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Precambrian Geology
Melgund Lake Area

Ontario Geological Survey
Report 268

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B.R. Berger

1989

CANADA
ONTARIO
Mineral Development
Exploitation Minérale

This project is part of the five-year Canada-Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario.

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Foreword

Detailed geological mapping of the Melgund Lake area was undertaken by the Ontario Geological Survey, as part of the Canada–Ontario Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed in 1985 by the governments of Canada and Ontario.

The Melgund Lake area had not previously been subject to detailed geological mapping. The project reported here was undertaken to identify the economic potential of this portion of the Wabigoon Subprovince.

V.G. Milne

Director
Ontario Geological Survey

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Scale 1:20 000

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

Conversion from SI to Imperial			**Conversion from Imperial to SI**		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
		LENGTH			
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
		AREA			
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
		VOLUME			
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
		CAPACITY			
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
		MASS			
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
		CONCENTRATION			
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in cooperation with the Coal Association of Canada.

Precambrian Geology Melgund Lake Area

B.R. Berger

Geologist, Precambrian Geology Section, Ontario Geological Survey.

Manuscript approved for publication by A.C. Colvine, Chief Geologist, February 25, 1988. Report published with the permission of V.G. Milne, Director, Ontario Geological Survey.

Abstract

The Melgund Lake area is bounded by latitudes 49°37′25″ to 49°53′46″N and by longitudes 92°16′38″ to 92°24′44″W, and includes all of Avery, MacFie and McAree townships in the District of Kenora.

The map area is underlain by a diverse assemblage of Archean supracrustal lithologies intruded by Archean felsic granitoid stocks and batholiths. The supracrustal rocks are subdivided into three major units:

1. The Southern Volcanic Belt composed of high-iron tholeiitic basalts with subordinate calc-alkalic andesites and plagioclase-phyric basalts (leopard rock) lies in the southern part of the area.
2. The Minnitaki Group of turbiditic wackes, siltstones and mudstones, with intercalated magnesian basalts and calc-alkalic pyroclastic deposits interpreted to represent subaqueous ash flows, underlies the central part of the area.
3. The Neepawa Group of tholeiitic and calc-alkalic basaltic, dacitic and rhyolitic flows and pyroclastics underlies the northern part of the map area. This group is also known as the Central Volcanic Belt.

Neepawa Group basalts contain high iron, titanium, phosphorous and zinc. They are distinctly different from the mafic metavolcanics of the Southern Volcanic Belt characterized by high iron, lower titanium, phosphorous and zinc. There are no substantial major element differences between the Neepawa Group felsic metavolcanics and felsic metavolcanics intercalated in the Minnitaki Group. However, Neepawa Group felsic metavolcanics are enriched in copper, nickel, zinc, chrome, cobalt and lead and depleted in barium and strontium relative to the Minnitaki Group felsic metavolcanics. Rare earth element analyses also show significant differences between the groups.

The Melgund Lake Stock, the Basket Lake Batholith, the Sandybeach Lake Stock and the Crossecho Lake Stock have intruded the supracrustals and vary from monzonite to granite in composition. A distinctive suite of white and pink peraluminous granitic pegmatites and aplites occurs along the north contact of the Sandybeach Lake Stock and represents the extension of the Dryden lithium-bearing pegmatite field into the map area.

The Wabigoon Fault, a major structural feature in the map area, marks the boundary between the Minnitaki Group and the Southern Volcanic Belt. It is characterized by intensely sheared metavolcanics which are locally carbonate altered and contain geochemically anomalous gold. In the Dryden area, the Wabigoon Fault separates the English River Subprovince from the Wabigoon Subprovince, based on a change of deformation styles and metamorphic patterns across the fault. In the map area, the Wabigoon Fault merges with a northeast-trending shear zone system and styles of deformation are the same on both sides of the fault. Metamorphic patterns in the map area indicate medium grade aureoles occur around the granitic plutons and this complicates interpretation in the map area.

Late northeast-trending shear zones, cleavages and fold axes representing the latest deformational event occur throughout the map area, indicating refolding of earlier structures in Avery Township. A unique feature in the map area is a fully closed structural dome elongated about a northeast-trending axis in McAree Township.

Gold is the most important economic mineral in the map area and is known to occur in five showings in three geological settings. These settings are described below:

1. large quartz veins contained within sheared mafic metavolcanics in shear zones parallel to the Wabigoon Fault
2. silica-carbonate alteration zones at the intersection of northeast-trending lineaments with east-northeast-trending lineaments

3. pyrite-arsenopyrite stringers within laminated magnetite-grunerite-bearing ironstone

There is also potential for economic gold mineralization within carbonate altered rocks associated with the Wabigoon Fault, within the Neepawa Group metavolcanics and within sulphide facies ironstones throughout the map area.

Other rock units that warrant exploration include white granitic pegmatite for lithium, feldspar and rare earth element mineralization, and the Melgund Lake Stock for building stone. The central part of MacFie Township contains sand and gravel deposits.

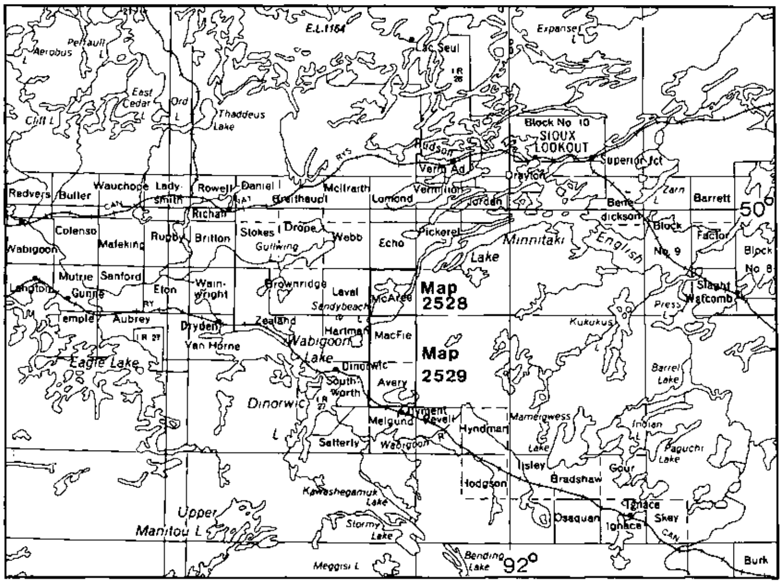

Figure 1. *Key map showing location of the Melgund Lake area. Scale 1:1 584 000.*

Résumé

La zone du lac Melgund se situe entre les latitudes 49°37′25″ et 49°53′46″ Nord et les longitudes 92°16′38″ et 92°24′44″ Ouest, et englobe la totalité des cantons d'Avery, de MacFie et de McAree, dans le District de Kenora.

La zone représentée sur la carte recouvre un ensemble diversifié de formations supracrustales archéennes pénétrées par des massifs intrusifs de roches granitiques de l'Archéen. Les roches supracrustales se divisent en trois grandes catégories:

1. La "ceinture volcanique méridionale" composée de basaltes tholéiitiques riches en fer avec des andésites calco-alcalines et des basaltes plagioclasophyriques ("leopard rock") se trouve dans la partie sud de la zone.
2. Le groupe Minnitaki, située dans la partie centrale de la zone, est constitué de grauwackes déposées par des courants de turbidité, de microgrès et de schistes argileux, avec des intercalations de basaltes magnésiens ainsi que de dépôts pyroclastiques calco-alcalines, qui semblent représenter des coulées de cendres sous-aquatiques.
3. Le groupe Neepawa, constitué de coulées tholéiitiques et calco-alcalines, de basaltes dacites et rhyolites, ainsi que des roches pyroclastiques, se situe dans la partie nord de la zone cartographiée. Ce groupe porte également le nom de "ceinture volcanique centrale".

Les basaltes du groupe Neepawa sont riches en fer, en titane, en phosphore et en zinc. Ils sont distinct des roches volcaniques mafiques métamorphisées de la "ceinture volcanique meridionale", lesquelles ont une haute teneur en fer, mais sont pauvres en titane, en phosphore et en zinc. Il n'y a pas de grande différences entre les roches volcaniques métamorphisées felsiques du groupe Neepawa et celles intercalées dans le groupe Minnitaki. Cependant, les roches volcaniques felsiques métamorphisées du groupe Neepawa sont en richies en cuivre, en nickel, en zinc, en chrome, en cobalt et en plomb, mais appauvries en baryum et en strontium par rapport à celles du groupe Minnitaki. Les analyes des elements du groupe des terres rares indiquent également des différences importantes entre les deux groupes.

Le massif intrusif du lac Melgund, le batholite du lac Basket, le massif intrusif du lac Sandybeach et celui du lac Crossecho ont pénétré les roches supracrustales. Leur composition va de la monzonite au granite. Un ensemble caractéristique de pegmatites granitiques et d'aplites hyperalumineuses blanches et roses s'observe le long de la surface de contact nord du massif du lac Sandybeach, et représente la continuation du champ de pegmatites à lithium intrusif de Dryden dans la zone cartographiée.

La faille de Wabigoon, une structure proéminente dans la zone étudiée, marque la frontière entre le groupe Minnitaki et la "ceinture volcanique méridionale". Elle se caractérise par des roches volcaniques métamorphisées intensivement cisaillées, qui sont localement altérées par des carbonates et contenant des teneurs geochimiquement élevées en or. Dans la région de Dryden, la faille de Wabigoon sépare la sous-province d'English River de celle de Wabigoon; celle separation se distingue par des différences dans le type de déformation et les caractéristiques de métamorphisme. Dans la zone cartographiée, la faille de Wabigoon converge avec un système de cisaillement orienté nord-est et les types de déformation sont les mêmes de part et d'autre de la faille. Les caractéristiques du métamorphisme de la zone cartographiée indiquent la présence d'auréoles de métamorphisme de moyen degré autour des plutons granitiques, ce qui complique l'interprétation.

Des zones de cisaillement tardives orientées au nord-est, des clivages et des axes de plis qui représentent le dernier stade de déformation recouvrent les structures anciennes dans le canton d'Avery. Une structure remarquable de la zone cartographiée est représentée par un dôme complètement fermé, étiré selon un axe orienté au nord-est, dans le canton de McAree.

L'or est le minéral economique le plus important dans la zone cartographiée et qui à été signalé dans cinq endroits des trois contextes géologiques suivants:

1. grands filons de quartz dans des roches volcaniques mafiques métamorphisées cisaillées dans les zones de cisaillement parallèles à la faille de Wabigoon
2. zones d'altération de carbonate et silice à l'intersection des linéaments orientés nord-est et est-nord-est
3. veinules de pyrite-arsénopyrite contenues dans des roches ferrugineuses stratifiés contenant de la magnétite et de la grünérite

Il existe également des possibilités de minéralisation d'or dans les roches altérées par des carbonates et apisent associées à la faille Wabigoon, dans les roches volcaniques métamorphisées du groupe Neepawa et dans les roches sédimentaires ferrugineuses à faciès sulfuré, à travers toute la zone représentée sur la carte.

D'autres roches qui offrent une potentiel d'exploitation comprennent des pegmatites granitiques blanches pour le lithium, le feldspath et les elements du groupe des terres rares ainsi que le massif intrusif du lac Melgund pour la pierre de construction. Dans la partie centrale du canton de MacFie, on trouve des dépôts sable et de gravier.

Precambrian geology, Melgund Lake area, by B.R. Berger, Ontario Geological Survey, Report 268, 68p. Accompanied by Maps 2528 and 2529, scale 1:20 000. Published 1989. ISBN 0-7729-6133-6.

Introduction

The Melgund Lake area is bounded by latitudes 49°37′25″ and 49°53′46″N and longitudes 92°16′38″ and 92°24′44″W. All of Avery, MacFie and McAree townships (approximately 278 km^2) was mapped at 1:15 840 scale in an effort to improve the geological data base for this area. Highway 72 provides easy access from Dryden (43 km west) and Sioux Lookout (55 km northeast). Seasonal gravel roads provide access to the larger navigable lakes and streams and only the central and southeastern parts of MacFie Township were difficult to reach due mainly to high water levels in numerous creeks and swamps.

History of Exploration

There are no known economic mineral deposits within the map area, however, there are several gold showings and the Goldlund gold mine, a past producer, occurs 1000 m north of the map area. Hurst (1933) reported that Midas Mines Limited was actively exploring for gold in 1907 by sinking two shafts on auriferous quartz veins east of Sandybeach Lake. Between 1907 and the outbreak of World War II, only the Alto-Gardnar gold showing was discovered in the map area.

Discovery of gold mineralization in Echo Township sparked intense exploration activity between 1946 and 1952 and resulted in discovery of the Goldlund deposit (Page and Christie 1980). At this time, a number of companies carried out exploration in northern McAree Township searching unsuccessfully for gold mineralization. Since 1960, three significant gold discoveries were made in the map area, namely, the Rivers Option, the Glatz showing and the Standon showing; however, as yet no economic deposits have been outlined.

Exploration for base metals began in the 1960s (Page and Christie 1980) and has been sporadic since. A number of companies have flown airborne electromagnetic and magnetic surveys and have tested selected geophysical anomalies by diamond drilling. To date, no significant base metal mineralization has been discovered.

The Melgund Lake area was actively being explored during the 1986 field season. A number of mining claims were in good standing at this time, with the Glatz showing in Avery Township receiving most of the attention by Noranda Exploration Company Incorporated which held an option on the ground.

Previous Geological Work

The earliest references to the geology of the map area are in the reports of Bell (1873), Coleman (1896), Parks (1898), Bow (1899, 1900) and McInnes (1905). Hurst mapped the Sioux Lookout area in 1932. Satterly (1943, 1960) mapped immediately west and south of the Melgund Lake area and reported on the Alto-Gardnar showing in 1943. Armstrong (1951) mapped Echo Township at 1 inch to 1000 feet following gold discoveries in the area, and Chisholm (1951) published a preliminary account of mining activity covering the area north of McAree Township. Johnston (1969, 1972) mapped in the Sioux Lookout area including most of Minnitaki Lake northeast of the map area. Palonen (1976) and Palonen and Speed (1974, 1976) carried out 1:15 840 scale mapping of McAree Township and part of the Keikewabik Lake area; however, the map and report were not published. Sutcliffe (1977) mapped parts of Avery and MacFie Townships and his results have been incorporated into Maps 2528 and 2529 that accompany this report (back pocket). Page and Christie (1980) remapped Echo Township as part of a larger program and some of their work has also been compiled onto the maps. Page (1984) summarized many of the critical features at the Goldlund deposit which the author has referred to throughout this report. Ontario Geological Survey data series maps P.2332 and P.2334 (Speed and Maxwell 1980a, 1980b) and Geological Data Inventory Folios 219, 220 and 322 (OGS 1985a, 1985b, 1986) cover the map area.

The map area was surveyed aeromagnetically in 1961, and the map sheets at a scale of 1:63 360 covering this area have been published jointly by the Geological Survey of Canada and the Ontario Geological Survey (ODM-GSC 1961a, 1961b).

Several scientific studies have been written on aspects of the geology of the area. Szewcyzk and West (1976) have examined the regional gravity response of the Basket Lake Batholith. Walker and Pettijohn (1971), Turner and Walker (1973), Page and Clifford (1977), Trowell et al. (1980, 1983) and Blackburn et al. (1985) have worked on various aspects of the supracrustal stratigraphy in the Sioux Lookout area and their work is referred to in this report.

Present Survey

The Melgund Lake area was mapped at 1:15 840 scale during the 1986 field season. The mapping crew comprised one geologist, one senior assistant, two junior assistants and two geological interns, augmented by a third junior assistant during the month of August which permitted three mapping crews to be used. Standard pace and compass traverses using 1:15 840 scale black and white, vertical aerial photographs for control were carried out in conjunction with shoreline and roadside traverses to map the area. Traverses were concentrated in areas of dense outcrop to provide thorough coverage of critical areas. However, many outcrops especially in southeastern MacFie Township were not examined due to poor access and are not represented on the maps.

Data taken in the field were plotted on acetate overlays to aerial photographs which were then transferred to base maps prepared by the Cartography Section, Ontario Division of Lands, from maps of the Forest Resources Inventory, Ontario Ministry of Natural Resources.

Physiography

The map area lies within the English River drainage basin which is part of the Arctic watershed. Drainage patterns are poorly developed and locally controlled by bedrock structures and glacial features. The Hartman terminal morraine (Zoltai 1961) covers most of the central part of MacFie Township and contains numerous kettle lakes.

The map area is characterized by gentle changes in relief (seldom exceeding 10 m from outcrop to outcrop) caused by glacial peneplanation. In general, elevation steadily rises from McAree to Avery Township with a maximum relief of approximately 100 m.

Outcrop density varies from 1 to 5 percent in central MacFie Township to 50 to 60 percent in parts of McAree and Avery townships, with an average density around 30 to 35 percent. As is typical of many northwestern Ontario "greenstone" terrains, a lot of outcrop is not visible on 1:15 840 scale air photographs and requires traversing and vegetation stripping to expose hidden rocks.

Acknowledgments

D. MacMillan capably served as senior assistant on this project and carried out independent mapping over approximately 40 percent of the area. M. Dolan, C. St. Louis, M. Matijevich, A. Tikkanen and G. Butler provided competent assistance. Mr. Butler carried out independent mapping in the later half of the field season covering approximately 10 percent of the map area. This project was carried out in conjunction with studies by L.C. Chorlton, of the Ontario Geological Survey and the mapping greatly benefited from her observations.

Logistical support provided by the Ministry of Natural Resources in Dryden, and Sioux Lookout is gratefully acknowledged as is the support from the Resident Geologists' offices in Sioux Lookout and Kenora.

General Geology

The Melgund Lake area is underlain by Archean rocks of the Superior Province of the Canadian Shield. Supracrustal lithologies (Ayres et al. 1985) comprise approximately 75 percent of the map area and are composed of mafic, intermediate and felsic metavolcanics, related subvolcanic intrusions including gabbroic sills and dikes, and feldspar and quartz-feldspar-phyric dikes, clastic and chemical metasediments. Felsic plutonic rocks composed of quartz monzonite, granodiorite, quartz monzodiorite, monzonite, tonalite and granite have intruded the supracrustal rocks in four spatially separated locations. A distinctive suite of granitic pegmatite and aplite intrusions also occurs within the map area.

A number of previous workers (Pettijohn 1939; Satterly 1943; Turner and Walker 1973; Trowell et al. 1980; Trowell, in preparation) have either undertaken detailed studies or proposed group names for various packages of lithologies within the map area. The following descriptions attempt to correlate lithologies within the map area to groups previously described in the Sioux Lookout and Dryden areas. The most recent work has concentrated in the Sioux Lookout area and group names applied here are referred to in this report. Members of the Southern Volcanic Belt (Turner and Walker 1973), the Minnitaki Group (Turner and Walker 1973) and the Neepawa Group (Page and Clifford 1977; Trowell, in preparation) which is also known as the Central Volcanic Belt (Turner and Walker 1973) underlie much of the Melgund Lake area.

The entire map area has undergone multiple deformations. Around Avery Lake, early east-trending fold axes, as defined by reversal in stratigraphic facings, have been tightly refolded about northeast-trending axes as defined by foliation fold patterns and stratigraphic facings. In the northern part of the map area, a northeast-trending crenulation cleavage is axial planar to small-scale Z-folds, crenulates a foliation subparallel to bedding and clearly represents a late structural event. Metamorphic patterns indicate that the southern, eastern and northeastern parts of the map area have undergone greenschist rank metamorphism. Amphibolite rank contact metamorphic aureoles are developed around the granitic plutons and overprint greenschist rank rocks. In the northern part of the map area, a later regional amphibolite rank metamorphism overprints the contact aureole developed around the Sandybeach Lake Stock and is characterized by staurolite, andalusite and sillimanite in metasediments.

Faulting is developed throughout the map area and placement of fault traces on the maps that accompany this report is based upon abrupt stratigraphic changes, location of zones of intense shearing, interpretation of airphoto lineaments and airborne geophysical data. The most prominent structural feature in the map area is the Wabigoon Fault, a zone of intensely sheared metavolcanics that separates southeast-facing metasediments of the Minnitaki Group from northwest-facing metavolcanics of the Southern Volcanic Belt and transects the map area. The Wabigoon Fault is correlative with a similar feature in the Dryden area (Satterly 1943), where south-facing migmatitic metasediments are separated from north-facing metavolcanics. In the Dryden area, Breaks et al. (1978), and Blackburn et al. (1985) contend that the Wabigoon Fault marks the boundary between the Wabigoon Subprovince, a granite-greenstone terrane and the English River Subprovince, a gneiss terrane. These workers indicate that the metasediments in the English River Subprovince are highly metamorphosed with development of metatexites and are multiply deformed about late northeast-trending fold axes. Further, these workers indicate that the metavolcanics in the Wabigoon Subprovince have undergone low to medium grade metamorphism and are simply deformed about east-trending subhorizontal fold axes.

In the Melgund Lake area, multiple deformation with late northeast-trending fold axes has affected lithologies on both sides of the Wabigoon Fault, and highly metamorphosed rocks occur regionally on both sides of the fault as well as within contact aureoles around felsic plutons. These differences, when compared to the Dryden area, indicate the Wabigoon Fault cannot be used as a subprovincial boundary in the map area. Based on the predominance of "greenstone and granite" lithologies, the Melgund lake area is considered by the author to lie entirely within the Wabigoon Subprovince.

Note that in the following descriptions of supracrustal units, all rocks have been metamorphosed, none have retained their original mineralogy and/or texture. The prefix "meta" has been omitted for brevity when referring to individual rock types and will only be used in the general sense, i.e., metasediments and metavolcanics.

Lithologies in the map area are outlined in Table 1.

EARLY TO LATE ARCHEAN

MAFIC METAVOLCANICS

Mafic metavolcanics form a continuous sequence underlying most of Avery Township, southern and central MacFie Township and the eastern part of McAree Township. Mafic metavolcanics also underlie the core of a structural dome in McAree Township and are intercalated with felsic metavolcanics

TABLE 1. TABLE OF LITHOLOGIC UNITS FOR THE MELGUND LAKE AREA.

PHANEROZOIC

CENOZOIC

QUATERNARY

RECENT

Swamp, lake and stream deposits.

PLEISTOCENE

Sand, gravel, clay, till and boulders.

Unconformity

PRECAMBRIAN

ARCHEAN

LATE ARCHEAN

MAFIC INTRUSIONS

Lamprophyre dikes.

EARLY TO LATE ARCHEAN

FELSIC INTRUSIONS

Quartz monzonite, granodiorite, quartz monzodiorite, monzonite, pegmatite, aplite, tonalite, quartz diorite, granite, monzodiorite.

MAFIC INTRUSIONS

Gabbro, leucogabbro, knobby gabbro, melagabbro, plagioclase-phyric gabbro.

CLASTIC AND CHEMICAL METASEDIMENTS

Wackes; mafic and ferruginous wackes, siltstones, pebbly sandstone, argillaceous, phyllitic and biotite-muscovite-quartz schists, hornblende-biotite-garnet amphibolite, chert, magnetite-quartz ironstone, pyrite-magnetite-quartz ironstone, metatexite, staurolite-bearing metasediments and conglomerate.

FELSIC METAVOLCANICS

Massive flows, autobrecciated flows, tuff, crystal tuff, lapilli tuff, lapillistone, tuff breccia, breccia, sericite-quartz schist, sericite-carbonate-quartz schist, feldspar-phyric dikes, quartz-feldspar-phyric dikes, quartz porphyry.

MAFIC TO INTERMEDIATE METAVOLCANICS

Massive flows, amygdaloidal and vesicular flows, porphyritic flows, pillowed flows, variolitic flows, hornblende-phyric flow, tuffs, lapilli tuffs, lapillistone, tuff breccia, breccia, chlorite-talc schist, chlorite-talc-carbonate schist, pillow breccia, hyaloclastite, basaltic dikes and sills, amphibolite, hornblende-epidote xenoliths and dikes.

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and metasediments south of Sandybeach Lake and in the Pickerel Arm area. Further, the northwestern corner of McAree Township is underlain by mafic and intermediate metavolcanics. These rocks in McAree Township are discussed separately as hornblende- and plagioclase-phyric rocks.

The mafic metavolcanics underlying Avery, MacFie and eastern McAree townships are composed predominantly of flows, minor pillow breccia, and hyaloclastite with very minor interflow cherty metasediments. An important subdivision of these mafic metavolcanics is the separation of plagioclase-phyric rocks ("leopard rock") from aphyric rocks. However, there is a complete gradation from aphyric sequences to plagioclase-phyric sequences containing up to 30 percent phenocrysts. In most cases, rocks classified as aphyric may contain a few widely separated, small (less than 1 cm diameter) plagioclase phenocrysts. Rocks containing more than 1 percent plagioclase phenocrysts were mapped as plagioclase phyric.

Massive aphyric flows are volumetrically the most abundant and vary from very fine grained, soft, massive rocks to medium-grained gabbroic flows. They are generally green to dark green on fresh surfaces in areas of greenschist rank metamorphism, becoming black, dense recrystallized rocks in amphibolite rank contact metamorphic aureoles around the Melgund Lake Stock and Basket Lake Batholith. Vesicles and amygdules are generally absent or widely spaced, but increase in abundance and size in the Avery Lake area. Here, vesicles and amygdules up to 3 cm long are common and commonly compose up to ten percent of flows. Calcite and quartz are the most common amygdule fillings, but a distinctive flow type in the Avery Lake–southwest MacFie Township area contains black chlorite-serpentine-filled amygdules in a green to dark green groundmass. These flows generally overlie or are in close proximity to gabbroic sills and dikes, suggesting they may possibly represent extrusive equivalents of the intrusions.

Massive plagioclase-phyric flows are most abundant in Avery Township and occur less commonly in MacFie and McAree townships. Rocks of greenschist rank metamorphism contain white to green, anhedral to euhedral plagioclase phenocrysts (1 to 2 cm diameter) in a green to grey weathering groundmass. Rocks at amphibolite rank metamorphism near the Melgund Lake Stock and the Basket Lake Batholith have a dark green to black recrystallized groundmass. Phenocryst density averages 10 to 15 percent with the highest density (30 percent) and largest size (4 cm) at Avery Lake. Phenocrysts usually occur as single groundmass-supported crystals rather than glomerophyric masses.

Plagioclase-phyric flows occur throughout Avery Township, but are most abundant in the central area south of and along the Melgund Lake access road. They occur to a lesser extent around the periphery of the Basket Lake Batholith. In MacFie and McAree townships, plagioclase-phyric flows only occur east of a long gabbroic sill and near the contact with the Basket Lake Batholith. Attempts to use individual plagioclase-phyric flows as marker units were not successful because they commonly grade into aphyric flows and because they are widespread throughout this sequence of rocks. Green (1975) concluded that glomeroporphyritic basalts observed in other Canadian Archean terranes represent relatively fractionated tholeiites which underwent low pressure crystallization, implying a lengthy residence time in subvolcanic magma chambers.

Pillowed aphyric and plagioclase-phyric flows are common in Avery and southern MacFie Township, but are less common elsewhere in the map area. Pillowed flows are typically green to black weathering depending upon grade of metamorphism, and show the same complete gradation from a totally aphyric rock to a plagioclase-phyric rock at Avery Lake that contains up to 30 percent plagioclase phenocrysts. Pillows vary from well-formed, close-packed, thin rimmed (1 to 2 cm) shapes to irregular, amoeboid forms with thick rims (2 to 5 cm) and a large amount of interpillow material (Photo 1). The latter pillow type usually contains radial or pipe-like vesicles and amygdules up to 5 cm long, whereas, the well-shaped pillows usually contain only a few oval vesicles or amygdules up to 5 mm diameter near the rims. Pillows average approximately 60 cm by 30 cm and a few are as large as 1 to 1.5 m long. The amoeboid type of pillow is found only in Avery Township with the greatest concentration in the Avery Lake area. Well-formed, closely packed pillows occur most commonly in MacFie and McAree townships, where they form a minor component of the entire sequence.

Lava tubes (Photo 2) occur almost exclusively in the Avery Lake area and are defined as pillow-like structures exceeding 2 m in the long axis and are commonly up to 5 m long. They are elliptically to irregularly shaped and in many places have smaller pillow forms budding from them. Both aphyric and plagioclase-phyric varieties were observed. In the

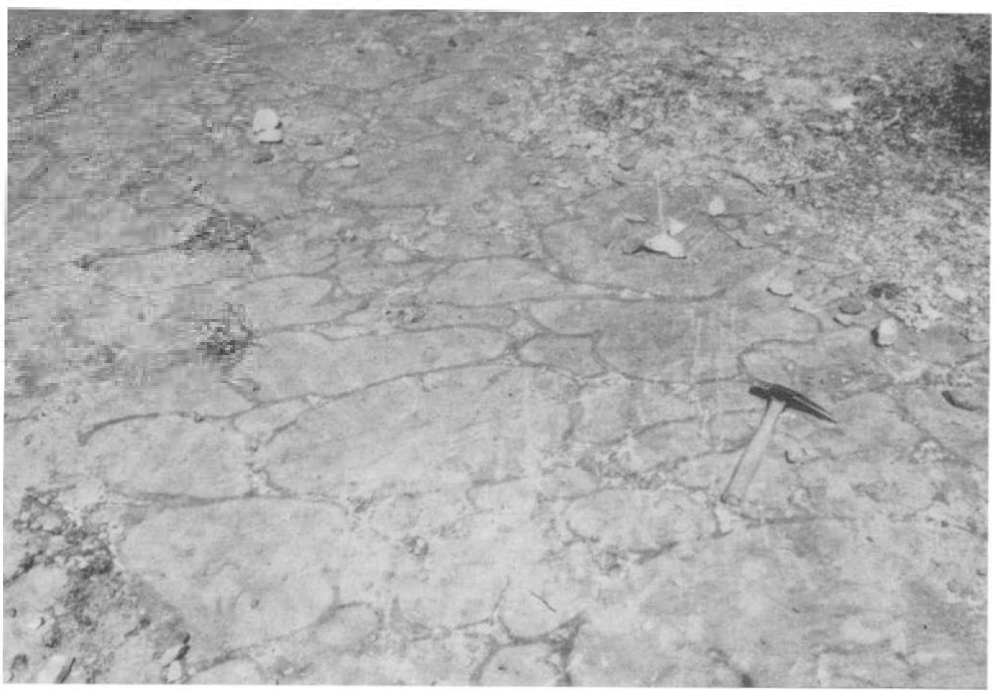


Photo 1. *Irregular to amoeboid pillows form part of the mafic flow sequence in Avery Township. Hammer is 40 cm long. Southern Volcanic Belt.*

Photo 2. *Lava tubes are defined as "pillow-like" structures greater than 2 m in long axis dimension. Note budding pillows below hammer. Hammer is 40 cm long. Avery Township; Southern Volcanic Belt.*

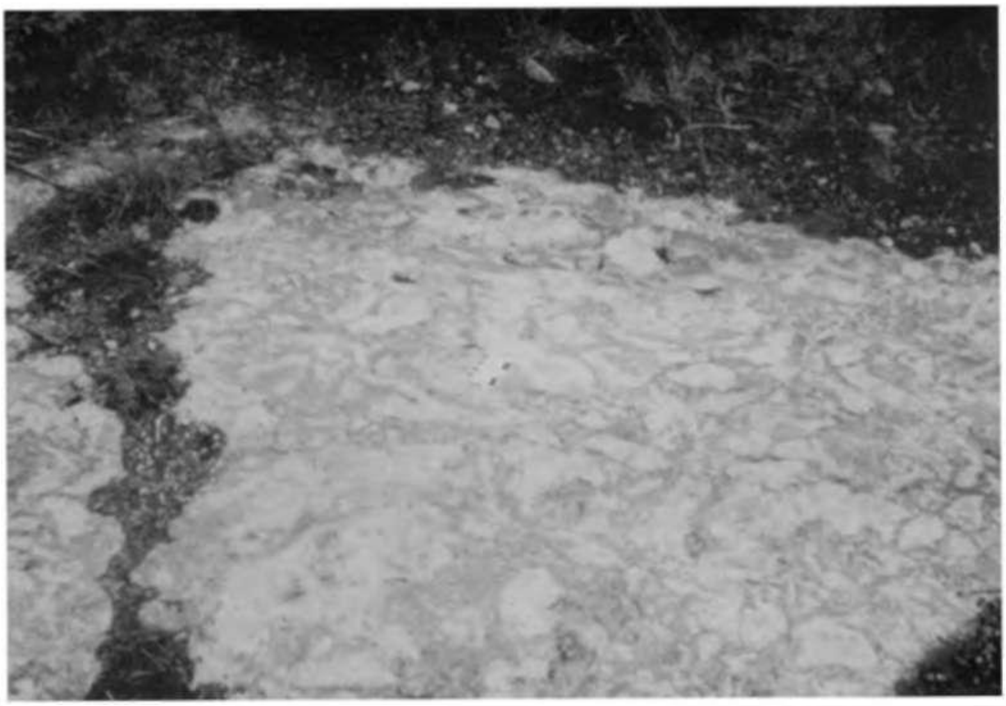


Photo 3. *Well-developed pillow breccia occurs at the top of several flows in Avery Township. Southern Volcanic Belt.*

map area, lava tubes commonly occur in vertically stratified flow units (Easton and Johns 1986) transitional from massive to pillowed rocks.

Pillow breccia and associated hyaloclastite units occur throughout the mafic metavolcanics south and east of the Wabigoon Fault, but occur most com-

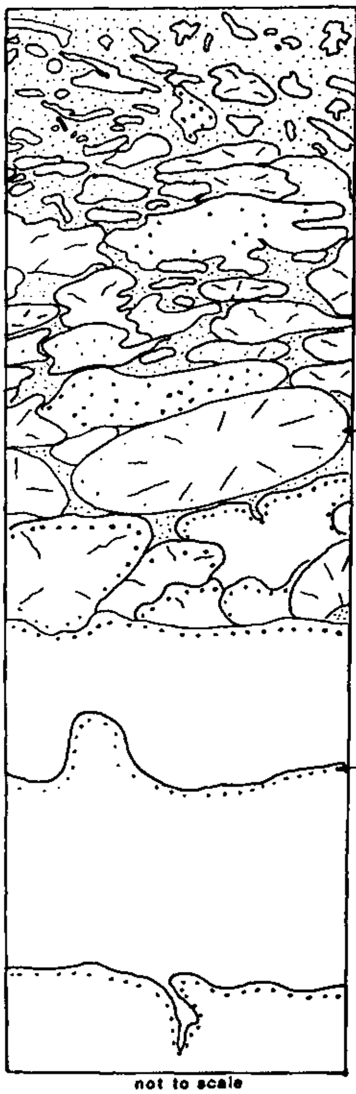


Figure 2. *Vertical section, mafic flow morphology, Avery Township.*

monly in Avery Township. Typically, pillow breccias contain grey to white weathering, rounded to angular pillow fragments (up to 60 cm diameter) in a green to dark green mafic matrix (Photo 3). The fragments commonly retain chilled rims and vesicles or amygdules. Individual units vary from 30 cm thick, composed predominantly of hyaloclastite to over 10 m thick, composed predominantly of pillow fragments. Pillow breccias usually occur at the top of flow units, and in several places individual flow units pass upwards from a basal massive rock to pillowed flow to pillow breccia (Figure 2). In the eastern part of Avery Township, flow units 3 to 5 m thick are common, whereas at Avery Lake, 30 to 50 m thick flow units showing the same vertical changes are developed.

In MacFie and McAree townships, pillow breccias are very minor components of the sequence and occur as discontinuous units less than 3 m thick. Both plagioclase-phyric and aphyric breccias were recognized.

Basaltic sills and dikes intrude supracrustal rocks throughout the map area. They are fine to medium grained and weather dark to bright green. They are usually narrow (0.5 to 10 m wide), discontinuous units exhibiting chilled contacts. These dikes and sills are part of the supracrustal sequence displaying metamorphic textures and hence are not related to Late Archean or Proterozoic diabase dike swarms, although some basaltic dikes and sills display diabasic textures as do the diabase dike swarms. Only aphyric members were recognized and they occur most commonly in the Avery Lake area.

Rocks mapped as amphibolites occur in metamorphic aureoles around the Melgund Lake Stock, the Basket Lake Batholith and in the core of the structural dome in McAree Township. These rocks are characterized by dark green to black weathered surfaces, recrystallized textures and a strongly foliated habit. Plagioclase phenocrysts are the only primary feature preserved in amphibolites and their subdivision is based on the presence or absence of phenocrysts. All rocks mapped as amphibolites have attained amphibolite rank metamorphism as characterized by the presence of hornblende and the absence of chlorite in thin section. However, if primary features such as pillows were recognized in rocks of amphibolite rank metamorphism, they were mapped as pillowed flows rather than amphibolites.

Mafic schists are highly foliated to fissile rocks containing no recognizable primary features other than plagioclase phenocrysts. They are best developed in deformation zones such as the Wabigoon Fault, related subsidiary structures and near the contacts of some gabbroic intrusions. Talc-chlorite schists weather dark green and are usually sulphide free; whereas, talc-chlorite-carbonate schists weather dark green to red-brown, are pervasively carbonate altered and generally contain minor amounts of disseminated sulphides. Parker and Blackburn (1986) concluded that several gold showings in the Eagle–Wabigoon lakes area near Dryden are associated with carbonate altered shear zones related to the Wabigoon Fault. It is suggested that talc-chlorite-carbonate schists in the map area are potential hosts for gold mineralization, especially those associated with the Wabigoon Fault.

An attempt has been made by the author to explain the variation of primary features observed in the mafic metavolcanics of Avery, MacFie and McAree townships in terms of a variation in depositional environments. The author's interpretation is mainly based on the model of Easton and Johns (1986), the mafic shield volcano, to represent the best analogy for a source to accumulate the bulk of volcanic material present in Archean greenstone terranes. Central, proximal and distal facies models based upon the spatial association of various primary features have been proposed by Easton and Johns (1986).

The flows comprised of a massive base vertically overlain by pillowed parts overlain by pillow breccia are commonly developed in Avery and southern MacFie townships and well developed around Avery Lake. At Avery Lake, flows of this type are usually 20 to 40 m thick and occasionally up to 60 m. Elsewhere, similar units are commonly 3 to 5 m thick and up to 10 m thick in eastern MacFie and McAree townships (Palonen 1976). Thick flows most commonly occur in proximal environments (Easton and Johns 1986).

With respect to the size and shape of pillows, it is common to find irregular, amoeboid and large pillows or lava tubes in the Avery Lake area, whereas, regularly shaped pillows of approximately equal size (60 cm long axis) are most common elsewhere. Ayres (1977) has documented the transition of mafic flows from a subaqueous to a subaerial depositional environment in which pillow shapes became progressively more irregular as water depth decreased. Ayres (1977) and Furnes and Fridliefsson (1978) have demonstrated that pillow shapes became progressively larger as water depth decreased. Finally, Easton and Johns (1986) indicated large pillows ("megapillows") in association with thick flows are common components of a proximal facies environment.

There is a pronounced increase in the size and abundance of vesicles and amygdules in mafic flows in the Avery Lake area when compared with vesicles and amygdules elsewhere in this sequence. Vesicles and amygdules are up to 5 cm long and comprise up to 10 volume percent of the rocks around Avery Lake; whereas, elsewhere, vesicles and amygdules are commonly less than 5 mm in diameter and seldom comprise more than 5 percent of the rock. Jones (1969) showed that both vesicle size and abundance increased in pillow lavas as water depth decreased. Easton and Johns (1986) considered this type of variation in vesicularity as strong evidence of relatively shallow water deposition of mafic flows.

There are a number of gabbroic and basaltic sills and dikes intruded into the mafic metavolcanics in the Avery Lake area. These intrusions (described under Mafic Intrusions) are considered by the author to be subvolcanic, based on their commonly gradational contacts to amygdaloidal flows. Easton and Johns (1986) indicated proximal volcanic environments often contain a greater number of synvolcanic sills and dikes than more distal depositional environments.

Therefore, based on flow unit thickness, size and shape of pillows, variation in vesicularity and abundance of subvolcanic intrusions, the metavolcanics in the Avery Lake area are interpreted to have been deposited in relatively shallow water in a proximal volcanic environment.

The mafic metavolcanics in Avery, MacFie and eastern McAree townships are correlated by the author with the Southern Volcanic Belt (Turner and Walker 1973; Trowell et al. 1980) northeast of the map area. This is based specifically on the continuation of the mafic lithologies from the map area into the type area of the Southern Volcanic Belt (Turner and Walker 1973) near Sioux Lookout; the continuity of northwest-facing pillow shapes from eastern McAree Township into the Redpine Bay area (Johnston 1969); the abundance of plagioclase-phyric basalts in both areas, and the relative paucity of interflow metasedimentary units throughout the stratigraphy (Trowell et al. 1983).

The mafic metavolcanics extend south of Avery Township and are correlated with rocks in Melgund, Revell and Hyndman townships. This correlation is based on Satterly's (1960) description of lithologies, in particular the presence of plagioclase-phyric units and the generally conformable stratigraphy as inferred from pillow facings (north to northeast in eastern Avery Township). The mafic metavolcanics in Melgund Township extend southward into the Kawashegamuk Lake area which has been recently mapped by Kresz et al. (1982a, 1982b). In this area, a sequence of metavolcanics has been recognized and named the Kawashegamuk Lake Group (Kresz 1984; Blackburn et al. 1985). Upper members of the Kawashegamuk Lake Group are plagioclase phyric (maximum 30 percent phenocrysts), contain abundant pillow breccia-hyaloclastite units and contain abundant large vesicles and amygdules (Kresz 1984). Irregular gabbroic intrusions are common within parts of the Kawashegamuk Lake Group (Kresz 1984). The author suggests that mafic metavolcanics in the Avery Lake area are correlative with the Kawashegamuk Lake Group south of the map area. If this is valid, it implies the stratigraphic equivalence of the Southern Volcanic Belt with the Kawashegamuk Lake Group.

Immediately west of Avery Township, mafic metavolcanics have been mapped in detail by Satterly (1943) and in semi-detail by Sutcliffe (1977). General lithologic descriptions by Satterly (1943) indicated that complex deformation has affected this area making correlation very difficult. Sutcliffe (1977) indicated that at one spot approximately 5.5 km west of Avery Township near Dinorwic a variolitic mafic flow occurs. Variolitic units are good marker horizons that greatly aid stratigraphic correlation (Trowell 1986), and if the flow identified by Sutcliffe (1977) can be traced to variolitic flows identified by Kresz (1984) in the Kawashegamuk Lake Group, a positive stratigraphic correlation could be made.

It is difficult to correlate the mafic metavolcanics in Avery, MacFie and eastern McAree townships with the Boyer Lake Group (Blackburn 1982) or the Wabigoon Volcanics (Satterly 1943) based on lithologic descriptions. If the metavolcanics in Avery

Township are equivalent to the Kawashegamuk Lake Group, then the Boyer Lake Group overlies them and no correlation exists (Kresz 1984; Blackburn et al. 1985). General descriptions of the Boyer Lake Group indicate these rocks are composed of a monotonous sequence of tholeiitic basaltic flows containing only a few features similar to the mafic metavolcanics in the map area (Blackburn 1982).

The Wabigoon Volcanics described by Satterly (1943) contain very few features similar to those in the map area. In general, there is a marked absence of plagioclase-phyric flows and well-developed pillow breccias. A further complication is the extension of the Manitou Straits Fault into the Dinorwic area. This fault is a major northeast-trending structural feature across which correlation of stratigraphic units has been tenuous at best (Blackburn 1982).

Mafic metavolcanics exposed in the core of a structural dome in central McAree Township are not correlative with the Southern Volcanic Group, based on textural differences. Mafic metavolcanics in the dome are composed of amphibolites, tuffs and heterolithic lapilli tuffs and tuff breccias interbedded with subordinate amounts of mafic wackes. Amphibolites are black, medium-grained recrystallized rocks that are massive to foliated. They are uniformly equigranular and are considered to be highly metamorphosed flows and tuffs. Tuffs are very hard to properly identify because of the high rank metamorphism, however, rocks containing millimetre-sized white grains in a black recrystallized matrix were mapped as tuffs because of their close spatial relationship to coarser pyroclastic units. Lapilli tuffs are volumetrically important, comprising much of the sequence. They are characterized by rounded white felsic fragments averaging 15 mm in diameter (commonly up to 30 mm) in black highly recrystallized matrix. Mafic fragments were not positively identified, but are suspected to be represented by dense hornblende clots. A strong fabric is imposed onto the rocks and stretched felsic clasts in many places define lineations. Lapilli tuffs are distributed throughout the sequence, but tend to be most abundant near the periphery of the structural dome with smaller felsic clasts more common in the interior.

Mafic tuff breccias form a minor component of this sequence, but are important because they form marker horizons. Mafic tuff breccias occur most commonly in a unit around the periphery of the dome near or at the contact with clastic and chemical metasediments. Stretched felsic clasts averaging 15 to 20 cm long are clast to matrix supported in black recrystallized tuff spotted with red garnets up to 1.5 cm in diameter and white lapilli (Photo 4). The characteristically large garnets in the matrix are unique in the map area and permit this unit to be traced over 5 km along the east and south side of the dome. The felsic clasts weather white, are hornblende and feldspar phyric and strongly resemble the felsic metavolcanics which in part underlie and are intercalated with the mafic units.

Pillows were identified at one locale on Highway 72 and represent the only primary flow feature observed in this sequence of rocks. The author could

Photo 4. *Felsic and mafic pyroclasts in a garnetiferous mafic tuff matrix is characteristic of pyroclastic deposits in the core of the structural dome in northern McAree Township (Neepawa Group).*

not determine tops from the exposure, however, Chorlton (1986) indicated the pillows face northwest.

A distal depositional environment is suggested by the fine fragmentals, and lack of flows. The heterolithic nature of the fragmentals may be attributed to predominantly mafic explosive volcanism coeval with subordinate felsic explosive volcanism or to predominantly mafic volcanism with a subordinate epiclastic felsic metavolcanic input. Although the intercalation of volcanically derived metasediments (mafic wackes) clearly indicates erosion of the volcanic pile occurred, the author prefers the process of coeval mafic and felsic volcanism for two reasons. Firstly, there are mafic fragments included in the felsic metavolcanics surrounding the dome, which is interpreted as resulting from predominant felsic volcanism with a minor mafic volcanic input. Secondly, there are no clastic sediments intercalated within the felsic metavolcanics west and north of the structural dome, which indicates there was no significant erosion of the volcanic pile.

These mafic metavolcanics were previously unrecognized and consequently had not been assigned to any stratigraphic unit. The author has included them within the Neepawa Group because of their predominantly fragmental nature, their intimate spatial and assumed coeval association with felsic metavolcanics correlated with the Neepawa Group and to their apparent conformable contacts with the overlying Minnitaki Group metasediments and metavolcanics. Chemically, these rocks contain high TiO_2 which is characteristic of the middle sequence of the Neepawa Group at Sioux Lookout (*see* section on Geochemistry).

Mafic metavolcanic units occur immediately north of the Wabigoon Fault in MacFie Township and are interlayered with metasediments. These rocks are dark green, fine-grained, massive to gabbroic textured flows that are virtually featureless. Their position north of the Wabigoon Fault would, on a strictly geographical basis, preclude inclusion within the Southern Volcanic Belt. These mafic metavolcanics are interpreted to be contained within the map area, however, they may extend west into Hartman Township. Tentative correlation with the Thunder River Volcanics (Pettijohn 1939; Satterly 1943) in the Dryden area is suggested.

Lastly, distinctive mafic inclusions near the northern contact of the Sandybeach Lake Stock were mapped as hornblende-epidote xenoliths. These rocks contain up to 50 percent euhedral megacrystic hornblende crystals in a granular epidote groundmass cut by pink to white alkali feldspar stringers. It is believed these rocks represent rafted metavolcanic inclusions which were partially re-melted and recrystallized to their present state.

Petrographic Summary of the Mafic Metavolcanics

Mafic metavolcanics are characterized by two general mineral assemblages:

Greenschist mineral assemblages:

1. Chlorite + talc + epidote + calcite + primary plagioclase (An_{46-64}) $\pm$ actinolite $\pm$ hornblende $\pm$ white mica.

Amphibolite mineral assemblages:

2. Hornblende + epidote + metamorphic and primary plagioclase (An_{29-62}) $\pm$ biotite $\pm$ chlorite $\pm$ garnet.

Greenschist rank metamorphism has affected Southern Volcanic Belt mafic metavolcanics in western Avery and MacFie townships and along a narrow "belt" between the Wabigoon Fault and an amphibolite rank contact metamorphic aureole developed around the Basket Lake Batholith. Greenschist rank metamorphism is also developed north of the Wabigoon Fault in mafic metavolcanics correlated with the Thunder River Volcanics (Satterly 1943).

Greenschist rank rocks are green to dark green weathering, soft and are usually fine grained. In thin section, relict hornblende, relict pyroxene and plagioclase were recognized, but are now highly altered to chlorite, talc, calcite and epidote. Primary plagioclase is rarely preserved well enough to determine anorthite content by optical methods. Original textures have usually been destroyed; however, occasionally, relict ophitic textures and pillow selvedges were observed.

Amphibolite rank rocks are dark green to black weathering, dense and are usually medium to coarse grained. Members of the Southern Volcanic Belt at amphibolite rank are localized in contact metamorphic aureoles around the Melgund Lake Stock, the Basket Lake Batholith and the area between the two intrusions. These rocks are typically hornfelsic and highly deformed. In thin section, blue-green pleochroic hornblende is more common than recrystallized plagioclase with anorthite content greater than 30. Talc, calcite and actinolite are largely absent from these assemblages and where present are only minor components.

The mafic metavolcanics in the structural dome contain amphibolite rank assemblages. These rocks weather black to dark green with extensively recrystallized medium- to coarse-grained matrices. Blue-green pleochroic hornblende and garnet are the major diagnostic minerals in thin section. Biotite, where present, is also characteristic of amphibolite rank metamorphism. Metamorphic plagioclase forms anhedral grains ranging from An_{29} to An_{62}, averaging An_{40}. Talc, calcite and actinolite are generally absent.

Hornblende and garnet in these metavolcanics are large (5 mm), idioblastic and helicitic. The grains appear unaltered, have no stress shadows developed and for the most part appear post kinematic. Based on this and the lack of a strongly developed foliation, the core of the structural dome is interpreted to be a thermal high. The crystal habits observed in rocks of the structural dome are most commonly associated with contact thermal metamorphism (Spry 1969) and one possible explanation is that an unexposed intrusion underlies the dome.

HORNBLENDE-PHYRIC (CALC-ALKALIC) MAFIC TO INTERMEDIATE METAVOLCANICS

A distinctive suite of mafic to intermediate metavolcanics underlies the northwestern corner of McAree Township attaining a maximum apparent thickness of 2500 m. This sequence which is composed of approximately equal volumes of flows and pyroclastics extends over 3700 m within the map area and is known to extend northeast and southwest of McAree Township. These rocks were distinguished from other mafic metavolcanics because they are geographically separate and because intermediate rocks, especially andesitic pyroclastics are associated with them. They are unlike any other rocks in the map area. Very commonly, the andesitic pyroclastics contain euhedral hornblende and plagioclase phenocrysts up to 1 cm in diameter and the phenocrysts are unique to these units in the map area. Similar units have been mapped in the Sioux Lookout area and are known to be calc-alkalic (Trowell et al. 1983).

Most flows are similar to previously described mafic metavolcanics in which euhedral hornblende phenocrysts are absent. They consist of massive, and pillowed rocks that are plagioclase phyric. In addition, variolitic flows and massive hornblende-phyric flows were identified. Massive flows predominate, are fine grained, dark grey to green and contain abundant vesicles and calcite-filled amygdules. Vesicles are commonly up to 1 cm in size and locally comprise up to 40 percent of the rock. A pervasive magnetite-calcite alteration is commonly developed and tends to darken the weathered surface of affected rocks.

Pillowed flows are not abundant and tend to be concentrated in the northern part of the sequence. Pillows are generally well formed, and exhibit close-packed shapes with 2 to 4 cm thick selvages. They are large (1 m average), green to dark green weathering and highly vesicular.

Plagioclase-phyric flows north and west of Tablerock Lake have an aggregate strike length of 1600 m. White, anhedral plagioclase phenocrysts up to 2 cm diameter (comprising 5 to 25 percent of the flows) occur in a dark green, fine-grained groundmass. Field relationships indicate that these flows occur approximately 300 m below the contact with felsic metavolcanics. This relationship has been noted elsewhere in the Canadian Shield by Green (1975) and indicates the gradual transition from tholeiitic volcanism to calc-alkalic volcanism. Trowell (in preparation) speculates that the felsic metavolcanics in Echo Township and extending into McAree Township represent an immiscible liquid that separated from the underlying mafic metavolcanics that also extend into McAree Township. The occurrence of the porphyritic basalts as a specific stratigraphic horizon would support Trowell's contention.

A distinctive dacitic to rhyolitic variolitic flow occurs on patented claim KRL 22684 in the hornblende-phyric unit approximately 150 m south of the McAree Township line. This rock weathers grey to brown, contains millimetre long black hornblende needles and 1 to 5 mm elongated varioles. The varioles are oval and no internal structures are apparent either in hand sample or microscopically. The flow is exposed over 10 m oblique to strike and contacts with other rock types were obscured by overburden. This unit is morphologically similar to a variolitic flow observed approximately 2000 m northeast on the Goldlund property. Mapping by Page and Christie (1980) has delineated at least two variolitic units on the Goldlund and Camreco properties and correlation with the southernmost unit on the Goldlund property is suggested for the flow in McAree Township. Trowell (in preparation) favours immiscible liquids as the mechanism of variole formation in these units, which provide field evidence for his contention of felsic magma generation by immiscible liquid splitting in this area.

Mafic to intermediate pyroclastics comprise approximately 50 percent of the hornblende-phyric metavolcanics. Hornblende porphyroblasts are usually more abundant in the matrix of pyroclastics than in flow rocks, and careful examination of clasts usually reveals the presence of stretched hornblende crystals of probable primary origin.

Tuffs are dark green, equigranular rocks that usually contain white feldspar grains. They are generally foliated and difficult to distinguish from massive flows. Generally, fine-grained, featureless rocks interlayered with coarser, fragmental units were mapped as tuffs.

Lapilli tuffs and lapillistones are the predominant pyroclastics in the hornblende-phyric metavolcanics. These rocks are heterolithic containing approximately equal quantities of mafic and intermediate fragments. Mafic fragments are usually dark green, rounded clasts averaging 1 to 2 cm (maximum 6 cm) and are assumed to be basaltic in composition. Intermediate fragments are light green to grey, rounded to subangular clasts averaging 1 to 3 cm (maximum 6 cm) and are assumed to be andesitic to dacitic in composition. These units are usually clast supported in a mafic tuff matrix and show poor sorting and no grading.

Tuff breccias and breccias are very similar to lapilli tuffs and lapillistones with regard to clast composition, sorting and internal organization. Fragment size varies from 6 to 30 cm (average 8 to 10 cm) with larger fragments occurring in the northern part of the sequence. Fragments are mafic to intermediate and are basaltic to dacitic in composition. Lapilli and tuff comprise the matrix and all observed units are clast supported. Angular blocks up to 20 cm containing abundant large vesicles are occasionally present and were identified as basaltic scoria. All units display poor sorting, and grading was not observed. Tuff breccias and breccias are gradational with other pyroclastics in the area and represent a coarsening in fragment size.

Near the western contact of the hornblende-phyric metavolcanics and the Crossecho Lake Stock, a deformation zone has sheared pyroclastics into chlorite-talc schists. These rocks are highly foliated to fissile, green to dark green and extend along the boundary of the Crossecho Lake Stock. Carbonate alteration is locally developed but sulphides were not observed.

At one locale north of Tom Chief Lake, a mafic quartz-feldspar porphyry intrudes the felsic metavolcanics. This rock is grouped with the hornblende-phyric metavolcanics because its plagioclase-rich nature suggests it may be of calc-alkalic affinity. Mineralogically, the unit is composed of biotite, plagioclase and calcite with minor quartz and muscovite. It weathers dark grey and is more easily classified as a mafic to intermediate porphyry rather than a felsic porphyry.

Stratigraphic facings are uncommon in the hornblende-phyric rocks and those that are present occur mainly in pillowed flows near the contact with felsic metavolcanics. Here, southeast facings indicate that the felsic metavolcanics are younger. Intercalations of mafic and felsic metavolcanics in the Tablerock and Tom Chief lakes area suggest the contact is conformable. South of Tablerock Lake, the contact between the hornblende-phyric rocks and metasedimentary rocks is marked by a shear zone across which stratigraphic correlations are unknown.

Hornblende-phyric metavolcanics along the northern boundary of McAree Township are interpreted to represent a proximal depositional environment. Metavolcanics in the southern part of the sequence were deposited in a more distal environment (Easton and Johns 1986). Supporting field evidence lies mainly in the high vesicularity of flows, the poor sorting in the pyroclastics, and the greater abundance of large (20 cm plus) subangular to angular clasts including basaltic scoria in the north part of the sequence. Subvolcanic gabbroic intrusions, discussed in greater detail in the section on Early to Late Archean Metamorphosed Mafic Intrusions, are present in the northern part of the sequence and appear to correlate with mafic intrusions on the Goldlund property north of the map area. A brief examination of the geology around the Goldlund mine area suggests these rocks represent a vent facies, an interpretation supported by Chorlton (1986).

The hornblende-phyric metavolcanics are correlated with the Neepawa Group (Trowell, in preparation; Page and Clifford 1977) also known as the Central Volcanic Belt (Turner and Walker 1973). Trowell (in preparation) has subdivided the Neepawa Group into several formations and has proposed informal names for each. The hornblende-phyric metavolcanics appear to correlate with the "Little Vermilion Metavolcanic Formation" described by Trowell (in preparation) as composed of alternating massive to pillowed flows and pyroclastics containing mafic to intermediate, vesicular and scoriaceous clasts. Variolitic horizons occur towards the top of the formation. Correlation of the hornblende-phyric metavolcanics with the Neepawa Group is further suggested by the similar southeast-facing direction in the map area with stratigraphic facings farther northeast towards Sioux Lookout (Page and Christie 1980; Johnston 1969; Trowell, in preparation). Chemically these rocks resemble the high TiO_2 middle member of the Neepawa Group in the Sioux Lookout area (*see* section on Geochemistry).

Petrographic Summary of the Hornblende-Phyric Metavolcanics

The hornblende-phyric metavolcanics contain mineral assemblages characteristic of upper greenschist to amphibolite rank metamorphism (Winkler 1979). This mineral assemblage contains:

1. Hornblende + epidote + chlorite + calcite + actinolite ± plagioclase ± talc.

Blue-green pleochroic hornblende occurs as poikiloblastic crystals, commonly defining a preferred orientation, and is considered indicative of middle to upper greenschist rank metamorphism in the presence of actinolite (Winkler 1979). Rarely, blue-green hornblende is the only amphibole present and suggests amphibolite rank metamorphism has been locally attained. Hornblende also occurs as primary, green to brown-green pleochroic, euhedral to subhedral, porphyritic phenocrysts. Commonly, actinolite pseudomorphs or actinolite-hornblende intergrowths replace these crystals.

Pale green, weakly pleochroic actinolite is common as small bladed crystals in the groundmass or matrix in most of the rocks or replaces large euhedral primary hornblende crystals. Actinolite never occurs exclusive of at least small amounts of blue-green hornblende, which is thought to indicate middle to upper greenschist rank metamorphism (Winkler 1979).

Primary plagioclase laths occur as white to greenish millimetre-sized grains on weathered surfaces of many rocks. However, in thin section, plagioclase is largely replaced by calcite, epidote and less commonly chlorite making optical determinations of composition difficult. Relict plagioclase crystals occur as porphyritic phenocrysts and are indicative of calc-alkalic affinity.

FELSIC METAVOLCANICS

Felsic extrusive rocks underlie two parts of the map area and each part is characterized by distinctive rock types and textures. In north-central McAree Township, felsic metavolcanics are composed predominantly of coarse, poorly sorted, poorly bedded and poorly organized pyroclastic deposits and subordinate flows. They are interbedded with schists and sulphide facies ironstones. In northeastern McAree Township, felsic metavolcanics are composed predominantly of poor to well sorted, well bedded and well organized pyroclastic-epiclastic deposits. They are interbedded with minor intermediate to mafic pyroclastic deposits and wackes. Flows appear to be absent here. Although there are no major element chemical differences between the two areas, trace element chemistry varies significantly (*see* section on Geochemistry).

For the purposes of this report, feldspar, quartz-feldspar and quartz-phyric dikes and intrusions which are widely distributed throughout the map area are grouped within the felsic metavolcanic map unit.

The felsic metavolcanics underlie north-central McAree Township, are exposed over a 3800 m thickness, are white to grey weathering and are best exposed along Highway 72. Heterolithic breccias, tuff breccias and lapilli tuffs comprise the bulk of the felsic metavolcanic deposits. Breccias and tuff breccias are composed of 90 percent white rhyolitic clasts and 10 percent mafic metavolcanic clasts in a felsic tuff to crystal tuff matrix (Photo 5).

These rocks have been highly strained and clasts are elongated in the plane of foliation with aspect ratios up to 10:1. Felsic clasts up to 70 cm long were observed but clasts 10 to 20 cm long are the average. Highly elongated mafic clasts up to 15 cm long were observed but lengths between 5 and 8 cm are average. Breccias and tuff breccia deposits are poorly sorted with clasts ranging from tuff to large block size. They generally show little or no internal organization, which may be in part a function of poor exposure. At one outcrop immediately north of the map area, breccias are graded and indicate "tops" are southeast (Photo 6).

Lapilli tuffs and lapillistone are generally subordinate in volume to breccias and tuff breccias. They are normally heterolithic containing up to 10 percent mafic metavolcanic and sulphide fragments in a tuff to crystal tuff matrix. Clasts of all fragment types range from 0.2 to 7.0 cm and have an estimated mean of approximately 5.0 cm. The deposits are poorly sorted, display little or no internal organization and are usually interlayered and gradational with breccias and tuff breccias.

Tuffs and crystal tuffs are common in the felsic metavolcanics in north-central McAree Township and tend to increase in volume towards the south-

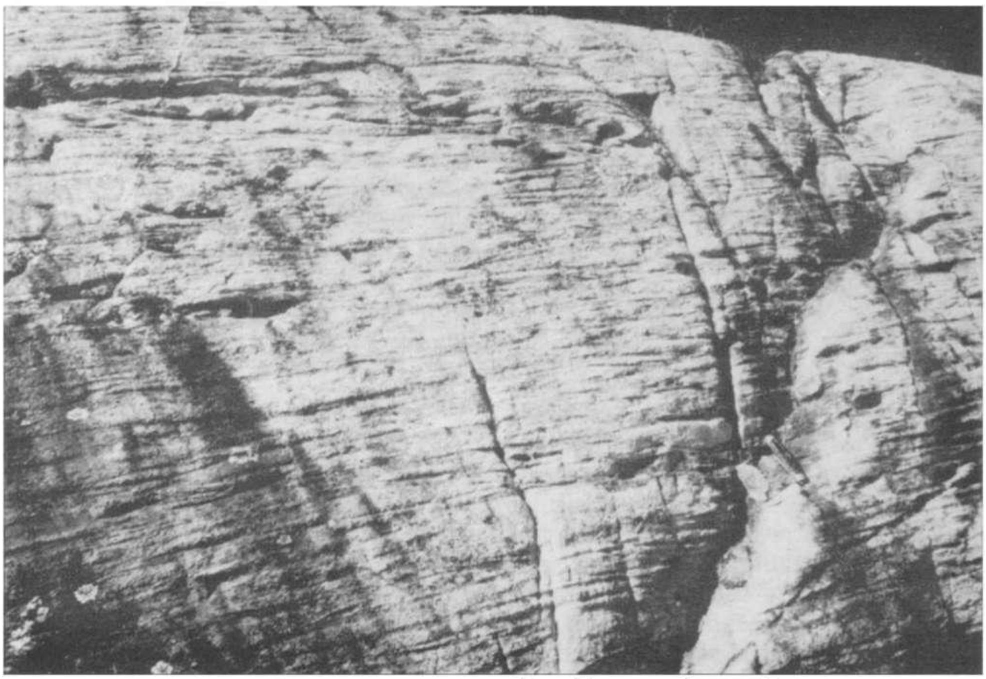


Photo 5. *Typical exposure of Neepawa Group felsic pyroclastics along Highway 72 in McAree Township. Knife is 6 cm long.*

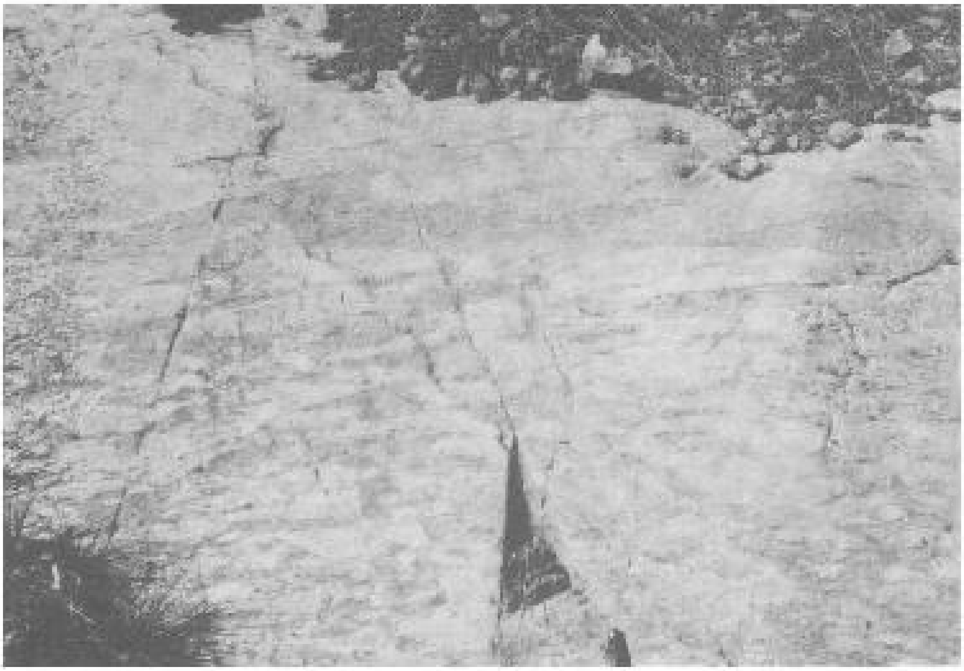


Photo 6. *Felsic tuff breccia (Neepawa Group) on Highway 72 showing grading of lithic pyroclasts. "Tops" toward bottom of photograph is southeast. Knife is 6 cm long. Echo Township.*

east. These units are white to buff weathering and are quartz and feldspar phyric. In most places, they are massive displaying little or no internal organization and few if any bedding planes. Tuffs of similar composition form the matrix of the coarser pyroclastics in this sequence. Due to metamorphic recrystallization and deformation, original grain size is poorly preserved. Thin section examination of crystal tuffs shows crystal fragments 1 to 2 mm in a coarsely (approximately 1 mm) crystalline matrix suggesting original coarse ash deposits.

Rocks interpreted as flows or ash flows are exposed at one location on Highway 72. These rocks of dacitic composition (*see* section on Geochemistry) are banded (5 to 40 cm) with individual bands distinguished from each other by colour variation. Alternating grey and white bands, respectively, contain greater amounts of biotite and hornblende or greater amounts of feldspar. Although this outcrop has undergone amphibolite rank metamorphism, the banding is interpreted to be primary (rather than tectonic-metamorphic) because a similar banded unit occurs on the shore of Sandybeach Lake. Furthermore individual bands can be traced throughout the length of the outcrop on Highway 72 for a distance of 50 m. Deformation has folded and boudinaged parts of the outcrop creating a fragmental appearance and separating once continuous bands.

A dacitic autobrecciated flow occurs along the north contact of the felsic metavolcanics with the overlying mafic metavolcanics in the core of the structural dome in McAree Township. This rock contains wisps and streaks of chlorite that surround centimetre-sized grey aphanitic blebs and dacitic fragments. This texture is gradational to a more massive flow texture, however, chloritic wisps are still present giving the outcrop an overall fragmental appearance.

Where shearing has affected pyroclastics north of Tom Chief Lake sericite-quartz schists are developed. These schists are white weathering, highly foliated to fissile rocks and contain various amounts of sulphide, in which case they commonly appear rusty. Locally, intense weathering has leached all mineralogy leaving just a silica framework in an otherwise porous rock. These schists are bounded by less deformed felsic pyroclastics which are interpreted to be their unsheared equivalents.

The felsic metavolcanics in north-central McAree Township have poorly preserved primary structures, and stratigraphic facings were determined at only one locale where tops were to the southeast (Photo 6). These metavolcanics conformably overlie the hornblende-phyric mafic and intermediate metavolcanics in northwest McAree Township. In turn, mafic metavolcanics previously described from the core of the structural dome overlie and in part are intercalated with the felsic metavolcanics. Mafic fragments which are almost always present in the felsic pyroclastics resemble the mafic rocks in the core of the dome and this is interpreted to represent coeval felsic and mafic volcanism. The felsic metavolcanics are conformably overlain by metasediments south of Tablerock Lake, on the north shore of Tom Chief Lake and at one location on the north shore of Sandybeach Lake. At all three locations a sulphide facies ironstone mixed with clastic wackes and schists occurs within 50 m of the inferred contact. The contact appears to be a rapid transition from pyroclastics to ironstone and wackes with some of the wackes apparently derived by erosion of the metavolcanics (i.e., they are very quartzose-feldspathic white weathering metasediments). The author believes that the sulphide ironstone occurs at a similar stratigraphic position throughout the map area and can be used as a marker horizon.

The felsic metavolcanics extend north of the map area into Echo Township where they have been mapped by Page and Christie (1980) and referred to by Page (1984) as the Franciscan Lake felsic metavolcanics within the Neepawa Group. Based on the relative coarseness of the pyroclastic deposits in McAree Township, along with their poor sorting, apparent lack of internal organization and the presence of flows, these felsic metavolcanics represent a proximal depositional environment (cf. Easton and Johns 1986). This interpretation is supported by Trowell's (in preparation) contention that quartz porphyry and feldspar porphyry intrusions at Franciscan Lake in Echo Township (3 km northeast of map area) represent a centre of felsic magmatism.

The second major area of felsic metavolcanics is in the area of Pickerel Arm of Minnitaki Lake in northeastern McAree Township. Here, felsic pyroclastic-epiclastic deposits and minor intermediate to mafic pyroclastic deposits are interbedded with wackes over an aggregate 1200 m thickness. Individual felsic units are up to 400 m thick. The felsic metavolcanics are composed predominantly of quartzofeldspathic lapillistones, crystal tuffs and laminated tuffs with lesser quantities of tuff breccias and no flows. The pyroclastic deposits are well to poorly sorted, well bedded, commonly contain lithic fragments as opposed to mafic metavolcanic fragments and in many places are internally graded especially the finer tuff and lapillistone units.

The pyroclastics are white to pink weathering and distinguished from wackes by their texture and relative paucity of micas as compared to the metasediments. Tuff breccias are volumetrically minor and are characterized by heterolithic angular to rounded feldspar-phyric felsic clasts and minor or rare subangular to elongated mafic clasts in felsic crystal tuff matrix. Felsic fragments range from 6 to 50 cm and average 8 cm diameter. Mafic fragments tend to be smaller with a maximum observed size of 8 cm. Tuff breccias are poorly sorted and grading within individual units was not observed. Bedding thickness could not be adequately determined due to lack of large outcrops across strike, however, one smaller unit of tuff breccia was determined to be approximately 8 to 10 m thick.

White weathering lapillistones and lapilli tuffs are volumetrically the most important units in the Pickerel Arm area. These rocks are heterolithic containing over 90 percent felsic feldspar and quartz-feldspar-phyric clasts averaging 2 to 5 cm and less than 10 percent lithic mudstone clasts and highly stretched clasts interpreted to represent pumice. The clasts are generally matrix supported in a tuff to crystal tuff matrix, but tectonic shearing often creates an apparent clast-supported texture. Lapilli units tend to be better sorted than tuff breccias and grading is occasionally well developed. Bedding thickness was not adequately determined, but units tend to be thinner than those consisting of tuff breccias. They rarely exceed 5 to 6 m in thickness.

Laminated to thinly bedded tuffs and crystal tuffs are a minor component of the felsic metavolcanics at Pickerel Arm but are locally well developed. These rocks weather white to grey and are composed of quartz, feldspar and minor amounts of biotite. Primary structures such as bedding planes, grain gradation and occasionally lag filled scour marks are well preserved and provide reliable younging data. Individual beds vary from approximately 2 mm to 3 cm thick and bedded tuff units up to 1 m thick are common. Based on the younging data, the sequence fines upward to the southeast from tuff breccia to tuff.

In places, tuffs are conformably overlain by tuff breccias and the fining-upward cycle is repeated. Commonly, tuffs are overlain by wackes and mudstones which are laterally continuous over hundreds of metres. These metasedimentary horizons, which vary between 50 cm and 200 m thickness, separate at least three major fining-upward felsic metavolcanic cycles and several minor fining-upward cycles.

From the lithological descriptions, the unit morphology and internal organization of the units, the felsic metavolcanic deposits at Pickerel Arm are interpreted to have formed by subaqueous pyroclastic flows (cf. Easton and Johns 1986; Fiske and Matsuda 1964). Among the strongest lines of supporting evidence are the presence of pumice and lithic fragments within the coarser units and the grading within individual beds and units which define a doubly graded sequence (Easton and Johns 1986).

Assuming that the Pickerel Arm felsic metavolcanics represent subaqueous pyroclastic flows, then these deposits are distal to their source (cf. Easton and Johns 1986) and indicate volcanism was explosive and episodic allowing clastic metasediments to accumulate during quiescent intervals.

The felsic metavolcanics at Pickerel Arm extend northeast of the map area and are contiguous with felsic metavolcanics mapped by Johnston (1969). Here, fragmental deposits have the appearance of "welded agglomerates and tuffs" (Johnston 1969, p.11) which may well represent subaerially deposited correlative units. In the Western Minnitaki Lake area, the felsic metavolcanics are enclosed within metasediments of the Minnitaki Group (Johnston 1969). Trowell et al. (1980) suggest that the felsic metavolcanics are intercalated with the Minnitaki Group metasediments and the interbedded aspect of the unit within the map area supports this interpretation.

Elsewhere in the map area, felsic extrusive rocks occur as small discontinuous units within the hornblende-phyric metavolcanics in northwest McAree Township. Highly foliated, white weathering rocks of possible flow or tuffaceous origin are interlayered with more mafic units and are composed of very fine grained to aphanitic quartz and feldspar. These units are only about 15 to 25 m thick and could not be traced more than 30 m along strike. They are assumed to be extrusive because of their fine-grained equigranular habit, which is unlike any felsic dikes in the map area.

Feldspar-phyric, quartz-feldspar-phyric and felsite dikes and sills for mapping purposes are grouped with the felsic metavolcanics because the groundmass is usually fine grained to aphanitic and these intrusions appear to be related to the extrusive felsic metavolcanics than to any of the felsic granitoid intrusions in the map area.

Rocks mapped as felsites are white to pink weathering, fine grained, equigranular and sugary textured. They are clearly intrusive, as demonstrated by their sharp, in many places chilled contacts which are discordant to stratigraphy and in many places discordant to foliation. Felsite dikes occur most frequently in the Southern Volcanic Belt where they vary between 1 to 5 m wide. In Avery Township, many dikes are pervasively carbonate altered which causes the dikes to weather pink, for example, along the Canadian Pacific railway line near their ballast quarry a felsite dike intrudes pillowed and massive basaltic flows. Finely disseminated pyrite in places accompanies the carbonate alteration and neither sulphidization nor carbonatization affects the host rocks.

Feldspar-phyric and quartz-feldspar-phyric dikes intrude the supracrustal rocks throughout the map area, but are most heavily concentrated within 1 km of the Wabigoon Fault. Both dike types are similar, with the only distinction between the two being the presence of quartz phenocrysts in sufficient quantity (usually 5 percent) in one type. Biotite is the major mafic mineral commonly comprising 5 percent or less of the rock. The intrusions weather white to grey, vary between equigranular and porphyritic and occur as dikes discordant to stratigraphy and discordant or parallel to foliation. The dikes vary between 60 cm to 25 m wide and can be traced for up to 100 m along strike. Within the Southern Volcanic Belt, feldspar and quartz-feldspar dikes form a swarm with strikes parallel to foliation in the proximity of the Wabigoon Fault. Dikes are spatially related to three gold showings (*see* section on Economic Geology) and appear to be associated with the mineralization at one of the showings (Rivers Option, Economic Geology).

Within the Wabigoon Fault deformation zone, felsic dikes become sheared and are locally altered to sericite-carbonate-quartz schists. These rocks are brown to yellow-green in colour and are generally fissile, folded and crenulated. Careful examination of the schists commonly reveals quartz "eyes" which indicate a probable quartz-feldspar dike origin. It is one of these schists which returned 33 ppb gold from a sample submitted for assay by the author (*see* section on Economic Geology) and suggests these units are potential exploration targets.

Quartz porphyry occurs in an oval body approximately 400 m south of the Wabigoon Fault in MacFie Township. This rock weathers white to yellow and contains widely spaced, small (0.1 mm) quartz phenocrysts in an aphanitic quartz-rich groundmass. The weathered surface is generally strongly lineated and fractured giving a ropy appearance to the outcrops. At the northeastern end of the quartz porphyry, numerous quartz-filled stringers and veins, some of which contain pyrite, occur suggesting this area warrants prospecting. The quartz porphyry is interpreted to be a subvolcanic felsic intrusion which may have been the source for the numerous felsic dikes in the immediate area.

In northwestern McAree Township, quartz-phyric felsic dikes that contain up to 25 percent quartz phenocrysts intrude metasediments and the hornblende-phyric metavolcanics. These dikes weather white to pink, are coarse grained to porphyritic. The quartz phenocrysts are up to 2 cm in size and commonly doubly terminated. These dikes are 1 to 3 m wide, and not extensive. They are similar to quartz-phyric dikes observed on the Goldlund property to the north. These dikes are lithologically similar to phases of the Crossecho Lake Stock with which they are assumed to be related (Chorlton 1986).

Petrographic Summary of the Felsic Metavolcanics

This section deals mainly with the felsic extrusive rocks in the map area and makes only brief reference to the felsic dikes. The mineral assemblage most commonly encountered in thin section is:

1. Quartz + plagioclase (An_{27-64}) + muscovite + biotite + calcite + chlorite $\pm$ epidote $\pm$ microcline $\pm$ garnet.

Common accessory minerals are apatite, tourmaline, titanite, zircon and opaque minerals. Most of the thin sections have a strongly anisotropic fabric defined by the preferred orientation of muscovite and biotite. Recrystallization has affected all rock types such that distinction between clast and matrix is rarely possible and for the most part all rocks have an equigranular to slightly porphyritic texture.

The widespread occurrence of biotite and garnet is indicative of medium-grade metamorphism. This is supported by the optically determined compositions of plagioclase which ranges between An_{27} and An_{64} with average compositions around An_{48}. Winkler (1979) indicated that anorthite content of plagioclases systematically increases as temperature increases and that anorthite contents above 30 percent are characteristic of amphibolite rank metamorphism.

The felsic metavolcanics containing the plagioclase with the highest anorthite content (An_{47-64}) occur on the east shore of Sandybeach Lake and clearly display zones of intense recrystallization and possibly partial melting. Potassic metasomatism is evident in these rocks as indicated by the presence of microcline in thin section. Felsic metavolcanics with plagioclase containing lower anorthite contents occur in the more northerly parts of McAree Township.

Aluminosilicates occur at one locale in felsic metavolcanics along Highway 72, near the western contact with mafic metavolcanics. Brown, squarish porphyroblasts of andalusite have been replaced by muscovite and fibrolitic sillimanite in a siliceous lapilli tuff. The rocks in this area are also cut by black tourmaline veinlets and tourmaline also occurs along foliation planes (Photo 7). These minerals are not only indicative of high metamorphic temperatures, but also indicate the alumina-rich nature of rocks in this area. The alumina enrichment in these rocks is interpreted to be the result of hydrothermal alteration and the presence of tourmaline veinlets supports this idea.

Although andalusite was observed in only one outcrop, tourmaline is more widespread in the felsic metavolcanics for over 200 m along Highway 72. Poor exposure between Highway 72 and Tom Chief Lake and previous indications of sulphide mineralization encountered by Canadian Nickel Company Limited (*see* section on Economic Geology) indicate this area is a potential exploration target.

CLASTIC AND CHEMICAL METASEDIMENTS

Metasediments are largely confined to a deformed and metamorphosed sequence in central McAree and northern MacFie townships which attains a maximum apparent thickness of 7500 m. Interflow metasedimentary units within the Southern Volcanic Belt are poorly developed and generally comprise less than one percent of this sequence. Metasediments are virtually absent in the Neepawa metavolcanics.

The main sequence of metasediments is predominantly wackes and derived schists. Wackes vary throughout the map area from predominantly grey to dark brown weathered surfaces, presumably reflecting the original high proportion of matrix to framework in most wackes, to light grey to white weather-

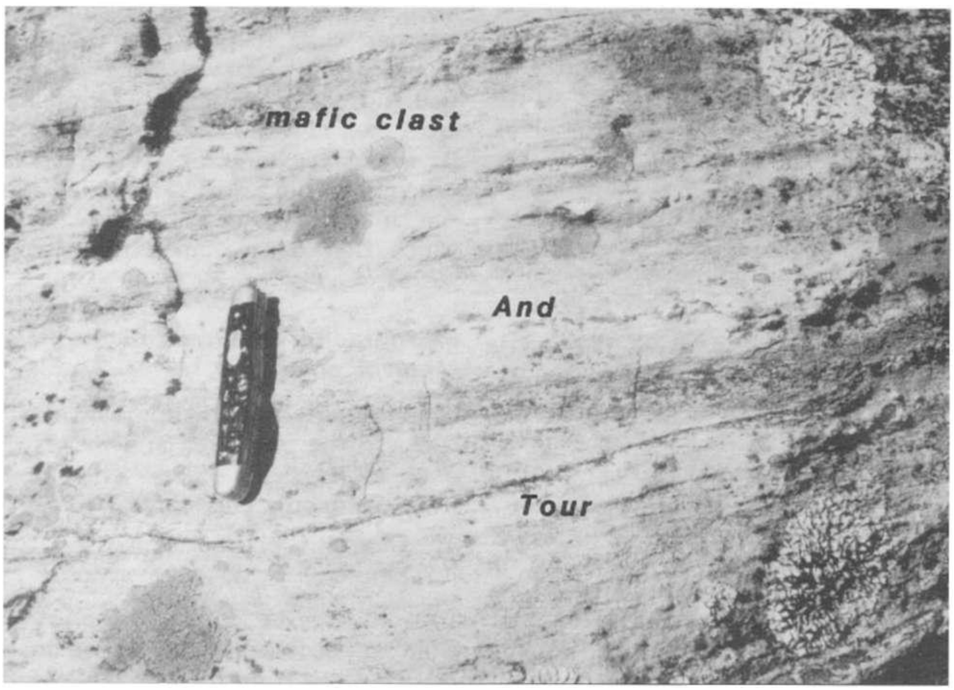


Photo 7. *Andalusite (And) and tourmaline (Tour) stringers in banded felsic pyroclastics indicating hydrothermal alteration. Highway 72, McAree Township. Knife is 6 cm long.*

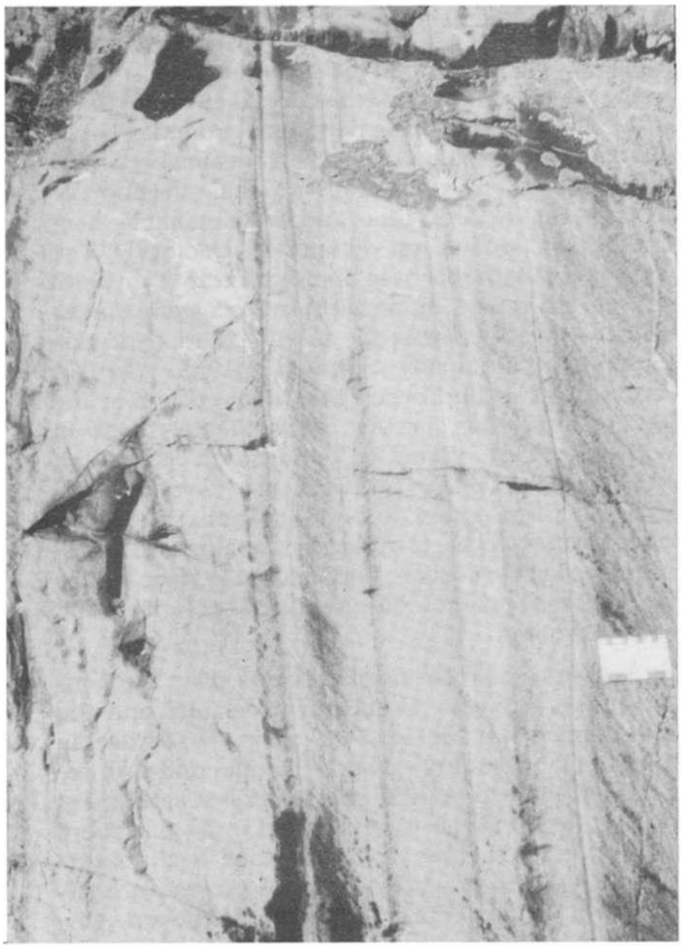


Photo 8. *Well-exposed bedded wackes of the Minnitaki Group on Sandybeach Lake, McAree Township. Grain gradation in these beds indicates a turbidity current origin. "Tops" is to the left which is south.*

ing wackes which are common in the Pickerel Arm area. The light colour reflects a high quartz and feldspar content. These units are presumably derived from the felsic metavolcanics with which they are interbedded, and commonly are distinguished by a micaceous sheen on cleavage faces which the felsic metavolcanics generally do not possess.

Bedding thickness ranges from 2 to 70 cm with an estimated average between 5 and 10 cm (Photo 8). Grain gradation is the most commonly preserved primary feature within wacke beds, however, many beds appear to be massive as well. Mudstone "rip-up" clasts and scours are locally preserved but are not abundant. At one locale on Highway 72, low angle assymetric cross-bedding in sets 5 to 15 cm thick is preserved, but bedding transposition prohibits an in-depth study of the bedded unit. Based largely on the presence of grain gradation, wackes are interpreted to have been deposited by turbidity currents (Walker 1976).

Two important additional types of wacke units in the area are mafic wackes and ferruginous wackes. Mafic wackes are hornblende-quartz-bearing metasediments that are spatially related to the mafic metavolcanics in northern McAree Township. These rocks contain from 10 to 50 percent hornblende in very thinly to thickly bedded massive units that are dark grey to green and white mottled. Grain gradation was not observed within these units; however, alternating quartz-rich and hornblende-rich layers are common and possibly represent "A–E" turbidites (cf. Walker 1976). Mafic wackes are interpreted to have formed by erosion of the mafic pyroclastics in McAree Township.

Ferruginous wackes occur on the east side of Sandybeach Lake near the portage to Pickerel Arm. These rocks are dark brown to rusty weathering, sandy and very thickly bedded. Fresh surfaces are difficult to obtain. Limonite commonly coats the framework grains. Framework grains are fine- to medium-grained quartz and feldspar sand indicating these were not originally mudstones. The limonite may result from sulphide oxidation, however, no sulphides were observed in these units.

Pebbly sandstones occur in close proximity to the ferruginous wackes and are characterized by subangular to rounded quartz, lithic and limonitic pebbles up to 1 cm in diameter in a sandy quartzose-feldspathic matrix. Like the ferruginous wackes, the pebbly sandstones are spatially restricted to the east shore of Sandybeach Lake and mark the coarsest metasediments in the map area.

Siltstones occur throughout the metasediments and are second in volume after the wackes. These rocks are grey to buff weathering and are generally thickly laminated to thinly bedded. Siltstones most commonly occur as thin beds overlying wacke beds and in this environment are interpreted as the "D" or "E" unit of classical turbidites (Walker 1976; Bouma 1962). Siltstones also occur in a semicontinuous unit that outcrops on Highway 72, on the west shore of Sandybeach Lake and on a couple of islands in northern Sandybeach Lake. This unit contains laminated siltstones which are gradational into and interbedded with dark grey to black mudstones and argillaceous to phyllitic schists. Due to their original high clay content, siltstones preferentially develop staurolite, cordierite and andalusite, whereas interbedded wackes develop only garnet and biotite.

In addition to being incorporated into siltstones, argillaceous and phyllitic schists occur near the Wabigoon Fault and have been intersected in diamond-drill holes sunk by various exploration companies. These rocks are dark grey to black, are strongly foliated to fissile and in many places contain graphite smeared along the foliation planes. The schists are interpreted to have been mudstones that were subsequently deformed. The schists are neither laterally extensive nor very thick and only rarely comprise the predominant rock type in any outcrop.

Brown weathering biotite-muscovite-quartz schists occur along the north contact of the Sandybeach Lake Stock. The schists are highly foliated to fissile and commonly crenulated retaining no readily identifiable primary structures. The rocks are inferred to be of metasedimentary origin because of their close spatial association with clearly recognizable metasediments and their mineralogy reflects a metasedimentary origin. The schists in many places contain less than 10 percent injected quartz and/or tonalitic stringers which are highly contorted, and discontinuous. Chorlton (1986) interpreted this area as part of a ductile shear zone. Pelitic schists containing staurolite porphyroblasts up to 3 cm occur throughout the metasediments and are designated as staurolite-bearing units on the map.

Along the southern and southeastern contact of the Sandybeach Lake Stock, a narrow zone (up to 500 m thick) of migmatitic metasediments is developed. Although intact metasedimentary schists form large areas, in general, 10 to 70 percent of the rocks are white weathering, semicontinuous granitic stringers. Wispy to continuous biotitic melanosome is present in some places and signifies derivation by *in situ* partial melting of the metasediments and thus permits use of the term metatexite (Brown 1973). Rarely agmatitic texture is developed further supporting a migmatitic origin for this zone. Note that staurolite, andalusite and sillimanite are developed in the paleosome of these metasediments.

At one location approximately 200 m north of Tablerock Lake in McAree Township, one outcrop of conglomerate was observed. This rock contains angular to rounded clasts of felsic and mafic metavolcanics, quartz and metasediments ranging in size from 5 mm to 30 cm. The matrix appears to be a quartz-rich sandy wacke. The conglomerate is unsorted and matrix supported. Contacts with other rocks were not observed, but felsic metavolcanics occur within 50 m on either side. Without further investigation, the origin of this conglomerate remains problematic.

Chemical metasediments are volumetrically minor components in the map area. Cherty metasediments rarely occur as interflow metasediments between mafic metavolcanic flows of the Southern Volcanic Belt. They are creamy-white, cryptocrystalline to sugary textured rocks that are occasionally laminated, but are more commonly contorted and interrupted by the overlying flow or by deformation. Chert in places is interlayered with ironstones, where it occurs as thick laminae or very thin beds between beds of sulphides as at the contact between felsic metavolcanics and ironstone south of Tablerock Lake and between magnetite and amphibole-rich laminae as at the Standon showing on Sandybeach Lake.

Ironstones occur predominantly in McAree Township and are of two types. Magnetite-quartz ironstone occurs only at the Standon gold showing on the west shore of Sandybeach Lake, where thinly to thickly laminated magnetite and grunerite bands alternate with laminae of quartz (presumably chert) and grunerite. Auriferous pyrite and arsenopyrite stringers cut the ironstone and are potentially economic (*see* section on Economic Geology). The ironstone is exposed over approximately 2 m width and can be traced by an airborne magnetic survey northeast and southwest for about 750 m (Noranda Exploration Company Limited, 1985, AFRO, Toronto). A second occurrence of ironstone at the Standon showing occurs approximately 450 m southeast on an island in Sandybeach Lake, but gold-bearing sulphide stringers are not observed here. The ironstones at both locations are interbedded with wackes, intruded by metadiabase dikes, granitic pegmatite dikes and feldspar-phyric dikes. All but the pegmatite dikes are highly deformed and metamorphosed.

Sulphide facies ironstone occurs near the contact of the Neepawa Group metavolcanics and the metasediments in McAree Township. Based on the distribution of outcrops and from diamond-drill reports filed by exploration companies for assessment credits, the ironstone is interpreted to be one more or less continuous unit. The ironstone is characterized by pyrite and to a lesser extent pyrrhotite, chalcopyrite and sphalerite interlayered with chert, graphitic mudstone and wackes. Sulphide content varies between 5 and 60 percent, with magnetite only locally present and seldom exceeding 10 percent. Sulphides occur as disseminated grains, in discrete massive beds, in massive aggregates, in stringers or rarely as oval concretions up to 5 mm diameter. Sulphide ironstones rarely exceed 3 m thickness in outcrop, but are reported up to be 7 m thick in diamond-drill holes.

From available stratigraphic younging data, it appears that the sulphide ironstones overlie the Neepawa Group (i.e., stratigraphy youngs to the southeast). The deposition of these chemically derived metasediments is interpreted to have occurred during a hiatus between volcanism and the onset of clastic sedimentation when chemical exhalation was predominant.

A hornblende-biotite-garnet-bearing amphibolite occurs along the north shore of Sandybeach Lake and has been reported in diamond-drill logs filed by exploration companies for assessment credits. It is a distinctive rock type characterized by dull red garnets up to 1 cm diameter in a black recrystallized matrix of hornblende, biotite and quartz. On the coloured maps that accompany this report, the rock is grouped with the metasediments because it occurs as a bedded unit up to 60 cm thick within the metasediments and can be traced over at least 1500 m strike length. Its origin is uncertain but it may represent a bedded mafic tuff or metasediments derived by degradation of the underlying mafic metavolcanics.

Due to the deformation, high grade of metamorphism and poorly preserved primary structures, very little paleoenvironmental interpretation has been attempted for the metasediments. The occurrence of turbidites with thin to thick beds and the relatively high proportion of siltstones to wackes suggests a distal submarine environment is most likely (Walker 1976). The rare occurrence of cross-bedding in sets up to 15 cm thick suggest that higher energy depositional environments were only locally present. The general lack of conglomerates and only local presence of pebbly sandstones further suggests the metasediments were deposited in a low energy, distal environment.

The metasediments in McAree and MacFie townships extend both northeast and southwest of the map area. The northeast extension of the metasediments is directly correlated with the Minnitaki Group (Turner and Walker 1973; Trowell et al. 1980). Turner and Walker (1973) proposed the Minnitaki Group represented deep water metasediments into which turbidity currents periodically deposited coarser grained material, an interpretation supported by the metasediments in the map area. Satterly (1943) has mapped the metasediments contiguous with those in the map area to the southwest and has referred to them as the Thunder Lake Sediments. Based on lithologic descriptions by Satterly (1943), the contiguous nature of the metasedimentary sequence into the map area and the conformable southeast younging data (Satterly 1943), the Thunder Lake Sediments are interpreted to be equivalent to the Minnitaki Group.

Petrographic Summary of the Metasediments

All metasediments of the Minnitaki Group contain mineral assemblages representative of medium-grade metamorphism. No rocks have retained their original textures or mineralogy and the resultant mineral assemblages are highly dependant upon the rocks' original bulk composition. With this in mind, the following three mineral assemblages are representative of most metasediments.

Mineral assemblage 1:

Quartz + plagioclase (An_{28-57}) + biotite + muscovite + garnet $\pm$ chlorite $\pm$ aluminosilicate $\pm$ epidote represent quartzose-feldspathic wackes. Apatite, tourmaline, opaque minerals and calcite are common accessory minerals.

Mineral assemblage 2:

Quartz + biotite + muscovite + chlorite + staurolite $\pm$ plagioclase (An_{55-65}) $\pm$ aluminosilicate $\pm$ cordierite represent pelitic wackes, siltstones and mudstones. Garnet, apatite, tourmaline, and opaque minerals are common accessory minerals.

Mineral assemblage 3:

Quartz + hornblende + epidote $\pm$ garnet $\pm$ biotite $\pm$ plagioclase (An_{55-60}) $\pm$ chlorite $\pm$ calcite represent mafic wackes, quartz-magnetite ironstones and hornblende-garnet amphibolites. This assemblage is clearly subordinate to the first two mineral assemblages. Opaque minerals and apatite are commonly present, actinolite occurs in one rock and grunerite occurs in ironstone.

Quartzose-feldspathic wackes contain between 55 and 65 percent quartz and metamorphic plagioclase with anorthite content ranging from 28 to 57 percent, which indicates upper greenschist to amphibolite rank metamorphism (Winkler 1979). Biotite content ranges from 15 to 35 percent of the examined thin sections, and when combined with quartz and plagioclase contents, restricts development of other metamorphic minerals. This is apparent as muscovite and garnet are almost always present but never in great quantities. In most samples, garnet is rarely visible in outcrop and in thin section forms small anhedral chips. Pelitic bulk compositions present in mudstones are necessary for development of garnet. In a few thin sections, small needles of fibrolitic sillimanite were observed in contact with biotite and/or garnet, indicating that amphibolite grade metamorphism was obtained (Winkler 1979).

Mineral assemblage 2 is commonly developed in rocks more pelitic than the first mineral assemblage. Pelitic wackes, siltstones and mudstones generally contain only 20 to 40 percent quartz and plagioclase and in many thin sections the latter mineral is absent. Muscovite, a second growth biotite and chlorite, which commonly appear to have pseudomorphed biotite, comprise 45 to 60 percent of the thin sections examined and muscovite always comprises at least 10 percent and up to 40 percent. Staurolite, andalusite and cordierite form large porphyroblasts in some of the pelitic units, indicating moderate metamorphic temperatures and low to moderate pressures affected most of the metasediments.

Andalusite is a common porphyroblast occurring in pelitic rocks around the periphery of the Sandybeach Lake Stock. It occurs as anhedral to subhedral crystals (typically greater than 3 mm in diameter) that weather white to light brown. In thin section, andalusite is largely altered to muscovite and less commonly sillimanite, although locally some andalusite crystals remain unaltered. Andalusite is typically poikiloblastic and is inferred to have developed in a thermal aureole around the Sandybeach Lake Stock. Adjacent to the contact of the Sandybeach Lake Stock, sillimanite has been observed forming within some andalusite crystals in pelitic rocks. This is interpreted to represent direct conversion of andalusite to sillimanite and is further interpreted to have resulted from the thermal aureole of the Sandybeach Lake Stock. Winkler (1979) indicated this reaction takes place between 640°C and 650°C at pressures between 3 and 2.5 kbar in the absence of potassium feldspar. Hall and Rigg (1986) indicated the same reaction can proceed between 550°C and 575°C over the same pressure range.

Staurolite is abundant in the pelitic rocks and occurs in two modes. In the more common mode, staurolite develops as porphyroblasts which are assumed to be related to development of the metamorphic aureole around the Sandybeach Lake Stock. These staurolites, now altered to muscovite, biotite, chlorite and rarely sillimanite, are pre- to syntectonic as indicated by their common crenulated and rotated habits with well to poorly developed stress shadows. Staurolite also occurs restricted to foliation planes transposing pre-existing staurolite and to pods of granitic "sweats" which is suggestive of introduction of fluids along foliation planes. These staurolites although largely altered may occur in the unaltered state as seen along Highway 72. Garnet occasionally occurs in the cores of some staurolites and cordierite has been identified in the foliation planes and "sweats". These relationships suggest higher temperatures were involved possibly at the beginning of anatexis (Winkler 1979).

Mineral assemblage 3 occurs in the mafic metasediments and is easily recognized in the field by the presence of hornblende. The occurrence of hornblende and the absence of actinolite indicates moderate metamorphic temperatures in the upper greenschist to amphibolite rank (Winkler 1979). Garnet is commonly developed and where present is readily visible in hand sample. Plagioclase is rarely present and generally very calcic (An_{55-60}). The oxide facies ironstone at the Standon showing is included in this mineral suite because it contains hornblende and grunerite. Blue-green hornblende is observed in thin section to be converted to grunerite in the presence of quartz and magnetite. This mineral assemblage occurs in ironstones at Opapimiskan Lake in northwestern Ontario where metamorphic conditions of 530°C to 570°C and 3 kbar prevailed (Hall and Rigg 1986). Winkler (1979) concluded the development of grunerite or cummingtonite in mafic rocks marks the onset of amphibolite conditions which he concluded begins at approximately 550°C.

METAMORPHOSED MAFIC INTRUSIONS

Mafic intrusions within the Melgund Lake area form gabbroic sills, dikes and small oval bodies within the Southern Volcanic Belt, subvolcanic sills and dikes in the hornblende-phyric mafic to intermediate metavolcanics of the Neepawa Group, and a poorly exposed stock centred at Cole Lake on the eastern boundary of the map area. All mafic intrusive rocks mapped are gabbroic in composition. Ultramafic rocks (i.e., pyroxenites or periodotites) are not present in the map area.

The gabbros are medium to coarse grained, have a colour index between 40 and 90 and weather green to black. Gabbros are commonly massive to foliated with well to poorly developed subophitic texture. Hornblende is the major mafic mineral in thin section and is observed replacing pyroxene. These rocks are easily mistaken for massive, medium-grained flows and in many places there is no distinction between the two rock types. This is especially true of a long sill-like gabbroic unit in northern MacFie and eastern McAree Township which although mapped as a gabbro may well be a flow. It is distinctive in the field and appears to separate plagioclase-phyric mafic flows on the east from aphyric flows on the west and in this respect can be used as a marker horizon.

In Avery and southern MacFie townships, intrusive contacts were observed and are characterized by narrow (1 to 5 cm) chilled margins. Locally, xenoliths of mafic lavas were observed on weathered surfaces of some outcrops providing additional evidence for an intrusive origin. At other locations, however, gabbroic rocks appear to grade laterally and vertically into flows. At two separate locations in western Avery Township, gabbros appear to pass into medium-grained rocks that contain polygonal jointing patterns and these rocks appear to grade into fine-grained massive to amygdaloidal flows. The gradation is not continuously exposed and contact relationships were not observed.

Melagabbros are scarce, black, coarse-grained magnetic rocks with a colour index of 90 or greater. The best exposed example occurs along the Melgund Lake access road on the western boundary of Avery Township. Here, the melagabbro occurs in a large outcrop (50 m) with gabbro and leucogabbro such that the intrusion appears to be layered at this point. Layering was not observed elsewhere in the map area, but the spatial arrangement of gabbros and leucogabbros in several intrusions leads the author to speculate layering may be present.

Quartz leucogabbros are common in the intrusions and in many places contain quartz as free grains or more commonly in myrmekitic intergrowths with plagioclase. Leucogabbros are medium-grained, equigranular rocks that weather pale green to green and generally have a colour index of 40 or less. The best example of a leucogabbro occurs in the same outcrop in Avery Township as the melagabbro previously described. The leucogabbro at this location contains rounded plagioclase and quartz in a grey-green mafic groundmass. It is gradational with gabbro and melagabbro, which supports the idea that this intrusion may in part be layered. In thin section, myrmekitic quartz and plagioclase is well developed suggesting the possible differentiation of the magmas towards a granophyric end member. Leucogabbros occur more extensively in southern MacFie Township, where they form part of a sill-like intrusion which has sulphide-rich chilled margins.

Knobby-gabbros are so named for their porphyroblastic texture in which hornblende crystals preferentially resist weathering and stand in relief of the groundmass. The separation of knobby-gabbros from gabbros is based solely on texture as there is little if any mineralogical difference between the two rock types. It is possible that knobby-gabbros represent pyroxenitic rocks which have been metamorphosed to hornblende-bearing rocks, but this cannot be confirmed by field or laboratory evidence.

Plagioclase-phyric gabbros resemble aphyric gabbros in most aspects, except euhedral to anhedral white to pale green plagioclase crystals (1 to 3 cm) are present in quantities varying between 1 to 5 percent. Plagioclase-phyric gabbros occur as sills and dikes within the Southern Volcanic Belt and are generally associated with aphyric gabbroic rocks. These rocks are interpreted to have formed in subvolcanic laccolithic magma chambers and acted as feeder sources for the plagioclase-phyric flows, an idea compatible with the method of crystal fractionation proposed by Green (1975).

The greatest concentration of gabbros in the Southern Volcanic Belt occurs in Avery and southern MacFie townships. Accepting the idea that these intrusions represent subvolcanic magma chambers which probably supplied some of the mafic flows strengthens the interpretation that the Avery Lake area represents a proximal volcanic, relatively shallow water environment.

A large gabbroic intrusion centred in the Cole Lake area is so poorly exposed that very little can be said about it. Medium-grained, dark green, equigranular gabbro occurs in one area north of Cole Lake but elsewhere swamp covers the intrusion. There has been no diamond drilling of the intrusion in the map area and geologic contacts are inferred from available airborne magnetic surveys (ODM-GSC 1961b, Map 1146G; maps filed for assessment credits, AFRO, Toronto).

Gabbroic sills intrude the hornblende-phyric mafic and intermediate metavolcanics in northwestern McAree Township. Examination of these rocks show dark green weathering equigranular gabbro as the major rock type. A leucogabbro outcrop in the northern part of the township is magnetite impregnated and in thin section contains myrmekitic quartz and plagioclase suggesting that these rocks have possibly undergone differentiation. These rocks are particularly important as they have been the main target for gold exploration in the map area by many exploration companies (*see* section on Economic Geology). Further, these gabbroic rocks are similar to sills and dikes exposed at the Windward Shaft and Goldlund deposit in Echo Township where compositional layering has been observed (Chorlton 1986).

FELSIC INTRUSIONS

There are five suites of felsic plutonic rocks in the Melgund Lake area forming the Melgund Lake Stock, the Basket Lake Batholith, the Sandybeach Lake Stock, the Crossecho Lake Stock and a miscellaneous intrusive suite composed of granitic pegmatite, apatite and tonalitic dikes and stringers.

Melgund Lake Stock

Located entirely within Avery Township, the Melgund Lake Stock is centred on Melgund Lake. The stock is oval and approximately 7500 m long by 3200 m wide and covers approximately 24 km^2. Diorite, monzodiorite, monzonite, quartz monzonite and granodiorite occur in the stock with the more quartz-rich rocks occurring in the central part of the intrusion.

Diorite, monzodiorite and monzonite occur most commonly around the margin of the stock. These rocks weather grey, white and pink, are generally porphyritic and commonly contain amphibolitized mafic metavolcanic xenoliths. Hornblende is the major mafic mineral with minor biotite, titanite and magnetite comprising up to 30 percent of the rock. Staining representative samples of these rocks demonstrates weathering and mafic mineral content are poor indicators of composition as most samples are monzonitic. Porphyritic plagioclase crystals contain minor exsolved microcline and several of the smaller feldspar crystals display sodic cores and potassic rims. These rocks are in sharp contact with the mafic metavolcanics, and except for a few xenoliths, show very little reaction with their host.

Approximately 80 percent of the stock is composed of equigranular to slightly porphyritic quartz monzonite. This rock is uniformly medium grained, pink to orange weathering, massive, and contains 15 to 30 percent hornblende with subordinate biotite. Plagioclase commonly displays oscillatory zoning and antiperthitic textures. Where plagioclase is not zoned, it is calcic with anorthite content ranging from 30 to 71 percent with most crystals around 55 percent. Occasionally, some feldspar crystals exhibit sodic cores and potassic rims. The intrusion is late kinematic and has sustained only minor metamorphism as indicated by the lack of foliation and well-preserved primary mineralogy.

Granodiorite is a minor phase of the pluton and occurs only in the central portion of the stock. It is similar texturally to the quartz monzonite, but contains up to 25 percent quartz and approximately 15 to 20 percent mafic minerals. Granodiorite generally is white to light pink and slightly coarser grained than quartz monzonite. Oscillatory zoning is strongly developed on most plagioclase and again several feldspar crystals display sodic cores and potassic rims.

Locally, monzonite to quartz monzonite dikes intrude the mafic metavolcanics, but these dikes are neither large (1 to 3 m wide) nor extensive and were observed only near the contacts of the pluton.

A contact-metamorphic aureole has developed around the Melgund Lake Stock, which has prograded the mafic metavolcanics to amphibolite rank. The aureole is confined to within 400 m of the stock and has recrystallized the metavolcanics to dense, black, hornfelsic-textured rocks.

Basket Lake Batholith

The Basket Lake intrusion is of batholithic proportion and only the western most extension occurs in the map area. The batholith has been studied gravimetrically by Szewczyk and West (1976). These authors concluded that it is typical of large Archean synkinematic, mesozonal to catazonal batholiths. In the map area, the batholith is composed predominantly of leucocratic granodiorite to granite with subordinate tonalite, quartz diorite and a mixed hybrid zone locally developed near the contact.

The hybrid zone is best developed along the southwest contact of the intrusion in Avery Township. Here, granitic rocks of dioritic to quartz dioritic composition have stoped and partially assimilated mafic metavolcanic amphibolites. The hybrid zone is extremely variable reflecting the incomplete mixing of host and granitic magma. Colour ranges from white to red, grain size from fine to coarse and texture from equigranular to porphyritic. Commonly, white tonalite dikes occur in this zone as well as intruding the adjacent metavolcanics. These dikes appear to crosscut the hybrid zone indicating they are later than the main mass of the batholith, but they are believed by the author to be part of the Basket Lake Batholith.

The main rock type of the intrusion is a white to pink weathering, biotite-rich granodiorite. This rock is medium to coarse grained, porphyritic to equigranular and is commonly foliated. Biotite is the major mafic mineral and commonly comprises less than 10 percent of the rock. Porphyritic phenocrysts are generally potassic as determined by staining which were observed to be up to 10 cm long in the field. Microcline is common in the groundmass of these rocks. Plagioclase is commonly oligoclase (An_{12-30}) but more calcic plagioclase (An_{55-60}) is present in places and oscillatory zoning is poorly developed.

Quartz-phyric apophyses intrude the mafic metavolcanics along the western and northwestern contacts of the batholith. These rocks of quartz monzonite composition are clearly related to the Basket Lake intrusion by their leucocratic biotite-bearing character and their textural similarity to lithologies within the batholith.

Granite is an important rock type of the Basket Lake Batholith and is recognized in the map area by its high quartz content. It weathers white to pink and is usually slightly coarser grained than granodiorite. Like in all lithologies of the intrusion, biotite is the major mafic mineral.

Pink to grey weathering aplite dikes intrude lithologies within the batholith. These rocks are fine grained, sugary textured and quartz rich. They are not common and indicate a late phase of intrusion.

Most lithologies in the batholith are foliated and metamorphosed supporting Szewczyk and West's (1976) contention that the intrusion is synkinematic. A metamorphic aureole is developed around the intrusion and appears to vary in width from 300 m along the northwest contact up to 1300 m along the southwest contact in Avery Township. The distribution of the metamorphic aureole may result from the batholith plunging southwest under the mafic metavolcanics in Avery Township; the overlapping with the Melgund Lake Stock metamorphic aureole; erosion has exposed a deeper crustal level on the southwest side of the batholith, or there were higher magmatic temperatures in the Basket Lake Batholith along the southwest contact. A combination of the latter two points is favoured because the development of the hybrid zone indicates high temperatures affected this area and dips are uniformly steep around the batholith suggesting the effect of plunge to be minimal.

Sandybeach Lake Stock

The Sandybeach Lake Stock is an oval intrusion approximately 4000 m by 7500 m in the map area and extends west out of the map area for at least 2000 m. Most of the intrusion lies under Sandybeach Lake, consequently, only the border phases are exposed in the map area. Grey weathering, equigranular quartz monzonite to quartz diorite comprises the western and central parts of the intrusion and, based upon short reconnaissance traverses, comprises most of the intrusion in Laval Township to the west. This rock is medium grained, hornblende and biotite bearing and generally contains small (up to 30 cm) rounded amphibolite xenoliths. The rock is foliated but poorly lineated. Hornblende is the major mafic mineral with minor amounts of biotite and titanite. Epidote commonly rims the hornblende indicating the intrusion was metamorphosed. Plagioclase (An_{55-60}) crystals are generally well formed and microcline occurs in the interstices with quartz. The contact of the quartz monzonite with the Minnitaki Group metasediments is characterized by stoping, shearing and the development of injection gneiss farther from the contacts, all of which is interpreted to indicate the pluton is synkinematic.

Pink to grey weathering monzonite is spatially restricted to the east side of the intrusion where it occurs intermixed with the quartz monzonite. The monzonite is equigranular to porphyritic, hornblende bearing and strongly lineated but poorly foliated. Hornblende is generally the only mafic mineral, although biotite is occasionally present. Calcic plagioclase (An_{52-60}) commonly forms the groundmass and sodic plagioclase (An_{43}) in many places occurs as large phenocrysts. Where the monzonite intrudes the metasediments, the contacts are generally very sharp with little or no development of migmatite. The monzonite is fresher in appearance than the quartz monzodiorite and may either be a satellite intrusion derived from the Sandybeach Lake Stock or a later intrusive phase of the quartz monzonite.

The Sandybeach Lake Stock has imposed a contact-metamorphic aureole upon the Minnitaki Group metasediments. The occurrence of sillimanite and staurolite and the development of injection gneisses indicate medium-grade metamorphism was attained. A regional medium-grade metamorphism appears to have been superimposed upon the contact aureole which is more thoroughly discussed under the section Metamorphism.

Crossecho Lake Stock

Only part of the eastern contact of the Crossecho Lake Stock is exposed in the map area. The principal lithology is a pink aplite which is fine grained, sugary textured and quartz rich. White quartz stringers commonly crosscut the aplite, and where the aplite has been intersected by diamond-drill holes, these quartz veins are tourmaline bearing. According to Chorlton (1986), the aplite is a late phase of the intrusion and occurs throughout the stock cutting all previous phases. The aplite does not occur outside the stock in the map area.

White weathering leucocratic tonalite also occurs in the map area, but is volumetrically subordinate to the aplite. This rock is biotite bearing, equigranular and quartz rich. For a more thorough description of the Crossecho Lake Stock's lithologies, the reader is referred to Page (1984) and Satterly (1943).

Miscellaneous Felsic Intrusions

A suite of felsic intrusive rocks were mapped in McAree Township which do not form discreet plutonic bodies. Widespread members of this group are tonalitic dikes and stringers that intrude the metasediments north of the Sandybeach Lake Stock. These rocks are white to pink, fine to medium grained and equigranular. They are hornblende and biotite bearing and resemble the quartz monzonite phase of the Sandybeach Lake Stock although their parentage is uncertain. The dikes are usually only a few centimetres wide and up to a few metres long, although a few attain thicknesses of 20 m and extend up to 1 km along strike. The dikes and stringers have been folded and metamorphosed indicating they are pre to syntectonic.

White and pink weathering granitic pegmatites and aplites occur along the north contact of the Sandybeach Lake Stock. These rocks are muscovite and biotite bearing, quartz rich and contain garnet, tourmaline and rarely fibrolitic sillimanite, which indicates they are not genetically related to the Sandybeach Lake Stock as has been suggested by previous mapping (Johnston 1972, Map 2243).

Pegmatite and aplite commonly occur as northeast-striking centimetre- to metre-scale interbands in the same outcrop which is interpreted to have formed by "filter-press action" (Hyndman 1972). There is also a poor- to well-developed colour differentiation such that pink pegmatites and aplites occur closest to the contact with the Sandybeach Lake Stock and white pegmatite and aplite occurs farther away from the contact.

Numerous metasedimentary xenoliths, some up to tens of metres in size, are contained within the intrusions. Bedding and foliation within the xenoliths commonly parallels the regional northeast trend indicating very little rotation during intrusion. These types of pegmatites, especially the white variety have been observed in the Fort Frances area by Percival et al. (1985) and in the Dryden area by Satterly (1943) where they are associated with rare element mineralization. The occurrence of fibrolitic sillimanite indicates the pegmatites are peraluminous, of "S" type granitoid affinity (Chappell and White 1974) and are likely of anatectic origin.

In the map area, the pegmatites and aplites appear to be younger than the Sandybeach Lake Stock, as they crosscut the contacts of the stock and rarely contain xenoliths of the quartz monzonite phase. It is inferred the pegmatites and aplites developed by anatexis of the Minnitaki Group metasediments and were intruded during regional deformation that post dated intrusion of the Sandybeach Lake Stock.

LATE ARCHEAN

MAFIC INTRUSIONS

Biotite-bearing mafic dikes intrude the Minnitaki Group metasediments and the Neepawa Group felsic metavolcanics in northwest McAree Township. These rocks were mapped as lamprophyres and occur as two types. A lamprophyre dike north of Tom Chief Lake is dark green with 1 to 3 percent biotite in a hornblende-plagioclase groundmass. This dike is poorly exposed but one contact was observed. It is irregular with and the dike includes fragments of the host felsic metavolcanics along the boundary.

A better exposed lamprophyre dike intrudes the metasediments west of Highway 72 and has been traced for over 2 km along a northeast-trending strike. The dike is 60 cm to 1 m wide and is composed of 1 to 3 percent biotite in a tremolite-plagioclase groundmass. The dike is foliated and weathers grey-green, which is similar to some of the flow lithologies of the hornblende-phyric metavolcanics. The most characteristic feature of this dike is the presence of 5 to 15 percent inclusions of granitic,

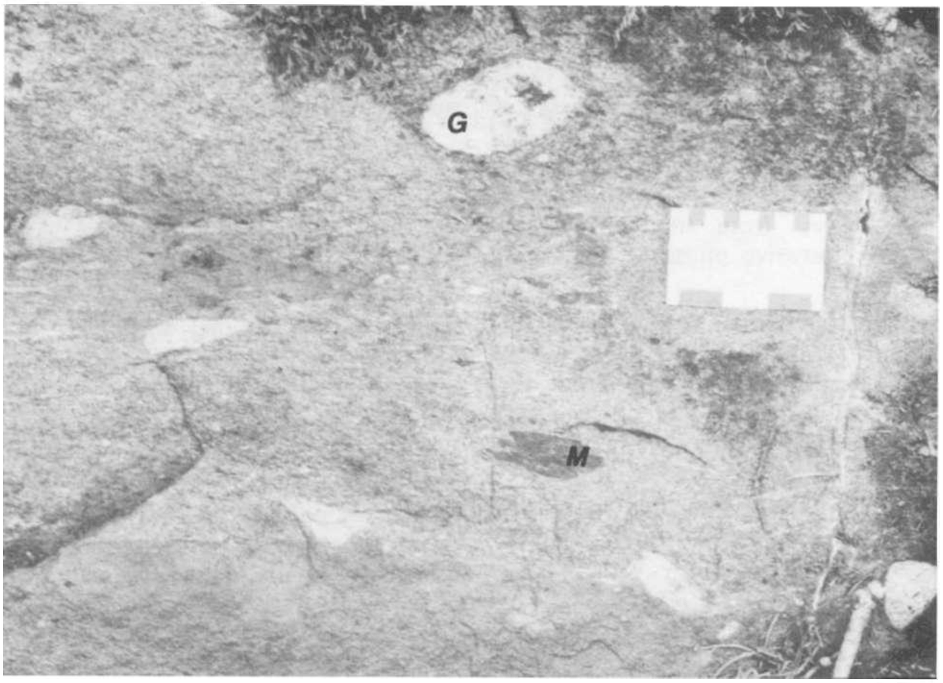


Photo 9. *Lamprophyre dike intruding Minnitaki Group metasediments contains granitic (G), mafic (M) and rarely metasedimentary xenoliths which indicates it is among the youngest rocks in the map area. McAree Township.*

metasedimentary and mafic xenoliths (Photo 9). Leucocratic, biotite-bearing rounded to angular granitoid inclusions up to 1 m by 15 cm are the most abundant xenoliths and are immediately apparent in any outcropping of the dike. Small, 2 to 5 mm thick reaction rims or annealed surfaces were observed on some of the xenoliths suggesting that minor interaction between xenolith and lamprophyre occurred.

Mafic xenoliths are the next most abundant fragment type, but rarely comprise more than one percent of the dike. These inclusions are subangular to rounded, 1 to 8 cm long and composed predominantly of hornblende. Reaction rims were not observed on these xenoliths.

Xenoliths of wacke, in places exhibiting bedding, occur at a couple of locations within the dike. They are angular, up to 15 cm long and appear to have reaction rims in at least one place.

From the field data, the lamprophyre dike is interpreted to have violently intruded the Archean supracrustal rocks incorporating materials through which it passed.. The occurrence of granitoid and pre-consolidated metasedimentary xenoliths indicates the dike is among the youngest rocks in the map area.

CENOZOIC

QUATERNARY

Pleistocene and Recent

Thin deposits of sand, gravel and boulder-clay till overlie many parts of the map area and were formed during the Wisconsinan glaciation (Zoltai 1961). Measured glacial striae and more rarely glacial gouging indicate the main advance was towards 215° ±5° in the map area. The most extensive glacial deposits occur in the central part of MacFie Township and are part of a regional terminal morraine, the Hartman morraine, which extends discontinuously from the map area both southeast and northwest for over 100 km (Zoltai 1961). Parts of the morraine have been reworked (Zoltai 1961). The reworking has formed sand and gravel deposits of possible commercial value (*see* section on Economic Geology). Eskers are rare in the map area with one well defined esker located east of Sandybeach Lake near the Rivers Option (No. 16 McAree Township, Economic Geology) and a less well defined esker along the Melgund Lake access road in Avery Township.

Throughout most of the map area, soil and vegetation cover is thin (less than 3 m) and numerous recent swamp and bog deposits typical of northwestern Ontario are common.

Geochemistry

A total of 37 samples from the map area were subjected to whole rock analysis to chemically characterize the various supracrustal and plutonic rocks. Major oxide and selected trace element analyses were carried out on each sample and rare earth element (REE) analyses were carried out on 17 selected rocks. All geochemical work was done by the Ontario Geoscience Laboratories, Ontario Geological Survey, Toronto.

The main purpose was to determine if the metavolcanic groups recognized in the field had distinctive geochemical signatures which could be used to further distinguish amongst them. To this end, the data was plotted on a number of discrimination diagrams to graphically display geochemical trends. The chemical characteristics of each group are thus described with respect to trends on the diagrams. Figure 3 shows that all metavolcanics in the map area are subalkalic, which is a prerequisite criterion for using the AFM and cation plots.

SOUTHERN VOLCANIC BELT

The Southern Volcanic Belt is composed of predominantly subalkalic (Figure 3) mafic metavolcanics (Table 2). The AFM plot (Figure 4a) after Irvine and Baragar (1971) indicates the majority of flows are tholeiitic with only minor calc-alkalic members. The cation plot (Figure 4b) (Jensen 1976) shows that the mafic metavolcanics are classified as high-iron tholeiitic basalts and calc-alkalic basalts and andesites. Both the AFM and Jensen plots show tightly spaced data points, indicating limited variation in composition.

The calc-alkalic members on Figure 4a contain greater than 55 percent silica, suggesting a more intermediate composition which was not apparent dur-

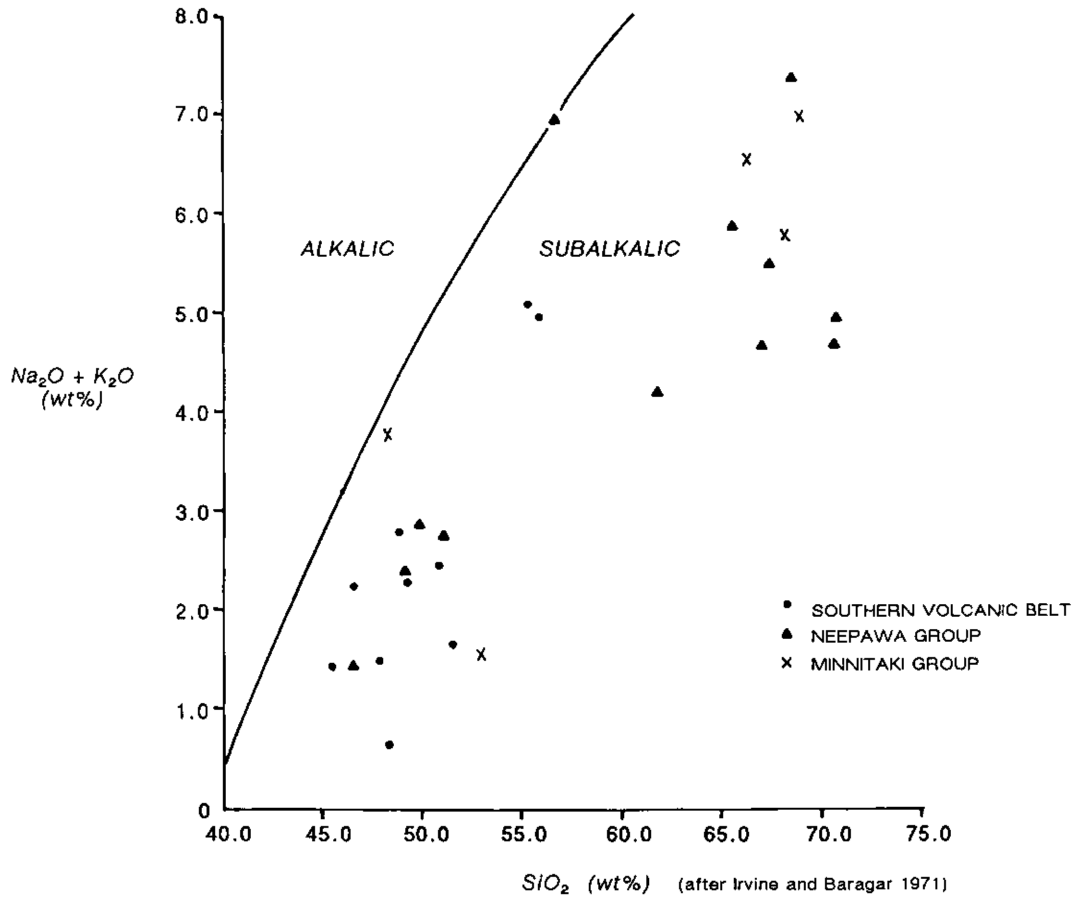


Figure 3. *$Na_2O + K_2O$ versus SiO_2 diagram.*

TABLE 2. SOUTHERN VOLCANIC BELT, CHEMISTRY, MELGUND LAKE AREA.

Element (wt%)	0004*	0006	0025	0029	0035	0046	0057	0180	0316	0348
SiO_2	50.8	47.8	51.5	46.5	48.4	48.7	55.9	49.2	45.4	55.2
Al_2O_3	16.6	15.2	12.8	13.4	14.6	12.4	17.0	14.0	11.1	16.8
Fe_2O_3	2.86	3.4	4.65	2.5	2.7	4.0	1.3	3.0	2.0	2.34
FeO	8.59	10.7	8.96	9.92	10.3	9.92	6.74	12.7	13.1	6.22
MgO	4.9	5.59	5.64	3.58	7.05	4.61	4.57	4.87	4.19	3.25
CaO	9.09	10.1	7.97	13.2	9.83	5.89	2.56	9.65	9.8	4.51
Na_2O	2.24	1.4	1.62	2.14	.59	2.79	4.88	2.17	1.41	5.05
K_2O	.20	.09	.04	.11	.05	-	.07	.12	-	.02
TiO_2	1.14	1.07	1.46	1.1	1.2	1.44	.9	1.56	1.48	1.26
P_2O_5	.16	.07	.11	.1	.08	.1	.14	.09	.14	.19
MnO	.16	.21	.16	.24	.16	.23	.08	.25	.22	.11
CO_2	.23	.67	.38	5.03	.25	4.49	1.74	.38	6.77	1.54
S	.11	.05	.09	.48	.06	.05	.01	.22	.11	.04
SOI	1.1	2.0	2.8	5.0	2.8	7.2	4.3	.4	10.1	3.5
	98.5	98.6	98.5	99.5	98.4	98.6	99.3	99.0	99.9	99.5
Ag (ppm)	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
As	1.5	1	3	1.5	4.5	1.5	2	17	1.5	4
Au (ppb)	-2	3	-2	-2	-2	-2	-2	-2	2	-2
Ba	120	70	50	80	50	40	80	100	40	40
Co	39	48	39	41	38	38	25	41	42	28
Cr	28	207	77	142	190	97	11	70	36	20
Cu	82	153	142	112	118	108	52	110	117	30
Ni	77	83	30	57	76	42	31	37	32	28
Pb	27	10	18	-10	-10	-10	-10	-10	-10	-10
Zn	96	123	98	90	92	127	88	135	150	86
Be	2	3	3	3	2	3	1	3	1	1
Mo	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
Sc	40	45	70	65	50	60	24	70	46	30
Sr	240	170	125	80	70	75	130	135	108	95
V	200	325	310	270	265	300	135	350	361	140
Y	30	25	35	30	21	12	10	35	12	25
Hg (ppb)	-20	-20	-20	-20	-20	-20	-20	-20	-20	-20

86BRB-0004 - Plagioclase-phyric basaltic flow, Avery Township.
86BRB-0006 - Fine-grained basaltic groundmass, no plagioclase, Avery Township.
86BRB-0025 - Chlorite-filled amygdaloidal basalt flow, Avery Township.
86BRB-0029 - Core of pillowed basalt, Avery Township.
86BRB-0035 - Amygdaloidal basaltic flow, Avery Lake.
86BRB-0046 - Massive flow, Avery Township.
86BRB-0057 - Light grey massive andesite, Avery Township.
86BRB-0180 - Massive basalt, Avery Township.
86BRB-0316 - Vesicular massive flow, MacFie Township.
86BRB-0348 - Massive andesite flow, MacFie Township.

* *All sample numbers are abbreviated from the standard OGS sample number, e.g., 86BRB-0004.*

ing the field mapping. The additional calc-alkalic member on Figure 4b represents a plagioclase-phyric basalt and the Al_2O_3 content of the plagioclase phenocrysts is responsible for the calc-alkalic designation (Green 1975).

The plot of TiO_2 versus Cr (Figure 5) illustrates the wide variance of chromium over a rather restricted titanium dioxide range for the rocks in the Southern Volcanic Belt. In fact, the titanium range between 0.9 and 1.56 weight percent is the best chemical criterion to distinguish the Southern Volcanic Belt rocks in the map area from the Neepawa Group basalts.

The plot of Cu versus Zn (Figure 6) shows a wide scatter of copper and zinc values for members of the Southern Volcanic Belt. There appears to be an approximately linear relationship between the two elements and, on average, Southern Volcanic Belt rocks contain less zinc than Neepawa Group metavolcanics.

Trowell et al. (1983) have geochemically examined members of the Southern Volcanic Belt, east of Sioux Lookout. AFM and Jensen cation plots show very similar patterns to those for the Melgund Lake area. Copper and zinc values from Trowell et al.'s (1983) data have been plotted on Figure 6 and show

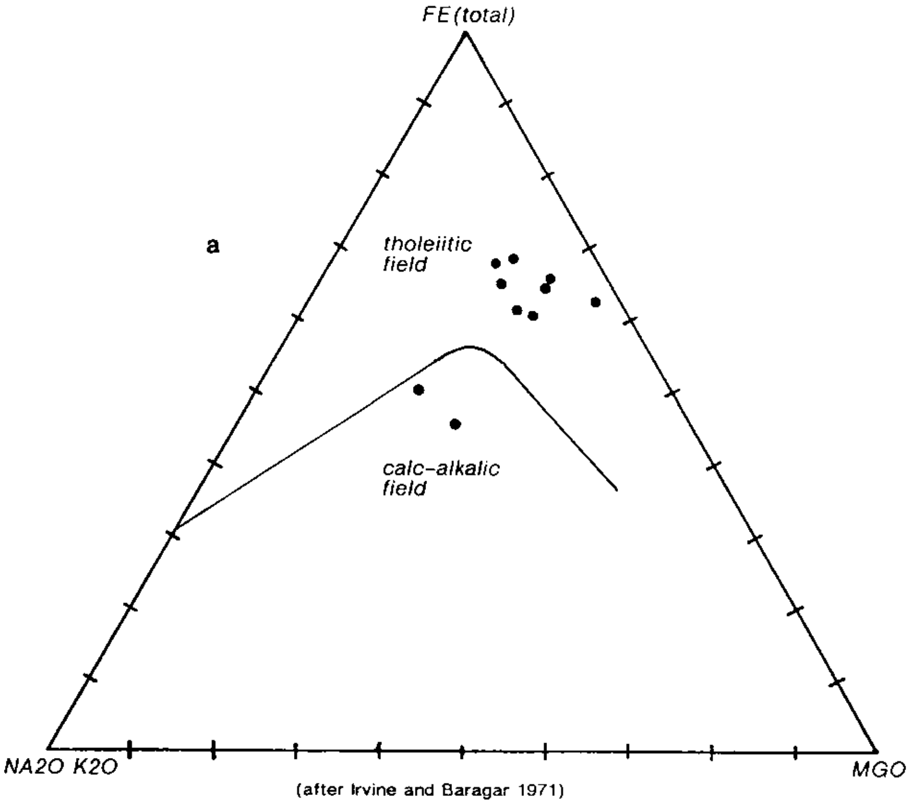


Figure 4a. *AFM plot for Southern Volcanic Belt.*

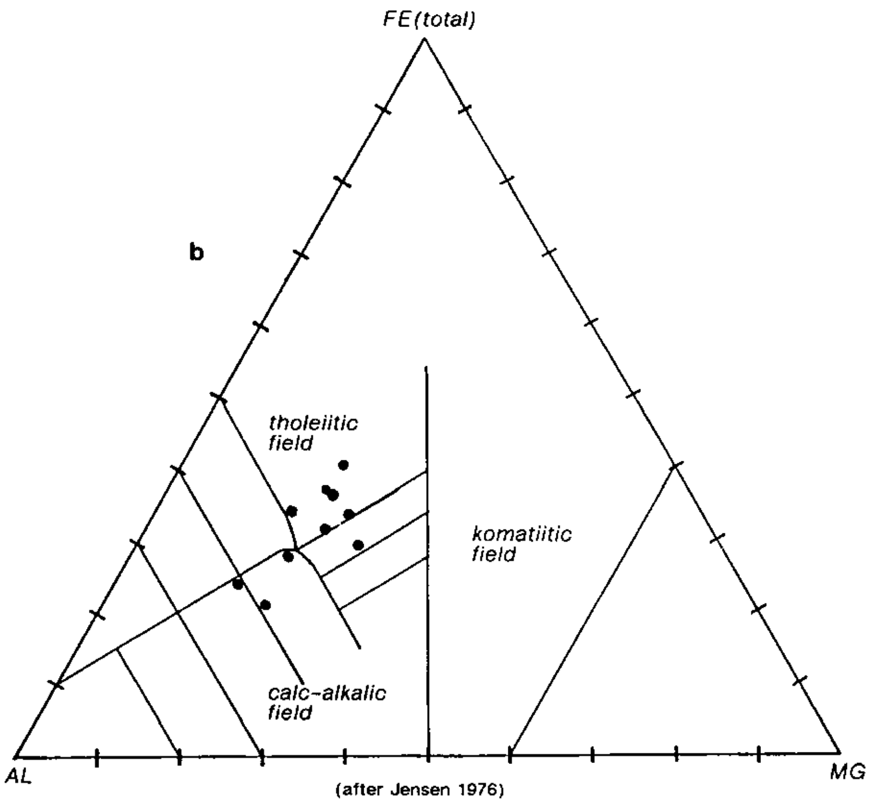


Figure 4b. *Cation plot for Southern Volcanic Belt.*

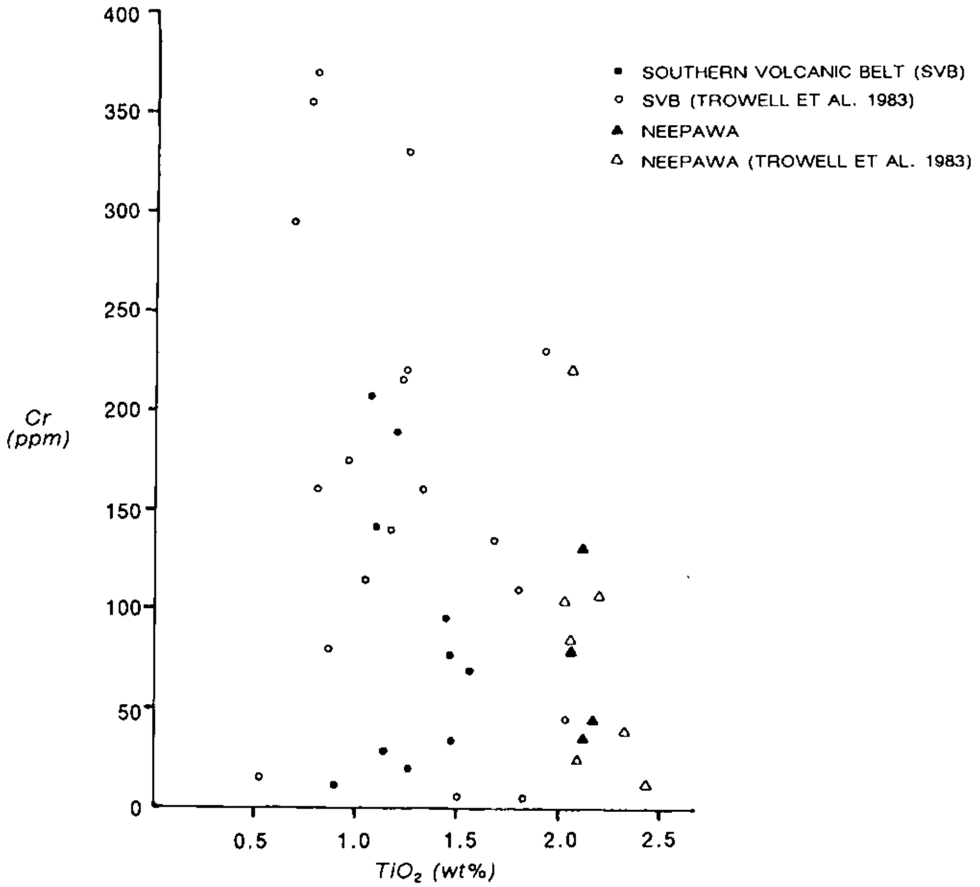


Figure 5. *TiO_2 versus Cr for mafic metavolcanics.*

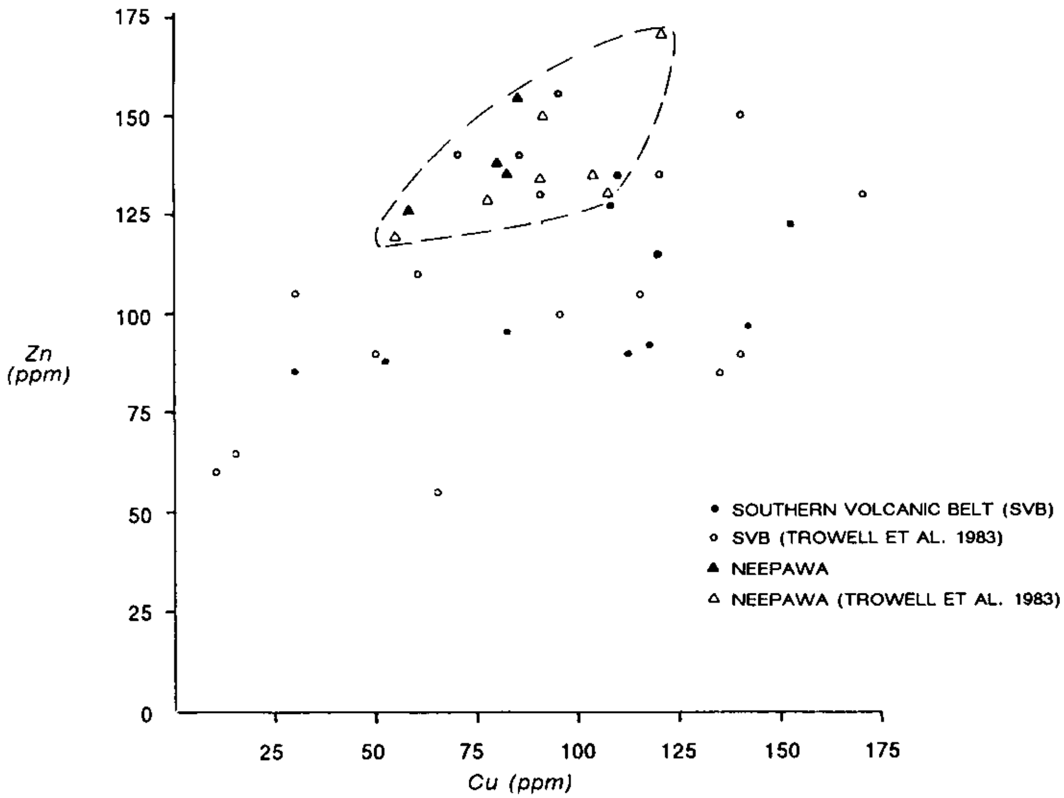


Figure 6. *Copper versus zinc for mafic metavolcanics.*

TABLE 3. NEEPAWA GROUP, CHEMISTRY, MELGUND LAKE AREA.

Element (wt%)	0368*	0383	0610	0612	0616	0063	0065	0068	0354	0380	0381	0398
SiO_2	49.8	51.0	49.1	70.6	46.5	57.1	61.8	65.5	67.4	66.90	70.7	68.5
Al_2O_3	13.4	12.8	13.6	12.3	14.5	19.5	16.6	19.0	15.0	15.8	15.3	17.2
Fe_2O_3	3.5	3.4	5.1	2.15	4.3	.89	1.16	.3	.78	1.14	1.25	.73
FeO	11.0	12.4	10.6	4.89	12.0	3.48	3.92	2.0	1.93	3.7	1.56	2.0
MgO	2.74	4.5	4.83	.91	7.35	1.5	2.44	1.2	1.16	1.22	.7	.5
CaO	9.19	7.12	7.55	2.37	6.75	5.36	6.16	3.82	4.60	4.16	3.65	1.51
Na_2O	2.57	2.6	2.28	4.3	1.34	5.84	2.78	4.65	4.52	3.11	2.80	6.6
K_2O	.30	.16	.11	.37	.1	1.08	1.41	1.21	.97	1.54	2.12	.77
TiO_2	2.13	2.17	2.06	.71	2.11	.55	.71	.58	.41	.65	.3	.51
P_2O_5	.24	.21	.2	.16	.22	.15	.19	.19	.1	.18	.08	.11
MnO	.21	.22	.23	.08	.17	.1	.08	.04	.06	.07	.03	.05
CO_2	2.6	.79	1.21	.35	.19	2.02	1.11	.22	2.12	.37	.18	.65
S	.12	.17	.09	.01	.07	.01	.01	.12	.01	.01	.01	.01
LOI	2.2	1.2	2.2	.9	2.6	3.3	1.5	1.1	2.7	.7	1.6	.9
	98.7	99.1	99.0	100.2	98.5	99.3	99.2	99.7	99.9	99.6	99.2	99.8
Ag (ppm)	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
As	-1	-1	2	2	-1	-1	-1	1	-1	-1	-1	1
Au (ppb)	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
Ba	390	60	60	150	40	230	320	480	340	340	470	300
Co	35	40	43	-5	42	15	18	12	10	11	7	8
Cr	36	44	80	-10	131	30	100	20	49	44	-10	20
Cu	83	85	80	5	58	42	34	26	12	14	5	28
Ni	20	27	32	-5	51	17	45	21	19	17	5	10
Pb	69	-10	-10	-10	10	38	-10	-10	20	27	-10	36
Zn	134	155	138	90	126	72	66	54	72	90	46	38
Be	4	2	2	3	2	2	1	1	1	1	1	1
Mo	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10
Sc	40	50	49	13	48	2	14	6	9	8	2	4
Sr	170	103	207	105	174	186	238	337	277	312	135	214
V	350	360	335	14	323	52	80	39	46	52	20	39
Y	55	52	54	173	45	7	11	6	6	14	6	7
Hg (ppb)	-20	-20	-20	-20	-20	30	-20	-20	-20	20	-20	-20

86BRB-0368 - Amphibolite, north shore of Sandybeach Lake.
86BRB-0383 - Amphibolite, north part of McAree Township.
86BRB-0610 - Hornblende-phyric basalt, northwest McAree Township.
86BRB-0612 - Spherulitic dacite flow, McAree Township.
86BRB-0616 - Massive basalt, McAree Township.
86BRB-0063 - Felsic lapilli tuff, Highway 72, McAree Township.
86BRB-0065 - Banded dacite flow, Highway 72, McAree Township.
86BRB-0068 - Felsic tuff, Highway 72, McAree Township.
86BRB-0354 - Crystal tuff, McAree Township.
86BRB-0380 - Felsic pyroclast from tuff breccia, McAree Township.
86BRB-0381 - Felsic tuff, McAree Township.
86BRB-0398 - Crystal tuff, Tom Chief Lake, McAree Township.

* *All sample numbers are abbreviated from the standard OGS sample number, e.g., 86BRB-0368.*

much the same linear trend as data from the map area. There is overlap into the Neepawa Group data; however, in general zinc values are still generally lower in the Southern Volcanic Belt rocks. Trowell et al.'s (1983) data show a greater range of TiO_2 values for the Southern Volcanic Belt; however, most values are below two weight percent (Figure 5).

NEEPAWA GROUP

The Neepawa Group is composed of diverse sub-alkalic (Figure 3) metavolcanic lithologies (Table 3). The AFM plot (Figure 7a) and the Jensen cation plot (Figure 7b) illustrate an essentially bimodal distribution between high-iron tholeiitic basalts and tholeiitic to calc-alkalic dacites and rhyolites. The calc-alkalic affinity thought to be represented by hornblende and plagioclase phenocrysts in some of the basalts is not borne out by the chemical data. Instead, the distribution of data more closely follows a tholeiitic differention trend.

The TiO_2 versus Cr plot (Figure 5) clearly shows that Neepawa Group basalts in the map area contain high titanium (over 2 weight percent) and based on

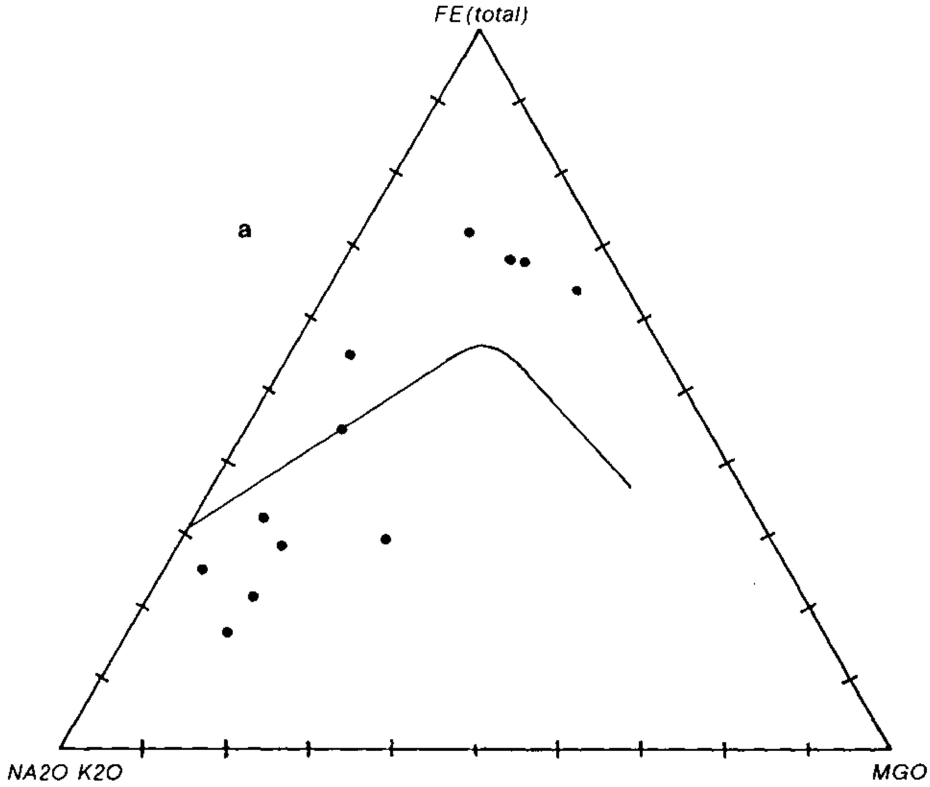


Figure 7a. *AFM plot for Neepawa Group.*

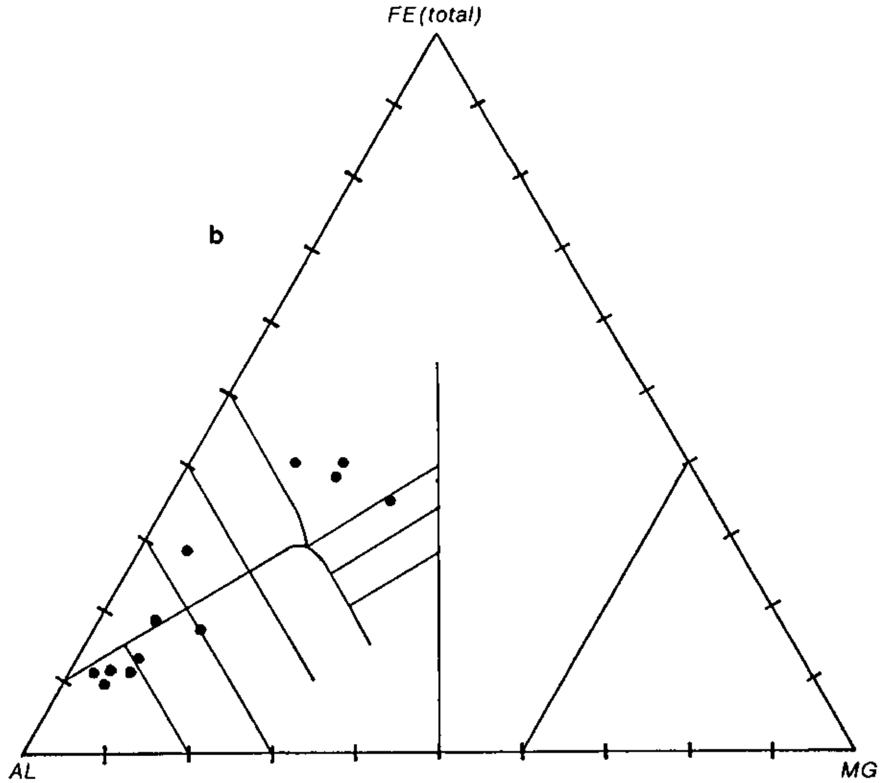


Figure 7b. *Cation plot for Neepawa Group.*

this characteristic are easily separated from the Southern Volcanic Belt basalts. Figure 5 includes two samples of mafic metavolcanics from the core of the structural dome which were previously unrecognized and therefore unclassified. Both samples contain over two weight percent TiO_2 and are therefore more closely related chemically to the Neepawa Group than to the Southern Volcanic Belt. Trowell et al. (1983) indicated that the Neepawa Group is divisible into three sequences in the Sioux Lookout area; namely, a lower sequence of intermediate tholeiites, a middle sequence of high-iron and high-titanium tholeiites and an upper calc-alkalic sequence. Based on Trowell et al.'s (1983) descriptions, only the middle sequence characterized by high TiO_2 and high total iron is present in the map area. Further, Trowell et al. (1983) noted that the middle sequence is characterized by high P_2O_5. In the map area, Neepawa Group mafic metavolcanics contain 0.2 percent P_2O_5 or greater, which is distinctly higher than P_2O_5 values (range 0.07 to 0.19 weight percent) for the Southern Volcanic Belt.

Examination of Figure 6, which includes samples from the map area and only Trowell et al.'s (1983) Neepawa Group basalts that contain over two weight percent TiO_2, shows a cluster of data points rather than a linear trend. On average, zinc is higher in the Neepawa Group rocks than in the Southern Volcanic Belt and this applies to Trowell et al.'s (1983) data as well. The high zinc in the Neepawa Group rocks is reflected by high zinc in soil geochemistry reported by Tarbush Lode Mining Company Limited in northwestern McAree Township (*see* section on Economic Geology).

The felsic metavolcanics of the Neepawa Group are characterized as subalkalic (Figure 3) tholeiitic to calc-alkalic dacites and rhyolites (Figure 7b) with a wide range in silica from 57 percent to over 70 percent (Figure 3). A tholeiitic magmatic affinity as suggested by Figures 7a and 7b relies mainly on samples of a variolitic flow which plots as tholeiitic dacite and of a felsic tuff which plots on the boundary between tholeiitic rhyolite and calc-alkalic dacite (Figure 7b). More sampling throughout the Neepawa Group in the map area is required to confirm actual magmatic affinity and comment upon petrogenesis.

MINNITAKI GROUP METAVOLCANICS

Most of the Minnitaki Group is composed of metasediments, subsequently, only a limited amount of data is available for the intercalated metavolcanics. The analyzed rocks are subalkalic (Figure 3) mafic flows and felsic pyroclastics. The AFM plot (Figure 8a) and Jensen cation plot (Figure 8b) illustrate a bimodal distribution between basaltic komatiites–high magnesium basalts and calc-alkalic dacites and rhyolites. This may in part be misleading due to the poor data base and to the fact that the sample plotting in the komatiitic field on Figure 8b (*see* Sample 86BRB-0514, Table 4) occurs as a xenolith within the Sandybeach Lake Stock and may be altered or related to the lamprophyric clan as suggested by the high barium, strontium and potassium. If the high magnesium trend is confirmed by future sampling, then clearly basalts within the Minnitaki Group are chemically different from both the Southern Volcanic Belt basalts and Neepawa Group basalts in the map area.

The felsic metavolcanics intercalated within the Minnitaki Group metasediments are calc-alkalic dacitic and rhyolitic, pyroclastics. Comparison of the Neepawa Group felsic metavolcanics (Figures 7a and 7b, Figure 3) with the Minnitaki Group felsic metavolcanics (Figures 8a and 8b, Figure 3) indicates there are no significant chemical differences between major oxides. Examination of trace elements (Table 4) suggests that on average the Minnitaki Group felsic metavolcanics contain lower copper, nickel, zinc, chrome, cobalt and lead and higher barium and strontium than Neepawa Group felsic metavolcanics.

Very little geochemical data for metavolcanics within the Minnitaki Group has been reported by previous workers. Whether chemical analyses were included within other groups or analyses were performed is unknown and, therefore, no comparison can be made with the map area.

RARE EARTH ELEMENT (REE) ANALYSES

A total of 17 metavolcanics were selected for REE analyses in addition to whole rock geochemistry. Sample selection was based primarily on providing equal distribution between mafic and felsic metavolcanics rather than problem-specific sampling which requires further detailed work. The primary purpose of the analyses was to characterize the REE patterns for the major lithologies. Although REE analyses are very useful tools in constructing petrogenetic models, such considerations are beyond the scope of this report. The data (Figures 9, 10, 11, Table 5) are best used as a basis for future work. All analyses were performed by the Geoscience Laboratories, Ontario Geological Survey, Toronto.

REE PATTERNS FOR MAFIC AND INTERMEDIATE FLOWS

Figures 9a and 9b illustrate the REE patterns for Southern Volcanic Belt basalts and Neepawa Group basalts, including a variolitic dacite flow. The Southern Volcanic Belt basalts display gently negative sloping REE patterns with Light Rare Earth Element (LREE) concentrations between 20 and 35 times chondrite normalized values and Heavy Rare Earth Element (HREE) concentrations at approximately 10 times chondrite normalized values. There are no major europium (Eu) anomalies and slight negative cerium (Ce) anomalies which is attributed to interaction of the rocks with seawater (Fleet 1984). REE

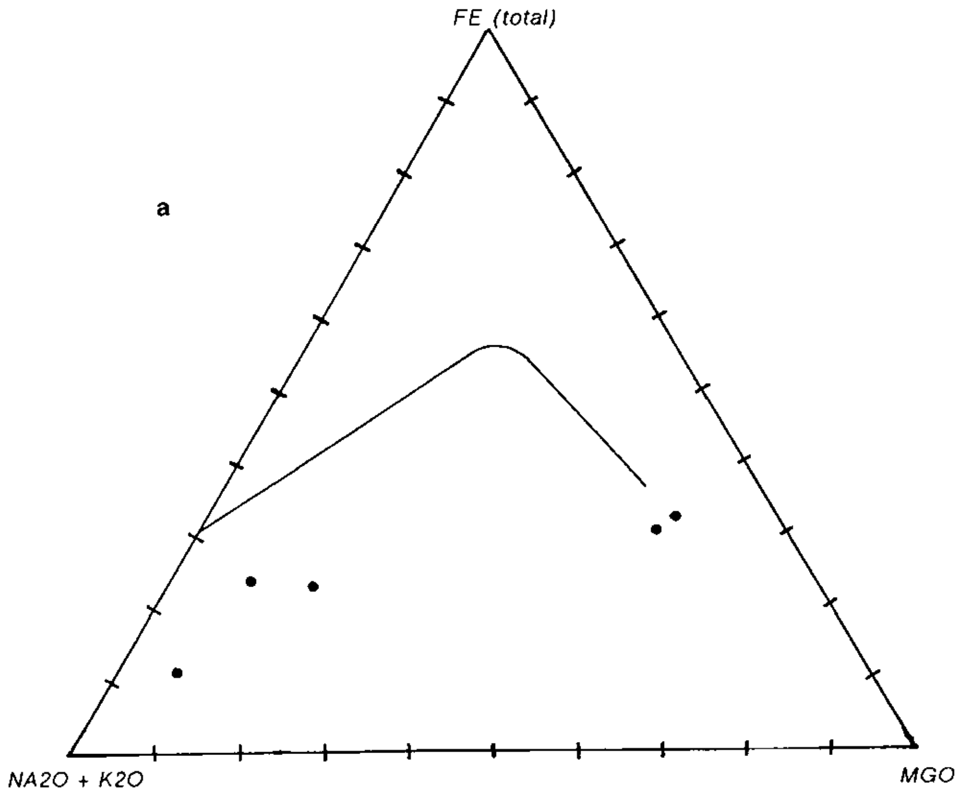


Figure 8a. *AFM plot metavolcanics Minnitaki Group.*

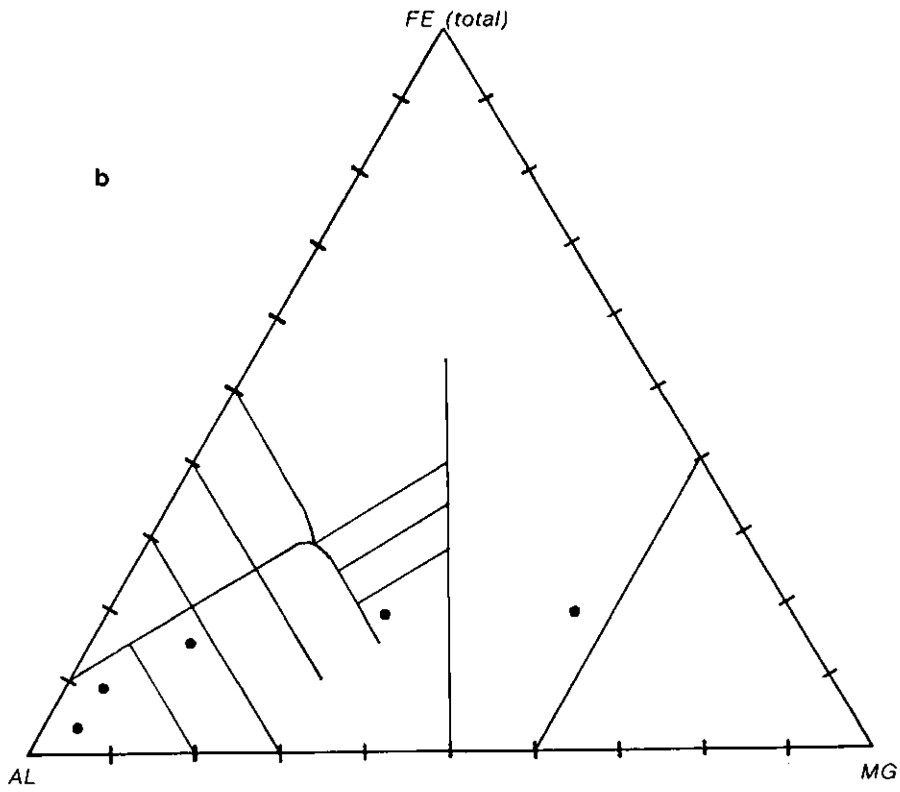


Figure 8b. *Cation plot metavolcanics Minnitaki Group.*

TABLE 4. MINNITAKI GROUP, CHEMISTRY, MELGUND LAKE AREA.

Element (wt%)	0095*	0096	0306	0514	0393	0418	0523
SiO_2	66.6	61.0	52.9	48.3	68.1	68.9	66.3
Al_2O_3	14.09	18.07	15.0	7.78	17.6	17.8	16.3
Fe_2O_3	1.23	.8	2.09	2.38	.79	.28	.75
FeO	4.44	4.74	6.18	5.36	1.33	.74	3.63
MgO	2.33	2.66	8.10	13.2	.82	.59	2.11
CaO	2.48	2.04	10.6	14.7	2.74	2.67	1.77
Na_2O	3.16	3.90	1.3	1.29	4.43	4.3	3.4
K_2O	1.99	2.58	.22	2.47	1.34	2.69	3.13
TiO_2	.57	.57	.61	.82	.66	.17	.59
P_2O_5	.13	.16	.05	.83	.07	.03	.17
MnO	0.08	0.6	.19	.13	.19	0.00	.09
CO_2	.14	.37	.34	.22	.46	.24	.18
S	.22	.03	.01	.01	.01	.01	.01
LOI	.8	1.5	1.3	1.0	1.2	.3	1.6
	99.1	99.3	98.6	98.3	99.2	98.7	100.3
Ag	-2	-2	-2	-2	-2	-2	-2
As	-1	2	2.5	-1	-1	-1	1
Au (ppb)	7	5	4	-2	-2	-2	-2
Ba	490	610	120	1130	370	760	840
Co	16	16	36	39	5	-5	7
Cr	147	158	247	535	-10	-10	21
Cu	44	22	95	12	10	6	7
Ni	46	50	60	230	-5	-5	17
Pb	19	31	52	-10	-10	-10	20
Zn	72	82	87	92	42	18	44
Be	1	2	1	2	-1	-1	2
Mo	-10	-10	-10	-10	-10	-10	-10
Sc	10	16	58	22	-2	2	5
Sr	273	378	146	750	505	470	382
V	77	108	247	130	24	13	67
Y	6	-5	16	24	-4	4	5
Hg (ppb)	-20	-20	-20	-20	-20	-20	-20

86BRB-0095 - Quartz-rich wacke, Highway 72, McAree Township.
86BRB-0096 - Staurolite-bearing metasedimentary schist, Highway 72, McAree Township.
86BRB-0306 - Massive, fine-grained basalt, MacFie Township.
86BRB-0514 - Mafic inclusion in Sandybeach Lake Stock, McAree Township.
86BRB-0393 - Felsic lapilli tuff, Minnitaki Lake, McAree Township.
86BRB-0418 - Recrystallized felsic metavolcanics, Sandybeach Lake, McAree Township.
86BRB-0523 - Felsic tuff, Minnitaki Lake, McAree Township.

* *All sample numbers are abbreviated from the standard OGS sample number, e.g., 86BRB-0095.*

patterns of this type and at these concentration levels in basalts are similar to other Archean greenstone terrains in northwestern Ontario which are interpreted as relatively evolved basalts (Thurston and Fryer 1983).

The Neepawa Group mafic flows (Figure 9b) display different REE patterns than the Southern Volcanic Belt. Two members (86BRB-0383 and 86BRB-0616) have essentially flat REE patterns at 25 times chondrite normalized values with small negative Eu anomalies. A third sample (86BRB-0610) contains LREE concentrations at 10 times chondrite and is depleted in the middle and heavy rare earth elements to approximately 1 time chondrite normalized levels. These patterns show that there are distinct REE differences between the Neepawa Group basalts and Southern Volcanic Belt basalts, possibly related to a different petrogenetic process or more likely a combination of processes. Figure 9b also shows the REE pattern for a variolitic dacite flow in McAree Township. The pattern and concentration levels are very similar to intermediate variolitic flows analyzed by Thurston and Fryer (1983); however, more work is required in the map area to apply their petrogenetic hypotheses.

Figure 10 shows the REE patterns for Neepawa Group felsic metavolcanics and felsic metavolcanics intercalated within the Minnitaki Group. The Neepawa Group felsic metavolcanics (Figures 10b and 10c) are remarkable for their uniformity in pattern and concentration levels. All samples display steep negative slopes with a few weakly positive Eu

TABLE 5. RARE EARTH ELEMENT, CHEMISTRY, MELGUND LAKE AREA.

Element	0004*	0046	0063	0065	0068	0354	0380	0381
La	12	6	21	20	24	16	19	18
Ce	28	12	42	40	46	28	37	34
Pr	4	2.2	4.8	5	5.5	3.3	4.8	4
Nd	16	9.8	17	18	20	11	17	12
Sm	3.9	2.7	3.0	3.0	3.1	2.0	3.2	1.9
Eu	1.2	.9	.85	.94	.97	.53	.87	.55
Gd	4.1	3.2	2.5	2.5	2.3	1.6	2.8	1.5
Tb	.6	.4	.29	.39	.31	.23	.4	.24
Dy	4.4	3.0	1.6	1.9	1.5	1.3	2.5	1.3
Ho	.9	.6	.31	.42	.27	.23	.48	.26
Er	2.9	1.7	.86	1.1	.73	.66	1.4	.72
Tm	.3	.2	.13	.16	90 ppb	.1	.19	.11
Yb	2.6	1.9	.82	.91	.56	.61	1.2	.77
Lu	.3	.3	.13	.13	80 ppb	90 ppb	.16	.11
	0383	**0398**	**0523**	**0601**	**0604**	**0610**	**0612**	**0616**
La	8.5	17	12	50	10	3.8	30	7.8
Ce	21	30	28	105	25	9.3	78	19
Pr	3.5	3.4	3.4	13	4	1.2	12	3.2
Nd	17	11	13	47	18	18	54	15
Sm	4.7	2.1	2.8	8.3	5.5	1.2	16	4.6
Eu	1.5	.65	.78	2.1	1.7	.37	3.3	1.6
Gd	6.5	1.8	2.5	5.4	6.6	.9	19	5.9
Tb	1.1	.28	.37	.75	1.3		3.5	1.0
Dy	7.1	1.5	2.4	3.6	7.7	.62	23	6.8
Ho	1.6	.28	.47	.71	1.7	.1	5.2	1.4
Er	5.1	.76	1.3	1.8	5.0	.27	15	4.2
Tm	.69	.1	.19	.27	.69	N.D.	2.2	.63
Yb	4.7	.67	1.4	1.8	4.4	.24	13	3.8
Lu	.72	.11	.2	.29	.64	N.D.	1.7	.57

* *All abundances in ppm unless otherwise stated.*

* *All sample numbers are abbreviated from the standard OGS sample number, e.g., 86BRB-0004.*

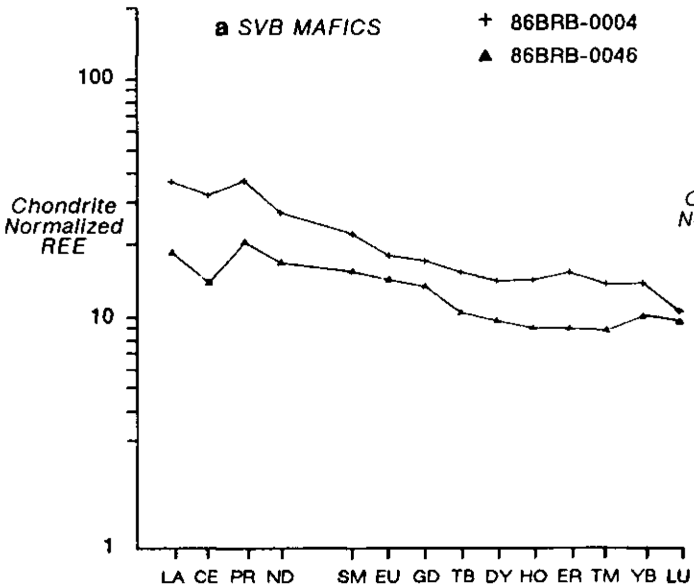


Figure 9a. *REE patterns for Southern Volcanic Belt mafic metavolcanics.*

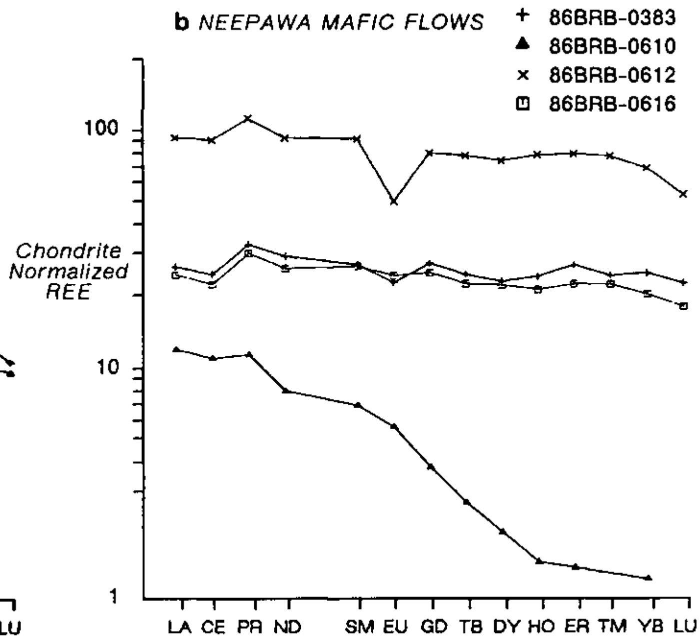


Figure 9b. *REE patterns for Neepawa Group mafic flows.*

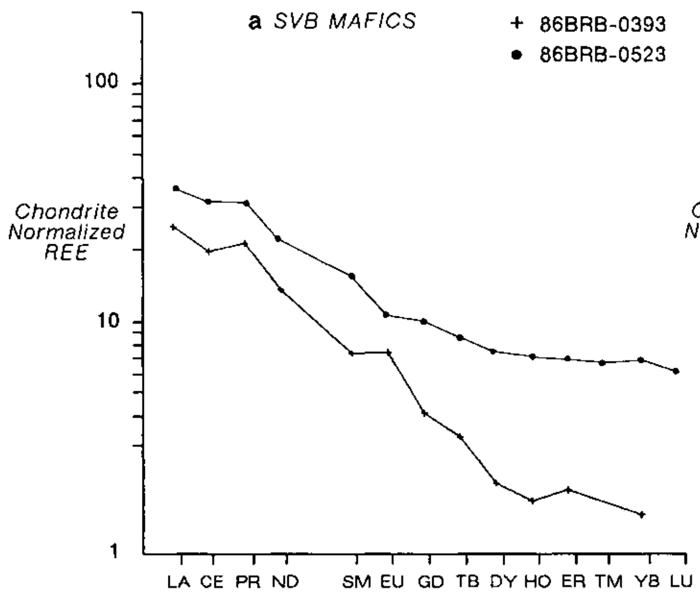


Figure 10a. *REE patterns for Minnitaki Group felsic metavolcanics.*

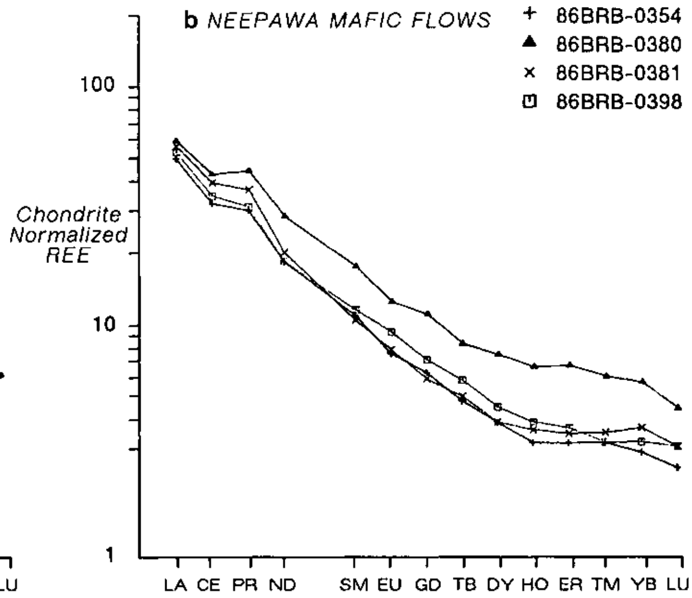


Figure 10b. *REE patterns for Neepawa Group felsic metavolcanics.*

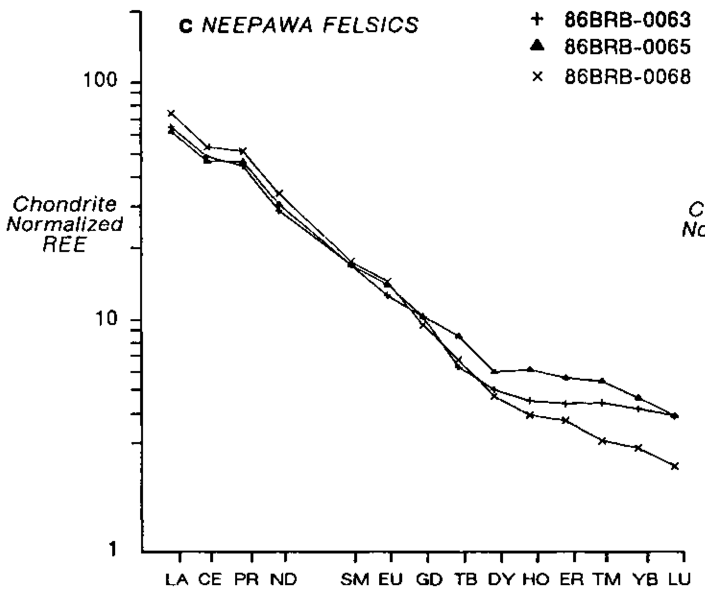


Figure 10c. *REE patterns for Neepawa Group felsic metavolcanics.*

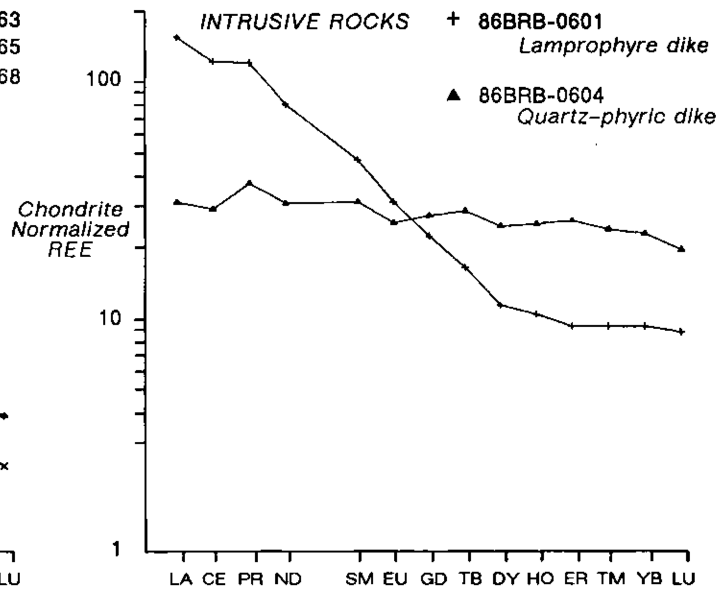


Figure 11. *REE patterns for intrusive rocks.*

anomalies. All samples show LREE enrichment between 50 and 80 times chondrite levels and HREE depletion to levels between 2.5 and 5 times chondrite. The similarity among all the samples suggests that all Neepawa Group felsic metavolcanics were formed by the same process and that they are all highly fractionated. Thurston and Fryer (1983) and Haskin (1984) indicated partial melting of garnetiferous mafic materials or metasediments could account for such REE patterns.

Figure 10a for the Minnitaki felsic metavolcanics shows two types of REE patterns. Sample 86BRB-0393 displays a steep negative slope, a positive Eu anomaly, and very strong HREE depletion to 0.5 time chondrite. Light rare earth elements are enriched to 25 times chondrite and although the negative slope is similar to that for the Neepawa Group felsic metavolcanics, concentration levels are very different. Sample 86BRB-0523 displays a gentle negative slope between 35 times chondrite for the LREE and 7 times chondrite for the HREE with a weakly negative Eu anomaly. Both samples could have originated by a number of processes (Thurston and Fryer 1983), but the essential point is the concentration levels, especially of the LREE, indicate the Minnitaki Group felsic metavolcanics are chemically distinct from the Neepawa Group felsic metavolcanics.

Figure 11 shows REE patterns for miscellaneous rock types in the map area. The lamprophyre dike intrudes members of the Neepawa Group and the quartz-feldspar porphyry dike intrudes Minnitaki Group metasediments. Both are presented without interpretation as there is insufficient data in the map area and in adjacent areas to make comparisons.

QAP DIAGRAM

The QAP diagram (Figure 12) after Streckeisen (1976) shows the distribution of the major granitoid plutonic rocks in the Melgund Lake area (Table 6).

Samples of the Crossecho Lake Stock are not represented on Figure 12 because the stock is poorly exposed in the map area. Data for construction of the QAP diagram (Figure 12) was derived from point counting stained representative samples from each intrusion (Table 7). In general, there is good correspondence between field terminology and the stained samples on Figure 12; however, the Basket Lake Batholith contains more quartz than originally mapped (i.e., granite rather than quartz monzonite). Further, Figure 12 shows reasonable chemical separation of each intrusion supporting their independent coding on the coloured maps.

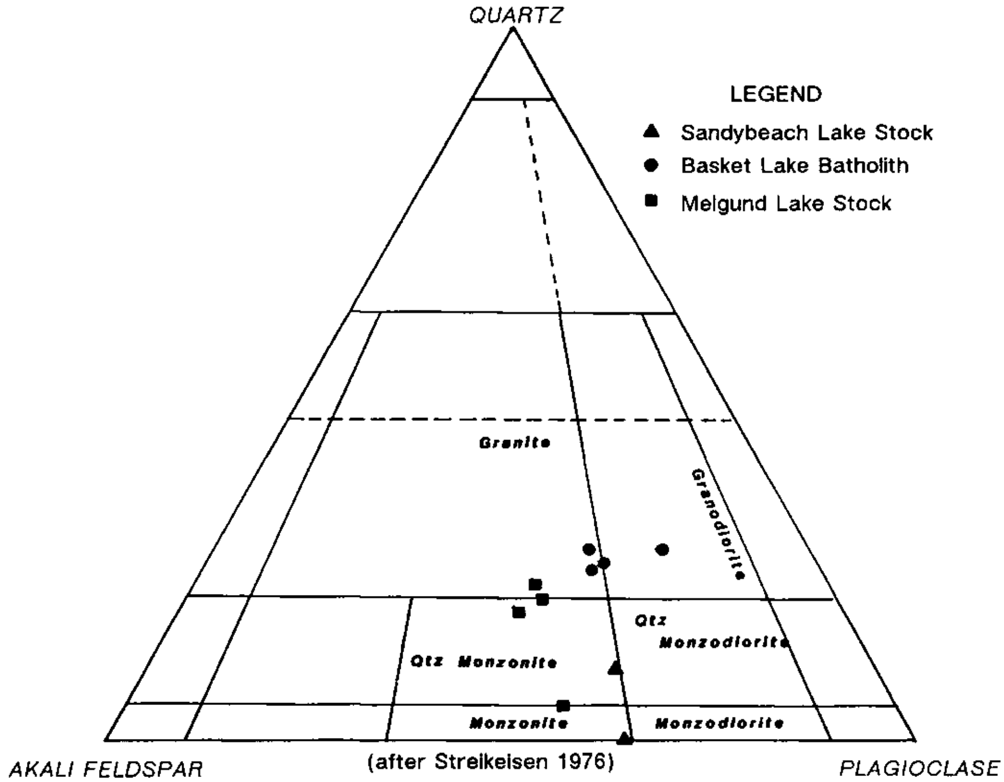


Figure 12. *QAP diagram (Melgund Lake area).*

TABLE 6. INTRUSIVE ROCKS, CHEMISTRY, MELGUND LAKE AREA.

Element (wt%)	0018*	0115	0249	0251	0260	0407	0601	0604
SiO_2	66.7	65.5	69.6	68.9	64.9	63.4	58.1	70.8
Al_2O_3	16.1	15.8	16.3	16.5	16.9	16.5	15.9	17.0
Fe_2O_3	1.87	.92	.98	1.28	1.85	1.8	2.47	.42
FeO	1.23	1.85	.52	.74	1.44	1.93	3.48	1.33
MgO	1.82	1.5	.36	.78	1.58	1.94	4.44	.73
CaO	2.75	3.01	2.38	1.99	3.47	3.56	5.64	1.76
Na_2O	4.31	4.82	5.85	4.64	5.07	6.31	4.7	4.8
K_2O	3.54	3.76	2.41	2.64	1.92	2.58	.65	1.46
TiO_2	.42	.3	.02	.33	.42	.47	.60	.19
P_2O_5	.15	.17	0.8	.08	.17	.13	.29	.09
MnO	.04	.06	.03	.01	.04	.07	.08	0.00
CO_2	.07	.55	.02	.15	.16	.35	1.8	.39
S	.01	.01	.01	.01	0.1	.01	.09	.02
LOI	1.0	.06	.08	.05	.06	.07	2.9	.09
	100.1	98.8	99.4	98.4	98.3	99.4	99.5	99.5
Ag	-2	-2	-2	-2	-2	-2	-2	-2
As	1	3	-1	-1	-1	5.5	3.5	1.5
Au (ppb)	6	2	-2	-2	-2	-2	-2	-2
Ba	1040	1100	760	760	860	850	340	610
Co	8	7	-5	-5	6	10	21	-5
Cr	29	28	-10	10	27	42	110	-10
Cu	21	18	6	8	12	19	36	6
Ni	21	17	-5	5	17	27	77	-5
Pb	65	17	10	18	14	18	135	-10
Zn	62	56	33	51	68	68	88	50
Be	3	3	1	2	2	3	2	1
Mo	-10	-10	-10	-10	-10	-10	-10	-10
Sc	6	4	-2	3	6	4	12	2
Sr	895	772	557	615	1105	685	639	421
V	45	39	19	25	50	54	90	21
Y	14	11	-5	9	19	10	18	-5
Hg (ppb)	-20	-20	-20	-20	-20	-20	-20	-20

86BRB-0018 – Quartz monzonite, Melgund Lake Stock, McAree Township.
86BRB-0115 – Monzonite, Melgund Lake Stock, McAree Township.
86BRB-0249 – Granodiorite, Basket Lake Batholith, MacFie Township.
86BRB-0251 – Granodiorite, Basket Lake Batholith, MacFie Township.
86BRB-0260 – Quartz monzonite, Sandybeach Lake Stock, McAree Township.
86BRB-0407 – Monzonite, Sandybeach Lake Stock, McAree Township.
86BRB-0601 – Biotite lamprophyre dike intruding Neepawa felsic metavolcanics, McAree Township.
86BRB-0604 – Quartz porphyry dike related to Crossecho Lake Stock, McAree Township.

* *All sample numbers are abbreviated from the standard OGS sample number, e.g., 86BRB-0018.*

TABLE 7. FELSIC INTRUSIVE ROCKS USED FOR QAP DIAGRAM, MELGUND LAKE AREA.

Sample No.	Quartz	Alkali Feldspar	Plagioclase	Total Points Counted	Intrusion	Rock Name
ML-101	5%	41%	54%	205	Melgund Lake	Monzonite
ML-115	20	36	44	218	Melgund Lake	Qtz. Monzonite
ML-127	22	36	42	279	Melgund Lake	Granite
ML-114	18	40	42	191	Melgund Lake	Qtz. Monzonite
ML-208	27	27	46	224	Basket Lake	Granite
ML-223	27	18	55	232	Basket Lake	Granodiorite
ML-228	25	26	49	270	Basket Lake	Granodiorite
ML-251	24	28	48	242	Basket Lake	Granite
ML-318	10	32	58	181	Sandybeach Lake	Qtz. Monzonite
ML-408	0	36	64	197	Sandybeach Lake	Monzonite

Note: Data derived by point counting stained slabs of representative samples.

Structure and Metamorphism

The Melgund Lake area is structurally and metamorphically complex. An early period of deformation characterized by an easterly foliation and fold axes is best developed in Avery Township but extends throughout the map area. A later period of deformation characterized by northeasterly crenulation cleavage, fold axes and small-scale faults has refolded and deformed the entire area. The most prominent structural feature in the map area is the Wabigoon Fault, a regional shear zone. This fault is correlated with the Wabigoon Fault in the Dryden area based on lithostratigraphy, however, contrasting metamorphic and structural styles between the Dryden area and Melgund Lake area indicate the Wabigoon Fault lies entirely within the Wabigoon Subprovince in the map area.

Amphibolite rank contact metamorphic aureoles developed around the Melgund Lake Stock and Basket Lake Batholith are superimposed upon regional greenschist rank metamorphism in the southern part of the Melgund Lake area. In the northern part of the area, greenschist rank rocks are subordinate to amphibolite rank rocks. Amphibolite rank contact aureoles around the Sandybeach Lake and Crossecho Lake stocks are overprinted by deformation and amphibolite rank metamorphism associated with later deformation that formed northeast-trending structures.

Evidence for an early period of folding is based largely on foliation and facing data in Avery Township. In the Avery Lake area, two foliations are developed at many outcrops and a northeast-trending foliation appears to overprint an older foliation. Although there is variation in the azimuth of the older foliation, it is most commonly easterly. Careful mapping of the foliations indicates the older foliation is folded about a northeast-trending axis.

Stratigraphic facings based on pillow shapes indicate a north or northeast-younging sequence in eastern Avery Township and southern MacFie Township. Stratigraphic facings based on the vertical succession of massive flows to pillow breccias (Figure 2), supplemented by pillow shapes indicate a southerly younging sequence in western Avery Township. An anticlinal axis is inferred from the reversals in facings, and mapping shows facing orientations vary as the older foliation varies indicating this is an early anticline. Similarly, an early synclinal axis is inferred at Avery Lake.

In the northern part of the map area, early fold axes were not defined; however, there is abundant evidence an early deformation has affected the area. In several outcrops of metasediments two generations of small-scale quartz veining is observed in which one set is parallel to bedding and has been dextrally offset by a second set of northeast-trending tensional quartz veins. In the absence of quartz veining, a foliation parallel to bedding is often crenulated and transposed by a northeast-trending foliation and this indicates an early deformation has affected the area. Examination of airborne magnetic Map 1146G (ODM-GSC 1961b) shows a dominant northeast magnetic pattern, however, east-west trends are present and these are interpreted to represent the trend of the early deformation.

A later deformation within the Melgund Lake area is characterized by northeast-trending fold axes, faults and crenulation foliation. In western Avery Township, the early fold axes are tightly refolded about a northeast-trending fold axis, an interpretation supported by the northeast-trending foliation which cuts the earlier foliation and supported by northeast-closing airborne magnetic contours on Map 1145G (ODM-GSC 1961a). Small-scale parasitic folds are not developed in this area as the mafic metavolcanics and gabbroic intrusions are structurally competent. Instead, fracturing and faulting related to the later folding are evident with pervasive carbonate alteration developed along some northeast-trending faults.

In McAree Township, the later deformation is characterized by a prominent northeast-trending crenulation foliation which commonly transposes bedding and deforms an earlier foliation. Small-scale folds commonly displaying dextral asymmetry are well developed in the Minnitaki Group metasediments and display northeast-trending, southwest-plunging axes and axial planar foliation. Stretching and mineral lineations developed along the northeast-trending foliation planes are also southwest to northeast plunging. Large-scale fold axes are oriented northeast and are interpreted to be late folds based on their parallelism to the crenulation foliation. A fully closed domal structure was mapped in northern McAree Township and lineations indicate the structure has a shallow plunge southwest and northeast. Based on the dips of foliation and the general stratigraphy of the Neepawa Group, the dome is inferred to be an anticline. The trace of other fold axes are inferred to lie southeast of the dome and all axes are broadly correlatable with fold axes interpreted by Johnston (1969) in the western Minnitaki Lake area to the northeast. In the author's opinion, the observed distribution of lithologies and structural data is best explained by interference fold patterns caused by multiple deformations with the later deformation represented by the northeast-trending foliation and fold axes.

There is enough field and geophysical evidence, however, to consider an alternate theory for the dome's formation. As previously pointed out (*see* section on General Geology), the mafic pyroclastic flow unit has undergone high rank metamorphism indicating the core of the dome is a thermal high as well as a structural high. Additionally, airborne magnetic patterns (ODM-GSC 1961b, Map 1146G) show a broad magnetic high centred on the dome but extending beyond the inferred surficial contacts of the mafic pyroclastic unit in the core of the dome. In the field, members of the pyroclastic and related flows were found to be nonmagnetic and geochemistry indicates high titanium and low ferric oxide content. This suggests the magnetic high is not caused by the mafic metavolcanics; rather, an unexposed intrusion may underlie the dome. An intrusion would also serve as a heat source responsible for the recrystallization of the mafic metavolcanics. The intrusion, if present, may be similar to the Sandybeach Lake Stock which has an aeromagnetic signature of similar intensity, or it may be similar to mafic intrusions exposed in Echo Township near the Goldlund deposit. An intrusion would not cause reversal of stratigraphic facings and a homoclinal sequence would be present. However, an intrusion would not explain other fold axes in McAree Township or the widespread development of a crenulation foliation. These features are more compatible with folding.

Faults are common in the Melgund Lake area and are recognized in the field as zones of fractured or sheared rocks. In the absence of outcrop, fault locations are interpreted by abrupt changes in orientation or termination of stratigraphic units, from airphoto lineaments and from discordance or termination of airborne magnetic features. Most small-scale faulting as around Avery Lake is related to brittle deformation accompanying refolding about northeast-trending axes. Here, stratigraphic units are terminated or displaced along highly fractured zones that are commonly carbonate altered. These faults are not extensive and are interpreted to have accommodated localized stress.

Large-scale regional structural features are represented in the map area by the Wabigoon Fault and possibly by a northeast-trending fault in MacFie Township. This fault is marked by a well defined airphoto lineament where it merges with the Wabigoon Fault south of Sandybeach Lake but is less well defined to the southwest. Where this fault merges with the Wabigoon Fault foliations change from between 050° to 080° azimuth to 025° to 050° azimuth. Age relationships between foliations are not clear; however, given that the northeast-trending foliation is younger throughout the rest of the map area, it is likely the fault is related to the later deformation. This northeast-trending fault is interpreted to extend southwest of the map area into the Dinorwic Lake area based on airphoto lineaments and a well defined geophysical signature from airborne magnetic surveys (ODM-GSC 1961a, Map 1145G). If this interpretation is valid, the northeast-trending structure represents an extension of the Manitou Straits Fault system (Blackburn 1982) into the map area.

The Wabigoon Fault, a major shear zone within the map area is a large regionally important structure. In the map area, it is located 1 km south of Sandybeach Lake in western MacFie Township and it is marked by a prominent airphoto lineament along which flows a small stream. The fault can be traced eastward to the southeast shore of Sandybeach Lake where it merges with the northeast-trending fault previously described. From this junction, both faults trend northeast approximately 100 to 500 m east of Sandybeach Lake and form anastomosing shear zones separated by less deformed rocks. The fault system can be traced east of Pickerel Arm on Minnitaki Lake in McAree Township where it leaves the map area.

The Wabigoon Fault marks the contact between southeast-facing metasediments of the Minnitaki Group and northwest-facing metavolcanics of the Southern Volcanic Belt. A typical cross section from south to north exposed along the southeast shore of Sandybeach Lake begins in massive to pillowed foliated basaltic flows and grades into intensely deformed mafic talc-chlorite ± carbonate schists in a deformation zone up to 300 m wide that marks the fault. These metavolcanic schists rapidly grade into foliated wackes, in many places retaining graded bedding. The wackes are transitional into metatexites and schists adjacent to the Sandybeach Lake Stock. Pervasive carbonate alteration is locally developed in the sheared metavolcanic schists but extensive sulphide mineralization was not observed. The geographic location of this structure (i.e., separating mafic metavolcanics from metasediments), the reversal in facing directions and the development of carbonate alteration are similar to the Wabigoon Fault as it is developed in the Dryden–Wabigoon area (Satterly 1943) and on this basis correlation is suggested with the structure in the map area. Although this structure is characterized by features most commonly developed in zones of high strain and ductile shearing, the term "fault" is used in keeping with historical usage in the Dryden–Wabigoon area as defined by Satterly (1943).

Among the ductile features developed along the fault in the map area, the most prominent are small-scale folds with dextral asymmetry. The dextral movement overprints an earlier sinistral movement demonstrated by left-hand slip along fractures affecting some of the felsic dikes in the Wabigoon Fault (L. Chorlton, Ontario Geological Survey, personal communication, 1986).

Although the Wabigoon Fault at Dryden is correlated with the fault in the map area, there are substantial differences in metamorphic and structural styles across the fault in each area. In the Dryden area, the Wabigoon Fault separates high metamorphic grade migmatitic metasediments on the north from lower grade metavolcanics on the south (Blackburn et al. 1985). Movement along the fault is dominantly dextral and a second generation of open, steep southwesterly plunging minor Z-folds has refolded rocks in the fault (Blackburn et al. 1985). The geometry and northeast-trending axial plane orientation of these second generation folds are similar to major fold structures north of the Wabigoon Fault, but none of these features has been recognized south of the fault, where folds have sub-horizontal axial traces (Blackburn et al. 1985). In the Melgund Lake area, migmatitic metasediments are developed adjacent to the Sandybeach Lake Stock, which is likely responsible for their formation, and both high and low metamorphic grade rocks occur on both sides of the fault. Movement along the fault is early sinistral, overprinted by a later dextral movement. Refolding within the fault zone is not evident. Thirdly, northeast-trending second generation fold axes are developed on both sides of the Wabigoon Fault in the map area.

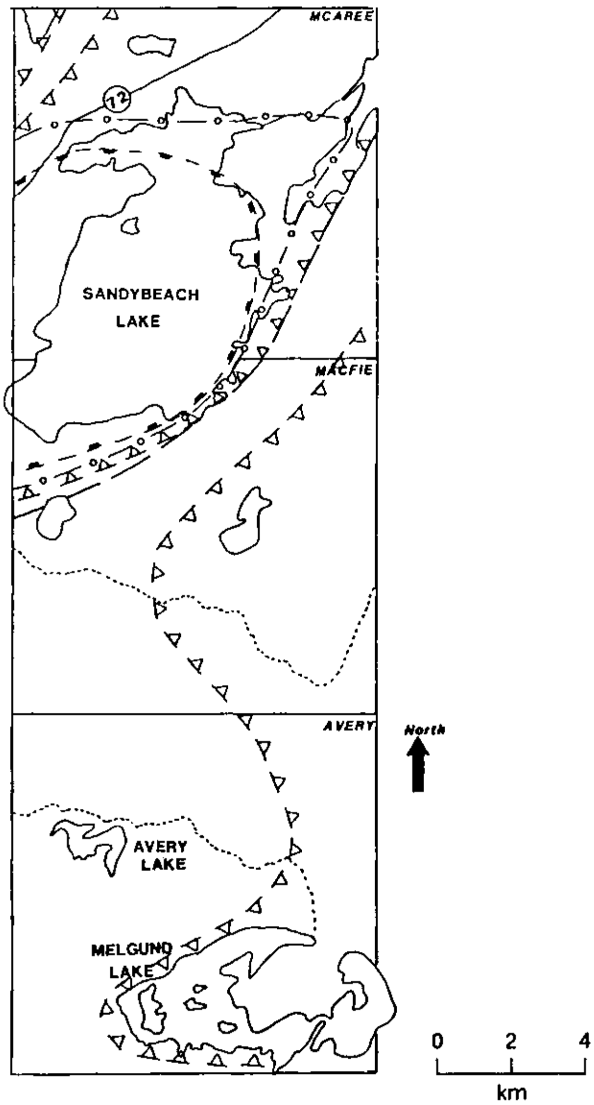
Breaks et al. (1978) and Blackburn et al. (1985) contended that the Wabigoon Fault separates the English River Subprovince from the Wabigoon Subprovince in the Dryden area using as evidence the differences in metamorphic and structural styles across the fault. In the Melgund Lake area, the Wabigoon Fault cannot be used as a subprovincial boundary because metamorphic and structural styles across the fault are different from those observed in the Dryden area.

METAMORPHISM

Metamorphic mineral assemblages in the Melgund Lake area were discussed in the section on General Geology. This section describes the pattern of facies distribution within the map area. Insufficient data exists on metamorphic patterns in adjacent areas; however, regional metamorphic patterns are fairly well known.

In general, amphibolite rank metamorphism has affected most of the northern part of the map area and greenschist rank metamorphism has affected the southern, eastern and northeastern parts of the map area (Figure 13). This pattern is largely controlled by development of aureoles around late felsic plutons; however, regional metamorphism is also important. The Melgund Lake Stock and Basket Lake Batholith both have developed amphibolite rank aureoles in an area of mainly greenschist rank mafic metavolcanics of the Southern Volcanic Belt. Greenschist metamorphism is a regional feature in contiguous mafic metavolcanic assemblages south and west of the map area and similarly amphibolite rank aureoles are developed around felsic plutons (Satterly 1943, 1960; Blackburn et al. 1985).

North of the Wabigoon Fault, the metamorphic pattern is very complex. Amphibolite rank rocks are well developed around the Sandybeach Lake Stock and over most of McAree Township; however, greenschist rank rocks occur in west-central MacFie Township and in northwest McAree Township (Figure 13). Based on descriptions by Page (1984), Trowell et al. (1983) and Satterly (1943), greenschist rank rocks are well developed north of McAree Township and higher metamorphic rank rocks are developed west of the map area. Much of this pattern is caused by development of a contact aureole around the Sandybeach Lake Stock. Amphibolite rank metamorphism around the stock is indicated by sillimanite, staurolite and cordierite development in pelitic metasediments and grunerite in magnetite-bearing ironstone. The apparent direct conversion of andalusite to sillimanite and the occurrence of grunerite adjacent to the stock suggest



LEGEND

▲▲	Greenschist to Amphibolite rank
—o—	Staurolite-cordierite-aluminosilicate in
—■—	Sillimanite-melt in

Figure 13. *Approximate metamorphic isograds (Melgund Lake area).*

maximum temperatures between 550°C and 650°C at 3 to 2.5 kbar can be associated with the intrusion (Winkler 1979; Hall and Rigg 1986). However, crenulated staurolite, staurolite forming in northeast-transposing cleavages and development of the fibrolitic sillimanite-bearing granitic pegmatites containing xenoliths of the Sandybeach Lake Stock indicate a later deformation and accompanying metamorphism affected most of McAree Township. The presence of sillimanite in the pegmatite indicated its peraluminous chemistry and likely affinity to anatectically derived magmas (Winkler 1979). Winkler (1979) indicated anatexis can begin between 655°C and 670°C at 4 to 2 kbar, respectively, and this indicates the minimum temperatures and pressures of pegmatite formation.

Metamorphic studies in the Dryden area are summarized by Blackburn et al. (1985) and indicate temperatures between 600°C and 750°C at pressures between 3 and 4 kbar affected metasediments north of the Wabigoon Fault. This suggests that rocks north of the Wabigoon Fault have undergone a regional amphibolite rank metamorphism which has overprinted the contact aureole surrounding the Sandybeach Lake Stock in the map area.

Pirie and Mackasey (1978) have studied regional metamorphism within the Quetico Subprovince and have estimated a pressure–temperature pathway. Pirie and Mackasey (1978) observed the apparent direct conversion of andalusite to fibrolitic sillimanite, the conversion of staurolite, muscovite and quartz to biotite, garnet plus an aluminosilicate and the conversion of staurolite to cordierite plus garnet plus an aluminosilicate all of which are inferred reactions within the map area. Further, reactions leading to anatexis of metasediments are characteristic of both areas. The pathway depicted by Pirie and Mackasey (1978) for the above mentioned reactions commences at 550°C and 3 kbar with conversion of andalusite to sillimanite and proceeds to about 660°C at 3.5 kbar for minimum partial melting. This suggests a similarity in regional metamorphic patterns between the area studied by Pirie and Mackasey (1978) and the northern part of the present map area. There are, however, critical differences between the two areas which preclude a direct analogy. In the sections of Quetico Subprovince studied by Pirie and Mackasey (1978), isograds are approximately parallel to the subprovincial boundary and metavolcanic lithologies. In the present map area, isograds north of the Wabigoon Fault are mostly concentric around the Sandybeach Lake Stock (Figure 13) and are not necessarily parallel to lithologic units. In the Quetico Subprovince, distances up to 4 km separate the aluminosilicate conversion isograd from the first partial melting isograd (Pirie and Mackasey 1978), yet in the map area aluminosilicate conversion occurs within the zone of partial melting adjacent to the Sandybeach Lake Stock. This apparent discrepancy can be explained in one of two ways. Firstly, Pirie and Mackasey's choice of an aluminosilicate triple point is much lower than the triple point used by Winkler (1979). Using Winkler's triple point would raise the temperature of conversion to approximately 630°C at 3.5 kbar which is close to the beginning of anatexis (Winkler 1979). The field, petrographic and regional evidence suggests that a more plausible explanation for the metamorphic pattern in the present area would be to superimpose a regional metamorphism upon the contact aureole of the Sandybeach Lake Stock. Features in the stock indicate that it is syntectonic. This implies either intrusion synchronous with deformation and metamorphism or, more likely, intrusion prior to peak metamorphism.

Economic Geology

INTRODUCTION

Gold has been the most actively sought-after economic mineral in the map area. Hurst (1933) reported Midas Mines Limited sunk two shafts on auriferous quartz veins in McAree Township in 1907. In 1937, the Alto-Gardnar showing was discovered in MacFie Township and explored until 1941. Gold mineralization was discovered in Echo Township (north of the map area) in 1941, which sparked intensive post-war exploration between 1946 and 1952 (Page and Christie 1980) and led to the discovery of the Goldlund deposit 1000 m north of central McAree Township. The Rivers Option (1960) in eastern McAree Township, the Standon showing (1985) on the west shore of Sandybeach Lake and the Glatz Option (1985) in northwest Avery Township are gold showings that have been explored more recently.

Exploration for base metals began in the 1960s (Page and Christie 1980) and has been sporadic since that time. A number of companies have flown airborne electromagnetic and magnetic surveys and have tested selected geophysical anomalies by diamond drilling. However, no significant discoveries were made.

An airborne radiometric survey was carried out in 1969 by C. Morton over the western half of McAree Township, however, no anomalous radioactivity was discovered and no follow-up investigations were reported.

Gold is the most important economic mineral in the map area and is known to occur in five places in three geological settings. These settings are described below:

1. large quartz veins hosted in sheared and altered metavolcanics
2. silicified and carbonate altered zones at the apparent intersection of northeast- and east-northeast-trending lineaments
3. sulphide stringers within iron-rich metasediments

The Alto-Gardnar showing (No. 1, 3, 5, Figure 16), Midas showing (No. 9, Figure 19) and Rivers Option (No. 12, 16, Figure 19) are examples of the quartz-vein type of mineralization. Gold is hosted in quartz veins and to a lesser extent in the altered wall rock containing accessory pyrite, tourmaline, chalcopyrite and various amounts of iron carbonate. The quartz veins are spatially associated with quartz- and feldspar-phyric dikes and are hosted by intensely sheared mafic metavolcanics, inferred by the author to be part of a continuous structure subsidiary to the Wabigoon Fault. These veins are typical of Archean lode gold deposits (Colvine et al. 1984).

The second type of gold setting is best illustrated by the Glatz Option in Avery Township (No. 1, 2, 3, Figure 14) where gold is associated with an alteration zone at the intersection of an east-northeast-trending lineament with a northeast-trending lineament. Pervasive carbonate alteration and brecciation appear to be localized within northeast-trending lineaments. Gold tenor is uniformly low. At the intersection of the northeast-trending lineament with the east-northeast-trending lineament, intense silicification, carbonatization and spotty pyritization are developed. Gold tenor appears to be sympathetic with pyritization and silicification, which in turn appear to be controlled in part by the east-northeast-trending lineament.

The third type of gold setting is auriferous pyrite-pyrrhotite-arsenopyrite stringers hosted by highly metamorphosed and deformed laminated magnetite-quartz-grunerite ironstone. The Standon showing (No. 11, Figure 19) on the west shore of Sandybeach Lake in McAree Township is an example of this type of gold mineralization. Poor exposure hampers interpretation of this showing, however, the occurrence of gold, ironstone and grunerite is known from other Archean gold deposits, notably the Musselwhite property north of Pickle Lake (Hall and Rigg 1986).

Throughout this section constant reference to assay values are made. Samples collected by the author and members of the field crew were analyzed by the Geoscience Laboratories, Ontario Geological Survey, Toronto. Other reported assay values were taken from reports and diamond-drill logs filed for assessment credits, available at the Assessment Files Research Office (AFRO) in Toronto, and the files in the Resident Geologists offices at Kenora and Sioux Lookout, Ontario. Unless otherwise stated, all information contained herein is available at Assessment Files Research Offices as of November 1986.

DESCRIPTION OF PROPERTIES

AVERY TOWNSHIP

To date, all economic activity has concentrated on one gold showing in northwestern Avery Township. Referred to as the Glatz Option after the owner at the time of writing, the showing has been explored by Kerr Addison Mines Limited and Selco Incorporated and was under option to Noranda Exploration Company Limited as of August 1986.

In 1975, Kerr Addison Mines Limited optioned a group of claims from G.L. Pidgeon, a local prospector, covering a gold showing in northwest Avery Township (No. 1, Figure 14). Subsequently, four diamond-drill holes, aggregating 1326 feet (404.3 m), were sunk to test the tenor of gold mi-

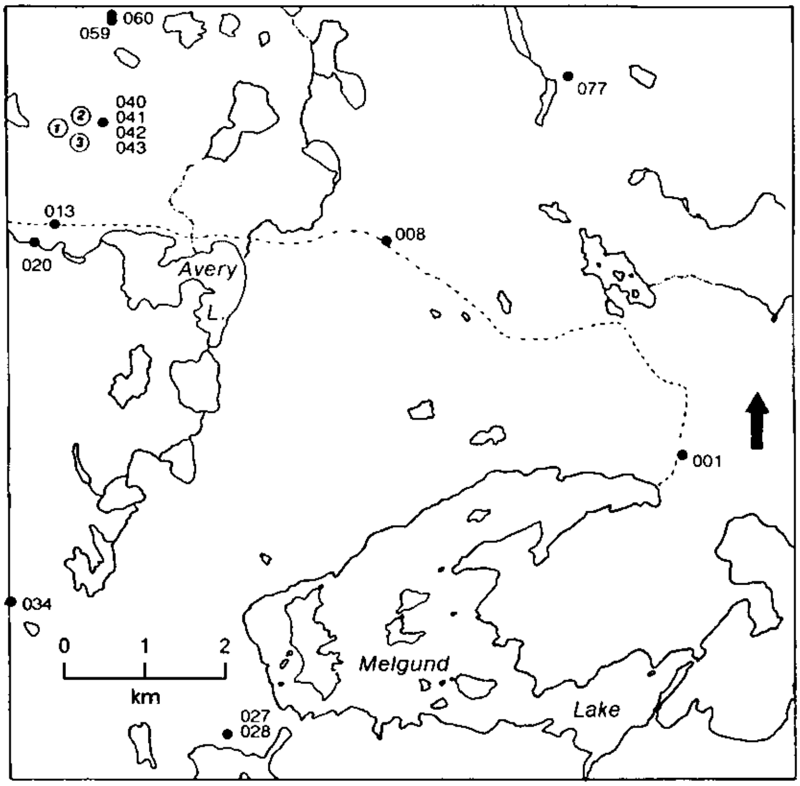


Figure 14. *Avery Township: List of properties and sample location map.*

neralization under a number of trenches. Variably altered basalt was encountered in all holes with minor quartz-feldspar and quartz porphyry dikes intruding the flows. Based on assay results, gold was erratically distributed within chloritized and quartz-carbonate altered basalt with the best assays returning 0.26 ounce gold per ton over 3 feet (8.9 g over 0.92 m) and 0.10 ounce gold per ton over 5 feet (3.4 g over 1.5 m). These results come from altered basalt containing 1 to 5 percent disseminated pyrite and pyrrhotite and 10 to 15 percent quartz-carbonate stringers; however, other equally altered basalt returned trace or nil gold assays. The porphyry dikes returned no gold assays greater than trace. Following the diamond drilling, the option was dropped and Kerr Addison returned the claims to G.L. Pidgeon.

In 1980, Selco Exploration Company Limited (now Selco Incorporated) (No. 3, Figure 14), held an option from G.L. Pidgeon on the gold showing and diamond drilled eleven EX (7/8 inch core diameter) holes totalling 850 feet (259.1 m). Eight holes (598 feet, 182.3 m) tested the same area previously diamond drilled by Kerr Addison, and three holes (252 feet, 768 m) tested a second alteration zone discovered 800 feet (244 m) to the southwest.

Results from the eight holes returned lower gold assays than those encountered by Kerr Addison with no values greater than trace. Selco did encounter erratic low-grade silver values with several assays in the 0.16 to 0.26 ounce silver per ton range (5.5 to 8.9 g) over core lengths up to 4.5 feet (1.37 m). These values are hosted by quartz-carbonate veins, quartz-carbonate breccia and silicified carbonate breccia containing no more than two to three percent disseminated pyrite and chalcopyrite.

The three diamond-drill holes testing the alteration zone to the southwest encountered extensive carbonatization but little or no silicification. Gold assays returned no values greater than trace and silver assays returned only one value greater than trace (0.16 ounce silver per ton over 6 feet, 5.5 g over 1.37 m).

From these results, Selco's geologist concluded extensive carbonate alteration was localized along northeast-trending subvertical shear zones and that gold mineralization was associated with silicification (Pryslak 1980). Specifically, gold mineralization tested by Kerr Addison was restricted to the upper portions of erratically distributed westerly plunging quartz-carbonate pods and lenses. The intense silicification and amount of sulphides rapidly decreases underground in this area (Pryslak 1980).

Further, it was noted that the host rocks are predominantly metabasalts and metagabbros. The author believes the metagabbro identified by Selco is a basalt flow based on the presence of widely spaced calcite-filled amygdules in the rock.

Following the diamond drilling program, Selco terminated the option agreement and returned the claims to G.L. Pidgeon.

In 1985, Noranda Exploration Company Limited (No. 2, Figure 14) held a group of claims covering the gold showing under option from A. Glatz. A very low frequency (VLF) electromagnetic survey was carried out over a portion of the claim group and a large area was stripped with bedrock samples taken over continuous intervals as well as selected grab samples. Assay results from these samples confirm the erratic nature of the gold mineralization with the highest assay returning 0.325 ounce gold per ton (11.1 g) from a selected grab sample of siliceous material previously tested by Kerr Addison and Selco. Other significant assays from the same area include 0.163 ounce gold per ton (5.6 g), 0.17 ounce gold per ton (5.8 g) and 0.10 ounce gold per ton (3.4 g), all from selected grab samples of pyritic quartz-carbonate zones.

Selected and continuous rock samples from the second showing southwest of the main area returned no assays greater than 0.04 ounce gold per ton (1.4 g).

As of August 1986, Noranda maintained their Glatz Option and was actively exploring on the claim group.

During the field mapping, the author visited the gold showing, examined and sampled the trenches and surface outcrops near the Kerr Addison diamond-drill holes (Figure 15, Table 8). An area approximately 40 m by 15 m has been stripped by more recent workers (*see* above) exposing a basalt-hosted silica-carbonate alteration zone. The most intense alteration as exposed in a single outcrop is characterized by a breccia containing carbonate and silica fragments in an amorphous silica-carbonate matrix. Quartz stringers, some containing pyrite, cut both matrix and fragments. Minor chlorite and sericite occurs along the contacts of the breccia, as small stringers in the breccia and occasionally around the edges of fragments. A random grab sample of this material (sample 040, Figure 14) collected by the author returned 635 ppb gold, 20 ppm copper, 25 ppm zinc and less than 2 ppm silver (cf. Figure 15).

A more widespread style of alteration exposed in the stripped area is a zone of pervasively brown carbonate (presumably ankerite) altered basalt contain-

TABLE 8. ASSAY RESULTS FOR AVERY TOWNSHIP.

Sample Number	Material	Au (ppb)	Ag (ppm)	Cu (ppm)	Zn (ppm)	Pb (ppm)	Ni (ppm)
001*	pyritic shear zone, silicified, 5-10% pyrite, 3 m wide	<2	<2	107	119	-	-
008	carbonate altered, sheared mafic metavolcanics	11	<2	80	68	-	-
013	carbonate altered pillowed basalt, trace pyrite	<2	<2	137	152	-	-
020	quartz-carbonate altered pillowed basalts, <1% pyrite	<2	<2	99	85	-	-
027	carbonate-silica flooded alteration zone, 5% py-cp sheared	<2	<2	60	28	<10	-
028	quartz-carbonate alteration zone, nil to trace sulphides	<2	<2	-	-	-	-
034	quartz-carbonate alteration zone, trace sulphides	3	<2	-	-	-	-
040	silica flooded breccia zone, carbonate fragments, trace pyrite	635	<2	20	25	-	-
041	altered amygdaloidal basalt, carbonate, 1% pyrite	5	2	-	-	-	-
042	quartz-carbonate breccia, <1% pyrite	980	<2	-	-	-	-
043	quartz-carbonate breccia, >1% pyrite	3060	<2	-	-	-	-
059	carbonate altered pillowed basalt and amygdaloidal basalt, trace sulphide	15	<2	-	-	-	-
060	carbonate-silica alteration zone, trace to 1% pyrite	70	<2	-	-	-	-
077	magnetite-sulphide rich amphibolite	3	<2	151	-	-	144

**All sample numbers are abbreviated from the standard OGS sample number, e.g., 86BRB-001.*

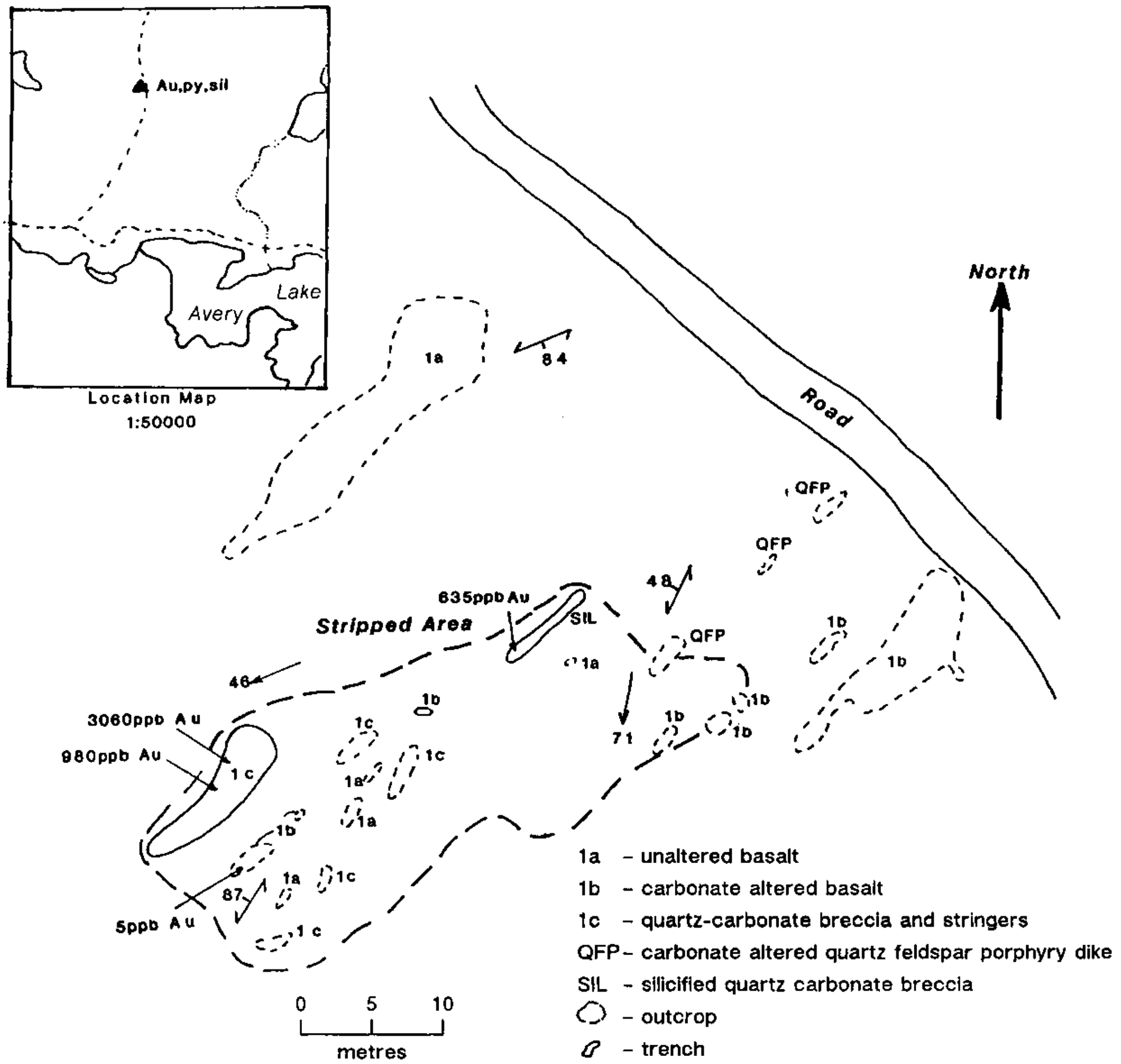


Figure 15. *Sketch map: Main showing—Glatz Option (modified after assessment file plans, Noranda Exploration Company Limited, 1985, AFRO, Kenora).*

ing quartz stringers and small discontinuous zones of the breccia described above. Pyrite content averages less than 1 percent in this zone, however, up to 10 percent is locally concentrated in the quartz stringers. The majority of the quartz stringers are aligned parallel to the main foliation (025° azimuth), but many are crosscutting and appear randomly oriented. Two samples were collected from this zone; one (042, Figure 14) from quartz-carbonate breccia with less than 1 percent sulphides returned 980 ppb gold, and less than 2 ppm silver (cf. Figure 15). The second sample (043, Figure 14) contained pervasively carbonate altered basalt with sulphide-bearing quartz stringers and returned 3060 ppb gold and less than 2 ppm silver (cf. Figure 15). One of Kerr Addison's diamond-drill holes tested this area and returned 0.10 ounce gold per ton over 5 feet (3.4 g over 1.5 m) at 70 feet vertical depth; however, Selco's diamond-drill holes in the same area returned only trace gold values.

A fourth sample (041, Figure 14) collected by the author from the stripped area consisted of pervasively carbonate altered amygdaloidal basalt without noticeable silica veining or alteration and containing 1 to 5 percent finely disseminated pyrite. This sample returned 5 ppb gold and less than 2 ppm silver when assayed (cf. Figure 15).

A quartz-feldspar porphyry dike is poorly exposed in the stripped area and contacts with the basalt were not observed. The dike is foliated parallel to the main direction (025° azimuth) and pervasively carbonate altered with minor pyrite. Chloritic clots in the dike define a pronounced southerly plunging mineral lineation.

The main structural trend in the showing as defined by a prominent foliation is 025° azimuth with a moderate (48°) westerly dip. The alteration zone appears to be comformable with the regional foliation and based on available data is abruptly terminated on the hanging wall but gradational with unaltered basalt on the footwall. A crosscutting foliation at 065° azimuth with a steep southerly dip is developed in unaltered massive to amygdaloidal basalt on the hanging wall side of the alteration zone. It is uncertain to what extent this foliation has on the control of the hanging wall contact of the alteration zone, and it may be only coincidental that the highest reported gold values are concentrated in this area. Further work is required in this regard.

Previous workers have concluded the gold mineralization is associated with silicification. The author agrees with this statement but contends, based on assays from diamond drilling and from assay samples collected during mapping, that samples with sulphide content greater than one percent and silicification return higher gold assays than samples with only silicification. Further, the author contends that the most intensely silicified rocks (i.e., the silica-carbonate breccia) do not necessarily contain a higher gold tenor than more weakly silicified zones (i.e., quartz stringers and quartz-carbonate breccia) containing sulphides.

MACFIE TOWNSHIP

Alto-Gardnar Showing (1) (3) (5)

In 1937, gold was discovered in a large quartz vein 2 km southeast of Sandybeach Lake and staked by J.W. Alto and W. Gardnar (No. 1, Figure 16). In 1940, the Sandybeach Lake Syndicate (No. 5, Figure 16) took an option on the claims and carried out extensive stripping, trenching, bulk sampling and limited diamond drilling. Subsequently, the claims were allowed to lapse and the area remained idle until 1982 when K. Bernier and M. Bernier (No. 3, Figure 16) restaked the ground. A VLF electromagnetic survey was carried out over a cut grid and the trenches previously sunk by the Sandybeach Lake Syndicate were resampled. In 1985 and 1986, the ground was again restaked by Loydex Resources Incorporated, but as of August 1986, work for assessment credits was not on file with the Assessment Files Research Office in Toronto.

Following the original discovery, J.W. Alto and W. Gardnar stripped and sampled a 1050-foot (320 m) long section of quartz vein. Visible gold was noted in a couple of places on the footwall of the

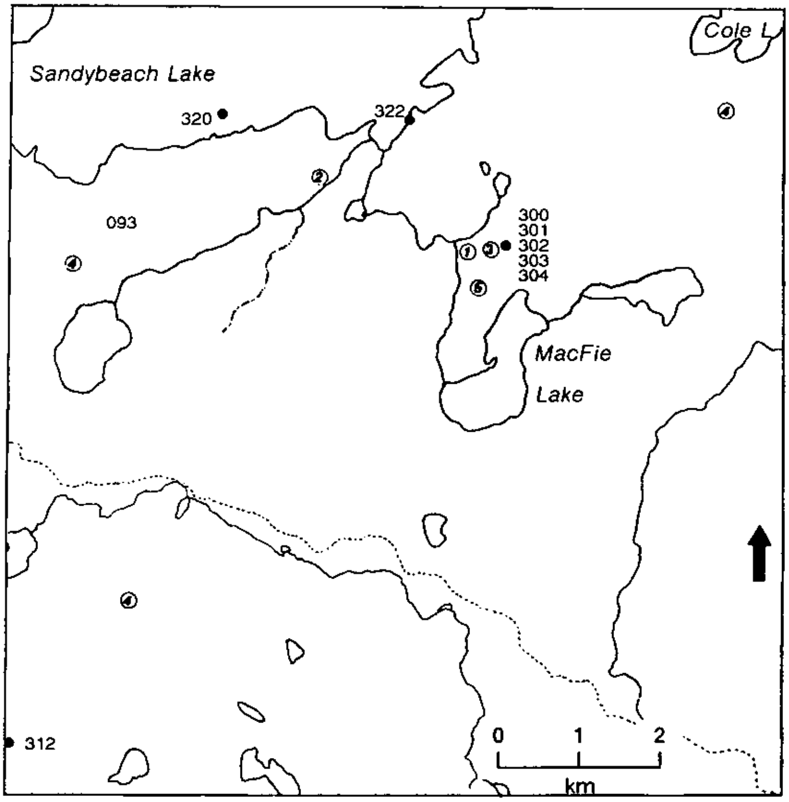


Figure 16. *MacFie Township: List of properties and sample location map.*

vein and assays returned up to $19.60 with gold at $35.00 an ounce (0.56 ounce gold per ton).

In 1940, the Sandybeach Lake Syndicate held an option on the Alto-Gardnar claims and undertook extensive surface exploration of the vein. A large open cut was driven into a cliff exposing the vein and systematic trenching and pitting was carried out to permit detailed sampling. Figure 17 shows the location of the gold showing in MacFie Township and a generalized section of the part of the vein most extensively explored and bulk sampled. Assays from the section shown in Figure 17 suggest uniform distribution of surface mineralization, and additional assays from samples collected at random and from other parts of the vein indicate high-grade pods containing up to $287.35 (gold at $35.00 per ton or 8.21 ounces gold per ton) were encountered. Company reports mention the occurrence of platinum in the quartz vein based on one assay purported to contain 9 ounces per ton. However, this could not

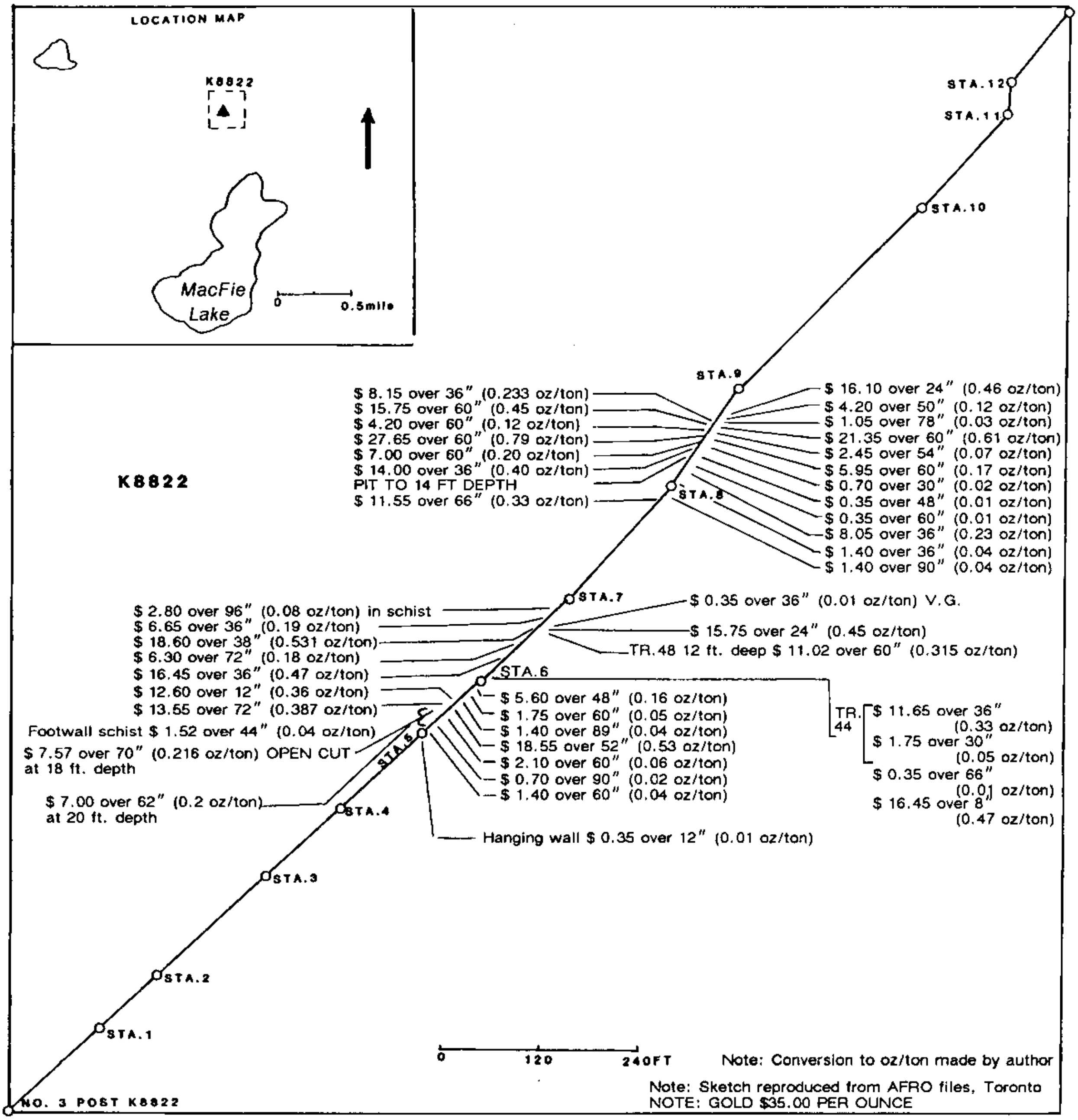


Figure 17. *Alto-Gardnar showing—sketch of surface sampling, October 1940.*

be substantiated by other assays and no systematic search for platinum was carried out at that time.

Scheelite is also reported to occur in the large quartz vein and within quartz-feldspar porphyry dikes to the northwest. Scheelite has been observed by other workers on the claims, but the author found none during his field examination of the gold showing.

Two diamond-drill holes (total 269 feet, 82.0 m) were sunk under the open cut to determine attitude and width of the quartz vein and host shear zone. Results from neither hole adequately determined the attitude of the quartz vein, but estimated thickness of the quartz vein and shear zone was 60 feet (18 m).

The area of quartz vein shown in Figure 17 provided most of the material collected for a 125-ton bulk sample. According to a report by Thomson (1946), then Resident Geologist, the bulk sample returned an average recovery of $8.09 per ton gold (gold at $35.00 per ounce). This converts to 0.231 ounce gold per ton or 28.89 ounces of gold recovered from the 125 tons. However, Satterly (1943) reported that from the 125-ton bulk sample only 10.14 ounces of gold (0.081 ounce gold per ton) were recovered. Only one bulk sample is reported to have been taken and the discrepancy remains unexplained.

From the surface work, geologists employed by Sandybeach Lake Syndicate concluded the gold mineralization was consistent enough and of high enough grade to warrant further development. However, no further work was carried out and the claims were allowed to eventually lapse.

In 1982, K. Bernier and M. Bernier staked four claims covering the Alto-Gardnar showing. They resampled one of the trenches and the highest assay returned 0.079 ounce gold per ton over six inches. In 1983, a VLF electromagnetic survey was carried out and ten conductors were outlined. None of these conductors were further tested and the claims were allowed to lapse.

As of August 1986, the Alto-Gardnar showing was staked and owned by Loydex Resources Incorporated. No exploration had been carried out, however, work was planned to begin early in 1987 (Loyd Nelson, Loydex Resources Incorporated, personal communication, 1986).

During the mapping, the author visited the Alto-Gardnar showing and examined and sampled the area in the vicinity of the open cut (Figure 17). In the open cut, a white quartz vein 2.5 m wide is exposed. The vein is oriented 050° azimuth with 50° dip to the southeast and is hosted entirely in sheared basalt. The shearing is developed over approximately a 5 m width (including the quartz vein) and is oriented 050° azimuth with a 56° dip to the southeast (Figure 18). The vein was traced for at least 150 m to the northeast (up to 320 m by previous workers) and appears to pinch and swell and bifurcate within the shear zone. The vein is generally milky white and commonly contains thin black seams of either chlorite or tourmaline. Pyrite and chalcopyrite are the main sulphides and rarely comprise over one percent of the vein. Brown and white carbonate, malachite, muscovite and tourmaline are accessory minerals. Visible gold was seen in two pieces of quartz picked from the open cut. A selected grab sample (No. 300, Figure 16, Table 9) of the quartz vein returned 3460 ppb gold, less than 2 ppm silver, 301 ppm copper, and less than 1 ppb platinum and palladium when assayed.

The hanging wall in the open cut is composed of approximately 2 m of talc-carbonate schist in contact with relatively unaltered massive basalt. The schist contains minor quartz stringers, sericite and approximately one percent pyrite. A selected chip sample (No. 301, Figure 16) returned 6 ppb gold, less than 2 ppm silver, and less than 1 ppb platinum and palladium when assayed (cf. Figure 18).

On the footwall side of the vein there is a 0.5 m wide chlorite schist without significant carbonate alteration in sharp contact with a quartz-feldspar-phyric dike at least 8 m wide. The chlorite schist dips approximately 50° to the southeast but the dip gradually approaches vertical in the felsic dike. A random chip sample over the exposed 8 m of the quartz-feldspar-phyric dike returned 5 ppb gold, less than 2 ppm silver, and less than 1 ppb platinum and palladium when assayed (No. 302, Figure 16).

To the northeast, the quartz vein pinches and swells never exceeding 4 m or diminishing below 8 cm and in many places the vein appears to be bifurcated with intervening talc-chlorite-carbonate schist. Talc-chlorite-carbonate schist appears to form the immediate hanging wall but either schist or quartz-feldspar porphyry form the immediate footwall. The quartz vein dips to the southeast but the dip ranges between 50° and vertical. A shallow to moderate southwest-plunging crenulation cleavage showing sinistral assymetry is poorly developed in the sheared basalt and Thomson (1946) mentioned that at one point the quartz vein "rolls over" with a moderate southwesterly plunge, suggesting the quartz vein was emplaced prior to or during the development of the crenulation cleavage.

A random grab sample (No. 304, Figure 16) of pyritic quartz carbonate material taken by the author from a trench approximately half way between station 8 and station 9 (Figure 17) returned 11 ppb gold, less than 2 ppm silver, and less than 1 ppb platinum and palladium when assayed. Another random grab sample (No. 303, Figure 16) of hanging wall chlorite-carbonate schist was collected from a trench in the station 8 area (Figure 17) and returned 10 ppb gold, less than 2 ppm silver, and less than 1 ppb platinum and palladium when assayed.

TABLE 9. ASSAY RESULTS FOR MacFIE TOWNSHIP.

Sample Number	Material	Au (ppb)	Ag (ppm)	Cu (ppm)	Zn (ppm)	Ni (ppm)	Pt (ppb)	Pd (ppb)
093*	graphitic sulphide facies ironstone, 50–60% pyrite	3	<2	25	26	-	-	-
300	Alto-Gardner showing selected chip sample of main quartz vein	3460	<2	301	-	-	<1	<1
301	chip sample of talc-carbonate schist hangingwall	6	<2	-	-	-	<1	<1
302	chip sample of felsic dike on footwall	5	<2	-	-	-	<1	<1
303	chlorite-carbonate schist, 1% pyrite, 100 m east of No. 300	10	<2	-	-	-	<1	<1
304	quartz-carbonate vein, 150 m east of No. 300	11	<2	-	-	-	<1	<1
312	chilled margin of gabbroic intrusion, 10–15% po, py, and cp	<2	<2	167	-	62	-	-
320	sulphide facies ironstone up to 15% pyrite	<2	<2	-	-	-	-	-
322	sericite-carbonate-quartz schist derived from sheared quartz-feldspar-phyric dikes	33	<2	-	-	-	-	-

**All sample numbers are abbreviated from the standard OGS sample number, e.g., 86BRB-093.*

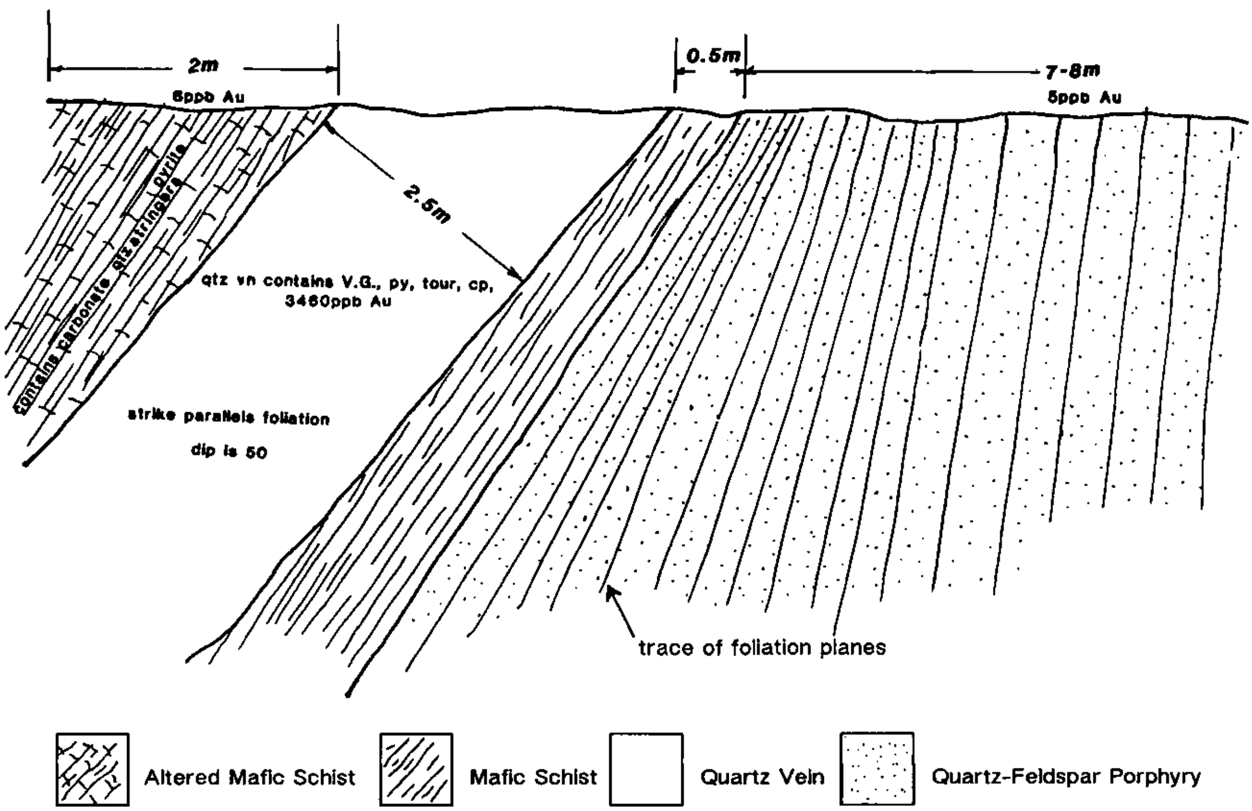


Figure 18. *Cross section of geology at open cut, Alto-Gardnar showing looking southwest.*

The Alto-Gardnar showing represents a quartz-vein hosted gold showing typical of Archean lode deposits (Blackburn and Janes 1983; Colvine et al. 1984). In spite of the extensive surface exploration carried out by the Sandybeach Lake Syndicate, the size, grade and subsurface extension of the quartz vein are poorly known. Based largely on data collected by the author and supplemented by Satterly's (1943) and Thomson's (1946) observations, the Alto-Gardnar showing is hosted in an intensely sheared and altered zone of mafic metavolcanics 5 to 15 m wide and over 300 m long. The sheared rocks trend approximately northeast and dip moderately to steeply southeast in a zone parallel to but developed 2 km southeast of the Wabigoon Fault. A southwesterly plunging crenulation cleavage is poorly developed and appears to have affected the quartz vein. Gold appears to be concentrated entirely within the quartz vein or veins and occurs largely in the free state. The immediate hanging wall is a talc-chlorite-carbonate schist and the footwall is either schist or quartz-feldspar-phyric dikes. The Basket Lake Batholith outcrops approximately 750 m to the south and geologists with the Sandybeach Lake Syndicate assumed the gold was genetically linked to its intrusion. Further work is required in the author's opinion to adequately resolve any genetic links as well as any economic potential.

Asarco Exploration Company of Canada Limited (2) (1970)

In 1970, Asarco (No. 2, Figure 16) diamond drilled one 210-foot (64.0 m) hole on their claim group approximately 600 m south of Sandybeach Lake. The drill hole encountered graphitic and sericitic schist containing magnetite, pyrrhotite, pyrite and trace amounts of chalcopyrite. Minor dacite, quartz-feldspar porphyry dikes, hornblende schist and argillite were also encountered. The highest reported assays include 0.01 percent copper, 0.01 percent lead and 0.03 percent nickel. Given the location and the preponderance of schist, the author assumes the drill hole intersected part of the Wabigoon Fault.

Beth-Canada Mining Company (4) (1979)

In 1978, Beth-Canada Mining Company began a base metal, specifically copper-nickel, exploration program in northwestern Ontario. Airborne electromagnetic and magnetic surveys were followed up by staking, ground magnetic and electromagnetic surveys and if results warranted, diamond drilling. In MacFie Township, four separate groups were staked, namely, in the northeast near Cole Lake, in the southwestern part of the township (two separate properties) and immediately south of Sandybeach Lake near the west township line (Figure 16).

No groundwork is reported from the Cole Lake claim group and the claims were allowed to lapse. Ground magnetic surveys were carried out on the two claim groups in the southwestern part of the township. Magnetic highs were correlated by Beth Canada's geologist with gabbroic rocks and no further work was carried out on either group. The results from ground surveys on the claim south of Sandybeach Lake were deemed sufficiently interesting to warrant the diamond drilling of three holes totalling 404.2 m (1326 feet) in 1979. Two holes were approximately 300 m apart and encountered similar geology. "Tuffaceous metasediments" containing pyrite, pyrrhotite, graphite, minor chalcopyrite and sphalerite occur throughout most of these two holes and are interbedded with subordinate amounts of wacke, shale and chert. Quartz porphyry dikes intrude the metasediments. Both holes ended in a "meta-gabbro", but based on nearby surface outcrops mapped by the author massive fine- to medium-grained basaltic flows were most likely encountered. Samples of the more graphitic and sulphide-rich material were assayed and the highest results obtained were 0.03 percent copper, 0.01 percent lead and 0.18 percent zinc over 1.4 m. Gold and silver values greater than trace were not detected.

The third diamond-drill hole was sunk approximately 800 m north of the first two holes and encountered interbedded wackes, mafic wackes, graphitic schists, siliceous metasediments and cherts. Granitic dikes and stringers commonly intrude the metasediments and may be injected mobilizate related to development of metatexite a little farther to the north. The highest assay returned 0.04 percent copper, trace lead and 0.12 percent zinc over 1.1 m of pyritic and graphitic metasediments. No gold or silver values greater than trace were detected.

Beth-Canada carried out no further work and subsequently allowed the claims to lapse. As of 1981, Beth-Canada Mining Company ceased exploration in Canada and the company is now defunct.

During the field season, collars for two of the three diamond-drill holes were located. Nearby outcrops indicate the geology is predominantly wackes interlayered with fine-grained to gabbroic textured basalts. A highly deformed graphitic sulphide facies ironstone with an apparent 100 m thickness is located south of one diamond-drill hole and apparently overlies basaltic flows and mafic wackes. A grab sample (093, Figure 16) of sulphide-rich ironstone returned 3 ppb gold, less than 2 ppm silver, 25 ppm copper and 26 ppm zinc when assayed.

McAREE TOWNSHIP

Asarco Exploration Company of Canada Limited (1) (1970)

In 1970, Asarco held two separate claim groups in the Pickerel Arm area in eastern McAree Township (No. 1, Figure 19). Three diamond-drill holes totalling 590 feet (179.9 m) were sunk presumably to test conductors outlined by ground geophysical surveys. The southernmost drill hole on the south side

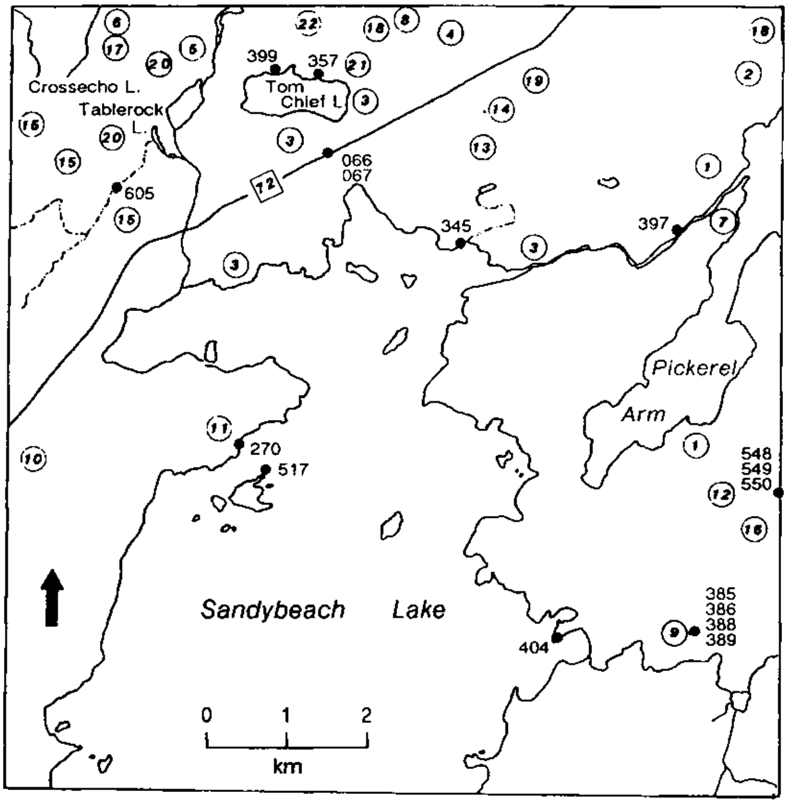


Figure 19. *McAree Township: List of properties and sample location map.*

of Pickerel Arm (Figure 19) encountered chlorite schist, plagioclase-phyric chlorite schist and massive andesite intruded by quartz-feldspar porphyry dikes. Sections of the schist contained graphite and pyrite, however, only low copper, lead and nickel values were returned from assays (0.002 percent copper, 0.01 percent lead and 0.006 percent nickel). The drill hole is inferred to have tested part of the Wabigoon Fault based on the location of the drill hole and the geology of the immediate area.

The other two holes were drilled west of Pickerel Arm, north of Sandybeach River (Figure 19). In both holes, graphitic and pyritic chlorite schist was encountered which returned only low copper, lead and nickel values. The schists are interlayered with amphibolite and dacitic tuffs, flows or dikes. The general geology in this area as interpreted from field mapping is complex and dominated by rapidly changing depositional environments of coeval mafic and felsic volcanism transitional to clastic and chemical sedimentation.

Beth-Canada Mining Company (2) (1979)

As part of Beth-Canada's search for copper-nickel mineralization in northwestern Ontario, a group of claims northwest of Pickerel Arm (No. 2, Figure 19) was explored in 1979. Three diamond-drill holes totalling 376 m (1233 feet) were sunk presumably to test conductors outlined by ground geophysical surveys. Sulphide facies ironstone and scattered zones of sulphide and graphite enrichment in wackes were encountered and considered by Beth-Canada to explain the conductors. Economic mineralization was not encountered and the highest assays returned 0.02 percent copper, 0.01 percent lead and 0.19 percent zinc over 65 cm, and 0.01 percent copper, trace lead and 0.12 percent zinc over 1.8 m. Only trace gold and silver values were detected. The geology encountered in the drill holes is predominantly wackes interbedded with sulphide facies ironstones. Based on drill log descriptions and the general geology of the area, rocks referred to as "meta-gabbros" on the drill logs more closely approximate mafic wacke, hornblende-garnet amphibolite and mafic pyroclastic/epiclastic rocks.

Following the diamond drilling, no further work was carried out and Beth-Canada allowed the claims to lapse.

Canadian Nickel Company Limited (3) (1970)

In 1970, the Canadian Nickel Company Limited (No. 3, Figure 19) held several mining claims in the central part of McAree Township. As part of their search for base metals, geophysical surveys were carried out and six diamond-drill holes (2530 feet, 771.3 m) tested the most prospective conductors.

The most easterly drill hole, located approximately 450 m from the northeast corner of Sandybeach Lake (Figure 19), encountered sulphide facies ironstones interbedded with wackes and metasedimentary schists. Minor rhyolitic tuff is interlayered with the wackes.

Farther west on the north shore of Sandybeach Lake, two diamond-drill holes tested the contact between the metasediments and the mafic metavolcanics. Pyritic and pyrrhotitic bands and lenses were encountered within the mafic metavolcanics and near their contacts with the metasediments. The metasediments encountered include crenulated schist and "impure quartzites" which are interpreted by the author to be wackes. The mafic metavolcanics are described as fine- to medium-grained recrystallized "meta-gabbros" containing quartz-biotite streaks, pods or specks which are most likely an extension of fragmentals or flows observed by the field party approximately 500 m to the east.

Another two drill holes were sunk east of Highway 72 (Figure 19), again testing the metasediment-mafic metavolcanic contact. Massive to disseminated pods of pyrite and pyrrhotite were encountered interbedded within the metasediments, within the mafic metavolcanics and near the contacts between the two rock types. The same rock types as described in the previous two drill holes were encountered and there is little doubt these holes tested the same units.

The sixth drill hole was sunk 120 m east of Tom Chief Lake. Pyrite, pyrrhotite and magnetite mineralization was encountered within white to grey "pure quartzite". Although there is poor surface exposure in this area, there is little doubt in the author's mind these rocks are felsic metavolcanic flows and tuffs similar to those exposed on the north shore of Tom Chief Lake.

No assays were reported from any of the holes and it is assumed no economic mineralization was encountered as the Canadian Nickel Company Limited allowed the claims to lapse.

Consolidated Ansley Gold Mines Limited (4) (1950)

According to the Canadian Mines Handbook 1951, Consolidated Ansley Gold Mines Limited changed its name to Ankeno Mines Limited in 1951. In 1955, the name changed again to Bankeno Mines Limited which is still in business but now involved with oil and gas exploration and development (Canadian Oil and Gas Handbook 1984–85).

In 1950, Consolidated Ansley Gold Mines Limited explored nine mining claims in northern McAree Township by ground magnetometer and geologic surveys (No. 4, Figure 19). Gold mineralization similar to the recently discovered Goldlund occurrence in Echo Township to the north was the principal deposit type sought. No follow-up work was carried out by Consolidated Ansley and the claims were allowed to lapse.

Conwest Exploration Company Limited (5) (1950)

In 1950, Conwest held two contiguous groups of claims under option in the Tablerock Lake and Tom Chief Lake areas (No. 5, Figure 19). Referred to as the Halls Option and the South Rivers Option, both groups are described below as one package because identical work was carried out on both properties.

Following a program of stripping, trenching and geological mapping, five diamond-drill holes totalling 2822 feet (860 m) were sunk on the west side of Tablerock Lake (Figure 19). The intended target was Goldlund-style gold mineralization; specifically "granodiorite-type" rocks amenable to brittle deformation hosting auriferous quartz veins. The five drill holes intersected the hornblende-phyric mafic flows, pyroclastics, felsic and mafic dikes. Three of these holes intersected "granodiorite-type" rocks which were interpreted by the Conwest staff as silicified mafic pyroclastics gradational into diorite. This particular horizon extends onto Camreco Incorporated's ground (*see* No. 22 below) where it is interpreted by the author as a magnetite-impregnated leucogabbro in outcrop. Tarbush Lode Mining Limited (No. 20 below) has encountered the same altered intrusion in diamond-drill holes to the southwest.

Surface geology examined by Conwest identified metasediments in the eastern part of claims. A large part of this unit was interpreted by the author to be felsic metavolcanic tuffs, lapilli tuffs and tuff breccias.

Conwest detected no gold values greater than 0.01 ounce gold per ton and subsequently terminated the options on the claims.

Frederick Mining and Development Limited (6) (1950)

Frederick Mining and Development Limited underwent a name change in 1957 to Consolidated Frederick Mining Limited. The company's charter to operate was cancelled in 1962.

In 1950, Frederick Mining held claims in the western part of McAree and Echo townships (No. 6, Figure 19). A ground magnetometer survey was carried out over cut grid lines but there is no report of further work and the claims were subsequently allowed to lapse.

Geophysical Engineering Limited (7) (1977)

In 1977, Geophysical Engineering Limited held a group of claims centred on the northwest shore of Pickerel Arm at the confluence with the Sandybeach River (No. 7, Figure 19). Two diamond-drill holes totalling 521.5 feet (159 m) were sunk to test a ground geophysical conductor presumably in a search for base metals. One drill hole failed to intersect the conductor; instead, felsic tuffs and tuffaceous metasediments were encountered. The second drill hole intersected approximately 15 feet (4.5 m) of disseminated to massive pyrrhotite and pyrite hosted in felsic tuff to lapilli tuff. Mapping by the field party indicates the felsic metavolcanics are intercalated with wackes and mafic tuff breccias in this area and is in a similar environment as inferred for Asarco's (No. 1, Figure 19) and Beth-Canada's (No. 2, Figure 19) work previously described.

No assays were reported by Geophysical Engineering Limited and the claims were subsequently allowed to lapse.

Goldlund Mines Limited (8) (1981)

In 1973, Goldlund Mines Limited started to rehabilitate the mine workings on the Goldlund gold deposit, approximately 1000 m north of McAree Township (Page and Christie 1980). An extensive surface exploration program to evaluate the property and surrounding area was also started and carried out over a number of years. As part of this program, 15 claims were staked by Goldlund in Echo and McAree townships that were southeast of and contiguous with their patented claims. Eight claims were staked in McAree Township and were explored by ground VLF electromagnetic and magnetic surveys as well as geologically mapped. Several anomalies were detected and those that had coincident high magnetics and electromagnetic conductance were assumed to be related to sulphide concentrations. The geologic survey indicated the claims were underlain by mafic metavolcanic flows in the northwest and intermediate to felsic pyroclastic rocks over the majority of the claims. Goldlund's geologist determined that intermediate pyroclastics contained approximately 30 percent mafic minerals and felsic pyroclastics contained less than 5 percent mafic minerals. The author included both of these subdivisions under felsic metavolcanics, based largely on the presence of a quartzofeldspathic matrix and white rhyodacitic to rhyolitic bombs.

Goldlund did no follow-up work on the McAree Township claims and they were allowed to lapse.

Midas Mines Limited (9) (1907)

Hurst (1933) reported that Midas Mines Limited was organized in 1907 to develop gold showings east of Sandybeach Lake on two patented claims, H.W.409 and H.W.410 of which the former is still in good standing and owned by the estate of Arthur Blackburn of London, Ontario. Two shafts of 30 feet and 75 feet were sunk on auriferous quartz veins containing chalcopyrite. No further work was reported and according to the Canadian Mines Register of Dormant and Defunct Companies (1960), Midas' charter was cancelled in 1916.

During the field mapping, the two shafts were located and the waste dumps were examined and sampled. The shafts which are approximately 45 m apart were each sunk on a quartz vein hosted by sheared and altered mafic metavolcanics. The most westerly shaft exposes a vertical section containing a 1 to 1.5 m wide quartz vein in shear zone no greater than 3 m wide. The vein follows the attitude of the shear zone which is oriented 029° azimuth with an 87° easterly dip. The vein contains one to five percent pyrite with minor chalcopyrite and malachite. White to brown carbonate and tourmaline are common accessory minerals in a milky white quartz gangue. A composite grab sample (No. 388, Figure 19, Table 10) of the quartz vein collected by the author returned 260 ppb gold, less than 2 ppm silver, and less than 1 ppb platinum and palladium. The wall rock hosting the westerly quartz vein is a carbonate-altered mafic schist injected with quartz-carbonate stringers. The schist and vein complex contains 10 to 20 percent pyrite, trace chalcopyrite, minor tourmaline and sericite and patchy pervasive silicification. A representative sample (No. 389, Figure 19) of this material returned less than 2 ppb gold, less than 2 ppm silver, 3 ppb platinum and 2 ppb palladium when assayed.

The quartz vein exposed in the easterly shaft is bifurcated with intervening schist and is an aggregate 1 m wide. The quartz vein material is similar to that exposed in the westerly shaft with identical mineralogy. A composite sample (No. 386, Figure 19) returned 1030 ppb gold, less 2 ppm silver, 345 ppm copper, and less than 1 ppb platinum and palladium. The wall rock is similar to that hosting the westerly quartz vein, but may locally contain up to 30 percent cubic and disseminated pyrite. A composite sample (No. 385, Figure 19) returned 120 ppb gold, less than 2 ppm silver, 3 ppb platinum and 2 ppb palladium when assayed.

Additional samples from the Midas shafts were collected during 1986 by J. Parker (geologist, Ministry of Northern Development and Mines, Kenora) and were submitted for analysis to the Geoscience Laboratories of the Ontario Geological Survey in Toronto. Quartz vein material from the western shaft returned 460 ppb gold, less than 2 ppm silver and 3480 ppm copper. Altered wall rock hosting the western vein returned 720 ppb gold, less than 2 ppm silver and 116 ppm copper. Three samples of quartz vein material were assayed from the eastern shaft and the highest values returned were 70 ppb gold, 5 ppm silver and 2960 ppm copper. Two samples of altered wall rock were analyzed and the highest values returned were 90 ppb gold and 2 ppm silver with no analyses for copper.

Neither quartz vein is exposed for any great strike length, however, carbonate-altered mafic metavolcanics with quartz stringers are exposed on strike 75 m to the north. The rock intervening between the two veins is deformed massive basalt, but

TABLE 10. ASSAY RESULTS FOR McAREE TOWNSHIP.

Sample Number	Material	Au (ppb)	Ag (ppm)	Cu (ppm)	Zn (ppm)	As (ppm)	Pb (ppm)	Pt (ppb)	Pd (ppb)
066*	sulphide breccia in ironstone	15	4	168	140	-	<10	-	-
067	disseminated sulphides in cherty metasediments	<2	<2	-	-	-	-	-	-
270	Standon showing, pyrite and arsenopyrite in magnetite-quartz ironstone	1620	<2	-	-	120	-	-	-
345	sulphide facies ironstone, 50-60% pyrite and pyrrhotite, 30 cm wide	4	<2	142	159	-	-	-	-
357	sericite-quartz schist, 10-30% pyrite	2	<2	28	45	-	-	-	-
385	Midas showing, wall rock, east shaft	120	<2	-	-	-	-	3	2
386	Midas showing, quartz vein, east shaft	1030	<2	345	-	-	-	<1	<1
388	Midas showing, quartz vein, west shaft	260	<2	-	-	-	-	<1	<1
389	Midas showing, wall rock, west shaft	<2	<2	-	-	-	-	3	2
397	rusty metasedimentary schist, no visible sulphides	<2	<2	-	-	-	-	-	-
399	sulphide facies ironstone, 5 mm diameter pyrite concretions	10	<2	20	78	-	-	-	-
404	silicified feldspar porphyry dike in metasediments, 10-25% pyrite	140	<2	-	-	-	-	-	-
517	magnetite-quartz ironstone, nil to 1% disseminated suphides	<2	<2	-	-	-	-	-	-
548	Rivers Option, silicified and pyritized felsic dike	25	<2	39	5	-	-	-	-
549	Rivers Option, quartz vein and dike material	45	<2	43	38	-	-	-	-
550	Rivers Option, quartz vein and dike material	340	2	-	-	-	-	-	-
605	pyrite-chert ironstone, banded	6	<2	31	8	-	-	-	-

* *All sample numbers are abbreviated from the standard OGS sample number, e.g., 86BRB-066.*

lacks the intense shearing and alteration hosting the veins.

The Midas showing is very similar to the Alto-Gardnar showing. At both, gold occurs in large quartz veins hosted within small discrete shear zones subparallel to but well removed from the Wabigoon Fault. Mineralogy in the veins and wall rocks is similar but pyrite is more greatly concentrated at the Midas. At both deposits, the host rock is mafic metavolcanics with subordinate feldspar and quartz-feldspar-phyric dikes. At the Midas showing, quartz-feldspar porphyry was observed in the rubble from the east shaft, although none is exposed at surface. The possibility, therefore, exists that similar types of gold mineralization may occur on the ground between the two showings and that the subsidiary shear zones to the Wabigoon Fault may be continuous.

Morton C. (10) (1969)

In 1969, Coleman Morton commissioned an airborne radiometric survey for a group of claims covering parts of Laval and McAree townships. The claims covered part of the Sandybeach Lake Stock and the granitic pegmatites developed along its northern contact. The airborne survey failed to detect any anomalous radioactivity and the claims were subsequently allowed to lapse.

Noranda Exploration Company Limited (11) (1985)

In 1985, Noranda Exploration Company Limited held under option a group of claims covering a gold showing on a peninsula on the west shore of Sandybeach Lake (No. 11, Figure 19). This showing is referred to as the Standon showing by local geologists and prospectors. Noranda carried out a combined airborne VLF electromagnetic and magnetic survey over the claim group, filed no further work for assessment and terminated their option agreement.

During the field season, the showing was examined and sampled by the field crew. Auriferous pyrite-arsenopyrite stringers and veins up to 3 cm wide are hosted in a grunerite-magnetite-quartz ironstone. The ironstone is interbedded with high-metamorphic rank wackes and metasedimentary schists which have been intruded by tonalitic and granitic pegmatite dikes, basaltic (diabasic-textured) dikes and feldspar-phyric dikes. The ironstone is thinly to thickly laminated and highly deformed. The airborne magnetic survey filed by Noranda indicates the ironstone strikes northeast and has a strike length of approximately 750 m. A second (separate?) band of oxide ironstone is exposed on an island in Sandybeach Lake 400 m to the southeast and airborne magnetics suggest a parallel strike and approximately equal strike length. This ironstone is rusty at several locations but sulphides occur in only trace amounts.

The sulphide stringers in the ironstone on the mainland are both conformable with and crosscutting the magnetite laminae and comprise less than 5 percent of the total outcrop. A sample of the sulphide-rich material (No. 270, Figure 19) returned 1620 ppb gold, less than 2 ppm silver and 120 ppm arsenic when assayed. A sample (No. 517, Figure 19) from the rusty ironstone on the island returned less than 2 ppb gold and less than 2 ppm silver. Representative samples from the mainland showing were collected by J. Parker (geologist, Ministry of Northern Development and Mines, Kenora) and analyzed by the Geoscience Laboratories, Ontario Geological Survey, Toronto. Two selected grab samples of sulphide-bearing ironstone from the main trench on the shore of Sandybeach Lake returned 4290 ppb gold, less than 2 ppm silver and 42 ppm arsenic, and 250 ppb gold, less than 2 ppm silver and 46 ppm arsenic. Two grab samples of sulphide barren ironstone returned 12 ppb and 13 ppb gold, less than 2 ppm silver and 44 ppm and 75 ppm arsenic.

The Standon showing is unique in the map area being the only gold showing associated with oxide facies ironstone. However, the showing is so poorly exposed and highly deformed that estimates of size and grade cannot be determined at present. Previous mapping (Blackburn 1981) suggests the gold showing is part of a roof pendant within the Sandybeach Lake pluton. Although the host rocks are highly metamorphosed and intruded by granitic dikes, this area is interpreted by the author to be predominantly metasedimentary at the contact with the Sandybeach Lake pluton and not underlain by granitic rocks. Considerably more work is required to adequately determine the economic potential of the gold showing.

Nova-Co Explorations Limited (12) (1980) and the Rivers Option (16) (1960)

The history of the property referred to as the Rivers Option (No. 16, Figure 19) is poorly documented. Sometime prior to 1960, a number of trenches and pits were sunk to test auriferous quartz veins within feldspar- and quartz-feldspar-phyric dikes and sheared mafic metavolcanics. This work has been attributed to the Schmidt-Wallbridge interests *circa* 1930 by Derry (1980), however, the property description provided is for a group of claims in the Keikewabik Lake area a farther 2.5 km east of the Rivers Option (Hurst 1933). In 1950, the property was examined and sampled by geologist John C. Rodgers (Derry 1980), who reported surface assays of 0.28 ounce gold per ton, 0.96 ounce silver per ton over 8.2 feet, 1.26 ounces gold per ton, 11.7 ounces silver per ton over 0.5 feet and 0.56 ounce gold per ton over 3.2 feet.

In 1960, Teck Corporation Limited held an option on the ground owned at this time by Mr. Rivers. Teck diamond drilled seven holes totalling 2725 feet (830.8 m) to test the ground under the trenches. Assays reported by Derry (1980) included 0.78 ounce gold per ton over 2 feet, 0.66 ounce gold per ton over 2.2 feet, 0.42 ounce gold per ton over 1.5 feet and 0.7 ounce gold per ton over 4.3 feet from four drill holes. Diamond-drill hole location sketches indicate the four holes were drilled to provide cross sections of the quartz vein and are an aggregate 15 m apart. The other three holes were drilled along strike but their assays are not mentioned by Derry (1980). Silver values are reported to average 2.5 ounces silver per ton from the gold-bearing sections.

In 1979, the property was staked by Dejour Mines Limited and was optioned by Nova-Co Explorations Limited (No. 12, Figure 19) in 1980. Nova-Co contracted the Derry, Michener and Booth consulting firm to carry out a ground magnetic survey, a humus geochemical survey and geologic mapping which involved re-sampling the old trenches and pits. The mapping shows that five large quartz-carbonate veins were located within 300 m of each other on the claims. The largest vein was traced for 85 m along strike and from 25 cm to 1 m across strike. The veins are predominantly sugary textured, milky white quartz with subordinate ankerite, epidote, tourmaline and sericite. Pyrite (usually less than one percent) is present in all veins and rarely chalcopyrite, galena and sphalerite were observed. Chip samples taken across the quartz veins returned nil to 0.02 ounce gold per ton with the highest assay value of 0.08 ounce gold per ton returned over four inches.

The veins trend northeast with near vertical dips and are aligned parallel with the felsic dikes and major foliation. Sheared mafic metavolcanics are the host rocks into which felsic porphyry dikes and the quartz veins are intruded. Silicification of host rocks is common with porphyry dikes usually more silicified than the mafic metavolcanics. Sulphides up to 20 percent volume are locally present in the silicified zones but no gold values have been reported.

The ground magnetics proved to be of limited value in outlining geological features as the survey encountered technical difficulties (Derry 1980). The humus geochemical survey outlined a gold anomaly over a portion of the old trenches with a peak value of 38 ppb gold over a background of 1 ppb gold. The survey failed to detect anomalous gold values over heavily vegetated ground. No further work was carried out and the claims were allowed to lapse.

As of August 1986, the Rivers Option was staked by Loydex Resources Incorporated but no work had been filed for assessment purposes.

During the field mapping, the property was visited and some of the old trenches were sampled. The geology as described by Derry (1980) is accurate in the author's opinion. The Rivers Option contains more felsic porphyry dikes and more widespread silicification than either the Midas showing or the Alto-Gardnar showing, but it is considered by the author to be in a similar geological environment and may be hosted by the same subsidiary structure to the Wabigoon Fault as the Midas showing. Three samples (548, 549, 550, Figure 19) of quartz vein collected by the author combined with silicified felsic dikes containing one to five percent pyrite were assayed. Sample 548 returned 25 ppb gold, less than 2 ppm silver, 39 ppm copper and 5 ppm zinc. Sample 549 returned 45 ppb gold, less than 2 ppm silver, 39 ppm copper and 5 ppm zinc. Sample 549 returned 45 ppb gold, less than 2 ppm silver, 43 ppm copper and 38 ppm zinc. Sample 550 returned 340 ppb gold and 2 ppm silver.

Orlac Red Lake Mines Limited (13) (1950)

Orlac Red Lake Mines Limited changed its name in 1953 to Consolidated Orlac Mines Limited. In 1956, the name was again changed to Abbican Mines Limited. In 1964, Abbican's charter was cancelled and the company is now defunct (Canadian Mines Handbook 1951, 1953, 1956, 1964).

In 1951, Orlac Red Lake Mines Limited held nine unpatented mining claims in the north-central part of McAree Township (No. 13, Figure 19). The claims were explored for gold by means of a ground magnetometer survey; however, no follow-up work was carried out and the claims were subsequently allowed to lapse.

Pacemaker Petroleums Limited (14) (1951)

Pacemaker Petroleums Limited changed its name to Pacemaker Mines and Oils Limited before its charter was cancelled in 1968. The company is now defunct (Canadian Mines Handbook 1951, 1964, 1968).

In 1951, Pacemaker held nine unpatented mining claims in the northern part of McAree Township (No. 14, Figure 19). The claims were explored for gold by means of a ground magnetometer survey. Results of the survey did not encourage Pacemaker to do any follow-up work and the claims were allowed to lapse.

Porcupine Peninsular Gold Mines Limited (15) (1950)

In 1953, Porcupine Peninsular Gold Mines Limited changed its name to Brunhurst Mines Limited. In 1959, Brunhurst was merged with several other companies to form Hydra Explorations Limited which still carries out mineral exploration and development (Canadian Mines Handbook 1950, 1953, 1959).

In 1950, Porcupine Peninsular (No. 15, Figure 19) held several claims in McAree Township and in Laval Township west of the map area. Ten diamond-drill holes totalling 6914 feet (2108 m) were sunk in McAree Township in the search for gold. Based on drill log descriptions of the lithologies and hole locations, five of the drill holes were sunk in the hornblende-phyric (calc-alkalic) mafic to intermediate metavolcanics which host the Goldlund deposit in Echo Township, 1000 m north of the map area. Diorite intrusions were encountered in two of the holes but no gold values were reported from any of the samples.

Two of the diamond-drill holes encountered parts of the Crossecho Lake Stock on the west boundary of McAree Township. "Granite" containing numerous quartz-tourmaline-pyrite stringers and veins were encountered but no gold values are reported.

The remaining three drill holes were sunk in the metasediments overlying the hornblende-phyric metavolcanics. Two holes encountered wackes intruded by quartz-feldspar-phyric dikes. The third drill hole whose collar was located during the field mapping was sunk into a cherty sulphide facies ironstone. The ironstone which outcrops near the drill hole collar contains 30 to 60 percent pyrite in alternating bands with chert and can be traced southerly for 150 m along the east side of a small creek flowing into Tablerock Lake. A sample (No. 605, Figure 19) of the ironstone collected by the author returned 6 ppb gold, less than 2 ppm silver, 31 ppm copper and 8 ppm zinc. The ironstone occurs at the contact of the metasediments with felsic tuffs and hornblende-phyric metavolcanics and appears to be equivalent with sulphide ironstones on the north shore of Tablerock Lake. Such a readily identifiable unit can be used as a marker horizon within the map area.

Gold values greater than trace were not reported in any of the drill holes and Porcupine Peninsular allowed the claims to lapse.

Ronayne Explorations Limited (17) (1947)

Ronayne Explorations Limited (No. 17, Figure 19) held one claim in the northwestern corner of McAree Township in 1947. After carrying out a ground magnetometer survey no further work was carried out and the claim was allowed to lapse. In 1948, Ronayne became inactive and remained so until its charter was cancelled in 1957 (Canadian Mines Handbook 1947, 1948, 1957).

Selco Exploration Company Limited (18) (1971)

In 1971, Selco Exploration Company Limited held several claims in the northern and northeastern parts of McAree Township (No. 18, Figure 19). Two diamond-drill holes totalling 273 feet (83.2 m) were sunk to presumably test conductors detected by ground geophysical surveys. Graphitic and pyritic metasediments and felsic tuffs containing minor quantities of pyrrhotite, chalcopyrite and sphalerite were encountered interlayered between mafic and felsic metavolcanic units. No assays were reported and it is assumed no economic mineralization was encountered as the claims were allowed to lapse. These drill holes are in the same general area as Asarco's (No. 1, Figure 19) and Beth-Canada's (No. 2, Figure 19) work and the area is characterized by rapidly changing depositional environments of coeval mafic and felsic volcanism transitional to clastic and chemical sedimentation. Traverses in the area and previous mapping by Page and Christie (1980) indicated the area in the immediate vicinity of Selco's claims is dominated by coarse felsic pyroclastic units.

In 1976, Selco held claims in the north-central part of McAree Township contiguous with claims extending into Echo Township. Grid lines were cut over portions of the claims and ground electromagnetic and magnetic surveys were carried out. The claims in McAree Township were not surveyed so no information is available in this area from Selco's work. The claims have subsequently lapsed.

Selco Exploration Company Limited is now part of British Petroleum Canada Incorporated and is known as Selco Incorporated.

Sulpetro Minerals Limited (19) (1984)

In 1980, Sulpetro Minerals Limited (No. 19, Figure 19) held a block of claims straddling Highway 72 in northern McAree Township. A grid covering the entire claim group was cut. A VLF electromagnetic, a magnetic and geologic mapping program was carried out prior to sinking one diamond-drill hole in 1984. The drill hole (85.6 m) encountered rhyolitic schist and felsic metavolcanics in sharp contact with mafic metavolcanic flows and amphibolite. Minor pyrite and chalcopyrite were encountered as well as a few small quartz veins. No assay values are reported and it is assumed no economic mineralization was encountered as the claims were allowed to lapse.

The claim group covers a portion of the contact between mafic metavolcanic units in the core of a structural dome and felsic pyroclastic units on its northwestern flank. The axial trace of a northeast-trending syncline has been interpreted on Sulpetro's map on the basis of dip reversals of foliation, which suggests this area is more complexly folded than indicated by the present mapping. The lack of well preserved primary structures suitable for determination of stratigraphic facing also hampers interpretation.

Tarbush Lode Mining Limited (20) (1985)

As of August 1986, Tarbush Lode Mining Limited (No. 20, Figure 19) held several mining claims in the northwestern part of McAree Township covering ground previously explored by Conwest Exploration Company Limited (No. 5, Figure 19), Frederick Mining and Development Limited (No. 6, Figure 19), Porcupine Peninsular Gold Mines Limited (No. 15, Figure 19) and Ronayne Explorations Limited (No. 17, Figure 19). Tarbush has spent several years searching for gold mineralization using the Goldlund deposit 1000 m north of the map area as an exploration model (cf. Page 1984 for geological description of the Goldlund deposit) (Frohberg 1952). To this end, Tarbush cut a grid over the entire property and has carried out a variety of surveys including airborne magnetic and VLF electromagnetic surveys, ground VLF electromagnetic and magnetic surveys, a soil sampling survey and geologic mapping. To date, seven diamond-drill holes totalling 2607 feet (794.8 m) have been sunk to test geophysical and geological targets.

The main exploration target is a "granodiorite-type" rock which is the main host of gold mineralization at the Goldlund deposit. Recent investigations by Chorlton (1986) indicated that these rocks are synvolcanic mafic sills and dikes, some of which are composite and rhythmically layered, that have been silicified and altered to resemble granodiorite in surface exposures. On Tarbush's property, the "granodiorite-type" rock is correlative with a gabbroic intrusion which has been traced by diamond drilling and surface exposure for approximately 1800 m along strike. Pervasive silicified zones containing up to 10 percent pyrite and pyrrhotite with trace chalcopyrite were encountered in several of Tarbush's drill holes; however, gold values greater than 0.005 ounce gold per ton were not reported. Felsic dikes that outcrop on Tarbush's property are either tonalitic or very quartz phyric. They resemble lithologies of the Crossecho Lake Stock farther west (Chorlton 1986), and are not correlative with the "granodiorite-type" intrusions associated with the Goldlund deposit.

The soil geochemistry survey analyzed for gold and zinc. Results for gold range from less than 2 ppb to 138 ppb with a background estimated by the author to be less than 2 ppb gold. Results for zinc range from 15 ppm to 320 ppm with a background estimated by the author to be between 50 and 70 ppm. According to the conclusions of reports filed for assessment, some of the anomalous gold values are associated with inferred faults and VLF electromagnetic conductors; however, there has been no apparent follow-up work as of December 1986.

Wilkinson, D. (21) (1976)

In 1976, one diamond-drill hole of 497 feet (151.5 m) was sunk north of Tom Chief Lake on claims owned by Donald Wilkinson (No. 21, Figure 19). The drill hole encountered rhyolitic tuffs and tuff breccias interbedded with minor amounts of wacke. Up to 10 percent pyrite and pyrrhotite in rhyolitic tuffs was encountered, however, no assay values were reported and the claims were allowed to lapse. On the shore of Tom Chief Lake in the vicinity of Wilkinson's drill hole, a carbonate-altered felsic breccia containing 10 percent disseminated pyrite outcrops. A sample (No. 357, Figure 19) of this material collected during the field season returned 2 ppb gold, less than 2 ppm silver, 28 ppm copper and 45 ppm zinc when assayed. This outcrop and the mineralization in D. Wilkinson's drill hole is part of a larger, complexly altered and mineralized area exposed along the entire north shore of Tom Chief Lake. The sulphides appear to be related to the sulphide ironstone diamond drilled by Porcupine Peninsular Gold Mines Limited (*see* No. 15 above) that occurs at the contact between the metavolcanics and metasediments west of Highway 72.

Windfall Oils and Mines Limited (22) (1970)

In 1981, Windfall Oils and Mines Limited changed its name to Camreco Incorporated. Camreco held seven patented mining claims numbered KRL 22681, KRL 22682, KRL 22683, KRL 22684, KRL 22685, KRL 22686 and KRL 22737 in McAree Township as of August 1986 (No. 22, Figure 19). In 1970, a ground VLF electromagnetic survey was carried over the claims in McAree Township but no work has been done subsequently.

The claims are underlain predominantly by mafic and intermediate hornblende-phyric metavolcanics with subordinate felsic pyroclastics and minor sulphide facies ironstones and metasedimentary schist. The hornblende-phyric units include highly vesiculated massive flows, pillowed basaltic flows and massive plagioclase-phyric mafic flows. A distinctive dacitic variolitic flow occurs in northwestern claim KRL 22684 and appears to be on strike with a variolitic flow mapped by Page and Christie (1980) in Echo Township. A magnetite impregnated gabbro sill or dike outcrops north of the variolitic flow and a thin section of this rock displays myrmekitic texture suggesting a possible granophyre affinity (Dear et al. 1971). This mafic intrusion extends onto Tarbush Lode Mining Limited's property to the southwest where it has been encountered in diamond-drill holes sunk by Tarbush Lode Mining Limited, Conwest Exploration Company Limited and probably by Porcupine Peninsular Gold Mines Limited. A very strong magnetic attraction on claim KRL 22683 may correspond with an as-yet undetected mafic intrusion.

The contact between the hornblende-phyric mafic metavolcanics and felsic metavolcanics is inferred to underlie the eastern part of the patented claims. Representatives of the felsic metavolcanics as exposed in southeastern claim KRL 22685 are composed predominantly of crystal tuffs and lapilli tuffs. Minor wackes are interbedded with the tuffs along the shore of Tom Chief Lake and sulphide facies ironstones outcrop immediately east of claim KRL 22683. A representative sample (No. 399, Figure 19) of the ironstone collected during the field season returned 10 ppb gold, less than 2 ppm silver, 20 ppm copper and 78 ppm zinc when assayed.

RECOMMENDATIONS TO PROSPECTORS

The main focus of past exploration efforts has been directed towards the discovery of gold mineralization. In the author's opinion, there are several prospective gold exploration targets within the Melgund Lake area.

Assuming the inference that the Rivers Option (No. 12, 16, Figure 19), the Midas showing (No. 9, Figure 19) and the Alto-Gardnar showing (No. 1, Figure 16) are on a continuous structure subsidiary to the Wabigoon Fault is valid, then the intervening ground between the three showings warrants exploration for a similar type of gold mineralization. In addition, none of the three showings that occur on this structure have been extensively explored in the author's opinion and neither the Alto-Gardnar nor the Midas showing has been recently diamond drilled.

The Standon showing (No. 11, Figure 19) is unique within the map area; however, poor exposure makes it difficult to properly assess its economic potential on surface. Based on airborne magnetics and field mapping, the ironstone is believed to extend both southwest and northeast from the showing under Sandybeach Lake. It is probable that the showing is not part of a roof pendant within the Sandybeach Lake Stock as previous workers have suggested (Palonen and Speed 1976) but rather may be part of the metasedimentary package exposed farther north of the showing.

The Glatz Option (No. 1, 2, 3, Figure 14) has been the centre of all exploration activity in Avery Township. A number of northeast-trending lineaments hosting carbonate alteration were observed in western Avery Township and samples collected during the field season returned only low gold, silver and base metal values (Table 8, Figure 14). Two samples (059, 060, Figure 14) were collected from carbonate and silicified altered east-northeast-trending lineaments near the intersection with northeast-trending lineaments and returned 15 ppb and 70 ppb gold suggesting this area warrants exploration.

Sections of the Wabigoon Fault are pervasively carbonate altered and contain minor amounts of pyrite. One such section on the southeast shore of Sandybeach Lake is altered over an area 1100 m by 300 m. A sample of sulphide barren sericite-carbonate schist returned 33 ppb gold when assayed and indicates the area warrants exploration (No. 322, Figure 16). Farther north on the east side of Sandybeach Lake near the Wabigoon Fault, a pyritic and silicified quartz-feldspar-phyric dike intruding wackes returned 140 ppb gold when assayed (No. 404, Figure 19). It is recommended this area be thoroughly prospected.

The hornblende-phyric mafic and intermediate metavolcanics in northwestern McAree Township are prospective hosts for gold. These rocks are the extension of units hosting the Goldlund deposit to the north in Echo Township. Although extensive exploration has so far failed to find economic gold mineralization there remains much untested ground.

Another area that warrants exploration for gold is in the core of the structural dome in McAree Township where numerous quartz veins intrude the mafic pyroclastics. Although most veins appear barren, detailed sampling is required to properly test the occurrence. A magnetic high (ODM-GSC 1961b, Map 1146G, Sandybeach Lake) characterizes the dome and may be caused by an unexposed intrusion. Altered mafic intrusions host the Goldlund deposit, which is also characterized by a magnetic high and an analogy with the dome may be present.

As previously mentioned, the contact between the metavolcanics and the metasediments in western and northern McAree Township is marked by a sulphide facies ironstone unit. This unit has been diamond drill tested by Porcupine Peninsular Gold Mines Limited and D. Wilkinson, and appears to be correlative with sulphide-bearing units diamond drilled by Canadian Nickel Company Limited, Selco Exploration Company Limited and Beth-Canada Mining Company. If this unit is as extensive as suggested, then it remains poorly explored for its gold potential.

Significant base metal mineralization is unknown in the map area and samples collected during the field season returned assays no greater than 345 ppm copper, 159 ppm zinc and 144 ppm nickel. The highest noteworthy assays reported by exploration companys' diamond-drill logs filed for assessment were 1900 ppm zinc near Pickerel Arm (No. 2, Figure 19) and 1800 ppm zinc south of Sandybeach Lake (No. 4, Figure 16). The quartz porphyry subvolcanic intrusion in MacFie Township contains varying amounts of pyrite and quartz stringers and is a possible host of base and precious metal mineralization. The most prospective area for base metal mineralization in the author's opinion is the area underlain by felsic metavolcanics in northern McAree Township.

Besides metallic minerals, the Melgund Lake area hosts potentially economic industrial minerals. The central portion of MacFie Township is covered by parts of the extensive Hartman terminal moraine (Zoltai 1961). Portions of the moraine have been reworked and contain well sorted sand and gravel deposits in addition to the more abundant boulder and clay till. The sand and gravel deposits have been locally exploited for construction of forest access roads and appear sizable enough for major road construction projects.

There are numerous sites for potentially economic building and ornamental stone. Sections of the Melgund Lake Stock in Avery Township are massive, unfractured and warrant examination for their building stone potential. Most of the more prospective areas are on islands in the west end of the lake; however, the large peninsula in the centre of the stock contains many massive sections as well.

Along the access road to Melgund Lake, a coarse-grained, massive gabbro outcrops. Preliminary examination of collected samples indicate the gabbro takes a good polish, is relatively sulphide free and would be suitable for decorative or ornamental stone (J. Redden, Ministry of Northern Development and Mines, Sioux Lookout, in preparation).

The granitic pegmatite and aplite intrusion east of Highway 72 in McAree Township is a potentially economic source of industrial and rare element minerals. A study of the white pegmatite phase of the intrusion has been undertaken by Redden (in preparation) and preliminary results indicate there is enrichment of lithium and gallium in muscovite separates when compared to rare element barren pegmatites. The white pegmatite, therefore, resembles more highly evolved lithium-cesium-bearing pegmatites elsewhere in the Dryden area (D. Janes, Ministry of Northern Development and Mines, Sioux Lookout, personal communication, 1986).

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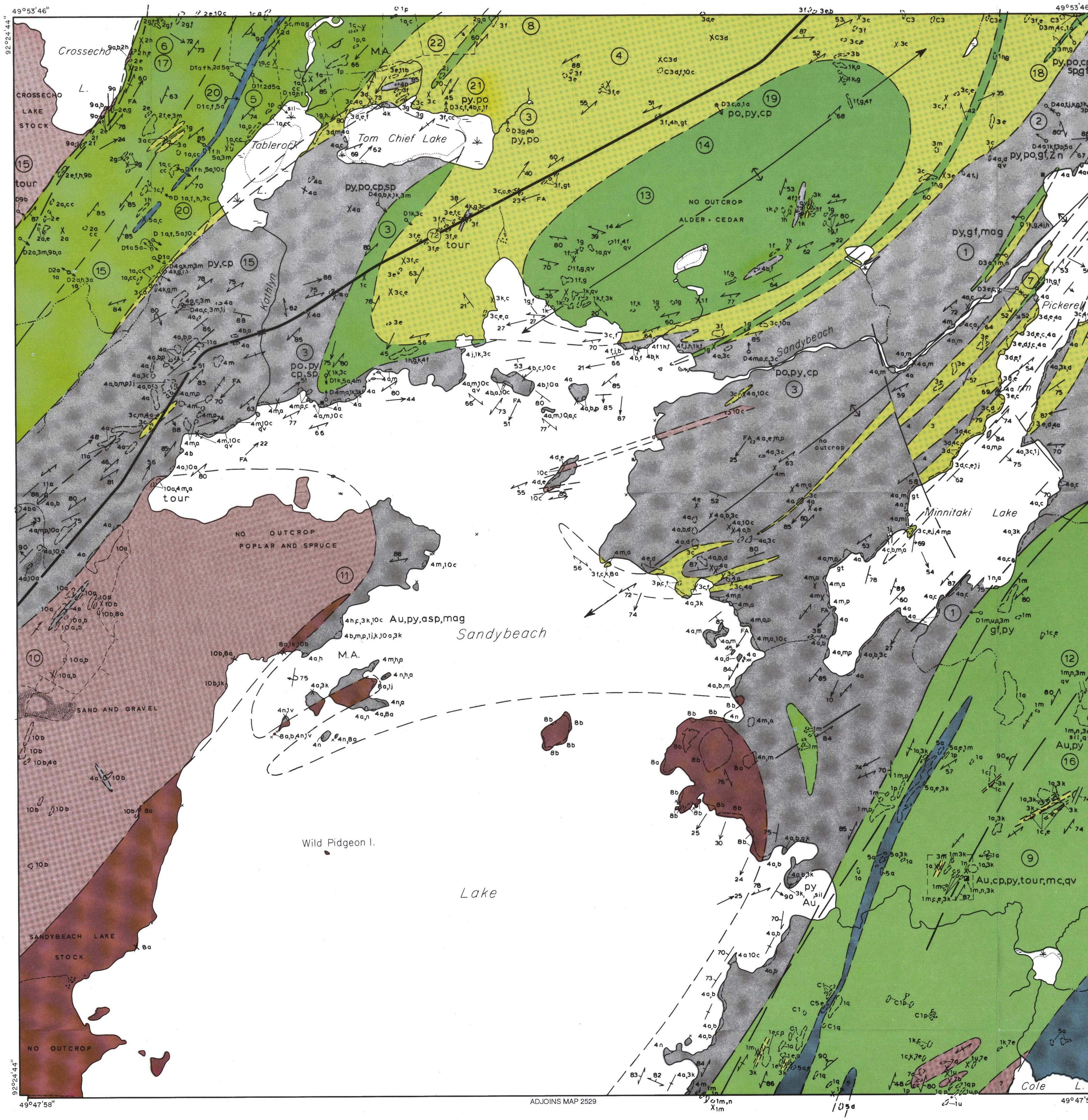

LEGEND

PHANEROZOIC
CENOZOIC
QUATERNARY
RECENT
Lake, stream, and swamp deposits
PLEISTOCENE
Sand and gravel deposits; boulder and clay till

UNCONFORMITY

PRECAMBRIAN
ARCHEAN
LATE ARCHEAN
MAFIC INTRUSIONS

11
- 11a Lamprophyre dikes: dark green; biotite phenocrysts in a tremolite-plagioclase groundmass; contains numerous xenoliths
- 11b Lamprophyre: light to dark green; biotite-hornblende-magnetite bearing; xenoliths absent

INTRUSIVE CONTACT

EARLY TO LATE ARCHEAN
METAMORPHOSED FELSIC INTRUSIONS
Miscellaneous Felsic Intrusions[a]

10
- 10a Granite pegmatite and aplite: white; biotite-muscovite bearing; may contain garnet, tourmaline, and/or fibrolitic sillimanite
- 10b Granite pegmatite and aplite: pink; biotite-muscovite bearing; may contain garnet and tourmaline; fibrolitic sillimanite absent
- 10c Tonalite, monzonite, granodiorite dikes and stringers: white to pink; fine to medium grained; equigranular; usually found intruding metasediments; parentage uncertain

INTRUSIVE CONTACT

Crossecho Lake Stock[a]

9
- 9a Aplite: pink; very fine grained; sugary texture; often cut by quartz veins
- 9b Tonalite: white; medium grained; biotite bearing

INTRUSIVE CONTACT

Sandybeach Lake Stock[a]

8
- 8a Quartz monzodiorite to quartz diorite: grey to pink; equigranular to porphyritic (plagioclase phenocrysts); medium grained; hornblende-biotite bearing; foliated
- 8b Quartz monzonite to monzonite: pink; equigranular to porphyritic (plagioclase phenocrysts); medium to coarse grained; hornblende greater than biotite

INTRUSIVE CONTACT

Basket Lake Batholith[a]

7
- 7a Hybrid zone: dioritic to quartz dioritic composition; variable colour and texture; contains numerous xenoliths and shows evidence of stoping and partial assimilation; hornblende earing
- 7b Quartz diorite: leucocratic; medium grained; equigranular to porphyritic; biotite bearing; massive to foliated
- 7c Quartz monzonite: white to pink; medium grained; equigranular to porphyritic (orthoclase phenocrysts); biotite bearing; massive to foliated
- 7d Granodiorite to granite: white to pink; medium to coarse grained; porphyritic (orthoclase phenocrysts) to equigranular; biotite bearing; massive to foliated
- 7e Tonalite: white; biotite bearing; usually occurs as dikes intruding mafic metavolcanics near the borders of the batholith
- 7f Aplite: pink to grey; fine grained; occurs as dikes within the batholith

INTRUSIVE CONTACT

Melgund Lake Stock[a]

6
- 6a Diorite to monzodiorite: grey to pink; porphyritic (plagioclase phenocrysts) to equigranular; medium to coarse grained; often contains amphibolite xenoliths; hornblende-biotite bearing
- 6b Monzonite: pink to white; medium grained; equigranular to porphyritic; hornblende greater than biotite
- 6c Quartz monzonite: pink to white; medium grained; equigranular; massive to weakly foliated; hornblende greater than biotite
- 6d Granodiorite: pink; medium to coarse grained; equigranular to porphyritic; hornblende much greater than biotite
- 6e Monzonite to quartz monzonite dikes: pink to white; fine to medium grained; hornblende-biotite bearing; intrudes mafic metvolcanics

INTRUSIVE CONTACT

METAMORPHOSED MAFIC INTRUSIONS

5
- 5a Gabbro: dark green to black; fine to coarse grained; equigranular; ophitic to recrystallized textures; hornblende bearing
- 5b Melanogabbro: black; medium to coarse grained; magnetic; equigranular; colour index ≤10; hornblende bearing
- 5c Leucogabbro: pale green to green; fine to medium grained; equigranular; colour index ≥40; hornblende bearing
- 5d Knobby gabbro: contains hornblende porphyroblasts (2 to 7 mm) in a gabbroic to leucogabbroic groundmass
- 5e Plagioclase-phyric gabbro: pale green to black; 1 to 5 percent euhedral to anhedral, white to pale green, plagioclase phenocrysts, up to 2 cm, in a gabbroic to leucogabbroic groundmass; hornblende bearing

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS
Clastic and Chemical Metasediments

4
- 4a Wackes: light to dark grey; feldspathic to quartzose; massive to graded; thinly to very thickly bedded
- 4b Siltstones: buff to grey; thickly laminated to thinly bedded; often interbedded with wackes
- 4c Argillaceous to phyllitic schist: dark grey to black, often graphitic; frequently interbedded with wackes
- 4d Ferruginous wackes: brown to rusty weathering; very thickly bedded, often with limonitic streaks and clasts; nil to trace sulphide minerals
- 4e Pebbly sandstone: millimetre- to centimetre-sized quartz and lithic clasts in a sandstone to wacke matrix; usually clast supported
- 4f Mafic wackes: dark grey to black; thinly to thickly bedded, usually massive; hornblende very much greater than biotite; derived from mafic metavolcanics
- 4g Chert: white to cream; very fine grained to cryptocrystalline; occurs mainly as interflow metasediments or with ironstones
- 4h Magnetite-quartz ironstone: laminated to thinly bedded; with or without garnet
- 4j Hornblende-biotite-garnet amphibolite: black with red spots (5 to 10 mm garnets); interbedded with mafic wackes and ironstones; derived from mafic metavolcanics; contains quartz in matrix
- 4k Pyrite-magnetite-quartz ironstone: usually gossany and schistose; sulphide minerals 5 to 60 percent of rock
- 4m Biotite-muscovite-quartz schist: derived from metasediments; fissile to crenulated; contains <10 percent injected granitic stringers and/or quartz veins
- 4n Metatexite: brown wacke paleosome with semicontinuous bedding; contains 10 to 70 percent granitic mobilizate; melanosome either poorly developed or absent; rarely agmatitic
- 4p Staurolite-bearing metasediments: staurolite porphyroblasts (2 mm to 2 cm) developed in wackes, schists, and metatexites
- 4q Conglomerate: angular to rounded clasts of felsic and mafic metavolcanics, quartz, and metasediments in a sandy wacke matrix; unsorted; 5 mm to 30 cm; matrix supported

Felsic Metavolcanics

3
- 3a Flows: massive to laminated; feldspar and/or quartz phyric; white to pale yellow; aphanitic to very fine grained
- 3b Flows: autobrecciated; white to grey; contains chloritic wisps and pods; may retain flow laminations
- 3c Tuffs: thickly bedded to laminated; massive to graded; white to cream coloured; biotitic at higher metamorphic grade
- 3d Crystal tuffs: thickly bedded; massive; white to pink; composed of feldspar and quartz crystals in a quartzo-feldspathic matrix
- 3e Lapilli tuff, lapillistone: heterolithic, commonly with <10 percent combined mafic metavolcanic, metasedimentary and sulphide mineral fragments; white
- 3f Breccia, tuff breccia: heterolithic; commonly contains mafic metavolcanic and feldspar porphyritic clasts in a felsic-tuff to crystal-tuff matrix; usually clast supported; white
- 3g Sericite-quartz schist: pale yellow to white; derived from sheared felsic metavolcanics and felsic dikes; fissile; may contain sulphide minerals
- 3h Sericite-carbonate-quartz schist: brown to yellow green; fissile; contains brown iron carbonate; derived from sheared felsic metavolcanics and felsic dikes; may contain sulphide minerals
- 3j Quartz-feldspar aplitic dikes: white to pink; sugary; fine grained; equigranular; may be pervasively carbonate altered; may contain sulphide minerals (cf. felsite)
- 3k Feldspar-phyric dikes: white to grey; equigranular to porphyritic; fine to medium grained; quartz phenocrysts rare or absent
- 3m Feldspar-quartz-phyric dikes: white, grey, or pink; fine to coarse grained; equigranular to porphyritic; prominent quartz phenocrysts occasionally up to 2 cm in diameter
- 3p Quartz porphyry: white to yellow; small quartz phenocrysts (0.1 mm) in an aphanitic, quartz-rich matrix; may be recrystallized

Hornblende-Phyric Mafic and Intermediate Metavolcanics[b]

2
- 2a Flows: massive; dark green; fine grained; vesicular to amygdaloidal; foliated
- 2b Flows: pillowed; dark green to green; vesicular to amygdaloidal; fine grained
- 2c Flows: plagioclase phyric; 5 to 25 percent anhedral to subhedral, white plagioclase phenocrysts in a dark-green, fine-grained groundmass
- 2d Flows: variolitic; dacitic composition; grey to brown; 1 to 5 mm elongated varioles
- 2e Tuffs: dark green; foliated; feldspathic
- 2f Lapilli tuff, lapillistone: heterolithic; andesitic and dacitic clasts in a fine-grained, dark-green tuff matrix
- 2g Breccia, tuff breccia: heterolithic; light-grey dacitic and dark-green andesitic clasts in a fine-grained, dark-green tuff matrix
- 2h Chlorite-talc schist: green to dark green; foliated; derived from sheared, hornblende-phyric metavolcanics
- 2j Quartz-feldspar-phyric porphyry: dark-grey groundmass with white plagioclase and blue-quartz phenocrysts; biotitic

Mafic Metavolcanics[c]

1
- 1a Flows: massive; green to dark green; fine to medium grained; contains <1 percent plagioclase phenocrysts
- 1b Flows: amygdaloidal; green to dark-green groundmass with large (up to 1 cm) chlorite-serpentine-filled amygdules (black)
- 1c Flows: pillowed; vesicular and amygdaloidal; green; pillows well formed, close packed to amoeboid, with thick selvedges and >10 percent interselvedge material
- 1d Lava tubes: defined as pillowlike structures with > 2 m long axes; amoeboid to mattress shaped
- 1e Pillow breccia, isolated pillow breccia, hyaloclastite: rounded to angular pillow fragments in a green to dark-green matrix; pillow fragments retain chilled margins
- 1f Tuff: green to dark green; massive to foliated; often recrystallized to black, coarse-grained, hornblende phenocrysts
- 1g Lapilli tuff, lapillistone: heterolithic; mafic and felsic metavolcanic clasts in a black to dark-green, mafic-tuff matrix; pyroclastic to epiclastic in origin
- 1h Breccia, tuff breccia: heterolithic; mafic and felsic metavolcanic clasts in a black to dark-green, mafic-tuff matrix; pyroclastic to epiclastic in origin
- 1j Basaltic dikes and sills: fine to medium grained; dark to bright green; very hard; contacts clearly observed
- 1k Amphibolite: tine to medium grained; dark green to black, often banded; recrystallized; derived from mafic-metavolcanic flows and tuffs
- 1m Talc-chlorite schist: dark green; fine grained; fissile; derived from mafic metavolcanics
- 1n Talc-cholorite-carbonate schist: dark green to brown; pervasively iron-carbonate to calcite altered; derived from mafic metavolcanics
- 1p Plagioclase-phyric flows: massive; contains >1 percent euhedral to anhedral, white to green plagioclase phenocrysts in a light to dark-green groundmass ("Leopard Rock")
- 1q Plagioclase-phyric flows: pillowed; plagioclase phenocrysts in pillow cores and selvedges
- 1r Plagioclase-phyric pillow breccia, isolated-pillow breccia, hyaloclastite: retains recognizable plagioclase phenocrysts throughout rock
- 1s Plagioclase-phyric lava tubes: as 1d with plagioclase phenocrysts
- 1t Plagioclase-phyric talc-chlorite schist: derived from plagioclase-phyric metavolcanics
- 1u Plagioclase-phyric amphibolite: contains stretched plagioclase phenocrysts
- 1v Hornblende-epidote xenoliths: dark green; megacrystic; occurs as inclusions in the Sandybeach Lake Stock

sil — Silicified zone

cc — Carbonate alteration

NOTES:

a. Felsic intrusions are separated on the basis of lithology, spatial separation, and style of deformation rather than rock stratigraphy; age relationships are not implied by the order of appearance in the legend.

b. Rocks contain prominent, millimetre-sized hornblende porphyroblasts and phenocrysts.

c. Rocks have no intermediate members, and hornblende phenocrysts and porphyroblasts are absent.

The legend, symbols and abbreviations are for the combined townships of McAree (Map 2528) and MacFie and Avery (Map 2529). Not all units may be found on this particular map sheet.

The letter "C" preceding a code refers to data compiled from existing maps and unpublished maps and reports covering portions of the Melgund Lake area. The letter "D" preceding a code refers to data compiled from diamond-drill logs filed for assessment work credits. The letter "G" preceding a code refers to data compiled from published airborne geophysical maps and maps filed for assessment work credits

PROPERTIES

1. Asarco Exploration Company of Canada Limited (1970)
2. Beth-Canada Mining Company (1979); now defunct
3. Canadian Nickel Company Limited (1970)
4. Consolidated Ansley Gold Mines Limited (1950); name changed to Ankeno Mines Limited (1950), then to Bankeno Mines Limited (1955)
5. Conwest Exploration Company Limited (1950)
6. Frederick Mining and Development Limited (1950); name changed to Consolidated Frederick Mining Limited; defunct 1962
7. Geophysical Engineering Limited (1977); exploration arm of Teck Corporation Limited
8. Goldlund Mines Limited (1981); receivership in November 1986
9. Midas Mines Limited (1907); now defunct
10. Morton, C. (1969)
11. Noranda Exploration Company Limited (1985): Standon showing
12. Nova-Co Explorations Limited (1980)
13. Orlac Red Lake Mines Limited (1951); name changed to Abbican Mines Limited; defunct 1964
14. Pacemaker Petroleums Limited (1951); name changed to Pacemaker Mines and Oils Limited; defunct 1968
15. Porcupine Peninsular Gold Mines Limited (1950); name changed to Brunhurst Mines Limited (1953); incorporated into Hydra Explorations Limited
16. Rivers Option (1960)
17. Ronayne Explorations Limited (1947); now defunct
18. Selco Exploration Company Limited (1971); now Selco Incorporated
19. Sulpetro Minerals Limited (1981); now Novamin Resources Incorporated
20. Tarbush Lode Mining Limited (1980, 1981, 1982)
21. Wilkinson, D. (1977)
22. Windfall Oils and Mines Limited (1970); name changed to Camreco Incorporated (1981)

ABBREVIATIONS

Ag	silver	po	pyrrhotite
asp	arsenopyrite	py	pyrite
Au	gold	qv	quartz vein
cp	chalcopyrite	shee	sheelite
gf	graphite	sp	sphalerite
gt	garnet	tour	tourmaline
mag	magnetite	Zn	zinc
mc	malachite		

Ministry of Northern Development and Mines
Ontario
Mines and Minerals Division

Stock Number 10 724

Ontario Geological Survey

MAP 2528

PRECAMBRIAN GEOLOGY

MELGUND LAKE AREA
McAREE TOWNSHIP

Scale: 1:20 000

Metres 500 0 1 Kilometre
Mile 1/4 0 1/2 Mile

NTS Reference: 52 F/16
ODM–GSC Aeromagnetic Map: 1146G
OGS Geological Compilation Map: 2443

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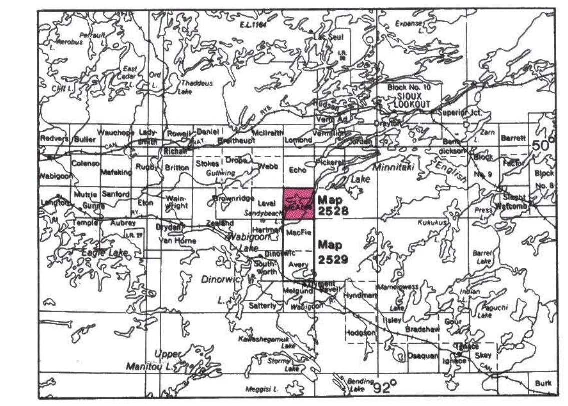
CANADA ONTARIO Mineral Development Exploitation Minérale

This project is part of the five-year Canada-Ontario 1985 Mineral Development Agreement (COMDA), a subsidiary agreement to the Economic and Regional Development Agreement (ERDA) signed by the governments of Canada and Ontario.



LOCATION MAP — Scale: 1:1 584 000 or 1 inch to 25 miles

SYMBOLS

- Small bedrock outcrop
- Area of bedrock outcrop
- Bedding, top unknown (inclined, vertical)
- Bedding, top indicated by arrow (inclined, overturned)
- Lava flow, top in direction of arrow
- Lava flow, dip overturned
- Lava flow, dip unknown
- Foliation, (inclined, vertical)
- Banding, (inclined)
- Lineation with plunge, note special designation for fold axis
- Geological boundary, observed
- Geological boundary, position interpreted
- Geological boundary, position deduced from geophysical-interpreted fault
- Anticline, syncline, with plunge
- Diamond-drill hole
- Shaft
- MA Magnetic attraction
- (6) Property

SOURCES OF INFORMATION

Base maps from maps of the Forest Resources Inventory, Lands and Waters Group, Ontario Ministry of Natural Resources, with revisions by B.R. Berger.

ODM–GSC Aeromagnetic Maps 1145G, Dyment, Kenora District, scale 1:50 000; 1146G, Sandybeach Lake, Kenora District, scale 1:50 000.

Assessment Files Research Offices, Ministry of Northern Development and Mines, Toronto, Sioux Lookout and Kenora.

Kenora–Fort Frances, Districts of Kenora and Rainy River; Ontario Geological Survey, Geological Compilation Series, Map 2443, by C.E. Blackburn, scale 1:253 440 or 1 inch to 4 miles, 1981, Compilation 1973–1978.

Operation Kenora–Ear Falls, Sandybeach–Route Lakes Sheet, District of Kenora; Ontario Division of Mines, Geological Series–Preliminary Map P.1204, by F.W. Breaks, W.D. Bond, N. Harris, C.J. Westerman and D.W. Desnayers, scale 1:63 360 or 1 inch to 1 mile, 1976, Geology 1975.

Sioux Lookout Area, District of Kenora; Ontario Department of Mines, Map 41h, Accompanying Annual Report 1932, Volume 41, Part 6, by M.E. Hurst, scale 1:95 040 or 1 inch to 1 1/2 miles, 1932, Geology 1931.

Lateral Lake Area (East Half), District of Kenora; Ontario Geological Survey, Geological Series–Preliminary Map P.2372, by R.O. Page and B.J. Christie, scale 1:15 840 or 1 inch to 1/4 mile, 1980, Geology 1979.

Dryden–Wabigoon Area, District of Kenora; Ontario Department of Mines, Map 50e, Accompanying Annual Report 1941, Volume 50, Part 2, by J. Satterly, scale 1:63 360 or 1 inch to 1 mile, 1941, Geology 1939 and 1940.

Palonen, P., Speed A.A. and Huggins, R. 1976. Unpublished map of Sandybeach Lake Area map covering McAree Township, scale 1:15 840 or 1 inch to 1/4 mile.

Sutcliffe, R.H. 1977. Unpublished maps of portions of Avery and MacFie townships, scale 1:15 840 or 1 inch to 1/4 mile.

Geology not tied to surveyed lines.

Magnetic declination approximately 3°06′E in 1986.

Metric conversion factor: 1 foot = 0.3048 m.

CREDITS

Geology by B.R. Berger, D. MacMillan, D. Butler and assistants, 1986.

Cartography by B.L. Aikman, Publication and Cartographic Services, Ontario Geological Survey, 1989.

This is one of a group of transitional stage, computer-assisted cartographic publications. The appearance of subsequent maps may change as technological refinements and modified production procedures are implemented.

Issued 1989

Information from this publication may be quoted if credit is given. It is recommended that reference to this map be made in the following form:

Berger, B.R., MacMillan, D. and Butler, G. 1989. Precambrian geology, Melgund Lake area, McAree Township; Ontario Geological Survey, Map 2528, scale 1:20 000.

LEGEND

PHANEROZOIC
CENOZOIC
QUATERNARY
RECENT
Lake, stream, and swamp deposits
PLEISTOCENE
Sand and gravel deposits; boulder and clay till

UNCONFORMITY

PRECAMBRIAN
ARCHEAN
LATE ARCHEAN
MAFIC INTRUSIONS

11
- 11a Lamprophyre dikes: dark green; biotite phenocrysts in a tremolite-plagioclase groundmass; contains numerous xenoliths
- 11b Lamprophyre: light to dark green; biotite-hornblende-magnetite bearing; xenoliths absent

INTRUSIVE CONTACT

EARLY TO LATE ARCHEAN
METAMORPHOSED FELSIC INTRUSIONS
Miscellaneous Felsic Intrusions[a]

10
- 10a Granite pegmatite and aplite: white; biotite-muscovite bearing; may contain garnet, tourmaline, and/or fibrolitic sillimanite
- 10b Granite pegmatite and aplite: pink; biotite-muscovite bearing; may contain garnet and tourmaline; fibrolitic sillimanite absent
- 10c Tonalite, monzonite, granodiorite dikes and stringers: white to pink; fine to medium grained; equigranular; usually found intruding metasediments; parentage uncertain

INTRUSIVE CONTACT

Crossecho Lake Stock[a]

9
- 9a Aplite: pink; very fine grained; sugary texture; often cut by quartz veins
- 9b Tonalite: white; medium grained; biotite bearing

INTRUSIVE CONTACT

Sandybeach Lake Stock[a]

8
- 8a Quartz monzodiorite to quartz diorite: grey to pink; equigranular to porphyritic (plagioclase phenocrysts); medium grained; hornblende-biotite bearing; foliated
- 8b Quartz monzonite to monzonite: pink; equigranular to porphyritic (plagioclase phenocrysts); medium to coarse grained; hornblende greater than biotite

INTRUSIVE CONTACT

Basket Lake Batholith[a]

7
- 7a Hybrid zone: dioritic to quartz dioritic composition; variable colour and texture; contains numerous xenoliths and shows evidence of stoping and partial assimilation; hornblende bearing
- 7b Quartz diorite: leucocratic; medium grained; equigranular to porphyritic; biotite bearing; massive to foliated
- 7c Quartz monzonite: white to pink; medium grained; equigranular to porphyritic (orthoclase phenocrysts); biotite bearing; massive to foliated
- 7d Granodiorite to granite: white to pink; medium to coarse grained; porphyritic (orthoclase phenocrysts) to equigranular; biotite bearing; massive to foliated
- 7e Tonalite: white; biotite bearing; usually occurs as dikes intruding mafic metavolcanics near the borders of the batholith
- 7f Aplite: pink to grey; fine grained; occurs as dikes within the batholith

INTRUSIVE CONTACT

Melgund Lake Stock[a]

6
- 6a Diorite to monzodiorite: grey to pink; porphyritic (plagioclase phenocrysts) to equigranular; medium to coarse grained; often contains amphibolite xenoliths; hornblende-biotite bearing
- 6b Monzonite: pink to white; medium grained; equigranular to porphyritic; hornblende greater than biotite
- 6c Quartz monzonite: pink to white; medium grained; equigranular; massive to weakly foliated; hornblende greater than biotite
- 6d Granodiorite: pink; medium to coarse grained; equigranular to porphyritic; hornblende much greater than biotite
- 6e Monzonite to quartz monzonite dikes: pink to white; fine to medium grained; hornblende-biotite bearing; intrudes mafic metvolcanics

INTRUSIVE CONTACT

METAMORPHOSED MAFIC INTRUSIONS

5
- 5a Gabbro: dark green to black; fine to coarse grained; equigranular; ophitic to recrystallized textures; hornblende bearing
- 5b Melanogabbro: black; medium to coarse grained; magnetic; equigranular; colour index ≤10; hornblende bearing
- 5c Leucogabbro: pale green to green; fine to medium grained; equigranular; colour index ≥40; hornblende bearing
- 5d Knobby gabbro: contains hornblende porphyroblasts (2 to 7 mm) in a gabbroic to leucogabbroic groundmass
- 5e Plagioclase-phyric gabbro: pale green to black; 1 to 5 percent euhedral to anhedral, white to pale green, plagioclase phenocrysts, up to 2 cm, in a gabbroic to leucogabbroic groundmass; hornblende bearing

INTRUSIVE CONTACT

METAVOLCANICS AND METASEDIMENTS
Clastic and Chemical Metasediments

4
- 4a Wackes: light to dark grey; feldspathic to quartzose; massive to graded; thinly to very thickly bedded
- 4b Siltstones: buff to grey; thickly laminated to thinly bedded; often interbedded with wackes
- 4c Argillaceous to phyllitic schist: dark grey to black, often graphitic; frequently interbedded with wackes
- 4d Ferruginous wackes: brown to rusty weathering; very thickly bedded, often with limonitic streaks and clasts; nil to trace sulphide minerals
- 4e Pebbly sandstone: millimetre- to centimetre-sized quartz and lithic clasts in a sandstone to wacke matrix; usually clast supported
- 4f Mafic wackes: dark grey to black; thinly to thickly bedded, usually massive; hornblende very much greater than biotite; derived from mafic metavolcanics
- 4g Chert: white to cream; very fine grained to cryptocrystalline; occurs mainly as interflow metasediments or with ironstones
- 4h Magnetite-quartz ironstone: laminated to thinly bedded; with or without garnet
- 4j Hornblende-biotite-garnet amphibolite: black with red spots (5 to 10 mm garnets); interbedded with mafic wackes and ironstones; derived from mafic metavolcanics; contains quartz in matrix
- 4k Pyrite-magnetite-quartz ironstone: usually gossany and schistose; sulphide minerals 5 to 60 percent of rock
- 4m Biotite-muscovite-quartz schist: derived from metasediments; fissile to crenulated; contains <10 percent injected granitic stringers and/or quartz veins
- 4n Metatexite: brown wacke paleosome with semicontinuous bedding; contains 10 to 70 percent granitic mobilizate; melanosome either poorly developed or absent; rarely agmatitic
- 4p Staurolite-bearing metasediments: staurolite porphyroblasts (2 mm to 2 cm) developed in wackes, schists, and metatexites
- 4q Conglomerate: angular to rounded clasts of felsic and mafic metavolcanics, quartz, and metasediments in a sandy wacke matrix; unsorted; 5 mm to 30 cm; matrix supported

Felsic Metavolcanics

3
- 3a Flows: massive to laminated; feldspar and/or quartz phyric; white to pale yellow; aphanitic to very fine grained
- 3b Flows: autobrecciated; white to grey; contains chloritic wisps and pods; may retain flow laminations
- 3c Tuffs: thickly bedded to laminated; massive to graded; white to cream coloured; biotitic at higher metamorphic grade
- 3d Crystal tuffs: thickly bedded; massive; white to pink; composed of feldspar and quartz crystals in a quartzo-feldspathic matrix
- 3e Lapilli tuff, lapillistone: heterolithic, commonly with <10 percent combined mafic metavolcanic, metasedimentary and sulphide mineral fragments; white
- 3f Breccia, tuff breccia: heterolithic; commonly contains mafic metavolcanic and feldspar porphyritic clasts in a felsic-tuff to crystal-tuff matrix; usually clast supported; white
- 3g Sericite-quartz schist: pale yellow to white; derived from sheared felsic metavolcanics and felsic dikes; fissile; may contain sulphide minerals
- 3h Sericite-carbonate-quartz schist: brown to yellow green; fissile; contains brown iron carbonate; derived from sheared felsic metavolcanics and felsic dikes; may contain sulphide minerals
- 3j Quartz-feldspar aplitic dikes: white to pink; sugary; fine grained; equigranular; may be pervasively carbonate altered; may contain sulphide minerals (cf. felsite)
- 3k Feldspar-phyric dikes: white to grey; equigranular to porphyritic; fine to medium grained; quartz phenocrysts rare or absent
- 3m Feldspar-quartz-phyric dikes: white, grey, or pink; fine to coarse grained; equigranular to porphyritic; prominent quartz phenocrysts occasionally up to 2 cm in diameter
- 3p Quartz porphyry: white to yellow; small quartz phenocrysts (0.1 mm) in an aphanitic, quartz-rich matrix; may be recrystallized

Hornblende-Phyric Mafic and Intermediate Metavolcanics[b]

2
- 2a Flows: massive; dark green; fine grained; vesicular to amygdaloidal; foliated
- 2b Flows: pillowed; dark green to green; vesicular to amygdaloidal; fine grained
- 2c Flows: plagioclase phyric; 5 to 25 percent anhedral to subhedral, white plagioclase phenocrysts in a dark-green, fine-grained groundmass
- 2d Flows: variolitic; dacitic composition; grey to brown; 1 to 5 mm elongated varioles
- 2e Tuffs: dark green; foliated; feldspathic
- 2f Lapilli tuff, lapillistone: heterolithic; andesitic and dacitic clasts in a fine-grained, dark-green tuff matrix
- 2g Breccia, tuff breccia: heterolithic; light-grey dacitic and dark-green andesitic clasts in a fine-grained, dark-green tuff matrix
- 2h Chlorite-talc schist: green to dark green; foliated; derived from sheared, hornblende-phyric metavolcanics
- 2j Quartz-feldspar-phyric porphyry: dark-grey groundmass with white plagioclase and blue-quartz phenocrysts; biotitic

Mafic Metavolcanics[c]

1
- 1a Flows: massive; green to dark green; fine to medium grained; contains <1 percent plagioclase phenocrysts
- 1b Flows: amygdaloidal; green to dark-green groundmass with large (up to 1 cm) chlorite-serpentine-filled amygdules (black)
- 1c Flows: pillowed; vesicular and amygdaloidal; green; pillows well formed, close packed to amoeboid, with thick selvedges and >10 percent interselvedge material
- 1d Lava tubes: defined as pillowlike structures with > 2 m long axes; amoeboid to mattress shaped
- 1e Pillow breccia, isolated pillow breccia, hyaloclastite: rounded to angular pillow fragments in a green to dark-green matrix; pillow fragments retain chilled margins
- 1f Tuff: green to dark green; massive to foliated; often recrystallized to black, coarse-grained, hornblende phenocrysts
- 1g Lapilli tuff, lapillistone: heterolithic; mafic and felsic metavolcanic clasts in a black to dark-green, mafic-tuff matrix; pyroclastic to epiclastic in origin
- 1h Breccia, tuff breccia: heterolithic; mafic and felsic metavolcanic clasts in a black to dark-green, mafic-tuff matrix; pyroclastic to epiclastic in origin
- 1j Basaltic dikes and sills: fine to medium grained; dark to bright green; very hard; contacts clearly observed
- 1k Amphibolite: fine to medium grained; dark green to black, often banded; recrystallized; derived from mafic-metavolcanic flows and tuffs
- 1m Talc-chlorite schist: dark green; fine grained; fissile; derived from mafic metavolcanics
- 1n Talc-cholorite-carbonate schist: dark green to brown; pervasively iron-carbonate to calcite altered; derived from mafic metavolcanics
- 1p Plagioclase-phyric flows: massive; contains >1 percent euhedral to anhedral, white to green plagioclase phenocrysts in a light to dark-green groundmass ("Leopard Rock")
- 1q Plagioclase-phyric flows: pillowed; plagioclase phenocrysts in pillow cores and selvedges
- 1r Plagioclase-phyric pillow breccia, isolated-pillow breccia, hyaloclastite: retains recognizable plagioclase phenocrysts throughout rock
- 1s Plagioclase-phyric lava tubes: as 1d with plagioclase phenocrysts
- 1t Plagioclase-phyric talc-chlorite schist: derived from plagioclase-phyric metavolcanics
- 1u Plagioclase-phyric amphibolite: contains stretched plagioclase phenocrysts
- 1v Hornblende-epidote xenoliths: dark green; megacrystic; occurs as inclusions in the Sandybeach Lake Stock

sil	Silicified zone
cc	Carbonate alteration

NOTES:

a. Felsic intrusions are separated on the basis of lithology, spatial separation, and style of deformation rather than rock stratigraphy; age relationships are not implied by the order of appearance in the legend.

b. Rocks contain prominent, millimetre-sized hornblende porphyroblasts and phenocrysts.

c. Rocks have no intermediate members, and hornblende phenocrysts and porphyroblasts are absent.

The legend, symbols and abbreviations are for the combined townships of McAree (Map ?528) and MacFie and Avery (Map 2529). Not all units may be found on this particular map sheet.

The letter "C" preceding a code refers to data compiled from existing maps and unpublished maps and reports covering portions of the Melgund Lake area. The letter "D" preceding a code refers to data compiled from diamond-drill logs filed for assessment work credits. The letter "G" preceding a code refers to data compiled from published airborne geophysical maps and maps filed for assessment work credits

Ministry of Northern Development and Mines
Mines and Minerals Division
Ontario

Ontario Geological Survey

MAP 2529

PRECAMBRIAN GEOLOGY

MELGUND LAKE AREA
MacFIE AND AVERY TOWNSHIPS

Scale: 1:20 000

Metres 500 0 1 Kilometre
Mile 1/4 0 1/2 Mile

NTS References: 52 F/9,16
ODM–GSC Aeromagnetic Maps: 1145G, 1146G
OGS Geological Compilation Map: 2443

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CANADA ONTARIO Mineral Development Exploration Minérale

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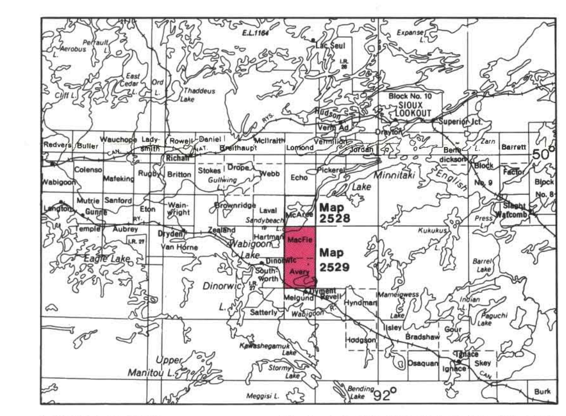

LOCATION MAP Scale: 1:1 584 000 or 1 inch to 25 miles

PROPERTIES

1. Alto–Gardnar showing (1938)
2. Asarco Exploration Company of Canada Limited (1970)
3. Bernier, K., Bernier, M. (1983)
4. Beth–Canada Mining Company (1979); now defunct
5. Sandybeach Lake Syndicate (1940)
6. Kerr Addison Mines Limited (1975)
7. Noranda Exploration Company Limited (1985); Glatz Option
8. Selco Exploration Company Limited (1980); now Selco Incorporated

ABBREVIATIONS

Ag	silver
asp	arsenopyrite
Au	gold
cp	chalcopyrite
gf	graphite
gt	garnet
mag	magnetite
mc	malachite
po	pyrrhotite
py	pyrite
qv	quartz vein
shee	sheelite
sp	sphalerite
tour	tourmaline
Zn	zinc

SYMBOLS

- Small bedrock outcrop
- Area of bedrock outcrop
- Bedding, top unknown (inclined, vertical)
- Bedding, top indicated by arrow (inclined, overturned)
- Lava flow, top in direction of arrow
- Lava flow, dip overturned
- Lava flow, dip unknown
- Foliation, (inclined, vertical)
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- Lineation with plunge, note special designation for fold axis
- Geological boundary, observed
- Geological boundary, position interpreted
- Geological boundary, position deduced from geophysical-interpreted fault
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- MA Magnetic attraction
- 6 Property

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Assessment Files Research Offices, Ministry of Northern Development and Mines, Toronto, Sioux Lookout and Kenora.

Kenora–Fort Frances, Districts of Kenora and Rainy River; Ontario Geological Survey, Geological Compilation Series, Map 2443, by C.E. Blackburn, scale 1:253 440 or 1 inch to 4 miles, 1981, Compilation 1973–1978.

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Palonen, P., Speed A.A. and Huggins, R. 1976. Unpublished map of Sandybeach Lake Area map covering McAree Township, scale 1:15 840 or 1 inch to 1/4 mile.

Sutcliffe, R.H. 1977. Unpublished maps of portions of Avery and MacFie townships, scale 1:15 840 or 1 inch to 1/4 mile.

Geology not tied to surveyed lines.

Magnetic declination approximately 3°06'E in 1986.

Metric conversion factor: 1 foot = 0.3048 m.

CREDITS

Geology by B.R. Berger, D. MacMillan, D. Butler and assistants, 1986.

Cartography by B.L. Aikman, Publication and Cartographic Services, Ontario Geological Survey, 1989.

Every possible effort has been made to ensure the accuracy of the information presented on this map; however, the Ontario Ministry of Northern Development and Mines does not assume any liability for errors that may occur. Users may wish to verify critical information; sources include both the references listed here, and information on file at the Resident Geologist's office and the Mining Recorder's office nearest the map area.

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Information from this publication may be quoted if credit is given. It is recommended that reference to this map be made in the following form:

Berger, B.R., MacMillan, D. and Butler, G. 1989. Precambrian geology, Melgund Lake area, MacFie and Avery townships; Ontario Geological Survey, Map 2529, scale 1:20 000.

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