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Geology of the

Righteye Lake Area

District of Rainy River

1986

Ontario

Ministry of
Northern Development
and Mines

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by
S. L. Fumerton

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FOREWORD

RIGHTEYE LAKE AREA

This area was mapped at a detailed scale. It straddles the Quetico Fault and includes both the sediments of the Quetico Gneiss Belt and the metavolcanic rocks and granitic rocks of the Wabigoon Subprovince.

The Harold Lake Mine and the Elizabeth Mine are former producing gold deposits which may be similar to deposits in the Mine Centre area that are related to shear zones along lithologic contacts. This report provides, along with the forthcoming Calm Lake report, valuable insight into structural and stratigraphic controls on Mine Centre-type gold mineralization.

V.G. Milne
Director
Ontario Geological Survey

CONTENTS

TABLES

FIGURES

PHOTOGRAPHS

GEOLOGICAL MAP

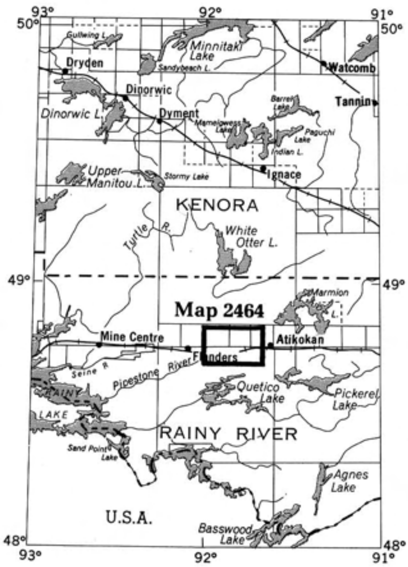

Figure 1–Key map showing location of the Righteye Lake Area. Scale 1:3 168 000 (1 inch to 50 miles).

ABSTRACT

The Righteye Lake area is located 5 km west of Atikokan.

The Quetico Fault separates a sequence of Early Precambrian turbidite-like metasediments in the Quetico Subprovince from Early Precambrian metavolcanic and granitic rocks in the Wabigoon Subprovince.

The metasedimentary sequence south of the Quetico Fault consists of north-facing interbedded wackes and mudstones that grade into each other.

Metavolcanics north of the Quetico Fault are predominantly mafic. Metasedimentary and carbonatized rocks within this sequence are known, but are not common. Several granitoid suites are intrusive into these metavolcanics. The oldest, a diorite to tonalite suite is dominant in the northwestern part of the area, whereas a leuco-tonalite suite, a granitic migmatite suite, and a suite of massive granitic rocks, are dominant in the northeastern part.

Faulting is the dominant structural feature in the area, and may obscure other structural features, especially within the Wabigoon Subprovince where faulting is best developed. Faults commonly trend east, and are located near the Wabigoon-Quetico Subprovince boundary in a narrow zone which contains the Quetico Fault. In the eastern part of the area, northeasterly-trending faults are common, especially in the Wabigoon Subprovince. Such faults are thought to be splay faults related to the Quetico Fault. Major northwesterly-trending faults have been recorded, but are not common.

Gold and copper mineralization occurs in the Wabigoon Subprovince, primarily within the metavolcanics. Two mineral occurrences of economic importance occur in the area. These are the former Harold Lake and Elizabeth Gold Mines.

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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)/ton (short)	20.0	pennyweights/ton (short)
1 pennyweight/ton (short)	0.05	ounce (troy)/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 co-operation with the Coal Association of Canada.

Geology of the Righteye Lake Area
District of Rainy River

by

S.L. Fumerton[1]

INTRODUCTION

The Righteye Lake map area is located about 215 km west-northwest of Thunder Bay and 5 km west of Atikokan. It covers about 310 km^2, and is bounded by Latitudes 48°42'30''N and 48°50'N, and by Longitudes 91°41'50''W and 92°00'W.

The map area is in the Superior Structural Province, which is part of the Canadian Shield. The boundary between the Quetico and Wabigoon Subprovinces passes through the area. The Quetico Subprovince consists of a monotonous sequence of metamorphosed wackes and mudstones which have the characteristics of turbidite. To the north, the Wabigoon Subprovince consists of metavolcanics and minor metasediments that have been intruded by granitoid rocks and then were extensively transected by faults. These rocks have been prospected for gold, copper, and iron with limited success since the end of the last century.

Geological mapping was done using standard pace-and-compass traverses inland, and shoreline traverses along the Seine River and some of the larger lakes. Aerial photographs at a scale of 1:15 840 and 1:50 000 were used in the field for geological mapping. The data obtained from the mapping were transferred to 1:15 840 base maps published by the Forest Resources Inventory series, Division of Lands, Ontario Ministry of Natural Resources.

The Seine River is a major water course. It flows from east to west through the map area. Within the area, this river interconnects a number of small lakes. The elevation of these is roughly 385 m above msl. The surrounding to-

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pography is, on the whole, gently undulating. On a local scale, some steep-sided hills and shallow gorges occur especially where the bedrock is exposed. Such fine scale topographical features tend to follow weaknesses in the underlying rocks. Elevations over the whole area vary from a maximum of 460 m down to a minimum of 384 m above msl.

Glacial deposits are distributed over most of the map area, but are variable in thickness. These deposits are primarily restricted to depressions in the bedrock surface. Nevertheless, a relatively thick moraine trending northwest occurs at Ear Lake and is coincident with a major fault. Furthermore, thick outwash deposits, occur downstream from this moraine. These deposits are located in the Miranda Creek area.

Access

Two major east-west transportation routes cross the map area and provide good access to the southern half of the area. The first route is the Canadian National Railway. It is located close to the Seine River valley, and is south of the river. The second route is Highway 11, which joins Thunder Bay, Atikokan, and Fort Frances. It is located on high ground south of the Seine River valley. Access to the northeastern part of the area is possible from Highway 622 which is outside the map area. The old lumber roads in the area are barely usable. Access is easy using motor vehicle and canoe in the southern and eastern part of the area. In the northwestern part of the area, however, long canoe portages or the use of float planes are required.

History of Previous Work

The first geological accounts of the area were recorded by Blue (1896) and Coleman (1897) who made inspection tours of mines in Northwestern Ontario for the Ontario Bureau of Mines. The first systematic geological mapping in the area was conducted by Smith and McInnes (1897) and McInnes (1899) for the Geological Survey of Canada. Subsequent maps of the area have been compiled by Tanton (1939), at a scale of 1 inch to 8 miles, and Moore (1940) at a scale of 1 inch to 1 mile.

The adjacent Steep Rock Lake area was mapped by Shklanka (1972), Fenwick (1976) mapped the Finlayson Lake area, and Young (1960) mapped the Bennet-Tanner area. The Atikokan-Lakehead Sheet compilation map (Pye and Fenwick 1965) includes the present map area.

Acknowledgments

The author was ably assisted in the field during the 1979 season by D.U. Kresz, Roger Fife, David Foley, and Steven Webster.

Thanks are extended to the staff of the Ontario Ministry of Natural Re-

sources at Atikokan for their cooperation and assistance during the course of the field season.

GENERAL GEOLOGY

The boundary between the Quetico Subprovince to the south and the Wabigoon Subprovince to the north passes through the map area. The boundary is formed by the Quetico Fault. Within the area, the Quetico Subprovince is composed of metasediments, whereas the Wabigoon Subprovince is composed of metavolcanics, granitic rocks, and metasediments.

Metasediments in the Quetico Subprovince consist of a monotonous sequence of interbanded wackes and mudstones that are gradational into each other. Bedding in these rocks is typically between 2 and 100 cm thick. Preserved primary sedimentary features indicate that these rocks comprise a turbidite-like sequence with tops to the north. Such primary structures are evident in the north, but are progressively obliterated southward by metamorphic recrystallization.

Highly sheared polymictic conglomerates occur adjacent to or within the main shear zone of the Quetico Fault. These rocks contain pebbles of granite, chert, highly altered metavolcanics, and a rock type which might be sheared and altered ironstone. Because of the rock types which occur as pebbles, these conglomerates can probably be grouped with the rocks of the Wabigoon Subprovince.

A single outcrop of conglomerate, which occurs on an island in Miranda Lake, is different from the other conglomerate; it is poorly sorted, and contains cobbles, composed mainly of granitic rocks, up to 30 cm in size. The matrix is different, being a very coarse grained arkose; the outcrop may lie unconformably upon intrusive tonalites.

Mafic metavolcanics exhibit a wide range of textural variations over short distances. Dark green tuffs, lahars, pillowed and massive flows are common in most locations, but are generally impossible to correlate along strike. Chemical metasediments consisting of carbonates, interbanded ironstones, and cherts are associated with the mafic metavolcanics. Chemical metasediments are not common in the map area.

Intermediate to felsic metavolcanics show a similar range in textures to that exhibited by the mafic metavolcanics. Light green to off-white tuffs, crystal tuffs, lahars, pillowed and massive flows are common, but compared with the mafic metavolcanics, tuffaceous rocks are more abundant. The tuffaceous rocks and lahars occur mainly in outcrops northeast of Modred Lake. These outcrops, as well as the intercalated mafic metavolcanics, correlate with the conglomerate, arkose, and wacke metasedimentary unit mapped by Moore (1940), Shklanka (1972), and Fenwick (1976). The difference in names may be because the rocks to the southwest are primarily pyroclastic rocks showing a limited amount of hydrodynamic and mechanical reworking, but the rocks to the northeast show a progressive increase in the detrital sedimentary and mechanical reworking components.

Plutonic rocks intrude the metavolcanics to the north in two separate bod-

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

PHANEROZOIC

CENOZOIC

QUATERNARY

PLEISTOCENE AND RECENT

Ground moraine, sand, clay, and organic mud.

Unconformity

PRECAMBRIAN

EARLY PRECAMBRIAN

CATACLASTIC ROCKS

Mafic and felsic submylonite, mylonite, conglomerate pebbles in comminuted matrix.

MAFIC INTRUSIVE ROCKS

Diorite dikes.

Intrusive Contact

FELSIC TO INTERMEDIATE PLUTONIC ROCKS*

MASSIVE GRANITIC ROCKS

Biotite granite, muscovite granite, locally garnetiferous muscovite granite.

Intrusive Contact

FOLIATED AND GNEISSIC PLUTONIC ROCKS

GRANITIC MIGMATITE

Biotite granite, biotite hornblende granite to granodiorite, tonalite, quartz diorite, and migmatite.

LEUCO-TONALITE

Muscovite, chlorite leuco-tonalite, chlorite, muscovite leuco-tonalite, hypabyssal phase.

DIORITE TO TONALITE

Biotite tonalite, amphibole tonalite, quartz diorite.

Intrusive and Faulted Contact

METAVOLCANICS AND METASEDIMENTS

METASEDIMENTS

CLASTIC METASEDIMENTS

Wacke, mudstone, conglomerate, biotite gneiss, amphibolitic, garnetiferous, and schistose rocks.

CHEMICAL METASEDIMENTS

Limestone, interbanded quartz-goethite, quartz-hematite, quartz-magnetite, pyritic ironstones, "paint rock", chert, graphite-bearing rocks.

METAVOLCANICS

INTERMEDIATE TO FELSIC METAVOLCANICS

Flows, tuffs, crystal tuff, sericite schist, phyllite, lahar, pillowed flows.

MAFIC TO INTERMEDIATE METAVOLCANICS

Flows, tuff, chlorite schist, phyllite, amphibolite, lahar, pillowed flows.

*The terminology used here follows the recommendations of the IUGS (Streckeisen 1976).

ies, both of which contain a different suite of rock types. The western body is largely underlain by rocks which form part of a fractionated series, ranging in composition from diorite to tonalite. This series is in turn intruded by massive granitic rocks. The eastern body is composed of four different plutonic rock types: the diorite to tonalite series, found to the west of this body; an occurrence of leuco-tonalite which is largely fault bounded; an inhomogeneous unit of granitic migmatites grading laterally to the northwest into banded granitic migmatites; and massive granitic rocks which intrude the eastern and western bodies.

Mafic dikes have only been recognized in a limited number of locations, and these are exposed primarily in the plutonic rocks. Most dikes are dioritic in composition, but some dikes have been metamorphosed while others have not. Therefore, there must have been at least two periods of dike emplacement.

Various kinds of Pleistocene glacial deposits are found throughout the area. Mainly glaciofluvial deposits occur in the northern part of the map area, and an arcuate recessional moraine is located at Ear Lake. In the southeastern part of the area, glaciolacustrine deposits are common.

Early Precambrian

METAVOLCANICS

The metavolcanics are divided into two main groups; mafic to intermediate, and intermediate to felsic. The division between these was established primarily on the basis of colour, and represents a somewhat arbitrary division of rocks which have a large compositional range. Because of this, the two subdivisions are complexly inter-related and distributed. In the map area, all known occurrences of the metavolcanics lie north of the Quetico Fault in the Wabigoon Subprovince, and form three interconnected belts. The first parallels and is adjacent to the Quetico Fault, the second trends northeast splaying from the first belt into the eastern part of the area. It extends beyond the map area. The third belt trends north-northwest from the Quetico Fault in the central part of the area. It extends beyond the map area.

In contact with the metavolcanics are the diorite-tonalite suite, the leuco-tonalite rocks, the granitic migmatite, and the massive granitic rocks, all of which form part of the Wabigoon Subprovince in the Righteye Lake area. Some metasediments are intercalated with the metavolcanics, and are separated from the Quetico Subprovince metasediments by the Quetico Fault.

Mafic to Intermediate Metavolcanics

The mafic to intermediate metavolcanics are subdivided into a number of different categories depending on rock fabric.

MAFIC TO INTERMEDIATE FLOWS

These outcrops are typically well rounded and massive, but foliated outcrops are common. An alteration zone 1 to 2 cm deep is considerably lighter in colour than the fresher surfaces. On the fresh surface the rock is dark olive-green, greyish green, or black, depending on the grain size and the amount of metamorphic alteration and carbonatization. In the flows, the minerals vary from being aphanitic to 2 to 3 mm in size; generally the finer grained rocks are lighter.

No contact between individual flows was identified, but the division into fine-grained flows (<0.5 mm), medium-grained flows (0.5 mm to 2 mm), and coarse-grained flows (>2 mm), even though arbitrary, is thought to reflect to some extent the grain size of different flows. Some flows could be distinguished from others by the presence or absence of anhedral feldspar phenocrysts. These phenocrysts are rare, and are usually less than 2 mm in size, but some up to 6 mm have been observed.

Pillowed flows are not abundant, but occur throughout the area, and are associated with metavolcanic flows. These pillowed flows are generally deformed so that tops are difficult or impossible to determine. In one locality, small pillows are moderately well preserved and show a compositional zonation. The zonation is marked by an increasing abundance and fusion of ocelli of intermediate composition with increasing distance away from the pillow margins (Photo 1).

Similar ocelli were noted elsewhere in the mafic to intermediate flows, but are sparsely distributed, are unrelated to any obvious structure, and are not common.

Thin section examination of these rocks reveals a highly variable composition which ranges from gabbro to basalt to andesite and to dacite. Furthermore, the state of alteration varies from negligible to completely altered. The principal constituents are plagioclase (up to 30 percent), chlorite (up to 75 percent), epidote (trace to 20 percent), amphibole (up to 60 percent), quartz (up to 15 percent), and clinopyroxene (up to 55 percent). Other minerals which occur in accessory amounts are sphene, zircon, hematite, and opaque minerals. Carbonate and talc occur as widespread alteration minerals in low concentrations. Typically, plagioclase is strongly saussuritized, but in some cases it is possible to determine the anorthite content at about An_{50}. In the more extensively altered rocks, chlorite and epidote commonly occur together in a fine-grained alteration matrix. Also, epidote occurs as poikiloblastic and porphyroblastic grains derived from the recrystallization of matrix material, as alteration products associated with amphiboles, and pyroxene, and mantling some opaque minerals. Recrystallized blades of chlorite also commonly occur aligned parallel to the foliation in the rock, and cut the fine-grained alteration matrix as well as amphibole crystals and grains of plagioclase and clinopyroxene. The amphibole is usually actinolite and in most cases is altered to chlorite, commonly poikiloblastic, and in some instances form pseudomorphs after clinopyroxene. Quartz appears to occur in two modes; in small clusters commonly interstitial to larger amphibole and epidote grains, and as small inclusions within poikiloblastic amphibole grains. Clinopyroxene, when present, is a major constituent of the rock and is commonly fragmented, strongly altered, and mantled by amphi-

OGS 10 476

Photo 1–Zoned pillowed flows. The margins are composed of massive aphanitic mafic rock (darker material). One to 2 cm from the pillow margins occelli of intermediate composition occur, and these increase in size and abundance towards the pillow core.

bole. The general appearance of the clinopyroxene suggests that it is a primary constituent of these rocks.

MAFIC TO INTERMEDIATE TUFFS

Tuffs were distinguished from flows by the presence of faint and irregular colour banding, strong foliation, and in some cases by the presence of small rock fragments (>2 mm) in the fine-grained matrix. The tuffs are generally lighter, but do have the same colour range as the mafic to intermediate flows. These mafic to intermediate tuffs are usually thin units (<100 m) which are intercalated with the flows, and are difficult to trace along strike.

Thin section examination shows that the mafic to intermediate tuffs are extensively altered to carbonate, epidote, chlorite, and quartz; actinolite occurs as porphyroblasts set in a highly altered matrix. In some samples, hornblende occurs in the cores of the actinolite porphyroblasts. Examination of thin sections indicated that primary textures could not be identified.

CHLORITE SCHIST, PHYLLITE, AMPHIBOLITE, AND LAHAR

Chlorite schists and phyllites are very common in the Righteye Lake map area. These rocks are most abundant in the vicinity of the Seine River which is largely coincident with the Quetico Fault. These rocks are distinguished from the mafic flows and tuffs by the pronounced schistosity present, and are gradational into mafic submylonites derived from mafic metavolcanics. Generally, such rocks were classified as chlorite schists and phyllites rather than as submylonite if no obvious related structure or lineament occurred in the vicinity of a schistose outcrop. Typically, the rocks have a highly etched outcrop surface, are dark green, and have a waxy lustre on cleavage surfaces, as well as having a waxy to soapy feel.

Amphibolites are uncommon and are largely restricted to isolated outcrops in the northern part of the metavolcanics near the contacts with foliated and gneissic plutonic rocks. Most amphibolites are dark green and medium to coarse grained and are massive. However, in some exposures a weak foliation may be observable.

Several exposures close to the Seine River are classified in this report as lahars, but may be agglomerates. These rocks contain numerous polymictic fragments which are angular or rounded, and some show an alteration zonation which suggests that some fragments had undergone alteration prior to re-lithification (Photo 2). All fragments are volcanic in origin and range in composition from felsic to mafic, and are set in a dark green fine-grained matrix.

CARBONATIZATION

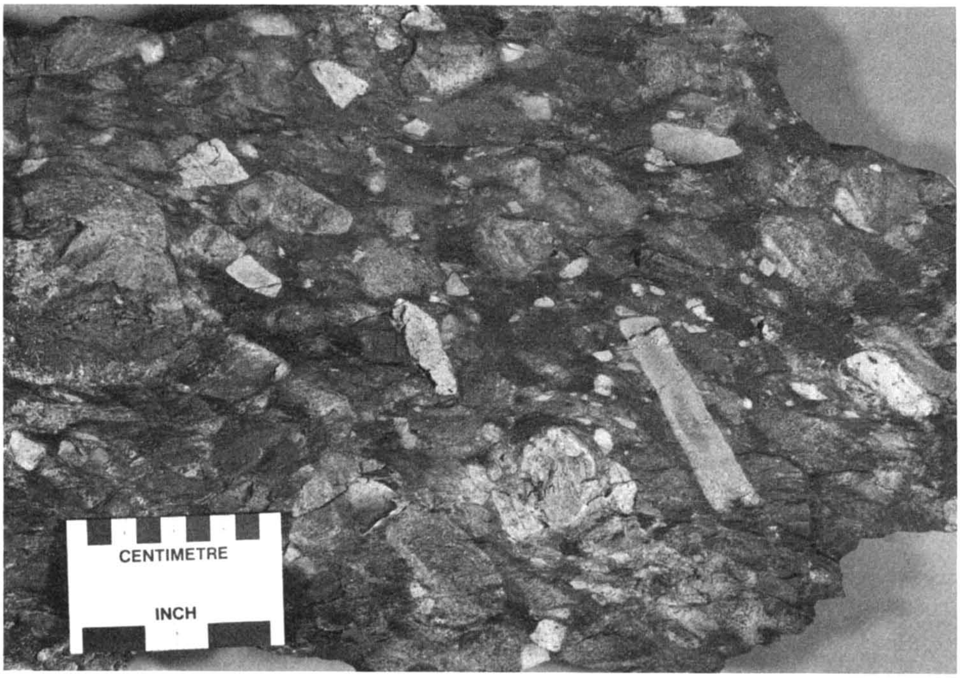
Close to the Seine River are a number of outcrops composed of a mixture of highly altered mafic tuffs and variable amounts of carbonate. These outcrops are deeply pitted, and the carbonate exhibits a rusty brown surface alteration.

Thin section examination shows that at least two generations of carbonate exist in these rocks. The earlier generation of carbonate consists of dirty brown microscopic grains. In one thin section, this material was observed to have a trachytic-like texture, and presumably represents a ghost texture derived by the complete carbonatization of some pre-existing volcanic rock. The second generation of carbonate is also formed of microscopic grains, but is off-white and fills voids left by the fragmentation of the first generation carbonate.

Such carbonatization appears to be spatially associated with zones of intense shearing related to the Quetico Fault.

CHEMICAL COMPOSITION

A total of nine metavolcanic samples were analyzed for their major element composition (Table 2), of which two were classified as intermediate to felsic in composition. The remaining seven were classified as mafic to intermediate in composition.



OGS 10 477

Photo 2–Mafic lahar. Angular clasts of assorted metavolcanic rock types are supported by a matrix composed of reworked mafic metavolcanic material in this lahar.

The limited data reported here confirms the original classification of the metavolcanics into mafic to intermediate and intermediate to felsic subunits. Furthermore, the intermediate to felsic rocks appear to have a calcalkalic affinity, whereas the mafic to intermediate rocks have a tholeiitic affinity, according to the criteria given by Irvine and Baragar (1971).

Intermediate to Felsic Metavolcanics

The intermediate to felsic metavolcanics are subdivided into a number of different categories depending on the dominant rock fabric.

INTERMEDIATE TO FELSIC FLOWS

Two different rock types occur that have been grouped in this subdivision. The most distinctive, but uncommon, rock types are the felsic flows. These rocks are off-white, grey, purple, and black. The felsic flows are typically angu-

TABLE 2 | MAJOR COMPONENT AND TRACE ELEMENT COMPOSITION OF SOME METAVOLCANICS IN THE RIGHTEYE LAKE AREA.

Field Number	F201	F205A	F208	F297	F464	F485	F564	F575	F667
Sample Number on Map	1	2	3	4	5	6	7	8	9
				Major Components in Weight Percent					
SiO_2	64.0	49.9	48.9	49.1	48.6	49.4	48.1	43.9	74.0
Al_2O_3	16.8	14.5	14.3	13.3	15.6	12.5	11.2	13.6	14.1
Fe_2O_3 *	5.73	13.0	9.48	17.1	11.0	17.0	8.63	17.8	2.34
MgO	2.05	6.03	10.3	5.30	7.31	5.77	11.6	6.68	0.45
CaO	5.27	11.2	13.1	8.52	8.71	5.85	10.4	11.4	1.39
Na_2O	2.31	1.98	1.62	1.70	1.56	3.70	3.41	2.49	4.07
K_2O	1.48	0.92	0.41	0.24	0.00	0.00	0.15	0.04	2.02
TiO_2	0.66	1.22	0.45	1.78	0.83	1.25	0.58	2.16	0.23
P_2O_5	0.14	0.04	0.02	0.09	0.06	0.10	0.30	0.08	0.03
H_2O	0.10	0.20	0.18	0.21	0.25	0.25	0.17	0.20	0.03
CD_2**	0.14	0.52	0.19	0.10	2.56	1.50	3.77	0.12	0.99
S**	0.01	0.05	0.05	0.07	0.04	0.01	0.16	0.15	0.03
L.O.I.	2.3	1.7	2.4	2.9	6.7	4.5	6.2	2.5	2.1
TOTAL	100.8	100.6	101.1	100.2	100.6	100.3	100.7	100.8	100.7

* Total Iron Expressed as Fe_2O_3.

** Not calculated in total summations.

L.O.I. - Loss on ignition.

Trace Elements in Parts Per Million (ppm)

Field Number	F201	F205A	F208	F297	F464	F485	F564	F575	F667
Sample Number on Map	1	2	3	4	5	6	7	8	9
Field Name from Irvine: and Baragar (1971) Affinity	Rhyolite Andesite Calc-Alk alic	Mafic Flow Basalt Tholei-ite	Mafic Flow Basalt Tholei-ite	Basalt Basalt Tholei-ite	Mafic Flow Basalt Tholei-ite	Mafic Flow Basalt Tholei-ite	Mafic Tuff Basalt Tholei ite	Mafic Flow Basalt Tholei-ite	Felsic Tuff Rhyolite Calc-Alk alic
Ba	310	220	460	90	70	60	160	80	510
Co	18	56	47	54	44	47	42	66	N.D.
Cr	12	242	630	18	307	12	1070	41	N.D.
Cu	19	178	64	260	150	79	66	320	48
Ni	9	58	133	52	98	21	250	151	N.D.
Pb	18	151	23	23	62	9	39	15	31
Zn	66	102	96	152	69	88	92	94	28

N.D. - Not determined

NOTE: Chemical analyses performed by Geoscience Laboratories, Ontario Geological Survey, Toronto.

lar in outcrop and the rock is aphanitic with occasional quartz and feldspar phenocrysts (<3 mm). The intermediate flows are the dominant rock type and are typically light green to greenish grey. This rock type usually is fine grained (<0.5 mm) and is rounded in outcrop.

Pillowed flows have been observed in this unit, but are uncommon, hard to discern, and only occur in the flows that have an intermediate composition.

Thin section examination shows that these flows are largely composed of a fine-grained matrix (<0.2 mm) consisting of the following alteration products: muscovite, carbonate, epidote, and chlorite. Quartz and feldspar are also found in this matrix as well as occurring as phenocrysts. The quartz phenocrysts, where present, have crude square outlines, but have undergone recrystallization, forming subgrains within the original outline with undulose extinction and, in some cases, basal deformation lamellae. The plagioclase phenocrysts, when present, are highly saussuritized, but original myrmekitic textures and compositional zonations are apparent in some grains. The composition of the plagioclase was determined to vary between An_5 and An_{31}.

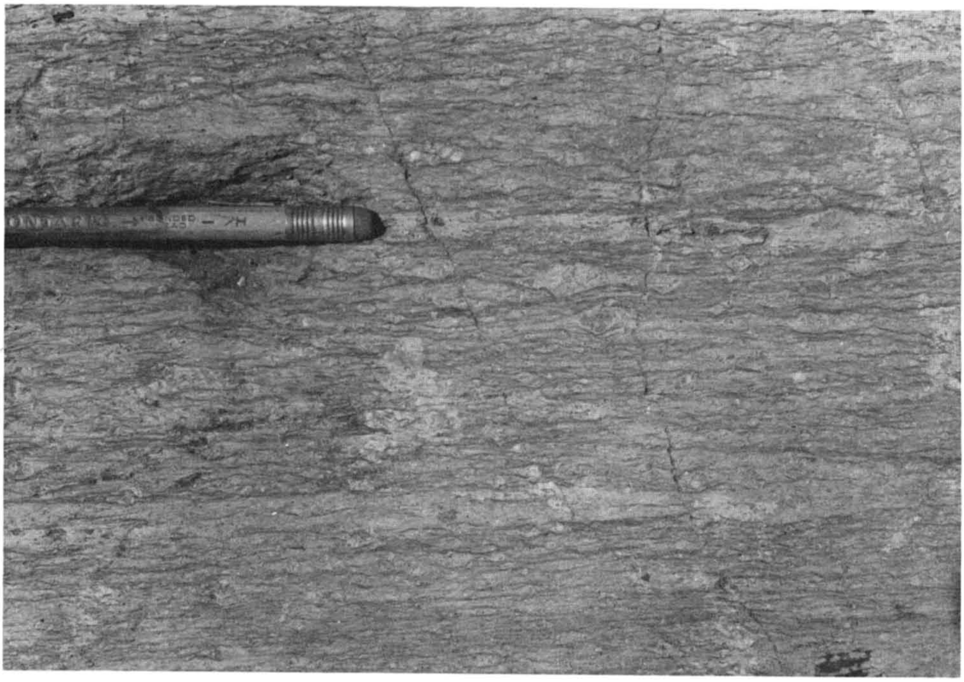
INTERMEDIATE TO FELSIC TUFFS, SERICITE SCHISTS, LAHARS

The intermediate to felsic tuffs are distinguished from flows by the presence of faint irregular colour banding, strong foliation, and rock and/or crystal fragments (Photo 3). The occurrence of lithic and crystal fragments is more frequent in intermediate to felsic tuffs than in the mafic tuffs. These tuffs are more abundant than felsic flows, especially to the northeast of Modred Lake. The tuffs range from off-white to pale green and the matrix grain size varies from fine grained to aphanitic. The maximum size of lithic or crystal fragments is 5 mm. The most common type of fragment is a milky blue quartz, with feldspar and lithic fragment in decreasing order of abundance.

Thin section examination reveals that the rock matrix is composed dominantly of fine-grained (<0.05 mm) quartz and feldspar, with lesser amounts of disseminated muscovite, talc, carbonate, chlorite, and epidote. Apatite and opaque grains occur in accessory amounts. The phyllosilicates occur in wavy lenticular aggregates aligned parallel to each other. Chlorite and epidote tend to be concentrated into bands which are parallel to the rock foliation. The quartz fragments in this unit have recrystallized to smaller subgrains with undulose extinction and the feldspar fragments are composed of strongly saussuritized plagioclase.

Sericite schists are not common in the map area. Where exposed, these rocks are usually intimately related to felsic submylonites. The schists are usually off-white, have a rusty stain, and a nearly perfect alignment of sericite and muscovite which imparts a strong schistosity to the rock.

A number of graded lahars are exposed in the intermediate to felsic metavolcanics which occur to the northeast of Modred Lake. Since some of the larger fragments are rounded, the rock could be classified as a conglomerate (Photos 4 and 5) (after Moore 1940). All the clasts in these lahars are of mafic to felsic metavolcanic material, and the matrix is of intermediate to felsic composition.



OGS 10 478

Photo 3–Felsic tuff with numerous lithic fragments and some feldspar fragments. Deformation of the rock has accentuated the flaser-like texture in this rock.

METASEDIMENTS

The metasediments are divided into two main groups; chemical metasediments and clastic metasediments. The known distribution of chemical metasediments is very limited in the map area. These rocks only occur within the Wabigoon Subprovince and are related to the metavolcanics. Very few outcrops are entirely composed of chemical metasediments; these rocks are subordinate to mafic metavolcanics.

Clastic metasediments underlie the whole of the Quetico Subprovince in the map area, and are separated from the metavolcanics by the Quetico Fault. Within the Wabigoon Subprovince, clastic metasediments are uncommon and highly variable.

Chemical Metasediments

The chemical metasediments have been subdivided into a number of rock types depending on their composition. These are described in the accounts that follow.

OGS 10 479

Photo 4–Graded lahar with large rounded and angular plus smaller angular metavolcanic fragments form this poorly sorted, though graded, outcrop. The roundness of some fragments indicates considerable mechanical transportation has occurred. The rock could also be classified as a conglomerate.

LIMESTONE

The only known outcrop of limestone in the map area is located at the mouth of the Seine River Diversion. The rock is massive, and composed of fine-grained grey carbonate with euhedral pyrite crystals, up to 2 cm, sparsley disseminated throughout the rock. This rock is distinguished from the completely carbonatized metavolcanics by the absence of altered tuffaceous fragments and by the massive fine-grained nature of the rock.

INTERBANDED QUARTZ-GOETHITE, QUARTZ HEMATITE, AND QUARTZ-MAGNETITE IRONSTONES

Two outcrops where these rocks are exposed were examined by the field party; one is at Banning Lake in a mylonite zone and the other is in a railway cut southwest of Tracy Rapids. These two occurrences contain interbanded chert and quartz with hematite and goethite in bands less than 5 cm thick. The

OGS 10 480

Photo 5–Graded lahar in the same outcrop as Photo 4 but lower down the outcrop face. The graded bedding is inverted and has a sharp decrease in clast size with stratigraphic thickness. An apparent hiatus in 'sedimentation' occurred before deposition of the ash rock or mudstone at the base of the outcrop.

chert has partly recrystallized to fine-grained quartz, and where goethite occurs, the elongated grains of goethite define a syntaxial texture which suggests that the goethite is a replacement mineral.

Interbanded magnetite and chert were not observed, but have been reported in a number of diamond-drill logs in the assessment files (Assessment Files Research Office, Ontario Geological Survey, Toronto).

PYRITIC IRONSTONES, 'PAINT ROCK', CHERT, GRAPHITIC HORIZONS

Exposures of pyritic ironstones were observed north of Perch Lake. These rocks are restricted to conformable horizons less than 1 m thick that contain disseminated pyrite (<30 percent) with traces of pyrrhotite, and are part of the otherwise dominantly metavolcanic pile. The rock type is medium grained (1 to 2 mm), and has a thick rusty alteration zone on the weathered surface.

'Paint Rock' is a colloquial term used for a manganiferous rock type which is well exposed in the Steep Rock Iron Mine at Atikokan. This rock type was not identified by the field party, but has been reported in diamond-drill logs. Consequently, the following description has been taken from McIntosh (1972, p.99).

> This manganese-rich rock is soft, earthy to clayey and is grey to black. It consists of a poorly sorted mixture of goethite, hematite, quartz, pyrolusite, manganite, carbonate, and kaolinite. Patches of a soft red dike, and ochreous yellow limonitic earth, containing chert fragments as well as remnant patches of banded chert and ferruginous dolomite, are found engulfed in the "paint rock". Small concentrations of pyrolusite and lenses of hard goethite are less common.

Chert is another rock type that was not observed *in-situ* by the field party, but banded chert has been recorded in diamond-drill logs in the Perch Lake area.

Graphitic horizons, which are less than 1 cm thick and usually less than 1 mm thick, occur commonly with carbonatized tuffaceous rocks associated with banded ironstones. The graphite is sparsely disseminated in rocks which have a strong schistosity, and it is possible that the graphite may have a tectonic origin.

Clastic Metasediments

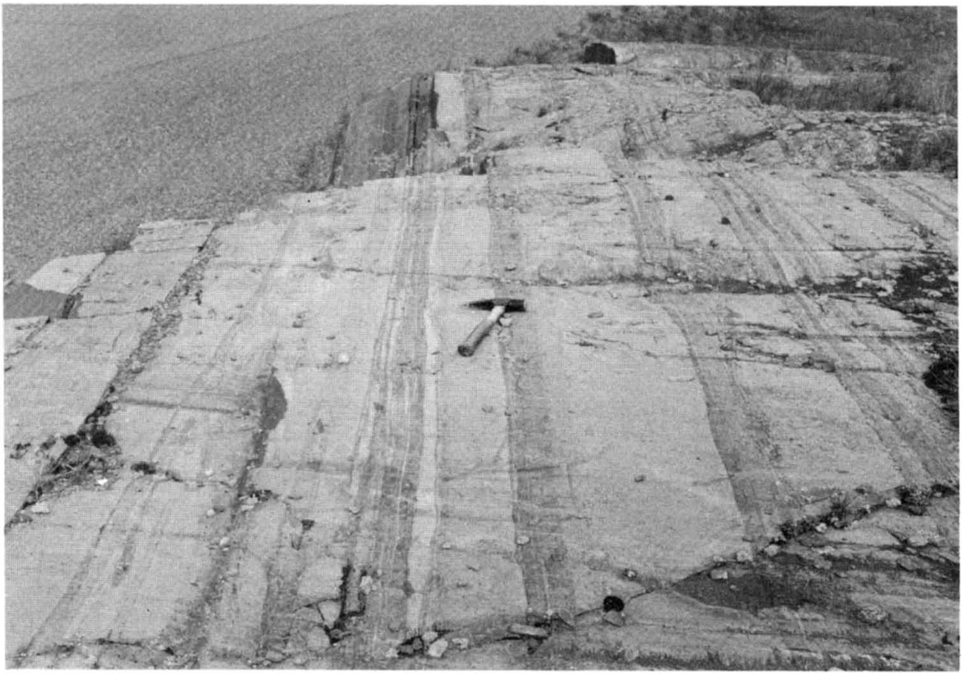
Three types of clastic metasediments occur in the map area. The first and most abundant type is the turbidite sequence of wackes and mudstones which outcrop in the Quetico Subprovince. The second is a polymictic conglomerate, the distribution of which closely corresponds to the main shear zone of the Quetico Fault. The third is another conglomerate which is poorly sorted, and is only known to occur on an island in Miranda Lake.

WACKES AND MUDSTONES

A monotonous wacke and mudstone sequence occurs south of the Quetico Fault and grades into biotite and hornblende gneisses to the south. Typically, the beds are between 2 and 100 cm thick and have distinct bases to wacke beds which grade upwards into mudstones (Photo 6). The ratio of wacke to mudstone is variable; in some instances there is very little mudstone present in the sedimentary cycle, and in other instances there is no wacke component in the cycle.

From the graded bedding in these cycles, the top of the sedimentary sequence is to the north, and therefore the youngest sediments are adjacent to the Quetico Fault. Horizons of massive wackes to arkoses, devoid of any graded bedding and up to 10 m in thickness, occur uncommonly within this cyclic sedimentary sequence.

The wackes are fine to medium grained (<0.5 mm to >2 mm), are inequigranular, with quartz, feldspar, and lithic clasts 2 to 3 mm in size. These clasts form up to 50 percent of the rock set in a fine-grained matrix. The rock is medium grey or greenish grey. Based on thin section and field examinations, these rocks correspond to a subarkosic wacke in a sandstone classification modified by Young (1967). The coarser clasts are subrounded to angular in outline. The quartz clasts have been recrystallized to subgrains, and trails of fine-grained



OGS 10 481

Photo 6–Typical appearance of the wacke to mudstone turbidite-like sequence south of the Quetico Fault. Graded bedding is well developed in this case and the top direction is to the north (left hand side of photo).

quartz locally occur parallel to the foliation. The potassic feldspar and plagioclase clasts are strongly saussuritized, and the only recognizable lithic clasts are chert. Grains in the rock matrix are typically less than 0.05 mm and consist of quartz, feldspar, opaque minerals, and sphene with muscovite, biotite, chlorite, carbonate, epidote, and hematite occurring as secondary minerals. These secondary minerals are of metamorphic origin, and the phylosilicate grains are preferentially aligned parallel to each other.

Cataclastic textures such as milled quartz clasts, pressure shadows, and limited fragmentation of the larger clasts are present in these wackes.

The mudstones are very fine grained, typically less than 0.03 mm, and have a well-developed foliation parallel to the bedding in the rock. The rock is characteristically dark grey. Thin section examination reveals that the rock is composed of small quartz clasts (approximately 0.03 mm), which form up to 10 percent of the rock, set in a matrix of chlorite, quartz, and feldspar. This matrix is laminated, with the percentage of chlorite varying from laminae to laminae.

Thin elliptical lenses of muscovite and chlorite (maximum dimension 40 by 20 by 1 mm) occur within the turbidite-like sequence, and are most notable, but not common, along Highway 11 (Photo 7). These are parallel to the foliation and were formed during the prograde metamorphism of the rocks.

OGS 10 482

Photo 7–Kink folds in the intercalated wackes and mudstone. Kink folds and conjugate kink folds are common in the turbidite-like sequence south of the Quetico Fault. Pencil is approximately 18 cm long.

BIOTITE GNEISS

The wacke and mudstone turbidite-like sequence grades imperceptibly into metasedimentary gneiss towards the southern boundary of the area. The initial stage in this transformation is the recrystallization of the rocks and the preservation of the compositional banding and/or laminae. In the more extensively recrystallized rocks, the compositional banding and/or laminae and graded bedding is obliterated.

The grain size of these gneisses marginally increases to the south of the area with most grains being less than 1 mm. The rock is light buff-brown, with a slight though pervasive rusty stain. In many outcrops, quartz-feldspar veins parallel the foliation in the rock.

Thin section examination reveals that the rock is composed primarily of quartz and feldspar which have a bimodal grain size. The larger quartz grains have well developed undulose extinction and are partly recrystallized to subgrains. The larger feldspar grains are extensively sericitized and recrystallized to a grain size similar to the matrix. The fine-grained matrix is dominated by polygonal grains of quartz and feldspar. Porphyroblastic and poikiloblastic laths of muscovite and biotite occur in the rock and are aligned subparallel and parallel to the foliation in the rock. In samples near the southern limit of the area, biotite laths are cut by subparallel poikiloblastic hornblende grains. Both the hornblende and biotite grains are cut by chlorite laths. Trace amounts of epidote are associated with opaque minerals. Trace amounts of minute garnet grains occur near the southern limit of the map area; these are subhedral and zoned. Other accessory minerals which occur in trace amounts in this unit are apatite, hematite, zircon, sphene, and opaque minerals. Carbonate occurs as an alteration product disseminated throughout the rock in trace amounts.

Near Righteye Lake, hornblende gneiss, too restricted to show on the map face, outcrops close to the area underlain by metasediments. These gneisses might be derived from metasediments. The rock is dark grey, fine grained (<0.5 mm), and relatively massive. Thin section examination shows that the rock is composed of about 20 percent quartz, which occurs as small grains (<0.2 mm) with rounded margins. Plagioclase forms about 50 percent of the rock and is only slightly altered. Hornblende forms about 30 percent of the rock and is loosely concentrated into clusters of ragged grains. Biotite, epidote, sphene, and opaque minerals occur in accessory amounts.

CONGLOMERATES

Only five occurrences of a polymictic conglomerate are known in the map area. From east to west these are located: 1) southeast of Boyce Rapids; 2) on the northern shore of Perch Lake; 3) and 4) two subparallel bands north of Chub Narrows; and 5) west of Chub Narrows. All these occurrences are within, or adjacent to, the main Quetico Fault shear zone. In four of the five occurrences, the rock is so highly sheared and comminuted that the conglomeratic nature of the rock is partly obscured (Photo 8). In the fifth case, the northern most occurrence at Chub Narrows, the degree of comminution is significantly lower. The trend of this band is discordant to the metavolcanic stratigraphy. This might be a result of the conglomerate being located within a faulted block and not being part of a dominant volcanic pile.

The conglomerates probably correlate with the Seine 'Series' which outcrops near Mine Centre.

The largest pebbles in this rock are less than 100 mm in maximum dimension and the smaller pebbles are about 10 mm in size. All pebbles are ellipsoidal, elongated, and are not aligned parallel to the schistosity in the matrix. The largest pebbles are composed of granitic rock and chert, whereas the smaller pebbles are composed of quartz, metavolcanics, and possible ironstones. The matrix is a rusty brown, highly sheared, and comminuted, and has two schistosity directions.

Thin section examination reveals that the metavolcanic and granitic clasts are highly altered. The quartz clasts have a well-developed undulose extinction and have been recrystallized along fractures. The quartz and chert clasts are dislocated along internal shear zones. The rock matrix is composed of quartz, feldspar, chlorite, muscovite, carbonate, and hematite in varying proportions. The phyllosilicates are strongly aligned parallel to the fluxion structure which locally is deflected around the clasts.

OGS 10 483

Photo 8–Highly sheared and comminuted conglomerate. This rock type is only known along the Quetico Fault. Granite, chert and quartz form the only readily recognizable pebbles and the matrix is highly comminuted with two directions of schistosity. Pencil is approximately 16 cm long.

A boulder conglomerate outcrop on an island in Miranda Lake is unique in the map area. The surrounding outcrops do not contain similar or related rocks. The conglomerate is very poorly sorted with clasts forming about 10 to 15 percent of the rock, and are set in a coarse-grained arkose matrix. The clasts range from 10 mm to 300 mm in size, and the larger clasts are well rounded, whereas the smaller clasts range between angular and rounded. Most clasts are granitic in composition, but a few altered metavolcanic clasts were found.

The matrix is composed of angular quartz and feldspar grains up to 3 mm in size. Extensively altered pyrite is disseminated through this matrix, and forms about 10 percent of the rock. In addition, unaltered pyrite occurs in irregular veins and concentrations centred on fractures in the rock.

FELSIC TO INTERMEDIATE PLUTONIC ROCKS

Four different plutonic units have been recognized in the map area and are distributed in two separate bodies north of the metavolcanics. The four units are: 1) diorite to tonalite suite, 2) leuco-tonalite, 3) granitic migmatites, and 4) massive granitic rocks. The diorite to tonalite suite with minor amounts of the massive granitic rocks form the western body, and all four units occur in the eastern body.

Diorite to Tonalite Suite

A continuous gradation exists between the end members of this suite and no contacts between two members of different composition were observed in the area. However, an overall progressive change in the abundance of dioritic to tonalitic rocks occurs with increasing distance from the metavolcanic contacts. In detail, the different compositions appear to be erratically distributed.

Typically, the rock is coarse to medium grained (1 to 5 mm), and is spotty off-white and dark green. The ratio of these colours varies with the composition of the rock. Diorite is dark (colour index <40) and leuco-tonalite is light (colour index >3). Leuco-tonalite differs from tonalite and the other rocks of this suite in that biotite rather than hornblende is the dominant mafic mineral. In most cases the rock is massive or weakly foliated and contains numerous metavolcanic xenoliths.

Examination and point counting of thin sections and stained slabs confirms that this suite exhibits a wide compositional range (Figure 2). The principal minerals are quartz, plagioclase, potassic feldspar, hornblende, and biotite. Quartz is present in every section, tending to occur as interstitial grains in the dioritic and quartz dioritic rocks, and as irregular aggregates in the tonalite. Plagioclase is typically saussuritized and occurs in subhedral grains which may have cyclic zoning. The anorthite content of the plagioclase ranges between An_{25} and An_{40}, and in some cases the original grains have been recrystallized as untwinned and almost unaltered grains. Potassic feldspar, where present, occurs with and without cross hatch twinning, and is noticeably less altered than the plagioclase. Most grains have some granophyric and/or perthitic textures. Hornblende occurs in a variety of forms where present, these include irregular laths, fragmented subhedral grains, and poikiloblastic grains. In most cases, hornblende is altered to epidote and chlorite especially along cleavage traces. Where biotite occurs, it is associated with the hornblende grains or in irregular aggregates, and in some cases is poikiloblastic. Alteration of biotite to chlorite can be extensive. Accessory minerals include sphene, apatite, allanite, zircon, opaque minerals, and epidote; chlorite, epidote, and carbonate occur as alteration products.

Leuco-Tonalite

The leuco-tonalite differs from the other plutonic rocks in that the main occurrence, located between Ear and McIntosh Lakes, is largely fault bounded and that most of the outcrops are composed of a rock characterized by the presence of chlorite, green muscovite, and blue or milky quartz.

This rock is coarse grained and has a maximum range in grain size from 1 to 10 mm, but the range is typically 1 to 3 mm. The rock is massive. Chlorite and green muscovite (? fuchsite) give a green tint to this off-white rock, and the

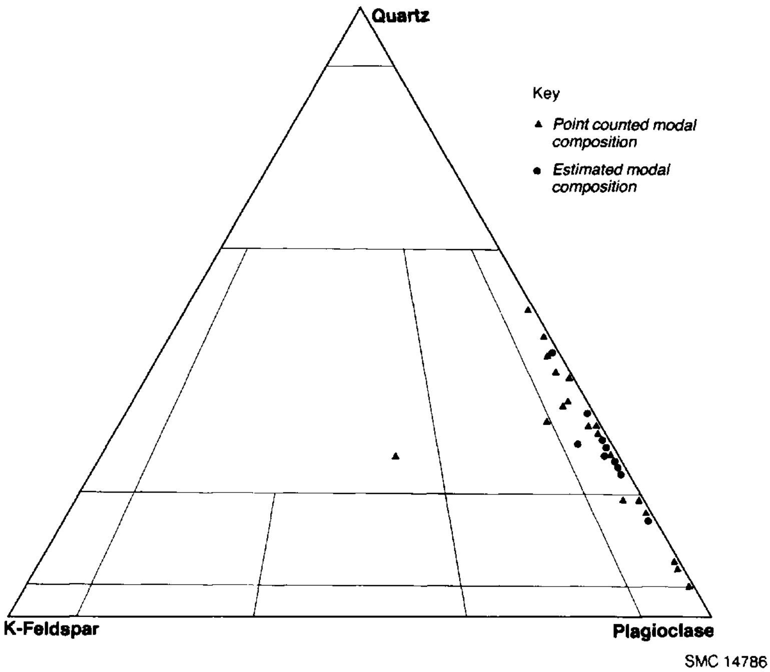


Figure 2–Triangular plot of modal compositions in the diorite to tonalite suite.

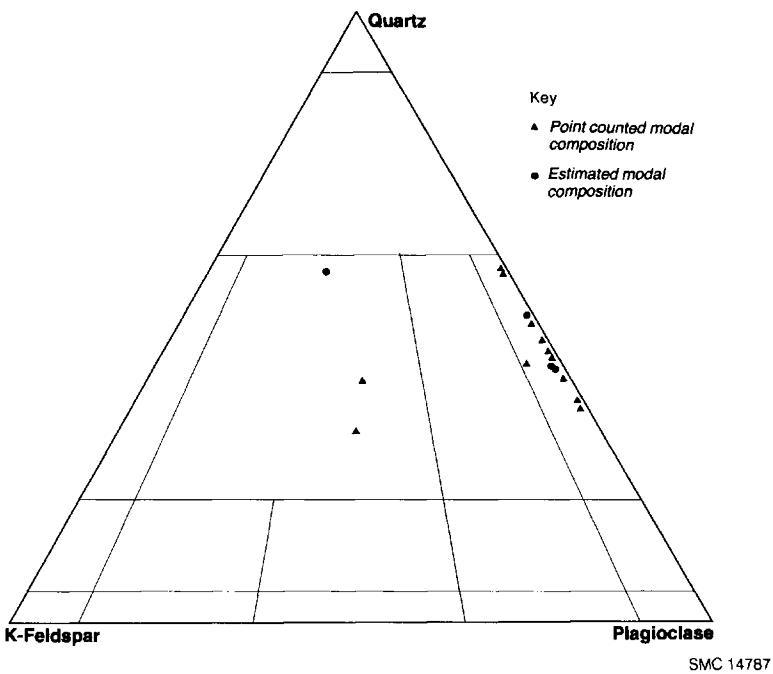


Figure 3–Triangular plot of modal compositions in the leuco-tonalite rocks.

blue and milky quartz grains are conspicuous. Local variations in this appearance do exist, and the most common of these is a dirty brown strongly foliated and flasered appearance which occurs near the shear zones. However, the rock is still recognizable because of the blue quartz grains. Other minor variations are; 1) the presence of a yellow colour to the phyllosilicates, and 2) the absence of the characteristic colouration of quartz and muscovite.

Examination of thin section and stained slabs reveals that most samples have a restricted compositional range (Figure 3). The exceptions to this are not distinguishable in hand specimen, and these samples are notable because they were obtained along lineaments in the main leuco-tonalite body. The major components in this unit are; quartz, plagioclase, muscovite, chlorite, biotite, and potassic feldspar. The quartz tends to occur in irregular clusters in which subgrains and undulose extinction are well developed. In some cases the quartz grains contain numerous minute inclusions and have transgressive trails of fine-grained recrystallized quartz (<0.1 mm). Plagioclase grains are extensively saussuritized with faint indications of zoning in the larger subhedral randomly oriented grains. In some cases, anti-perthitic and myrmekitic textures are present. Muscovite, chlorite, and biotite are concentrated into lenticular aggregates and trails, and the individual mineral laths parallel the lenses and trails. Biotite is partly altered to chlorite. Flame and bead perthitic textures are common in potassic feldspar. This feldspar is slightly sericitized and occurs both with and without cross-hatch twinning. Accessory minerals include allanite, sphene, hematite, apatite, zircon, and opaque minerals; epidote and carbonate occur as minor alteration products.

A small concordant dike, tentatively included in this unit, occurs with a mineral occurrence southwest of Tracy Rapids. In this location, the rock is dirty light grey-brown, and has a granular matrix with grains about 1 mm in size. Within this matrix, are large (<6 mm) blue quartz phenocrysts which are anhedral and make up about 5 to 10 percent of the rock. Thin section examination reveals that a fine-grained ghost trachytic texture exists in this rock. The accicular needles which define this texture are formed of a very fine grained carbonate, plagioclase, and opaque dust aggregate. The quartz phenocrysts are well rounded and contain abundant microscopic inclusions and basal deformation lamellae. Large though fragmented (about 2 to 3 mm) plagioclase grains make up the bulk of the rock. The interstitial mode of occurrence with respect to quartz and the trachytic texture, suggests that the majority of the plagioclase is of secondary origin. Chlorite, muscovite, hematite, sphene, and epidote also appear to be secondary alteration minerals.

Granitic Migmatite

These rocks occur in an area centred on and north of Righteye Lake. This unit has a large textural range. Rocks of different compositions have been included in it. East of Lefteye and north of Righteye Lakes, this compositional variation is characterized by three principal rock types namely; leuco-granite, granite to granodiorite, and tonalite. Compositional variation in this area is not regarded as a result of a fractionating suite, because the unit is more of a heterogeneous mixture of indistinct rock types.

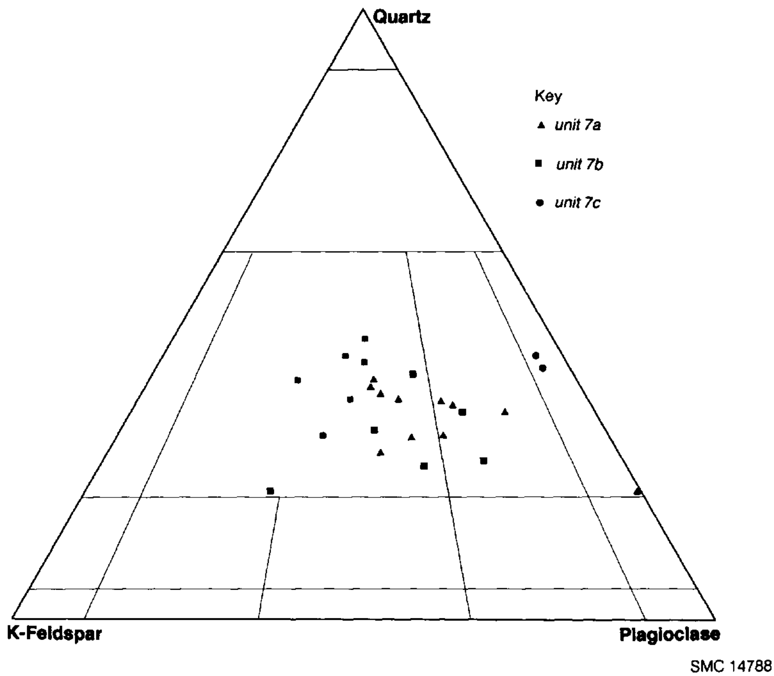


Figure 4–Triangular plot of modal compositions of samples from the granitic migmatite.

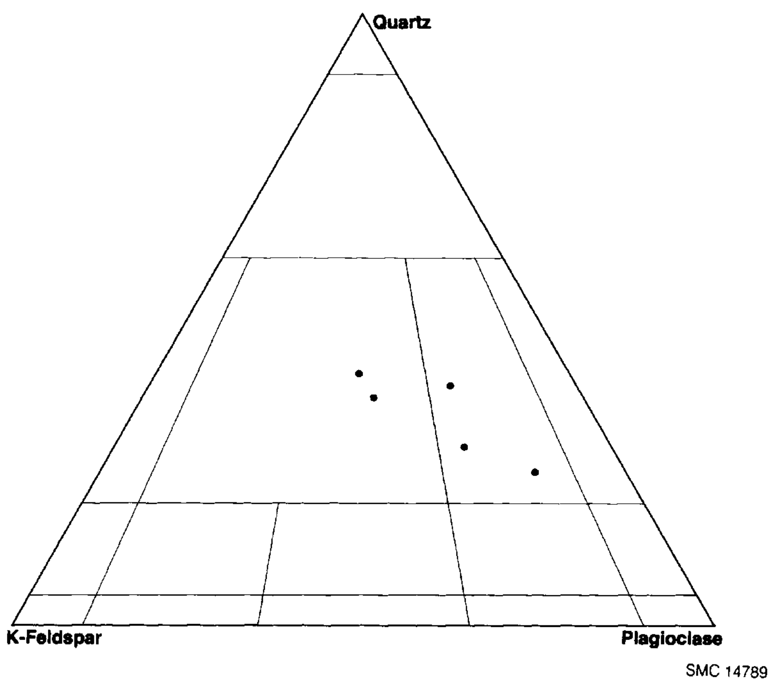


Figure 5–Plot of modal compositions of samples from granitic rocks.

Northwards, these rocks grade into banded granitic migmatites interlayered with amphibolite. The banded material varies from a couple of centimetres to over 2 m in thickness. Concordant and discordant pegmatite veins occur in the bands.

The textural fabric of the three principal rock types in this area range between massive, strongly foliated, and flasered. The colour of these rocks varies between red, pink and off-white, and in some cases, grey where there is a high colour index. There may or may not be a red tint to the feldspars. The grain size is variable and inequigranular because the quartz and feldspar grains range between 10 and 1 mm in size; whereas the mafic grains rarely exceed 2 mm. Rocks which have a higher colour index generally have a finer grain size relative to the more leucocratic rocks.

Examination of thin sections and stained slabs confirms that these rocks have an inhomogeneous composition (Figure 4) and that the quartz-feldspar composition of the rock does not systematically vary with the colour index of the rock. The principal minerals in these rocks are; quartz, microcline, plagioclase, biotite, and hornblende. Quartz occurs in irregular and loosely formed aggregates and varies from relatively undeformed to moderately deformed. Quartz grains have undulose extinction, are polygonized, and recrystallized along grain margins. Microcline where present, usually occurs in grains with negligible alteration to muscovite, and may in some cases show granophyric and perthitic textures. The mode of these grains varies from large (<5 mm) fragmented, subhedral grains to smaller grains in which the margins have been milled by tectonism. Plagioclase has a similar mode of occurrence as the microcline, but the grains vary from slightly to completely saussuritized. Myrmekitic and antiperthitic textures are present, but are uncommon and the anorthite content varies between An_{17} and An_{23} with some irregular zoning. Biotite laths have an irregular outline and are randomly oriented. In most grains, moderate to extensive alteration to chlorite occurs. Hornblende, where present, occurs in anhedral poikiloblastic grains. Accessory minerals include allanite, apatite, epidote, zircon, and opaque minerals.

Massive Granitic Rocks

Massive granitic rocks intrude earlier phases of the granitic migmatite at Righteye Lake. The unit is subdivided into three categories. The first is the most common and is biotite granite. The second is a muscovite granite, and the third is a muscovite garnet granite not shown on Map 2464, back pocket. The latter two types are similar and probably related to each other, but are not related to the biotite granite.

Biotite granite is coarse grained (1 to 3 mm), and varies from off-white with green tints through pink to red. In most places the rock has about 20 to 30 percent quartz, 40 to 50 percent potassic feldspar, 20 percent plagioclase, and less than 5 percent mafic minerals. Biotite is the principal mafic mineral, but hornblende and magnetite are also present.

The muscovite-bearing granites are typically off-white with uncommon pink tints. The mineral grains are inequigranular and highly variable in shape, even within a single outcrop. Quartz and feldspar grains range from 0.5

mm to 10 mm in size, whereas the mafic minerals rarely exceed 2 mm in size. Examination of thin sections and stained slabs reveals that the composition of these rocks range between granites and granodiorites (Figure 5). Quartz occurs in irregular aggregates which are locally recrystallized to very fine grains along the margins of the larger grains. Microcline with perthitic and granophyric textures are common and most grains are extensively recrystallized. The mode of occurrence of plagioclase is similar to that of microcline. Muscovite is the main mafic mineral and occurs in highly irregular grains which are locally replaced by chlorite. Epidote and garnet are associated with muscovite in the muscovite garnet granite, which is otherwise the same [muscovite garnet granite not shown on map].

MAFIC INTRUSIVE ROCKS

Diorite Dikes

A few mafic dikes have been recognized in the map area, primarily because these rocks have cross-cutting relationships. In most cases, samples from these dikes are practically indistinguishable from the mafic metavolcanic flows and amphibolites. In one example a distinctive rock type, however, forms a small dike. The rock has a fine-grained dark green matrix in which euhedral magnetite crystals and anhedral pyrite crystals occur. The magnetite grains are up to 1 mm in size and form 5 to 7 percent of the rock, whereas the pyrite grains are up to 2 mm in size and occur in trace amounts.

CATACLASTIC ROCKS

Cataclastic textures have been observed in most units in the map area. Submylonites as well as mylonites are common. Most of these mylonitic rocks are located along shear zones related to the Quetico Fault. The cataclastic rocks have been subdivided into three categories; mafic submylonite to mylonite, felsic submylonite to mylonite, and conglomerate pebbles in a comminuted matrix. All three categories have equivalent rock types in the non-cataclastic units. The mafic submylonite to mylonite corresponds to chlorite schist in the mafic metavolcanics and the schistose metasediments depending on the adjacent host rock type. The felsic submylonite to mylonite corresponds to the sericite schist in the intermediate to felsic metavolcanics and have also been derived from the intrusive plutonic rocks. The conglomerate pebbles in a comminuted matrix correspond to the polymictic conglomerate.

These cataclastic rocks occur in an astomosing shear zones that range from 1 mm to tens of metres thick. The lenticular pods within these shear zones are relatively undeformed. The reason that the mylonitic nature of these rocks has been stressed is to emphasize the length, thickness and trend of the sheared rocks.

OGS 10 484

Photo 9–Trough crossbedding in glacio-fluvial deposits which are overlain by a thin veneer of probable reworked or glaciolacustrine deposits. These deposits are exploited for road ballast.

Cenozoic

QUATERNARY

Pleistocene and Recent

During the Wisconsinan glaciation (Zoltai 1965; Tucker, geologist with Ontario Geological Survey, personal communication 1980), continental ice sheets deposited a discontinuous cover of glacial debris. Glacial striae are common throughout the area and usually there is one set which generally trends 010° to 015°. However, a second set was measured and this generally trends 030° to 040°. The surficial geology was initially mapped by Zoltai (1965) and part of the area was re-assessed by Tucker and Crosbie (geologists with Ontario Geological Survey, personal communication, 1980) who indicated that: in the northern part of the area, glaciofluvial deposits are dominant; and towards the southeast in areas of low lying bedrock topography, glaciolacustrine deposits overlie the glaciofluvial deposits (Photo 9). Trending northwest through Ear Lake, is a small recessional moraine which is separated by about 10 km to the southwest from the main Eagle Lake-Finlayson Lake recessional moraine.

STRUCTURAL GEOLOGY

Structures north and south of the Quetico Fault are different. No units in the map area can be correlated across the fault. For this reason, rocks to the south of the this fault will be treated as part of a different structural domain compared to that north of the fault.

The reader is informed that the major folds described in this section are not plotted on Map 2464, back pocket.

Minor Structures South of Quetico Fault

Throughout the northern part of the metasediments, primary structures in the form of graded bedding within the turbidite like sequence consistently indicate that the younging direction is to the north. In general, these beds strike N070°E to N090°E and dips range from 70°N to 80°S. A strong foliation is present in all outcrops and generally parallels the bedding or compositional banding in the rocks. Locally, the foliation is oblique to the bedding (Photo 10).

This foliation is always orientated anticlockwise to the bedding by 5° to 25°, and is best developed in the wacke horizons. The intensity of this foliation decreases with the grain size and is not common in the mudstone horizon which commonly has a strong foliation parallel to bedding. This relationship has been observed sporadically throughout the metasediments.

Minor kink folds are common in the northern part of the metasediments exposed in the area. These kinks occur singly or in conjugate pairs (*see* Photo 7). The fold axes plunge steeply within the foliation/bedding plane. In some cases, the axes between different sets of kink folds are non-parallel, but probably formed during the same period of deformation. Folding could have occurred at the same time that the Quetico Fault formed.

Minor Structures North of Quetico Fault

In the metavolcanics north of the Quetico Fault, primary structures are uncommon. Two types of rock (lava) have been recognized, firstly pillow lavas which are the most common, and secondly graded lahars which are not common. Younging directions have been deduced from some outcrops which have pillow lavas, but the pillows are generally deformed and their original shapes are distorted. The deduced younging directions are towards the north and the south. In the graded lahar (*see* Photos 4 and 5), which occurs on the northwesterly flank of the intermediate to felsic metavolcanics, northeast of Modred Lake, the younging direction is to the southeast.

The foliation in the metavolcanics is best developed in the tuffaceous rocks and is defined primarily by the parallel alignment of phyllosilicate grains. Clasts within these tuffs are elongated parallel to the foliation. The clasts were possibly transposed by tectonic deformation.

OGS 10 485

Photo 10–Foliation development in the intercalated wacke and mudstones. A foliation oblique to bedding is present locally in the wacke phase but is rarely developed in the mudstone phase of the turbidite-like sequence south of the Quetico Fault. The fly in the upper left of photo is 9 mm in length. The part of the pencil in the upper right of the photo is 14 cm long.

Major Structures North of Quetico Fault

Two major fold structures have been identified north of the Quetico Fault. The largest is a near vertically-plunging structure and the second is a synformal structure having an axis that plunges to the northeast at a shallow angle. The folds are real, but the axial traces of them have not been delineated on the Map 2464, back pocket.

The form of the first fold structure is complicated by faulting and the intrusion of the diorite to tonalite suite at Miranda Lake. Because of this, the fold is described in two parts as follows. The eastern part of the fold has a limb trending southeast from Little Dragon Lake to Arnold Lake. At Arnold Lake, a sharp swing in the trend occurs so that the southern limb trends to the southwest. The western part of the fold is more tightly compressed, but the hinge zone is much larger and has a more gradual swing. The northern limb is outlined by the tonalite-metavolcanic contact from the northern edge of the map area to Miranda Lake. At Miranda Lake, the trend of the rocks continues in a clockwise swing till it is parallel to the Seine River at Banning Lake.

The second fold, a synform, is not readily apparent from an examination of Map 2464, back pocket. This is because of the shallow plunge, but northeast from Modred Lake, a thick unit of intermediate to felsic metavolcanics is exposed with some intercalated mafic metavolcanics. This unit is mantled by mafic metavolcanics. The intermediate metavolcanics are in the core of the synform. Northeast of the map area, clastic metasediments occur within the intermediate metavolcanics (Fenwick 1976). This fold has been recognized by Shklanka (1972) and Fenwick (1976).

Faults

Faults related to, and including the Quetico Fault, are the dominant structural features in the area. Faults unrelated to the Quetico Fault are known, but are of minor importance.

The Quetico Fault is a major regional structure, extending from Lac Des Mille Lacs to the east through the Fort Francis area into Minnesota in the west, a distance of approximately 300 km. Hawley (1930) and Mackasey *et al.* (1974) have postulated a major horizontal right lateral displacement along the Quetico Fault. Within the map area, the fault separates metasediments in the Quetico Subprovince from metavolcanics and minor metasediments in the Wabigoon Subprovince. The main fault which approximately follows the Seine River, is not obvious in the field. In most places, the shear zone associated with the fault is narrow, and it is only east of Boyce Rapids that a thicker anastomosing shear zone is located mainly within metavolcanics. The Quetico Fault appears to have been the décollement zone related to a plumose-arrangement of splay faults that have an arcuate trend to the northeast. Splay faults and lineaments thought to be related to the Quetico Fault form at least two plumose arrangements (Figure 6). The most obvious splay faults include the Rawn and Bartley Faults and come to an apex with the Quetico 'décollement zone' at Perch Lake. The second which occurs in the western part of the map area appears to come to an apex near the western margin at 1 km south of the main fault. Therefore, a largely unrecognized second parallel décollement zone possibly exists south of the main fault. This zone would post date the main Quetico Fault (*sensu stricto*) which is apparently displaced by splay faults apparently related to this second décollement zone. Multiple movement directions, both vertical and horizontal have been inferred from striations and step structures, but were probably formed during the final movement adjustments along these faults. The sense of movement along the splay faults is generally left-lateral (*see* Chub Narrows on Map 2464, back pocket, and Figure 6). Similar displacements have been recorded by Shklanka (1972). These movements are in contradiction to the generally accepted right-lateral displacement of the Quetico Fault. This problem is recognized by the author who can give no explanation.

The Ear Lake Fault is an enigma because to the east it merges with faults related to the Quetico Fault. Its northwesterly trend is anomalous. Reference has been made to northwest-trending faults at Atikokan (Shklanka 1972).

A few prominent northwesterly-trending lineaments transect all lithologies and structures in the map area. These might be related to a major north-

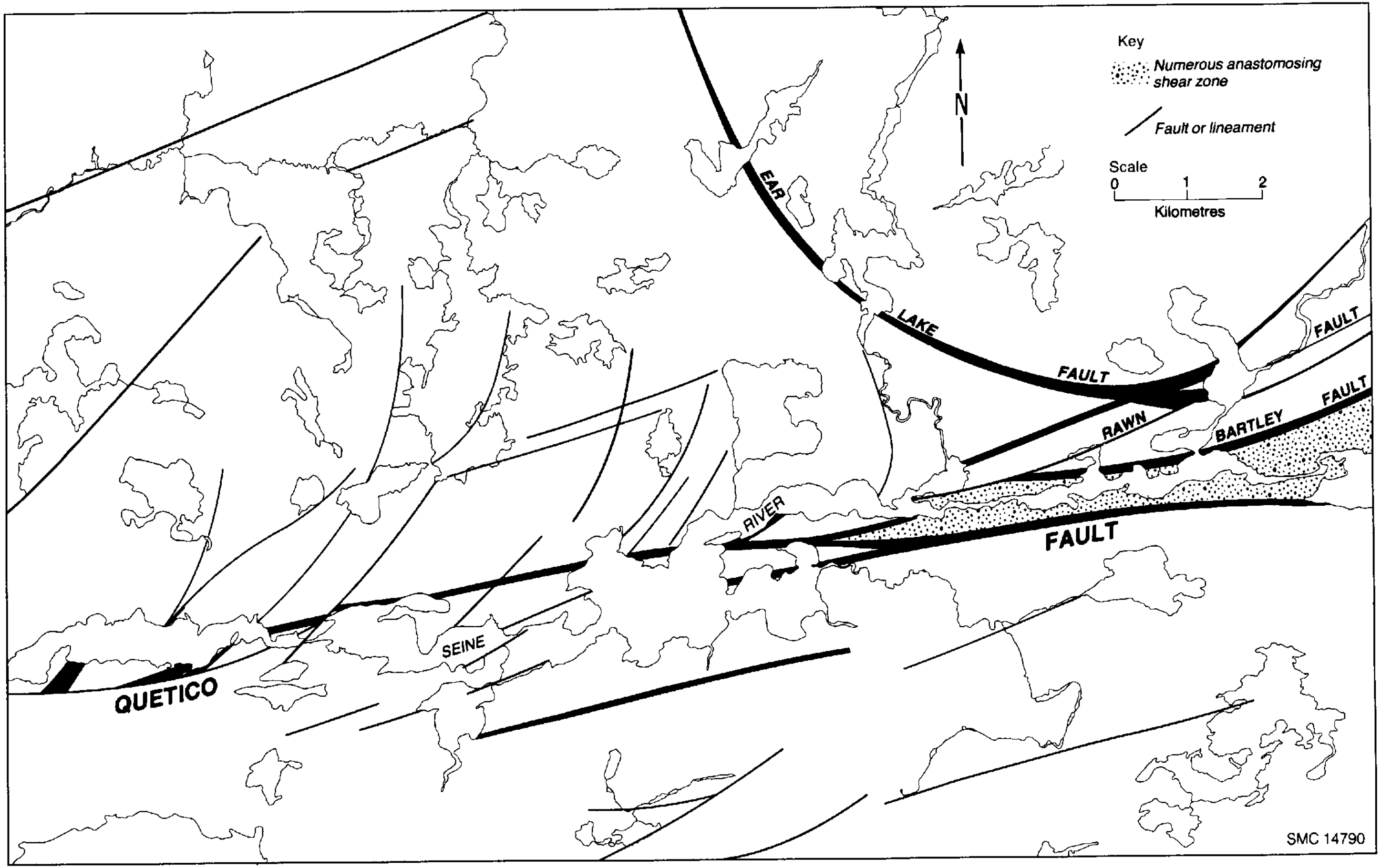


Figure 6–Faults, lineaments, and shear zones related to the Quetico Fault in the Righteye Lake Area.

westerly-trending lineament set recognized in the centre of the Quetico Subprovince (Pye and Fenwick 1965).

Other minor faults and lineaments have been recognized in the map area. These are mainly located in the granitic rocks in the northern part of the map area. None of these minor faults and lineaments are regarded as major structures. The trend of the various sets is variable.

ECONOMIC GEOLOGY

The metavolcanic and plutonic rocks of the Wabigoon Subprovince were prospected for gold in the latter part of the 19th century and the earlier part of this century. Exploration for iron has been restricted to the metavolcanics and was carried out spasmodically since the turn of the century. To date, five gold, numerous iron, and several base-metal occurrences are known to exist in the map area. One asbestos and one talc occurrence are also known. All are associated with the metavolcanics.

Gold

The five gold occurrences consist of the Elizabeth and Harold Lake Mines; and the Law, Rebair, and Ed-Vic Occurrences. All five are associated with quartz veins and shear zones located in the metavolcanics and granitic rocks near to the contacts between the two rock types.

Gold mineralization at the Elizabeth Mine is associated with pyrite, galena, chalcopyrite, and scheelite. Silver mineralization is associated with the gold mineralization. This mineralization is concentrated in ore shoots within discontinuous quartz veins that are located adjacent to, or within northerly-trending shear zones and lineaments. Chalcopyrite, pyrite, sphalerite, and galena are the only minerals known to be associated with the gold mineralization at the Harold Lake Mine. This mineralization is located in several veins of different orientation near faulted contacts between metavolcanics and a leuco-tonalite. This leuco-tonalite is situated adjacent to both the Harold Lake and Elizabeth Mines, and contains a green muscovite which probably is fuchsite. Gold at the Law Occurrence is subordinate to pyrite, pyrrhotite, chalcopyrite, and the accompanying silver mineralization. In the case of the Ed-Vic Occurrence, the gold and silver mineralization is primarily located in ill-defined lenses within a quartz vein. The lenses also carry pyrite and chalcopyrite (Tanton 1927). Nothing has been reported about the nature of the gold mineralization at the Rebair Occurrence.

The gold mineralization at the Elizabeth and Harold Lake Mines is part of a separate ongoing study by the Ontario Geological Survey (Wilkinson 1979). Encouraging gold values have been reported from these two former mines[1], but

[1]Assessment Files, Regional Geologist's Office, Ontario Ministry of Natural Resources, Thunder Bay.

exploration work to date has not delineated sufficient ore to warrant a resumption of mining.

Twenty two selected and non-selected grab samples were collected by the field party from several locations in the map area and were analysed for gold (Table 3). The rock types collected include quartz veins with and without sulphide minerals; banded ironstones containing sulphide or oxide minerals; and iron or copper stained mylonites, metavolcanics, and carbonatized metavolcanics. None of these samples contained significant amounts of gold.

Silver

Four minor occurrences of silver are known in the area. Three are associated with gold mineralization and have previously been briefly discussed (Ed-Vic Occurrence, Law Occurrence, and Elizabeth Mine). The fourth, like the other three, is also associated with quartz veins and is located in the southern part of Modred Lake on the west shore (Table 3, Sample 22).

Ten grab samples collected by the field party were analysed for silver, two of which contained significant quantities (Table 3). One sample came from a trench at the Law Occurrence and the other sample came from the quartz vein at Modred Lake. The silver mineralization in the latter case is associated with chlorite, pyrite, and malachite, and is irregularly and sparsely distributed through the quartz vein. The form of the silver mineralization is unknown. This mineralized vein is part of a limited series of vertical veins that are up to 2 m thick and trend to the southwest under the lake. No record of exploration work exists for these veins.

Iron

Numerous minor metasedimentary occurrences of iron are known in the map area, a result of the exploration that has been carried out in the area since the 1890s. These occurrences are situated in metavolcanics and are unlike the iron deposits that are exploited to the east at Atikokan, for example the Steeprock Iron Mine and the Caland Mine. Shklanka (1972) and McIntosh (1972) gave an extensive description of the geology of the Atikokan ore bodies. The broad stratigraphic sequence of these deposits is basal conglomerate overlain by finer clastics that grade into dolomite and then into the hematite-goethite ore. Overlying these metasediments are pyritic ironstones and an ultramafic tuff (locally known as ash rock).

Pyritic and hematite-goethite ironstone occur within the Righteye Lake area. The full stratigraphic sequence as found at Atikokan is not known to be present in the area. Furthermore, all occurrences are less than 1 m thick except for one occurrence located southeast of Boyce Rapids in which the maximum observed thickness was less than 30 m thick.

Along segments of the Quetico Fault, banded magnetite, hematite-goethite and minor pyritic iron occurrences are adjacent to polymictic conglomerates. Such occurrences are known at Banning Lake and are irregularly distributed

TABLE 3 | TRACE METAL ANALYSES OF SOME GRAB SAMPLES IN THE RIGHTEYE LAKE AREA.

Rock Type	Description	Association	Sample No.	Location	Au oz/ton	Ag oz/ton	Ba PPM	Co PPM	Ca PPM	Cu PPM	Ni PPM	Pb PPM	Zn PPM
Mylonite-schist	Aphanitic, pale-green schistose rock with some pyrite and a strong iron stain.	A felsic metavolcanic transformed to a schist.	10	NW shore of Perch Lake	Tr		460	23	298	60	69	10	32
Banded tuff	Alternating black and green colour in a fine-grained rock.	In an outcrop with sparsly disseminated sulphide-bearing iron-stone band. Associated with samples 2 & 12.	11	NW of Perch Lake.	Tr		40	8	7	6	N.D.	32	82
Mafic tuff	Fine-grained dark green rock with horn-blende, chlorite, and 10% sulphide minerals.	Associated with samples 29 & 11.	12	NW of Perch Lake.	Tr		100	51	74	260	103	59	430
Mafic tuff	Similar to sample 12.		13	NW of Perch Lake.	Tr		40	6	9	38	N.D.	83	106
Carbonate nodule	Medium-grained impure carbonate with 20% chlorite, 10% sulphide minerals and a copper stain.	Associated with felsic tuffs, banded oxide and sulphide iron-stones, schists and wackes, samples 15 to 18	14	W of Tracy Rapids.	Tr		40	55	82	480	106	58	220
Ironstone	1 cm thick bands of goethite and quartz.	See sample 14.	15	" " "	0.01		60	N.D.	22	96	N.D.	44	210
Carbonatized meta-volcanic	Medium-grained grey and white carbonate with a strong iron stain.	" " "	16	" " "	Tr		30	5	13	82	21	117	300
Schist	Dark-green to black schist with 5-10% sulphide minerals and a strong iron stain.	" " "	17	" " "	0.01		60	63	460	390	97	135	550
Meta-wacke	1 cm quartz clasts in a medium-grained greywacke	" " "	18	" " "	Tr		200	39	218	96	65	107	112
Chloritic carbonatiz-ed volcanic	variable between 20-40% chlorite in a medium-grained rock.	Associated with metavolcanic tuffs.	19	SSW of Harold Lake	Tr		30	38	208	134	153	53	96
Tuffs carbonatiz-ed meta-volcanic	Fragmented mixture of carbonate and chlorite with 5-10% sulphide in both phases and a copper stain.	Hetrogeneous consisting of carbonates and tuffs.	20	SW of Modred Lake	Tr		130	53	23	470	72	39	68

Tuff carbonatized meta-volcanic	As for 20.	As for 20.	21	" " "	Tr		120	15	15	104	48	40	45
Quartz vein	Coarse-grained with a patchy distribution of chlorite plus minor sulphide minerals, trace of copper stain and an overall pink stain.	Network of veins in mafic volcanic rocks	22	Modred Lake	Tr	0.13	30	16	12	182	11	45	7
Quartz vein	Fine-grained quartz with lenses of chlorite.	Network of veins located close to and along the granite volcanic contact.	23	Modred Lake	Tr	Tr	30	N.D.	N.D.	N.D.	N.D.	71	6
Quartz vein	Fine-grained quartz with lenses or chlorite and host rock. Some sulphide and a copper-iron stain.	*En-echelon* veins in mafic volcanic rocks. Par of the Law Occurrence.	24	S of Niven Lake	0.01	Tr	90	31	109	6100	50	102	69
Quartz vein	Fine-grained quartz with grey and white bands.	Part of the Elizabeth mine Quartz vein in No. 2 shaft.	25	NE of Modred Lake.	Tr	0.01	50	N.D.	N.D.	190	N.D.	240	17
Quartz vein	Coarse-grained quartz with selvedges of host rock.	A vein from the Rebair property.	26	NE of Modred Lake	Tr	N.D.	80	14	58	6	28	N.D.	52
Mafic tuff	Strongly sheared fine-grained rock with 3% sulphides	Part of the Law showing see Samples 28,29, & 70.	27	S of Niven Lake	Tr	0.24	80	190	550	810	1080	N.D.	40
Mafic tuff	Similar to sample 27 and from the same trench.	" " "	28	" " "	Tr	N.D.	40	45	1650	420	560	20	64
Mafic tuff	Similar to sample 27, and from the same trench but also contains quartz rods.	" " "	29	" " "	Tr	N.D.	20	71	1810	380	500	13	40
Mafic Tuff	Similar to sample 27, but also contains thin quartz veins. From a trench to the northeast of that sampled with samples 27 to 29.	" " "	30	" " "	Tr	N.D.	190	30	580	640	340	32	76
Mafic Tuff	Strongly foliated fine-grain rock with 1% sulphide minerals.	Part of the Law showing.	31	" " "	0.01	Tr	100	54	440	240	113	18	10

between Perch Lake, Boyce Rapids, and west of Tracy Rapids. Three to 10 m of ironstone of variable grade typically occur in these sequences. There is a lack of the carbonate units relative to the Steeprock deposit.

Occurrences of low grade iron oxides associated with significant amounts of 'Paint Rock' cherts, and some ultramafic tuffs (ash rock) are recorded in diamond-drill logs from drillholes put down in the vicinity of Arnold and Garrett Lakes. Otherwise, all known occurrences of iron consist of thin bands (<1 m) of pyrite-rich metasediments and tuffaceous horizons intercalated with metavolcanic flows.

Base Metals

Minor disseminated pyrite, chalcopyrite, and pyrrhotite are widespread throughout the metavolcanics. Along the western margin of the map area, pyrrhotite, chalcopyrite, and pyrite are associated with shear zones and quartz veins within these shear zones. All the sulphide showings in the area between Banning and Niven Lakes are collectively known as the Law Occurrence. Six selected grab samples collected from existing trenches by the field party from the Law Occurrence (Figure 8) were analyzed and some samples contained significant, but low base-metal concentrations (samples 24, 27, 28, 29, 30 and 31, Table 3). The elements of interest include Cu, Ni, Cr, and to a lesser extent Ag.

The carbonatized metavolcanic and banded ironstone sequences which have been explored for their iron mineralization contain traces of base-metal mineralization. In the carbonatized metavolcanic phases, sparsely disseminated sulphide minerals have a dark but indistinct green copper stain on the weathered surfaces. Most of these carbonatized phases are less than 1 m thick and principally contain pyrite with trace amounts of associated chalcopyrite. Five samples from these carbonatized metavolcanics, both with and without sulphide minerals were collected by the field party and analysed (Samples 14, 16 19, 20, and 21; Table 3). The base-metal concentrations in these samples are not considered significantly high by the author and probably represent the original volcanic rock concentrations. Rocks associated with these carbonatized metavolcanics, namely banded goethite and quartz, graphitic schists, and submylonites, do not contain visible base-metal mineralization. Analyses of grab samples collected by the field party (*see* samples 15, 17, and 18; Table 3) contain only trace amounts of base metals.

Base-metal mineralization is also associated with quartz veins explored for gold. The quartz veins in shear zones at the Law Occurrence contain coarse, erratically distributed crystals of chalcopyrite. Otherwise, the only base metal mineralization associated with quartz veins is the occurrence of chalcopyrite, galena, and sphalerite at the Elizabeth and Harold Lake Mines. Allegedly, veins of galena were found in the underground workings of the Elizabeth Mine[1] and locally, scheelite was associated with them.

[1] Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay.

MOLYBDENUM

One occurrence of molybdenite was found within the diorite to tonalite suite at McIntosh Lake. The occurrence consists of a single grain (2 mm) within an otherwise typical rock from this unit. This occurrence may be insignificant, but in conjunction with the occurrences at Eye Lake (Fenwick 1976) and Turtle Lake (Tanton 1927), it indicates that molybdenite is probably widely dispersed within the plutonic rocks surrounding Righteye Lake in trace amounts.

MANGANESE

The so-called occurrence of 'Paint Rock' in the diamond-drill intersections near Arnold Lake, Garrett Lake, and along the Seine River east of Perch Lake[1] suggests that manganese mineralization occurs in the Righteye Lake area. This is because in the Atikokan area, 'Paint Rock' contains significant amounts of pyrolusite, cryptomelane, and manganite (McIntosh 1972). However, large bodies of 'Paint Rock' occur in the open pits at the Steep Rock Iron Mines and Caland Mines (McIntosh 1972). To date, recovery of the manganese from these large bodies as a by-product of the iron has not been practical. Thus, the smaller bodies in the Righteye Lake area are probably of negligible importance as a source of manganese.

TUNGSTEN

Scheelite associated with galena and to a lesser extent gold, has been reported in the underground workings of the Elizabeth Mine (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). This mineralization was not verified during the course of the current mapping.

Non Metallics

Talc and soapstone have been reported by Tanton (1927) and Moore (1940). Tanton (1927) gave the following description:

> On the west shore of Buttermilk lake [Buttermilk Lake is currently called Milk Lake], 3 miles northeast of Banning station, there is a rectangular area, measuring about 400 feet on each side, underlain by a contorted, dark green, chlorite schist believed to be a highly altered, basic, pyroclastic rock. The schist is traversed by a few irregularly disposed aplite seams and lenses with an average width of 6 inches, which follow the beds in the schistosity for distances of a few feet and, in one case, scores of feet. The rock along the margins and beyond the terminations of these seams has been altered to grey soapstone and consists of talc with a small percentage of serpentine. The soapstone merges with both the aplite and the chlorite schist. The largest observed soapstone mass is 25

[1]Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay.

feet wide. It strikes northwesterly from the lake shore and may be safely assumed to have a length of at least 100 feet. Four other irregular, lenticular masses are partly exposed, with maximum known widths of 4 feet and lengths of 12 feet; and there are other small masses.

The soapstone occurrence is on unstaked Crown land and no development work has been done on it. The rock outcrops in this vicinity are sufficiently numerous to show that the dark green, soapstone-bearing schist is of restricted extent. Beyond where the soapstone occurs the schist is visible for only a few hundred feet south and in that direction no soapstone outcrops. Massive pillow lavas and pyroclastics of intermediate composition cut by pegmatite and aplite dikes outcrops around the area underlain by the dark green schist.

Fourteen hundred feet west of the north end of the bay at the outlet of Arnold lake, there is an outcrop of soapstone 4 feet in diameter. Its boundaries are concealed by a thin covering of drift, but no extension of the mass was observed in the numerous neighbouring rock outcrops. The rock assemblage is very similar to that at the previously mentioned soapstone occurrence, 4 miles to the west. The trend of the schistose rocks locally is north 20 degrees west.

The occurrence of soapstone at Milk Lake was not visited by the field party. It appears to be associated with a splay fault from the Quetico Fault which passes through the lake. Furthermore, chlorite schists found associated with this talc, are common in shear zones throughout the map area, but no additional occurrences of talc were found.

Minor occurrences of asbestos have been reported near the margins of a small peridotite body at Niven Lake (Regional Geologist's Files, Ontario Geological Survey, Thunder Bay) but not verified.

Description of Properties

ANDOWAN MINES LIMITED (1)

Andowan Mines Limited holds three patented claims (FF 3419, FF 3420, and FF 3696) immediately southeast of Dog Bay at the eastern boundary of the area. Only part of FF 3696 lies within the map area, most of the ground lies within the Steep Rock Lake area. Shklanka (1972) gave the following description:

A ground magnetometer survey was made of the property and a limited amount of shallow drilling is reported[1] to have been done near the north boundary of the claim group. Slate and iron carbonate were intersected in drill core.

R.R. BROWN [1956] (2)

In 1956, R.R. Brown held 18 claims along the Seine River at Boyce Rapids. Nine diamond-drill holes were put down to intersect rocks beneath the river for a total length of 5273 feet. The rocks intersected were intermediate to mafic metavolcanics, chlorite schists, graphitic schists, carbonate schists (carbonatized metavolcanics), "Paint Rock" and banded ironstones. The rocks are highly

[1]Assessment Files, Resident Geologist's Files, Ontario Geological Survey, Kenora.

comminuted because of their proximity to the Quetico Fault. No mention of the grade of the iron mineralization is given. The ground was open to staking on the 31st August, 1979.

In 1956, R.R. Brown held 26 claims in the vicinity of Garratt Lake. Nine diamond-drill holes were put down, mainly to the south of Garratt Lake, for a total length of 5168 feet. Rock types intersected included chlorite-carbonate schists (? carbonatized metavolcanics), chlorite schists, "Paint Rock", intermediate and mafic metavolcanics, granitic dikes, and banded chert and chert-ironstones. As of 31st August, 1979, this ground was open.

CAMBERTON IRON EXPLORATIONS LIMITED [1953] (3)

The Camberton Iron Explorations Limited held a group of 81 former claims (Numbers FF 6532 to 6613 inclusive) which were located north of Banning Lake at the western boundary of the map area.

In 1947, Mr. R.C. Fummerton and Mr. Cambell found some high grade hematite float north of Banning Lake. In 1952, a geological reconnaissance exploration was carried out on behalf of the owners. During 1953, an aeromagnetic survey was carried out over and north of the claim block held by Camberton Iron Explorations Limited. No further work is reported. The rocks underlying this former claim block are known to consist primarily of mafic metavolcanics with minor felsic to intermediate metavolcanics and some diorites to tonalites.

ED-VIC EXPLORATION LIMITED [1975] (4)

Ed-Vic Exploration Limited held one claim (TB 384211) centred upon an island in Miranda Lake. This property encompassed a gold-bearing quartz vein which was initially discovered by Mr. Marks prior to 1925 and was re-examined by Tanton (1927). After stripping and trenching this vein, Mr. Marks had a number of unspecified samples taken from across the vein which were assayed with discouraging results. Tanton (1927), resampled some lenses within the vein which contained visible pyrite and chalcopyrite with the following results: 2.10 ounces of gold per ton and 3.52 ounces of silver per ton. During 1975, Ed-Vic Explorations Limited cleared the vegetation once again and blasted a number of pits in and around the vein. No assay results were reported.

The quartz vein is greater than 350 feet long, approximately 30 feet wide, has a vertical dip, and trends 115°. Tonalite occurs to the southwest of the vein, and the rocks are sheared along the contact. A large mafic metavolcanic xenolith or roof-pendant occurs to the northeast, and again the rocks are sheared along the contact. Tanton (1927) noted that lenses with pyrite and chalcopyrite are few in number, have ill-defined margins, and have a maximum size of 2 feet by 20 feet. Furthermore, he also noted that the quartz vein is cut by a 10-foot thick lamprophyre dike.

Tanton (1927) recommended further exploration, but the classification of this quartz vein as a gold occurrence is based on the single sample that he collected, the assay results of which are reported above. There is no record of any other assays from this 'occurrence' which have encouraging results.

HAROLD LAKE MINE (5)

Location and Ownership

A former block of nine patented claims located about Harold Lake enclosed the workings of the Harold Lake Mine. These claims were originally held by A.M. Wiley and F.N. Gibbs from 15th October 1890 until 10th November 1936. From 1936 to 1947, ownership changed several times, and in 1947, the claims were forfeited to the crown because of non-payment of taxes. From 1947 until June 1979, the ground has been repeatedly staked by interested parties, and in June 1979, the single claim (TB 433294) which was not in good standing was allowed to lapse. As of September 1979, the ground was open.

History of Exploration

According to Blue (1896), the Harold Lake Mine was discovered after a prospector exploring for iron collected some gold-bearing samples at Harold Lake. Exploration and development work was carried out during 1894, and the mine was in production during 1895 and 1896. Detail of this work is given by Coleman (1897), and the average reported grade of ore passed through the mill was 0.61 ounce of gold per ton. During the period of operation, 1,131 tons of ore were milled and this was worth $11,236 at that time (Ferguson *et al.* 1971). Blue (1896) noted that ore was extracted from the Lake Shore and McComber veins and the Number 1 and 2 drifts (Figure 7). The Lake Shore vein was stoped for about 75 m. The McComber vein was stoped for about 15 m and was between 3 and 6 m deep. According to Blue (1896) and Coleman (1897), the Number 1 drift is about 20 m long and has a 5 m deep shaft; the Number 2 drift is about 40 m long, stoping raised the hanging wall 6 m above the drift, and a 16 m deep shaft has been sunk below the drift.

In 1937 Canadian Longyear Limited optioned this property and did stripping, trenching, and refurbished the old workings. Subsequent to this exploration program, the option on the property was allowed to lapse. After 1947, private prospectors have carried out trenching and blasting, but no results have been reported.

The Harold Lake Mine is included in an ongoing study of gold mineralization by the Ontario Geological Survey (Wilkinson 1979).

The quartz veins containing the gold mineralization are primarily located within a coarse-grained leuco-tonalite that characteristically contains blue quartz and green muscovite (? fuchsite). The contact of this leuco-tonalite with adjacent metavolcanics is known to be sheared in the south, and is probably also sheared in the northeast. Most of the quartz veins which were exploited were not located by the field party. Therefore, details of the geology have been taken from Moore (1940) who remapped the property. Moore used complete plans from Canadian Longyear Limited, at a time when the property was stripped of vegetation. The geology is summarized in Figure 7. Moore (1940) gave the following detailed description:

The geology of the property is somewhat similar to that of the Elizabeth. The veins are along the contact of the Algoman granite and Keewatin greenstone, in the granite, generally along inclusions of greenstone, and in the greenstone in association with dikes emanating from the granite magma. Altogether Longyear performed work on 18 different veins. These are mostly short and rarely can be followed for 100 feet along the strike. Many of them carry little or nothing in gold values.

On the west shore of the lake, in the southeast corner of claim X.219, is a shaft 30 feet from the water, which is reported to be 37 feet deep. A trench runs 100 feet north and 65 feet south from the shaft. Some recent work had been done on this trench, and streaks of quartz from 12 to 15 inches wide occur at intervals along the trench in sericitized granite. This is known as vein No. 1. The vein runs N.30°W. and dips 65°S.W. The shaft has a lower dip, 15 to 20 degrees. Some of the quartz carries much chalcopyrite and some galena. Fragments of quartz near the shaft contain visible gold, chalcopyrite, pyrite, galena, sphalerite, and carbonate. A sample taken by Longyear from the quartz, well-mineralized with sulphides, gave 1.67 ounces of gold to the ton. Other samples gave low values. These minerals extend into the hanging wall, and the quartz lies in a rusty band about 6 feet in width. On a hill of granite rising 40 feet above the lake, southwest of the shaft and at 100 feet from it, there is a stope open to the surface for a length of 75 feet. The vein, No. 2, which seems to have had quite distinct walls and to have been 3 to 5 feet wide, has been stoped out to an apparent depth of 35 to 40 feet. The vein makes a sharp turn to the east and pinches out at the south end, and the north end is concealed. The mill, which has been burned, leaving five stamps as a relic, was situated at the foot of the hill near the southeast end of this vein.

Near the west end of claim X.219, there is an adit driven into a hill of granite, which is partly sheared and altered to sericite schist. The adit is 135 feet long, 4 feet wide, and 5 to 6 feet high; and is driven along a vein that ranges from stringers a few inches wide to a vein 2 ½ feet wide. The adit has not been driven on a horizontal line. At 40 feet from the entrance there is a winze full of water and a little stoping has been done in the adit. The quartz carried pyrite, chalcopyrite, and galena. Samples taken by Longyear at various points along this adit showed values from 0.03 to 0.83 ounce of gold to the ton of quartz.

There is another adit 500 feet southeast of the one described. The vein lies partly in granite and partly along the contact of granite and an inclusion of greenstone. Values obtained by Longyear were 0.10 ounces over 0.4 feet and nil in two other samples.

Directly east of the first adit and 900 feet from it is an old shaft on a small vein. No information is available concerning the depth of this shaft or what was encountered in it.

Near the middle of the east boundary of claim X.219, there is a stripping exposing two nearly parallel veins about 1 and 2 feet wide. These veins can be followed for 150 feet, and they run along an inclusion of greenstone in coarse granite. They are weakly mineralized with pyrite, and assays showed that appreciable values were lacking.

In the southeast corner of claim F.F. 2,650, there are two trenches. One of these runs nearly east-west and is 120 feet long. It is on a slightly mineralized quartz vein, which has a maximum width of 4 feet near the centre and pinches out at the ends. The veins runs along inclusions of schisted and carbonated greenstone. Another trench runs northwest from this one for 700 feet. The first 200 feet show a vein, seldom more than a foot wide, and for the remainder of the distance there is no regular vein, only stringers and small lenses of quartz. The country rock varies from a coarse

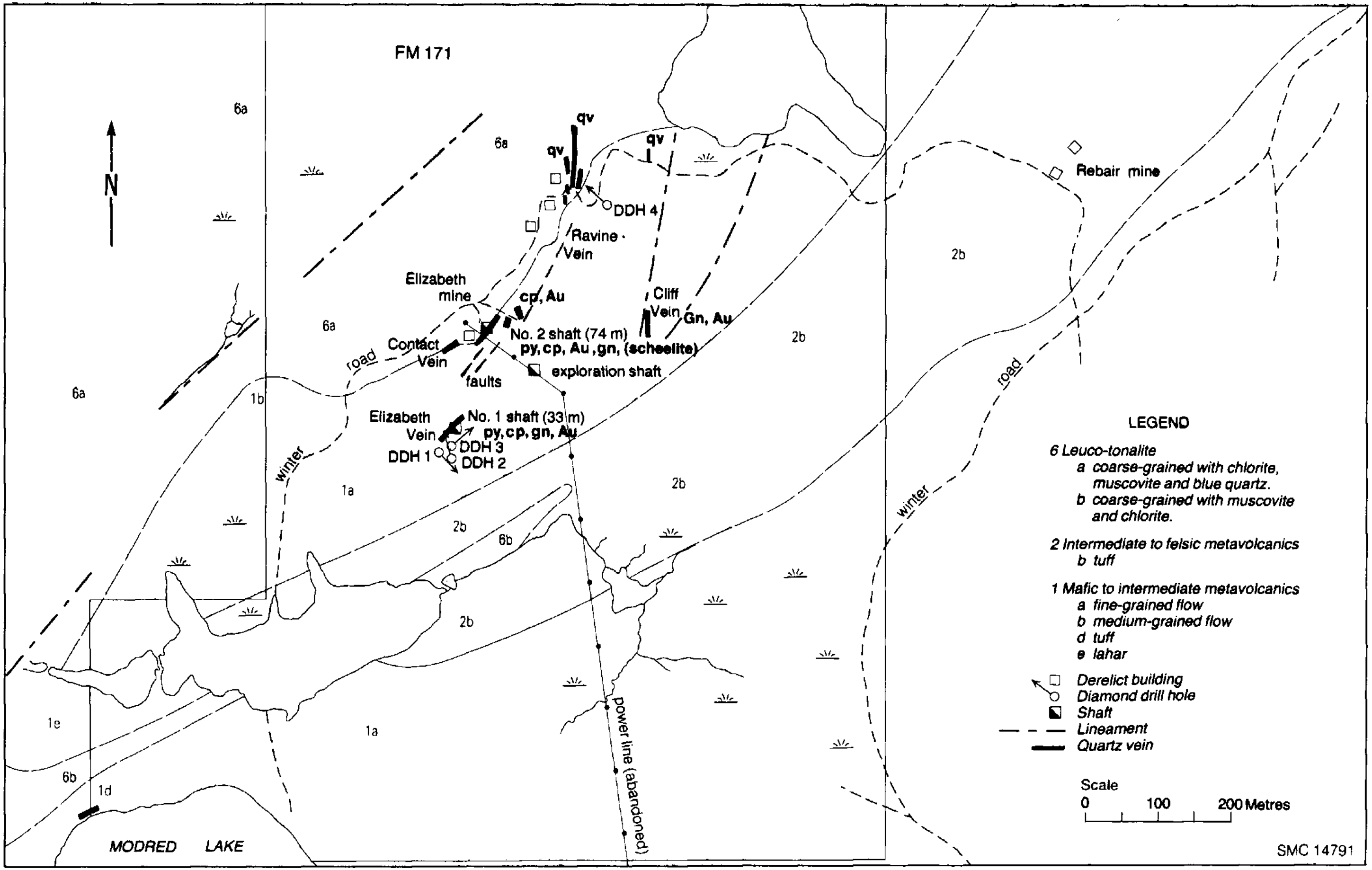


Figure 7–Geological sketch map showing part of the Harold Lake Mine (adapted from Moore 1940).

red granite to a sheared sericitized granite containing streaks of schistose and carbonated greenstone. Values up to 1.20 ounces to the ton across 0.4 feet were obtained from the latter trench by Longyear, but they were low across a mining width. In the same claim and 650 feet west of the first trench described, there is a small stockwork on the west side of a hill of granite. A stripping 50 feet along the foot of the hill, and for 30 feet up the face, exposes a network of stringers and lenses of quartz in a body of squeezed and contorted granite containing inclusions of greenstone. No values were found in this quartz.

On the east boundary of claim F.F. 2,649 and 650 feet north of Harold lake, there is a large stripping on greenstone cut by several irregular intrusions of rhyolite, varying from dikelets a few inches wide to one body 25 feet wide. Associated with these intrusions are numerous stringers and short, irregular bodies of quartz up to 8 feet wide. Stringers of quartz extend across a zone that is 20 feet wide in one section, and in this zone a band of greenstone 10 feet wide is impregnated with ferriferous carbonate and chrome mica. This mica is believed to be mariposite. A small quantity of pyrite is disseminated in the quartz veins and country rock. Longyear found very little gold in these veins, practically none in the west exposure and, except for one sample that yielded 0.47 ounces to the ton across 1.1 feet, nothing of any interest in the east.

The large amount of sampling done on the whole property failed to disclose new ore bodies of commercial importance.

In the area in which the Elizabeth, Harold Lake, and Rebair properties occur, the veins are usually found in or near granite where it has been sheared and chemically altered. They are not far from the greenstone contact and are frequently associated with remnants of greenstone inclusions that have been highly altered. This seems to account to some extent for the small size of the veins. In the greenstone the veins are all associated with intrusions, and their extent is usually limited by the extent of these intrusions. The veins so far found are not in major shear zones or faults, but owe their origin largely to contact conditions resulting from the intrusion of the acid magma into the greenstone. The presence of chalcopyrite is regarded by those who have worked in this section of the Atikokan area as the most favourable indicator for the occurrence of gold.

LAW OCCURRENCE (6)

The Law Occurrence is composed of a number of sulphide showings situated between Banning and Niven Lakes at the western boundary of the area. Since these showings were originally discovered in the twenties, they have been repeatedly staked by various prospectors, and on occasions the property has been optioned to exploration companies. Currently none of the ground is staked.

Tanton (1927) reported that Mr. Law had found the original gold-chalcopyrite occurrence, and exploration work was being carried out by the Law Syndicate in 1929 (Hawley 1930). For the period between 1929 and 1956, no reported records of any exploration being carried out on the occurrence exists. During 1956, Moneta Porcupine Mines Limited carried out a restricted geological mapping and ground magnetic geophysical surveying program (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). In 1956, Cominco Limited carried out geological mapping, a ground electromagnetic geophysical surveying program, and put down three diamond-drill holes for a total length of 500 feet. The holes were sited to intersect the electromagnetic conductors. The mineralized rocks intersected consist of silicified and graphitic zones up to 10 feet thick with massive pyrite, pyrrhotite, and trace amounts of chalcopyrite. These were analysed for copper and gold (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay).

The sulphide showings occur within mafic metavolcanics in the core of a large nearly vertical fold. The form of this fold has been complicated by extensive faulting, and some of the minor shear zones are associated with the mineralization. Minor bands of intermediate to felsic metavolcanic tuffs are inter-laminated with the mafic to intermediate metavolcanics. These metavolcanics are intruded by a number of coarse-grained metavolcanic and gabbroic dikes (Figure 8). In the northern group of trenches [just west of the map area] near Wright Lake the host rocks consist of compositionally banded and homogeneous tuffs which are strongly foliated or sheared parallel to the banding where present. Quartz veins, mineralized with chalcopyrite and pyrite, are parallel to the foliation, but are discontinuous and up to 25 cm thick. The total sulphide concentrations range from between trace amounts to 2 percent. The veins form up to 40 percent of the rock in bands up to 1 m wide. These bands are widely spaced (72 m). In the southern group of trenches (west of Law Lake, Figure 8) some sparsely disseminated pyrite, pyrrhotite, and trace amounts of chalcopyrite occur in bands of highly sheared and altered rock. These shear zones are up to 3 m thick and have some thin unmineralized quartz veins (<2 cm) that parallel the shear zones. Abundant disseminated carbonate occurs throughout these shear zones. Laterally, the shear zones grade into fine-grained basalts.

Assays of the mineralized sections of the diamond-drill core collected by Cominco Limited in general contained only trace amounts of copper and gold (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay).

REBAIR GOLD MINES LIMITED [1940] (7)

A former block of 15 claims located east of the Elizabeth Mine and northeast of Modred Lake in 1937 comprises the currently defunct Rebair Property. The Rebair Gold Syndicate carried out exploration work on a number of quartz veins in 1937. The Rebair Gold Mines Limited sunk a 110-foot deep shaft, completed 1100 feet of diamond drilling, and 650 feet of trenching by 1940. No results from this work have been reported, and no subsequent exploration is known to have taken place.

The current mapping program indicates that all the exploration work was conducted in intermediate to felsic metavolcanics consisting primarily of crystal tuff, tuff, and lahar. Evidence of the development work reported was not found during the mapping other than some small trenches which contain very small quartz veins. Therefore, the following description by Moore (1940) is the most detailed description available:

> The Rebair camp is situated on the main body of greenstone where it is cut up by a great many small intrusions of granite and porphyry. A band of Steeprock conglomerate, lying in a small syncline in the greenstone, cuts across the south end of the property, and small patches of conglomerate, cut by granite, may be seen near the west side of the camp. The greenstone at many places is cut by irregular dikes and small stocks of porphyry. The strike of the country rock is generally northeast-southwest, and in some places the dikes follow the strike of the schistose greenstone but in many places disregard the major trend of the country rock. The porphyry ranges from distinct orthoclase porphyry to a fine-grained granite or to a rock approaching a dacite porphyry. In some cases the phenocrysts have been crushed and drawn out, indicating that the intrusions were squeezed after cooling. The feldspars are sericitized. Quartz stringers and small veins form a network in some of the porphyry bodies, and carbonate is scattered through much of the quartz. These

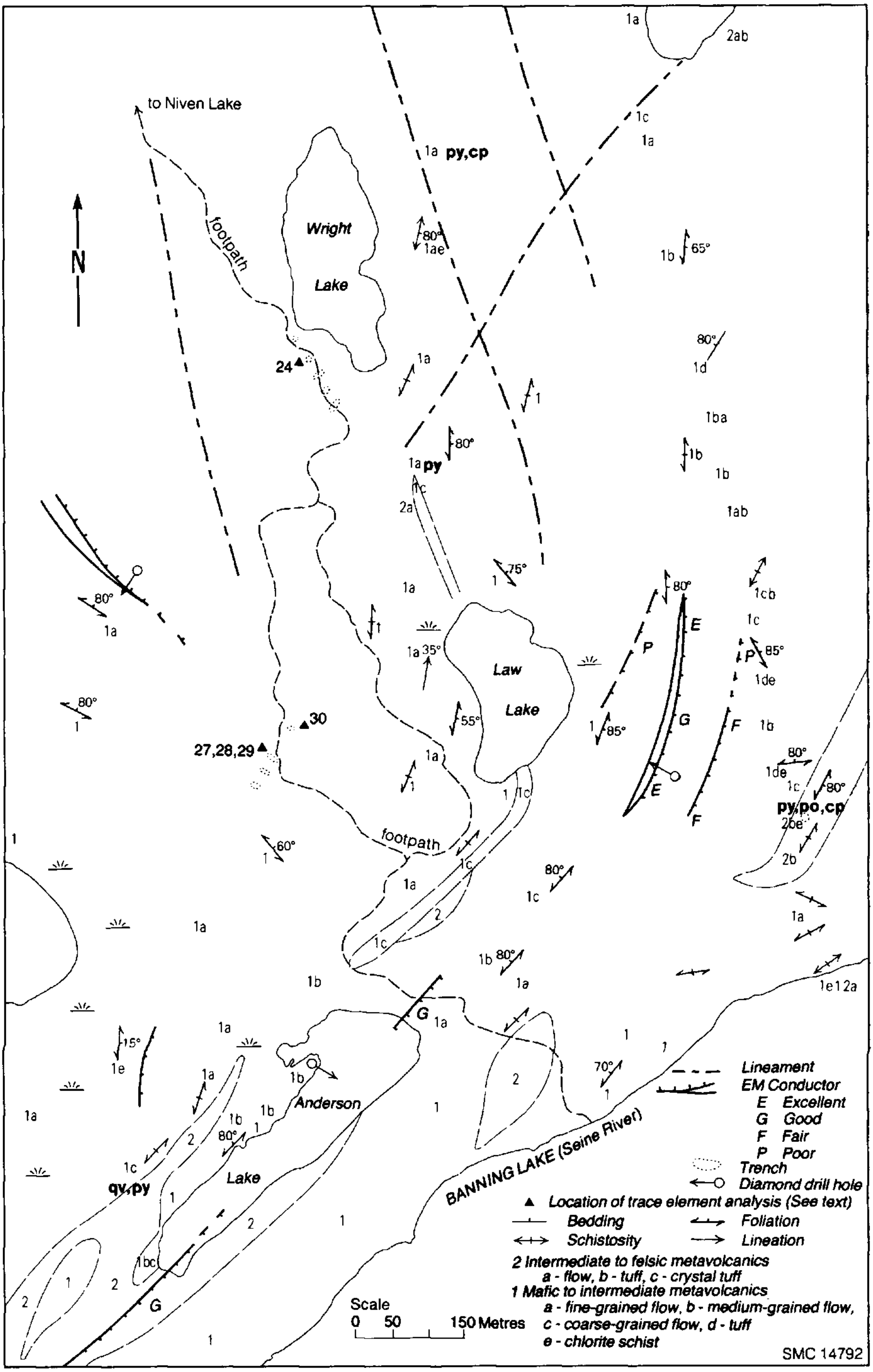


Figure 8–Sketch map of the Law Occurrences. Information obtained from field work and assessment work held on file in Resident Geologist's Files, Ontario Ministry of Natural Resources, Kenora, and in the Assessment Files Research Office, Ontario Geological Survey, Toronto.

intrusions are mineralized with disseminated pyrite, and chalcopyrite occurs in small quantity in some of them.

A rock trench, 40 by 8 feet in area and 4 feet deep, runs northwest from the middle of the south boundary of claim F.F. 2,614. In this trench three dikes of feldspar porphyry, ranging from 2 to 10 feet in width, intrude the greenstone.

The porphyry contains pyrite, disseminated and in streaks and blotches, and the rock is cut by stringers of quartz with carbonate. Some 45 feet northeast of this trench is another trench 95 feet long, running parallel to the schistosity in the greenstone. Scattered along the trench for about 40 feet are lenses and streaks of quartz, up to 20 inches in width, in the schist. In one section, small quartz veins occur across 3½ feet. Across a small swamp to the northeast of the last trench, the so-called Dome vein begins. This is a long, irregular intrusion of porphyry containing stringers, small veins, and irregular masses of quartz. The vein, on which drilling and test-pitting has been done, ranges in width from 2 inches to 6 feet.

The conglomerate mentioned by Moore has been classified as a lahar in this report.

STEEP ROCK IRON MINES LIMITED [1962] (8)

Six claims, which have been allowed to lapse, were situated east of Niven Lake and covered an asbestos occurrence. In 1959, James Gareau noted the occurrence of asbestos in the vicinity of Niven Lake. During 1960 and 1961, Steep Rock Iron Mines Limited optioned this property and implemented an exploration program to pursue the initial discovery. No results from this program have been reported for assessment purposes, and the ground is currently open. The occurrence was not located by the field party during the course of the mapping program.

STEEP ROCK IRON MINES LIMITED (9)

Steep Rock Iron Mines Limited currently holds 21 patented claims in the eastern part of the map area, and these are peripheral to the Steep Rock Iron Mine. There is no work on these claims reported in the assessment files (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay).

The rocks underlying these claims consist of a complex distribution of metavolcanics which are locally carbonatized and have been transected by numerous splay faults which are related to the Quetico Fault.

STRATMAT LIMITED [1956] (10)

Stratmat Limited of Montreal held 86 claims in 1955 and 1956 which covered Arnold Lake and part of Perch Lake. Stratmat Limited were involved in an exploration program for iron. A total length of 7440 feet was drilled during this program which covered both metasediments in the Quetico Subprovince and metavolcanics in the Wabigoon Subprovince. Banded ironstones and 'Paint Rock' were repeatedly intersected within the Wabigoon metavolcanics; however, in most cases, unmineralized metavolcanics, metasediments, schists, and banded cherts were recorded. No further work has been reported and the ground is currently open.

The Quetico Fault passes through the property and no iron mineralization is known to occur in the Quetico metasediments. Only a few minor pyritic and hematite ironstones were found in the Wabigoon metavolcanics by the field party. The work of Stratmat Limited has added to the number of these minor ironstone occurrences known to occur in the Righteye Lake area.

M. WICHERUK [ELIZABETH MINE] (11)

Location and Ownership

The Elizabeth Mine is located northeast of Liz Bay on Modred Lake. Originally, the mine was covered by two patented claims (FM 171, FM 172) and these were forfeited in 1956. Currently, the surface rights of the original claims are held by the Atikokan Municipality, and as of September 1st, 1979, the old mine site was covered by four mining claims that are contained within the original FM 171 patented claim (TB 385606 to TB 385609).

History of Exploration

Gold was discovered in 1900 and development work was carried out during 1902 and 1903 by Anglo-Canadian Gold Estates Limited. Work was discontinued until 1912 to 1914 when the mine was brought to limited production. At this time, it is reported that some 50 tons of ore worth $400 at that time had been milled and some 20 000 tons of ore blocked out (Moore 1940; Ferguson *et al.* 1971). Between 1914 and 1934, the property changed ownership a number of times, but no work was reported. In 1934, the Elizabeth Gold Syndicate purchased the property and later, as the Elizabeth Gold Mining Company Limited, resumed exploration and development work until 1939. The mine was never brought back into production. Since 1956, the ground has been repeatedly staked by a number of private prospectors who carried out trenching and diamond drilling in the area of the old mine.

Geology

Moore (1940), who mapped the property when the vegetation was stripped off and the trenches were accessible, gave the following description of the geology in the vicinity of the old workings:

Geology of the Property: The contact between the main body of Algoman granite in the northwestern section of the map-sheet and the main body of greenstone passes through the mine. The granite is coarse-grained, pink to red in colour, rich in quartz, and deficient in ferromagnesian constituents. A specimen taken 650 feet from the contact shows a quartz-rich, microcline granite with a little titanite and apatite and streaks consisting of hornblende. The latter are probably due to inclusions of the greenstone engulfed in the granite. Such inclusions, some of considerable size, may be seen at several places.

At No. 2 shaft and close to the granite-greenstone contact, the granite is much altered. It is greenish-yellow in colour and consists chiefly of quartz, sericite, and muscovite, the muscovite in flakes of considerable size. The microcline is all altered and mostly replaced by sericite, quartz, and a little albite. It appears that some albitization has occurred during the alteration of the granite.

Several dikes may be seen near the mine. Some of these cut both greenstone and granite, and at least two cut quartz veins. Just east of the dining hall, a small sheared dike, which has a maximum width of 8 feet and is slightly reddish to grey in colour, cuts granite and a quartz vein. Under the microscope this proves to be a peculiar rock. It is probably a lamprophyre, which has been highly altered to sericite and serpentine. In a fine-grained groundmass there are dark patches of considerable size, consisting almost entirely of serpentine in an indefinite colourless material. These patches resemble inclusions, and if the rock were not in a distinct dike, it might easily be mistaken for a tuff. What appears as a similar rock forms a dikelet near the southwest corner of the office building. Another dike, found 800 feet down the trail from the mine to Modred lake, consists of a massive, fine-grained rock with many small grains of pyrite. It lies parallel to a quartz vein and between it and greenstone. In thin section, this rock is seen to be made up of a network of interlocking, small lath-shaped crystals of plagioclase with many crystals of hornblende partly replaced by carbonate and chlorite. What appear to have been plates of biotite, now green in colour but lacking pleochroism, are present. The rock originally was probably a lamprophyre or camptonite.

In addition to the rather basic dikes described, there are several acid dikes in the vicinity of the mine. One-eighth of a mile south of No. 1 shaft there is a complex of porphyry dikelets intruding greenstone. This body is 200 feet long by 65 feet wide. South of shaft No. 2 are two small dikes, one a quartz-orthoclase porphyry and the other an orthoclase porphyry. The feldspars are highly sericitized and kaolinized. Another quartz-orthoclase porphyry dike was seen near the road from the Elizabeth mine to the Rebair camp. This dike contains many flakes of biotite as well as quartz and feldspar phenocrysts, which form white spots on a dark-grey, brown weathering surface.

Quartz Veins:- The veins occur in fractures in the granite, in short shear zones in the greenstone, and along the contact between these two formations. They do not show evidence of being related to major structures and they are, therefore, mostly short and vary greatly in width within short distances. When they occur in granite, they are usually along zones with chlorite and amphibole, which indicate inclusions of greenstone that have been highly altered. Ferriferous carbonate, probably ankerite, is present in many of the veins and in the wall rocks. The veins represent a late phase of the Algoman igneous activity and came from the same magma as the granite and dikes in the vicinity of the mine. The quartz-feldspar dikes preceded the veins in formation, and at least some of the basic dikes are later than the quartz.

There are two types of quartz in the veins, a normal solid type and a granular, sugary type, the latter probably representing quartz that originally contained ankerite and pyrite, which have been partly removed in solution. The sulphides present are pyrite and chalcopyrite with a little pyrrhotite and galena. The quartz in most places is not highly mineralized. A number of veins have been uncovered on the property. These vary in width from a foot to about 20 feet and they can, in a few cases, be followed continuously for more than 100 feet along the strike. The main vein in No. 2 shaft is reported to be from 1 to 14 feet wide, and it was mined for about 75 feet along the strike.

From files held at the Thunder Bay regional geologist's office, it is apparent that the gold occurs in two types of quartz veins. Firstly in a network of small veins associated with north-south shear zones in the metavolcanics. Secondly, in larger veins which are primarily located near the leuco-tonalite/metavolcanic contact and which also appear to be related to shearing. Both types contain gold mineralization, but only the larger veins were exploited and these large veins include the Elizabeth vein, Contact vein, and Cliff vein (Figure 9).

The Elizabeth vein was the original discovery vein and may have contained a thin seam of visible gold. This gold was apparently distributed irregularly throughout the vein and is associated with pyrite, chalcopyrite, and galena (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder

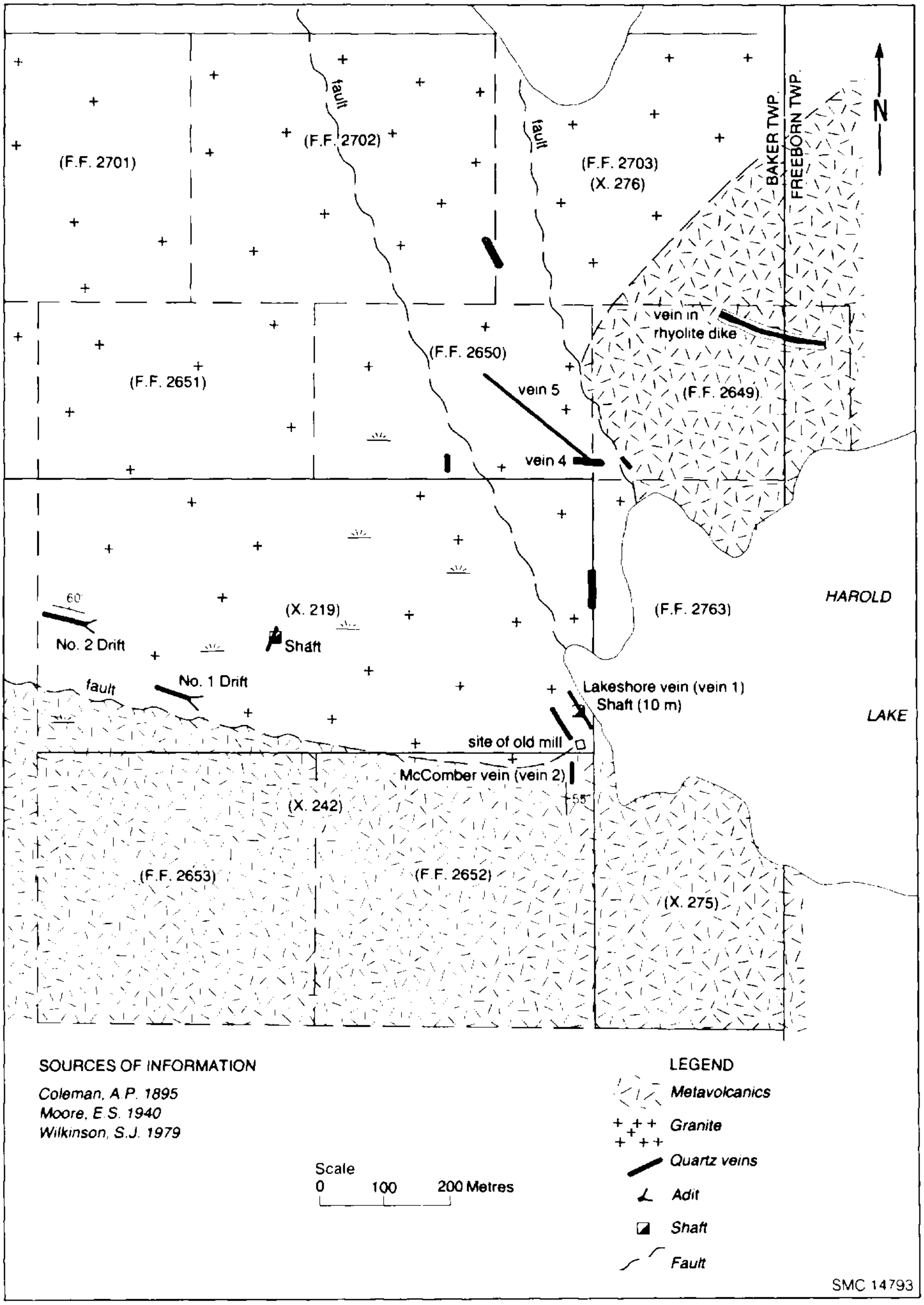


Figure 9–Sketch map of the Elizabeth Mine Area. Information obtained from fieldwork and assessment work held on file in Resident Geologist's Files, Ontario Ministry of Natural Resources, Kenora, and in the Assessment Files Research Office, Ontario Geological Survey, Toronto.

Bay). The shape of the mineralized zone within the vein has not been defined and no production was realized from this vein. Development work on this vein consisted of a 110-foot deep shaft with drifts 80 feet and 50 feet long extending north and south respectively from the shaft at the 80-foot level.

The contact vein has been the most thoroughly studied. Apparently the gold is concentrated in two and possibly more shoots that plunge to the north at a steep angle (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). Background values of trace to 0.08 ounce of gold per ton have been reported in the vein, and values of 0.17 to 0.78 ounce of gold per ton are apparently typical of the ore shoots (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). One shoot, which was exploited was some 10 by 20 feet and was mined vertically down for 110 feet, presumably continues deeper. The host vein increases in width with depth and the following assays were obtained from bulk samples (presumably from the high grade shoot).

1) 2000 lb sample divided into eight aliquots; mean 0.56 ounce gold per ton; maximum 0.96 ounce gold per ton; and minimum 0.45 ounce gold per ton. 2) Two 150 lb samples: 1.26 ounces gold per ton; and 3.12 ounce gold per ton; 3) One 200 lb sample: 1.01 ounces gold per ton; 0.55 ounce silver per ton; 0.49 percent copper; and trace amounts of arsenic.

Metallic minerals identified in this vein include malachite, limonite, pyrite, chalcopyrite, bornite, covelite, tetrahedrite, pyrrhotite, cuprite, magnetite, arsenopyrite, free gold, and scheelite. Four selected grab samples in which scheelite was recognized were assayed with the following results 5.58, 7.48, 1.47, and 5.84 percent tungsten (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). Development work centred on this vein consists of a shaft 280 feet deep and about 500 feet of development at three levels. Overhand stoping from the first and second levels was carried out up to the contact of the glacial cover with the bedrock. In 1973, these workings were destroyed during a seismic study.

The cliff vein is exposed on surface and appears to have received only a cursory examination in which galena was recognized and the single unspecified sample assayed contained about 0.5 ounce gold per ton (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). The lateral and vertical extent of this mineralization was not tested or reported[1].

Numerous trenches have been made on this property, but most are infilled with debris.

SUGGESTIONS FOR FUTURE EXPLORATION

Extensive work including geophysics has probably been carried out in search of iron deposits, but not reported. Besides the iron oxide mineralization itself, ferruginous carbonates, pyritic horizons, and ultramafic tuffs associated

[1] Additional work on the cliff vein has exposed a pocket of visible gold. This vein may be called the Bernie Mitch vein and details are given by Schneider *et al.* (1981).

with the Atikokan iron deposits were also sought as a key to possible hematite deposits. Care must be exercised in correlating carbonaceous rocks with hematite deposits because of the common occurrence of carbonatized metavolcanics in the Righteye Lake area.

Exploration for cobalt is currently being conducted east of Atikokan in the Atikokan Iron Range within the Wabigoon metavolcanics (Regional Geologist's Files, Ontario Ministry of Natural Resources, Thunder Bay). The ironstones in the map area are possible correlatives of the Atikokan Iron Range, and though the results gathered to date (Table 3) are not encouraging, most of the ironstones remain untested.

The Harold Lake and Elizabeth Mines are the only two known prospects that are regarded as significant for their gold mineralization. The size, location, and type of samples assayed by previous operators is generally not given. Therefore a thorough re-examination of the gold mineralization is warranted to establish grades of mineralization present and their limits. An added incentive in the re-evaluation of the Elizabeth Mine would be to delineate the limits of the galena and scheelite mineralization.

The Harold Lake and Elizabeth Mines are situated near the metavolcanic and leuco-tonalite contact, and are associated with extensive shearing. Further, deposits of a similar kind might be expected elsewhere along this contact. The potential of this environment is enhanced by the occurrence of green muscovite (? fuchsite) in the leuco-tonalite, this is because of the correlation of fuchsite with gold mineralization (Boyle 1979).

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INDEX

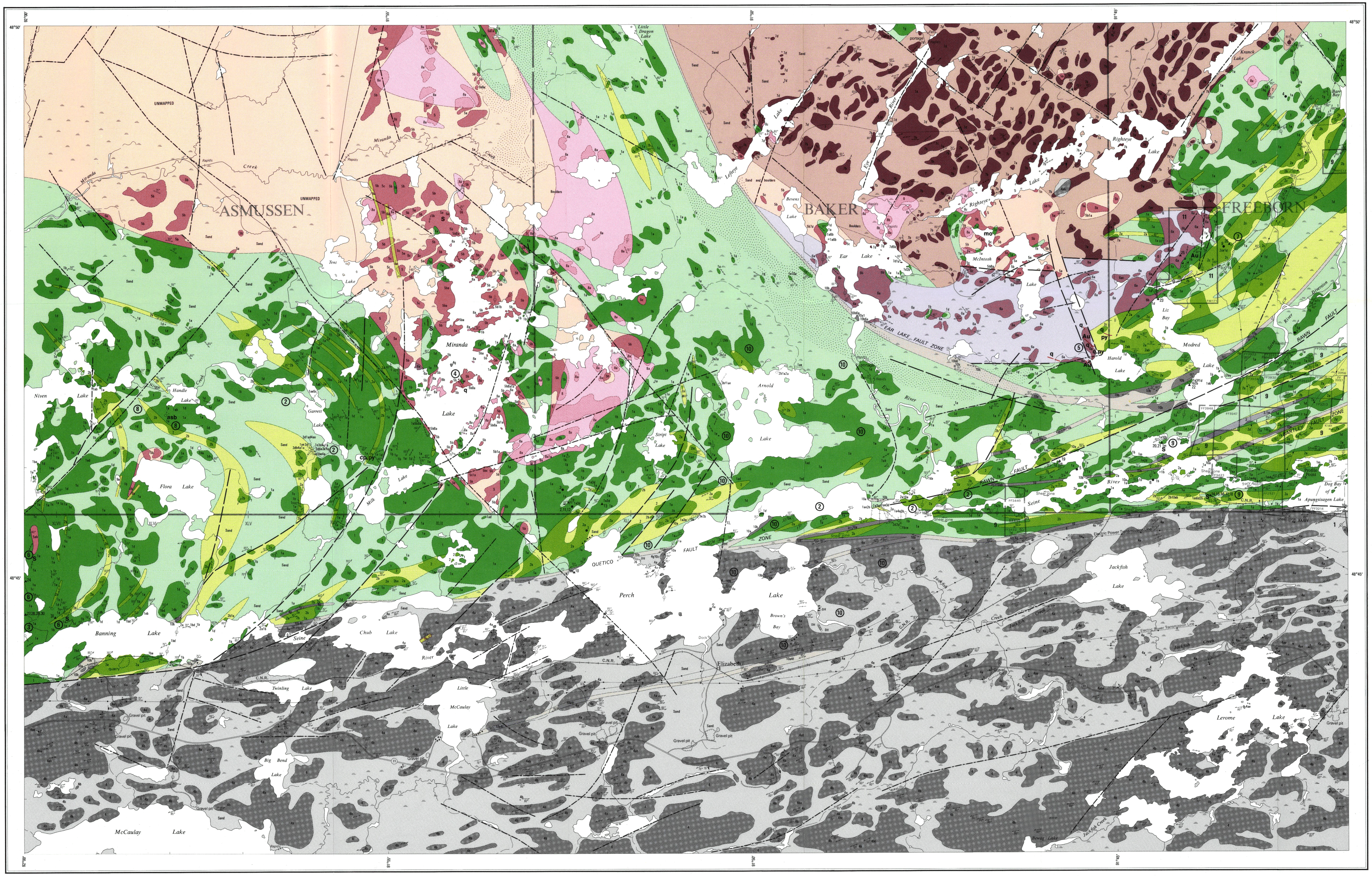
INDEX

Ministry of Natural Resources
Ontario

Ontario Geological Survey
Map 2464
Righteye Lake

SYMBOLS

- Glacial striae.
- Moraine.
- Small bedrock outcrop.
- Area of bedrock outcrop.
- Bedding, top unknown; (inclined, vertical).
- Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).
- Lava flow; top (arrow) from pillows shape and packing.
- Schistosity; (horizontal, inclined, vertical).
- Gneissosity; (horizontal, inclined, vertical).
- Foliation; (horizontal, inclined, vertical).
- Banding; (horizontal, inclined, vertical).
- Lineation with plunge.
- Geological boundary, observed.
- Geological boundary, position interpreted.
- Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
- Lineament.
- Jointing; (horizontal, inclined, vertical).
- Minor folds with plunge.
- Drill hole; (vertical, inclined).
- Drill hole; (projected vertically, projected up dip). Overburden shown.
- Vein.
- Shaft; depth in feet.
- Swamp.
- Motor road. Provincial highway number encircled where applicable.
- Other road.
- Trail, portage, winter road.
- Building.
- Township boundary, with milepost; approximate position only.
- Township boundary, unsurveyed, approximate position only.
- Mining property, surveyed. Boundary approximate position only.
- Mineral deposit; mining property, unsurveyed. Approximate position only.
- Surveyed line, approximate position only.



Published 1985

PROPERTIES, MINERAL DEPOSITS

1. Andowan Mines Limited [1957].
2. Brown, R.R. [1956].
3. Camberton Iron Explorations Limited [1953].
4. Ed-Vic Exploration [1975].
5. Harold Lake mine.
6. Law Occurrence.
7. Rebair Gold Mines Limited [1940].
8. Steep Rock Iron Mines Limited [1962].
9. Steep Rock Iron Mines Limited.
10. Stratmat Limited [1956].
11. Wicheruk, M. (Elizabeth Mine).

Information current to September 15, 1979.

Former properties on ground now open for staking are only shown where exploration information is available. A date in square brackets indicates last year of exploration activity. For further information see report.

SOURCES OF INFORMATION

Geology by S.L. Fumerton, D.U. Kresz and assistants, with additional information by S.J. Wilkinson, Ontario Geological Survey, 1979.

Geology is not tied to surveyed lines.

Assessment work data of mining companies, on file in the office of the Resident Geologist, Ministry of Natural Resources, Kenora.

ODM – GSC Aeromagnetic maps 1132G and 1133G.

Geological Survey of Canada, Map 266A, 2nd Edition, 1939.

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Map 48a, Atikokan Area, 1940
Map 2065, Atikokan-Lakehead Sheet, Geological Compilation Series, 1965.

Preliminary Map (OGS)
P2358, Righteye Lake Sheet, 1 inch to 1/4 mile, 1979.

Cartography by T. Wade and assistants, Surveys and Mapping Branch, 1984.

Basemap derived from maps of the Forest Resources Inventory, Surveys and Mapping Branch, with additional information by S.L. Fumerton and D.U. Kresz, Ontario Geological Survey.

Magnetic declination in the area was approximately 3° East in 1979.

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

Fumerton, S.L. and Kresz, D.U.
1981: Righteye Lake; Ontario Geological Survey Map 2464, Precambrian Geology Series, scale 1 inch to 1/2 mile, Geology 1979.

Ontario Geological Survey

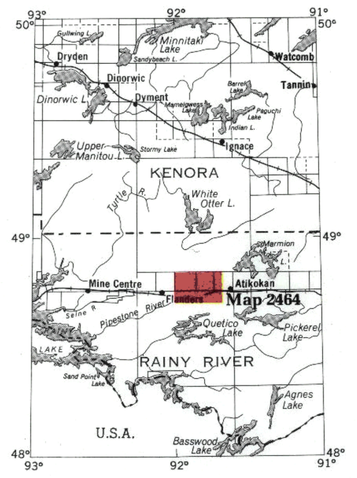
Map 2464

RIGHTEYE LAKE

RAINY RIVER DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

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



Scale 1 inch to 50 miles
N.T.S. reference 52B/12, 52B/13

LEGEND

PHANEROZOIC

CENOZOIC[a]

QUATERNARY

RECENT

Organic swamp deposits.

PLEISTOCENE

Ground moraine, sand, clay, and till.

UNCONFORMITY

PRECAMBRIAN[b]

EARLY PRECAMBRIAN

CATACLASTIC ROCKS

- 10 Unsubdivided.
- 10a Mafic submylonite, mylonite.
- 10b Felsic submylonite, mylonite.
- 10c Conglomerate pebbles in a comminuted matrix.

MAFIC INTRUSIVE ROCKS

- 9a Diorite dikes.

INTRUSIVE CONTACT

FELSIC TO INTERMEDIATE PLUTONIC ROCKS

MASSIVE GRANITIC ROCKS

- 8 Unsubdivided.
- 8a Coarse-grained, biotite granite.
- 8b Medium to coarse-grained granite locally with muscovite.
- 8c Medium to coarse-grained muscovite granite, locally with garnet.

INTRUSIVE CONTACT

FOLIATED AND GNEISSIC PLUTONIC ROCKS

GRANITIC MIGMATITE.

- 7 Unsubdivided.
- 7a Leuco granite.
- 7b Biotite and biotite hornblende granite to granodiorite.
- 7c Tonalite and quartz diorite.
- 7d Banded to heterogeneous mixture of rocks from units 5, 6, 7, and 8.

LEUCO-TONALITE

- 6 Unsubdivided.
- 6a Coarse-granite, muscovite, chlorite leuco-tonalite characterized by blue quartz.
- 6b Coarse-grained, chlorite, muscovite, leuco-tonalite.
- 6c Coarse-grained chlorite, green muscovite granite.
- 6d Hypabyssal phase with anhedral blue quartz phenocrysts.

DIORITE TO TONALITE

- 5 Unsubdivided.
- 5a Leucocratic, biotite tonalite.
- 5b Amphibole tonalite.
- 5c Quartz diorite.

INTRUSIVE AND FAULTED CONTACT

METAVOLCANICS AND METASEDIMENTS[c]

METASEDIMENTS

CLASTIC METASEDIMENTS.

- 4 Unsubdivided.
- 4a Graded and intercalated wackes and mudstones.
- 4b Biotite gneiss derived from 4a.
- 4c Amphibolitic.
- 4d Garnetiferous.
- 4e Containing blades composed of a fine-grained mixture of chlorite and mica.
- 4f Schistose.
- 4g Conglomerate.

CHEMICAL METASEDIMENTS

- 3 Unsubdivided.
- 3a Limestone.
- 3b Interbanded quartz-goethite, quartz hematite, quartz-magnetite ironstones.
- 3c Pyritic ironstones.
- 3d 'Paintrock'.
- 3e Chert.
- 3f Graphitic horizons.

METAVOLCANICS

INTERMEDIATE TO FELSIC METAVOLCANICS

- 2 Unsubdivided.
- 2a Flows.
- 2b Tuff.
- 2c Crystal tuff.
- 2d Sericite schist, phyllite.
- 2e Lahar.
- 2f Pillowed flows.

MAFIC TO INTERMEDIATE METAVOLCANICS

- 1 Unsubdivided.
- 1a Fine-grained flows.
- 1b Medium-grained flows.[d]
- 1c Coarse-grained flows.[d]
- 1d Tuff.
- 1e Chlorite schist, phyllite.
- 1g Amphibolite.[c]
- 1h Lahar.
- 1k Pillowed flows.
- 1m Carbonatized.

---

asb	*Asbestos*
Au	*Gold*
cp	*Chalcopyrite*
mo	*Molybdenite*
py	*Pyrite*
q	*Quartz*
S	*Sulphides*

▲ *Location of trace element analysis.*
● *Location of major element analysis.*

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

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

[c] *Rocks in this group are subdivided lithologically and order does not imply an age relationship.*

[d] *Some of these may be mafic intrusive rocks.*