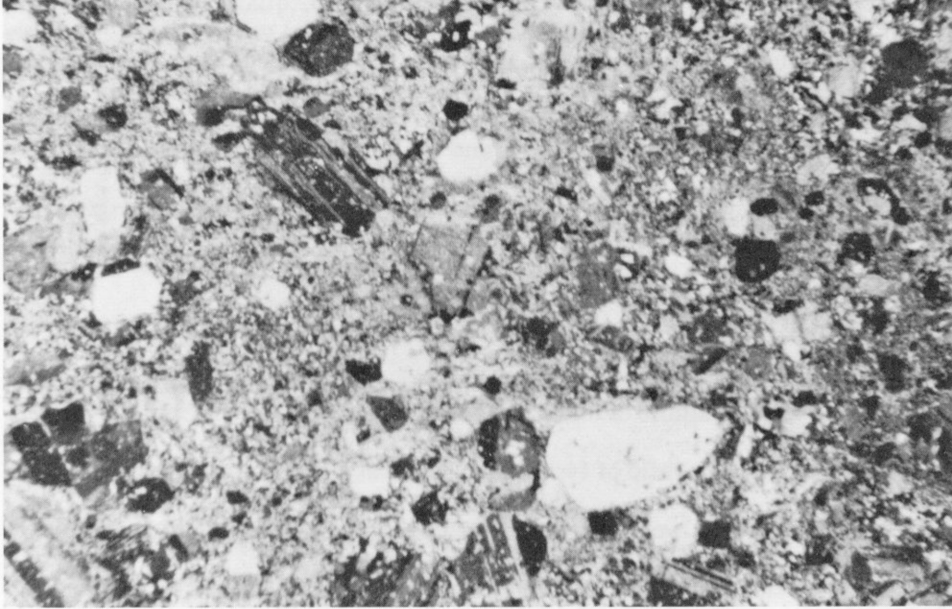

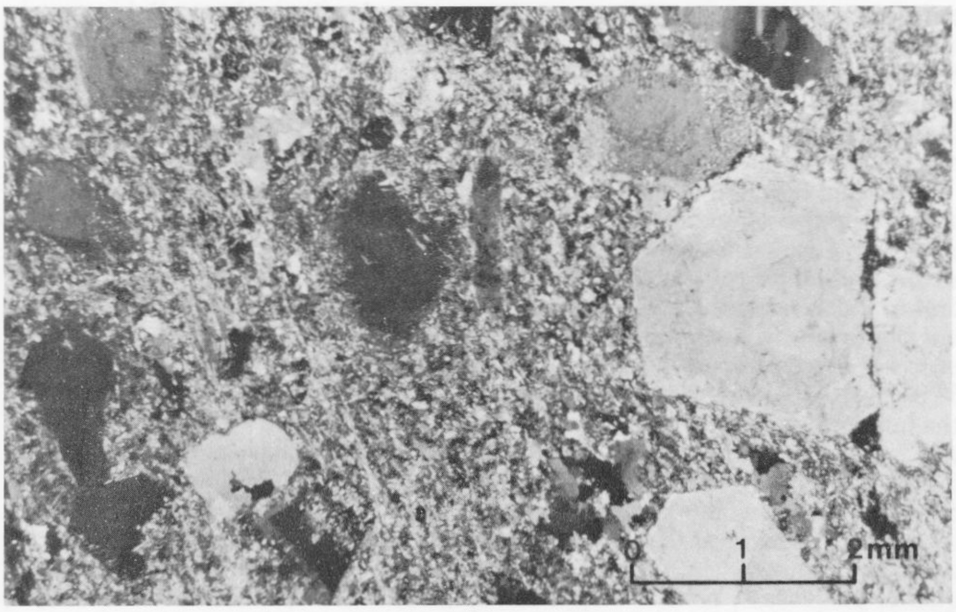

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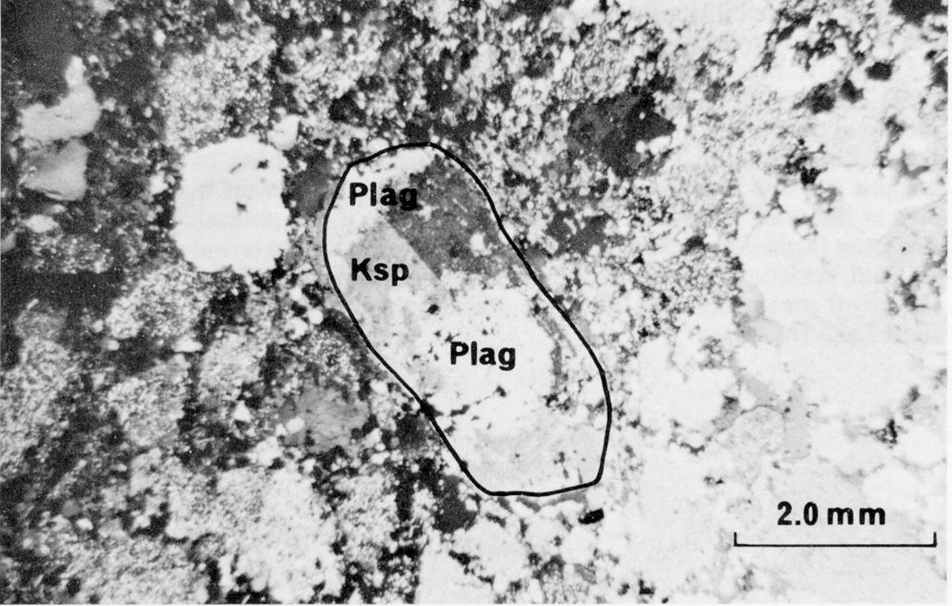
Photo 12–Photomicrograph of quartz-feldspar porphyry intrusive showing zoning in feldspar phenocryst near right margin of photo. From exposure on the east shore of the South Arm of Savant Lake near the west central boundary of Jutten Township. Crossed-Nicols, field of view is approximately 8 mm.

Biotite Trondhjemite

In Jutten Township, the mafic metavolcanics are intruded by a medium- to locally coarse-grained white-weathering, trondhjemite. Biotite forms clots 6.35 to 12.7 mm (¼ to ½ inch) in length that are aligned and impart a distinct foliation to this rock. The margin of the trondhjemitic intrusion is further marked by the presence of 3 to 5 percent iridescent blue quartz crystals that locally form crystal aggregates. The biotite clots, and blue quartz are the most distinctive properties of this trondhjemite. Besides the blue quartz, there is also grey quartz visible in the hand specimen. On the fresh surface the rock is grey. Shearing is locally found as sinuous shear planes near the margin of the granitic body, but is most prevalent in the exposures located on the west shore of Jutten Lake just south of the portage into the South Arm of Savant Lake in southeast Conant Township. Several of the early mappers (Moore 1928, and Rittenhouse 1926) interpreted this exposure to be conglomerate. The confusion arises from the presence of sinuous shear planes several cm wide along which granulation has occurred. Adjacent to these fine-grained shear zones, which are nearly concordant to the nearby contact, are medium-grained massive, more competent parts giving an overall conglomeratic appearance to the exposure. Several small mafic metavolcanic inclusions are also present, and these add to the overall confusion. The


Plag
Ksp
Plag
2.0 mm


Canon

Ministry of Natural Resources

Hon. Frank S. Miller
Minister

Dr. J. K. Reynolds
Deputy Minister

Ontario

Ontario Geological Survey
Map 2398
Conant, Jutten, and Smye Townships

LEGEND

PHANEROZOIC

CENOZOIC[a]

QUATERNARY

RECENT

Swamp and stream deposits.

PLEISTOCENE

Silt, sand, gravel and boulders.

UNCONFORMITY

PRECAMBRIAN[b]

EARLY PRECAMBRIAN (ARCHEAN)

FELSIC INTRUSIVE ROCKS

MASSIVE FELSIC INTRUSIVE ROCKS

9
- 9a Quartz monzonite.
- 9b Granodiorite to quartz monzonite.
- 9c Xenolithic granitic rocks.
- 9d Pink aplite.[c]
- 9e White leucocratic aplite.
- 9f Hornblendic granitic rocks.

INTRUSIVE CONTACT

METAMORPHOSED FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

CONANT LAKE INTRUSIVE

8
- 8a Trondhjemite.
- 8b Granodiorite, trondhjemite.
- 8c Porphyritic granodiorite, trondhjemite.
- 8d Trondhjemite, granodiorite with quartz phenocrysts.

JUTTEN BATHOLITH

8
- 8e Biotite trondhjemite.
- 8f Biotite granodiorite, trondhjemite.
- 8g Biotite quartz monzonite, granodiorite.
- 8h Porphyritic biotite granodiorite.
- 8j Granitic rocks with blue quartz crystals.
- 8k Hornblende, biotite-hornblende granitic rocks.
- 8m Fine-to-medium-grained granitic rocks.
- 8n Medium-to coarse-grained granitic rocks.
- 8p Xenolithic granitic rocks, hybrid granitic rocks.
- 8q Quartz diorite.
- 8r Aplite.[c]

INTRUSIVE CONTACT

HANDY LAKE PORPHYRITIC SILLS

7
- 7 Unsubdivided.
- 7a Quartz-feldspar porphyry.
- 7b Quartz porphyry, feldspar-quartz porphyry.
- 7c Feldspar porphyry.
- 7d Xenolithic porphyritic intrusive rocks.

INTRUSIVE CONTACT

METAMORPHOSED MAFIC INTRUSIVE ROCKS

6
- 6a Biotite diorite.
- 6b Biotite-hornblende diorite.
- 6c Gabbro.
- 6d Fine-grained gabbro.[d]
- 6e Diorite to leucocratic diorite.
- 6f Xenolithic.

INTRUSIVE CONTACT

METASEDIMENTS[e,f]

ARENACEOUS METASEDIMENTS

5
- 5a Greywacke, subgreywacke, arkosic greywacke.
- 5b Siltstone.
- 5c Sandstone.
- 5d Cherty metasediments, siliceous siltstone, mudstone.
- 5e Tuffaceous metasediments.

FERRUGINOUS METASEDIMENTS

4
- 4a Quartz-magnetite iron formation.
- 4b Quartz-magnetite iron formation with greywacke, subgreywacke, arkosic greywacke.
- 4c Quartz-magnetite iron formation with siltstone.
- 4d Quartz-magnetite iron formation with tuffaceous metasediments.

CONGLOMERATIC METASEDIMENTS

3
- 3a Volcanic conglomerate.
- 3b Conglomerate.

UNCONFORMITY

METAVOLCANICS

FELSIC TO INTERMEDIATE METAVOLCANICS[e,f,g]

2
- 2a Dacitic to rhyolitic metavolcanics.
- 2b Dacitic to andesitic metavolcanics.
- 2c Quartz-feldspar porphyry, quartz porphyry.[h]
- 2d Feldspar porphyry.[h]
- 2e Tuff.
- 2f Lapilli-tuff.
- 2g Tuff-breccia.
- 2h Crystal tuff.
- 2j Reworked tuff-breccia, lapilli-tuff.
- 2k Flow breccia.[i]
- 2m Sedimentary volcanic ash deposits, reworked tuff.
- 2n Fine-to medium-grained flows.
- 2p Porphyritic (feldspar) flows.
- 2q Intermediate metavolcanics tuffaceous metasediments with mafic (amphibolite), locally garnetiferous metavolcanics.[j]
- 2r Garnetiferous-magnetite horizons.
- 2s Volcanic sandstone.
- 2t Volcanic lahar.

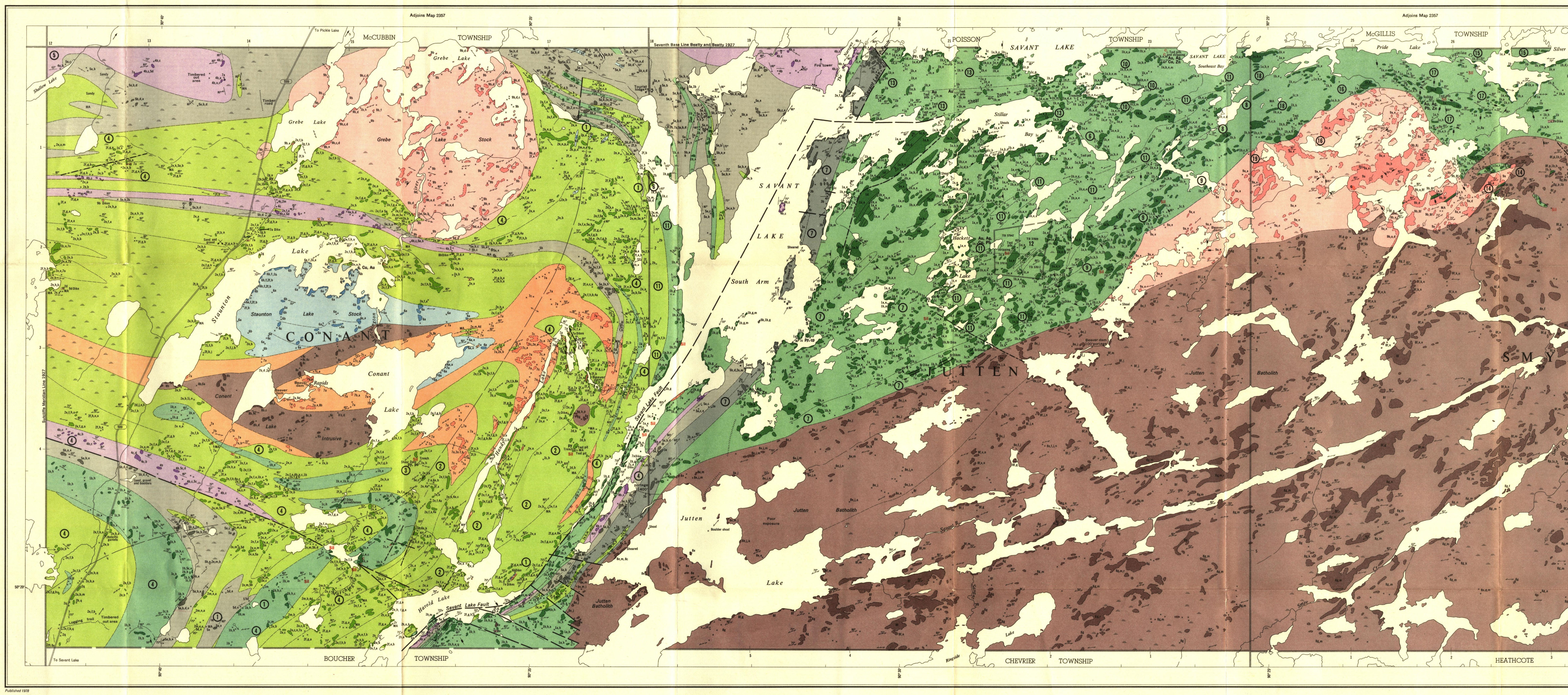
INTERMEDIATE TO MAFIC METAVOLCANICS[k]

1
- 1a Pillow lavas.
- 1b Fine-to medium-grained flows, derived amphibolites.
- 1c Medium-to coarse-grained flows, derived amphibolites.[h]
- 1d Porphyritic (feldspar) flows.[h]
- 1e Light green metavolcanics.
- 1g Grey metavolcanics.
- 1h Dark green metavolcanics, amphibolite.
- 1j Tuff, lapilli-tuff, tuff-breccia.
- 1k Metavolcanics with chlorite (biotite) clots.
- 1m Sheared, gneissic metavolcanics.
- 1n Metavolcanics with blue quartz crystals.
- 1p Epidote.
- 1r Flow breccia.

---

c c c	Carbonatized rock.
Sil	Silicified zone.

Ag	Silver.
Au	Gold.
cp	Chalcopyrite.
Cu	Copper.
Pb	Lead.
po	Pyrrhotite.
py	Pyrite.
q	Quartz.
S	Sulphide mineralization.
tour	Tourmaline.
Zn	Zinc.



[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]Occurs as small dikes or sills.

[d]This category of rocks may be extrusive in part.

[e]Formerly classified as the Savant Series or Timiskaming type.

[f]Formerly classified as the Savant Group.

[g]Formerly classified as the Handy Lake Volcanics.

[h]May be intrusive in part.

[i]May be a collapsed dome breccia.

[j]This gneissic structure may be due to the mixing of mafic metavolcanic flows and metasediments or tuffaceous rocks.

[k]Formerly classified as the Jutten Volcanics or Keewatin type.

Ontario Geological Survey
Map 2398

CONANT, JUTTEN, AND SMYE TOWNSHIPS

THUNDER BAY DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

PROPERTIES, MINERAL DEPOSITS

CONANT TOWNSHIP

1. Canadian Nickel Co. Ltd.
2. Cam Mines Ltd.
3. Falconbridge Nickel Mines Ltd.
4. Noranda Exploration Co. Ltd.
5. Ramsay, Ray.

JUTTEN TOWNSHIP

6. Canadian Nickel Co. Ltd.
7. Donner, John.

Mid-North Engineering Services Ltd.

8. New Kelore Mines Ltd.
9. Nickel Rim Mines Ltd.
10. United Macfie Mines Ltd.
11. Noranda Exploration Co. Ltd.
12. Northern Canada Mines Ltd.
13. Quebec Sturgeon Mines Ltd.

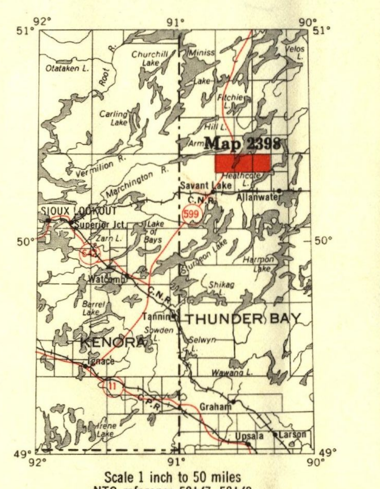
SMYE TOWNSHIP

14. Best, A. P.
15. Dome Exploration (Canada) Ltd.

Mid-North Engineering Services Ltd.

16. Amalgamated Rare Earth Mines Ltd.
17. Langis, Silver and Cobalt Mining Co. Ltd.
18. New Kelore Mines Ltd.
19. Nickel Rim Mines Ltd.

Information current to December 31st, 1972.
For further information see report.



Scale 1 inch to 50 miles
NTS reference 52J/7, 52J/8

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).
- 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.
- Lineament.
- Jointing; (horizontal, inclined, vertical).
- Drag folds with plunge.
- Anticline, syncline, with plunge.
- Drill hole; (vertical, inclined).
- Vein, vein network.
- MA Magnetic attraction.
- Muskeg swamp.
- 599 Motor road. Provincial highway number encircled where applicable.
- Other road.
- Trail, portage, winter road.
- Building.
- Township boundary with milepost, approximate position only.
- Township boundary, unsurveyed.
- 12 Mining property, surveyed.
- 17 Mineral deposit; mining property, unsurveyed.
- Surveyed line, approximate position only.

SOURCES OF INFORMATION

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Geology is not tied to survey lines.

Assessment work data on file with the Ministry of Natural Resources.

Ontario Department of Mines: Map 37J, Savant Lake Gold Area, scale 1 inch to 2 miles, 1929.

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O.D.M.—G.S.C. Aeromagnetic maps 1109G and 1119G.

Preliminary maps: P. 803 Conant Tp., P. 804 Jutten Tp., P. 805 Smye Tp., scale 1 inch to ¼ mile, issued 1973.

Basemap derived from maps of the Forest Resources Inventory, Ministry of Natural Resources.

Cartography by M. J. Colman and assistants, Ministry of Natural Resources, 1977.

Magnetic declination in the area was approximately 1°E, 1975.