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SUMMARY OF FIELD WORK, 1973

by the

GEOLOGICAL BRANCH

ERRATA FOR MP56

Summary of Field Work, 1973, by the Geological Branch, Edited by V.G. Milne, D.F. Hewitt, and W.J. Wolfe.

References on page 32 should continue after references on page 74. "No. 8 East Half of Sapawe Lake Area, District of Rainy River, by W.H. McIlwaine and L.B. Chorlton".

MISCELLANEOUS PAPER 56

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Fenwick, K.G., and Weinstock, F.D.
1973: The Blackwell and Laurie Townships, District of Thunder Bay; p.75-79 *in* Summary of Field Work, 1973, by the Geological Branch, edited by V.G. Milne, D.F. Hewitt, and W.J. Wolfe, Ontario Div. Mines, MP56, 201p.

SUMMARY OF FIELD WORK, 1973

by the

GEOLOGICAL BRANCH

ONTARIO DIVISION OF MINES

PREFACE

During the summer of 1973 the Geological Branch, Ontario Division of Mines, undertook 29 Geological Survey Projects, 3 Geophysical Survey Projects, and 3 Geochemical Survey Projects in the field. In all 35 projects were carried out, involving the services of 29 permanent staff and 136 casual staff. Staff of the Precambrian Geology Section directed 22 of these projects, 7 projects were directed by the staff of the Phanerozoic Geology Section, and 4 by staff of the Geophysics/Geochemistry Section.

The locations of the areas investigated are shown on the map of the Province, at the beginning of this report. The preliminary results of the work are outlined in this summary, which contains reports prepared by leaders of each of the projects. In these reports, some emphasis has been placed on the economic aspects of the different investigations. It is the hope of the Geological Branch that the information thus provided will help in the mineral resource evaluation of these areas and so will be a valuable aid to mineral prospecting and resource planning in the Province.

Coloured maps and final detailed reports covering most of the field projects are being prepared for publication. In the interim, however, uncoloured preliminary geoscience maps with comprehensive marginal notes, will be released for distribution mostly during the winter of 1973-1974. These will mainly be published at the field scale of 1 inch to ¼ mile, 1 inch to 1 mile, or 1 inch to 2 miles. Notices of the releases will be mailed to all persons or organizations on the Ontario Division of Mines notification list, and will be published in the technical journals and other media.

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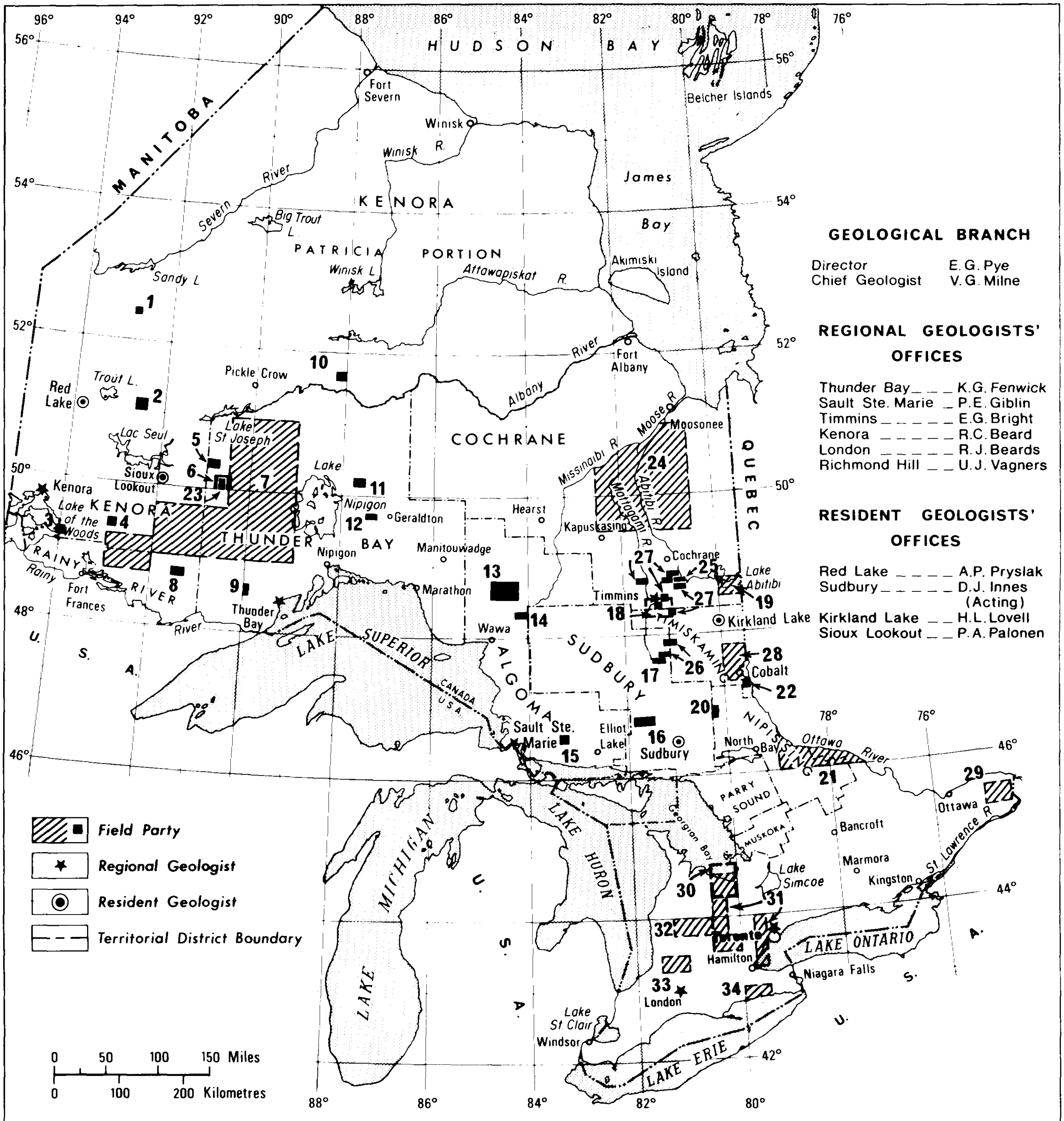

LOCATION OF FIELD PARTIES, 1973

GEOLOGICAL BRANCH
ONTARIO DIVISION OF MINES

ODM 4952

LIST OF FIELD PARTIES, 1973

No.	Location	Leader(s)
1.	Hewitt Lake (North Spirit Lake) Area	J. Wood
2.	Earngey, Birkett, Agnew, and Costello Townships	P.C. Thurston
3.	Crow Lake Area	L. Kaye
4.	Upper Manitou Lake Area	C.E. Blackburn
5.	Houghton-Hough Lakes Area (Thunder Bay)	W.D. Bond
6.	Squaw and Sturgeon Lakes Area	N.F. Trowell
7.	Operation Ignace-Armstrong	R.P. Sage F.W. Breaks G.M. Stott G.M. McWilliams
8.	Sapawe Lake Area	W.H. McIlwaine L.B. Chorlton
9.	Blackwell and Laurie Townships	K.G. Fenwick F.D. Weinstock
10.	Opikeigen Lake Area (Kenora)	H. Wallace
11.	Tashota Area (Thunder Bay)	S.E. Amukun
12.	Legault, Colter, Lapierre, and Hipel Townships	W.O. Mackasey
13.	Nameigos, Mosambik, Carney, Doucett, Cudney, and Simpson Townships	G.M. Siragusa
14.	Townships 46 and 47, Range 27	P. Srivastava
15.	Wakomata Lake Area	K.M. Siemiatkowska
16.	Benny Lake Area	K.D. Card D.G. Innes
17.	Connaught and Churchill Townships	M.W. Carter
18.	Timmins Area	D.R. Pyke
19.	Lightning River Area	L.S. Jensen
20.	Clement and Scholes Townships	H.D. Meyn
21.	Mattawa-Deep River Area	S.B. Lumbers
22.	Lorrain Township, Southern Part	H.L. Lovell J.W. de Grijs
23.	Magnetic Survey of the Sturgeon Lake Area	R.B. Barlow
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Precambrian Geology Section

PRECAMBRIAN GEOLOGY SECTION SURVEYS, 1973

INTRODUCTION

BY

V.G. MILNE[1]

Staff of the Section carried out 22 geological field mapping projects in the Precambrian Shield area of Ontario. Of these projects: field work was completed on 13 detailed, 1 inch to ½ mile scale, projects covering between 72- and 100-square miles each; 4 other detailed projects were started and will continue into 1974; 3 areal reconnaissance projects at a scale of 1 inch to 1 mile were completed covering from 400- to 500-square miles each and 1 covering about 1,000-square miles will continue into 1974; Operation Ignace-Armstrong, a regional helicopter reconnaissance project covering approximately 16,600-square miles was also completed in 1973.

The summaries appended represent rapid syntheses of geological field data as do the Preliminary Maps which are in preparation for publication during the winter of 1973-1974. These field reports and maps are designed as a means of rapidly disseminating highlights and general outlines of new information. More extended analysis of field data in conjunction with detailed office and laboratory research for final report and map publication can be expected to result in changes to the field terminology, interpretations, and concepts expressed.

Funding for 3 of the detailed surveys in northwestern Ontario was provided through the Ministry of Treasury Economics and Intergovernmental Affairs as part of the Design for Development Program-Northwestern Ontario.

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[1]Chief Geologist and Chief Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

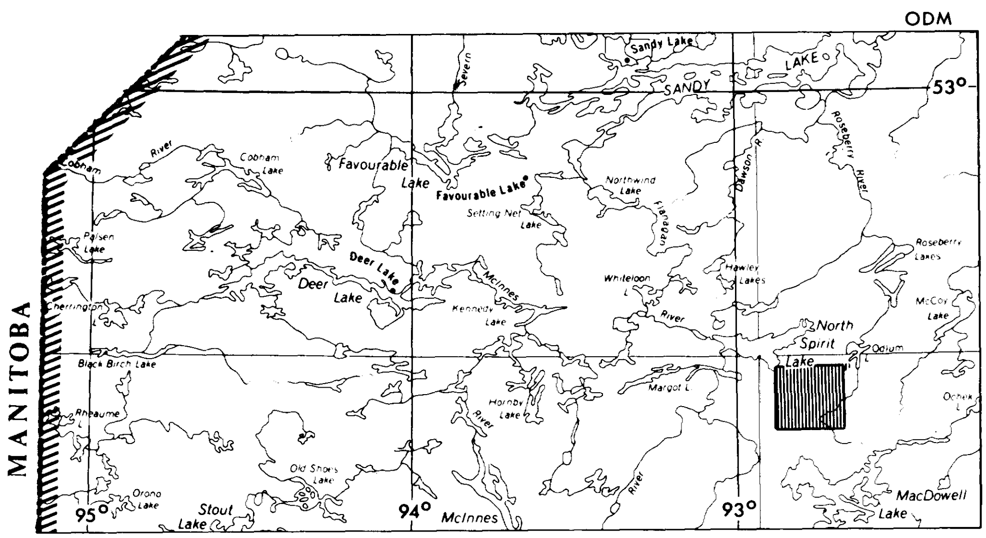
No.1 HEWITT LAKE AREA (EAST HALF)

DISTRICT OF KENORA, PATRICIA PORTION

by

J. Wood[1]

LOCATION: The Hewitt Lake area (east half), bounded by Longitudes 92°40' and 92°52'30"W and by Latitudes 52°21'30" and 52°28'45"N covers the east-central part of the North Spirit Lake-MacDowell Lake metavolcanic-metased-



LOCATION MAP

Scale: 1 inch to 25 miles

imentary belt. The area lies about 110 miles north-northeast of Red Lake. Access is by float-equipped aircraft.

MINERAL EXPLORATION: Early mineral exploration in the general region was for gold (Hurst 1929; Bateman 1938); more recently iron, base metals, and uranium have been the objects of exploration.

Within the map-area, the more recent period of exploration commenced in 1959 with a geophysical and geological survey by Crown Trust of an iron

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[1]Geologist, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

formation property in the northwestern part of the area. Since then Chimo Gold Mines Limited, Cochenour Willans Gold Mines Limited, Madsen Red Lake Gold Mines Limited, and Noranda Exploration Company Limited, have been active in mineral exploration, mostly on ground optioned from individual prospectors.

No exploration activity occurred within the map-area during the 1973 field season. As of September 1973 all of the map-area was open for staking with the exception of 14 patented claims in the northwestern part of the map-area and a group of 4 claims extending south from the east end of Makataiamik Lake.

GENERAL GEOLOGY: Most of the rock types can be assigned to one of three broad classes; metasedimentary, metavolcanic, and batholithic granitic ingeous. The contact of the granitic rocks with the metavolcanic-metasedimentary types trends northwest-southeast from Wapisipi Lake to Makataiamik Lake. From the east end of Makataiamik Lake the contact strikes southwest for about 2.5 miles (4 km) whence it resumes its northwest-southeast trend. The metasediments and metavolcanics lie to the southwest. The strike of the metavolcanics and metasediments is generally subparallel to the trend of the granitic contact, but the stratiform rocks always strike closer to east-west by about 10°-25° than the contact. As a consequence, from north to south along this contact, higher levels of the original volcanic and sedimentary sequence are encountered. For approximately 2 miles (3.2 km) southwest of the contact the stratiform rocks young to the southwest. Further to the west the structure becomes more complex, making stratigraphic analysis more difficult.

Three summers of field work (see Wood 1971; 1972) have shown that the rocks in the North Spirit Lake-MacDowell Lake 'greenstone' belt can be empirically divided into two groups, a volcanic group and a sedimentary group. The sedimentary group overlies the volcanic group. The groups are not exclusive, thus volcanic rocks occur in the sedimentary group and vice versa. In the map-area all of the stratified rocks are in the sedimentary group with the exception of ultramafic metavolcanics and meta-iron formation in the northern part of the area southwest and southeast of Wapisipi Lake.

The chert-magnetite-type iron formation is the southward extension of the more extensive iron formation found farther north, it underlies the ultramafic metavolcanics. The ultramafic metavolcanics occur as thin flows that are about 2 feet (60 cm) thick, in many places, and show spinifex texture. The base of a flow unit is usually chilled, many of the flows have chilled and fractured tops. The ultramafic metavolcanics occur at the visible top of the volcanic group.

Wherever visible the base of the sedimentary group is a polymictic pebble to boulder orthoconglomerate with a wacke matrix. The lower part of the group consists mostly of sedimentary rock types and is best developed in the neighbourhood of Makataiamik Lake. There are many horizons of conglomerate, all are orthoconglomerates, but grain size and large-clast composition vary considerably between units. Other rock types include pebbly sandstone, grit, arkose, wackes of different composition, graded wacke-siltstone, siltstone, and mudstone. Intermediate and in a few places mafic metavolcanic units occur in this lower part of the group. The metasediments show a general decrease in grain size upwards in the sequence.

The middle part of the metasedimentary group consists largely of pyroclastic rocks, intermediate to felsic in composition and of variable grain size. Silty metasediments are interbedded with the tuffaceous rocks and difficulty can be experienced in determining the origin of some beds. This tuffaceous part of the group is persistent within the map-area and unconformably overlies the lower part of the group, but its relationship to the upper part of the group is not known.

The upper part of the sedimentary group consists of many rock types; conglomerates are uncommon. Fine grained clastic metasediments such as those in the lower part of the sedimentary group are common, but cherts, both magnetite- and sulphide-bearing, and carbonate rocks are important in the sequence. Metavolcanics (flow rocks) range from mafic to felsic in composition.

Intra-belt igneous intrusions, comprising ultramafic, mafic, intermediate, and felsic rocks, are abundant. The ultramafic intrusions are present near Hewitt Lake and northwest of Makataiamik Lake. Mafic intrusions are abundant south of Makataiamik Lake. Intermediate intrusions are abundant near Wokokotai Lake. Rare-felsic intrusions occur near Wapisipi Lake. Most of the intrusive bodies are sill-like and subconcordant to the host strata.

The grade of metamorphism varies from lower greenschist facies in those parts of the belt distant from the granitic contact zone to hornblende-hornfels facies near the contact zone with the granitic rocks.

The granitic batholithic rocks are younger than the metasediments and metavolcanics. There are probably several phases of intrusion of granitic material. The absence of exposed contacts obscures intrusive relationships. Near Makataiamik Lake there is a body of fine-grained equigranular biotite-bearing granitic rock, which may be old relative to the other granitic rock types. Southeast of Wapisipi Lake, most of the granitic rocks are biotitic but some hybrid types occur. The remainder of the area is underlain by a coarse porphyritic biotite quartz-monzonite. The granitic batholithic rocks are the youngest in the area.

STRUCTURAL GEOLOGY: The metavolcanic-metasedimentary sequence has been folded along an axis sub-parallel to the contact with the granitic rocks. Within 2.5 to 3 miles (4 to 4.8 km) of the contact there has been only one major phase of folding. Southwest of this, there have been several phases of folding.

There is only one important fault system. It affects the rocks within the metavolcanic-metasedimentary belt and has a northeast trend, at right angles to the general strike of the strata.

ECONOMIC GEOLOGY: Thin units of iron formation occur throughout the metasedimentary sequence. Probably all are too small to be of economic importance. The thickest occurrences of iron formation are southeast of Wapisipi Lake and southeast of South Bay.

Molybdenite, disseminated and in small quartz filled fractures, was encountered during field mapping in granitic rocks about 2 miles (3.2 km) south of the west end of Makataiamik Lake.

One mile (1.6 km) south-southwest of the east end of Makataiamik Lake there are 2 local showings of sulphide minerals, about ¼ mile (0.4 km) apart, in one of the mafic, sill-like intrusive bodies. Minerals identified by the author include chalcopyrite and sphalerite. Samples from a pit on one of the showings are reputed to contain minor amounts of chalcopyrite, pyrrhotite, pyrite, sphalerite, and molybdenite. (Resident Geologist's files, Ontario Ministry of Natural Resources, Red Lake).

About 2 miles (3.2 km) south-southwest of the east end of Makataiamik Lake there is a mineralized northwest-trending shear zone. Minerals identified by the author include sphalerite and galena. Drill hole assay samples yielded up to 3.72 ounces per ton silver (Ontario Division of Mines, Assessment Files Research Office).

The pyroclastic rocks previously referred to as the 'middle part of the sedimentary group' contain minor (less than 2 percent by visual estimation) disseminated sulphide minerals throughout most of their strike length of several miles. Locally, chalcopyrite is amongst the sulphides identified by the author; pyrite and pyrrhotite are most widespread. Sphalerite and galena are reputed to be present also (Ontario Division of Mines, Assessment Files Research Office).

The chert horizons, in particular the one north of Hewitt Lake on the west side of the map-area, generally contain sulphide minerals. However pyrite and pyrrhotite are the dominant sulphides, northwest of Wokokotai Lake a few disseminated grains of chalcopyrite were observed in a drill core section.

Sulphide showings within the clastic sedimentary sequence generally have arsenopyrite as the dominant sulphide mineral, although pyrite and pyrrhotite are commonly present. About 3/4 mile (1.2 km) south of the west end of Makataiamik Lake there is a showing of arsenopyrite and galena in a wacke. Associated with this mineralization are tourmaline and a green micaceous mineral tentatively identified as fuchsite. The outcrop area has been extensively blasted but in what remains of the exposure the mineralization appears to be in veins, one such vein probably had an original exposed length of about 50 feet (15 m) and width of about 3 feet (1 m). Grab samples collected by the author and analyzed by the Mineral Research Branch of the Division of Mines contained up to 0.05 ounce per ton gold and 0.40 percent lead. About 1¼ miles (2.0 km) west-northwest of the west end of Makataiamik Lake is a showing of magnetite, chalcopyrite, azurite, and malachite in a cobble ortho-conglomerate. One trench at this locality is about 70 feet (21 m) long by 3 feet (1 m) wide and up to 6 feet (2 m) deep. The metallic minerals may be detrital. Grab samples collected from this locality by the author and analyzed by the Mineral Research Branch, Division of Mines, contained up to 0.05 percent copper and 0.08 percent nickel. Pyrite, magnetite, chalcopyrite, and arsenopyrite are present at the contact of conglomerate and mafic meta-volcanics just south of the west end of Makataiamik Lake. One trench at this locality measures about 50 feet (15 m) in length, 5 feet (1.5 m) in width, and 3 feet (1 m) in depth. Grab samples collected from this locality by the author and analyzed by the Mineral Research Branch, Division of Mines, contained up to 0.06 percent copper, 0.15 percent cobalt, and 0.03 percent nickel.

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Bateman, J.D.

1938: Geology of the North Spirit Lake Area; Ontario Dept. Mines, Vol. 47, pt.7, p.44-78 (published 1939). Accompanied by Map 47g, scale 1 inch to 1 mile.

Hurst, M.E.

1929: Geology of the Area Between Favourable Lake and Sandy Lake, District of Kenora (Patricia Portion); Ontario Dept. Mines, Vol. 38, pt.2, p.49-84. (published 1930). Accompanied by Map 38a, scale 1 inch to 2 miles.

Wood, J.

1971: North Spirit Lake Area, District of Kenora (Patricia Portion); p.9-12 in Summary of Field Work, 1971, by the geological Branch, edited by E.G. Pye, Ontario Dept. Mines and Northern Affairs, MP49, 109p.

1972: Hewitt Lake Area (West Half), District of Kenora (Patricia Portion); p.14-16 in Summary of Field Work 1972, by the Geological Branch, edited by V.G. Milne and D.F. Hewitt, Ontario Div. Mines, MP53, 165p.

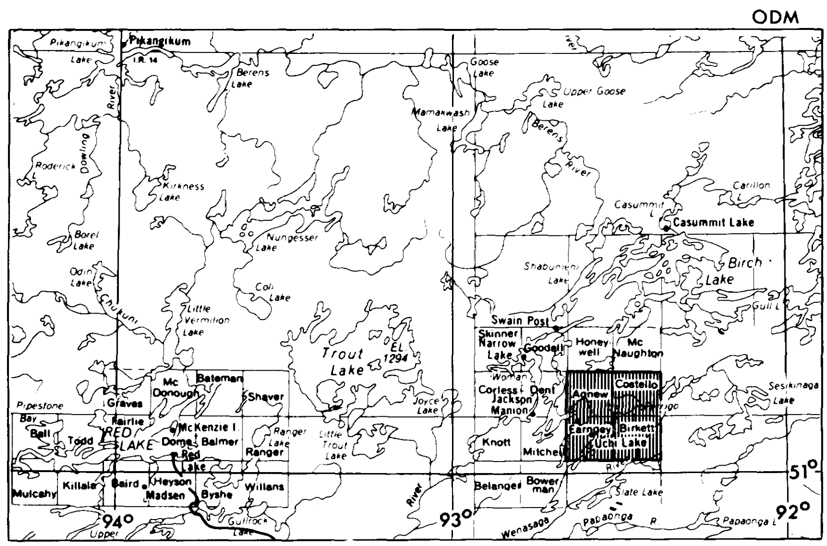
No.2 EARNGEY-COSTELLO TOWNSHIPS AREA

DISTRICT OF KENORA, PATRICIA PORTION

by

P.C. Thurston[1]

LOCATION: The map-area lies 55 miles east of Red Lake and consists of the Townships of Earngey, Birkett, Agnew, and Costello. The area lies east of the area mapped previously by the Branch in 1969 and 1970 (Pryslak 1970 a, b;



LOCATION MAP   Scale: 1 inch to 25 miles

1971a,b). Access to Confederation Lake is via the road to the South Bay Mine from Ear Falls. The remainder of the area is accessible by float-equipped aircraft from Red Lake. Earngey Township and the western part of Birkett Township were mapped during the 1973 field season.

MINERAL EXPLORATION: Large parts of Earngey Township were staked in 1926 and 1927, at the time of the gold exploration rush in the Red Lake area. Exploration at that time resulted in the discovery of the Bobjo prospect, and early work on the Uchi Gold Mine, the Grassett property, the Berrigan property, the Conwo property, and the Tremblay property. Work was conducted on a larger scale during the period 1937-1939 when the Uchi Gold Mine was in production.

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The Uchi Gold Mine was originally described as the MacAuley claims (Bruce 1928, p.49) when they were optioned in 1927 to The Huronian Belt Company Limited. Little work was done upon the expiry of the option until the fall of 1936 when the property was taken over by J.C. Hammell, Val d'Or Mineral Holdings Limited and Harker Gold Mines Limited (Thomson 1930, p.74). Production at the Uchi Gold Mine began in 1938 from a plant consisting of a 500 ton per day mill serving 2 shafts each about 600 feet deep, serving levels at 100, 300, 450, and 600 feet. Total production was: 114,467,979 ounces Au and 14,144 ounces Ag. (Ontario Division of Mines, statistical files) and ceased in December 1942. The property is currently held by Little Long Lac Mines Limited who in 1973 optioned the ground and a number of surrounding claims to Selco Mining Corporation Limited who carried out ground and airborne geophysical surveys and drilled 2 holes totalling 757 feet (Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake).

A number of other gold properties were explored during the late 1930s and they are fully described by Bateman (1939) and Thomson (1938). As no production resulted, they are not described here.

Prospecting activity for base-metals resulted in a flurry of activity in 1956. Kolak Mines Limited acquired a property of 18 claims on the peninsula jutting into the northern part of Uchi Lake west of Wabunk Bay in 1956. Ownership passed in 1956 to Campbell Island Mines and Exploration Limited. They had geological mapping and diamond drilling of 22 holes totalling 4,899 feet completed in 1956 and 1957 (Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake). The work attempted to delineate the extent of Cu-Ni mineralization within a gabbro sill.

Northgate Exploration Limited optioned a 17-claim group on Uchi Lake in 1959. The claim group occupies the northwestern corner of the area examined by Woco Gold Developments Limited at the south end of the Uchi Gold Mine property in the 1930s. The former company diamond drilled seven holes, totalling 2957.9 feet in the process of outlining a quartz vein having a length of about 150 feet (Ontario Division of Mines, Assessment Files Research Office). Gold 'values' however proved disappointing. The property has since been idle, however eight leased claims are still in good standing.

Activity in the area enjoyed a resurgence upon the discovery by Selco Mining Corporation Limited of their South Bay Mine in Mitchell Township adjoining the map-area. The whole of Earngey Township was staked, and airborne and ground geophysical surveys were carried out on several claim blocks. Holders of major claim groups included Selco Mining Corporation Limited, New Hosco Mines Limited, Murray Watts, R.J. Jowsey Mining Company Limited, Falconbridge Nickel Mines Limited, Hanna Gold Mines Limited, T. Loon, and D.R. Cameron.

Selco Mining Corporation Limited carried out the following exploration, based upon assessment work filed at the Red Lake Resident Geologist's office (Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake):

1) Colombiere option (east of Fly Lake) in 1970 ground EM and ground magnetic survey;
2) Wasp Grid (east of Fly Lake) diamond drilling; 11 holes, totalling 5,320.6 feet;
3) Uchi River group (extending north from Neepawa Bay, Uchi Lake) diamond drilling 8 holes, 2,356.8 feet;
4) Lost Bay group (lies between Lost Bay and Perrigo Lake, north of Uchi Lake) diamond drilling 4 holes, totalling 1,364 feet.

Salem Exploration Limited (re-named Agena Mining Company Limited in 1966) acquired by staking a group of 72 claims covering the east shore of Uchi Lake from the north end of the lake to Wabanook Bay. The Resident Geologist's office at Red Lake has on file a geological map and it would appear that a magnetometer survey was carried out.

In 1969, Tashota Nipigon Mines Limited carried out a geologic survey and drilled 4 diamond drill holes totalling 1,257 feet on the J.D.S. Bohme property, which consisted of 31 claims. (Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake). The property lies just south of the Uchi Gold Mine and work concentrated on the southerly extensions of the zones mined to the north. Diamond drilling gave disappointing results and the claims have reverted to the Crown.

New Hosco Mines Limited held a group of 24 claims known as group 4 in 1969. Ground electromagnetic and magnetic surveys were carried out. The ground lies northeast of Neepawa Bay of Uchi Lake. The claims have since lapsed. Group 5, consisting of 89 claims, lying between Leg and Uchi Lake, received similar geophysical surveys. Group 6, consisting of 45 claims, lying east of the northern part of Fly Lake, had similar surveys carried out on it.

Little Long Lac Mines Limited held a block of 20 staked claims east of the Uchi Gold Mine in 1969. A combined gamma ray spectrometer, electromagnetic, and magnetic survey was carried out over the claim group. The claims have since lapsed and no drilling is known to have been done on the conductors disclosed (Resident Geologist's Files, Ontario Ministry of Natural Resources, Red Lake).

Falconbridge Nickel Mines Limited held a block of claims lying east of Wabunk Bay of Uchi Lake, work in this group consisted of magnetometer and AFMAG surveys (Company files). In addition, they held a block consisting of at least two claims on the peninsula west of Wabunk Bay of Uchi Lake, upon which two diamond drill holes, totalling 401 feet, were drilled. The claims have since lapsed.

Hanna Gold Mines Limited held a block of 15 claims at the north end of Leg Lake in 1969. An airborne electromagnetic and magnetometer survey was carried out, but no diamond drilling is known to have been conducted. The claims have since lapsed (Ontario Division of Mines, Assessment Files Research Office).

GENERAL GEOLOGY: The map-area covers the southeastern part of the Birch-Uchi Lakes metavolcanic-metasedimentary belt, which extends from Slate Lake on the south, to Birch Lake and to just south of Upper Goose Lake on the north. The belt is a maximum of 20 miles wide at the southern end, where it consists of two arms, one in the area of Belanger Township, the other in the area of Slate Lake, separated by the Bruce Lake Pluton, (Shklanka 1970, p.9) centered on the Belanger-Bowerman township boundary. The belt has a north-south extent of about 54 miles. Toward the north end, i.e. north of Birch and Casummit Lakes, the belt is less than 4 miles wide over the last 13 miles of its length.

The belt consists of metavolcanic sequences that represent several centres of volcanism with minor intercalated clastic and chemically precipitated metasediments. Major thicknesses of clastic metasediments lie to the north in the Birch Lake area and to the south and east at Slate Lake and in the western part of Birkett Township.

The volcanic sequences display a cyclicity from a dominantly mafic base to a dominantly felsic upper part. Three major sequences occur in the eastern part of the map-area and have been designated the Lower Basic, Lower Acid, and Upper Basic sequences by Goodwin (1967, Figure 5). The Lower Basic sequence consists of porphyritic to massive mafic flows with pillowed units in a few places, cut by mafic to ultramafic intrusive rocks. This unit is bordered on the east by a sequence of metasediments (dominantly greywacke and arkose) termed the Slate Lake Sediments by Bateman (1939, p.20). Stratigraphically above the Lower Basic unit is the Lower Acid volcanic sequence which, within the map-area, consists of a unit of re-worked felsic tuffs and metasediments (feldspathic wackes and lithic wackes) extending along the east shore of Uchi Lake from just south of the bay into which Leg Creek flows to a few hundred feet north of the Hydro-Electric Power Commission power-line, and a sequence of intermediate pyroclastic rocks. The latter sequence comprises of a complex interbedded unit of tuff, lapilli-tuff, tuff-breccia, and, in a few places, minor occurrences of pyroclastic breccia. Based upon fragment-matrix relationships, presence and type of bedding, and general size and extent of the unit, it would appear to be similar in origin to the Ohanapekosh Formation (Fiske 1963), a subaqueous mudflow. These rocks are succeeded by finer, more felsic pyroclastics consisting dominantly of fine tuffs, commonly well-bedded, with a few examples of graded bedding, and minor units of pillowed mafic flows, a few hundred feet thick.

The Upper Basic sequence consists of minor felsic lapilli-tuff composed generally of angular to subangular felsic fragments, commonly under 2 inches (5 cm) in their long dimension, 10 to 20 percent intermediate to felsic ash matrix, and a few interbeds of metasediment, succeeded upwards by about a 3,500 foot thickness of mafic to intermediate pillowed metavolcanics. This sequence contains spherulitic units in a few places, such as at Bobjo Point (local name), on Confederation Lake. Most of the unit is rich in epidote and contains 10 to 15 percent quartz, but is commonly pillowed, suggesting perhaps an alteration of a mafic unit, as pillows are more common in rocks of basaltic composition (Macdonald 1972, p.103).

The Upper Acid sequence consists of a complex mélange of felsic pyroclastic, extrusive, and intrusive rocks. Spherulitic flows, lapilli-tuffs, tuff-breccias, tuff, quartz porphyry, quartz-feldspar porphyry, and an intermediate quartz porphyry are present.

The Slate Lake sediments of Bateman (1939, p.20) consist dominantly of greywacke with interbeds of arkose, in a few places. Primary structures were not observed in these rocks, but the writer tentatively suggests that they underlie rocks of the Lower Basic sequence. There is no evidence as to the nature of the contact with the volcanic rocks as it is not exposed.

The Lower Basic sequence is cut by rocks of dioritic, quartz dioritic, and gabbroic composition, especially in the area to the east of Leg Lake. The age relations among these three rock types are unknown. They are interbanded with, and cut by, serpentinites that probably are peridotitic in composition. This mass of mafic to ultramafic rocks extends from south of Leg Lake to north of Wabunk Bay of Uchi Lake, with the southern end and the middle part consisting of complex interlayering of all four rock types. The mass to the east of Wabunk Bay, whereas it appears continuous with the mafic rocks to the south, is dominantly gabbroic in composition, with only minor representation of dioritic rocks.

In a few places felsic to intermediate intrusive rocks, probably synvolcanic, ranging in width from a few inches to 20 to 30 feet cut the volcanic-sedimentary belt as conformable and crosscutting dikes and sills. In general these cannot be traced beyond individual outcrop areas. East and south of Lost Bay of Confederation Lake, the metavolcanics are cut by several gabbroic to dioritic sills up to 500 feet thick with strike lengths of up to 2.5 miles.

South of Perrigo Lake in Birkett Township the metavolcanic-metasedimentary belt is cut by the Perrigo Pluton. The extent of this body is not fully delineated by the present mapping but previous work (Bateman 1939) would indicate that the area mapped by the author is but a small outlier of a major pluton. The major rock type is a porphyritic hornblende quartz monzonite to granodiorite with minor amounts of hornblende diorite to syenodiorite and hornblende trondhjemite to quartz diorite.

STRUCTURAL GEOLOGY: The belt is isoclinally folded about north-south trending axes with the whole belt involved in a synclinorium of regional dimensions proposed by Goodwin (1967). The axis of this synclinorium lies west of the amp-area in Mitchell Township (Pryslak 1970b).

Top determinations based upon graded bedding in metasediments and fine-grained felsic pyroclastic rocks, and upon pillow shape and packing in the mafic metavolcanics, provide the basis upon which several subsidiary folds are postulated in the eastern part of Earngey Township.

These postulated folds are, from west to east, as follows:
1) The trace of the axial plane of an anticline follows the central channel of Uchi Lake north from the south end of Wabanook Bay where it is faulted

right laterally about 2,500 feet from whence it continues northward to Drake Lake (local name) just inland from the east shore of Uchi Lake north of Leg Creek.

2) A syncline is centered about the east shore of Leg Lake and the nose of this fold appears, on the basis of airphoto interpretation, to lie just south of the map-area. The fold can be traced from the south end of Leg Lake northeastward to the east boundary of Earngey Township, 2.75 miles along the boundary.

3) An anticline, trending northeast, extends 2.25 miles from a point ½ mile east of the south end of Leg Lake before being lost in the structural complexities of the metasediments to the east.

Structural details in the Slate Lake metasediments are difficult to decipher because marker horizons and top determinations are lacking.

East-west- to southeast-striking faults are abundant in the area south and east of Confederation Lake where right lateral stratigraphic offsets of up to 200 feet are observed in some places. A major fault striking east-southeast trends through Wabanook Bay. Right lateral offset of about 2,500 feet is postulated in the area of Wabanook Bay.

Whereas bedding, where observed, strikes in a generally north-south direction, foliation, defined by planar arrangement of platy and acicular minerals, trends generally east-west.

ECONOMIC GEOLOGY:

Gold: As most of the gold exploration and production was carried out some time ago, the condition of prospect pits and shafts did not permit a thorough examination of all properties. Therefore a great deal of reliance must be placed upon property descriptions in previous reports.

Thomson (1938, p.73) outlines four modes of occurrence of gold mineralization as follows:

1) Quartz veins and stringers filling fractures with mineralization consisting of native gold, with associated sulphide minerals and carbonates also carrying gold 'values'. This is represented by the Uchi Gold Mine and Kenelda Gold Mines Limited properties.

2) Fissure veins filled with quartz, and minor carbonate and tourmaline. The veins are long, narrow and fairly regular, in contrast to type 1. This situation obtains for properties along the Hill-Sloan-Tivey vein, a north-south striking vein extending from east of Lost Bay southwards for about 1.5 miles. Properties along the vein include the Kenelda Gold Mines Limited property and Conwo Gold Mines Limited.

3) Shear zones occupied by sulphide minerals and quartz veins. Representative of this group is the Raingold property.

4) Quartz veins and stringers in iron formation; only minor examples present.

The Grassett property was examined in 1973. The northern part of the Hill-Sloan-Tivey vein crosses the property, which consists of patented claims KRL4505, KRL4506, and KRL4568. The main vein is 1.5 feet to 3 feet wide. It parallels and lies close to a north-trending contact between rhyolite and mafic flows.

About 300 feet north of the shaft, subsidiary quartz veins occur in two outcrops 150 feet east of the main vein. Grab samples taken by the author from the main vein returned assays ranging from trace to 0.25 ounce per ton Au with a trace of silver. Sampling of the veins to the north and east yielded 0.32 ounce per ton Au. Grab samples taken south of the shaft in the Hill-Sloan-Tivey vein yielded values ranging from 0.03 to 0.22 ounce per ton Au (Assays by Mineral Research Branch, Ontario Division of Mines).

The Bobjo prospect on the peninsula forming the west side of Lost Bay, described by Bruce (1928, p.46) and Bateman, (1939, p.40) was sampled by the author. Grab samples, assayed by the Mineral Research Branch of the Ontario Division of Mines, of the quartz veins exposed 150 feet east of the shaft in a large pit returned 'values' ranging from trace to 0.06 ounce per ton Au. The property is underlain by pillowed intermediate to mafic flows, cut by a small body of quartz porphyry (100 by 500 feet), which is in turn cut by a north-trending lamprophyre dike 2 to 3 feet wide and exposed over a length of about 20 feet. The porphyry is cut by three north-trending vertical quartz veins up to about 3.5 feet wide, which have an uncertain lateral extend.

Base-Metal Sulphide Deposits: The only property upon which a sufficient amount of trenching and surface exposure exists to warrant mapping and sampling is that formerly optioned to Kolak Mines Limited and Campbell Island Mines And Explorations Limited on a peninsula jutting into the north part of Uchi Lake. A medium- to coarse-grained gabbro sill 100 to 150 feet thick is found intruding pillowed mafic flows. The sill trends generally north-south, paralleling minor divergences to this trend over a strike length of about 4,600 feet. Mineralization exposed in two pits about 700 feet inland along a drill road extending west from the east shore of the peninsula consisted of, in order of abundance, pyrite, chalcopyrite, and pyrrhotite. The mineralization occurs as irregular interstitial blebs in a horizon of coarse-grained gabbro or gabbroic pegmatite within a differentiated gabbro sill. The mineralized phase of the intrusion appears to be a crystal cumulate with the sulphide minerals giving the appearance of immiscible droplets within it. Representative samples obtained by the author's assistants from the above pits gave the following 'values' upon assay: Copper 0.22 and 0.12 percent and Nickel 0.04 percent in both samples (Assays by the Mineral Research Branch, Ontario Division of Mines).

Part of the area optioned to Campbell Island Mines And Explorations Limited was re-staked in May 1973 by H. Polkholm, Red Lake.

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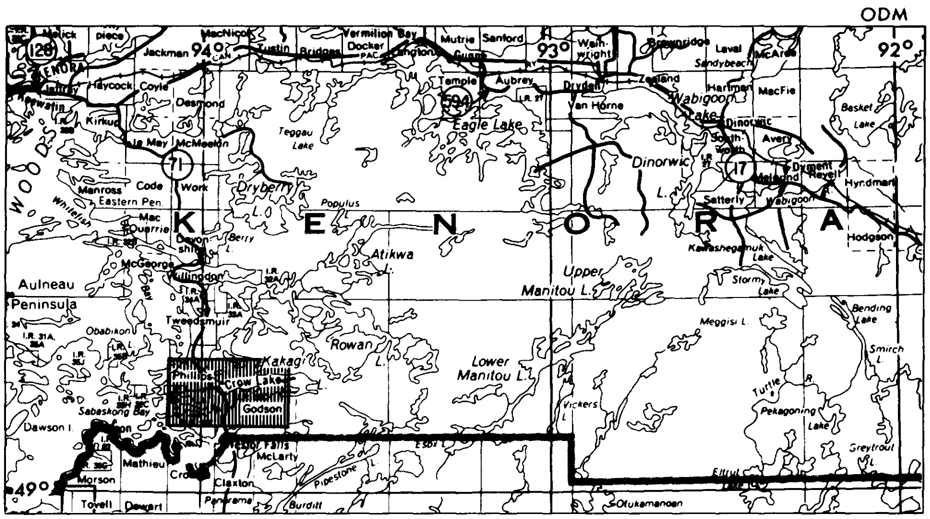
No.3 CROW LAKE AREA

DISTRICT OF KENORA

by

L. Kaye[1]

LOCATION: The Crow Lake area covers about 125-square miles (324-square km.) and is bounded by Latitudes $49^{\circ}7'30''$ and $49^{\circ}15'$N and Longitudes $93^{\circ}45'$ and $94^{\circ}05'$W; it includes Godson and Phillips Townships. Highway 71 crosses the



LOCATION MAP

Scale: 1 inch to 25 miles

western part of the map-area, which lies approximately midway between Kenora and Fort Frances. About one-third of the map-area is covered by the waters of Kakagi (Crow) Lake.

MINERAL EXPLORATION: Gold prospecting that followed from the discovery of gold northwest of Kakagi Lake about 1897 led to the discovery of several gold occurrences in the present map-area which, by the turn of the century, had been tested by exploratory shafts and workings. The Trojan Mine shaft, located at the south end of Gerard Lake, was excavated in 1899 on quartz vein

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gold showings. A gold prospect known as the Mascotte Mine, located on the southeastern shore of Gerard Lake, was explored by shaft and adit workings in 1932. Gold occurrences associated with strong shear zones in the east-central part of Kakagi Lake were sampled and trenched by Noranda Mines Limited in 1944 (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora): a revival of interest in these occurrences has generated some staking activity within the past two years.

Exploration for base metals in the map-area gained momentum in 1956 when Kennco Explorations (Canada) Limited drilled four holes east of Blacky Bay, totalling 1,600 feet (488 m) in length (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora). In 1968, Selco Mining Corporation Limited diamond drilled one short hole near a contact between peridotite and felsic pyroclastics in the central area of Kakagi Lake; the drilling followed an airborne INPUT geophysical survey in the previous year (Company records). Canadian Nickel Company Limited was active in the north-central part of the map-area in 1969 and diamond drilled several holes, with a total length of about 1,000 feet (305 m) (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

In 1970, Amax Exploration Incorporated carried out airborne and ground magnetic and electromagnetic surveys, geological mapping, and soil sampling covering an 18-claim group located on the southeastern shore of Kakagi Lake (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora), and on a strike east of the area that was the scene of the earlier Kennco activity. Hudson's Bay Oil and Gas Limited has, since 1972, carried out further detailed ground geophysical surveys and trenching on the Amax claim group (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora) as well as general exploration in the map-area.

GENERAL GEOLOGY: The geology of the Crow Lake area has been previously described in the regional reconnaissance mapping by Burwash (1933). More recently, detailed stratigraphic studies in the general area of Kakagi Lake have contributed to a broader appraisal of the regional volcano-tectonic framework (Goodwin 1965). Many of the rock-units described in the mapping of the Cedartree Lake area to the north (Davies and Morin 1972) extend into the present map-area.

Bedrock is of Lower Precambrian (Archean) age, with the exception of several northwest-trending Middle to Late Precambrian (Proterozoic) diabase dikes. The larger part of the map-area is occupied by a complex mafic-felsic metavolcanic sequence, the salient features of which are:

i) A basal platform, more than 15,000 feet (4,570 m) thick, consisting mainly of massive and pillowed basalt and andesite flows.

ii) A remarkable formation of interlayered chert, tuffwacke, felsic pyroclastic, and basal units of graphitic argillite. The formation, which is about 6,000 feet (1,830 m) thick, is traced westwards from the east-central boundary of the map-area for a strike-length of 5 miles (8 km). It is removed by faulting and folding from north-striking rock-units with similar lithology that exist in the north-central part of the map-area.

iii) A dominantly felsic pyroclastic accumulation, confined to the northern half of the map-area, which is more than 5,000 feet (1,524 km) thick, which forms the upper component of the mafic-felsic volcanic sequence and consists of a wide variety of tuffs, lapilli-tuffs, and pyroclastic breccias.

Differentiated ultramafic to mafic sills are conspicuously present within the upper felsic pyroclastics. Individual composite sills consist of two or more of the following units: peridotite, pyroxenite, gabbro, and anorthositic gabbro. A more local development of ultramafic differentiates is associated with numerous gabbro units that are found intercalated with mafic flows.

The northwestern and southwestern parts of the map-area are, respectively, occupied by granitic intrusive rocks of the Alneau Batholith and the Pipestone Batholith. The batholiths are separated in the vicinity of South Narrow Lake by an attenuated westward extension of the metavolcanic belt that contains the Robinson Lake Stock, a late-phase, discrete porphyritic quartz monzonite intrusion.

Adjacent to the granite batholiths are broad contact zones in which the metavolcanics are metamorphosed to amphibolite facies rank in contrast to the general greenschist facies rock metamorphism of the metavolcanics in the remainder of the belt.

STRUCTURAL GEOLOGY: The distribution of rock-units of the metavolcanic belt is strongly affected by the presence of large- and small-scale, steeply plunging, east-trending, tight, isoclinal folds, and other complex fold structures. Oblique and strike-slip faults are prevalent. Structural deformation is the result of several tectonic events the most important of which is probably co-incidental with the emplacement of the granite batholiths.

An intense schistosity, tectonic flattening and stretching is developed in the axial zones of isoclinal fold structures. In the northwest part of the map-area, ultramafic sill markers outline a tight, steeply north-northwest-plunging, east-trending syncline (South Narrow Lake Syncline) that forms a keel-like wedge between the Alneau and Pipestone Batholiths. The sill markers also trace the northward structural continuity via an intervening anticline, with the large, open syncline that exists in the Cedartree Lake area (Davies and Morin 1972).

Several prominent sets of sub-vertical faults, with significant displacement, were recognized. A dextral sense of movement is evident on a fault set that strikes S60E; late sinistral movements on faults that strike N20W displace the Proterozoic diabase dikes. Structural complexity in the east-central part of the map-area is the result of a major displacement on a fault that is tentatively assumed to strike northeast through Blacky Bay.

ECONOMIC GEOLOGY: The presence of gold mineralization in the map-area provides a potential target for exploration. Of about 40 samples collected by the author during the field season and analyzed for gold content by the Mineral Research Branch, Ontario Division of Mines, all yielded at least a trace of gold.

Of the 40 samples: grab samples collected in the vicinity of the Trojan Mine and Mascotte Mine prospects yielded 0.13 ounce and 0.10 ounce gold per ton, respectively.

Two samples taken from a rusty, intensely schisted zone in felsic pyroclastics located on the southeastern shore of an island in Kakagi Lake, near the eastern boundary of the map-area yielded 0.34 ounce and 0.04 ounce gold per ton: the schist zone, which is about 15 feet (4.6 m) in width, is associated with a major east-striking shear zone. The gold occurrence is significant in the light of current interest in large-tonnage, low-grade gold deposits, and in this respect other strong shear and schist zones that are associated with fold and fault structures in the map-area merit further investigation.

Sulphide mineralization was not observed within the ultramafic-mafic intrusive suite of rocks. Minor occurrences of cross-fibre asbestos veining are found in some of the peridotite sills.

Sulphide mineralization, mainly pyrite, is found in the thin graphitic agillite beds near the base of the chert-felsic pyroclastic formation. Chalcopyrite and sphalerite are reported by Davies and Morin (1972) to occur in a felsic pyroclastic unit east of Weisner Lake, in the Cedartree Lake area; this same unit extends southward into the present map-area.

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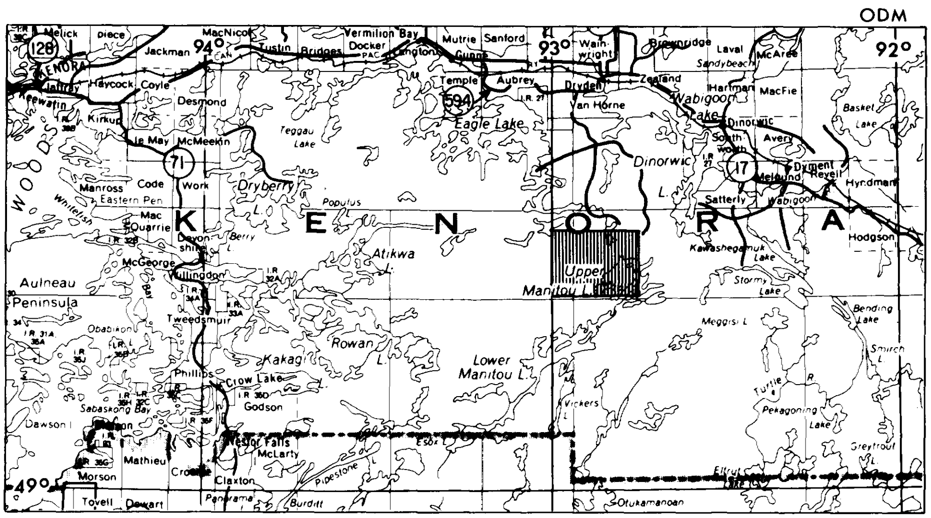
No.4 UPPER MANITOU LAKE AREA

DISTRICT OF KENORA

by

C.E. Blackburn[1]

LOCATION: Upper Manitou Lake lies about 25 miles south of Dryden, in the District of Kenora. The map-area is bounded by Latitudes 49°22'30" and 49°30'N, and Longitudes 92°45' and 93°00'W and covers approximately 100-square miles.



LOCATION MAP

Scale: 1 inch to 25 miles

The northwest half of the map-area is accessible by a system of logging roads extending southward from Dryden. Two of these roads extend to Upper Manitou Lake. Float-equipped aircraft may be chartered at Dryden, Fort Frances, and Nestor Falls.

MINERAL EXPLORATION: The Manitou Lakes were the scene of considerable gold prospecting and mining activity during the period 1895 to 1912, and again in the 1930s (Thomson 1933). A number of old prospects lie within the present map-area, but all have been inactive for at least 40 years. Patents are presently held on two of these, the Swede Boys Island prospect, and the Haycock property, also called the Gold Rock Mine. No amount of gold of any consequence was produced from any of the properties within the map-area.

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Molybdenite and minor amounts of bismuthinite have long been known from a narrow zone of quartz veining east of Navimar Lake (Eardley-Wilmot 1925, p.77; Parsons 1917, p.304).

Exploration for base metals has been a more recent development. During the summer of 1967 and the following winter, Kerr Addison Mines Limited carried out ground electromagnetic surveys of seven groups of claims in the Manitou Lakes area; one of these lies wholly within the present map-area, and the northern part of a second group lies partly within the map-area. The southern part of the second group was discussed by Blackburn (1972, p.55). Anomalies were located on these groups, both of which lie in the south of the map-area, close to the northwest shore of Upper Manitou Lake. A number of drill holes were put down to test these anomalies. Records available in the Assessment Files Research Library, Ontario Division of Mines, covering 8 holes totalling 1,561 feet, report minor amounts of pyrrhotite and pyrite, very 'weak' chalcopyrite, and in one hole very 'weak' sphalerite.

During the spring of 1970, a combined airborne electromagnetic and magnetic survey was flown by Questor Surveys Limited for Freeport Canadian Exploration Company over Straw Lake (southwest of the map-area), Eagle Lake (northwest of the map-area), and the Manitou Lakes as a joint venture with Beth-Canada Mining Company. In the Manitou Lakes part, electromagnetic and attendent magnetic anomalies were located at two places within the present map-area. One of these was coincident with, but only partially as extensive as, that found by the Kerr Addison Mines Limited ground electromagnetic survey along the northwest shore of Upper Manitou Lake, and near to the old Haycock property. The other was located in the southeast corner of the map-area, along the Manitou Straits. No follow-up program was carried out on these anomalies (Ontario Division of Mines, Assessment Files Research Office).

GENERAL GEOLOGY: The Upper Manitou Lake area was previously mapped as part of a reconnaissance survey extending from Lower Manitou Lake to Stormy Lake, some 20 miles to the east of Upper Manitou Lake, by Thomson (1933). The geology as delineated by Thomson's survey is incorporated in the Kenora-Fort Frances Compilation map (Davies and Pryslak 1967). The present survey is part of a continuing program of 1 inch to ¼ mile mapping of the Manitou Lakes-Stormy Lake area, and adjoins, on its north side, the Lower Manitou-Uphill Lakes area, mapped during the 1972 field season (Blackburn 1972; 1973).

The Manitou Lakes-Stormy Lake metavolcanic-metasedimentary belt is arcuate in form, approximately 12 miles in width, and some 50 miles long, tapering at either end, and joining on its north side with metavolcanics extending northward toward Dryden. Bedrock in the belt is of Early Precambrian (Archean) age, and consists of thick volcanic and sedimentary sequences intruded by porphyry dikes, granitic stocks, granitic rocks of marginal batholithic domes, and gabbroic bodies. The present map-area is situated on the northwestern side of the belt.

Within the map-area, thick flow and pyroclastic volcanic sequences are bordered to the northwest by granitic and gneissic rocks of the Atikwa-Niven dome (Goodwin, 1965), and intruded by a gabbroic stock-like body at Mitchell Lake. The metavolcanics occupy the southeastern half of the map-area, and comprise three sequences, a lower mafic flow sequence, a middle predominantly pyroclastic sequence of intermediate composition, and an upper mixed sequence of mafic flows and intermediate pyroclastics.

Numerous felsitic and porphyritic dikes intrude the volcanic sequences.

Voluminous amounts of hybrid dioritic rock occur along the broad contact zone between metavolcanics and felsic plutonic rocks. Rafts and xenoliths of volcanic rocks, metamorphosed under amphibolite facies conditions, and further areas of hybrid diorites occur within the plutonic rocks of the Atikwa-Niven dome. Volcanic and dike rocks are metamorphosed under amphibolite facies conditions up to 2 miles from the contact zone. Elsewhere, and in the vicinity of Upper Manitou Lake, they are metamorphosed under greenschist facies conditions.

STRUCTURAL GEOLOGY: Regional structural trend in the metavolcanics is predominantly northeast. Within the Atikwa-Niven dome the trend is more variable, but conforms with that in the metavolcanics close to the contact zone. Primary structural criteria are not abundant, and mostly confined to pillow facings in the mafic metavolcanics. They indicate the presence of an anticlinal fold, the Manitou Anticline (Goodwin 1965), the axial plane of which is aligned northeast-southwest, underlying Upper Manitou Lake. Abundant secondary linear structures indicate that the fold axis plunges steeply to the east and is overturned.

The establishment of this major fold modifies the previous stratigraphic and structural synthesis for the Lower Manitou-Uphill Lakes area (Blackburn 1972; 1973). In particular, the major fold axis lies within Unit 4 of the northwestern sequence of that synthesis. Strong planar and linear deformation throughout the Manitou Lakes metavolcanic-sedimentary sequences makes any estimates of original thicknesses hazardous, and are not attempted here.

A major fault, the Manitou Straits Fault, passes in a northeasterly direction through the extreme southeastern corner of the map-area. The geological succession southeast of this fault has been shown elsewhere to be substantially different from that to the northwest (Blackburn 1972; 1973).

A synclinal fold may lie between and parallel to the Manitou Anticline and the northwestern margin of the metavolcanic belt.

ECONOMIC GEOLOGY: Gold occurrences in the Manitou Lakes area are invariably associated with quartz veins that cut both mafic and intermediate volcanic rocks. In the present map-area, gold has been found at Swede Boys Island, Frenchman Island, and the Haycock Mine on the northwest shore of Upper Manitou Lake. All three are discussed by Thomson (1933, p.31-33, 36). Mafic grab samples from the Haycock Mine dump, and a grab sample from the main quartz vein on Frenchman Island, were submitted by the writer for assay to the Mineral Research Branch, Ontario Division of Mines. Only trace amounts of gold were detected in both samples, whereas the former contained traces of copper and nickel. The old gold locations on Swede Boys Island could not be found.

Disseminated magnetite and minor pyrrhotite occur in gabbroic and dioritic rocks at Navimar and Mitchell Lakes and give rise to two magnetite anomalies, in excess of 61,000 gammas, one each centred over these lakes, as delineated on the Aeromagnetic Map (ODM-GSC 1961).

Nickel-copper mineralization has not been found in these bodies, but by analogy with similar rocks, which do contain these metals occurring close to the granite-greenstone contact elsewhere around the Atikwa-Niven dome, such deposits might be prospected for.

Molybdenite and minor bismuthinite occur in a quartzose pegmatite vein near Navimar Lake (Eardley Wilmot 1925). The vein cuts hybrid quartz diorite of the contact zone between the metavolcanic belt and the Atikwa-Niven dome.

Molybdenite occurrences are scattered along the greenstone-granite contact zone around the eastern end of the Atikwa-Niven dome (eg. Goodwin 1965; Davies and Pryslak 1967; Blackburn 1972; 1973). They appear to be associated in general with quartz or quartzose pegmatite veins of either epigenetic or syngenetic origin. These veins, in themselves, do not appear to be of exploitable dimensions but may indicate the presence of low grade molybdenum within plutonic rocks of the Atikwa-Niven dome. Samples of granitic country rock from near a similar molybdenite occurrence at Olsen Bay of Lower Manitou Lake (Blackburn 1972, p.57) were submitted for qualitative spectrographic analysis to the Mineral Research Branch, Ontario Division of Mines, but yielded no trace of molybdenum.

Narrow stringers and veins of specular hematite occur in brecciated granitic rock near Kekekwa Lake. The zone of brecciation is about 5 feet wide, oriented north-south, and may be 20 feet or more long. It occurs about a quarter mile north of the granitic-greenstone contact along a disused lumber road on the east side of the lake.

Disseminated pyrrhotite and pyrite is ubiquitous in volcanic rocks at the southwest end of Upper Manitou Lake, and in particular in coarse-grained intermediate pyroclastic rocks metamorphosed under at least amphibolite facies conditions at the southwest Bay of Upper Manitou Lakes.

Results of airborne and ground electromagnetic and magnetic surveys by Kerr Addison Mines Limited and Freeport Canadian Exploration Company point to a zone of anomalies extending in a northeasterly direction along the northwest shore of Upper Manitou Lake. The little amount of drilling done on these anomalies has indicated them to be due to pyrrhotitic sulphides, with negligible amounts of chalcopyrite.

Two small ultramafic bodies have been located at the north end of Wawapus Lake. No sulphide mineralization was found to be associated with them in outcrop.

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No.5 HOUGHTON-HOUGH LAKES AREA

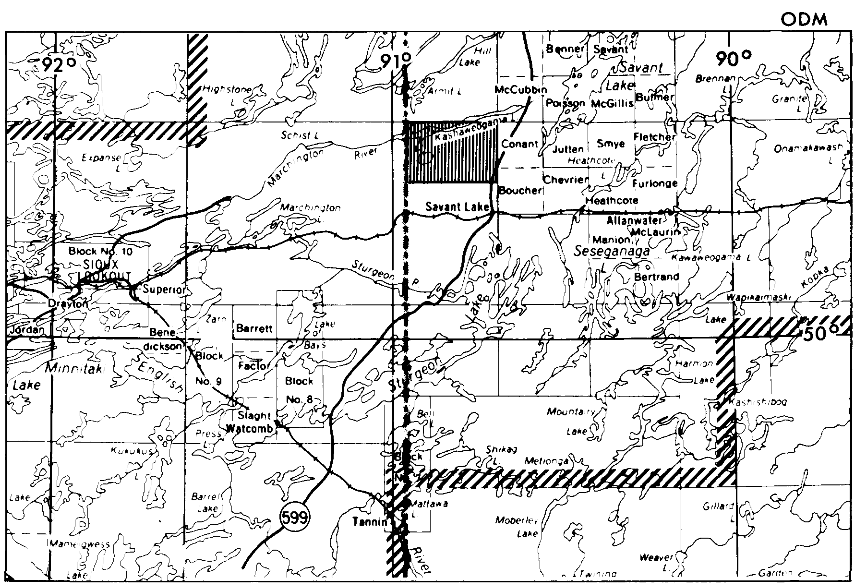
(SAVANT LAKE AREA)

DISTRICT OF THUNDER BAY

by

W.D. Bond[1]

LOCATION: Hough Lake is situated about 10 miles north of the Town of Savant Lake. The geological survey is limited in the north by the 7th Base Line (Latitude 50°24'42"N) and in the south by Latitude 50°18'N. The western



LOCATION MAP

Scale: 1 inch to 25 miles

boundary of the map-area coincides with the western boundary of the Thunder Bay District and the area extends eastward to the Conant and Boucher Township lines; the area totals 93.6-square miles.

Highway 599 runs north from the Town of Savant Lake, and passes through the extreme southeastern corner of the area surveyed. Kashaweogama and Fairchild Lakes provide water access by boat or canoe in the northern part of the area. Several isolated, small lakes in the south and southwest parts of the map-area are accessible by fixed-wing aircraft.

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MINERAL EXPLORATION: The Savant Lake region has been prospected for precious minerals since the turn of the century. Prior to 1965 only minor base metal exploration was undertaken. Since 1968 interest in the Savant Lake Greenstone Belt which is a northern extension of the Sturgeon Lake Greenstone Belt has been enhanced by the discovery of a Cu-Pb-Zn-Ag sulphide ore body by Mattagami Lake Mines Limited, Exploration Division, in the sturgeon Lake area.

Within the Houghton-Hough Lakes area, evidence of early exploration activity is restricted to a few isolated test pits and strippings. Airborne geophysical surveys have been flown over the area but extensive overburden and limited access have continued to hamper exploration activities.

Cam Mines Limited, in April 1972, held title to four claim blocks in the Savant Lake region, two of which lay in the map-area. These two claim blocks totalled 46 claims. A combined ground electromagnetic and magnetic survey was carried out over the claim groups and two parallel anomalous zones were found over a small lake in the southeast corner of the map-area and one anomalous response with an accompanying magnetic high was obtained in the northern part of the property. Further detailed prospecting and mapping were recommended for the property but no further work was submitted to the assessment work files.

During January and February 1970, Canex Aerial Exploration Limited staked a total of 171 claims in the Savant Lake area. Of these claims, 165 lay within the limits of the Houghton-Hough Lakes map-area. The area was flown and eleven airborne electromagnetic and magnetometer anomalies were located on the ground. A geological survey of the ground was carried out and five of these anomalous zones were tested by diamond drilling. Six diamond drill holes were drilled for a total of 1,057 feet. Mainly disseminated pyrite, pyrrhotite, graphite, and only specks of chalcopyrite, were intersected with no actual economically important mineralization being encountered. Consequently the last of these claims were allowed to lapse during the 1973 field season.

In 1970, Jorex Limited optioned a 22 claim group near Evans Lake in the southeast corner of the map-area. Of the 22 claims, only 5 lie within the limits of the present survey. A geophysical ground survey was carried out but no anomalous electromagnetic zones were obtained and the corresponding magnetic survey done at the same time over the same ground supported this interpretation. As a result the claims have since been allowed to lapse.

In 1971, Noranda Exploration Company Limited staked a four claim group in the centre of the map-area. Two weak responses from an airborne survey were checked but could not be located by subsequent ground geophysics. It was concluded that a vertical loop survey was necessary for a greater depth penetration (Ontario Division of Mines, Assessment Files Research Office). No further work was recorded and the claims were allowed to lapse during the 1973 field season. The Noranda Exploration Company Limited also controls a large claim block southeast of Hough Lake, of which 13 claims are situated within the map-area. A combined ground electromagnetic and magnetic survey was conducted over the claims and three anomalous electromagnetic zones with associated magnetic highs were found.

R.G. Ramsay holds several claims in the northeast corner of the map-area. This area has received considerable attention for its iron reserves and its development dates back to 1908 when nine pits and two shafts were excavated. The history thereafter is not recorded until 1956 when Pershland Gold Mines Limited acquired the property from an unknown syndicate and did some trenching and diamond drilling in 1956. This was followed up with a magnetometer survey and further diamond drilling in 1957 and 1965. Pershland Gold Mines optioned the property to Moore Iron Ore of Duluth, Minnesota, U.S.A., in 1960 and to the Algoma Steel Corporation Limited. The latter carried out a magnetometer and geological survey over the ground in 1967. In 1971, R.G. Ramsay extracted a 600 pound bulk sample in order to do a benefication test (Ontario Division of Mines, Assessment Files Research Office, File 2.838).

At the present time only about 5 percent of the entire map-area is staked.

GENERAL GEOLOGY: Previous regional mapping by Moore (1928) and Skinner (1969) indicated that the area is underlain primarily by intermediate to felsic metavolcanics with local intercalated metasediments of Early Precambrian (Archean) age. Stratigraphically these rocks represent an upper metavolcanic sequence overlying a lower, more extensive, metavolcanic sequence. The entire succession has been folded and the present mapping program centered on the west limb and nose of this fold with the nose being situated in the southeast corner of the map-area.

The oldest rocks in the map-area are exposed north of Kashaweogama Lake and are part of the lower mafic metavolcanic sequence. Composed of fine- to-medium-grained mafic flows with minor associated pillow lavas, these rocks are generally strongly foliated due to their close proximity to two nearby granitic intrusions. Intercalated with the lower mafic metavolcanics is a band of chemically precipitated, in part clastically deposited, metasediments composed of interbedded grey quartz, white quartz, minor carbonate, and minor chlorite-rich siltstone. The band is curvalinear, following the margins of the nearby granitic intrusions closely; stratigraphically, it appears continuous with a band of iron formation indicated by Skinner (1969) to be present north of the map-area.

Exposed discontinuously along Kashaweogama and Fairchild Lakes, a heterogeneous conglomerate unconformably overlies the lower mafic metavolcanic sequence. The conglomerate, characterized by leucotrondhjemitic boulders, is similar to, and is continuous with, that exposed in McCubbin Township to the northeast (see Bond 1972).

Metasediments underlie the extreme northeastern part of the map-area but are not nearly as extensive as suggested by Skinner (1969). These trend east-west and appear to be truncated by a fault striking west-southwest down Kashaweogama Lake. The metasediments are composed of intimately interbedded greywacke-sandstone, siltstone, iron formation, and reworked tuffs. In places the iron formation becomes fairly concentrated in bands up to 1,000 feet wide.

South from Kashaweogama Lake, the major part of the map-area is underlain by a complex sequence of partial to complete metavolcanic cycles (i.e. mafic, intermediate, and felsic metavolcanics where complete). If no repetition has occurred due to folding there may be up to 6 partial sequences. However, folding or facies change has probably produced some stratigraphic repetition. Intercalated with some of the earlier cycles are arenaceous, tuffaceous, and ferruginous metasediments. At a minimum, the upper metavolcanic sequence is 22,000 feet thick in the thinnest part of the belt and maybe as much as 40,000 feet thick (the latter estimate coincides, in part, with a fold axial trace trending approximately N25E). The individual mafic, intermediate, and felsic units, which constitute the cycles, each average from 1,000 to 2,000 feet thick.

The mafic metavolcanic units of the upper metavolcanic sequence are largely massive, medium- to coarse-grained flows that are amphibolitized in many places. Intermediate and felsic metavolcanics are composed of at least 75 percent pyroclastic material. The coarsest pyroclastics are intermediate in composition and are most abundant in the vicinity of Hough Lake. Rhyodacitic to rhyolitic metavolcanics extend across the central part of the map-area and also occur in the southeast part of the map-area. Felsic metavolcanics in many of the exposures are fine-grained and differentiating the fine pyroclastic rocks from the flows was difficult. The writer estimates that about 90 percent of these rocks are tuffaceous in character. Many of the finer grained tuffs contain porphyritic quartz and feldspar phenocrysts and some of these could be porphyritic hypabyssal intrusions or flows inpart.

An unusual rock underlies parts of the southeast corner of the map-area just west of Highway 599. The rock is translucent and hard, suggesting that it is extremely siliceous. Locally the rock appears bedded; this bedding is contorted in many places and may in fact be flow banding. The presence of sparse, minute crystals (fragments?) of plagioclase and locally lapilli-tuff breccia-sized fragments support a volcanic origin although the possibility that this is a metasedimentary quartzite cannot be overruled without further investigation.

Underlying the southwest part of the map-area is a complex sequence of felsic to intermediate plutonic rocks that include coarse-grained trondhjemite, and granodiorite to quartz-monzonite phases. A hornblende-quartz diorite-hornblende trondhjemite with local zones of gabbro occurs as a sill within this felsic plutonic sequence.

Quartz and quartz-feldspar porphyries border this granitic sequence. These porphyries contain inclusions of mafic metavolcanics and the hornblende trondhjemite (and are probably early hypabyssal intrusive phases).

The contact of the granitic batholith was delineated in the southwestern part of the area, but was not observed in the south-central and southeast parts of the map-area. Below the granitic sequence, which forms a lobe that extends eastward into the metavolcanics in the latter area, mafic and felsic metavolcanics were observed in outcrop. Most likely the contact of the 'greenstone' belt to the south is similar to that shown by Skinner (1969).

North of Fairchild Lake a moderately deep-seated migmatitic granitic complex with pegmatitic phases occurs.

North of Kashaweogama Lake, a massive, quartz monzonite (locally granodiorite) stock has been intruded into the lower mafic metavolcanic sequence. The pluton appears fresher than the rest of the granitic rocks and probably intruded as a diapir in the later stages of orogenesis.

STRUCTURE: The map-area occupies the west limb of a fold with the nose located in the southeast. The lithologic units are gently curvalinear trending from northwest in the east to northeast in the west. In the west the various lithologies are squeezed together or pinched out by granitic intrusions to the south and to the north.

From previous mapping in Conant Township (see Bond 1973) the fold axis to the east trends N80E but in the present map-area the fold axis trends N25E. The reason for this dramatic change is not known. Moore (1928), Rittenhouse (1936), and Skinner (1969) have inferred the fold to be a syncline, however, tops in several places suggest that the fold is an anticline plunging 70 to 80° to the northeast.

The marked change in lithologies, structural trend, and reverse of top direction from north of Kashaweogama Lake to the south of Kashaweogama Lake, indicate that faulting may be present striking through Kashaweogama Lake. This theory is supported by intense shearing along the lake and the presence of a strong topographical lineament in the form of the lake.

Several transverse faults with small en echelon dexteral offsets are present in the southeast. Their northeasterly trend is fairly constant and consistent with several major faults in the area.

ECONOMIC GEOLOGY: A few old test pits found along Kashaweogama Lake are generally associated with secondary, discontinuous, barren quartz veins. Minor disseminated pyrite is widespread in the metavolcanic flows and some finer grained pyroclastics.

Minor disseminated pyrite, pyrrhotite, and chalcopyrite are found locally in the mafic metavolcanics north-northeast of the narrows between Kashaweogama and Fairchild Lakes.

In the centre of the map-area, disseminated pyrite with minor pyrrhotite occurs restricted to a contact between mafic to intermediate metavolcanics and rhyolitic metavolcanics. The contact is traceable discontinuously for about two miles.

From the field mapping, there appears to be a few rhyolite-andesite contacts in the area and these should be investigated in some depth for any possible mineralization. During any further investigation it will be important to determine:

i) Whether the fine-grained felsic metavolcanics are flows or tuffs; and

ii) The true origin of some of the fine-grained porphyritic felsic rocks (i.e. extrusive or intrusive).

Three thousand feet southeast of Houghton Lake, local, very minor, disseminated chalcopyrite and pyrite is associated along a joint within the porphyritic (hypabyssal?) border phase of the granitic lobe.

The iron formation concentrated in the northeast corner of the map-area is the only potentially economic prospect to date. According to the Pershland Gold Mines prospectus 1957 (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora) the magnetometer survey indicated a 500 million ton iron deposit amenable to open pit extraction. A benefication test was done on a 600 pound bulk sample extracted from the area by R.G. Ramsay in July 1971. The sample assayed 34.1 to 35.1 percent acid soluble iron (Ontario Division of Mines, Assessment Files Research Office, File 2.838). Although the magnetite mineralization is very fine-grained, preliminary tests showed that an iron super-concentrate with 70 percent Fe and 2 percent insolubles with greater than 80 percent recovery could be obtained; a full scale test program has been ordered (Ontario Division of Mines, Assessment Files Research Office, File 2.838).

Sand and gravel deposits are extensive as two major eskers run through the area.

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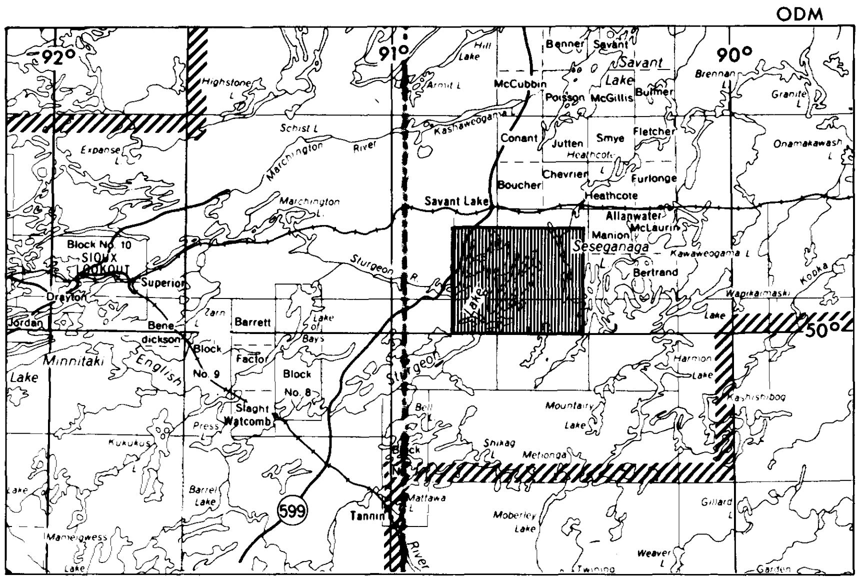
No.6 SQUAW LAKE-STURGEON LAKE AREA

DISTRICT OF THUNDER BAY

by

N.F. Trowell[1]

LOCATION: In 1972, the author began a two-year mapping project in the Squaw Lake-Sturgeon Lake Area. The total area now covered is approximately bounded by Latitudes 50°00'-50°9'30"N and Longitudes 90°27'-90°50'W; approximately



LOCATION MAP Scale: 1 inch to 25 miles

150-square miles. The part of this area mapped during the summer of 1973 includes the general Vista Lake-Squaw Lake area and the northern parts of Couture and Sturgeon Lakes. Much of the western part of the area is accessible from Sturgeon Lake whereas float-equipped aircraft provide access to the eastern part of the area.

MINERAL EXPLORATION: According to W. McInnes (1900) of the Geological Survey of Canada, who first mapped in the Sturgeon Lake area, gold was first discovered in the area in 1898 with the result that extensive prospecting for gold was conducted during the early part of this century. The St. Anthony Gold Mine

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located on the west shore of Couture Lake was in production intermittently between the years 1903 and 1941; 331,069 tons of ore were mined with a valuation of 2,165,292 dollars (ODM 1943, table V). Other gold occurrences in the area, specifically on Couture Lake and the Northeast Arm of Sturgeon Lake, were explored by trenching and shallow shafts. Some vein material was milled.

The discovery in 1968, of a Cu-Zn-Ag-Pb (-Au) sulphide deposit by Mattagami Lake Mines Limited, Exploration Division, located approximately 20 miles to the southwest resulted in the present map-area being almost completely claimed and prospected. Along the Northeast Arm of Sturgeon Lake Phelps Dodge Corporation of Canada Limited were active in the last field season.

GENERAL GEOLOGY: The map-area covers the north-central part of the Sturgeon Lake metavolcanic-metasedimentary belt. Within the confines of the map-area the belt is 11 miles long by 9.5 miles wide. It is bounded on both the west and east by granitic batholiths.

With reference to the previous year's mapping wherein it was suggested that there was one complete volcanic assemblage (with mafic, intermediate, and felsic rocks) overlain by one partial volcanic assemblage (including only the mafic and intermediate rocks), (Trowell 1972) further work to the north and south would suggest that whereas there exists a lower mafic to intermediate metavolcanic assemblage, higher stratigraphic levels comprise a complexly, finely intercalated sequence of mafic to intermediate and intermediate to felsic metavolcanics. In the northern part of the area, especially, the rapid alternation of mafic to intermediate, and intermediate to felsic metavolcanic units would suggest that both types of volcanism had occurred simultaneously. Also, many of the fragmental rocks in this area possess various structures suggestive of subaqueous reworking (graded bedding, roundness of clasts) possibly indicative of the presence of local mixed assemblages of pyroclastic rocks and volcanogenic metasediments.

The metasediments that appear to be primarily volcanoclastic in origin extend in a belt from East Bay northeast to Vanessa Lake. The belt has been intruded and effectively divided in two by the Vista Lake intrusion.

The carbonate fragmental rocks initially mapped during 1972 (Trowell 1972) was found to extend 3 miles northeast of Morgan Island. While the question of whether this sequence is in part intrusive in origin has not yet been resolved the author thinks that overall these carbonate rocks probably represent volcanogenic replacement deposits. These carbonate rocks can be subdivided into what the author believes to be the primary rock types, specifically mafic and felsic fragmental units of possible hyaloclastic and pyroclastic origin. Local apparent bedding structures would suggest that these units have possibly been slightly reworked. The author suspects that the carbonate was exhalative in origin and was somehow trapped within and subsequently replaced these fragmental units. No explanation can yet be presented to explain the mafic to ultramafic suite of trace elements that characterize this sequence.

Sills, dikes, and irregular bodies of metagabbro and metadiorite have intruded, mainly, the metavolcanics but also locally the metasedimentary sequence. Along the Northeast Arm of Sturgeon Lake highly porphyritic anorthositic metagabbroic dikes have intruded the metavolcanic sequence. Gabbro units along the west and south sides of Squaw Lake might be related to the 'Squaw Lake Alkalic Complex' (see below).

Three syenite-monzonite (-trondhjemite) complexes intrude the metavolcanic and metasedimentary sequence at Vista and Vanessa Lakes.

An undersaturated, nepheline and (or) scapolite alkalic complex ('Squaw Lake Alkalic Complex') has intruded the mafic to intermediate metavolcanics and associated mafic intrusive rocks on Squaw Lake. The author believes that this complex is both cogenetic, and contemporaneous with the 'Sturgeon Narrows Alkalic Complex' (Trowell 1972), which lies 9 miles to the southwest.

A granitic gneiss terrain essentially devoid of a border migmatite zone is exposed in the eastern part of the map-area.

STRUCTURAL GEOLOGY: A major shear zone, with concomitant development of penetrative schistosity extends along the Northeast Arm of Sturgeon Lake; in fact, two schistosities are present, one trending approximately northeast and the other east-northeast. Tight shear folding is also in evidence along this zone. Axial planes trend approximately northeast whereas fold axes are subvertical. The author believes that this shear zone and shear folding have been superimposed on regional flexural-slip folding with east-west-trending fold axes. Crenulation foliation and kink folding have developed on the pre-existing foliations. The intrusion of the Squaw Lake and Sturgeon Narrows Complexes and the three intrusive complexes of Vista and Vanessa Lakes resulted in warping of the foliations in the metavolcanic-metasedimentary sequence around these intrusions. Extensive faulting, as indicated by displacement of lithological units, is not evident although the author suspects that considerable faulting parallel to stratigraphy could have occurred.

ECONOMIC GEOLOGY: Pyrite, pyrrhotite, and in a few places, minor chalcopyrite mineralization, generally less than 1 to 2 percent occurs locally as disseminations in most of the metavolcanics.

Several of the felsic pyroclastic units exposed on the Northeast Arm of Sturgeon Lake contain local clot-like concentrations of sulphide minerals that constitute up to 5 percent of the particular rock unit.

A narrow (1.5 to 2.5 foot) siliceous zone containing from 3 to 10 percent sulphide minerals occurs along the west shore of Vanessa Lake. The zone lies between a massive amphibolite (massive mafic flow) unit on the west and a pillowed volcanic flow unit on the east; the zone striking approximately north, dipping 75W, and is exposed for 10 feet along the shore. The sulphide minerals consist predominantly of pyrite and pyrrhotite occurring as breccia fragments set in a siliceous matrix.

A 6-foot thick zone of sulphide iron formation occurs in the metasediments west of Vista Lake. The zone is exposed for 7 feet and is stratigraphically concordant to the surrounding metasediments striking northeast and dipping 85N. The zone can be roughly subdivided into 4 separate sub-zones from north to south: massive sulphide; disseminated sulphide in argillaceous groundmass; interlaminated sulphide and argillite; and a breccia sub-zone of sulphide fragments set in an argillaceous groundmass. The outcrop shows recent signs of prospecting, primarily blasting and trenching.

An area of high magnetic response with circular configuration occurs in the southeast corner of the map-area west of Vista Lake, (ODM-GSC 1961). The immediate area is swamp-covered and no outcrop was found. The author suspects that the anomaly is due to iron formation but is uncertain whether it is of the oxide or sulphide facies type.

Magnetite is a ubiquitous mineral in the 'Squaw Lake Alkalic Complex'. It occurs disseminated throughout the entire complex in amounts of 1 to 2 percent. Locally it occurs as clot-like aggregates comprising 3 to 5 percent of the particular rock unit. Along the western contact of this complex with the metavolcanic sequence, local magnetite veins and veinlets cut the border phases of this complex. It is possible that the high magnetic responses along the western and southern sides of the complex might be due to either local magnetite concentrations or to mafic intrusive bodies.

The 'carbonate fragmental unit' carries 1 to 2 percent sulphide minerals with local titaniferous magnetite. It is characterized by relatively high trace element contents of titanium, chromium, nickel, vanadium, and cobalt; that is, it apparently is characterized by a mafic to ultramafic suite of trace elements. Whereas the presence of fuchsite in this unit can explain the presence of chromium, preliminary investigations would suggest that the other elements are possibly present within the carbonate structure itself.

The St. Anthony Gold Mine was developed within a quartz-breccia zone, or vein system, that occurred within a body of 'hydrothermally' altered granitic rocks. Grab samples taken from the mine-dump and examined by the author, indicate that associated minerals include pyrite-marcasite, galena, and sericite (alteration mineral) all set in a quartz (±carbonate) gangue.

The other gold prospects and occurrences in the area appear to be associated with quartz+carbonate+chalcopyrite+pyrite±marcasite±fuchsite veins and shear zones commonly occurring at the contacts between mafic and felsic metavolcanic rocks.

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No.7 OPERATION IGNACE-ARMSTRONG

DISTRICTS OF KENORA, RAINY RIVER, AND THUNDER BAY

by

R.P. Sage[1], F.W. Breaks[1], G.M. Stott[2],

and G.M. McWilliams[3]

LOCATION: The map-area for Operation Ignace-Armstrong, as indicated in the key map, is bounded by Latitude 49°00' and 51°00'N and Longitudes 89°00' and 90°30'W, Latitudes 49°00' and 49°45'N and Longitudes 90°30' and 92°00'W and Latitudes 48°45' and 49°15'N and Longitudes 92°00' and 93°00'W. The enclosed area totals approximately, 15,000-square miles (38,850-square km).

The shape of the map-area, combined with a generally east-west road system, prevented the establishment of an effective centralized base of control for the Operation. Consequently, the map-area was broken into four parts with mapping in each area being done under the direction of one of the four party chiefs assigned to the project (Sketch map). Mapping in each of the areas was undertaken in a somewhat independent fashion with each party chief having the assistance of one senior geological assistant. The geological summaries for each of the respective areas has been prepared by the party chief responsible for mapping.

Outcrop density is highly variable within the map-area, varying from almost non-existent to almost continuous outcrop. A number of areas of metasedimentary-metavolcanic rocks within the map-area have undergone previous detailed or reconnaissance mapping. Reference to this previous work will be made during the brief discussion of each of the belts.

A greater emphasis was placed on the granitic rocks of the area during this helicopter operation than has been done during past operations. This emphasis was in keeping with the fact that coverage already existed in most of the metasedimentary-metavolcanic belts and that the largely unknown areas are of granitic composition.

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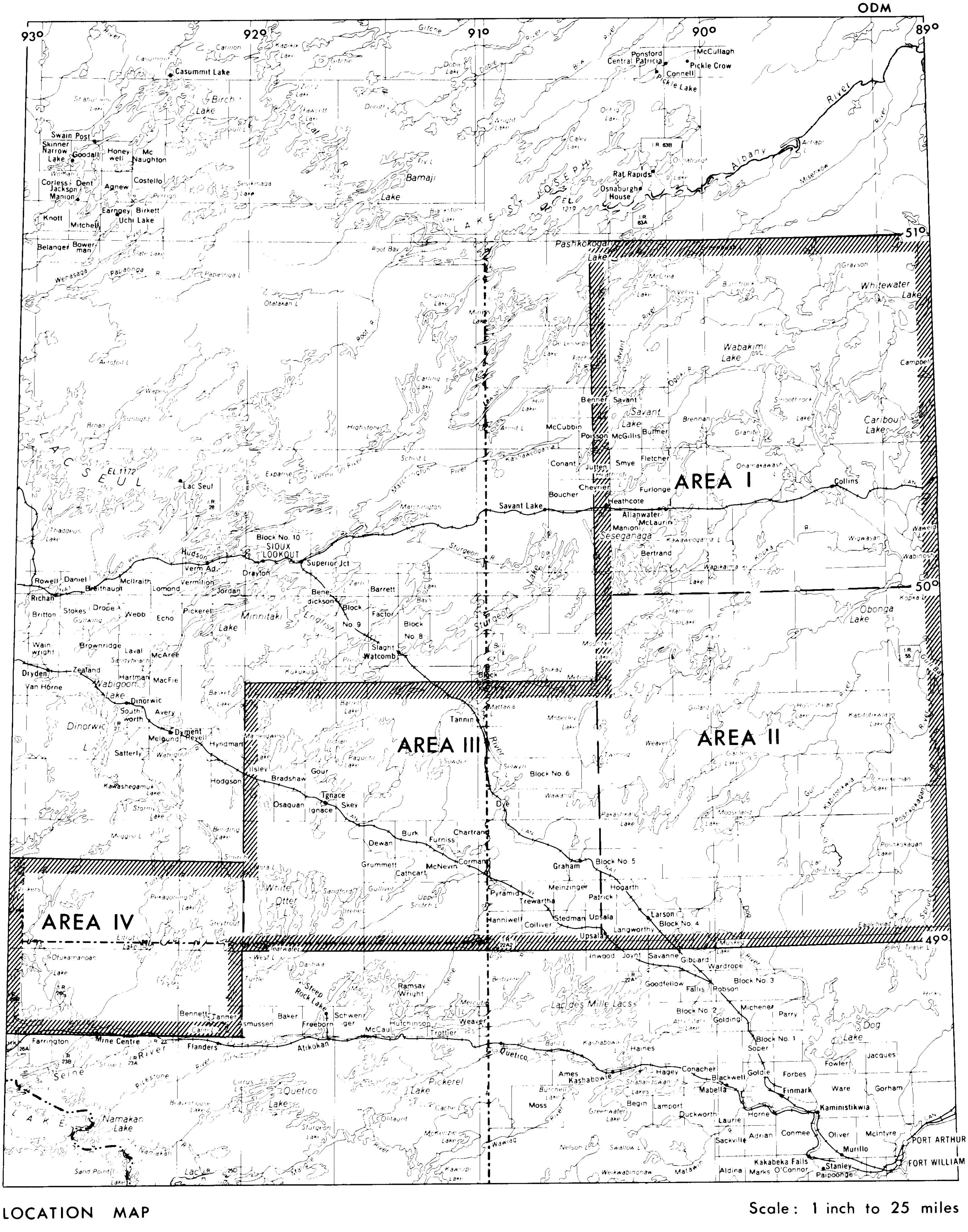
[3]Geological Assistant, Precambrian Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto.

GENERAL GEOLOGY: The main project area incorporates parts of several structural blocks of the Superior Province (Wilson 1971). A small part of the Red Lake Block is present in the northwest corner of Area I covering a part of the Pashkokogan Lake metavolcanic-metasedimentary belt. Approximately one-third of Area I is covered by the English River Block with small parts of the Kenora Block being present along the southwestern and eastern-central margins. All of Areas II, III and IV lie within the Kenora Block.

A very generalized geological map accompanies this report. The numbered areas referred to in the text are indicated on this map.



LOCATION MAP

Scale: 1 inch to 25 miles

AREA I

1. Caribou Lake-Pikitigushi River Belt
2. Pashkokogan Lake-Misehkow River Belt
3. Savant Lake Belt

AREA II

4. Kearns-Garden Lakes Belt
5. Bo Lake-Heaven Lake Belt
6. Bo Lake-Heaven Lakes and Lac des Iles Area
7. Lac des Iles Area
8. Obonga Lake Belt
9. Hilltop-Mountairy Lakes Area

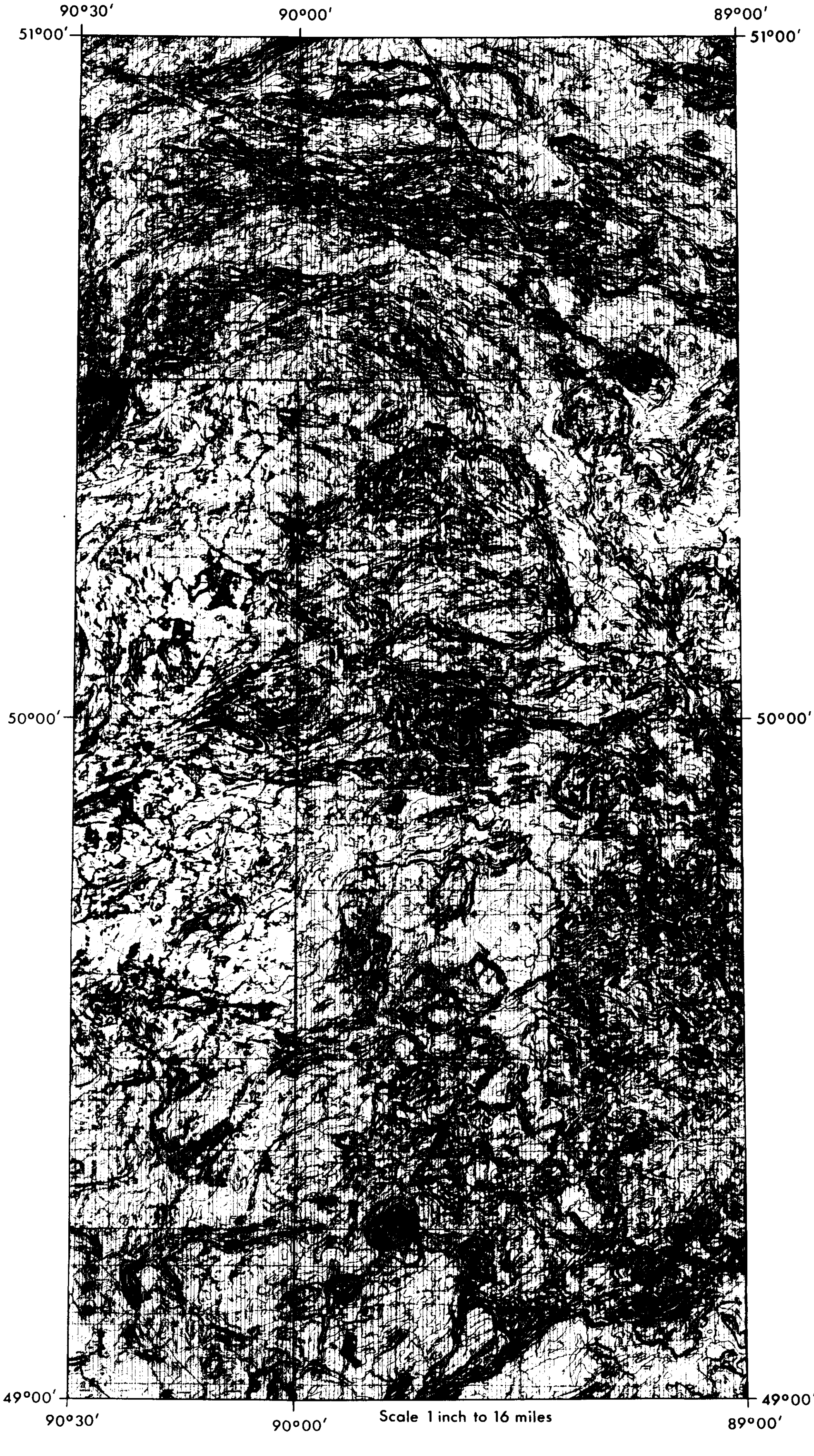
AREA III

10. Raleigh Lake Belt
11. Phyllis Lake Belt
12. Upsala-Firesteel River Belt
13. Chartrand Township Belt
14. Notman Belt
15. Victoria Lake Belt
16. Press Lake Belt

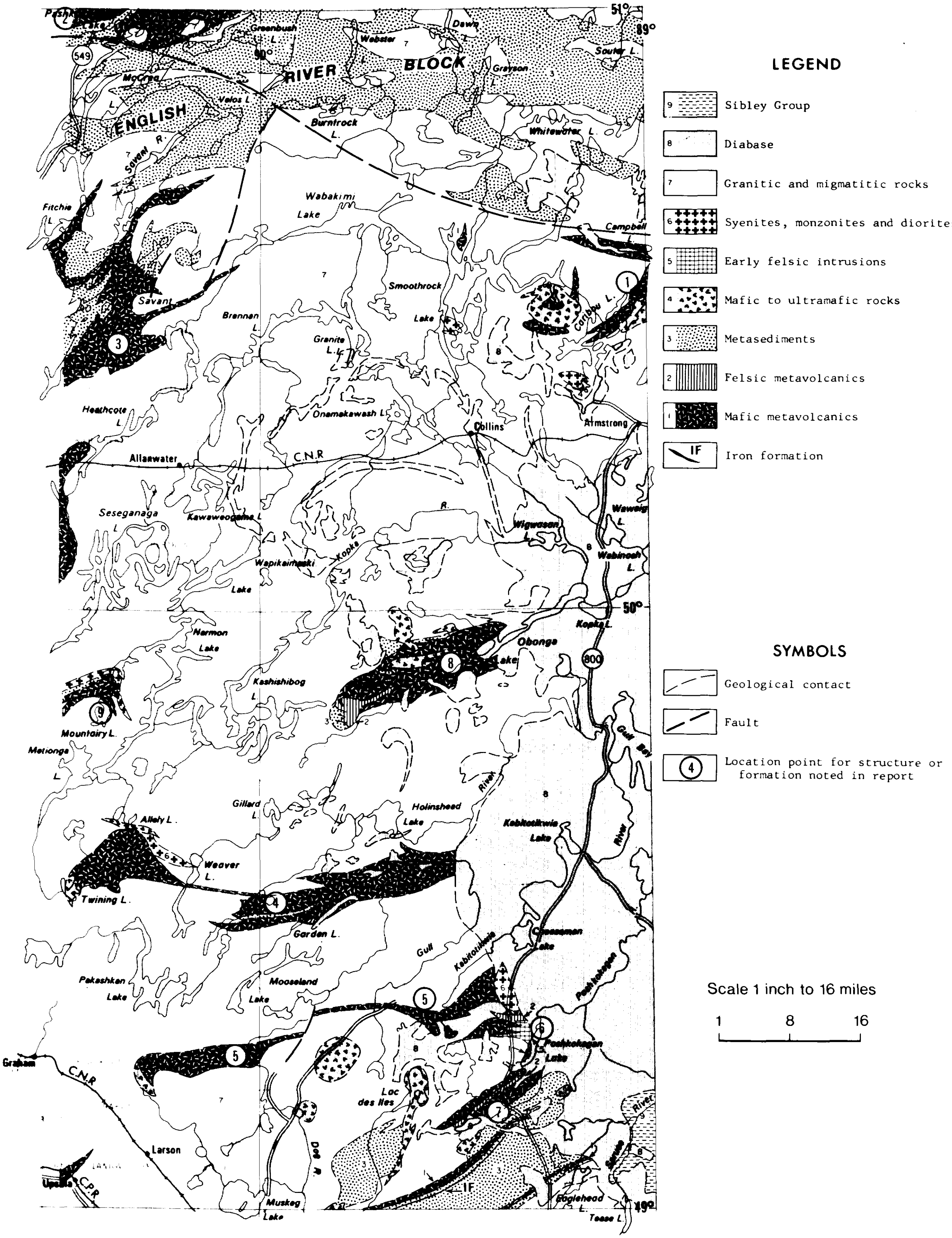
AREA IV

17. Otukamamoan Lake Arm of the Kenora Block
18. Seine River Belt
19. Lower Manitou Lake Belt
20. Smirch Lake Area

The boundaries between the above belts are arbitrary and selected only for mapping convenience. Extremities of the belts have been previously indicated (Ayres et al. 1971a,b). Geological and boundary modifications have been made in most of the metavolcanic-metasedimentary belts.



Operation Ignace – Armstrong, Aeromagnetic Map.



Operation Ignace – Armstrong, Geological Map.

AREA I: BY F.W. BREAKS

This area encompasses segments of the Kenora, Red Lake, and English River Blocks of the Superior Province (see geological sketch map). Parts of three metavolcanic-metasedimentary belts straddle the area boundaries, namely, the Pashkokogan Lake-Misehkow River Belt, the Savant Lake-Sturgeon Lake Belt, and the Caribou Lake-Pikitigushi River Belt.

Caribou Lake-Pikitigushi River Belt (1):

The easterly-trending Caribou-Pikitigushi River Belt formerly mapped by Gussow (1940) bifurcates into two narrow arms, which enter into the east-central part of the map-area. These segments will subsequently be denoted as the Caribou Lake Belt and the Campbell Lake Belt. The Caribou Lake Belt extends 8 miles (12.8 km) southwest from Kellar Island and reaches a maximum width of 1½ miles (2.4 km). Amphibolitized, massive to foliated, fine- to medium-grained mafic metavolcanics constitute the major rock type; mafic volcanic rocks of greenschist facies rank are scarce and always confined to the central part of this narrow belt. Two narrow (about 100 m and 30 m; 330 feet and 95 feet) previously unmapped, felsic metatuff units were delineated. The narrower unit, situated near Kellar Island, was previously interpreted by Gussow (1940) as part of the surrounding granitic batholithic complex. This unit stratigraphically underlies lean chert-magnetite iron formation that is relatively common in the immediate area. A small, lensoid, quartz-feldspar porphyry stock, located 1½ miles (2.4 km) southwest of Kellar Island, maximum dimensions 2 miles (3.2 km) by ½ mile (0.8 km) appears to be a synvolcanic intrusion rather than a phase of the surrounding granitic complex as interpreted by Gussow (1940, p.8). A few fine-grained felsic fragments of possible volcanic origin occur within this body. Mapping in the Campbell Lake Belt was restricted to a few helicopter stops within the major units delineated by Gussow. This belt appears to terminate between Rove Lake and Lonebreast Bay (Smoothrock Lake) although exposures here are exceedingly sparse.

Two relatively large, previously unknown, metagabbroic stocks occur in proximity to the Caribou Lake Belt. The largest stock, maximum dimensions 7 miles (11.2 km) by 5 miles (8.0 km), is situated between Outlet Bay on Caribou Lake and Caribou Bay on Smoothrock Lake (see sketch map). The second stock is located on Caribou Lake approximately 5 miles (3.2 km) east from the entrance of Outlet Bay. Both plutons are remarkably similar in texture, grain size, bulk composition, magnetic susceptibility, and age relations, and doubtlessly are consanguineous. Sparse xenoliths of amphibolitized mafic metavolcanics and small pods of altered ultramafic rocks, maximum dimensions 100 feet (30 m) by 200 feet (60 m), are present in both stocks.

Economic Geology and Mineral Exploration: The Caribou Lake-Pikitigushi River Belt has been the scene of sporadic mineral exploration, mainly focussed upon a search for gold-bearing quartz veins.

In 1956, Central Manitoba Mines Limited carried out ground electromagnetic-magnetic surveys over the area of abundant iron formation near Kellar Island. Three drill holes totalling 611 feet (186 m) intersected very lean, uneconomic iron formation (assessment Files Research Office, Ontario Division of Mines, Toronto). Numerous, scattered, minor occurrences of disseminated to patchy pyrite, pyrrhotite, and, in a few places, chalcopyrite were encountered in the Caribou-Smoothrock Lakes area. Thirty-one samples containing sulphide mineralization were analyzed by the Mineral Research Branch, Ontario Division of Mines, for gold, silver, and some samples additionally for copper and nickel. The large majority of these samples revealed only trace amounts of the above metals. The highest gold assay registered 0.03 ounces gold per ton from a grab sample of felsic metatuff located near Kellar Island, and the best copper assay, 0.12 percent copper from amphibolite containing pyrrhotite and chalcopyrite on Smoothrock Lake. Minor sulphide mineralization is not uncommon within the two metagabbro stocks in the Caribou Lake area, and usually consists of fracture controlled pyrite and ancillary pyrrhotite. Mafic metavolcanic rafts within these stocks, as exemplified by the Caribou Bay occurrences (Smoothrock Lake), are commonly mineralized with disseminated to patchy pyrite and pyrrhotite. The late C. Manefy of Armstrong, reputedly investigated mineralization in this area in the 1950s by shallow diamond drilling and trenching (J. Friesen, Armstrong, personal communication).

Pashkokogan Lake-Misehkow River Belt (2):

This belt, which is located in the extreme northwest corner of the project area, has been mapped by Dyer (1933), and Goodwin (1965). Lakeshore mapping was carried out along Pashkokogan Lake, Greenbush Lake, Thelma Lake, and the Payne River. The major rock types consist of mafic to intermediate metavolcanics and a diverse assemblage of metasediments. Only a small proportion of felsic to intermediate metavolcanics (2-3 percent) appear to be present contrary to the relatively higher abundance indicated by Goodwin's (1965) mapping. Felsic metavolcanics form several narrow bands along Pashkokogan and East Pashkokogan Lakes and consist of massive to foliated rhyolite and dacite flows and pyroclastic deposits ranging from tuff to agglomerate. Most of the metasediments are contained within three discrete units, which are partly to completely enveloped by metavolcanics. The largest unit trends southwest for 7 miles through the map-area and appears to merge with metasediments of the English River Block in the region between Medcalf Lake and the southwest extremity of Pashkokogan Lake. Metagreywacke is the most prevalent rock type, commonly associated with local units of arkose, polymictic conglomerate, and argillite. Metasediments additionally occur as relatively minor intercalations within the metavolcanics. The Pashkokogan Lake-Misehkow River Belt has been intruded by four late tectonic granitic stocks consisting of massive to weakly foliated, equigranular, biotite granodiorite to quartz monzonite. Stratigraphic relations between this belt and the bordering English River Block could not be resolved due to a lack of outcrop in the Greenbush Lake area and the presence of a mylonitic zone along the south shore of Pashkokogan Lake.

Economic Geology and Mineral Exploration: Sulphide occurrences are uncommon in this belt. A lithium-bearing granitic pegmatite occurs on South Pashkokogan Lake. A chip sample across 50 feet registered 1.25 Li_2O and traces of cesium and berylium (Goodwin 1965, p.54-55). Recently, in 1970, Selco Exploration Company Limited conducted ground electromagnetic and magnetic surveys over a total of 127 claims in the Greenbush-Pashkokogan Lakes area, followed by limited diamond drilling (Assessment Files Research Office, Ontario Division Mines, Toronto). In 1972, The Hanna Mining Company contracted an airborne magnetic survey over approximately 38-square miles (98.4 square km). Seventeen drill holes totalling 4,165 feet focused on an 84 claim block between Pashkokogan and Medcalf Lakes within the airborne survey area (Assessment Files Research Office, Ontario Division Mines, Toronto).

Savant Lake Belt (3):

Brief attention was directed towards that part of the Savant Lake Belt, exclusive of the recent detailed mapping of Bond (1972a,b; 1973a,b), viz Savant and Benner Townships and several of the narrow branches protruding from the main belt. Mapping was largely confined to the lake shore of Savant Lake. Fine-grained massive to foliated, chloritic mafic metavolcanics represents the major rock type. Pillow structures and pillow breccia are relatively common. Only a few narrow units of felsic metavolcanics were noted. In the Elwood-Seldom Lakes area a large mass of metasediments comprised of arkose, greywacke, and local conglomerate was delineated. The extreme northern branch of the Savant Lake Belt was extended beyond Koval Lake.

Economic Geology and Mineral Exploration: For information on the economic geology of Poisson, McGillis, Jutten, and Smye Townships, the reader is referred to the recent preliminary maps of Bond (1972a,b; 1973 a,b). A moderate amount of exploration activity has occurred in Savant and Benner Townships. Between 1959 and 1963 a diamond drilling program by Northern Canada Mines Limited (20 holes totalling 3,283 feet; 984.9 m) on several claim groups in southeast Savant Township indicated several mineralized zones. Best assays registered 3.20 ounces silver per ton, 0.18 ounce gold per ton, 3.70 percent lead, 3.08 percent zinc, and 1.20 percent copper over 10 feet (3.0 m) Assessment Files Research Office, Ontario Division Mines, Toronto). In 1962 a magnetometer survey covered 27 claims and shortly after interest in this exploration area by Northern Canada Mines Limited appeared to diminish.

More recently, limited diamond drilling programs by both The International Nickel Company of Canada Limited (1968-1969) and Dome Exploration (Canada) Limited (1969-1970) encountered minor mineralization in Benner and Savant Townships (Resident Geologist's Files). During 1971-1972, New Cinch Uranium Limited conducted a ground magnetic-electromagnetic survey over 36 claims in southeast Savant Township. Nine diamond drill holes totalling 4,216 feet (1281.7 m) probed a finely banded to massive chert-magnetite iron-formation mineralized with moderate to high amounts of pyrite and pyrrhotite accompanied by minor chalcopyrite and sphalerite. (The above information from Assessment Files Research Office, Ontario Division Mines, Toronto).

English River Block:

The English River Block occupies approximately one-third of Area I. East of Longitude 90°00'W the southern boundary of this structural block is well defined by a prominent lineament which extends from Takeoff Lake, southeast through Kenoji Lake, and thence passing slightly north of Campbell Lake. One exposure of heterolithologic fault breccia was encountered along this zone between Takeoff and Kenoji Lakes. West of Longitude 90°00'W the boundary is difficult to define. The presence of English River-type metasediments and metasedimentary migmatite along both the eastern periphery of the Savant Lake Belt, and to the north in the McCrea Lake area, suggests that the subprovince boundary curves sharply southward from the aforementioned major fault zone near Muskiga Lake to later merge with the Savant Lake Belt.

The English River Block is underlain primarily by metasediments, metasedimentary migmatite, and a wide variety of granitic rocks. Metavolcanics and mafic intrusive rocks are extremely rare. The metasedimentary component consists of fine-grained, foliated, garnet-biotite-quartz-plagioclase metagreywacke and, rarely, thinly-bedded intercalated meta-arkose. Conglomerate and coarse sandstone rocks are almost totally absent; an exposure of pebbly polymictic conglomerate occurs on Greenbush Lake near the Block boundary. Magnetite-metagreywacke iron formation bands are relatively scarce and tend to occur near that Block margin which is in contact with volcanic-rich belts.

The metasediments and metasedimentary migmatite are largely confined to a continuous easterly trending belt interrupted by several elongate to ovoid shaped granitic masses that presently appear to have originated either as relatively simple recrystallized syntectonic plutons (e.g. Whitewater Lake Stock) or as more complex intrusive masses possibly consisting of tectonically reworked former granitic basement material. The belt reaches a maximum width of 16 miles (26 km). The granitic masses collectively underlie approximately 50 percent of the English River Block within the project area. Closely allied with the metasediments are variable proportions of distinctive earthy white weathering, medium-grained to pegmatitic, highly leucocratic, non-metamorphosed garnet-biotite, and garnetiferous granitic rock with highly variable K-feldspar to total feldspar ratios. This mobilizate chiefly occurs as lit-par-lit dikes and to a lesser extent as small stocks. A salient feature of these rocks is the ubiquity of wine-red almandine garnet which, in many places, constitutes the sole ferromagnesian mineral present. Within the project area these garnetiferous granitic rocks are unique to the English River Block and never occur in the absence of metagreywacke. It is probable that these rocks were generated during the Kenoran orogeny by widespread partial melting of the metasedimentary component. This mobilizate varies between 5 and 50 percent of the outcrops. Metamorphic rank is believed by the writer to be generally middle to upper amphibolite facies although megascopically indicator minerals in the metasediments are generally absent.

Three early mafic plutons previously postulated to occur north of Whitewater Lake (Ayres et al. 1971) do not appear to exist. The mapped extent of Keweenawan diabase sills have been considerably increased, particularly in the Smoothrock-Whitewater Lakes area.

Economic Geology and Mineral Exploration: Mineral exploration has been minimal and desultory in the English River Block to date. Sulphide mineral occurrences are notably rare, as is the presence of rock types of potentially economic importance. An assay of a grab sample of foliated amphibolite mineralized with disseminations and stringers of pyrrhotite and pyrite (located at the head of Outlet Bay, Smoothrock Lake) taken by the writer registered 0.01 ounce silver per ton. (Analysis by the Mineral Research Branch, Ontario Division of Mines).

In 1958, Panther International Mining Company Limited probed several airborne electromagnetic conductors in the Goldsborough-Kenoji Lakes area. Five holes totalling 1,120 feet (336.0 m) encountered disseminated to massive pyrrhotite, pyrite, and minor chalcopyrite. Highest assays revealed 0.04 percent nickel over 0.5 feet and 0.04 percent copper over 3.7 feet (1.1 m) (Assessment Files Research Office, Ontario Division Mines, Toronto).

The International Nickel Company of Canada Limited intersected pyrrhotite-pyrite mineralization within garnetiferous metagreywacke in a drill hole 1 mile south of Dawn Lake. (Assessment Files Research Office, Ontario Division of Mines, Toronto).

AREA II: BY R.P. SAGE

Towards the east, Keweenawan, diabase sills and dikes of Late Precambrian age intrude and overlie Sibley Group rocks of Middle Precambrian age and various rocks of Early Precambrian (Archean) age. The Middle Precambrian rocks are unmetamorphosed, flat lying, carbonates, argillites, and siltstones, which form a discontinuous sheet filling hollows in the post-Archean erosional surface. The Archean rocks consist of massive, equigranular to porphyritic, trondhjemite to quartz monzonite bodies, of batholithic proportions in many places, which are surrounded by foliated and gneissic trondhjemitic to granodioritic rocks that are commonly, in part, migmatitic. Separating the various granitic complexes and their generally gneissic borders, more or less as screens, are the metavolcanic-metasedimentary complexes and their related intrusive rocks. The metavolcanic-metasedimentary rocks of the area are the most favourable rocks for mineralization within Area II.

Kearns-Garden Lake Belt (4):

The Kearns-Garden Lake Belt has been previously mapped by Milne (1964). This belt disappears eastward beneath glacial drift and Keweenawan diabase sills east of the junction of the Mooseland and Gull Rivers. To the west, at Kearns Lake, the belt has been extended from the previous mapping to, and just beyond South Allely Lake. This extension is based on scattered isolated outcrops of amphibolite and on aeromagnetic trends (ODM-GSC 1961c). The belt has a generally east-west-strike and is approximately 44 miles (72 km) in length with widely varying widths. Mapping during this past field season has extended (20.9 and 22.5 km) the overall strike length of the belt between 13 and 14 miles. At Weaver Lake the belt has narrowed to approximately ¼ mile (0.4 km) in width but widens out to approximately 3 miles (4.8 km) at South Allely Lake.

No attempt was made to remap this belt. Previous mapping by Milne (1964) indicates that the rocks are predominantly intermediate to mafic metavolcanics with minor intercalations of metagreywacke, felsic metavolcanics, ferruginous quartzite, sericite-chlorite schist, and slate. A metasedimentary unit approximately ¼ mile (0.4 km) wide and 9 miles (14.5 km) long is indicated in the western part of the belt and a small mafic plug is present along the Mooseland River. Outliers of the Keweenawan diabase sills locally overlie the Early Precambrian metasedimentary-metavolcanic and intrusive rocks.

South and southeast of Kearns Lake observations from the air would indicate the presence of more outcrop than is indicated to be present by Milne (1964).

Economic Geology: Early prospecting efforts along this belt was for gold. The gold mineralization occurred in small quartz stringers as visible gold in association with arsenopyrite near Conick Lake. For a more complete description of the gold occurrence and a summary of the economic geology of the area up to 1964, the reader is referred to Milne (1964).

In 1966 and 1967, the Canadian Nickel Company Limited completed a diamond drill program in the Garden Lake area. This drilling disclosed predominately pyrite, pyrrhotite, and graphite mineralization and some iron formation (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Disseminated pyrite was observed in several localities associated with shear zones and along foliation planes of the amphibolites in the western extension of the Garden Lake Belt. Approximately ½ mile (0.8 km) southeast of Cibber Lake and along a forest access road of the Great Lakes Paper Company Limited a boulder of ultramafic composition was found that was cut by a fine-grained feldspathic dikelet carrying coarse-grained flakes (± 1.0 cm) of molybdenite. The source of this float material is unknown.

Bo Lake-Heaven Lake Belt (5):

The Bo Lake-Heaven Lake Belt is an east-west-trending belt of metavolcanics and metasediments with a strike length of approximately 42 miles (67.7 km) and a widely varying width. Previous mapping in the Bo Lake area was by Kaye (1966) and in the Heaven Lake area by Milne (1964). Little change has been made in this previous work and the reader should refer to this earlier work for a more detailed account of the geology at these locations.

West of the mapping by Kaye (1966) the metavolcanics and metasediments disappear beneath extensive drift cover and can be traced only by aeromagnetic trends (DOM-GSC 1961a,b), and scattered diamond drill holes that have been filed for assessment work credit. To the east, mapping of this belt was terminated by Milne (1964) in the vicinity of Heaven, Magoffin, and Whitton Lakes. Mapping during this past field season (1973) has extended this belt eastward to the area just north and west of Poshkokagan Lake.

In the Tib Lake area, and in close proximity to the Bo Lake-Heaven Lake Belt, a fresh appearing, layered, mafic intrusion is well exposed (Kaye 1966). This body is one of several along the Dog River. The age relationships between these mafic bodies are unknown. The position and shape of these bodies is well displayed on ODM-GSC Maps 2099G and 2100G (ODM-GSC 1962a,b). Kaye (1966) indicated some sulphide mineralization is present along the south contact of this mafic intrusion.

The rocks within the Bo-Heaven Lakes Belt are predominantly mafic in composition and commonly display pillow structures. Abundant outcrop occurs in the logged over area east of Cowan Creek (Milne 1964) and extensive logging operations combined with a forest fire in 1971 have exposed considerable outcrops east of McLay Lake over to and just beyond Highway 800.

A previously unmapped felsic metavolcanic unit of rhyodacitic to rhyolitic composition and of unknown extent was located just north of McLay Lake along a logging access road. Disseminated pyrite mineralization is locally present in this unit. Spinifex textured rocks indicating ultramafic composition, (Pyke, et al. 1973) were located in two outcrops along a logging skid road approximately 1.5 miles (2.4 km) east of Whitton Lake. Also, an intermediate to felsic metavolcanic breccia unit of probable dacitic composition and of unknown width and length is present about a quarter mile (0.4 km) northwest of an unnamed lake approximately 1.5 miles (2.4 km) southeast of Whitton Lake. North, and in contact with this pyroclastic unit lies a banded chert-carbonate layer that, from scattered outcrop data, appears to be in excess of 50 feet (15.2 m) wide. Boulders of intermediate to mafic volcanics containing disseminated pyrite are common in the area and the felsic pyroclastic outcrops locally display silicification in close proximity to the chert-carbonate unit.

Farther eastward the 'greenstone' belt wraps around a massive, medium-grained, equigranular to porphyritic, hornblende monzonite body of unknown dimensions; its eastern contact is covered by the Keweenawan diabase sills. The metavolcanics and metasediments are locally overlain by outliers of Keweenawan diabase sills. Reconnaissance mapping of this area was incomplete and confined to the major logging roads.

Economic Geology: In the Bo Lake area Phelps Dodge Corporation of Canada Limited completed an extensive diamond drill program in 1965, (Assessment Files Research Office, Ontario Division of Mines, Toronto). This drilling disclosed graphite, pyrite, and pyrrhotite mineralization with local minor copper values.

Staking and prospecting is presently in evidence in the vicinity of McLay Lake.

Widespread showings of minor concentrations of disseminated sulphides and local occurrences of massive sulphides, spinifex textured rocks and the presence of felsic metavolcanic units would suggest that the area, particularly near and eastward from McLay Lake warrants close examination for the possible occurrences of economic mineralization (Assessment Files Research Office, Ontario Division of Mines, Toronto). The reader should refer to the Bo Lake-Heaven Lake and Lac des Iles Lake section in this report for additional information on this area.

Bo Lake-Heaven Lake and Lac des Iles Area (6):

This area lies between the areas mapped by Milne (1964) and Pye (1968) and has not been previously mapped. This area is largely the eastward extension of the Bo Lake-Heaven Lake Belt and it disappears eastward beneath overlying diabase sills. Reconnaissance mapping of this area was largely confined to the major access roads.

Excellent exposures of the rocks within this extension occur in road cuts along Highway 800 south of the south contact of a hornblende monzonite intrusion. At the monzonite contact, exposed along Highway 800, the monzonite intrusion lies in sharp contact with a banded amphibolite unit approximately 400 or 500 foot thick (121.6 to 152.0 m). To the south, the amphibolite is in contact with a unit of felsic metatuffs and agglomerates approximately ½ mile (0.8 km) thick. The felsic metavolcanics are then separated from mafic metavolcanics to the south by a massive quartz-feldspar porphyry intrusion. Continuing southward the quartz-feldspar porphyry occurs in lit-par-lit fashion with massive and pillowed mafic metavolcanics culminating in a massive body about

2 miles (3.2 km) wide in the general vicinity of the Whistle Lake access road of the Abitibi Paper Company Limited. South of the Whistle Lake access road the quartz-feldspar porphyry again occurs lit-par-lit with mafic metavolcanics. Several exposures suggest two ages of quartz feldspar porphyry intrusion. Continuing to the south the porphyry lies in contact with more equigranular trondhjemitic to granodioritic rocks. Several narrow septa of mafic metavolcanic amphibolite cross the highway north of Pye's (1968) map-area.

Along the west shore of Poshkokagan Lake metamorphosed felsic and mafic volcanics and intermediate to felsic intrusive rocks characteristic of a normal greenstone belt assemblage were present. Outcrops along the east shore were of diabase.

Previously unmapped volcanic rocks were observed by members of this field party on Magoffin, Sauerbrei, Box, Spevak, and Nault Lakes (Milne 1964). Felsic metavolcanics, and quartz-feldspar porphyry intrusive rocks were found on Nault Lake and along forest access roads east of Whistle Lake.

The felsic metavolcanics of Whistle and Nault Lakes and along Highway 800 are believed to be rhyodacite to rhyolite in composition. The best exposure of these rocks lie in logging skid trails immediately east and west of Highway 800. Disseminated sulphide mineralization is not uncommon in these felsic rocks but the most impressive sulphide occurrence is found approximately ¼ mile (0.4 km) east of the northeast corner of Whistle Lake where one zone of massive pyrrhotite and pyrite approaching 50 feet (15.2 m) in thickness and extending for over 200 feet (160.8 m) in strike length occurs between a felsic metavolcanic tuff to the south and a banded chert unit to the north. The rocks within the main part of this belt are of greenschist facies rank of regional metamorphism. Metamorphism increases slightly towards the margins of the belt.

Several outcrops of felsic lapilli-tuff are also present in a window within the diabase at the narrows at the middle of Lever Lake.

Outliers of diabase locally overlie the Early Precambrian rocks and may comprise approximately 40 percent of the total surface area.

Economic Geology: Prospecting within this area has been limited. In 1965, Steep Rock Iron Mines Limited conducted an exploration program in the vicinity of Highway 800 east of Nault Lake, and in 1970 Phelps Dodge Corporation of Canada Limited completed a limited diamond drilling program in the same area. The work of both of these companies has disclosed widespread minor disseminated chalcopyrite and pyrite mineralization associated with the quartz-feldspar porphyry intrusion and mafic metavolcanics (Assessment Files Research Office, Ontario Division of Mines, Toronto).

The massive sulphide occurrence at Whistle Lake is presently staked by Mr. Clark Noyes. Mr. Noyes (personal communication 1973) reported that one 275-foot (83.6 m) diamond drill hole at 45 degrees was drilled by Mineral Resources International Limited encountering copper and gold 'values'.

The occurrence of disseminated and massive sulphide mineralization and the occurrence of a number of rock types considered favourable to sulphide mineralization suggests that this area warrants close examination for economic mineralization. Prospecting should be for both massive and disseminated sulphide minerals in association with the felsic metavolcanics, and quartz porphyry intrusions. The mafic and ultramafic rocks of the area also warrant close examination for possible copper-nickel mineralization.

Lac des Iles Area (7):

Mapping of the Lac des Iles area has been largely completed by Pye (1968), and Kaye (1969) extended this mapping southwards beyond the present project limits. To the east, Coates (1972) extended the work of Pye and Kaye and found mostly Keweenawan diabase or sedimentary rocks of the Sibley Group. Coates encountered Archean rocks along the eastern margin of the map-area and within windows in the diabase sills and Sibley sedimentary rocks.

No attempt to remap this previously mapped area was made. Logging access roads, cut since the earlier mapping was completed, were examined by members of the present operation. For a more complete description of the geology of these areas the reader should refer to the original works mentioned in the previous paragraph.

The Lac des Iles 'greenstone' belt is a northeast-striking belt that consists of predominantly massive to pillowed intermediate to mafic metavolcanics with thin (up to 1 mile, 1.6 km, in width) units of felsic metavolcanics.

A predominantly metasedimentary unit consisting of conglomerate, iron formation, greywacke, and argillite is present south of and in contact with the metavolcanics. Minor units of mafic metavolcanics and felsic metavolcanics occur intercalated with the sedimentary rocks. Good exposures of the metasediments and metavolcanics can be found along Highway 800. Previous mapping by Pye (1968) indicated numerous isoclinal folds in the metasediments and metavolcanics exposed along Highway 800.

Westward, the metavolcanics terminate in the vicinity of Legris Lake where a large mafic intrusive body is found. A second large mafic to ultramafic body is found farther west centred on, and south of Lac des Iles. This body is known to contain sulphide mineralization (Pye, 1968a) and the ultramafic core has been the subject of a masters dissertation (Guarnera 1967).

This mafic body is enclosed within granitic rocks of widely varying compositions.

The metasedimentary band strikes southwest conformably with the metavolcanics until it narrows and pinches out in the vicinity of Orbit Lake, which lies just south of the map-area (Kaye 1969).

A mafic plug is present at Wakinoo Lake and northeast of this body an elongate mafic body, striking northeast, represents the southern continuation of the Lac des Iles mafic body (Pye 1968; Kaye 1969).

West of the above northeast-trending elongate tongue of mafic rocks lies a sequence of mixed metavolcanics and metasediments (Kaye 1969). This sequence is predominantly metasedimentary, has been intruded by various granitic rock types, and is of apparently higher metamorphic rank than the metasediments found at Whitefin Lake, Max Lake, and other lakes towards the east.

East of Pye's (1968a) mapping and on Stucco Lake, the granitic rocks mapped by Coates (1972) are reinterpreted as dioritic and more closely related to mafic intrusions commonly found within Archean metavolcanic-metasedimentary sequences, than to rocks of the enclosing granitic terrains. Strong linear aeromagnetic anomalies along the south shore of Stucco Lake, striking northeast, are interpreted to represent iron formation lying beneath the diabase sills (ODM-GSC 1962c,d).

Mapping by Pye (1968a) and Kaye (1969) has indicated numerous outliers of diabase covering the Archean rocks.

<u>Economic Geology</u>: Exploration activity within this belt has been locally intense.

Towards the east copper mineralization occurring as chalcocite in the Sibley limestone and as disseminated chalcopyrite in the diabase sills has been found in the Disraeli Lake area (Coates 1972). These various showings have been examined by the Algoma Steel Corporation Limited, Commerce Nickel Mines Limited, Falconbridge Nickel Mines Limited, and William McTeer-Weldon P. Gilbert (Coates 1972). Investigation of these occurrences has failed to disclose economic mineralization (Coates 1972).

In 1972, Dome Exploration (Canada) Limited conducted an extensive airborne survey in the general area north of Max Lake and southwest of Poshkokagan Lake. An extensive diamond drill program followed on several claim groups. This effort disclosed numerous occurrences of pyrite, pyrrhotite, graphite, and magnetite. Minor 'values' in copper and zinc were encountered in some holes but economic occurrences were not disclosed (Assessment Files Research Office, Ontario Division of Mines, Toronto).

In the Lac des Iles area disseminated sulphide mineralization in association with the mafic intrusion have been investigated by Gunnex Limited and F.H. Jowsey Limited. Anaconda American Brass Limited was active on these occurrences in 1966, but the results of this work is unavailable. Prospecting at Lac des Iles has disclosed the presence of copper, nickel, and platinum group metals in presently subeconomic quantities within the mafic intrusive (Pye 1968a; Assessment Files Research Office, Ontario Division of Mines, Toronto).

The Canadian Nickel Company Limited has drilled diamond drill holes in a number of areas but its greatest effort has been centred in an area about 2 miles (3.2 km) northwest of Prophet Lake and in an area just south of Starnes Lake (Assessment Files Research Office, Ontario Division of Mines, Toronto). This work was done during 1966 and disclosed pyrite, pyrrhotite, graphite, and magnetite mineralization with a speck of chalcopyrite in a few places.

Gold and molybdenite mineralization are also known to occur within this belt (Pye 1968a; Kay 1969).

Obonga Lake Belt (8):

The Obonga Lake area has attracted prospecting interest since the discovery of chromite in association with serpentinites in 1928 (Graham 1930). The area has been mapped by Graham (1930), Kustra (1966, 1967a,b) and Thurston (1967; 1968a,b,c,d,e,f), and Kustra (personal communication, 1973) is currently preparing a more detailed report on the area. Kidd (1934) and Hurst (1931) published earlier works on the geology and chromite deposits of the area and Karvinen (1968) recently completed a detailed study of the ultramafic rocks associated with the chromite mineralization at Puddy Lake. Because of the detailed nature of the previous work no attempt was made to remap the area. Thurston (1967) and Kustra (1966) described the rocks of this northeast-trending belt as a synclinally folded sequence of metavolcanics and metasediments. To the east the Archean rocks of the belt disappear beneath Pleistocene cover and Keweenawan diabase. To the west, and north of Tommyhow Lake, there is a large mass of felsic metavolcanics and associated quartz porphyry intrusions, whereas towards the east the metavolcanics are dominantly intermediate to mafic in composition. The metasediments associated with the metavolcanics consist of conglomerate, greywacke, arkose, slate, and phyllite. The mafic metavolcanics are dominantly schistose to massive and the felsic metavolcanics consist of tuffs, agglomerates, and porphyries of rhyolitic composition.

The metasediments and metavolcanics have been intruded by mafic to ultramafic rocks. Serpentinized equivalents of the ultramafic rocks host the chromite mineralization of the area.

Economic Geology: Initial intense prospecting in the Obonga Lake Belt began in 1928 with the discovery of chromite mineralization in a serpentinized ultramafic rock along Wig Creek (Graham 1930). Hurst (1931) reported that general chromite showings in the vicinity of Chrome Lake were tested by trenching and diamond drilling. A shaft 350 feet deep with some lateral development was completed to test the chrome showings on the northwest shore of Chrome Lake (Hurst 1931). This work failed to locate a commercial chrome deposit. From the Assessment Files Research Office, Ontario Division of Mines, Toronto, the following abbreviated summary of exploration activity in the area since Kidd (1934) has been prepared.

TABLE OF ASSESSMENT WORK DATA*

Date	Company	Type of Work	Location	Mineralization Found
1963	Harrison Minerals Ltd.	Trenching, diamond drilling	Near Wig Lake	Minor Cu, Ni
1965-1969	Canadian Nickel Co. Ltd.	Diamond drilling	Puddy Lake	Pyrrhotite, pyrite, graphit
1965	Commerce Nickel Mines Ltd.	Diamond drilling	Puddy Lake	Minor Cu
1966	Cantri Mines Ltd.	Diamond drilling	Wig Lake area	Pyrite
1968	Newmont Mining Corporation of Canada Ltd.	Ground magnetometer survey	Puddy Lake	
1971	Falconbridge Nickel Mines Ltd.	1 Diamond drill hole	Puddy Lake	
1971	Dome Exploration (Canada) Ltd.	Diamond drilling	Leig Lake S.W. of Survey Lake towards Muller Lake 6.5m N. of Tommyhow Lake	Pyrite, pyrrhotite, minor Cu
1971	Jorex Ltd.	Diamond drilling	Paddon Lake	Pyrite, pyrrhotite, minor chal-copyrite
1972	Amax Exploration Inc.	Geological-geo-chemical survey	W.of Muller Lake, S. of Survey Lake	
1972	F. Koosel-Labrador Ex-ploration (Ontario) Ltd.	Airborne electro-magnetic, magnet-ometer and radio-metric survey	W.end Obonga Lake	
1973	Labrador Exploration (Ontario) Ltd.	Diamond drilling	W.end Obonga Lake	

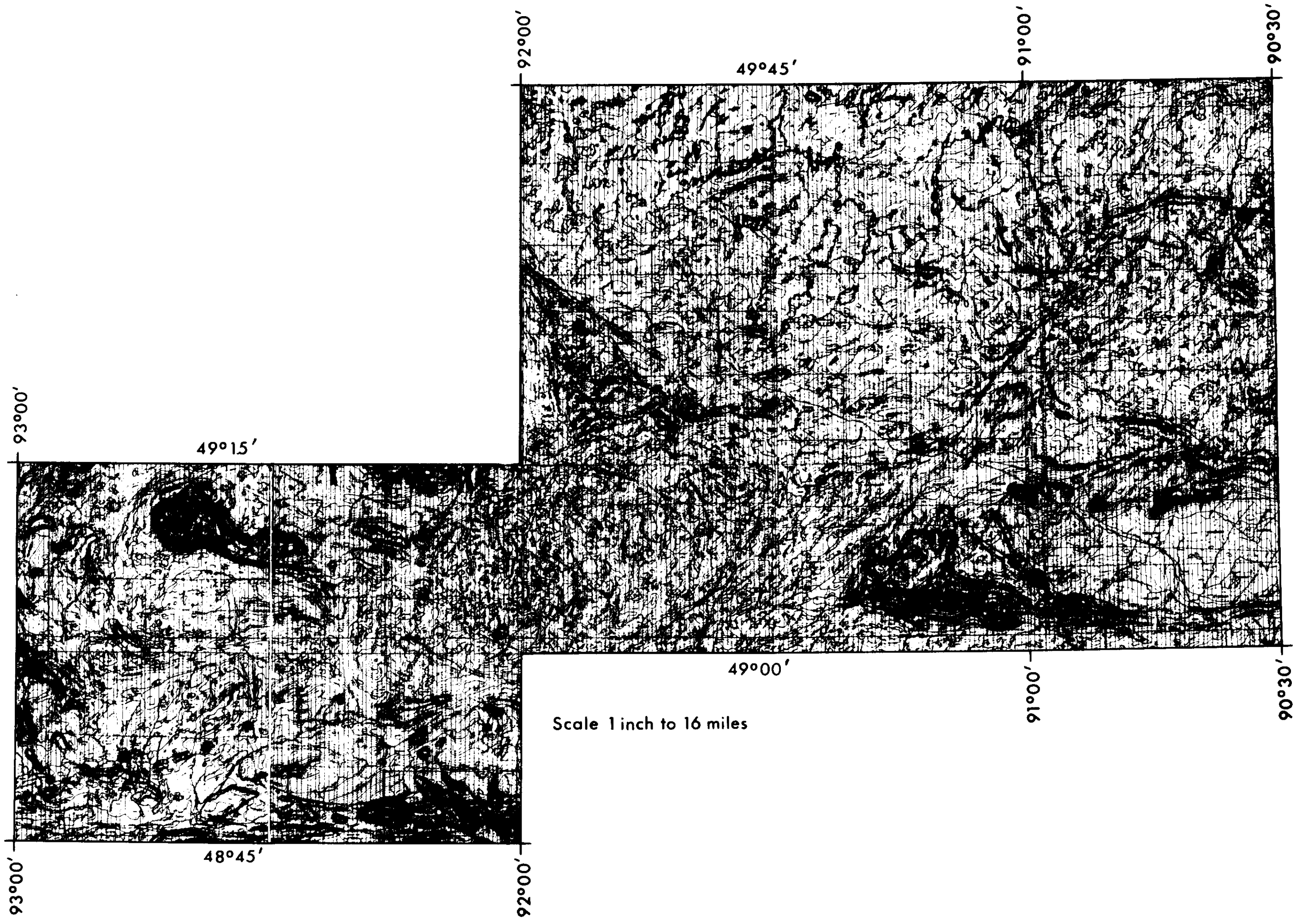
*On file with Assessment Files Research Office, Ontario Division of Mines, Toronto

The widespread occurrence of rock types considered to be geologically favourable hosts for potential economic mineralization of various types has drawn considerable exploratory attention to the area, particularly within the last 10 years. Even though considerable effort has already been expended with largely negative results the area is still thought to contain the possibility of economic mineralization and warrants further examination.

Hilltop-Mountairy Lakes Area (9):

Narrow, generally less than 1 mile (1.6 km) wide, bands and isolated remnants of a metasedimentary-metavolcanic sequence are present within this area and previous work by Rogers (1964) has fairly accurately delineated these units. The rocks are generally schistose to gneissic amphibolites with some paragneiss and thin units of iron formation. These rocks represent an east-trending lobe of the Sturgeon Lake metasedimentary-metavolcanic belt. For a detailed description of these rocks, the reader should refer to Rogers (1964).

Economic Geology: Any effective evaluation of the economic potential of these rather small metavolcanic-metasedimentary belts would have to take into account the western extension of these units, which lie outside the project area.



Operation Ignace – Armstrong, Aeromagnetic Map.

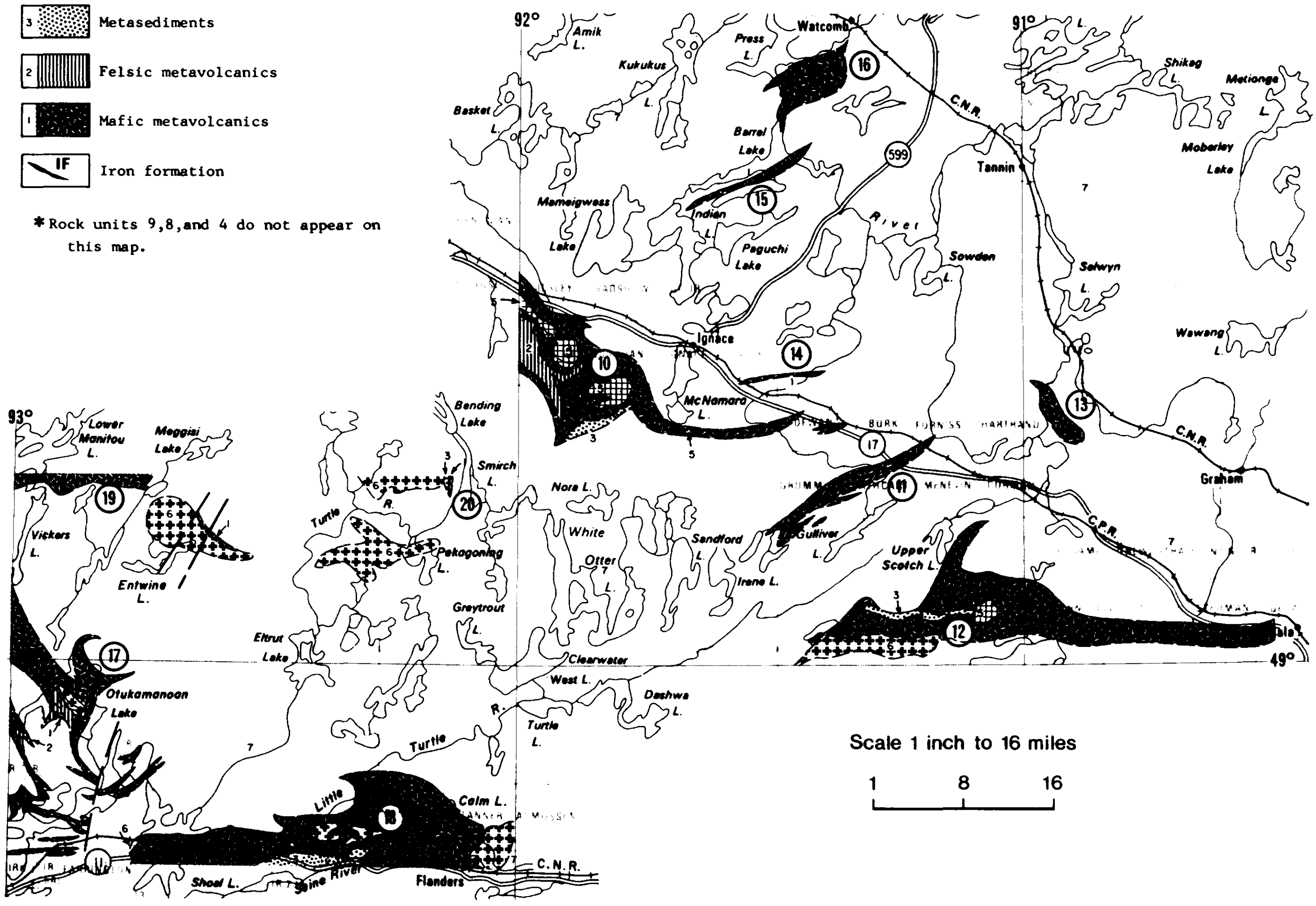
LEGEND

- 9 Sibley Group*
- 8 Diabase*
- 7 Granitic and migmatitic rocks
- 6 Syenites, monzonites and diorites
- 5 Early felsic intrusions
- 4 Mafic to ultramafic rocks*
- 3 Metasediments
- 2 Felsic metavolcanics
- 1 Mafic metavolcanics
- IF Iron formation

*Rock units 9,8,and 4 do not appear on this map.

SYMBOLS

- Geological contact
- Fault
- (4) Location point for structure or formation noted in report



Scale 1 inch to 16 miles

1 8 16

Operation Ignace – Armstrong, Geological Map.

AREA III: BY G.M. STOTT

Outcrop density is generally good in the eastern part of Area III. Outcrop is sparse in the northwestern quarter of the area and in the area south of Sowden Lake, and around Graham.

Area III lies completely within the Kenora Block. Metavolcanic-metasedimentary belts present are generally east- to northeast-striking with the exception of the Raleigh Lake and Chartrand Township Belts which strike southeast.

Apart from a few small 'greenstone' remnants, notably along Highway 17, there are seven metavolcanic-metasedimentary belts within or partly enclosed within Area III.

Raleigh Lake Belt (10):

This belt is an extension of the Kenora Block of the Dryden area. It is composed dominantly of mafic to intermediate metavolcanics metamorphosed to lower amphibolite facies rank. Previously unrecorded, intermediate to felsic metavolcanics, mainly pyroclastic in origin, comprise a major part of this belt particularly in the southwestern half. It is estimated that the intermediate to felsic units make up approximately 25 percent of those parts of the belt enclosed within the project area. The major intermediate to felsic unit was previously interpreted as metasediment (Tanton 1934). A few isolated outcrops of ultramafic rock were noted, particularly southwest of Greenheart Lake and north of Balmoral Lake.

Metasediments composed essentially of greywacke are confined to two, narrow, east-trending units in the southern part of the belt. Two granitic plutons lie within this belt and strongly influence the structural trends of the enveloping metavolcanics.

The elongate easterly continuation of the belt southeast of McNamara Lake is composed essentially of mafic to intermediate metavolcanics.

Outcrop exposure in this belt is particularly good except for the Greenheart Lake-Valjean Lake area.

Economic Geology: Very little exploration activity is recorded in this belt with the exception of several investigations close to the margin of the belt on McNamara Lake. There, a zone of pyrrhotite-pyrite mineralization occurs for approximately 4 miles (6.4 km) along the strike of a prominent lineament at the south end of the lake. Drilling of this zone has been carried out by Addicks Development Company and by Canadian Nickel Company Limited (Assessment Files Research Office, Ontario Division of Mines, Toronto). Apart from pyrrhotite and pyrite, only minor molybdenite has been noted.

Phyllis Lake Belt (11):

This elongate, northeast-trending belt is composed almost exclusively of mafic to intermediate metavolcanics, dominantly amphibolite, with scarce, isolated outcrops of intermediate to felsic metavolcanics. The belt is enveloped by a trondhjemite to granodiorite gneiss and both the belt rocks, and enveloping gneiss, have been forcefully ruptured by a porphyritic feldspar quartz monzonite to granodiorite intrusion, along the length of the belt. Outcrop exposure in this belt is fair especially in the vicinity of the Gulliver River and Phyllis Lake.

Economic Geology: No prospecting activity has been recorded within this belt.

Upsala-Firesteel River Belt (12):

The western half of this belt was mapped previously by R.S. Woolverton (1960). An extension of this belt eastward from that previously mapped, towards Upsala was completed during this field season. Mafic to intermediate metavolcanics metamorphosed to greenschist facies rank appear to be the exclusive rock type of this eastern extension. The outcrops of this elongate eastern part are strongly east-west foliated and are usually exposed as isolated outcrops along old lumbering roads, and clearings, otherwise outcrop is poor.

Economic Geology: Former exploration activity has been concentrated in the east half of the belt particularly in the vicinity of several major shear zones close to the belt margins. Much of the exploration activity has been discussed by Woolverton (1960) and the reader is referred to that report for this data.

Chartrand Township Belt (13):

This belt lies on the east side of The English River and along the east side of Chartrand Township. It appears to be composed of only mafic to intermediate metavolcanics with minor mafic intrusive outcrops observed in the central part of the belt. Lumbering operations have cleared much of the land and outcrops are easily observed. Sufficient exposure exists across the central part of the belt to get a fairly good cross section. Outcrops become rather scarce toward the southeast end of the belt.

Economic Geology: No exploration activity has been recorded from within this area.

Notman Lake Belt (14):

This very narrow elongate belt is very poorly exposed and its existence is based on a few isolated outcrops of mafic to intermediate metavolcanics coupled with aeromagnetic interpretation (ODM-GSC 1961f,g).

Economic Geology: No exploration activity has been recorded for this area.

Victoria Lake Belt (15):

This previously unmapped, narrow, elongate belt of mafic to intermediate metavolcanics, typically amphibolite, is fairly well exposed and closely parallels the north margin of Victoria Lake. The belt is generally 5/10 mile (1.0 km) in width and is at least 11 miles long (17.6 km). The northeastern limit of the belt remains uncertain but the southwestern end appears to have been ruptured and abruptly cut off just short of Indian Lake by a major granitic intrusion centred in the Mameigweiss Lake-Indian Lake area.

Economic Geology: No exploration activity has been recorded from this belt.

Press Lake Belt (16):

This belt appears to be a southerly estension of the Sturgeon Lake Belt and its existence is based on several mafic to intermediate metavolcanic outcrops found on Barrel Lake and on an east-trending road north of the lake. Exposure is poor and the extent of the belt is uncertain.

Economic Geology: No exploration activity has been recorded for this area.

AREA IV: BY G.M. McWILLIAMS

The map-area lies within the Kenora Block just north of the Quetico-Kenora Blocks boundary. Bedrock underlying the map-area consists of approximately 75 percent felsic intrusive rocks, and 20 percent metavolcanic-metasedimentary sequences. The metavolcanic assemblages are generally confined to the southern and western margins of the area.

Intrusive Rocks

For simplicity, the intrusive rocks can be subdivided into four categories; mafic, anorthositic, granitic (greater than 10 percent quartz) and syenitic (less than 10 percent quartz).

The present investigation indicates that the banana-shaped, metavolcanic belt previously shown as extending (Davies and Pryslak 1967) from Little Turtle Lake to Moosetrack Lake, is largely comprised of granitic intrusive, rather than metavolcanic rocks. The granitic rock is quartz diorite, and is associated with banded amphibolite. This largely intrusive body is generally gneissic and is in places folded and brecciated by the later intrusions of trondhjemite and quartz monzonite.

In addition to the anorthosite body mapped by A.C. Lawson (1913) on Bad Vermilion Lake, anorthosite was encountered 7 miles north of Highway 11 on the access road leading to Manion Lake. A shallow but pervasive cover of sand and till prevented the outlining of this body, which has been recently exposed by the road construction.

Several phases of granitic rocks occur. Where crosscutting relationships were present the most common sequence from oldest to youngest was: massive trondhjemite, foliated trondhjemite, massive to foliated quartz monzonite to quartz diorite, pegmatitic and aplitic granite to granodiortie.

Syenitic intrusions occur in massive bodies ranging in composition from monzonite to syenodiorite; no true syenites were found. These syenitic plutons were found adjacent to the metavolcanics of the Kenora Block, and are enclosed by metavolcanics in the Entwine Lake Complex. These syenitic bodies have magnetic expressions of greater intensity than the granitic rocks, but of lesser intensity than the metavolcanic-metasedimentary belts (ODM-GSC 1961d,e).

The Otukamamoan Lake Arm of the Kenora Block (17):

Previous work in this area included mapping by Farris (1970) and Blackburn (1971). Work during the 1973 field season included a brief survey of previously defined units and the extension of these units eastwards. The metavolcanic-metasedimentary sequence is presently represented by narrow units deformed by the intrusion of the granitic plutons. Lenses and narrow bands of felsic flows and pyroclastic rocks occur within the predominantly intermediate to mafic flows.

Economic Geology: No known economic mineral occurrences are located within this area. Mineral prospects in adjacent areas are centred around copper-nickel showings along the margins of mafic intrusions and uranium and molybdenum occurrences on the border of granitic stocks (Blackburn 1973).

Seine River Belt (18):

Interest in this belt dates back to A.C. Lawson's Work in 1888 and 1913 (Lawson 1888; 1913), which initiated controversy over the stratigraphic position of the Coutchiching sediments. Later geological mapping in this area includes Tanton's (1936) mapping of the gold camp, Young's (1960) work on Bennett and Tanner Townships. Hsu's (1971) Ph.d thesis on the Shoal Lake Conglomerate, and Gray's 1970 geological maps prepared for Northgate Exploration Limited, and submitted for assessment work credit (Assessment Files Research Office, Ontario Division of Mines, Toronto). Only the northern most units are located within the present map-area.

Volcanic flows and tuff are presently represented by chlorite and chlorite-sericite schists. South of the metavolcanics straddling Highway 11, the Seine conglomerate and associated volcanogenic sedimentary rocks constitute a major unit extending from about Mine Centre east 20 miles (32.0 km) to Calm Lake. This polymictic, paraconglomerate generally lacks sorting or grading and most probably represents a mass movement of detritus from the volcanic pile.

Economic Geology: One of the oldest gold mining camps in Ontario is located around Bad Vermilion Lake. Tanton (1935) did an economic study of the properties and reported over 60 gold-bearing veins as being present in the area. Ore minerals associated with these quartz veins include siderite, pyrite, arsenopyrite, molybdenite, chalcopyrite, galena, and sphalerite. Of the many properties investigated by Tanton only three: the Gold Star, Foley and Olive produced gold bullion.

Recent gold prospecting has been centred around Bennett Lake where E. Corrigan in 1971 reported gold 'values' of up to 0.22 ounce per ton in one hole (Assessment Files Research Office, Ontario Division of Mines, Toronto). E. Rivers (personal communication, 1973) reopened two old trenches on a prospect 1 mile north of Bennett Lake with showings of visible gold.

In addition to gold, several copper showings are located in the Mine Centre area. Port Arthur Copper Company cut a test pit in 1916 and sank a 100-foot shaft only to abandon their property in 1918 (Pye 1968b). Stratmat Limited took out an option on the property in 1955 and carried out a drilling program, which revealed some narrow high-grade zones of insufficient quantity to be profitable. (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Recent prospecting for copper has been conducted in the Reed Lake area by Turbenn Minerals Limited, 1959; and Noranda Exploration Company Limited, 1968 (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Lower Manitou Lake Area (19):

The southern margin of the Kenora metavolcanic-metasedimentary belt passes through the northwest corner of the map-area. Previous geological mapping adjoining and overlapping this area includes work by Thomson (1934) and Blackburn (1973). The metavolcanic unit consists predominantly of thick massive mafic volcanic flows, possibly some metagabbroic sills, with narrow foliated southeast facing pillowed units. Where observed the contact between the metavolcanics and granitic batholiths is fault bounded.

Economic Geology: The International Nickel Company of Canada Limited was active in the area east of Aronson Lake in 1972. Seven holes drilled to an average depth of 600 feet revealed minor pyrite, pyrrhotite, and chalcopyrite (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Smirch Lake Area (20):

A narrow finger of the Wabigoon Volcanic Belt extends south into the map-area to the west of Smirch Lake. This metavolcanic-metasedimentary sequence is presently represented by migmatitic amphibolite and paragneiss. The belt is in contact with a massive monzonite body to the west and foliated trondhjemite and massive pegmatitic granodiorite to the south and east.

Economic Geology: No known occurrences of economic minerals have been found in this area.

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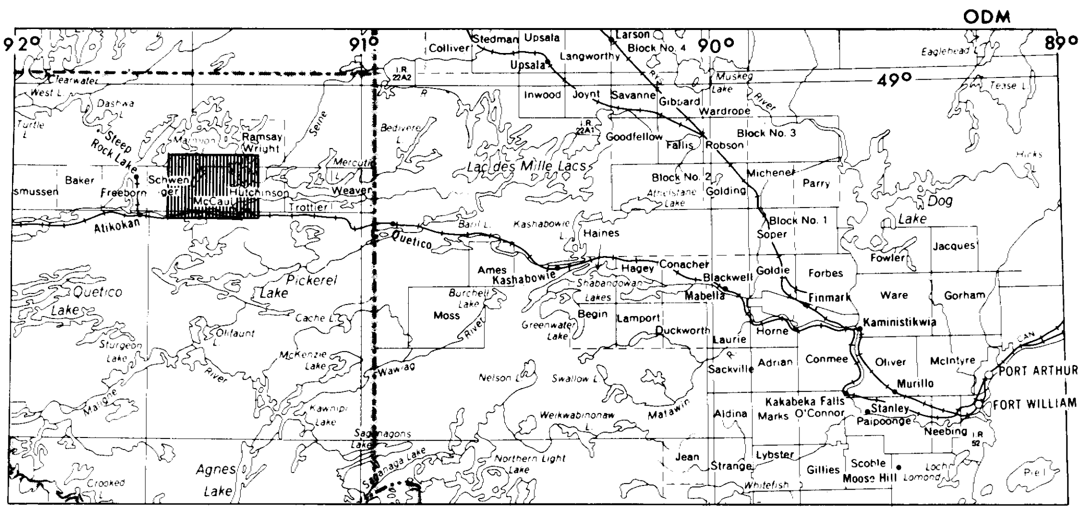
No.8 EAST HALF OF SAPAWE LAKE AREA

DISTRICT OF RAINY RIVER

by

W.H. McIlwaine[1] and L.B. Chorlton[2]

INTRODUCTION: A program to re-map the area between Steep Rock Lake (Shklanka 1972) and Lac de Mille Lacs (Irvine 1963) was started in 1973. During the summer the authors mapped the east half of the assigned area; this comprises



LOCATION MAP

Scale: 1 inch to 25 miles

the eastern quarter of McCaul Township, the western two-thirds of Hutchinson Township, the southern third of Ramsay-Wright Township and adjacent unsurveyed territory. The area is about 110 miles (176 km) west of Thunder Bay and 12 miles (19 km) east of Atikokan. Previous mapping was done by Hawley (1929).

MINERAL EXPLORATION: The main metals explored for have been iron and gold and to a lesser extent nickel. The iron deposits in the area comprise part of the Atikokan Iron Range. The largest known occurrence is the Atikokan Iron Mine

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from which 90,680 tons of ore were mined and shipped from 1907 to 1913 (ODM 1923, p.155). From 1900 to 1913 exploration and development work included excavation of 5 tunnels, 3 shafts with crosscuts, 2 open cuts, and the drilling of 6 diamond drill holes. All this work was by the Atikokan Iron Company Limited (ODM 1923, p.155-158). The deposit is located just east of Sapawe Lake. Several similar prospects, including the Hanna-Gano, the Pattison, and the Sapawe Lake are located south of and west of Sapawe Lake. These prospects (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay) have been examined either by trenching, diamond drilling or adits. In 1972, Monteagle Explorations Limited diamond drilled the iron range in the vicinity of the Atikokan Iron Mine.

Several gold occurrences have been found in the area and these include two small past producers. The Sapawe Mine, just south of Osinawi Lake, was mined from 1964 to 1966 and produced 4,547 ounces of gold and 1,315 ounces of silver from 33,013 tons of ore (Ontario Division of Mines Statistical Files). The shaft is 1,016 feet (310 m) deep with levels established at 170 feet (52 m), 320 feet (97 m), 520 feet (159 m), 720 feet (219 m) and 920 feet (280 m) (Riddell 1967, p.52). This work was done by Lindsay Exploration Limited and Sapawe Gold Mines Limited.

The Sunbeam Gold Mine is in the northeast part of the map-area and has a history dating back to about 1898 (Bow 1900, p.35). An inclined shaft eventually reached a depth of 410 feet (125 m) with levels established at 96 feet (29.2 m), 113 feet (34.5 m), 212 feet (64.7 m) and 295 feet (90 m). This development work was done by the Railroaders Gold Mining Company (Railroad Mining and Development Company Limited, 1898-1899) and unrecorded operator, 1899-1902, and by the New York and Ontario Gold Mining Company from 1902 to 1905. In 1904 there was a total of 650 tons milled giving a value of $4,875 (Ontario Division of Mines Statistical Files; gold at approximately $17.50 per ounce in 1904).

Other prospects include the Jack Lake Mine described by Fenwick (1972, p.93-95).

From the writer's observations, small, nickeliferous gabbroic sills intrusive into Early Precambrian metasedimentary rocks have been examined by pitting and trenching and some diamond drilling.

GENERAL GEOLOGY: Early Precambrian rocks underlie the whole area. These rocks can be divided into 3 major units which are; the east-west-trending metasedimentary belt; a parallel metavolcanic belt with associated intrusive rocks north of the metasediments; and granitoid rocks. The metasediments are separated from the metavolcanics by the Quetico Fault. The granitoid rocks comprise three separate bodies; a batholith located south of the metasediments, a central pluton intrusive into the metasediments, and a batholith north of the metavolcanic rocks.

The belt of metasediments extends east-west across the entire width of the map-area; it ranges from 10,000 feet (3,050 m) to 14,000 feet (4,270 m) in width. The southern part of the belt is dominantly a quartz-biotite schist grading to the north into less metamorphosed greywacke. To the north sedimentary structures such as graded bedding and scour occur locally. The gradation from quartz-biotite schist to metagreywacke is a function of increasing distance from the southern granitoid body. Locally, near the Quetico Fault, sericite schist is developed in the metasediments. Local migmatitic zones are present in the metasedimentary belt.

The metavolcanic belt is characterized by abundant mafic sills and dikes (feeders?) that commonly have a diabasic or a porphyritic texture with phenocrysts of zoned plagioclase up to 1 inch (2.5 cm) in diameter. These sills(?) intruded the earlier volcanic assemblage, which ranges in composition from felsic to mafic. The intermediate to mafic rocks consist of massive and porphyritic flows, flow-breccia, and pyroclastic units. Chlorite schist is common. Rocks of the felsic unit range in composition from rhyolite to dacite and form a narrow zone along the southern edge of the belt. These are mainly pyroclastic rocks with flows of secondary abundance.

Intrusive bodies of quartz porphyry and quartz-feldspar porphyry also occur.Because of shearing along the contacts the relationship of these porphyries with the earlier mentioned gabbros is often obscure. This shearing is evident in the gabbro but not in the more competent felsic rock.

The iron deposits of Atikokan Iron Range are located between the metasedimentary and metavolcanic belts in the Quetico Fault zone; Hawley (1929) considered the deposits to be of hydrothermal replacement type.

Small, lensoid, gabbro to pyroxenite bodies cut the metasediments. These intrusions vary greatly in texture, are locally very coarse-grained and exhibit compositional layering locally.

The age relationships between the three granitoid bodies are not clear. The southern batholith comprises an early, fine-grained, grey, equigranular biotite trondhjemite, apparently followed by the most abundant phase, which is medium-grained, equigranular to porphyritic, biotite-muscovite granite to quartz-monzonite, and a late stage pegmatite and coarse-grained porphyroblastic granite. Tourmaline is present locally in the pegmatite. The contact zone of the batholith is characterized by numerous xenoliths, and infolded zones of metasediments.

The central body is mainly monzonite in composition and mapping to date suggests that it is entirely within the metasedimentary belt. There are at least 3 and possibly 4 phases mapped to date; each one of these is progressively more felsic than a preceeding one; all except the one porphyritic phase are equigranular. Hornblende is the main mafic mineral. All phases have abundant xenoliths many of which are cognate.

The northern granitoid body, or Marmion Lake Batholith (Fenwick 1972), is the southern part on a large, metamorphosed, and highly altered, high level intrusion comprising: biotite-chlorite trondhjemite to quartz diorite, which is locally layered, especially in the northeast corner of the area; a less mafic trondhjemite characterized by plagioclase grains of two distinct sizes in which granophyric patches are common; a fine-grained felsite, which is common in the contact zone; and a late aplite phase, which has a fine-grained sugary texture, is light pink to white, and contains little or no mafic material.

The contact zone between the Marmion Lake Batholith and the adjacent metavolcanic rocks is complex and relationships are commonly obscure and contradictory. These conflicting relationships are similar to those described by Strong and Payne (1973) and suggestive of felsic and mafic magmatism taking place during and after metamorphism.

STRUCTURAL GEOLOGY: The main structural feature is the east-west trending Quetico Fault that divides the metasediments from the metavolcanics.

An east-northeast foliation is strongly developed in the metavolcanics and metasediments and a similar direction of foliation in biotite is developed in the southern granitoid batholith. The foliation in the granitic rocks is best developed near the contact.

Bedding in the metasediments is evident away from the granitoid contact and is generally sub-parallel to the foliation. Top determinations from graded bedding and scour marks suggest that a major fold in the form of an anticline, with an easterly plunging axis, has developed along the northern part of the sedimentary belt adjacent to the Quetico Fault.

ECONOMIC GEOLOGY:

Gold: The gold deposits at the Sapawe Mine are in quartz veins in the contact zone between the metavolcanics and the Marmion Lake Batholith (Hawley 1929) Other gold occurrences in the batholith are in localized shear zones instance the Jack Lake (Fenwick 1972) Mine. Whether mineralization is associated with a particular phase of the batholith is not clear.

Iron: The iron deposits of the Atikokan Iron range occur near or in the Quetico Fault. Magnetite and pyrrhotite occur as lenses and irregular masses in the mafic metavolcanics and gabbroic intrusions (Hawley 1929). As previously stated these deposits have been ascribed to hydrothermal replacement (Hawley 1929). Pyrite also occurs and its laminated nature is suggestive of sulphide facies iron formation.

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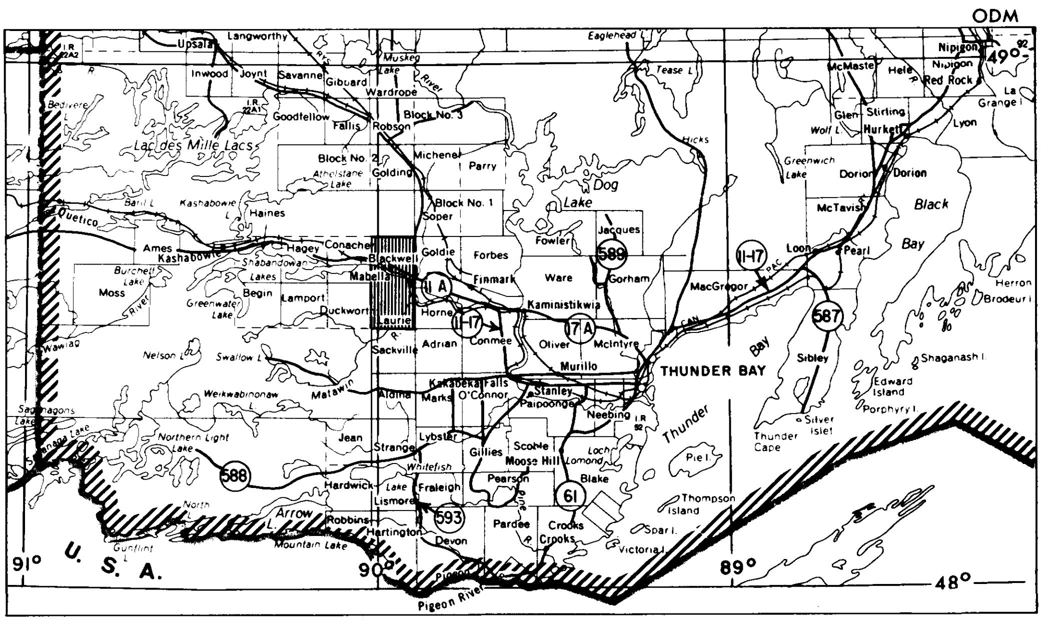
No.9 BLACKWELL AND LAURIE TOWNSHIPS

DISTRICT OF THUNDER BAY

by

K.G. Fenwick[1] and F.D. Weinstock[2]

LOCATION: Blackwell and Laurie Townships are bounded by Latitudes 48°30' and 48°40'N and Longitudes 89°54' and 90°01'W. The centre of the map-area lies 36 air miles west-northwest of the City of Thunder Bay.



LOCATION MAP

Scale: 1 inch to 25 miles

Lumber roads provide access to the northern and western parts, and Highways 11 and 17 to the southern and eastern parts, respectively, of Blackwell Township. The eastern half of Laurie Township can be reached by the Matawin River and by bush roads. The western part is accessible by way of tracked-vehicle trails from the dam on the Matawin River.

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The map-area covered during the 1973 field season was approximately 72-square miles.

MINERAL EXPLORATION: T.L. Tanton (1924) carried out a reconnaissance geological survey of the eastern part of the Matawin Iron Range, which included Laurie Township and the southern part of Blackwell Township. P. Srivastava and K.G. Fenwick (1973) mapped the two townships directly west of Laurie Township and J.A. Morin (1972) mapped the two townships west of Blackwell Township.

In 1945, Sylvanite Gold Mines Limited (Kasper Option) did detailed geological mapping and sampling on 9 claims in the southeast part of Blackwell Township (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay).

Abex Mines Limited, in 1953, carried out a ground magnetometer survey over 5 claims in the vicinity of the Conacher-Blackwell township boundary (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay).

In 1956, Three Brothers Mining Exploration Limited drilled five holes (3,600 feet) on 30 claims in the southeastern part of Blackwell Township (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay).

Falconbridge Nickel Mines Limited, in 1962, held 19 claims in the southeastern part of Blackwell Township. One hole of 651 feet was drilled (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay).

Canadian Nickel Company Limited, from 1966 to 1969, held 55 claims in the southwestern corner of Blackwell Township and 3 claims in the northwestern corner of Laurie Township. In 1967, a ground magnetic survey, with follow-up electromagnetic work, was conducted over the claims and outlined four conductive zones. From 1966 to 1969, there have been 12 holes (6,439 feet) drilled on the Blackwell Township claims and 2 holes (1,320 feet) on the Laurie Township claims. All claims have lapsed (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay).

G. Chilian, in 1958, held 9 claims in the northwestern corner, Sand Lake (local name) area, of Laurie Township. A detailed program of geological mapping, trenching, and diamond drilling (10 holes, 562 feet) was carried out (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay).

Noranda Exploration Limited, in 1962, held 4 claims in the southeast part of Laurie Township. They drilled one hole (217 feet). In 1970, Noranda Exploration Limited held 20 claims in the vicinity of the Duckworth-Laurie township boundary. Ground magnetometer and electromagnetic surveys were conducted over 14 of these claims (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay).

Monpre Iron Mines Limited holds 68 patented claims in the central part of Laurie Township. From 1956 to 1964, the company carried out geological and geophysical surveys and did extensive diamond drilling (19 holes, 9,933 feet) on this part of the Matawin Iron Range (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay).

In 1971, Caltor Syndicate had a combined helicopter-borne electromagnetic and magnetometer survey flown over the southwestern corner of Laurie Township and the southeastern corner of Duckworth Township. As a result, between 1971 and 1973, detailed geological and geophysical surveys and follow-up drilling (9 holes, 3,371 feet) was undertaken on 118 claims in Laurie Township (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay).

GENERAL GEOLOGY: The map-area is underlain by an extensive belt of Precambrian metavolcanic-metasedimentary rocks that extends from City of Thunder to the western boundary of the District of Thunder Bay. This belt is bounded on the north by the Kashabowie Group of metasedimentary rocks (Hodgkinson 1968) and on the south by felsic intrusive rocks.

The bulk of the metavolcanic rocks in the belt are of mafic to intermediate composition and these are exposed both north and south of the central core of metasediments and felsic to intermediate metavolcanics. The mafic metavolcanics consist of massive, pillowed, foliated, variolitic, porphyritic, amygdaloidal, and coarse-grained flows, and minor amounts of tuffs and tuff-breccias.

The felsic to intermediate metavolcanics lie mainly in Laurie Township, south of the main band of metasediments, and trend east-west. These rocks are 15,000 feet wide at the western boundary of Laurie Township and narrow down to 2,500 feet going eastward. These metavolcanics consist of massive and foliated lavas, tuffs, crystal tuffs, tuff-breccias, and flow-breccias. The tuff and crystal tuff are the most abundant rock types. Another small south-east-trending band of felsic metavolcanics was observed just north of Highway 11.

The metasediments within the metavolcanic-metasedimentary belt consist of conglomerate, greywacke, arkose, argillite, slate, and iron formation. These metasediments occur principally in the central part of Laurie Township, trend east-west, and have a maximum thickness of 9,000 feet; also a smaller belt of metasediments parallels Highway 11.

The Kashabowie Group of metasediments north of the metavolcanic-metasedimentary belt range from a well-bedded metagreywacke in the southern half of the sequence to a biotite-quartz-feldspar schist in the northern part. Almandine and sillimanite were noted in these metasediments.

Mafic intrusive rocks occur as small sills and irregular bodies within the metavolcanic-metasedimentary belt and are comprised of diorite and gabbro.

A granitic body of batholithic size, with a migmatitic marginal zone, intrudes the southern part of the metavolcanic-metasedimentary belt. The granitic mass in the northern part of the area has a lit-par-lit contact with the biotite-quartz-feldspar schist of the Kashabowie Group.

A few diabase dikes are found cutting the mafic metavolcanic.

STRUCTURAL GEOLOGY: The metavolcanic-metasedimentary belt trends easterly through the map-area. Top determinations based on grain gradations and pillow lavas indicate that an isoclinally folded syncline occupies the centre of the belt. An anticline that trends easterly and plunges eastward at a moderate angle was also located just north of the Blackwell-Laurie township boundary. In the southeast corner of Laurie Township, a minor anticline is superimposed on the major synclinal fold.

A major fault, the Crayfish Creek Fault (Hodgkinson 1968), trends southeast across the central part of Laurie Township.

ECONOMIC GEOLOGY:

Iron: Iron formation has been found throughout the map-area intercalated with the mafic metavolcanics and metasediments. The thickest and most extensive unit occurs in the central part of Laurie Township and is the central extension of the Matawin Iron Range. Monpre Mining Company has outlined a zone that is 1,000 feet long and 100 to 500 feet wide averaging 26 percent soluble Fe (Regional Geologist's files, Ontario Ministry of Natural Resources, Thunder Bay).

Gold: From the writer's observations, all the known gold occurrences in Laurie and Blackwell Townships are associated with quartz veins that generally contain minor amounts of sulphide minerals. These veins occur in a variety of host rocks. Channel and grab samples of the quartz veins were collected by the author and were submitted for gold analysis to the Mineral Research Branch, Ontario Division of Mines, and all contained less than 0.07 ounce per ton gold, and 0.39 ounce per ton silver.

Sulphide Minerals: Minor disseminated pyrite and pyrrhotite are ubiquitous in the metavolcanic rocks.

Sand and Gravel: Large quantities of sand and gravel are available in Blackwell and Laurie Townships.

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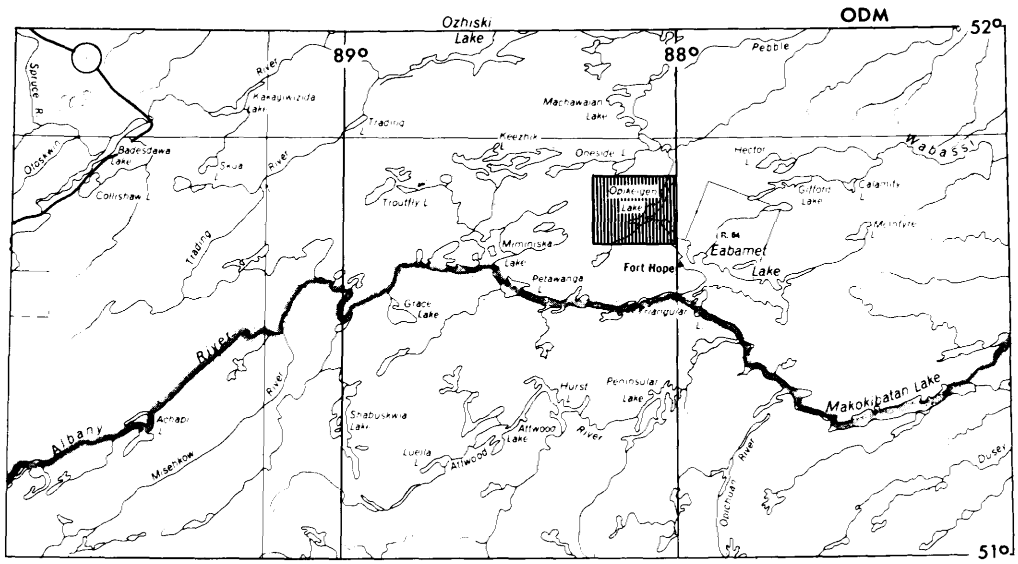
No.10 OPIKEIGEN LAKE AREA

DISTRICT OF KENORA, PATRICIA PORTION

by

Henry Wallace[1]

LOCATION AND ACCESS: The Opikeigen Lake map-area covers 98-square miles (354-square km), bounded by Latitudes 51°35'30" to 51°43'30" and Longitudes 88°00' to 88°15'. The centre of the area is 10 miles (16 km) northwest of



LOCATION MAP Scale: 1 inch to 25 miles

the settlement of Fort Hope on Indian Reserve 64, and approximately 95 miles (153 km) due north of Lake Nipigon.

In the summer, access is by float-equipped aircraft, or by small boat or canoe from Eabamet Lake. The accessibility of the west-central part of the map-area is poor, but it can be reached along Lilypad Creek from Opikeigen Lake in the east or from the Lilypad Lakes to the west. A winter road connects the northern part of Opikeigen Lake with Eabamet Lake.

MINERAL EXPLORATION: Prospecting for gold and silver began in this region in the mid 1920s. A gold showing, originally called the Fort Hope Mine and now known as the Golden Hope prospect, was discovered south of Rond Lake in 1927. During the brief 'rush' that followed, several other gold occurrences were staked around Rond Lake, Lilypad Creek, and Rich Creek (Burwash 1929).

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In 1927-1928, in the vicinity of the first gold find, Fort Hope Mines Limited put down a 125-foot (38-m) shaft, with 330 feet (101 m) of drifting at the 100-foot (30-m) level (Sinclair et al 1929). No production was recorded. On the same property in 1934-1935, Fort Hope Consolidated Gold Mines Limited drilled 17 diamond drill holes totalling 5,000 feet (1,520 m) and in 1946-1947, 5,400 feet (1,650 m) of diamond drilling, a ground magnetometer survey, and considerable trenching were done by Golden Hope Mines Limited, who still hold the property (Canadian Mines Handbook 1947).

In the early 1940s, the discovery of scheelite-bearing quartz veins in the vicinity of the map-area attracted attention. One showing, known as the Rich Lake Patricia prospect, is located half a mile northwest of Rich Creek. Trenching and diamond drilling on this site was described by Prest (1942) but no work has been done on the property since 1941.

Spodumene-bearing and lepidolite-bearing, pegmatite veins, north of the Lilypad Lakes, were staked in 1956 by Standard Lithium Corporation. That company did geological mapping and trenching and drilled seven drill holes totalling 2,500 feet (760 m). In 1962 after the showing was restaked by R.J. Campbell, another 3 holes were drilled (Ontario Division of Mines, Assessment Files Research Office).

Recent exploration (Ontario Division of Mines, Assessment Files Research Office) appears to have been directed at possible base metal sulphide mineralization within metavolcanics and basic intrusions. In 1971, Selco Exploration Company Limited carried out ground magnetometer surveys in two small areas, at the mouth of Rich Creek and at the southwest end of Opikeigen Lake, and in the same year Rexdale Mines Limited carried out an airborne electromagnetic and magnetometer survey over part of the map-area east of Opikeigen Lake. In 1972-1973 Canadian Nickel Company Limited drilled a total of five holes in the map-area; three of these were drilled in mafic metavolcanics on the northeast side of Opikeigen Lake. The objectives of the other holes were probably to intersect extensions of two diorite-gabbro sills that outcrop northwest of Opikeigen Lake and South of Rond Lake.

No exploration work took place in the area during the 1973 field season.

GENERAL GEOLOGY: This area was first mapped on a reconnaissance scale by Bell (1886, p.15-16), and later by Burwash 1929). The first detailed mapping was by Prest (1942) and the most recent examination was made by Thurston and Carter (1970) as part of Operation Fort Hope.

All of the rocks in the region are Archean (Early Precambrian). A large part of the map-area is underlain by a metavolcanic-metasedimentary sequence cut by a variety of minor intrusions. This sequence has been folded into an east-west-trending belt bounded to the south by migmatized metasediments and paragneiss, and to the north by a granodioritic batholith. Much of the northwestern part of the map-area is underlain by a circular diapiric intrusion of granite. With the exception of a few areas of good exposure, Pleistocene sand and boulder deposits and Recent swamp deposits form extensive overburden throughout the area.

The Keewatin-type mafic metavolcanics are now amphibolite, garnetiferous amphibolite, and chlorite schist, which can in most places be recognized as originally having been massive lava, pillow lava, or autoclastic breccias of basaltic composition. Coarse mafic pyroclastic material is common, particularly in the southern part of Opikeigen Lake. Thin beds of fine mafic pyroclastic rock occur intercalated with mafic flows, or very commonly with more felsic tuff. Typical Archean (Algoma-type) quartz-magnetite banded iron formation occurs in the mafic metavolcanics to the northwest of Opikeigen Lake.

Rhyolitic to dacitic metavolcanics, mostly lapilli-tuff, tuff-breccia, and autobrecciated flows form a band about 5,000 to 6,000 feet (1,530 to 1,830 m) wide extending from Rond Lake to the Lilypad Lakes, a distance of about 10 miles (16 km). These rocks are intercalated with mafic pyroclastic rocks and flow units, and with argillaceous to conglomeratic metasediments, some of which contain staurolite metacrysts. Oxide-facies iron formation also occurs in this felsic sequence although it is rarely exposed.

There are two metasedimentary sequences within the map-area. One sequence, which is gradational into paragneiss north of Rich Lake, consists of metagreywacke, meta-arkose, staurolite, garnet, and biotite schists, and iron formation. This extends for about 12 miles (19 km) from Eabamet Lake to the Lilypad Lakes with an average thickness of 3,000 feet (900 km). The second metasedimentary band, which is comprised of sericitic and biotitic schists, is poorly exposed and extends across the map-area parallel to Lilypad Creek. The regional metamorphic grade, based on the mineralogy of these metasediments, corresponds to the staurolite-almandine subfacies of the almandine-amphibolite facies (Winkler 1967).

Several metadiorite-metagabbro sills intrude the metavolcanic-metasedimentary sequence; where shearing has been intense these resemble metavolcanic amphibolite. The largest of the sills, which is northwest of Opikeigen Lake, is at least 1,500 feet (460 m) thick in places, but most have thicknesses of less than 300 feet (90 m). Small feldspar porphyry, quartz-feldspar porphyry, and felsic hornblende porphyry sills and dikes are common, but some bodies previously called felsic intrusions by Prest (1942) have been identified as lapilli-tuff and crystal tuff layers.

STRUCTURAL GEOLOGY: The dominant structural trend is produced by isoclinal folding along east-west to northwest-trending axes. Top determinations from pillow lavas were possible in only a few localities, but these suggest that a major anticline with a core of felsic metavolcanics strikes eastward along the Eabamet River through the southern part of Opikeigen Lake and the Lilypad Lakes. At least one, and possibly two other major northwest-trending folds occur in the northern half of the map-area. One can be recognized on the basis of the aeromagnetic expression of thick units of iron formation in the mafic sequence northwest of Opikeigen Lake. This too is believed to be an anticline. The other fold, which is north of Lilypad Creek, is poorly exposed and is largely obliterated by the granitic Cluff Lake intrusion.

Several north- and northeast-trending topographic lineaments occur throughout the central and southern parts of the map-area. These features may be related to faulting, but no major stratigraphic displacement or zones of shearing are associated with them. Narrow, small-scale, east-trending shear zones are common, particularly in the mafic metavolcanics. A northwest-trending fault, extending through Rond Lake north to Opikeigen Lake, is inferred from an apparent stratigraphic offset. Linear glacial features such as striations, grooves, and stream channels trend between 70° and 80°.

ECONOMIC GEOLOGY:

Gold: Burwash (1929), and Prest (1942) reported low gold contents in quartz veins and shear zones cutting mafic metavolcanics in several places in the southern part of the map-area. The Fort Hope Mine, where gold occurs with pyrite, pyrrhotite, and other sulphide minerals in a northeast-striking quartz-carbonate vein, is the most significant prospect. Burwash (1929) reported an average of 1.01 ounce of gold per ton over an average width of 3 feet (1 m) and a length of 575 feet (175 m) for this deposit.

Sulphide Minerals: Disseminated pyrite and pyrrhotite commonly form less than 2 percent of mafic metavolcanics and many quartz veins in the map-area. Higher concentrations of pyrrhotite occur within mafic to intermediate tuff horizons in the mafic sequence. Zones of massive pyrrhotite and gossan up to 10 feet (3 m) wide and exposed over tens of feet, were found in mafic to intermediate metavolcanics 3,500 feet west of Rich Creek and in mafic lavas on the west side of Lilypad Creek 2 miles (3.2 km) west of Opikeigen Lake, and 4,000 feet north of the Lilypad Lakes. These bodies contain no other visible sulphide minerals.

Iron: Banded quartz-magnetite iron formation is found throughout the area intercalated with metavolcanics and metasediments, including paragneiss south of Rich Lake. Most bands consist of ½- to 2-inch wide laminae of almost pure magnetite alternating with thin beds of recrystallized felsic material in approximately equal proportions. Although they are generally poorly exposed, widths of 25 to 40 feet (8 to 12 m) were found in units of iron formation northwest of Opikeigen Lake, north of Rich Lake, and north of the Lilypad Lakes. Strong magnetic attraction indicates a wide band on the south side of the Eabamet River. No exploration work has been conducted on these occurrences and they are believed to be subeconomic at present.

Tungsten: Minor amounts of scheelite were found in some quartz veins northwest of Rich Creek and north of Lilypad Creek and the Lilypad Lakes. The major occurrence, the Rich Lake Patricia Syndicate showing, has been described by Prest (1942) and Thurston and Carter (1970). Grab samples collected by Thurston, and analyzed by the Mineral Research Branch, Ontario Division of Mines, were found to contain 1.50 wt percent W. The irregular quartz-scheelite veins are conformable and continuous through mafic metavolcanics for about 300 feet (90 m) with an average width of 1 foot to 2 feet (.3 m to .6 m).

Lithium: Spodumene-bearing and lepidolite-bearing, pegmatite veins cutting mafic metavolcanics occur in at least two localities north of the Lilypad Lakes. Minor amounts of scheelite and fluorite are also found in the veins. The main mineralized pegmatite is vertical and cross-cutting, varying from about 5 feet to 25 feet (1.5 to 8 m) in width over a length of 800 feet (240 m) traced in several outcrops and drill holes. It contains about 20 percent spodumene, with individual crystals up to 1.5 feet (.5 m) in length. Thurston and Carter (1970) reported that the best intersection from drilling that body was 34 feet (10.4 m) of 1.08 wt. percent LiO_2.

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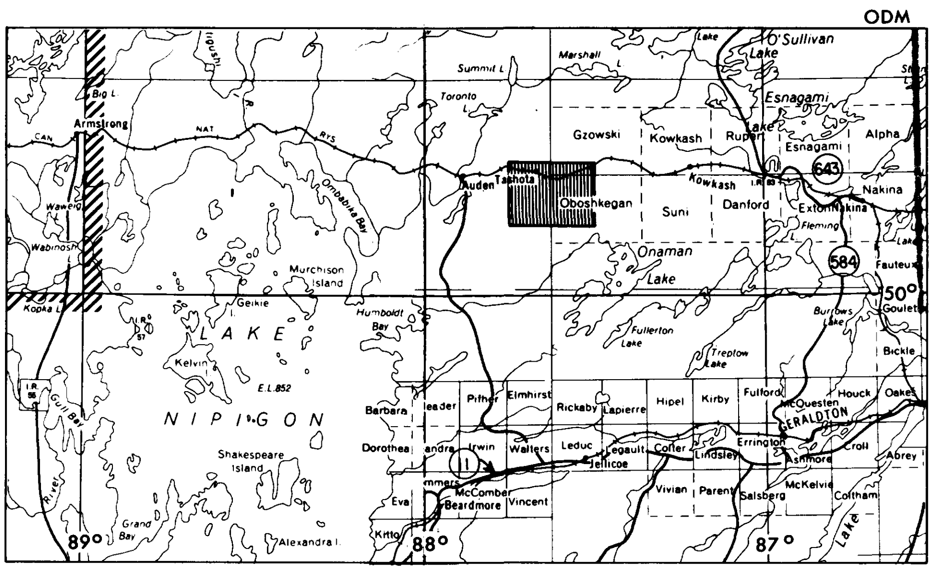
No.11 TASHOTA AREA

DISTRICT OF THUNDER BAY

by

S.E. Amukun[1]

LOCATION: The area is located about 35 miles north of Jellicoe and about 45 miles northwest of Geraldton. It covers an area of approximately 100-square miles, bounded by Latitudes 50°07'30" and 50°15'00"N and Longitudes 87°30'00"



LOCATION MAP

Scale: 1 inch to 25 miles

and 87°45'00"W. Access to the area is by pontoon-equipped aircraft, which can be chartered from Jellicoe, Geraldton, Armstrong, or Nakina. The western part of the map area can be reached by subsidiary logging roads branching off from the road to Auden. Most of the waterways, except lakes and some rivers, are navigable only with considerable difficulty because of fallen logs, rapids, and shallow water. The Canadian National Railway transcontinental line traverses the northern section of the map-area.

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MINERAL EXPLORATION: The completion of the Canadian National Railway line through the area in 1913 (Kindle 1931) greatly improved access into the area and triggered mining exploration activity. Gold was first discovered by R. Wells in 1916 southeast of Tashota station (Hopkins 1917, p.218). His property was sold to Tash-Orn Mines Limited for $25,000.00 (Hopkins, 1917) who during underground development shipped 700 pounds of test gold ore, in 1917, reported to be valued at $20.00 per ton (Hopkins 1917; Kindle 1931). The price of gold in 1917 was about $20.67 per ounce. This property was subsequently acquired by Wascanna Mines Limited in 1936, who during the sinking of a shaft in 1937, made a test shipment of 1,000 pounds of ore, reported to have run 1.12 ounces per ton in gold (Moorhouse 1938, p.25; Sinclair et al 1937, p.215-216; 1938, p.223-224). The ground is currently leased by Harry P. Brightman. A gold discovery was also made along Tashota Creek south of the station at Tashota by George H. Adair in 1924 (Kindle 1931, p.87). Development work within the property, including a 27-foot deep shaft, produced 34 tons of ore assaying 6.07 ounces per ton in gold (Rogers and Young 1932, p.9; Kindle, 1931, p.94). This property was transferred to several groups and (or) individuals viz.: Tashota Creek Gold Mines Limited in 1934; Invaday Mining and Exploration Limited in 1948; Rowan '990' claims in 1961; V. Feeley in 1965-1966; Cashback-Dean in 1971-1972; and L.G. Phelan-R.F. Liard (Projex Limited) in 1973. On July 30, 1973, the property was transferred to William J. Cummer. During the 1973 field season, blasting, trenching, and ground geophysical surveys were carried out on this property. Edgelake Gold Mining Company Limited owned a property at the west end of Tashota Lake in 1935. A shaft was sunk to a depth of 31 feet (Sinclair et al 1936, p.105; 1937, p.130; 1938, p.120) and underground development was planned to commence in 1937 (Sinclair et al 1938, p.120) but operations were apparently suspended with no production being realized. This ground is currently on lease to Mildred U. Johnstone and Kenneth G. Cameron. The surrounding country is leased by Julien J. Picotte and Paulpic Gold Mines Limited.

Numerous other exploration surveys including diamond drilling, geophysical, and geological methods, in search of gold and base metals have been conducted in the map-area. Recent diamond drilling, probably following an airborne survey, was carried out by Phelps Dodge Corporation of Canada Limited in 1970. Detailed exploration surveys are currently being conducted by Noranda Exploration Company Limited on their ground. The present ownership of claims in the map-area includes patented claims leased by Albert P. Hopkins, Frank Cuzzola, and Richard Noffke; non-patented claims of: H.A. Cosman; J.F.M. Croteau; W.J. Cummer; Roger Desjardins; Kenneth Ellard; Dennis Low; Richard Middaugh, Noranda Exploration Company Limited; Harry Schmitt; and Walter Yzerdraat.

GENERAL GEOLOGY: Parts of the area had previously been studied by Hopkins (1916; 1917), Gledhill (1925), Kindle (1931), and Moorhouse (1938). The consolidated rocks of the map-area form a complex, greatly altered Early Precambrian (Archean) 'greenstone' belt consisting of metavolcanic-metasedimentary and metagabbroic assemblages bordered and intruded by granitic bodies.

The metavolcanics form about one half of the map-area and are composed of mafic (60 percent), intermediate (10 percent) and felsic types (30 percent). The mafic volcanic rocks have been metamorphosed to chlorite-amphibole schists with a steeply dipping foliation. Pillowed and porphyritic zones, usually massive to foliate, are abundant, whereas amygdaloidal, vesicular, and pyroclastic mafic metavolcanic units are rare. Bands of metamorphosed iron formation are associated with the mafic metavolcanics.

Felsic metavolcanics are predominantly coarse rhyolitic and quartz porphyritic pyroclastic units. These rocks are composed of lenticular felsic fragments as much as 2½ to 3 feet long in a siliceous and chloritic matrix. The fragments concentrate in layers 3 to 10 feet thick but are distributed locally and randomly throughout the felsic belts. The average strike length and width of the Metcalfe Lake band is 40,000 by 8,000 feet, whereas that centred around Lac Ste. Marie is 10,000 by 16,000 feet (only within the map-area). The author tentatively considers that the Oboshkegan Lake felsic band is connected to the main Metcalfe Lake lithologic unit. The intermediate metavolcanics are rare and where found, they lie astride the mafic-felsic contacts. Metamorphosed iron formation outcrops north of Lac Ste. Marie within the rhyolite quartz porphyritic pyroclastic rocks.

In the metasedimentary belt located south of Knucklethumb Lake, thin laminae of metagreywacke, argillite, and slate predominate, but metaconglomerate, meta-arkose, and chert are locally distributed. A narrow, ferruginous, metasedimentary belt also outcrops northeast of Lac Ste. Marie. The metasediments make up only about 1/8 of the map-area and appear to rest conformably upon the metavolcanics.

The metavolcanics and metasediments are intruded by dikes and sills of metagabbro, metadiorite, and lamprophyre that pre-dated the granitic emplacement.

The felsic granitic intrusive activity appears to have repeatedly invaded the 'greenstone' belt. The oldest, most widespread stock around Elbow Lake is a medium-grained, well foliated quartz diorite, trondhjemite, and granodiorite gneiss, but the relatively younger coarse-grained and massive type around Robinson Lake is a biotite quartz monzonite. The hornblende quartz monzonite batholith around Gzowski Lake is unusual because: 1) it is medium-grained, 2) it appears to be a high level intrusion forcefully injected and emplaced at a shallow depth, 3) it contains copper mineralization. As with most 'greenstone' areas of northern Ontario true granites (sensu stricto) seem to be absent in the map-area. Late diabase dikes post-date the granitic rocks and form high ridges.

STRUCTURAL GEOLOGY: A majority of the rocks within the metavolcanic-metasedimentary assemblage have a well-developed metamorphic and cataclastic foliation defined by subparallel alignment of amphiboles, micas, chlorite, sericite, or lenticular orientation of fragments. Metamorphic foliation is developed in the gneissic granitic rocks, but is rare in the metagabbroic, and later quartz monzonite bodies. In the metagabbroic and quartz monzonite rocks, cataclastic foliation is of local random distribution. The foliation intersected bedding obliquely at 15° to 20° in the layered rocks. Two or possibly three separate lineation orientations were observed, and their attitudes plunge steeply in the foliation and bedding planes. Slaty cleavage is well developed in argillaceous metasedimentary beds. Traces of northeasterly trending axial planes of a major anticlinal-synclinal pair are documented by interpretation of available structural, stratigraphic, and geophysical data (ODM-GSC 1963a, b). The major folds are centred around McDonough, Metcalfe, and Shed Lakes. Minor folds are also widely exposed. There are a number of major faults and (or) shears recognized from topographic (lineaments, scarps), structural (offset, crushed wall-rock), and petrologic (wall-rock alteration and brecciation) criteria. Some of these fault areas have been filled by silica-rich rocks and diabase dikes. The faults are widespread mainly in the area of the Gzowski Lake hornblende quartz monzonite.

ECONOMIC GEOLOGY: Nearly all of the exploration activity in the area has been centred around auriferous quartz veins but recent endeavours have focused on the search for base metals. The gold occurs in sheared veins of quartz, cutting across mafic metavolcanics with associated interbeds of rhyolite (Kindle 1931, p.86). As in the Adair property (Kindle 1931; Hopkins 1917), quartz-feldspar porphyry dikes are invariably intruded in the vicinity of mineralization. The minerals associated with the gold in the veins and identified in the field are: Pyrite, pyrrhotite, chalcopyrite, galena, sphalerite. Silver concentration was identified only by assay results done by Mineral Research Branch, Ontario Division of Mines. Five selected grab samples collected by the field party from Adair shaft area were analyzed by the Mineral Research Branch, Ontario Division of Mines, and the following metal values were returned:

	Cu%	Pb%	Zn%	Gold, ounces per ton	Silver, ounces per ton
Sample 1	0.12	0.10	Tr	0.07	Tr
Sample 2	0.05	1.60	Tr	2.41	2.34
Sample 3	0.17	4.65	0.19	5.86	3.60
Sample 4	0.45	3.18	0.18	14.86	6.84
Sample 5	0.05	0.03	Tr	0.01	Tr

Numerous exploratory pits and trenches throughout the map-area have exposed sheared and schistose zones, which were selectively grab sampled by the field party and samples were also analyzed by the Mineral Research Branch, Ontario Division of Mines. Metal concentrations ranges obtained included gold (0.01-0.05 ounces per ton), silver (trace to 6.19 ounces per ton), copper (0.01 to 0.25 percent), iron (5.85 to 31.9 percent), and trace amounts of zinc-lead.

The most significant untested mineralization was observed on the outcrop at the tip of the southwest shore of Gzowski Lake. In this area, a partly altered hornblende quartz monzonite has minor amounts of visible disseminated chalcopyrite. The mineralization was visible only in one part of the outcrop, 250 feet x 100 feet, which was notably permeated with quartz veinlets. Disseminated chalcopyrite was also found in another outcrop 1,500 feet to the northeast. Copper content of 3 samples submitted to the Mineral Research Branch, Ontario Division of Mines, was only trace, but these samples also returned trace to low (0.05 to .50 percent) values of titanium. The area may have porphyry copper economic connotations and it is recommended that further prospecting be done to check out the extent of this mineralization. Another favourable area was noted in the central part of the map-area, 4,000 feet south of Hull Lake and 8,000 feet north of Shed Lake. This area consists of a highly weathered (gossan) and sheared quartz porphyry rock containing pyrite (over 5 percent), sericite, and pyrrhotite (less 1 percent). Results of assays on selected grab samples collected by the author, as determined by the Mineral Research Branch, Ontario Division of Mines, indicated trace amounts of gold, tin, lead, chromium, and titanium, but one sample returned assays of 0.23 percent copper and 6.19 ounces per ton silver.

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No.12 LEGAULT AND COLTER TOWNSHIPS

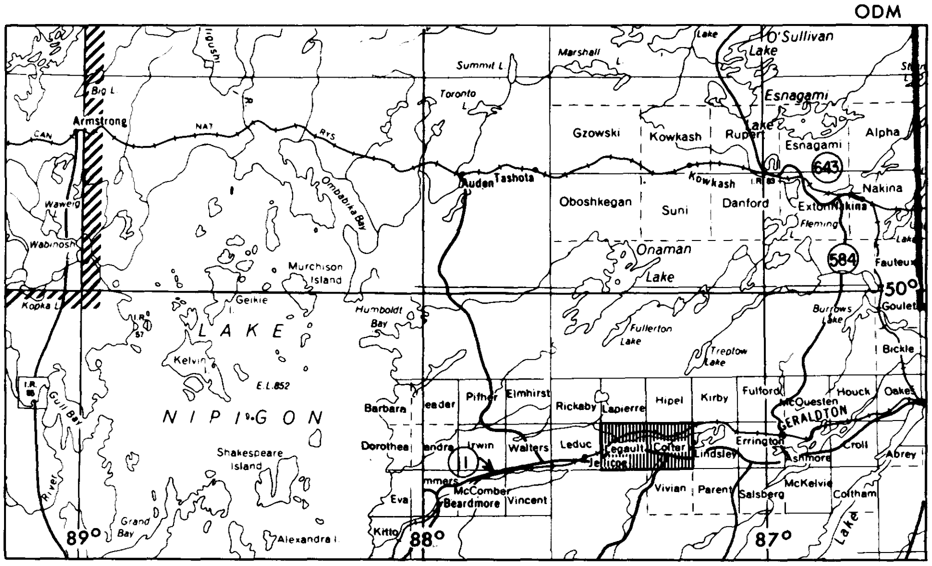
DISTRICT OF THUNDER BAY

by

W.O. Mackasey[1]

LOCATION: Legault and Colter Townships are located on the east side of Lake Nipigon and form part of the 'Sturgeon River Gold Belt'. The western boundary of the map-area is 2 miles east of the settlement of Jellicoe. The City of

ODM



LOCATION MAP

Scale: 1 inch to 25 miles

Thunder Bay lies to the southwest, a distance of approximately 140 miles via Highway 11. Along with Highway 11, a line of the Canadian National Railway and the TransCanada natural-gas pipeline pass through the map-area. An abundance of logging roads and trails provide excellent access through both townships. A float-plane base and a compacted gravel airstrip are located at Jellicoe.

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MINERAL EXPLORATION: Although mining claims are shown on the 1936 geological map of the area (Bruce 1936; Laird 1936) the files of the Ontario Division of Mines Assessment Files Research Office show that the earliest recorded exploration activity in the map-area was in 1949. During this time a total of nine diamond drill holes were completed on the G. Lattimer property in southwestern Legault Township (Ontario Division of Mines, Assessment Files Research Office). Only low 'values' of gold were intersected by the drilling. In 1954 and 1955 trenching and diamond drilling were undertaken on the R.W. Potter property north of the Canadian National railway tracks at the west end of Partridge Lake, Legault Township. Although the exploration work was presumably for gold, nothing of economic interest is reported in the files of the Ontario Division of Mines Files Research Office. A program of diamond drilling was completed by March Minerals Limited in 1961 on a property in the vicinity of Dumas Creek in northwestern Colter Township. This work was apparently a follow-up of a trenching and x-ray drilling project done by an unnamed party in 1959 and 1960. Only traces of gold were encountered by the exploration work (Ontario Division of Mines, Assessment Files Research Office).

The Algoma Steel Corporation Limited staked a block of 31 claims between Partridge and Turkey Lakes, Colter Township during the winter of 1964-1965. A ground magnetic survey was then conducted to test the extent of iron formation in the claim group. No further work appears to have been done and the claims have since been cancelled.

Hudson Bay Exploration and Development Company Limited carried out an exploration program in the Jellicoe area in 1971 and 1972 to check out a number of airborne electromagnetic anomalies. A group of 18 claims was staked at the east end of Vezina Lake, Legault Township. This ground was later tested by a horizontal loop electromagnetic survey and two diamond drill holes were completed in the winter of 1972. The claim group has since been dropped. Canadian Nickel Company Limited currently holds a group of seven claims at the northwestern corner of Vezina Lake, Legault Township. The only work reported in the files of the Ontario Division of Mines Assessment Files Research Office is for the completion of one diamond drill hole on the north shore of Vezina Lake in September 1972.

Amede Lafontaine presently holds one claim in the vicinity of the R.W. Potter prospect north of Partridge Lake, Legault Township, and John Kondrat holds four claims in northern Colter Township covering part of the March Minerals Limited prospect.

GENERAL GEOLOGY: Legault and Colter Townships are underlain dominantly by Early Precambrian (Archean) metasediments and metavolcanics that form part of the Beardmore-Geraldton belt (Mackasey 1970). Thin-bedded to laminated greywacke sandstone, siltstone, and argillite occur in the southern part of the map-area and make up more than half of the entire stratigraphic succession. A polymictic conglomerate unit with minor related clastic metasediments strikes across the northern extremities of the two townships. A second conglomerate unit, composed mainly of volcanic material and displaying a relatively open framework, was recognized in the northwestern part of Legault Township.

The metavolcanics are predominantly of mafic composition and include pillowed and amygdaloidal units. These form two narrow bands that roughly strike east-west across the map-area. The southern band parallels the southern boundary of the map-area and contains a distinctive 200- to 300-foot wide porphyritic flow that was traced across Legault Township. Mafic to intermediate metavolcanics, which form a third unit of flows, occur in the northwestern part of Legault Township.

Iron formation composed of magnetite, hematite, chert, and jasper is associated with thin-bedded greywacke sandstone, siltstone, and argillite at the greywacke-mafic flow contact trending east-west across the central part of the map-area. Light grey weathering magnetite-chert iron formation, with minor associated pyrrhotite and pyrite, forms 5- to 10-foot thick units within the mafic flows in the southern part of the map-area.

A 1,500-foot long elliptical-shaped granitic body of probable trondhjemitic composition intrudes mafic flows on the south boundary of Legault Township 1½ miles west of Colter Township. Numerous other smaller felsic and mafic intrusions and dikes occur throughout the map-area. Late Precambrian diabase dikes cut all other rock types.

STRUCTURAL GEOLOGY: The map-area lies along the boundary between the Quetico and Wabigoon Belts, comprising an east-trending succession of interbedded metavolcanics and metasediments known as the Beardmore-Geraldton belt (Mackasey 1970). All major stratigraphic units are steeply dipping and have an easterly strike. A moderate to well developed east-striking schistosity is present in all the Early Precambrian (Archean) strata.

Several east-striking faults are present and have been detected by zones of shearing and displacement of north-striking diabase dikes. Distinct broad folds occur in the metasediments in southern Legault Township and may be the result of drag by regional east-west faulting.

ECONOMIC GEOLOGY:

Iron: Iron formation is present in two separate localities in the map-area. The northern band extends across the townships in the vicinity of Partridge and Turkey Lakes and displays a well defined magnetic trend on ODM-GSC aeromagnetic maps of the region (ODM-GSC 1962 plus the 1 inch to 1 mile aeromagnetic maps of the surrounding area). An extensive area of drift cover prevents a detailed examination of the iron formation. Hematite is present in some iron formation units in the area (Mackasey 1971) and could also occur in the present map-area. Evaluation of iron deposits in the Partridge-Turkey Lakes area is therefore best done by combined gravity and magnetic methods and diamond drilling.

The iron formation associated with the mafic metavolcanics in the southern part of the map-area appears to be in units too thin for economic consideration at the present time.

Gold: Only minor amounts of gold have been found in the map-area to date. The gold occurs mainly in quartz stringers and veins in metavolcanic rocks. Some zones of sulphide mineralization in drill core contain minor gold as well.

Gold may be associated with quartz veins cutting the folded metasediments in the south half of Legault Township and prospecting in this area is recommended.

Sulphide Minerals: Minor amounts of base metals are present in the sulphide minerals associated with the iron formation in the mafic metavolcanics in the south part of the map-area. Concentration of base metals could have occurred within or near the iron formation in the vicinity of the small trondhjemite body on the south boundary of Legault Township. Prospecting in this area is therefore suggested.

The conductive zones in the Vezina Lake area are associated with graphitic schists containing variable amounts of pyrite and pyrrhotite.

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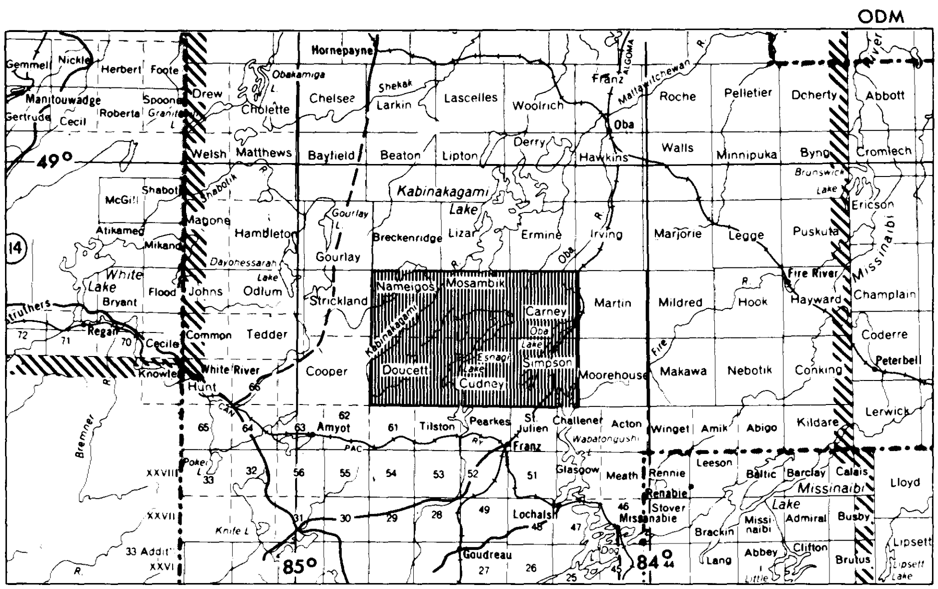
No.13 NAMEIGOS, MOSAMBIK, CARNEY, DOUCETT, CUDNEY, AND SIMPSON TOWNSHIPS DISTRICT OF ALGOMA

by

G.M. Siragusa[1]

LOCATION, AND ACCESS: The map-area is bounded by Latitudes 48°32' and 48°47'N and by Longitudes 84°12' and 84°48'W. It includes the six contiguous Townships of Nameigos, Mosambik, Carney, Doucett, Cudney, and Simpson for a total of



LOCATION MAP

Scale: 1 inch to 25 miles

approximately 486-square miles. The eastern part of the area can be reached by float-equipped aircraft from White River; the Canadian Pacific Railway crosses the Magpie River at the southeastern end of Esnagi Lake in Pearkes Township approximately 4 miles south of the map-area, and the Algoma Central Railway provides access to Simpson Township and the southeastern corner of Carney Township. An all-weather road connects Mosher (just outside the eastern boundary of Carney Township) with the northern half of Mildred Township.

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Parts of Nameigos and northern Mosambik Townships were mapped by J.E. Maynard in 1929 and the whole area is covered at the scale of 1 inch to 2 miles by ODM Preliminary Map P.476, Hornepayne Sheet, compiled by P.E. Giblin in 1968.

The 1973 field work consisted of:

a) Lakeshore mapping and ground traverses at ½ mile intervals or less in volcanic terrain of known or assumed sufficient outcrop density;

b) Reconnaissance ground traverses in areas of little outcrop density but with geologically interesting aeromagnetic patterns; and

c) Helicopter reconnaissance runs at 1½- to 2-mile intervals in areas of problematic access and where rocks other than granites were not expected to be present.

MINERAL EXPLORATION: There is no record of exploration work in Cudney and Carney Townships. A traverse across the right-of-way of the Algoma Central railway at Mile 203 in Simpson Township, and shoreline work in the northeastern arm of Wabatongushi Lake in the same Township were recorded in 1962 (Resident Geologist's files, Ontario Ministry of Natural Resources, Sault Ste. Marie), but the date of this work is unknown to the writer. The traverse was apparently aimed at exploring a quartz vein. In the summer of 1935 a gold prospect was discovered by J.E. Stenabaugh in northeastern Nameigos Township and 15 unpatented claims were staked following the discovery. In the winter of 1936 the claims were optioned by Consolidated Mining and Smelting Company of Canada Limited (presently Cominco) and 215-linear feet of trenching were completed by this company. The results of this work were not encouraging and the property was abandoned in the summer of 1936.

Trenching of a pyrite-molybdenite showing in west-central Nameigos Township, stripping of a lithium occurrence in west-central Mosambik Township, and the occurrence of copper float in northeastern Doucett Township were reported by M.W. Bartley (in Giblin 1968a)

In the summer of 1973 field crews of Noranda Mines Limited and Rio Tinto Canadian Exploration Limited were active in the Kabinakagami-Nameigos Lakes area.

GENERAL GEOLOGY: Amphibolite and greenschist facies Early Precambrian (Archean) mafic metavolcanics form two main subparallel belts trending west-northwest and extending through the northern and the central parts of the map-area; these areas are hereafter referred to as the northern and the central belts, respectively. The northern and the central belts are connected by a shorter volcano-sedimentary belt trending north-northeast.

The northern belt extends for approximately 15 miles from the eastern shore of Nameigos Lake to western Carney Township. Although this belt is very poorly exposed, being covered by extensive Pleistocene deposits particularly toward the east, it is suggested that it is the largest in the map-area and that in eastern Mosambik Township it probably exceeds 3 miles in width. To the east the metavolcanics of this belt are thought to be in fault-contact with the regional granitic rocks at a locality about 3 miles north and 2 miles east of the northern shore of Esnagi Lake in Carney Township. This is suggested by the fault-contact relationships found at the eastern end of the central volcanic belt (referred to further on), and by interpretation of aeromagnetic data (ODM-GSC 1963a,b).

The central volcanic belt extends for approximately 14 miles from the western boundary of Nameigos Township to the western shore of Esnagi Lake in northern Cudney Township. It is moderately, to locally, well exposed, and about half mile east of Honeymoon Falls (southeastern Nameigos Township) it has an estimated thickness of 9,000 feet. In northern Cudney Township the belt outcrops along the western shore of Esnagi Lake where it has a thickness of approximately 4,800 feet; facing the metavolcanics of the western shore, and at a distance of 1,000 to 1,500 feet from them along strike, are exposures of pegmatitic quartz monzonite. This abrupt truncation of the metavolcanics indicates that Esnagi Lake is the locus of a northeast-trending fault, which, as previously mentioned, is also thought to truncate the eastern end of the northern belt. The western tip of the central metavolcanic belt is exposed along the northern side of the Nameigos River close to the western boundary of Nameigos Township. Fault-contact relationships probably exist also in this area.

The belt trending north-northeast underlies an area of approximately 10-square miles, half of which is in eastern Nameigos Township and the other half is in western Mosambik Township. Mapping priorities did not permit visits to all the outcrop areas of this belt. The belt contains a mafic meta-agglomerate unit that is exposed on the southern shore of North Wejinabikun Lake (western Mosambik Township). This unit has a probable maximum thickness of 1,200 feet and has undergone severe deformation and stretching; it was traced for approximately 3 miles north and 2½ miles south of North Wejinabikun Lake. Westward the agglomerate grades into a lighter coloured rock in which limited evidence of re-working of the clastic fragments is recognizable, thus suggesting a sedimentary origin. Owing to deformation, similarity between the matrix components, and scarcity of lakeshore exposures, the distinction between meta-agglomerate and metaconglomerate is often problematic. The metaconglomeratic unit has a probable maximum thickness of 2,000 feet and was traced for approximately 4 miles to the south and west of North Wejinabikun Lake; south of this lake the trend of both the volcanic and the sedimentary clastic units changes from north-northeast to west-northwest thus conforming to the trend of the northern and central belts.

Minor elongated bodies and disrupted bands of mafic metavolcanics trending north-northeast are found surrounded by granites in the area between Mosambik Lake and the eastern boundary of the belt trending north-northeast.

The metavolcanics of all belts are mostly strongly foliated metabasalts containing minor tuffaceous, sedimentary, and felsic metavolcanic layers, the latter being much less common than they are in the Kabinakagami Lake area

Siragusa (1973a,b,c). In general the felsic metavolcanic layers vary in thickness between a few inches and 3 to 4 feet. Rusty stains are commonly seen in the metavolcanics, and, minor pyrite stringers and (or) disseminations were found in a few places. Equigranular medium-grained mafic, and possibly ultramafic, rocks that could be of intrusive origin are locally associated with the mafic metavolcanics.

Metasedimentary rocks include metaconglomerate (which is best exposed slightly inland of the first set of rapids of Kabinakagami River in Northwestern Mosambik Township) metasandstone, metasilstone, and paragneisses. The granitic rocks include different types among which biotite granodiorite to trondhjemite and pegmatitic quartz monzonite are most common; the latter, being a younger phase, contains inclusions of the former.

Bands of biotite trondhjemite and hornblende-biotite trondhjemite are locally found associated with the matavolcanics, mostly with concordant intrusive relationships. Since the emplacement of these rocks was controlled to some extent by the foliation in the metavolcanics within which they occur, and since they are also foliated, they represent an early stage of sodic granitization. Other granitic types are medium- to fine-grained homogeneous quartz monzonite, biotite pegmatite (containing magnetite nodules in many places) minor muscovite pegmatite, and hornblende diorite (of metamorphic origin). The granitic rocks as well as all the other rocks in the map-area are cut by numerous diabase dikes trending northeast and northwest. Some diabase dikes are porphyritic and most of them contain traces of pyrite.

STRUCTURAL GEOLOGY: Foliation is well developed in the metavolcanics, metasediments, and in the trondhjemitic bands within metavoncanics. It is moderately developed in the regional trondhjemitic to granodioritic rocks, and is absent in quartz monzonite. Pillowed metavolcanics were observed in few localities and in most places these occurrences were useless for top determinations. Variations in size of the fragments in the clastic units of the belt trending north-northeast suggest tops to the west; the main feature of this belt is an isoclinally folded syncline that underwent axial plane folding about a vertical axis.

Faulting has already been mentioned with reference to contact relationships in the northern and central belts (see section on General Geology).

ECONOMIC GEOLOGY: Data on assay values for the gold prospect found by J.E. Stenabaugh in 1935 in northeastern Nameigos Township (see section on Mineral Exploration) are summarized by Giblin (1968a) as follows:

"Eleven samples taken along a cross-trench, each representing a length of 3.0 feet, assayed trace Au in 4 cases; 0.10 oz. Au in 3 cases; while the others assayed 0.02, 0.04, 0.22, and 0.22 oz. Au per ton. One 2-foot sample assayed 0.24 oz. per ton. (File SSM - 1051)."

One crystal of molybdenite approximately ¼ inch in size was seen in pegmatite cutting mafic metavolcanics at one locality in Nameigos Township; disseminated molybdenite was also found in a small granitic body cutting mafic metavolcanics at one locality of western Mosambik Township. An approximately 8-feet wide subvertical zone of sulphide mineralization, striking N40E, was found on the northeastern side of the prominent northward-projecting peninsula of the eastern shore of Nameigos Lake, Nameigos Township.

Mineralization consists of pervasive fine-granied pyrite and pyrite stringers in mafic metavolcanics, and is quite obvious owing to the large rusty staining of the metavolcanics.

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ODM-GSC

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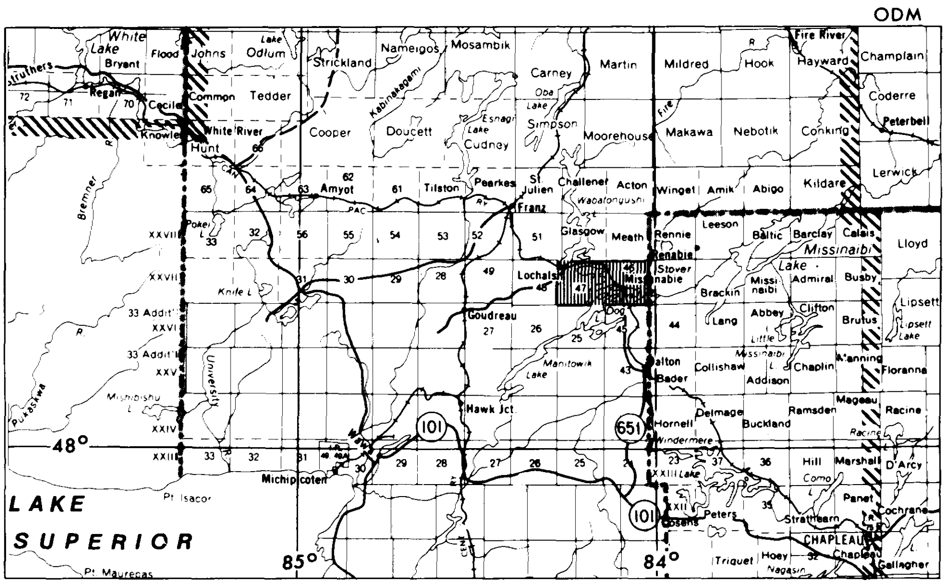
No.14 TOWNSHIPS 46 AND 47

DISTRICT OF ALGOMA

by

P. Srivastava[1]

LOCATION: Townships 46 and 47 in the District of Algoma are located in the northeastern part of the Michipicoten metavolcanic-metasedimentary belt. The two townships, with a total area of 72-square miles, are centred 39-air miles



LOCATION MAP   Scale: 1 inch to 25 miles

northeast of the mining community of Wawa, and 130-air miles north of Sault Ste. Marie.

The area is most readily accessible by road and railway. The Town of Missanabie in Township 46, and Lochalsh in the northwest corner of Township 47 are on the Canadian Pacific Railway. Missanabie is also accessible by Highway 651, a 36-mile long, gravel-surfaced, all weather highway. Dog Lake occupies considerable parts of Township 46, and eastern, southeast, and northern parts of Township 47; thus providing easy access to these areas. The central parts of Township 47 can be reached by a trail along a power line, which runs in an easterly direction through Township 47. The southwest corner of Township 47 can only be reached from the northeast arm of Cawdron Lake, which comes within ¼ mile of Township 47.

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MINERAL EXPLORATION: Since the discovery of the Emily Bay gold deposit in 1896 on Dog Lake (Coleman 1906, p.187), the area in general has been extensively prospected for gold. E. Thomson (1926) mapped the Missanabie area. T.L. Gledhill (1927, p.84) described certain gold deposits, including the Emily Bay deposit in Township 47. Burwash (1935) mapped part of the Missanabie area including Township 47 in 1934. E.L. Bruce (1945) published a detailed geological map of Township 47 in 1945, and reviewed all the gold deposits in that area.

Glasgow and Rennie Townships immediately to the north have been mapped by R. Riley (1971). Bennett, Dupuis, Hunter, and Soucie (1972) and Bennett, Dupuis, Elmhirst, and Andrews (1972) mapped the areas to the southeast and to the east of Township 46 respectively.

Mineral exploration programs undertaken after 1945 are described here because all the mineral exploration and developments prior to 1945 are discussed by Bruce (1945), Horwood (1943), and Burwash (1935).*

Winabie Gold Mines Limited acquired a total of 46 claims in the east-central part of Township 47, including the Bankfield Consolidated Mines Limited claims (see Bruce 1945, p.20) in 1944. During 1945-1946, geophysical surveying, bulldozer stripping, and diamond drilling were carried out on the property. The property has been idle since 1947.

Camex Prospecting Trust's property of 20 claims on the west side of Dog Lake in Township 47 was taken over by Lochabie Mines Limited in 1945. Diamond drilling was carried out in 1946 for a total of 5,200 feet. In 1962, the Lochabie Mines Limited charter was cancelled and the properties lapsed. R. Campbell restaked and patented 4 claims out of the above 20 claims. In 1973, Campbell staked 8 more claims around the above 4 patented claims. The gold assays obtained from these claims range between .01 to 24 ounces per ton (from files of Mineral Deposit Branch, Canada, Dept. of Energy, Mines and Resources).

Algoma Ore Properties Limited held 2 claims in the central part of Township 47, north of Campbell's claim SSM12594. Three diamond drill holes, totalling 1,541 feet, were drilled in 1958. The property has since lapsed.

Kent Mines Limited held 6 unpatented claims in northeast Township 46. Gravimeter and spontaneous polarization surveys for sulphide mineralization were carried out in the 1950s. The property since has lapsed.

Milmar Island Mines Limited held a group of 8 claims east and south of Kent Mines Limited property. Twelve diamond drill holes were drilled to a total of 2,825 feet in 1959.

Guarnaccio Gold Mines Limited staked 12 claims in the northeast corner of Township 46, and conducted a ground magnetometer survey.

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*The properties described in the mentioned references: Bankfield Prospect, Emily Bay Mines, Smith Claims (Missanabie Gold Shores), Camex Prospect, Emily Range occurrence, White's property.

N. Soroka held 9 unpatented claims in the east-central part of Township 46. Sampling and assaying for gold was done on one of the claims in 1943 (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie, file No. 342).

Maisondore Gold Mines Limited staked one claim in the north-central part of Township 46, approximately 1 mile east of Dog River along the township boundary line. Nine holes were drilled for a total of 765 feet during 1949-1950.

Ontario Syndicate had a combined airborne electromagnetic and magnetometer survey flown over the two townships in 1970. Noranda Exploration Company Limited covered 88-square miles by airborne geophysical survey including the north-central part of Township 46, in 1969. No record of any follow-up work by either of the above companies is available in the assessment files in Toronto or Sault Ste. Marie.

Amax Exploration Incorporated recently acquired a group of claims in Township 47. The geological work on these claims was in progress during the summer of 1973.

GENERAL GEOLOGY: Townships 46 and 47 are underlain mainly by metavolcanic, granitic, and minor metasedimentary rocks, all of Precambrian age. The metavolcanic-metasedimentary sequence is part of the large, northeasterly trending Michipicoten greenstone belt.

The metavolcanics that underlie Township 47, and the northwest and south parts of Township 46 are predominantly mafic to intermediate (basalt to andesite) in composition. Metavolcanics of intermediate to felsic composition occur as narrow bands and lenses (100 to 2,000 feet thick) within the mafic metavolcanics. Mafic to intermediate metavolcanics consist mostly of fine-grained massive and pillowed flows, tuff, and lapilli-tuff. Porphyritic and amygdaloidal flows occur in a few places within the massive flows in Township 46. Regional and thermal metamorphism has produced mineral assemblages characteristic of the greenschist, amphibolite, and hornblende-hornfels facies. Pillowed flows are well developed in east-central, southeast, and south-central parts of Township 47. Three such pillowed flow units have been traced laterally for about 1½ miles. In the central and east-central parts of Township 47 thinly laminated magnetite-chert layers are interbedded with tuffs.

Felsic to intermediate metavolcanics occur in easterly trending belts north and south of Lochalsh Bay in Township 47, and in southeasterly trending belts in northern and northeastern parts of Township 46. The rocks in these felsic belts consist of sericite schists, tuff, lapilli-tuff, and tuff-breccia. In a few places they are massive, pillowed, or thinly laminated. Wherever felsic tuffs have been reworked and stratified by water they show grain gradation and cross lamination; and have been included in metasediments.

Metasediments constitute a minor proportion of the whole metavolcanic-metasediment sequence. Only one belt has been outlined. This belt, about 1,000 feet thick, lies north of Lochalsh Bay and consists of stratified, quartz-rich, waterlain felsic tuffs, quartz sandstones, argillites, and their metamorphic equivalents.

Many dikes, sills, and small stocks of feldspar and quartz-feldspar porphyry occur in the metavolcanics. These porphyries are of subvolcanic origin, and cannot be distinguished from felsic tuffs in the absence of cross-cutting relationships or other evidence. Since these porphyries, in the east-central part of Township 47 and west-central part of Township 46, are found only within mafic metavolcanics, it is presumed that they predate the early mafic intrusions. There are, however, feldspar porphyry dikes cutting the earlier gabbroic and younger granitic rocks, but these porphyries are of darker colour, and have well developed K-feldspar phenocrysts. It appears, therefore, that there are <u>at least</u> two ages of such porphyritic intrusions.

Early mafic intrusions occur as minor dikes, sills, and small stocks, and range in composition from diorite to gabbro.

Syntectonic and post-tectonic felsic intrusions include plutons of batholithic size and small stocks, in both townships. Syntectonic plutons underlie a large section of Township 46, and the northwestern part of Township 47, and are composed predominantly of submassive to foliated trondhjemite. Post-tectonic felsic intrusions occur as roughly circular stocks, and dikes, in the north-central part of Township 46, and north-central and southeast parts of Township 47. These intrusions range in composition from hornblende quartz monzonite to syenite.

A northwest-trending lamprophyre body, about 1,700 feet long and several hundred feet wide occurs in the northeast corner of Township 46. Because of heavy drift cover, it is difficult to establish its exact relationship with the syenite dikes and syenite stock to the northwest. Associated with the lamprophyre are patches of syenite. This association may suggest that lamprophyre and syenite are two immiscible phases of the same magma. The lamprophyre body appears to be older than the syenite stock to the northwest.

A diatreme breccia occurs east of McKewen Lake and contains fragments of metavolcanics, gabbro, diorite, and granites.

Swarms of diabase and in a few places quartz diabase, olivine diabase, and diorite dikes intrude all the rocks described above. The diabase dikes vary in texture from medium-grained, diabasic or gabbroic to porphyritic. Such variation is very irregular and not characteristic of any particular dike.

The youngest consolidated rock in this area is an intrusion of olivine gabbro of Late Precambrian age, which forms the Manitou Mountain. The intrusion, a plug, is subcircular in shape and has two distinct phases of intrusion; the older phase forming the rim and the younger phase forming the core.

Unconsolidated Pleistocene sediments consisting of ground and terminal moraine and glaciofluvial deposits are extensive in both townships.

<u>STRUCTURAL GEOLOGY AND STRATIGRAPHY</u>: Bedding, banding, foliation, and gneissosity of lithologic units, in the northern, central, and western parts of Township 47 have easterly trends, and assume a southeasterly trend in the northern, central and eastern parts of Township 46. The metavolcanic flows in the southeast corner of Township 47 have northeasterly strike and swing to a southeasterly trend around Rabbit Island.

Where structural data permit, the trace of the axial planes of two major folds, and anticline and a syncline, have been outlined. A northeast-trending anticline lies in the southeast corner of Township 47. The axial plane seems to assume a southeasterly trend around Rabbit Island, thus producing a double-folded anticline. The axial plane of an east-west-trending syncline, the core of which has been intruded by a granitic stock and the olivine-gabbro plug, lies in Lochalsh Bay, and swings to a southeasterly trend in Township 46. The rocks along the northern boundary of Townships 46 and 47 lie on the south limb of an east-west-trending isoclinal anticline, the core of which has been intruded by a syenitic stock in Township 46. All the folds described above plunge gently to the east.

Joints are well developed in more massive metavolcanics and granitic rocks. There appears to be two prominent sets of jointing; 1) N25W to N10W, and 2) NE.

There are two major faults, and a few small faults along the northern boundary of the map-area: 1) A northwest-trending fault in the northwest corner of Township 46, which is the southward continuation of the Meach Lake Fault (Riley 1971); 2) a northeast-trending fault in the northeastern and central parts of Township 46. The smaller faults also have northeasterly trend. Movement along these faults appears mostly to be vertical or near vertical.

With available structural and stratigraphic data, an attempt has been made to evaluate the stratigraphic sequence in the metavolcanics. There are three stratigraphic units present in this area: i) a lower sequence of intermediate to mafic metavolcanics, made up of pillowed flows at the bottom, massive flows in the middle, and pyroclastics at the top; ii) felsic metavolcanics comprised predominantly of tuff, crystal tuff, and tuff-breccia; and iii) an upper sequence of mafic to intermediate metavolcanics made up mostly of massive to foliated flows and a small amount of pyroclastics.

ECONOMIC GEOLOGY:

Gold: The area has been prospected for gold quite extensively since the Emily Bay discovery in 1896 (Coleman 1906; Bruce 1945). No large deposits of commercial value have been found to date. Quartz veins seem to be the host rock of gold in the area. These auriferous quartz veins range in thickness from a few inches to 5-6 feet, and occur in the vicinity of granitic intrusions. The assay values reported in assessment files (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie) vary from .01 to 24 ounces per ton. Many new occurrences of quartz veins and shear zones have been outlined in the map-area and should be further explored for gold.

Iron: Thin iron formation (1 cm to 2 cm thick) occurs within mafic pyroclastics in the east-central part of Township 47. These bands are very thin, and to date, have not been proved to be of any economic value.

<u>Sulphide Minerals</u>: Disseminated sulphide minerals (pyrite and pyrrhotite) are found in the metavolcanics and in many quartz veins. Traces of malachite and (or) chalcopyrite have been seen in the east-central part of Township 46, Rabbit Island, and the west-central part of Township 47. Disseminated sulphide minerals also occur in the diatreme breccia located 1,000 feet east of McKewen Lake, and should be looked into in detail.

<u>Sand and Gravel</u>: Extensive parts of both townships are covered by Pleistocene deposits of sand and gravel. Such deposits, south of Missanabie, have been used in road construction.

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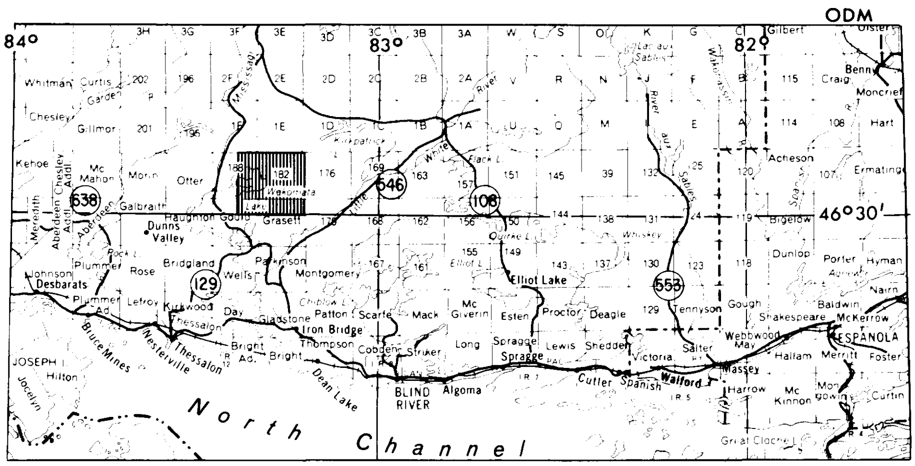
No.15 WAKOMATA LAKE AREA (EAST HALF)

DISTRICT OF ALGOMA

by

Krystyna M. Siemiatkowska[1]

LOCATION: The area, consisting of Township 182 and parts of Townships 188, Gould, and Grasett, is situated approximately 36 miles, by highway, north of Thessalon, on Highway 129, which connects with Chapleau, and 50 miles northeast



LOCATION MAP

Scale: 1 inch to 25 miles

of Sault Ste. Marie. Primary access is by boat from Wakomata Lake and by old lumber roads in the southern part of the area. The east part can be conveniently reached by float-equipped aircraft via numerous small lakes.

MINERAL EXPLORATION: The area has been prospected for copper since the beginning of the century and for uranium since the Blind River uranium discovery in early 1950.

In 1968, an airborne radiometric and magnetic survey was carried out for Canadian Johns-Manville Company Limited; and also for D.J. Happy. And in 1970, an airborne magnetic-electromagnetic survey was carried out for David S. Robertson and Associates Limited; and also one for Radex Uranium Syndicate (Ontario Division of Mines, Assessment Files Research Office).

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In 1956, Harico Mining and Development Company Limited reported very slight radioactivity in pegmatite dikes north of East Caribou Lake (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

In 1968, Pacific Petroleums Limited-Mississagi Syndicate drilled a diamond drill hole to a depth of 3,211 feet in Grasett Township, southeast of Last Lake. The hole cut through Gowganda Formation and intersected Early Precambrian basement rocks in the last 42 feet of the hole (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie).

In Gould Township, two patented claims, located on lot 6 and lot 4, Concession V, are part of the Cheney Copper Mine claim group that has been intermittently worked since 1929. In 1955, Headvue Mines Limited put down two diamond drill holes on lot 6 and three diamond drill holes reaching depths of 146, 147, and 369 feet, on lot 4. In 1959, Rothsay Mines Limited acquired the property consisting of 856 acres of patented claims.

The only active claims in the map-area are situated north of Wakomata Lake around Frobel and Snowshoe Lakes. They are presently owned by Process Minerals Limited and C.W. Archibald, P.Eng., Toronto. Nineteen unpatented contiguous mining claims were staked in 1968 and one diamond drill hole was drilled to 588 feet intersecting spotty chalcopyrite (Ontario Division of Mines, Assessment Files Research Office). In 1969, another hole to a depth of 1,200 feet showed much disseminated chalcopyrite (Ontario Division of Mines, Assessment Files Research Office). In 1970, Aggressive Mining Limited carried out an electromagnetic survey and in 1971 the claims were transferred to Process Minerals Limited and to C.W. Archibald. That same year, four holes were drilled to a total of 1,758 feet (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie). Hole no. 71-2, drilled to a depth of 701 feet, revealed 0.30 percent Cu, 0.13 ounce per ton Ag, and 3.91 percent $BaSO_4$, over a core length of 7 feet (Northern Miner 1972). In 1972, another hole was drilled from which grab samples taken by the writer during this project assayed 1.62 percent and 1.94 percent Cu and 0.01 ounce per ton of Au with traces of silver, nickel, and cobalt (Mineral Research Branch, Ontario Division of Mines).

GENERAL GEOLOGY: The map-area is located at the contact between the Superior and Southern Provinces of the Canadian Shield. The rocks of the area, previously mapped by Emmons (1926), can be subdivided into five major units: 1) the Early Precambrian felsic plutonic rocks; 2) Early Precambrian mafic intrusions; 3) Middle Precambrian sedimentary rocks of the Huronian Supergroup; 4) Middle Precambrian, post-Huronian mafic intrusions; and 5) Cenozoic, Pleistocene and Recent, unconsolidated sediments.

The felsic plutonic rocks of the Superior Province are grey to pink, massive and equigranular granitic rocks. They contain xenoliths of older metasediments and igneous rocks and are cut by narrow pegmatite and aplite dikes. A swarm of narrow dikes intruding the basement rocks were classified into two major types: a northwest-trending set of porphyritic metadiabase dikes probably of Matachewan type; and fine-grained amphibolitic diabases similar to the later Nipissing metagabbro bodies, which intrude the Huronian rocks. However, these dikes are probably pre-Huronian since they do not appear to cut the sedimentary rocks.

A local occurrence of green arkose, of unknown stratigraphic classification, belonging to the Huronian Supergroup unconformably overlies the Early Precambrian granitic basement rocks. The unconformity is well exposed west of East Caribou Lake and east of the Pearl Lake Fault. The green arkose is overlain by a pink arkose, which is succeeded by a boulder conglomerate of the Gowganda Formation.

The lowermost member of the Gowganda Formation, a polymictic boulder orthoconglomerate, rests unconformably on the Early Precambrian basement north of Caribou Creek. The actual unconformity is not exposed here. The orthoconglomerate is overlain by polymictic paraconglomerate with a protoquartzite matrix, which grades upwards stratigraphically into finely laminated argillite and siltstone. A prominent 'slumped' unit with sandstone ball-and-pillow structures in fine-grained massive greywacke matrix occurs in the laminated argillite-siltstone sequence towards the upper part of the Gowganda Formation in Chub Lake Area. The top of the Gowganda Formation consists of pink to purple feldspathic quartzite. An outlier of Gowganda-type conglomerate and quartzite was found southeast of Two Camp Lake.

A gradational contact of approximately 100 feet, true thickness, exists between the quartzites of the Gowganda Formation and the overlying Lorrain Formation. The Lorrain Formation was subdivided into 6 main members with gradational contacts, which from the base up are: 1) the lowest member is a purplish, coarse-grained, poorly sorted, cross-bedded arkose with less than 1 percent 'floating' quartz and jasper pebbles; 2) a pink feldspathic quartzite with prominent trough cross-bedding and quartz and jasper pebble bands; 3) a white quartzite with about 50 to 60 percent pebbly bands containing up to 60 percent pebbles consisting of 30 percent jasper, 20 percent chert, and 50 percent quartz pebbles, and commonly known as puddingstone; 4) a reddish fine-grained hematite-rich quartzite with good crossbedding, Leisgang Rings, and no pebbles (this unit was used as a marker horizon); 5) a pink to buff, coarse-grained hematite-rich quartzite with pebble bands containing from 1 percent to 5 percent jasper pebbles. The hematite content decreases toward the top of this unit and in the bottom half, pebble-free hematitic, cross-bedded sandstone is interbedded with hematitic pebbly sandstone; and 6) a white orthoquartzite with cyclic repetition of coarse-grained pebble bands consisting of well rounded quartz pebbles and 1 percent jasper and fine-grained pebble-free units.

The Huronian sedimentary rocks and the Early Precambrian granites are intruded by bodies and dikes of Nipissing-type metagabbro. These intrusions range from fine-grained, at chilled contacts, to coarse-grained amphibolites. Fresh pyroxene-bearing gabbro and granophyre patches were observed in some of the larger bodies. The metagabbro has a strong magnetic expression.

A fine-grained variety of small diabase dikes intruding the Huronian sedimentary rocks are rich in epidote and disseminated pyrite. Porphyritic diabase dikes were found south of Wakomata Lake and on the southwest end of the big island in Wakomata Lake.

The youngest intrusion is a small olivine diabase dike of the Sudbury Swarm found east of Highland Lake.

STRUCTURE: The shallow-dipping (10^{o} - 15^{o}) Huronian strata form a syncline with a shallow easterly plunge of about 5^{o}. Eastwards the axial trace, which strikes east-west along the south shore of Wakomata Lake, is successively moved north by a series of northwest-striking faults. This syncline is possibly the westward continuation of the Quirke Lake Syncline. Metamorphism in the area is low and can be seen only in the diabase bodies and in the granites where locally a gneissic foliation is developed.

The prominent faults in the area trend northwest, and east-west, and are probably part of the system associated with the Flack Lake Fault, which crosses the northeastern corner of the map-area. A few northeast-southwest faults are also present and prominent lineaments, of different trends, can be seen on the airphotos.

ECONOMIC GEOLOGY: Copper in the form of chalcopyrite and malachite occurs at several localities in the area in association with specularite-bearing quartz-carbonate veins that are in turn associated with shear zones and Nipissing-type diabase intrusions.

In Gould Township, concession V, lot 4, four pits and trenches exposed a quartz carbonate vein striking northwest and dipping 50^{o} south (Regional Geologist's Files, Ontario Ministry of Natural Resources, Sault Ste. Marie) for a length of 140 feet in laminated argillite. The vein, consisting of quartz and carbonate with massive to disseminated chalcopyrite and malachite, occurs in a small shear zone about 10 feet wide and is well exposed in a 20 foot x 10 foot x 10 foot pit. A grab sample taken by the writer of high grade material yielded 26.5 percent Cu upon assay (Mineral Research Branch, Ontario Division of Mines). On lot 5, concession V, Gould Township, three pits exposed quartz veins, striking approximately east-west, containing carbonate centres with blebs and disseminations of chalcopyrite, malachite, and specularite. Three grab samples taken by the writer assayed 1.54 percent, 0.62 percent, 3.14 percent Cu and 0.01 ounce per ton Au (Mineral Research Branch, Ontario Division of Mines). On the south shore of Chub Lake, between lot 3 and 4 of concession V, Gould Township, a quartz vein about 10 feet long and 3 feet wide striking east-west with disseminated chalcopyrite was observed cutting a metadiabase dike. Grab samples taken by the writer assayed 0.20 percent Cu (Mineral Research Branch, Ontario Division of Mines).

In Township 188, a large medium- to coarse-grained amphibolitized metagabbro of the Nipissing-type occurs in the area north of Frobel Lake. Two faults striking northwest and northeast intersect on the south shore of Frobel Lake and offset the metagabbro. Chalcopyrite and pyrite associated with quartz and carbonate veins are found along and near shear zones within the main faults and smaller subsidiary fractures.

In Township 182, about 1 mile east of Wakomata Lake along Caribou Creek and 1 mile north, malachite, pyrite, and magnetite occur in quartz veins associated with a shear zone near a diabase dike. Three grab samples taken by the writer assayed 0.42 percent, 1,36 percent, 0.56 percent Cu and 0.01 to 0.02 ounce per ton of Au (Mineral Research Branch, Ontario Division of Mines).

Three other occurrences of the same type were found: one on the south shore and one on the north shore of East Caribou Lake and one south of Rogers Lake known as Renner Claims.

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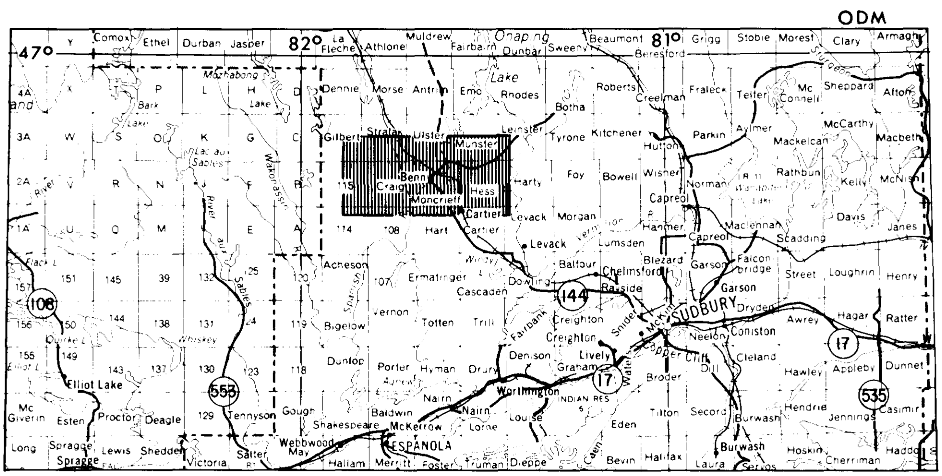
No.16 BENNY AREA

DISTRICT OF SUDBURY

by

K.D. Card[1] and D.G. Innes[2]

LOCATION: The Benny area, located some 40 miles (64 km) northwest of Sudbury, Ontario, is bounded by Latitudes $46^{\circ}42'$ and $46^{\circ}51'$N and Longitudes $81^{\circ}26'$ and $81^{\circ}53'$W. During the 1973 field season the eastern half of this area, including



LOCATION MAP Scale: 1 inch to 25 miles

Hess Township, most of Moncrieff Township, and parts of Munster, Ulster, Hart, and Cartier Townships, an area of approximately 130-square miles (330-square km) was mapped at a scale of 1 inch to ¼ mile. Parts of the map-area were previously mapped by Quirke (1920) and Osborne (1929).

MINERAL EXPLORATION: Exploration for base metals, iron, and uranium has been carried out at a number of localities within the map-area, and in the early 1940s, about 10,400,000 pounds of zinc, 3,600,000 pounds of lead, and silver valued at $28,416 were produced by the Lake Geneva Mine in Hess Township.

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When the mine closed in 1944, approximately 150,000 tons of ore-grade material were left (S.L. MacDonald, May, 1951, Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury) and from 1944 to present, several companies have attempted to outline additional reserves. The property is currently owned by Geneva Metals Incorporated who carried out diamond drilling in 1972-1973.

Magnetite deposits in southwestern Hess Township and south-central Munster Township have been tested by drilling and geophysical methods as have strata-bound pyritic deposits in metavolcanics.

A recent airborne geophysical survey, by Tex-Sol Explorations Limited, of much of the map-area revealed the presence of a number of electromagnetic-magnetic anomalies; several of these were investigated during the 1973 field season.

In east-central Hess Township, a mafic dike containing nickel-copper sulphide mineralization has been tested by pitting and drilling. This dike apparently represents the extension of the Foy Offset, a dike-like offshoot from the Sudbury Nickel Irruptive.

During the present mapping, lead-zinc-copper mineralization was discovered in rocks of the Espanola Formation in central Hess Township.

GENERAL GEOLOGY: The map-area is located in the southern part of the Superior Province a short distance north of the Sudbury Nickel Irruptive. This terrain has been affected by both Early and Middle Precambrian depositional and orogenic events. The major rock groups include Early Precambrian metavolcanics, metasediments, and mafic and felsic intrusions that are unconformably overlain by Middle Precambrian metasedimentary rocks of the Huronian Supergroup. Middle Precambrian Nipissing-type mafic intrusions and late diabase dikes are prevalent. Throughout the area mapped, the foregoing rock units, with exception of the late diabases, are affected by brecciation of several types and ages.

The Early Precambrian metavolcanic sequence forms an east-west belt up to 2 miles (3 km) in outcrop width, which extends through the map-area. The sequence, which is bordered by intrusive granitic rocks, dips steeply southward, has a maximum preserved thickness of at least 10,000 feet (3,000 m) and consists mainly of stratified, foliated, felsic to intermediate pyroclastics, agglomerate, felsic lapilli-tuff, and tuffaceous metasediments, with minor amounts of mafic, intermediate, and felsic flows and lean iron formation. The flows occur mainly in the northern part of the belt, suggesting that the sequence faces southward. Stratabound sulphide-bearing units, most containing only pyrite and pyrrhotite, are present in the metasedimentary-pyroclastic sequences. For the most part, the metavolcanics are relatively unaltered, have suffered only low rank (low greenschist facies) regional metamorphism and consequently the original pyroclastic and metasedimentary textures and structures are preserved. The felsic-intermediate flows are commonly porphyritic; pillow structures and vesicles are locally present in mafic flows.

The felsic plutonic rocks that surround and intrude the metavolcanics can be divided into two main groups: an older gneissic granitic (granodiorite) complex commonly containing numerous xenoliths and schlieren of mafic metavolcanics, which occurs mainly to the north of the metavolcanic belt; and younger, massive, relatively homogeneous granitic rocks, which occur mainly to the south. An equigranular syenite pluton that contains minor amounts of fluorite and molybdenite and several very coarse porphyritic granite-syenite bodies intrude the metavolcanics along the southern margin. Around the margin of the metavolcanic belt, and especially toward its eastern end, there is an extensive zone of lit-par-lit injection gneiss and migmatite consisting of variable proportions of metavolcanic and felsic intrusive material.

Ramifying swarms of metamorphosed, equigranular and porphyritic, mafic dikes intrude the metavolcanic and granitic rocks but apparently not the younger Huronian strata.

Middle Precambrian Huronian metasedimentary rocks form a discontinuous, erratically distributed cover unconformably overlying the Early Precambrian basement. These rocks belong to the Espanola, Serpent, Gowganda, and Lorrain Formations and represent mainly coarse clastic accumulations deposited on an irregular erosion surface developed on the basement terrain. The Espanola Formation, which unconformably overlies basement at several localities, is up to 400 feet (120 m) thick, and consists of a lower sequence of relatively pure, thin-bedded dolostone and limestone, a middle sequence of thicker-bedded dolostone and limestone, and an upper sequence of siltstone. The Serpent Formation, consisting mainly of coarse, conglomeratic feldspathic sandstone, is locally up to 1,000 feet (300 m) thick but in general much less. The Gowganda Formation, which is also commonly nonconformable on basement, is up to 3,000 feet thick (900 m) and consists of a lower sequence of stratified conglomerate, sandstone, and siltstone, and an upper sequence of interbedded siltstone and sandstone. The Lorrain Formation, some 1,000 to 1,500 feet (300 to 450 m) thick, is comprised of thick-bedded, coarse pebbly sandstone, coloured in various shades of green, pink, buff, and white, with lenses of well-sorted quartz pebble conglomerate. The Huronian rocks have suffered only low rank (low greenschist facies) regional metamorphism and depositional features and structures, such as the Huronian-basement unconformity, ripples, cross-stratification, and ball-and-pillow structures are well preserved. A few scattered paleocurrent determinations indicate that the depositional currents flowed south to southwest.

Nipissing-type mafic intrusions, consisting of pyroxene and hornblende gabbro and metagabbro, intrude the foregoing rock units and are in turn cut by late diabase dikes that are part of a northwest-trending regional dike swarm.

All rocks of the area, with the exception of the late diabase dikes, are cut by dike-like bodies of breccia. Many breccias are of the Sudbury or pseudotachylite type, consisting of rounded, locally derived, country rock fragments in a flinty crush matrix. However, there are also numerous breccia dikes containing mafic or lamprophyric rock fragments in a matrix rich in biotite and magnetite.

The bedrock is extensively mantled by thick till, moraine, and esker deposits, the products of Pleistocene glaciation. Huge glacial erratics and boulder trains, derived mainly from the nearby bedrock terrain, are scattered throughout the district. Glacial striae on bedrock trend S10W to S20W.

STRUCTURAL GEOLOGY: The Early Precambrian metavolcanics apparently form a south-dipping homocline as both primary stratification and tectonic foliation strike east-west and dip uniformly southward at high angles. Locally, as in the vicinity of the Lake Geneva Mine, these structural trends are deflected from east-west to northwest. The dominant foliation in the metavolcanics is subparallel to primary stratification and is displayed by flattening and alignment of lithic fragments and minerals. Much of the flattening of lithic fragments in the agglomerate and pyroclastic rocks is, however, probably attributable to welding as there are distinct variations in amount of flattening across strike in these sequences. Gneissosity in the granitic rocks trends east-west and dips steeply both north and south.

The Huronian supracrustal rocks have been tectonically deformed but the intensity of the deformation, along with the orientation of tectonic structures such as folds and foliations, is highly variable. At many localities, the contacts between near vertical supracrustal rocks and the basement are steeply dipping faults; in other localities, practically flat-lying cover rocks lie on an undisturbed erosional nonconformity developed on the basement rocks. The foregoing phenomena suggest that Middle Precambrian deformation was dominated by vertical movement on fault-bounded basement blocks that resulted in gravity sliding and passive deformation of the Middle Precambrian cover rocks.

Faults belonging to two major sets, one trending northeast, the other northwest, are present, as are late northwest-trending cataclastic zones and strain-slip cleavages in both the Early and Middle Precambrian rocks.

ECONOMIC GEOLOGY:

Lead-Zinc-Silver: The Lake Geneva Mine in Hess Township produced some 80,588 tons of ore grading 9.21 percent Zn, and 3.34 percent Pb with 22 ounces per ton Ag in the lead concentrate during the period 1941 to 1944 (Hawley 1948). The mine was owned and operated by Lake Geneva Mining Company Limited from 1922 to 1944, and workings consist of a shaft and winze sunk to a depth of 640 feet (190 m) with lateral workings on 5 levels (Hawley 1948). The mineralization, mainly sphalerite with lesser galena and pyrite, replaces and fills fractures in a sheet-like quartz carbonate zone that strikes northwest and dips steeply southward conformable with the bedding in the pyritic felsic pyroclastic and metasedimentary host rocks. The mineralized zone is 700 feet (210 m) long, averages 5 feet (1.5 m) in width, and has been tested to a depth of 1,000 feet (300 m). The deposit is located near the northeastern end of the metavolcanic belt in a zone of flexure where structural trends in the host rocks are deflected from east-west to southeast, and in area where mafic and felsic intrusions and Sudbury-type breccias are prevalent.

An apparently previously undiscovered lead-zinc-copper deposit was located during the present mapping in central Hess Township approximately ½ mile (0.8 km) southeast of the east end of Geneva Lake in carbonate rocks of the lower part of the Espanola Formation, which unconformably overlie granitic basement. Mineralization consists of replacement pods, veins, and disseminations of galena, sphalerite, pyrite, and chalcopyrite in recrystallized, silicified dolomite. The main zone of mineralization, averaging about 25 percent sulphide minerals, is exposed over a width of approximately 15 feet (4.5 m) but for only a short distance along strike on the north shore of a large, dry marsh. The mineralized zone apparently strikes east-west and dips steeply northward conformable with the bedding in the host rocks. To the south, there is a drift-covered interval of about 30 feet (9 m), followed by an 'island' exposure of recrystallized dolomite with disseminated pyrite, chalcopyrite, galena, and sphalerite (up to 10 percent) over an outcrop width of some 30 feet (9 m). At the southeastern end of the 'island' outcrop, steeply-dipping, thin-bedded Espanola dolomite unconformably overlies deformed granitic basement rocks. To the north of the main zone, minor amounts (1 percent to 5 percent) of disseminated sulphide minerals are present in recrystallized dolomite over an outcrop width of about 70 feet (21 m). The dolomite is succeeded by thin-bedded black calcareous siltstone of the upper Espanola Formation. Some 600 feet (180 m) to the east, minor disseminated sulphide minerals, mainly pyrite and galena, are present in an exposure of Espanola dolomite. To the west, the strike of the formation changes abruptly from east-west to south and approximately 1,000 feet (300 m) to the southwest of the main occurrence, recrystallized Espanola dolomite with minor amounts (1 percent to 5 percent) of disseminated galena and pyrite is again exposed. This occurrence definitely warrents further exploration, especially in view of its apparent stratabound nature and possible large size.

Iron: A magnetite deposit located in central Munster Township about ½ mile (0.8 km) north of the south boundary has been tested in the past, mainly by B and M Explorations Limited in the 1950s by a number of shallow pits, an adit, geophysical surveys, and limited diamond drilling (B and M Explorations Limited, Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury). The deposit has been described as an Algoma-type, oxide facies iron formation in Archean rocks (Shklanka 1968) but it is more probably a replacement deposit along the contact of a mafic intrusion with Huronian metasediments. The country rocks consist of thin-bedded (¼ to 1 inch; 0.5 cm to 2.5 cm), fine-grained, greenish grey chloritic quartzite tentatively correlated with the Serpent Formation. Fragments of Espanola-type limestone are present on one of the dumps. The metasediments are intensely silicified and brecciated and are cut by numerous magnetite- and hematite-bearing quartz veins. A highly altered chloritic mafic dike cuts the metasediments and the main pod-like concentrations of crystalline magnetite occur along the contact, both in the dike and in the metasediments. Two zones of magnetite mineralization are indicated by a magnetometer survey by B and M Explorations Limited; a western body measuring 60 by 340 feet (18 x 100 m) and an eastern body measuring 120 by 140 feet (36 x 42 m). Drilling intersected up to 86 feet (26 m) (core length) of iron mineralization with assays ranging from 15 percent to 45 percent Fe over core lengths ranging from 5 feet (1.5 m) to 8.5 feet (2.5 m) (B and M Explorations Limited, Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury). Approximately one-half mile (0.8 km) north of the main occurrence, thin-bedded, brecciated metasediments with magnetite-bearing quartz veins are exposed on the west side of an old road. On the east side of the road, an altered mafic dike, possibly the extension of the dike described previously, cuts the metasediments and contains disseminations and pods of magnetite. To the northwest, the metasediments are overlain, apparently conformably, by the Gowganda Formation.

A magnetite deposit at the southwest end of Hess Lake, Hess Township, has been explored by Jaybee Landry Exploration and Mining Company Limited in 1966 by pitting, trenching, limited diamond drilling, and a magnetometer survey. This work outlined a magnetite deposit, with disseminated chalcopyrite locally, some 120 feet (7.6 m) wide and 600 feet (180 m) long trending northeast. Assayed drill core sections are mainly in the range 31 percent to 57 percent Fe and trace to 0.65 percent Cu (Jaybee Landry Exploration and Mining Company Limited, Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury). The mineralization apparently represents a replacement in an isolated occurrence of sandy limestone and siltstone of the Espanola Formation, which unconformably overlies granite and is cut by mafic intrusions. The deposit occurs at the northeast end of an aeromagnetic anomaly that extends about 5 miles (8 km) southwestward through an area of heavy overburden. This deposit deserves further exploration to determine its extent and to assess its potential for copper.

Nickel-Copper: A mafic dike containing nickel-copper sulphide mineralization is exposed at several localities in east-central Hess Township where it has intruded altered, brecciated, silicified granitic rocks. This intrusion is probably part of the Foy Offset, a dike extending northwest and west from the Sudbury Nickel Irruptive. The mineralization was tested by Canadian Nickel Company Limited in 1966-1967 who carried out about 9,000 feet (2700 m) of diamond drilling on 9 claims (Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury). The dike trends west-southwest, is apparently vertical, and is about 50 to 100 feet (15 to 30 m) wide.

Sulphide minerals, including pyrrhotite, chalcopyrite, and pentlandite, occur as disseminations (generally less than 10 percent but locally up to 30 percent) in fresh quartz diorite or gabbro. Three water-filled pits each about 10 feet (3 m) square have been blasted into the mineralized dike on the north side of a small pond. If this dike is actually part of the Foy Offset, the Offset is in excess of 20 miles (32 km) in length and represents the longest known offset dike of the Nickel Irruptive.

Sulphide Minerals: A number of stratabound deposits of sulphide minerals, mainly pyrite and pyrrhotite with very minor chalcopyrite, occur locally in the siliceous metasediments and felsic pyroclastics of the Early Precambrian metavolcanic belt. The sulphide minerals occur as massive layers up to 1 foot (0.3 m) thick, as disseminations and veinlets, and in quartz-carbonate veins. The main occurrences of this type are located in northeastern Moncrieff Township, northwestern Hess Township, and southwestern Munster Township. Exploration work, including airborne and ground geophysical surveys, diamond drilling, and pitting, has been carried out on these deposits by Southern Union Oils Limited and Northcal Oils Limited in 1959, and by Canadian Nickel Company Limited in 1968 (Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury).

Uranium: In the late 1950s and again in the late 1960s, the Huronian rocks in Moncrieff and Hess Townships were explored for uranium, apparently with negative results (Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury).

Molybdenite and Fluorite: Minor amounts of fluorite occur in pegmatite dikes and as joint coatings in a syenite pluton that intrudes the metavolcanics along Highway 144 north of Munster Creek. Several dikes extending from this pluton into the agglomerate are exposed in road cuts and these contain minor amounts of disseminated molybdenite.

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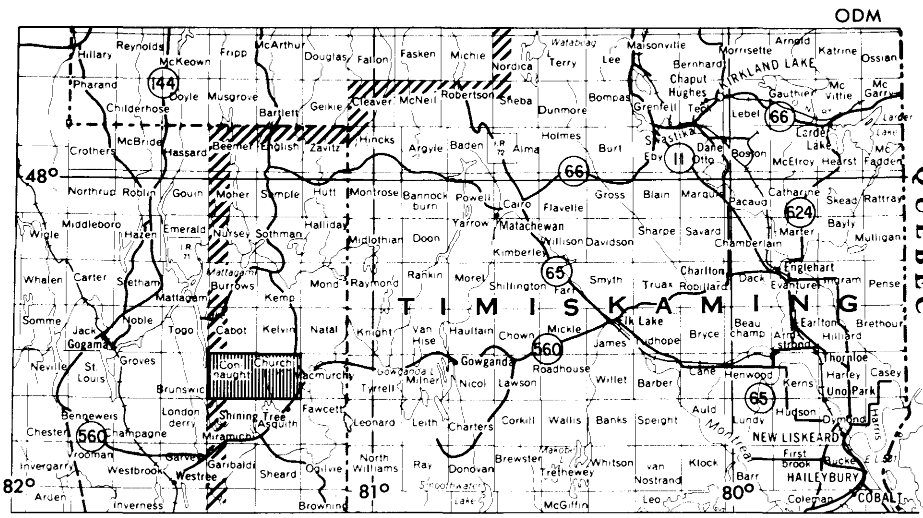
No.17 CONNAUGHT AND CHURCHILL TOWNSHIPS

DISTRICT OF SUDBURY

by

M.W. Carter[1]

LOCATION: Connaught and Churchill Townships lie in the district of Gogama between Latitudes 47°35' and 47°40'N and Longitudes 81°12' and 81°20'W. Access is good for Churchill Township but poor for Connaught Township.



LOCATION MAP

Scale: 1 inch to 25 miles

Highway 560 passes through the southeastern corner of Churchill Township and crosses Michiwakenda Lake. Here canoes can enter the Michiwakenda-Okawakenda Lake system of the township. Access to the southwestern part of the township is via Highway 560 and West Shining Tree Lake. Connaught Township can be reached by a rough Hydro-Electric Power Commission road that branches off northwards from Highway 560 in Garibaldi Township, giving access to western Connaught. Float-equipped aircraft are required to reach other parts of the township.

Both townships were mapped at a scale of 1 inch to ¼ mile during the summer of 1973.

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MINERAL EXPLORATION: Exploration activity in the two townships was carried out mainly for gold and copper deposits. Gold exploration activity was centred mainly in Churchill Township and copper exploration primarily in Connaught Township. The preponderance of granite and glacial cover in southwestern Connaught Township served to restrict exploration activity to the northeastern part of this township. Prospecting in the map-area began in 1911 and was continuous to the present time except for a short break, between 1936 and 1945.

In Connaught Township recorded exploration activity began in 1913 when "John Mataris discovered copper mineralization about three-quarters of a mile southwest of the extreme west end of Okawakenda Lake, on what is now mining claim T.R.S. 3556. In 1916, several deep test pits were sunk,.... In 1927, Noah Timmins took an option on the property and drilled one 200-foot hole...." (Laird 1934). This deposit is located between Mataris and Clapper Lakes in northeastern Connaught and is the most important in the township. No further activity occurred until 1956 when Earl Kelly logged 9 holes drilled to depths ranging from 39 feet 6 inches to 67 feet at the site (Ontario Division of Mines, Assessment Files Research Office). Later in the year Lundberg Explorations Limited carried out an aeromagnetic survey for Montgary Explorations Limited. This was followed by a ground electromagnetic survey that revealed several conductive shears. In 1957, Bardyke Mines Limited retained Patricia Drilling Limited to drill 9 holes for a combined length of 3,812 feet on the deposit, and copper, silver and gold mineralization was detected (Ontario Division of Mines, Assessment Files, Research Office). Exploration work was taken up again in 1965 when the property, optioned to Monarch Gold Mines Limited, was magnetically and electromagnetically surveyed by Scope Mining and Exploration Consultants Limited. Mineralization was found to be associated with brecciation in the metavolcanics, with a conductive zone extending into felsic metavolcanics. Diamond drilling was recommended to test the anomaly, and two holes totalling 750 feet in length were drilled by Continental Drilling Company in 1965 (Ontario Division of Mines, Assessment Files Research Office). In 1970, six further holes were drilled by Gome Diamond Drilling Limited to an aggregate length of 1,644 feet for Coniston Copper Mines Limited (Ontario Division of Mines, Assessment Files Research Office). The latter had also carried out an induced polarization survey. In 1971, further drilling, geochemical soil sampling, and an electromagnetic survey were carried out, exploration activity continuing up to 1973.

"In 1927, Lloyd Fraser did considerable surface work on two parallel bands of iron formation occurring on a trail leading northwest from the north end of Burns Lake...." (Laird 1934). "In November 1933, J.C. Mahon staked a group of 12 claims lying between Wire Lake and Elephant Head Creek. The group is centred about a small boss of feldspar porphyry...." (Laird 1934, p.67). Bagamac Mines Limited, in 1947, began exploration work on their property in the northern part of Connaught township with geomagnetic and geological surveys. These resulted in the discovery of several magnetic anomalies, but most were considered to be due to diabase dikes. The others were believed to be of economic interest, and in 1949 electromagnetic ratiometer surveys were conducted on selected anomalies in 10 separate areas. An important conductor, considered to be due to mineralization, was located in the vicinity of Wire Lake. In 1949, further magnetometer, electromagnetic, and self-potential surveys were carried out that indicated that the sulphide mineralization was disseminated. It was concluded that no large scale concentrated mineralization was present. In 1950, Duvay Gold Mines Limited drilled 5 holes aggregating 662 feet on their claim located in southern Connaught Township (Ontario Division of Mines, Assessment Files Research Office). In 1954, four drill holes totalling 1,438 feet were drilled on the Saville deposit ¼ mile northeast of the northern part of Elephant Head Lake in southern Connaught Township (Ontario Division of Mines, Assessment Files Research Office). In 1956, 13 drill holes totalling 719 feet were drilled on the Banks deposit, at the east end of Burns Lake in Connaught Township, and pyrite and chalcopyrite were observed (Ontario Division of Mines, Assessment Files Research Office). In 1961, six holes were drilled on the McLean claims, in Connaught Township, to a total of 248 linear feet (Ontario Division of Mines, Assessment Files Research Office). In 1967, Murky Fault Metal Mines Limited carried out magnetometer, self-potential and electromagnetic surveys on their property in Connaught Township, and two strong self-potential anomalies were located (Ontario Division of Mines, Assessment Files Research Office).

In 1970, Amax Exploration Incorporated carried out an airborne geophysical survey of Connaught Township and the results of this work led to ground exploration programs by other exploration companies. Thus, in 1971, Amalgamated Rare Earths Mines Limited and Active Mines Limited carried out ground magnetic and electromagnetic surveys of their properties in northern Connaught Township. In the latter case a 1,200-foot long conductor containing pyrite and chalcopyrite was found. A soil geochemical survey followed, and high copper and lead contents were obtained. This was followed by drilling in 1971 and 1972 when five drill holes totalling 1,212 linear feet were drilled yielding occurrences of pyrite, pyrrhotite and magnetite (Ontario Division of Mines, Assessment Files Research Office).

In Churchill Township the earliest recorded prospecting activity was in 1911 when gold was first discovered in the area on claim W.D. 1151 by Fred Gosselin, H. Frith, and C. Speed. The gold occurs in quartz veins that straddle the Churchill-Asquith township boundary between Highway 560 and Speed and Frith Lakes. In 1912, V. Pakowsky took an option on the property and carried out considerable exploration activity consisting of trenching, pitting, systematic sampling, and the sinking of an inclined 50-foot shaft west of the Main Vein. This work led to the discovery of at least six different veins. In 1913, Gosselin Gold Mines Limited was incorporated and acquired the property. Further trenching and sampling were done by the company in 1928 and 1929; by McIntyre Porcupine Mines Limited probably in the 1930s; and by Sylvanite Gold Mines Limited in 1937. No drilling was recorded for the property, and development work appeared to have ceased by 1937. In 1958, the property was under option to Bolduc Gold Mines Limited and was last sampled in 1959. In 1916, The Mining Corporation of Canada Limited held an option on the Gold Corona, formerly Queen of Sheba, property in southeast Churchill Township, where gold was found associated with quartz and pyrite in iron formation. Development work consisted of trenching and the sinking of a 40-foot pit on the main vein. In 1925, systematic channel sampling was done and later, in 1945, Wright-Hargreaves Mines Limited had an option on the property. The latter drilled 13 diamond drill holes for a combined length of 1,761 feet (Ontario Division of Mines, Assessment Files Research Office). No intersections of interest were found and no further work was done. In 1918, J.A. Knox discovered the Kingsley Vein, an auriferous quartz vein in the southwestern part of Michiwakenda Lake. The property was acquired by

Herrick Gold Mines Limited and developed by trenching, pitting, and sampling. A 10 foot x 7 foot vertical two-compartment shaft was sunk to a depth of 300 feet with levels at 50 feet, 100 feet, 200 feet, and 300 feet. Over 1,000 feet of lateral work and 3,000 feet of diamond drilling from four holes were carried out until work ceased in 1923 (Finley 1926). Grantland Gold Limited has held the property since about 1936. Also in 1918, the Churchill Mining and Milling Company Limited was formed and carried out considerable surface prospecting on other veins discovered by J.A. Knox on claim TRS 3774, south of the Herrick Gold Mines Limited property. A pit was sunk to 38 feet and a 7 foot x 9 foot vertical two-compartment shaft sunk to 110 feet in 1934. A level was set up at 109 feet on this shaft and 70 feet of drifting and 154 feet of cross-cutting were done (Sinclair et al 1936). Operations were suspended in 1936. In 1971, Royal Mining Corporation carried out a magnetic and electromagnetic survey on their property in southeastern Churchill Township west of Cryderman Lake. The survey defined several rock units and an east-west shear. In the same year, Winnebago Mines Limited carried out similar surveys in the southeastern corner of the township in a search for gold and porphyry copper mineralization. A magnetic anomaly was found.

GENERAL GEOLOGY: Geological investigations began in the area in 1875 when Robert Bell (1877, p.307) described the rocks at the southern end of Mattagami Lake, which forms part of the western boundary of Connaught Township. Subsequent examinations in this part of the area were by Parks (1900, p.127, 141) and Coleman (1901, p.181,182). The first reports dealing with the map-area in greater detail were by Collins (1911; 1917), Stewart (1912; 1913), Hopkins (1920; 1921, p.36-39) and Finley (1926). The latest mapping in the area was in 1933 by Laird (1934) who also made an examination of the deposits in the area in the following year, 1934 (Laird 1935). Laird's map is the most detailed one for the area.

Connaught and Churchill Townships are underlain by consolidated rocks of Precambrian age, and Pleistocene glacial deposits.

Early Precambrian rocks consist of metamorphosed volcanic, sedimentary, and intrusive rocks. The metavolcanics range in composition from basaltic to rhyolitic, and both lavas and pyroclastics are represented. These comprise the majority of the rocks underlying the map-area and are well exposed in Churchill Township and northeastern Connaught Township. The general occurrence of pillow structures in the basaltic-dacitic flows, well displayed along West Shining Tree Lake, and well-preserved primary sedimentary features such as graded-bedding, ripple marks, flame-structures, and load-casts (seen to perfection in and along Michiwakenda and Okawakenda Lakes), indicate that the volcanic rocks are in part subaqueous. Pyroclastics consist of block-tuffs, lapilli-tuffs, and ash-tuffs, well exposed in Okawakenda Lake. These are associated with subaqueous crystal tuffs of greywacke aspect. Interstratified with these are conglomerates, cherts, argillites, and iron formation. A conformable sheet of serpentinite exhibiting spinifex texture occurs within the metavolcanics in southeastern Churchill Township at Gosselin Lake. The excellent preservation of primary lithological structures and numerous orientation data permit a division of the volcanic sequence into three parts: a lower part dominated by basalt-andesite rocks with minor rhyolite; a middle part dominated by dacite and rhyolite flows and coarse pyroclastics; and an upper part dominated by andesitic-dacitic subaqueous crystal tuffs with conglomerate, argillite, chert, and iron formation. There was no evidence to suggest an unconformity within the sequence and the whole is therefore considered to be one group.

These rocks are cut by a massive coarse-grained biotite and hornblende-biotite granite body in southwestern Connaught Township. Apophyses of this mass cut the metavolcanics in areas away from the intrusive contact. These apophyses consist of granite porphyry and feldspar porphyry, which are mostly brown or pink. Cutting the metavolcanics, and presumably later than the granite, are fresh, black and in many places magnetic, diabase dikes which trend between north-northwest and north-northeast. North-trending, mauve and dark-red, mica and hornblende lamprophyre dikes also cut the metavolcanics. The diabase and lamprophyre dikes range in width from 50 to 100 feet.

Flat lying Middle Precambrian, Gowganda-type conglomerate and red arkose are best exposed in north-central Connaught Township. These rocks form a large remnant elongated in a north-northwest direction stretching from Connaught Lake to Burns Lake, unconformably overlying the Early Precambrian rocks.

Nipissing 'Diabase' is associated with these Middle Precambrian sedimentary rocks at Connaught Lake and also occur as apparent sill remnants in southwestern Churchill Township. The diabase is medium to coarse grained, in a few places has quartz phenocrysts, and in places may be very coarse grained. Red granophyre occurs as a differentiate of the diabase especially in the southeastern corner of Churchill Township. Where this granophyre is developed calcite veins and cobalt bloom are observed.

Glacial deposits, consisting of fine white and yellow sand, cover most of the southwestern half of Connaught Township, and occur as ridges and plains.

STRUCTURAL GEOLOGY: Abundant orientation data in the upper (sedimentary) and lower (volcanic) part of the Early Precambrian sequence indicate that the rocks are tightly folded and steeply dipping. Little orientation data are available in the middle part of the sequence. On the basis of lithological distribution patterns, the folding of the entire sequence appears to be about southeasterly axes in Churchill Township and southeastern Connaught Township, with the axes swinging to assume an east-west trend in northern Connaught Township. These axes are doubly plunging and in eastern Churchill Township the plunge is about 30 to the southeast, as determined by observations on minor folds.

The Connaught Township granite pluton is massive and appears to post-date the folding.

The Middle Precambrian rocks appear to be flat-lying, resting with marked unconformity on the steeply dipping Early Precambrian volcanic-sedimentary rocks, and associated intrusions.

ECONOMIC GEOLOGY:

Copper: The Mataris deposit of Coniston Explorations and Holdings Limited is the most important copper discovery to date. The original showing was described by Laird (1934, p.67) as occurring in a "dark coloured, aphanitic, brecciated or fragmented type of rock..." showing "vesicular structures" in places. The rock "consists mainly of quartz, a pale-greenish chloritic material, and glass; tiny flow structures are very much in evidence.... The mineralized zone attains a width of 100 feet, and has been traced for several hundred feet." The deposit is a disseminated type, consisting of pyrite, chalcopyrite, bornite, and covellite; the mineralized zone striking N70W. The showing was drilled many times and various estimates of grade were given. Drilling by Earl Kelly in 1956 returned a best intersection of 12.35 percent Cu, with 0.06 ounce Au, and 1.88 ounce Ag per ton over 18 inches (Company Rept.; Ontario Division of Mines, Assessment Files Research Office). Drilling by Bardyke Mines Limited in 1957 returned a best intersection of 3.31 percent Cu, with 0.01 ounce Au, and 0.93 ounce Ag per ton over 5 feet (Company Rept. in Ontario Division of Mines, Assessment Files Research Office). Gome Diamond Drilling Limited obtained 1.13 percent Cu with minor added silver 'values' over 30 feet as its best intersection in 1970 (Northern Miner 1970). The drilling indicates a possible copper zone about 100 feet long; electromagnetic surveys in 1971 by Conniston Exploration and Holdings Limited indicated a conductor 500 feet long associated with the deposit. The best intersection was 0.86 percent copper over 16 feet in 1973 (Company Rept. in Ontario Division of Mines, Assessment Files Research Office).

The next most important copper occurrence is the Royal Agassiz Mines Limited showing in southern Connaught Township. This deposit strikes northwest-southeast, is 12 feet wide, and occurs in rhyolite and iron formation host rocks. "A grab sample... from a 4.0-foot massive section... assayed 10.80 percent copper, 0.23 percent zinc, 4.90 ounces silver and 0.10 ounce gold per ton. Likewise, a grab sample from the lower grade disseminated material in the wall returned 1.52 percent copper, 0.04 percent zinc, 0.72 ounce silver and 0.07 ounce gold" (Northern Miner 1971a).

There are two other deposits of interest: the Active Mines Limited deposit, in Connaught Township, and the Jonsmith Mines Limited deposit in Churchill Township. The Active Mines Limited deposit comprises a 1,200 foot long conductor, which, where drilled, showed pyrite, pyrrhotite, and magnetite mineralization. In two of the holes assays of 1.71 percent copper over 1.6 feet and of 0.73 percent copper and 0.11 percent zinc across 1.0 feet are reported (Company Rept.; Ontario Division of Mines, Assessment Files Research Office). A grab sample from the Jonsmith occurrence returned 2.57 percent copper (Northern Miner 1971b).

Gold: The most important deposits are the Gosselin and Herrick deposits in Churchill Township. Gold occurs either in quartz veins, in mineralized shears impregnated with quartz stringers, or in iron formation. The Gosselin deposit is the largest and consists of two veins: the Main Vein and Discovery Vein. Sampling and development were confined to the Main Vein, which is 1½ miles long and straddles Churchill and Asquith Townships. In Churchill Township this vien is 4,600 feet long, 6 to 65 feet wide, strikes N15W, and dips approximately 60W. The vein consists of white or rose quartz, which is commonly brecciated, and occurs in altered pillow lava, and rusty-weathering iron-magnesium-calcium carbonate, cut by felsite or rhyolite. The best assay obtained in 1922 showed 4 ounces Au and 20.1 ounces Ag per ton (Company Report, Ontario Division of Mines, Assessment Files Research Office). Resampling in

1959 gave assay values of 0.21 ounce Au per ton over 7.8 feet yielding $7.35 per ton (gold at $35.00 per ounce, Company Rept.; Ontario Division of Mines, Assessment Files Research Office). The Discovery Vein, which is entirely in Churchill Township, is 2,300 feet long and 4 to 6 feet wide. It strikes N73W into the Main Vein but the dip is unknown. Assay values are not available.

The main vein of the Herrick deposit is the Kingsley Vein. It strikes north-south, extending for 1,000 feet on the surface and to a depth of 800 feet, with a steep dip to the west. The vein consists of bluish free-milling quartz, containing visible gold, as lenses 10 to 200 feet long, and up to 18 feet wide in a well developed schistose zone, thought to be a fault. The zone contains fine pyrite, carbonate, chlorite, and talc. The vein cuts conglomerate, slate, rhyolite, and a reddish lamprophyre host rocks. Average grade at the surface was $10.20 gold per ton, (about $20.00 per ounce, 1933 price) from channel and selected samples (Company Rept.; Ontario Division of Mines, Assessment Files Research Office).

The next most important property was that of the Churchill Mining and Milling Company, Limited, in southeastern Churchill Township, south of the Herrick deposit. There were three veins on the property the most important being the Number 3 quartz vein which is 300 feet long at the surface, from 2 to 3 feet wide, striking N80E and dipping 75S. The vein is of the fissure type enclosed in light coloured rhyolite or quartz porphyry sheared at S80E. Mineralization consists of gold, and pyrite, assaying 0.8 ounce Au per ton over 4 feet (Company Rept.; Ontario Division of Mines, Assessment Files Research Office).

About 500 feet northwest of this deposit lay the Gold Corona property. The most important deposit is in a north-south shear 400 feet long containing narrow quartz lenses striking 10 - 20 from the shear en echelon. The gold is associated with pyrite and quartz in iron formation. Assay results in 1916 showed $10.00 gold over 20 inches (Company Report in Ontario Division of Mines, Assessment Files Research Office) and drilling in 1945 gave as a best intersection on the vein $7.70 gold over 1 foot (gold at $35.00 per ounce; Company Rept.; Ontario Division of Mines, Assessment Files Research Office).

Iron: Although iron formations occur in the area these do not form important deposits. However, during the drilling for copper by Active Mines Limited in Connaught Township, a 15.6 foot intersection of magnetite and pyrrhotite gave a total iron content of 46.4 percent and a titanium content of 0.02 percent (Company Rept.; Ontario Division of Mines, Assessment Files Research Office).

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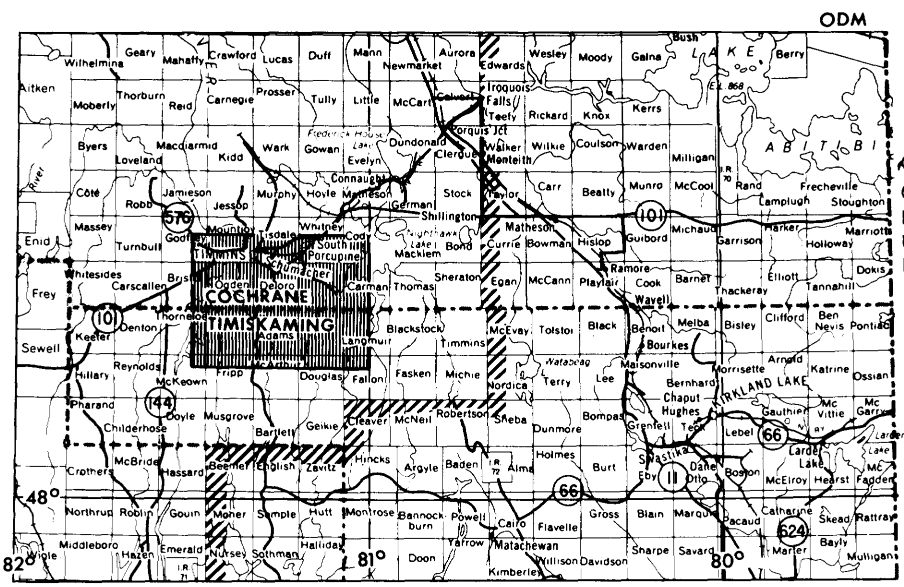
No.18 TIMMINS AREA

DISTRICT OF COCHRANE

by

D.R. Pyke[1]

LOCATION: The Timmins area covers about 400-square miles (1,036-square km) and is located entirely within the newly established boundaries of the city of Timmins; embracing an area 45 miles (72 km) by 30 miles (48 km). The



LOCATION MAP   Scale: 1 inch to 25 miles

map-area is bounded by Longitudes 81°00' to 81°30'W and Latitudes 48°15' to 48°30'N.

ACCESSIBILITY: Access to most of the area, particularly the northern half, is good. Highway 101 traverses the northwest part of the area, and numerous roads, both seasonal and all-weather, extend south into many of the townships. Parts of the area, notably east Whitney Township and adjacent Cody Township as well as southern Eldorado Township are best reached via helicopter.

MINERAL EXPLORATION: Extensive prospecting and exploration ensued in the Timmins area commencing with the discovery of gold in 1909. In total, 22 mines have produced gold in the map-area since the initial discovery. Currently there are

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two producing gold mines in the area; McIntyre Porcupine Mines Limited and Dome Mines Limited, which have accounted for about 40 percent of the entire gold production from the Timmins camp. The largest producer was Hollinger Mines Limited, which suspended operations in the Timmins area in 1969. Other major past producers of notable importance include Aunor Gold Mines Limited, Associated Porcupine Mines Limited-Paymaster Mine, Delnite Mines Limited, Preston Mines Limited, and Romfield Building Corporation Limited-Buffalo Ankerite Mine. Total gold production from the area as of 1970 was 35,284,216 ounces; total silver production was 8,044,840 ounces (Ontario Division of Mines, Statistical Files). Because of the increase in the price of gold over the last several months ($98.75 per ounce on the T.S.E. October 9, 1973, Northern Miner, 1973), some exploration companies have initiated new exploration programs in the Timmins area for hitherto uneconomic gold mineralization.

During the period 1923 to 1926, 194 tons of asbestos was produced from the Bowman Mine in central Deloro Township (Hewitt and Satterly 1953). Most of the production took place under the ownership of Porcupine Asbestos Mining Syndicate; the property is currently owned by Nakhodas Mining Company Limited.

In 1917, Slade-Forbes Asbestos Company, and in 1951 Teegana Mines Limited produced minor asbestos from a deposit on patented claim P6886 in the southeastern part of Deloro Township (Carlson 1967).

Copper mineralization is currently being mined at the McIntyre Mine. The ore body was discovered in 1963, and total production to the end of 1969 was 59,134,972 pounds of copper (Ontario Division of Mines, Statistical Files).

Scheelite was produced in the Timmins area during the period 1940 to 1953, and amounted to 445,502 pounds of contained tungsten trioxide (Ferguson et al 1968). Most of the production was from Hollinger Mines Limited.

A magnesite deposit occurs near the south central boundary of Deloro Township. The deposit is held by Canadian Magnesite Mines Limited who have recently been conducting tests (Griffis 1972) to assess the economic potential. The deposit is largely confined to two main outcrop zones averaging about 3,000 feet (914 m) in length and 400 feet (122 m) in width (dips are steep, 60 to 70 degrees). The limited assays available (Lawrence 1962) suggest that the deposit contains about 25 percent soluble MgO (that is MgO from the mineral magnesite).

Between 1911 and 1948, minor barite was intermittently mined from two narrow veins near the south boundary of Langmuir Township. An evaluation of the veins by Peerless Canadian Explorations Limited (Pyke 1970) in 1966, indicated that under current market conditions the deposit is far from being of economic value.

Most of the exploration in the last few years has been directed toward the discovery of nickel mineralization. This was prompted by the discovery of a small nickel deposit in southern Langmuir Township by McWatters Gold Mines Limited in 1964. Subsequently, numerous companies undertook extensive exploration programs throughout much of Eldorado, Langmuir, and Carman Townships, and more restricted parts of Adams, Deloro, and Shaw Townships. During this period, a joint venture by Noranda Mines Limited and Canadian Nickel Company Limited lead to the discovery of a nickel ore body in north central Langmuir Township. Production began in 1973 and ore reserves are estimated at 1.4 million tons averaging 1.87 percent nickel (Panorama 1973).

GENERAL GEOLOGY: With the exception of a few diabase dikes, all the bedrock in the area is of Early Precambrian (Archean) age.

The two cycles of volcanism present in the Peterlong Lake area (Pyke 1973) to the south are recognized in the Timmins area, although the lower ultramafic formation is not exposed.

The apparent stratigraphic succession from oldest to youngest consists of the following:

Lower Cycle

1) Fine grained, commonly pillowed and amygdaloidal, mafic metavolcanics; best exposed in northern Shaw Township and the north and east parts of Deloro Township. Pillow breccia and intercalated mafic tuff-breccia and lapilli-breccia are common.
2) Felsic to intermediate metavolcanics composed largely of tuff and lesser tuff-breccia. Interlayered sulphide- and oxide-bearing iron formation is common, and locally serves to outline the sequence in lieu of felsic to intermediate metavolcanics.

Upper Cycle

3) Ultramafic metavolcanics, and locally minor high magnesium basalts. Average thickness is probably no greater than 500 feet (152 m), which is decidedly less than the equivalent unit in the Peterlong Lake area (that is 3,000 feet (915 m), Pyke 1973). This ultramafic volcanism forms what is interpreted to be the base of the second volcanic cycle.
4) Mafic metavolcanics, commonly pillowed and locally variolitic, as best developed in Tisdale Township. Interlayered ultramafic metavolcanics are locally common, as in southern Langmuir Township.
5) Felsic metavolcanics, largely composed of tuff-breccia and tuff.
6) Metasedimentary rocks consisting dominantly of interlayered greywacke and siltstone. Locally the metasediments unconformably overlie the metavolcanics.

In correlating the above stratigraphy across the Destor-Porcupine Fault, it is presumed that the ultramafic metavolcanics north and south of the fault are stratigraphic equivalents.

Large, generally sill-like bodies of medium- to coarse-grained dunite were emplaced almost entirely within the lower cycle of mafic and felsic to intermediate metavolcanics. Conceivably, some of the sills may have acted as magma reservoirs, thereby providing a source for some of the overlying ultramafic metavolcanics. Differentiation has resulted in the development of a narrow zone of pyroxenite and gabbro along the roof of some of the sills.

Minor, small epizonal quartz-feldspar porphyry intrusions, probably of sub-volcanic derivation, are intrusive into the metavolcanics. A small stock of biotite-hornblende trondhjemite outcrops in east-central Eldorado Township, and a large stock of porphyritic granodiorite underlies much of Adams and Price Townships.

Northeast-trending diabase dikes of Middle and Late Precambrian age (Pyke et al 1973) traverse the area.

STRUCTURAL GEOLOGY: A large northwest-trending domal structure about 13 by 10 miles (21 by 16 km) is centred in Shaw Township, and forms the main structural feature of the area. A major northeast-trending fault zone, the Destor-Porcupine Fault, forms the northern periphery of part of the Shaw dome. The relative age of the metavolcanic rocks on either side of the fault zone has never been established, although it was suspected that the metavolcanics south of the fault were older than those north of the fault. (Hogg 1950; Carlson 1967; Ferguson et al 1968). This relationship is confirmed from the present mapping, insofar as the ultramafic metavolcanics on either side of the Destor-Porcupine Fault are interpreted as being correlative; on the north side of the fault the ultramafic metavolcanics are at or near the exposed base of the volcanic pile.

A strong penetrative lineation that plunges east at about 45 to 60 degrees is an extremely prominent feature of nearly all the metavolcanic-metasedimentary rocks north of the Destor-Porcupine Fault. The lineation is weak to absent south of the fault zone.

ECONOMIC GEOLOGY:

Gold: Ferguson et al (1968) have given a comprehensive description of the gold-bearing veins and mines of Tisdale Township, and Carlson (1967) of the mines and showings in Deloro and Ogden Townships. Virtually all the production from the area has been from the metavolcanics north of the Destor-Porcupine Fault. Most of the auriferous quartz veins tend to be along anticlinal axes, and most are in close proximity to stocks of quartz-feldspar porphyry (Ferguson et al 1968).

Copper: A copper ore body (8 million tons, 0.7 percent copper, Pyke and Middleton 1970) occurs in a sub-volcanic (Hurst 1936) quartz-feldspar porphyry on the property of McIntyre Porcupine Mines Limited in south central Tisdale Township. The ore zone consists of a number of steeply plunging ore shoots in a zone 300 feet (91 m) wide and 1,200 feet (365 m) long. The porphyry is extensively sheared and sericitized and contains abundant gypsum and anhydrite in and around the ore zones. Mineralization consists mainly of chalcopyrite and bornite.

Magnesite: Locally, large bodies of ultramafic rocks have been replaced by carbonate, minor talc, and quartz. The large deposit of magnesite in southern Deloro Township suggests that other carbonatized ultramafic rocks in the area may also contain substantial quantities of magnesite.

Nickel: The Langmuir Property nickel mine of Noranda Mines Limited was brought into production in 1973. The ore zone averages about 20 feet (6 m) thick and occurs at the base of a medium-grained serpentinized peridotite about 200 feet (60 m) thick. Massive sulphides tend to occupy depressions at the base of the serpentinite and are overlain by a halo of disseminated sulphide. Footwall rocks consist of massive andesite or fine-grained peridotite. Ore minerals consist of both pentlandite and millerite, the latter being most abundant at the north end of the orebody where the footwall rocks are ultramafic rather than andesitic.

The general stratigraphic interval at which the Langmuir Property ore zone is located is the same interval at which the McWatters deposit and Hart deposit are located (Pyke and Middleton 1970). That is, at or near the base of the second volcanic cycle in the area, as defined by the beginning of ultramafic volcanism. This contact can be traced intermittently around much of the south part of the Shaw dome, thereby providing a useful guideline for exploration. This is also the same stratigraphic interval at which the Texmont Mine occurs in Bartlett and Gerkie Townships (Pyke 1973).

Asbestos: Narrow veinlets of asbestos occur in both the intrusive and extrusive ultramafic rocks, but are invariably best developed in the former. In general, this relationship seems to be true throughout the Timmins-Kirkland Lake area, as both the Reeves Mines (Milne 1972) and the Munro Mine (Satterly 1951) occur in intrusive sill-like bodies of ultramafic rocks. The limited production from the Timmins area has all been from the intrusive sills in central Deloro Township.

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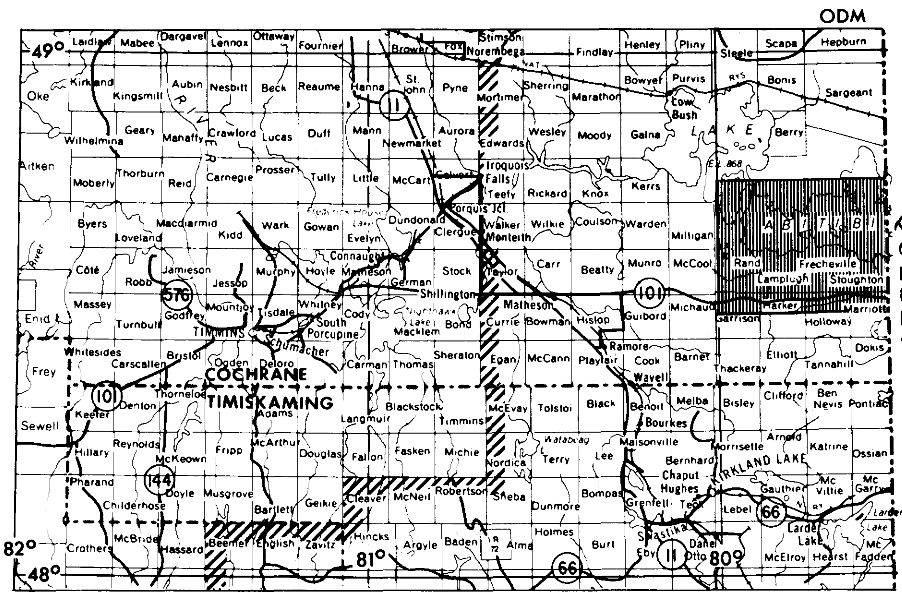
No.19 LIGHTNING RIVER AREA

DISTRICT OF COCHRANE

by

L.S. Jensen[1]

INTRODUCTION: In 1972, a new program of geological compilation and mapping was initiated for the Timmins-Kirkland Lake area. The program will lead to a series of geological maps to be published at a scale of 1 inch to 1 mile; the boundaries



LOCATION MAP

Scale: 1 inch to 25 miles

of the map-areas will conform to the GSC Aeromagnetic Maps at the same scale (see D.R. Pyke, No. 18, this report). In 1972, the Magusi River Area was completed with the mapping of Thackeray and Marriott Townships and the second map, the Lightning River Area, was started with the mapping of Stoughton Township. In 1973, the remaining part of the Lightning River Area was completed at a scale of 1 inch to ¼ mile and tied in with the geological mapping previously done by Satterly (1949; 1951; 1953).

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LOCATION: The Lightning River Area is located about 20 miles east of Matheson and extends as far east as the Quebec boundary. It is bounded by Latitudes 48°30' to 48°45'N and by Longitudes 79°30' to 80°00'W and covers about 400-square miles. The area encompasses the townships of Stoughton, Frecheville, Lamplugh, and Rand and the north parts of Garrison, Harker, Holloway, and Marriott as well as Indian Reserve 70 and the southern part of Lake Abitibi.

The southern part of the map-area can be reached by Highway 101, which extends east from Matheson into the Province of Quebec. Further access is possible by numerous logging roads that extend short distances north and south of Highway 101, and by canoe on the Ghost River. Lake Abitibi provides access to the northern part of the map-area.

MINERAL EXPLORATION: Mineral exploration started with the discovery of gold in 1906 along the south shore of Lake Abitibi (Miller 1907) and in 1917 in Harker and Holloway Townships (Knight et al 1919). Documentation of this early mineral exploration can be found in a report by Gledhill (1925) and in the reports on Garrison, Harker, and Holloway Townships by Satterly (1949; 1951; 1953 respectively). A recent summary of the mineral exploration in Marriott and Stoughton Townships is given on Preliminary Maps P.823 and P.824 (Jensen 1973 a,b). In recent years mineral exploration has shifted to include asbestos and base metals as well as gold.

The search for asbestos has been concentrated in the ultramafic rocks that occur in the north parts of Garrison, Harker, and Holloway Townships and in the south parts of Lamplugh and Frecheville Townships. In 1950, Dominion Gulf Company and the Asbestos Corporation drilled 14 holes totalling 8,806 feet in the north part of Holloway Township and the southwest part of Frecheville Township following a magnetometer survey in the area (Resident Geolgist's files, Ontario Ministry of Natural Resources, Kirkland Lake). In 1960, Canadian Johns-Manville Company Limited diamond drilled 7 holes totalling 3,391 feet in the southwest part of Frecheville and southeast part of Lamplugh Township (Resident Geologist's files, Ontario Ministry of Natural Resources, Kirkland Lake). Locations of this and other exploration for asbestos is shown on Ontario Division of Mines, Preliminary Maps P.797, P.798, and P.799 (Lovell and Frey 1973a,b,c).

Between 1968 and 1970, Canadian Johns-Manville Company Limited explored asbestos mineralization in the north part of Garrison Township. Underground exploration of 13,560 feet of drifting and cross-cutting and extensive diamond drilling was done with the stockpiling of some 20,000 tons of ore on surface for fibre quality tests. (ODMNA 1970).

Only a limited amount of work has been done for base metals. In 1946, Hans Lundberg had an electromagnetic survey carried out in the north-central part of Rand Township and in 1964, Keevil Mining Group Limited conducted an airborne electromagnetic survey over the southwest parts of Rand and Lamplugh Townships. No conductors were found and the properties were consequently dropped (Resident Geologist's files, Ontario Ministry of Natural Resources, Kirkland Lake).

In 1971, The Patino Mining Corporation conducted an airborne electromagnetic and magnetic survey over Lamplugh, Frecheville, and Stoughton Townships. From the survey, anomalies were discovered in all three townships. Follow-up work consisted of ground magnetometer and electromagnetic surveys and the drilling of 4 holes totalling 1,255 feet. One 27-foot intersection averaging 0.11 percent copper was found in a drill core from Lamplugh Township (Resident Geologist's files, Ontario Ministry of Natural Resources, Kirkland Lake).

In 1973, Sciminex Limited and Anatole Resources Limited carried out a diamond drilling program consisting of 4 holes totalling about 2,000 feet in search of gold mineralization on 18 claims in the north part of Harker Township (Northern Miner 1973; L. Cunningham, Consultant, Kirkland Lake, personal communication, 1973).

GENERAL GEOLOGY: All bedrock is of Early Precambrian (Archean) age except for a few northeast-trending diabase dikes that are considered to be of Late Precambrian (Keweenawan) age. Extensive Pleistocene deposits of varved clay and esker-deltaic sand overlie the bedrock in the north part of the area.

The bedrock consists of a sequence of volcanic rocks approximately 40,000 feet thick, which is cut off toward its base by granitic gneiss. The volcanic rocks are composed of ultramafic, mafic, intermediate, and felsic flows and pyroclastic units and represent the lower half of a thick volcanic sequence that extends stratigraphically upwards into the Magusi River Area, to the south.

Felsic tuff and flow breccias of unknown thickness form the base of the volcanic sequence. The felsic volcanics are directly overlain by a series of massive diabasic to gabbroic textured flows of mafic and ultramafic composition. These rocks are in turn overlain by a thick series of alternating massive and pillowed flows of mafic to intermediate composition that extend to the top of the sequence in Frecheville Township. Toward the base of the sequence thin units of cherty tuffs with jaspilite are intercalated in the volcanic flows. Toward the top of the sequence chert and carbonaceous argillite are intercalated in the flows.

No major stocks or sills of gabbro and diorite were found in the map-area. All the coarse-grained gabbroic rocks appeared to be massive flows for which extrusive, fine-grained amygdaloidal contacts are found in the field. Most of the ultramafic rocks are poorly exposed and field evidence is lacking as to whether they are extrusive or intrusive.

Felsic intrusions can be divided approximately into three types according to composition and texture. The first type comprises feldspar and quartz-feldspar porphyry stocks that appear to be associated with felsic volcanism and are altered by later felsic intrusions. Two such stocks were mapped, the first occurs in the south part of Rand Township and is a mile in diameter, and the second is located north of Ghost River Bay in Lake Abitibi.

The second type includes the granitic gneisses of the large batholith that occurs along the north shore and adjacent islands of Lake Abitibi. The batholith is composed of several circular non-gneissic bodies of granodiorite and trondhjemite mixed with quartz-feldspar-biotite gneiss.

The third type comprises granite and syenite stocks in Garrison and Harker Townships described by Satterly (1949; 1951).

STRUCTURAL GEOLOGY: The general style of folding is concentric with the folding becoming strongly isoclinal to the north. Two major folds occur in the area; a doubly plunging, west-trending syncline in the central parts of Lamplugh, Frecheville, and Stoughton Townships, and a subparallel anticline in the south parts of Frecheville and Stoughton Townships. The northern limb of the syncline has been refolded into a series of north-trending anticlines and synclines by granitic rocks to the north, in the north parts of Frecheville and Lamplugh Townships.

Two major types of faults can be recognized. The first is typified by east-striking faults in the south part of the area, and along the south shore of Lake Abitibi, and these faults are considered by the writer to be major shear zones; the faults in the south appear to be associated with the Destor-Porcupine Fault System; the faults in Lake Abitibi are reverse-slip faults caused by the thrusting from the north. The second type comprises north-northwest-striking normal faults with down drop to the east, and these appear to be the youngest major feature of the area.

ECONOMIC GEOLOGY:

Asbestos: Asbestos occurs in the serpentinized dunite and peridotite in Garrison, Harker, and Holloway Townships and has previously been described by Satterly (1951; 1953). Similar small amounts of fibre were also observed in Lamplugh and Frecheville Townships and on the south shore of South Bay, Lake Abitibi, in Indian Reserve 70. The only sizeable deposit of asbestos found to date is that in the north part of Garrison Township where Canadian Johns-Manville Company Limited has stockpiled about 20,000 tons of ore for fibre quality tests. Here, the fibre occurs predominantly in dunite both as cross-fibre up to 1 inch wide and slip-fibre up to several inches long.

Copper: Minor amounts of chalcopyrite occur in the area as follows:

1. As finely disseminated grains, up to 0.5 percent chalcopyrite, with pyrite, pyrrhotite, and sparse sphalerite in rhyodacitic quartz-feldspar porphyry in the west parts of Lake Abitibi;

2. Locally developed finely disseminated grains in strongly pyritized (about 5% sulphides) fracture zones in a feldspar porphyry stock in the south part of Rand Township;

3. In a few places as "blebs" up to ¼ inch diameter in quartz-calcite veins, 6 inches to 3 feet wide and 10 feet to 30 feet long; the veins are mainly in volcanic flows of mafic composition, in the south part of Indian Reserve 70, South Bay, and in the islands in the east part of Lake Abitibi;

4. As numerous mica-like grains along, locally abundant but regionally sparse, east-west-trending slip-planes in the sheared mafic metavolcanics on the south shore and adjacent islands of Lake Abitibi; and

5. In the drill cores of recently explored graphitic sedimentary rocks in Stoughton, Lamplugh, and Frecheville Townships associated with disseminated and nodular pyrite, analyses give up to 0.11 percent chalcopyrite over 27 feet (Resident Geologist's files, Ontario Ministry of Natural Resources, Kirkland Lake).

Gold: Gold mineralization occurs mainly in the townships of Garrison, Harker, and Holloway and according to Satterly (1949; 1951; 1953) several types of gold mineralization occur in the area.

Gold occurs:

(1) In sheared and fractured zones in volcanic, sedimentary, and felsic intrusive rocks;

(2) In mineralized felsic dikes which have been carbonatized, or silicified, with or without a stockwork of quartz veins;

(3) In quartz veins, fillings, and stockworks.

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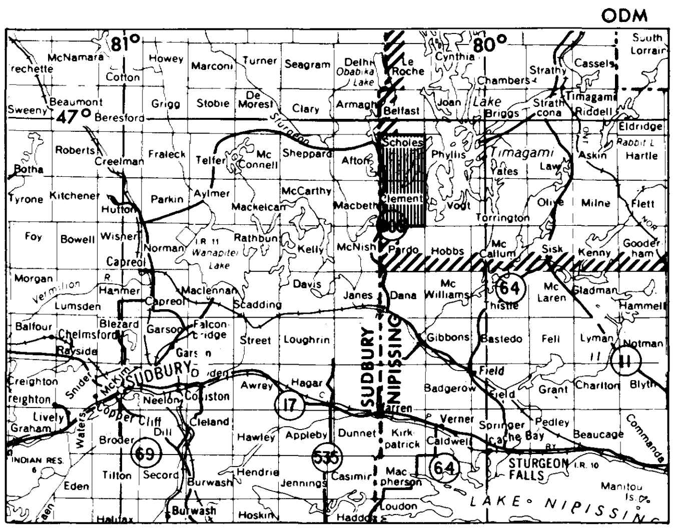
No.20 SCHOLES AND CLEMENT TOWNSHIPS

DISTRICT OF NIPISSING

by

H.D. Meyn[1]

LOCATION: Scholes and Clement Townships are each about 6 miles square and are located about 45 air miles northeast of Sudbury on the east side of the Sudbury-Nipissing district boundary. Field mapping of a four township area comprising



LOCATION MAP Scale: 1 inch to 25 miles

Scholes and Clement Townships and Afton and Macbeth Townships to the west, was started in 1972 and completed in 1973. Access to the area is provided from Highway 17 via Highways 64, 539, and 805. Highway 805 runs northwards close to the western edge of the two townships. A private lumber company road, open to the public, extends from Highway 805 to Gull Lake through the northern part of Scholes Township; another lumber road extends from Highway 805 to Turtleshell Lake along the northern part of Clement Township. The southwestern part of Clement Township can be reached via an old road past Tee Lake, Pardo Township. Former lumber roads (1940s) are now reduced to trails and, in many places, rutted watercourses but can frequently be seen on airphotographs and used for walking.

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The western half of Scholes Township was mapped by E.S. Moore (1936). Additional information is available in Assessment Files Research Office of the Ontario Division of Mines in Toronto, and the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake. Belfast Township to the north of Scholes Township and Phyllis Township to the east of Scholes Township were mapped in 1960 by P.S. Simony (1964). Vogt Township adjoining Clement Township in the east was mapped by J.A. Grant in 1959 and 1960. (Grant 1964). The area adjoining to the west was mapped in 1972 by the author (Meyn 1973a,b). The area to the south was mapped by E.L. Bruce (1932) and by S.B. Lumbers (1971; 1973).

MINERAL EXPLORATION: Since about 1800 there has been mineral exploration in the area for gold, silver, copper, and iron. Gold was produced from the New Golden Rose Mine from 1937 to 1941 (ODM 1950). Active exploration in the two townships during the 1973 field season was confined to the drilling of one diamond drill hole searching for a quartz vein with gold-copper potential.

GENERAL GEOLOGY: The area is underlain by Precambrian rocks and partly covered by Pleistocene to Recent deposits of gravel, sand, clay, and organic matter. The oldest rocks of the map-area are metavolcanic and associated rocks of Lower Precambrian age (Archean) that are exposed in windows in overlying Middle Precambrian (Proterozoic) rocks; the Gowganda Formation of the Huronian Supergroup, and Nipissing gabbro. The Early Precambrian rocks consist predominantly of felsic flows, pyroclastics, and metasediments with minor mafic flows and pyroclastics. A few bands of bedded iron formation composed of magnetite and chert are also present. These rocks are cut by a small number of mafic and felsic intrusions. Moore (1936, p.41) outlined Timiskaming Series sedimentary rocks in Afton and Scholes Townships that are reinterpreted as being in part Early Precambrian pyroclastic and sedimentary rocks and in part Huronian (Middle Precambrian) sedimentary rocks. Moore (1936, p.42) outlined pink and grey Algoman intrusive porphyries that are reinterpreted as felsic volcanic flows.

The Early Precambrian rocks form the basement for the Huronian sedimentary rocks and the Nipissing gabbro. Conglomerate and greywacke assigned, by the author, to the Mississagi Formation are present in the southwest corner of Clement Township. In the basal conglomerate uranium is present to the south of Tee Lake, Pardo Township, (Thomson 1960, p.33). The Mississagi Formation is conformably overlain by rocks of the Gowganda Formation. This formation comprises boulder conglomerate, argillite, arkose, and pebbly sandstone.

All the above rocks are intruded by large sill-like sheets of Nipissing gabbro. The sheets show a preference for intruding Huronian rocks but around Eaglerock Lake, Scholes Township, and Arcand Lake, Clement Township, Nipissing gabbro is in contact with Early Precambrian rocks. Over much of Scholes Township there is outcrop and drill hole evidence that a thin layer of Gowganda Formation rocks occur between a single, large gabbro sheet and the basement. The gabbro is variable in composition and appearance. Predominant is a medium-grained (2mm) fresh and uralitized two-pyroxene gabbro, grey to brownish weathering, dark grey on the fresh surface (color index 40-60), with subophitic texture. Texture varies from truly diabasic near the chilled base to ophitic near the centre of the sheets. Pegmatitic patches with amphiboles up to 3 inches in length are common. Exposures of the top of a sheet were not found. From drill hole information in central-northern Scholes Township the sheet is at least 920 feet thick, but in most places it is much less. Because the sheet or sheets are dissected and eroded to expose older rocks underneath, the topography is very rugged.

STRUCTURAL GEOLOGY: The Early Precambrian metavolcanics and metasediments have a well-developed schistosity that generally parallels bedding. These rocks have been isoclinally folded into a vertical position. Graded bedding and crossbedding are preserved locally. In most outcrops the foliation is planar with only minor folding, but in the iron formation complex folding is evident.

The overlying Huronian rocks show little sign of post-depositional disturbance and dips are original in most localities. Near faults, however, these rocks are folded, sheared, and brecciated.

The basal contact of the Nipissing gabbro sheets appears to be nearly horizontal and unfolded in most localities. The sheets have been faulted so that the basal contact is not at the same elevation everywhere. West of Eaglerock Lake the Nipissing gabbro is in side-by-side contact with the Early Precambrian basement, suggesting a vertical intrusive, or a fault contact. Near faults these rocks are sheared and altered to chlorite schist.

ECONOMIC GEOLOGY: Surface exploration, and diamond drilling were carried out in the map-area and an exploration shaft was sunk to a depth of 1,177 feet in central northern Scholes Township. This latter shaft and much of the diamond drilling was carried out by North American Rare Metals Limited to investigate a major magnetic anomaly in northern Scholes Township. (GSC 1965). This anomaly was found to be caused by Early Precambrian iron formation. There are two bands of iron formation present in the township. The northern band extends westward into Afton Township where gold was mined from 1937 to 1941 from quartz veins in the iron formation. (ODM 1950). On the northern band, 328 million tons of iron formation grading 27.2 percent soluble iron were outlined by the exploration work in northern Scholes Township. (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake). The southern band is lensoid in nature along strike and it disappears under the gabbro west of Eaglerock Lake.

Minor sulphide mineralization (less than 2 percent of the rock), mostly pyrite, was seen at some localities in the Early Precambrian rocks of the map-area. Several pits exploring sulphide mineralization are present west of Eaglerock Lake.

In the Elliot Lake-Blind River region the mineralization associated with the Mississagi Formation and specifically with its basal pebble conglomerate is uranium. Although conglomeratic phases rich in quartz pebbles with a pyritic matrix occur in the Mississagi Formation in Clement Township none of them were found to be radioactive above background; sampling by writer with hand held Geiger Counter. Single crystals and small aggregations of pyrite, commonly weathered out and only indicated by rusty cavities, is the only mineralization associated with the Gowganda Formation.

Very little primary sulphide mineralization is present in the Nipissing gabbro. Very scattered specks of pyrite are present and although locally these form as much as 5 percent of the rock, in general they are small, very minor and erratic. Minor disseminations, with scattered local pods of pyrrhotite and chalcopyrite, are present in the gabbro near major shear and breccia zones such as around Boucher Lake, Clement Township, and the east shore of Gull Lake, southeastern Scholes Township. Quartz veins up to 10 feet thick occur near the base of the Nipissing gabbro sheets. Their origin is not clear. They carry minor gold and copper (chalcopyrite) mineralization which is very erratically distributed (R. Vaillancourt, Sturgeon Falls, personal communication 1973).

Minor quartz veins and quartz-carbonate veins are associated with faulting and shearing and occur in all rocks of the map-area. Some of these carry erratically distributed chalcopyrite and gold. One small quartz vein in Gowganda rocks between Manitou and Turtleshell Lakes, Clement Township, is reported to have assayed 15 percent copper in a single pod of chalcopyrite measuring 6 by 6 by 8 inches (R. Vaillancourt, Sturgeon Falls, personal communication 1973).

It should be noted that the mapping done in the four townships of Macbeth, Afton, Scholes, and Clement suggests that the Early Precambrian rocks of the map-area are part of a 'greenstone' belt that is continuous under cover of the Huronian and Nipissing rocks from Lake Temagami in the east to Hutton and Parking Townships in the west (Card et al 1971).

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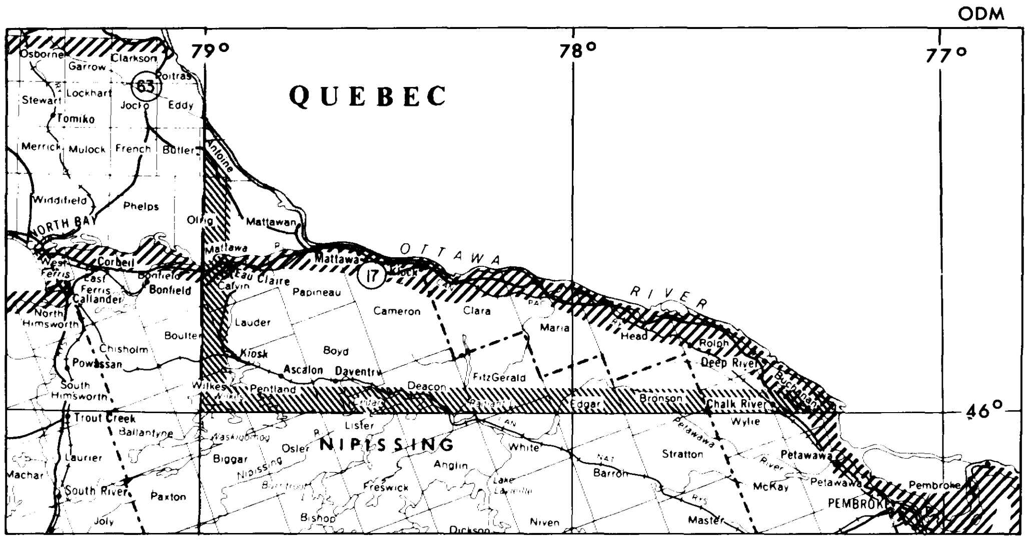
No.21 MATTAWA-DEEP RIVER AREA

DISTRICT OF NIPISSING AND COUNTY OF RENFREW

by

S.B. Lumbers[1]

LOCATION: The Mattawa-Deep River area covers about 2,100-square miles between Longitude 79°00'W and the Ottawa River. The southern boundary is Latitude 46°00'N. The northern part of Algonquin Provincial Park and the Towns of



LOCATION MAP

Scale: 1 inch to 25 miles

Mattawa, Deep River, and Chalk River are included in the area. Mapping was commenced during the 1972 field season (Lumbers 1972), and continued during the 1973 field season. To date, much of the area between Longitudes 79°00'W and 78°00'W has been mapped at a scale of 1 inch to 1 mile.

MINERAL EXPLORATION: Deposits of iron, titanium, vanadium, molybdenum, uranium, rare earths, magnesium, beryllium, garnet, feldspar, mica, graphite, kyanite, and sand and gravel have been explored and utilized in the Mattawa-Deep River area, but present production is confined to sand and gravel used mainly for local construction purposes. Recent exploration activity, carried out mainly in the 1960s, has centred upon concentrations of iron-titanium oxide minerals in anorthositic intrusions.

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GENERAL GEOLOGY: Major features of the general geology of the Mattawa-Deep River area were described previously (Lumbers 1972). That part of the area mapped to date, between Longitudes 79°00'W and 78°00'W is underlain mainly by rocks of the Grenville Province of the Canadian Precambrian Shield. About half of the rocks exposed are metasediments, and the remainder are igneous rocks, mainly members of the anorthosite suite. Rock exposure in several parts of the area, particularly in the Algonquin Provincial Park portion, is poor due to extensive Pleistocene and Recent deposits, and this presents considerable difficulty in tracing bedrock units.

The metasediments constitute the oldest rocks exposed and are probably Middle Precambrian in age. These rocks are coarsely recrystallized derivatives of predominantly moderately to well sorted sandstones containing abundant intercalated shales and minor calcareous sandstone and siltstone. A few units of coarse-grained, feldspathic metasandstone are intercalated with the finer grained metasediments, and thin marble units are intercalated with a metasandstone sequence in northern Deacon Township. Thin units derived from black shale and sulphide facies iron formation are locally intercalated with the metasandstones in the northern part of the map-area.

The oldest intrusions are a few complexly deformed sheets and irregularly shaped plutons of metagabbro and gneissic quartz monzonite, all of which are probably Middle Precambrian in age. The metagabbro bodies are generally less than 0.5 mile wide and 2 miles long; most intrude relatively well-sorted metasandstone in Olrig and Mattawan Townships. The gneissic quartz monzonite bodies are irregular in plan with numerous screens and locally abundant inclusions of metasediments. These intrusions are exposed over areas of up to 90-square miles, with the largest body underlying most of northern Clara Township. Late Precambrian rocks of the anorthosite suite are abundant and widespread, and parts of at least eight intrusions have now been mapped. Six of these intrusions were mentioned previously (Lumbers 1972), but during the 1973 field season, two additional ones composed mainly of syenitic and tonalitic rocks were partly mapped in Clara and Fitzgerald Townships. All of the bodies are complex intrusions and are regionally metamorphosed; their rocks are mainly gneissic, but local massive phases with primary igneous textures are present. The largest of the anorthosite suite intrusions mapped is an irregularly shaped pluton up to 26 miles long and 10 miles wide that extends northwestward from Lister Township through Boyd Township, southwestern Cameron Township, Papineau Township, and northeastern Lauder to central Calvin and southeastern Mattawan Townships. The northwestern part of this intrusion consists mainly of anorthosite and gabbroic anorthosite, but the northeastern part is dominated by tonalite, and the remainder is mainly syenitic and monzonitic rocks. This intrusion contains late alkalic syenite phases and local concentrations of iron-titanium oxide minerals. A second anorthosite suite intrusion partly mapped in southern Clara Township also contains alkalic phases and local iron-titanium oxide mineral concentrations.

All of the metasediments and intrusive rocks discussed above were subjected to an intense, Late Precambrian regional metamorphism that caused them to be coarsely recrystallized and deformed into gneisses (Lumbers 1972). When this metamorphism was on the wane, granite pegmatite dikes were emplaced throughout the metasediments and intrusive rocks, and following this event, diabase and lamprophyre dikes, some of which may be Phanerozoic in age, were emplaced along fault zones active in post-Precambrian time (Lumbers 1972). In the North Bay area to the west of the Mattawa-Deep River area, this late tectonism was accompanied by the emplacement of alkalic rock-carbonatitic bodies during the Early Cambrian (Lumbers 1971). Although no such intrusive activity has been proven in the present map-area, some features of the Brent Crater and the surrounding rocks in northwestern Deacon Township suggest that this structure may represent the uppermost part of a carbonatitic complex. Moreover, several large boulders of fenite, a metasomatic rock commonly found at the borders of carbonatitic complexes, were found in Pleistocene drift along recently bulldozed logging roads in Fitzgerald Township, about 6 miles due east of Brent Crater. Rock exposure is poor at this locality, and to date, no outcrops of fenite have been found.

STRUCTURAL GEOLOGY: The main structural features of the map-area were described previously (Lumbers 1972). The Mattawa River Fault, a westerly trending structure marking the northern margin of the Ottawa-Bonnechere Graben in the adjacent North Bay area (Lumbers 1971) was mapped in considerable detail. This fault extends eastward across the map-area along the Mattawa and Ottawa Rivers and is marked by prominent zones of mylonitization, cataclasis, brecciation, and hematitization up to ¼ mile across. During the 1973 field season, the fault was studied as far east as Bissett Creek. The fault has had a long and complex history and is presently seismically active with minor earthquakes recorded annually along its trend. Several generations of mafic dikes are concentrated within and nearby the fault, and some of these were recrystallized by the Late Precambrian regional metamorphism. Further work may result in a more accurate extimate of the antiquity of this structure, but present indications are that it existed in at least Late Precambrian time, and is possibly much older. Some normal faults on the southern side of the graben in the map-area also show evidence of Late Precambrian and younger activity. Thin, isolated, Paleozoic outliers are present near one of these faults on Cedar Lake in Deacon and Lister Townships. Thicker and more extensive Paleozoic outliers occur near the Mattawa River Fault, 3 miles west of Deux Rivieres on the north and south side of Ottawa River, and about 2 miles east of Mattawa on the north side of Ottawa River.

ECONOMIC GEOLOGY: The economic geology of the map-area was summarized previously (Lumbers 1972). During the 1973 field season, additional deposits of kyanite were discovered, by the writer, in muscovitic metashales intercalated with quartzose and feldspathic metasandstones in Olrig Township, and minor concentrations of iron-titanium oxide minerals were discovered, by the writer, in anorthosite suite intrusions near Wendigo Lake, Clara Township, in west-central Boyd Township, and in Pentland Township. Sparsely disseminated sulphide minerals, chiefly pyrite pyrrhotite, and rare chalcopyrite, are present in some of the small, Middle Precambrian metagabbro intrusions. Minor concentrations of graphite associated with calcareous metasediments and in shear zones in rocks of the anorthosite suite were also discovered, by the writer. Many of the anorthosite suite intrusive rocks are locally rich in garnet, but no studies have been carried out to evaluate the economic potential of these deposits.

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No.22 LORRAIN TOWNSHIP, SOUTHERN PART

DISTRICT OF TIMISKAMING

by

J.W. de Grijs[1] and H.L. Lovell[2]

LOCATION: The map-area comprises Concessions I to VI of Lorrain Township located 10 miles southeast of Cobalt between Lake Timiskaming and the Montreal River. Access to the eastern part is provided by Highway 567 from North Cobalt

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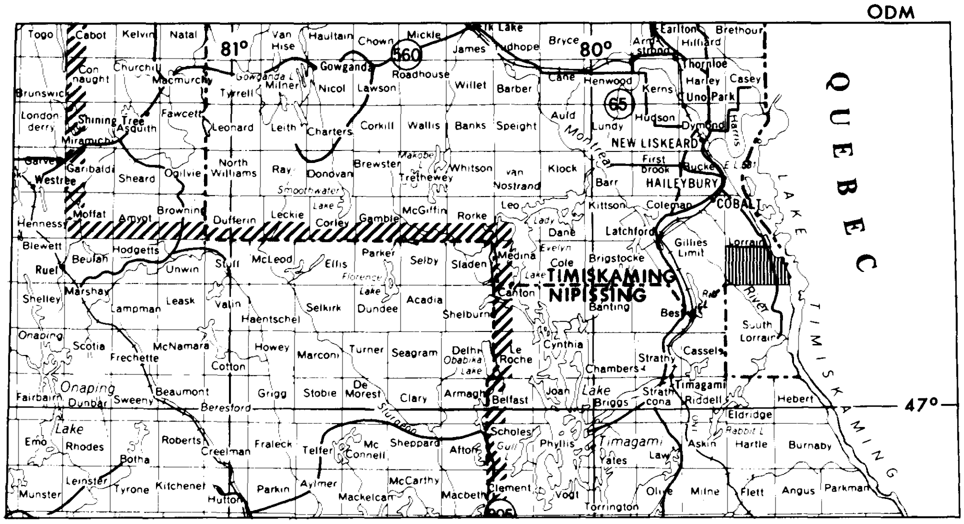

LOCATION MAP

Scale: 1 inch to 25 miles

through the Lorrain Valley farming area with side roads to Lake Timiskaming. The southwestern part is reached by the Ontario Hydro Electric Commission Road along the Montreal River. The northwestern part is accessible along the abandoned electric power transmission line from Cobalt to Silver Centre and is drivable to 1 mile south of Silver Lake. Several auxiliary bush roads, trails and Hydro 'right of ways' provide further access. Water access is provided by Lake Timiskaming and the Montreal River.

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MINERAL EXPLORATION: The following information in this section is mainly from the Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake. Early work consisted mainly of pits and trenches in the Nipissing diabase and Keewatin metavolcanics. A number of shafts were also sunk. Circa 1911 Lang Caswell Silver Mines Limited sank two shafts. In 1916 and 1923 two 50-foot shafts were sunk near Anderson Lake. Between the years 1925-1929 a 225-foot shaft was sunk south of Bouck Lake.

The earliest known drilling was in 1923 by McKinley-Darragh-Savage Mines of Cobalt Limited. No records of the results are known. From 1949 to the present, drilling and geological, geochemical, and electromagnetic surveys were carried out.

GENERAL GEOLOGY: The Early Precambrian rocks include andesitic and basaltic lavas and diabasic intrusions, as well as 'Algoman' intrusions that include the massive Lorrain granite and hornblende syenite, and associated lamprophyre and syenitic dikes in the Keewatin metavolcanics.

The Middle Precambrian is represented by the Gowganda and Lorrain Formations of the Cobalt Group, and Nipissing diabase. The Gowganda Formation consists of greywackes, siltstones, and lenses of conglomerate. The Lorrain Formation is a medium- to coarse-grained arkose (Thomson 1960, p.23; Hadley 1968). The arkose occurs as massive, weakly bedded and crossbedded units. The Nipissing diabase, intrusive into all the older rocks, is a massive, relatively unaltered, mafic rock.

The Pleistocene and Recent deposits consist of sand, gravel, varved clay, and till.

STRUCTURAL GEOLOGY: The major fault system consists of the northwesterly striking faults (for example the southern Montreal River, Maidens Creek, and Cross Lake Faults) of the Lake Timiskaming Rift Valley. The fault blocks to the northeast are downdropped. An auxiliary set of northeast-trending faults and lineaments is present. The Nipissing diabase is well jointed, the Cobalt sedimentary rocks less so.

The sedimentary rocks are generally flat lying, with dips up to 20° in the southern part of the map-area.

ECONOMIC GEOLOGY: Silver and associated metals have been sought in the southern part of Lorrain Township since the early days of the Cobalt camp and are still being searched for. Mineralization reported includes pyrite, chalcopyrite, cobalt, silver, and trace amounts of gold (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kirkland Lake). No production has been recorded.

Sand and gravel deposits are available.

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Geophysics/ Geochemistry Section

GEOPHYSICAL AND GEOCHEMICAL SURVEYS, 1973

by

W.J. Wolfe[1]

During the summer of 1973 the Geophysics/Geochemistry Section had 3 geophysical survey parties and 3 geochemical survey parties in the field.

Relative, vertical field, ground magnetic surveys by Barlow in the Sturgeon Lake metavolcanic belt, and by McCance and Wadge in the drift-covered central Abitibi Belt, were extensions of earlier Geological Branch projects designed to improve geological-geophysical interpretation and correlation. The Lake Timiskaming-Englehart gravity survey by McCance outlined specific deep geological and structural features related to the Timiskaming rift valley and the Nipissing intrusions, but also formed part of a long-term project to improve the detail of the gravity station network in Ontario.

An integrated exploration geochemistry-Quaternary geology survey by Closs and Sado investigated metal dispersion in areas blanketed by glacial sediments and applied the results to the problem of detecting unexposed mineral deposits in continentally glaciated terrain of the Precambrian Shield. A study of Cu, Ni, Co, and S distribution in ultramafic rocks of the Abitibi 'greenstone' belt was commenced in 1972 and completed during 1973. The Geophysics/Geochemistry Section supervised the planning and completion of a contracted regional survey of 6,000-square miles of the James Bay Lowlands that outlined the distribution of diagnostic heavy minerals associated with the sub-surface occurrence of kimberlite pipes and diatremes.

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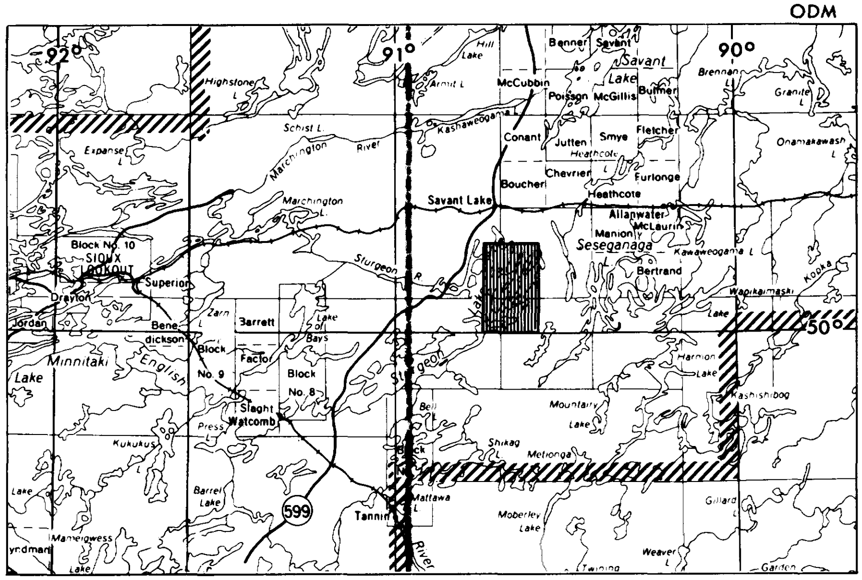
No.23 A MAGNETIC SURVEY OF THE NORTHERN PART OF THE STURGEON LAKE AREA DISTRICT OF THUNDER BAY

by

R.B. Barlow[1]

LOCATION: The map-area is bounded by Latitudes 50°00' and 50°10'N and Longitudes 90°35' and 90°45'W, covering an area of approximately 84-square miles. The central part of the area is approximately 55 miles east of Sioux Lookout



LOCATION MAP   Scale: 1 inch to 25 miles

and 60 miles northeast of Ignace. General access to the region is provided by Highway 599, which passes close by the western part of the present survey area. The survey area is locally accessible by watercraft departing from various public and private water-accesses adjoining Highway 599.

MAGNETIC SURVEY: The ground magnetic survey reports and maps filed by companies with the Ontario Ministry of Natural Resources for assessment work credit were utilized in constructing a relative, vertical field, ground magnetic map. Areas

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not previously covered by company grids were traversed with a Sharpe MF-1 and a Scintrex MF-2 magnetometer (both Fluxgate) at line intervals of 800 feet with station spacings of 100 feet. Chain-and-compass techniques were used throughout the survey and air photographs at a scale of 1 inch to 800 feet provided traverse location control.

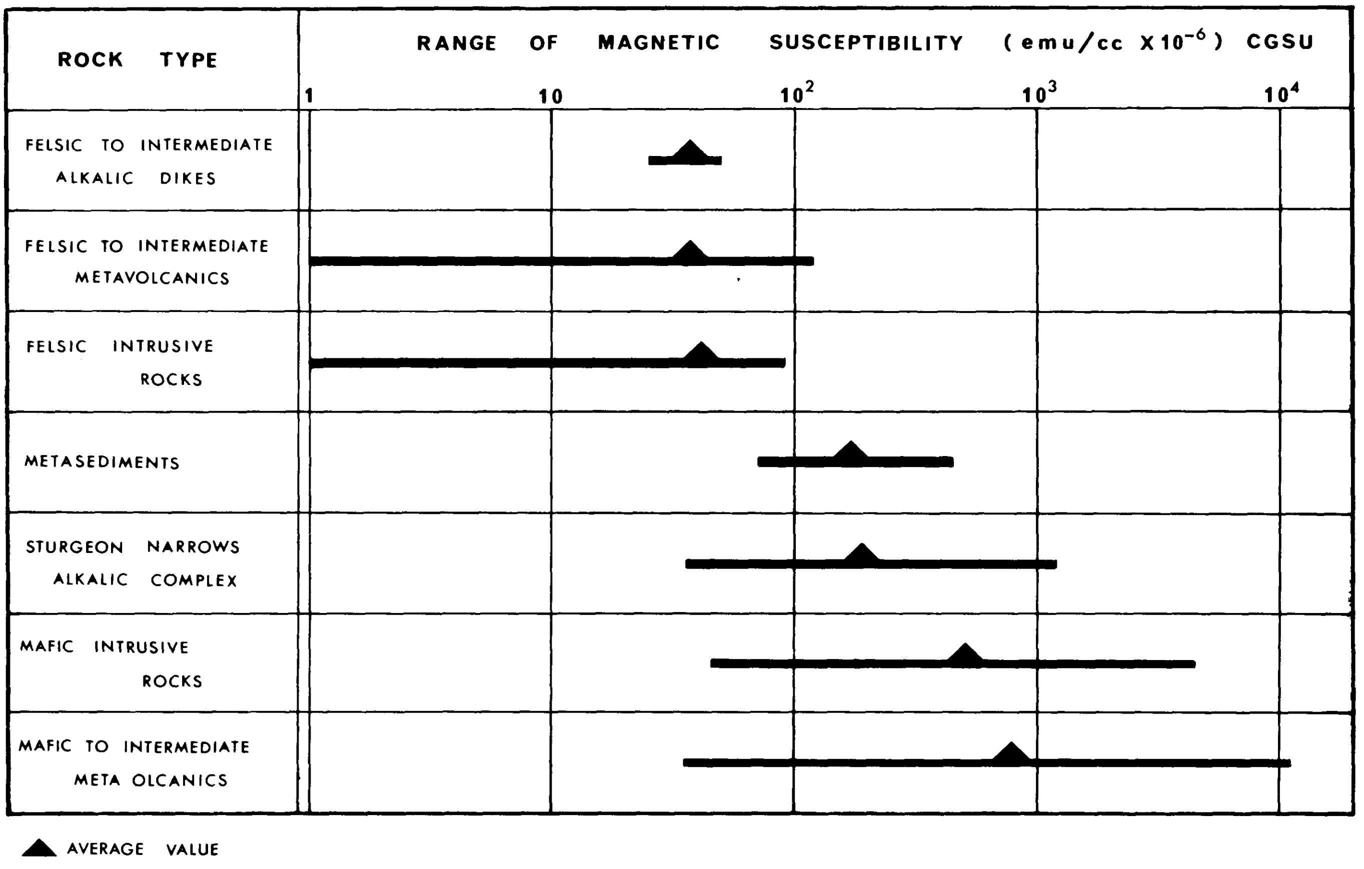
The data were compiled using a common magnetic base value established during the present field survey, with the relative differences between company survey values and present values obtained by reoccupying parts of a number of company traverses in localities having a low magnetic gradient. An arithmetic average of the differences was then applied to reduce the company magnetic survey values to a common base level. Local base level was established by having both survey magnetometers read in a base station network consisting of two temporary base stations and one permanent base station at Lumberjack Lodge established by Moon (1972). Values for the temporary base stations at East Bay and Horizontal Bay were 790 ± 10 gammas and 1100 ± 10 gammas respectively and were relative to the Lumberjack Lodge base station value of 1000 ± 10 gammas.

Diurnal changes in the earth's magnetic field were recorded to an accuracy of ± 5 gammas using a McPhar M-700 (Fluxgate) magnetometer and a Rustrak Model 288 Recorder, powered by a 12-volt automobile battery. Continuous monitoring of diurnal variations at the temporary East Bay base station showed the average summer variation, during daylight hours and excluding magnetic storm activity, to be approximately 20 gammas. The magnetogram records show this average 20 gamma peak to be most prevalent around 2 pm. daily, excluding disturbed days. Maximums of much higher intensity- generally considered to be related to abnormal activity on the sun (Chapman and Bartels 1940), were observed to be within the range of 75-400 gammas and were most prevalent during nighttime hours.

Magnetic susceptibility values, which include every major rock type in the map-area, were obtained at 114 locations utilizing a Bison 3120 'in situ' coil. This instrument enables the user to obtain a direct readout in CGS units at the sample site. A summary of the susceptibility ranges associated with the major rock types are shown in the bar graph.

<u>MINERAL EXPLORATION AND ECONOMIC GEOLOGY</u>: Early exploration for gold in the Sturgeon Lake area is reported to have begun around 1898 (Moore 1911). The most important gold deposit of the region, known as the St. Anthony Mine, currently controlled by Can-Con Enterprises and Explorations Limited, was discovered soon after this period. Mining continued, with periods of cessation, until 1941 with a total of 63,310 ounces of gold and 16,341 ounces of silver being recovered from 331,069 tons of rock milled (Ontario Division of Mines, Statistical Files, St. Anthony Gold Mines Limited, Northern Gold Reef Limited). Approximately 64 other workings are shown within the survey area (Moore 1911, Map).

Renewed interest in gold exploration in the area was demonstrated throughout the 1973 summer field season with a few claims being staked over old workings and with some preliminary evaluation work undertaken.



Bar graph showing range of magnetic susceptibility for rocks of the northern part of Sturgeon Lake

Trowell (1972) has reported that most of the gold occurrences in the map-area are found in quartz veins and porphyritic granitic dikes that cut the mafic to intermediate metavolcanics. Chalcopyrite and pyrite are locally present in minor amounts.

The discovery in 1968 of a Cu-Zn-Ag-Pb sulphide deposit by Mattagami Lake Mines Limited, located 12 miles to the southwest of the present survey-area, resulted in renewed exploration activity. More recently, in November 1970, Falconbridge Nickel Mines Limited announced the discovery of important Cu-Zn-Ag-(Pb) mineralization on their New Brunswick Uranium Metals and Mining Limited optioned property. A large part of the present survey area has been staked by a number of exploration concerns and subsequent geophysical and geological projects have been carried out in areas considered to have base metal potential.

GEOLOGICAL COVERAGE: The geology of the Sturgeon Lake area was first described by W. McInnes of the Canadian Geological Survey in 1899 (McInnes 1902). In 1901, A.P. Coleman (1902) described early development work at the St. Anthony Mine. The first geological map at a scale of 1 inch to ½ mile was published together with a report by E.S. Moore in 1911 (Moore 1911). A geological compilation (Sioux Lookout-Armstrong Sheet) Map 2169 was published in 1968 at a scale of 1 inch to 4 miles (Davies, Pryslak, and Pye 1970).

During the 1972 and 1973 summer field seasons, N.F. Trowell and assistants mapped the survey area at a scale of 1 inch to ¼ mile. A preliminary geological map (Trowell 1973a) covering the southern part of the survey area was released in 1973.

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No.24 HEAVY MINERAL INDICATORS IN ALLUVIAL AND ESKER GRAVELS OF THE MOOSE RIVER BASIN, JAMES BAY LOWLANDS DISTRICT OF COCHRANE

by

W.J. Wolfe[1] and H.A. Lee[2]

INTRODUCTION: During 1973, the Geophysics/Geochemistry Section of the Geological Branch supervised the planning and completion of a regional survey of 6,000-square miles of the James Bay Lowlands with the purpose of outlining the distribution of diagnostic heavy minerals associated with the sub-surface occurrence of possible diamond-bearing kimberlite pipes and diatremes. The survey was designed to locate concentrations of the minerals pyrope garnet, magnesian limenite, chrome diopside, and diamond, in river and esker gravels of the Moose River Basin in an area from Latitude 49°30' to 51°00'N bounded to the east by Longitude 80°30'W and to the west by the Abitibi River. Additional esker sampling was carried out in the area between the Opasatika and Mattagami Rivers from Latitude 49°30 to Latitude 50°00'N. The field sampling, preliminary concentration of heavy minerals in the field, and a study of the Quaternary geology and stratigraphy, were carried out under a contract awarded to Lee Geo-Indicators Limited of Stittsville, Ontario. Preparation of final heavy media concentrates, mineralogical studies, and chemical analyses were performed by the Mineral Research Branch of the Ontario Division of Mines.

REGIONAL GEOLOGY: The survey area is traversed by the northeast-trending Kapuskasing granulite structural zone and its associated regional gravity and magnetic anomalies and has been regarded as a prime regional target for kimberlite exploration (Satterly 1971). Reconnaissance geological mapping (Bennett et al. 1967) has confirmed close correlations between the regionally positive gravity anomaly, the zone of major northeast faulting and the northeast-trending zone of granulite metamorphic grade; features which support the concept of crustal thinning and uplift along the axis of the gravity anomaly.

The bedrock in the area ranges in age from Early Precambrian to Mesozoic. Two belts of Archean mafic volcanic, felsic volcanic and sedimentary rocks (Partridge River and Kesagami Lake Belts) occur in the northeast part of the region. A large part of the map-area is underlain by almandine-amphibolite facies metamorphic rocks consisting of biotite-hornblende-quartz-feldspar gneiss and migmatite. Exceptionally high grade metamorphic rocks, consisting of magnetite-garnet-hornblende-pyroxene-quartz-feldspar granulite occur in a

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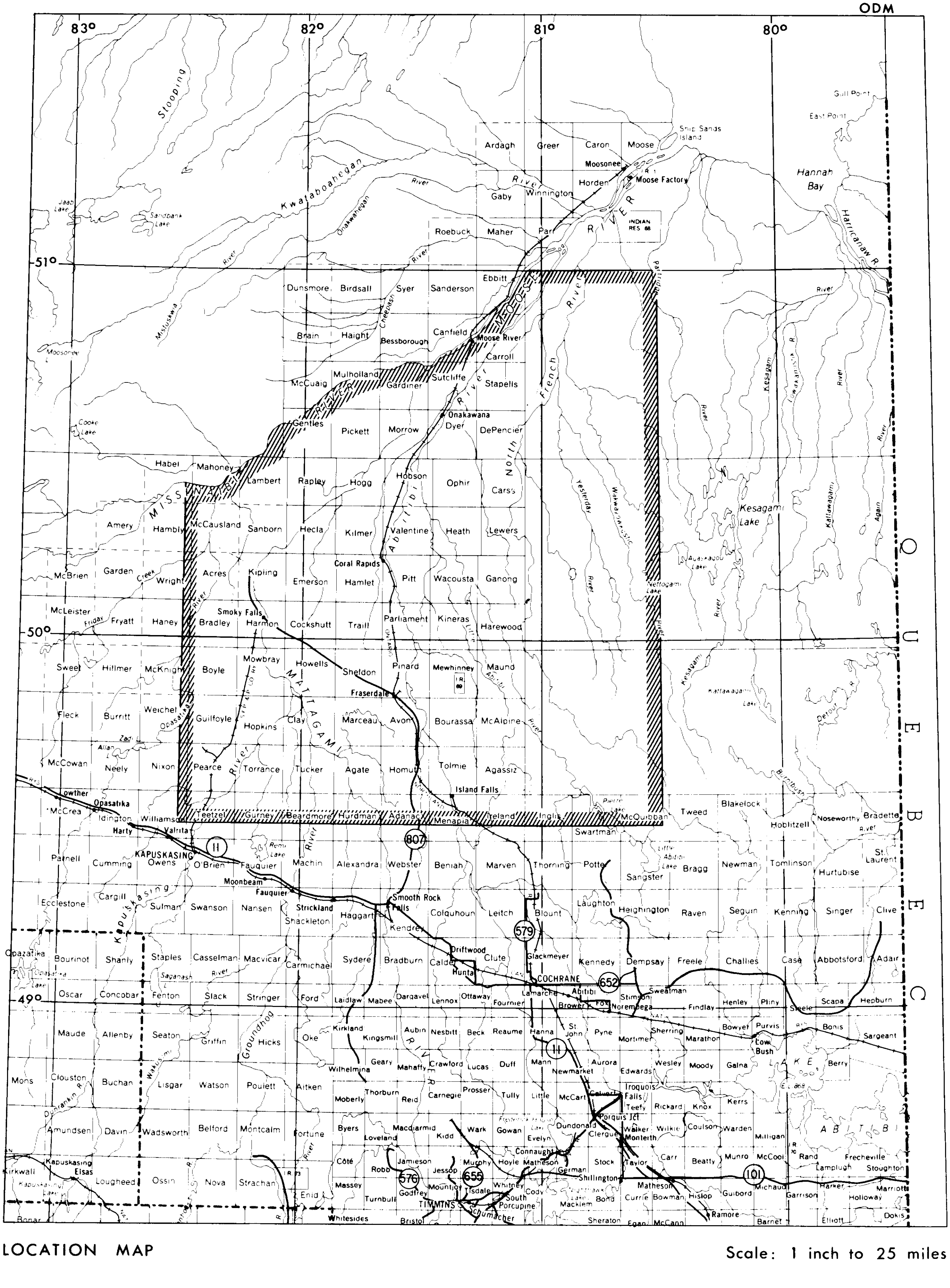
[2]President, Lee Geo-Indicators Limited, Stittsville, Ontario.



LOCATION MAP

Scale: 1 inch to 25 miles

zone of northeast-trending fault-bounded blocks that traverses the east-central part of the map-area. Large synorogenic batholiths and satellite stocks of granodiorite, quartz monzonite, and granite, intrude the gneiss complex and the metavolcanic-metasedimentary 'greenstone' belts in the eastern part of the region.

Carbonatite intrusions of two different ages occur in the area. The Clay-Howells Complex located 20 miles west of Fraserdale in the southwest part of the area is dated at 1,010 million year (K-Ar), and the Argor and Goldray Complexes situated along faults within the northeast-trending granulite zone have been dated at 1,655 and 1,695 million years (K-Ar) respectively (Gittens et al 1967).

Paleozoic sedimentary rocks of Silurian and Devonian age outcrop in the north and northwest parts of the map-area, in the James Bay Lowlands. Ultra-mafic, lamprophyre, and 'kimberlite-type' sills and dikes intrude the Lower Devonian Sextant Formation and middle to upper members of the Middle Devonian Abitibi River Formation near Coral Rapids (Brown et al 1967).

Mesozoic rocks of Lower Cretaceous age outcrop in a sedimentary basin situated northwest of the area of the heavy mineral investigation.

QUATERNARY GEOLOGY: Much of the map-area is covered by Quaternary sediments of glacial, glacio-fluvial, lacustrine, and marine origin. The average thickness of unconsolidated Quaternary sediments may be in excess of 40 feet (McDonald 1969); an abnormal thickness of 700 feet has been reported between the Mattagami and Missinaibi Rivers (Hogg, Satterly, and Wilson 1954). In the northern part of the region, interfluve areas are extensively blanketed by poorly-drained peat and marine clay but a fairly consistent Quaternary stratigraphy is recorded in abundant river valley exposures that are commonly as high as 100 feet above the present water level.

Non-glacial sediments that include marine clay and silt strata, peat, and stream deposits, are underlain and overlain by till units over a widespread area of the James Bay Lowlands. The lower till unit is a highly compacted, silty, calcareous grey-green till transported from a northeastern direction and containing a high percentage of limestone and dolomite clasts derived from Paleozoic-Mesozoic strata of the Hudson Bay Basin. The overlying Missinaibi interglacial beds contain wood and peat that is beyond the limit of radiocarbon dating; the age of these beds probably exceeds 53,000 C^{14} years B.P. (McDonald 1969). The stratified interglacial sediments are overlain by a loosely-packed, brownish grey basal till that may be of Wisconsinan Age. This till may be overlain by a poorly stratified sandy to gravelly ablation till, glaciofluvial sediments, or in some places, by an uppermost unit of basal till that may be correlative with the Cochrane Till farther south. The youngest Pleistocene strata consist of fossiliferous marine sediments deposited in the postglacial Tyrrell Sea.

In the southern part of the region, the basal Pleistocene consists of glacial till and associated glaciofluvial deposits equivalent to the till unit overlying the Missinaibi interglacial beds in the north. The till is overlain by Barlow-Ojibway lacustrine sediments consisting of varved clay and silt. The Barlow-Ojibway sediments are overlain by the Cochrane Till sheet; a calcareous clay till deposited during a late glacial readvance that overrode varved clays of glacial Lake Ojibway. Younger fresh water lacustrine and fluvial sediments lie above the Cochrane Till at some localities. The pre-Barlow-Ojibway eskers have been overridden by the Cochrane readvance and are identifiable as topographic features only in the southern half of the map-area, where they are commonly recognizable even when covered by a thin veneer of varved sediment or Cochrane Till.

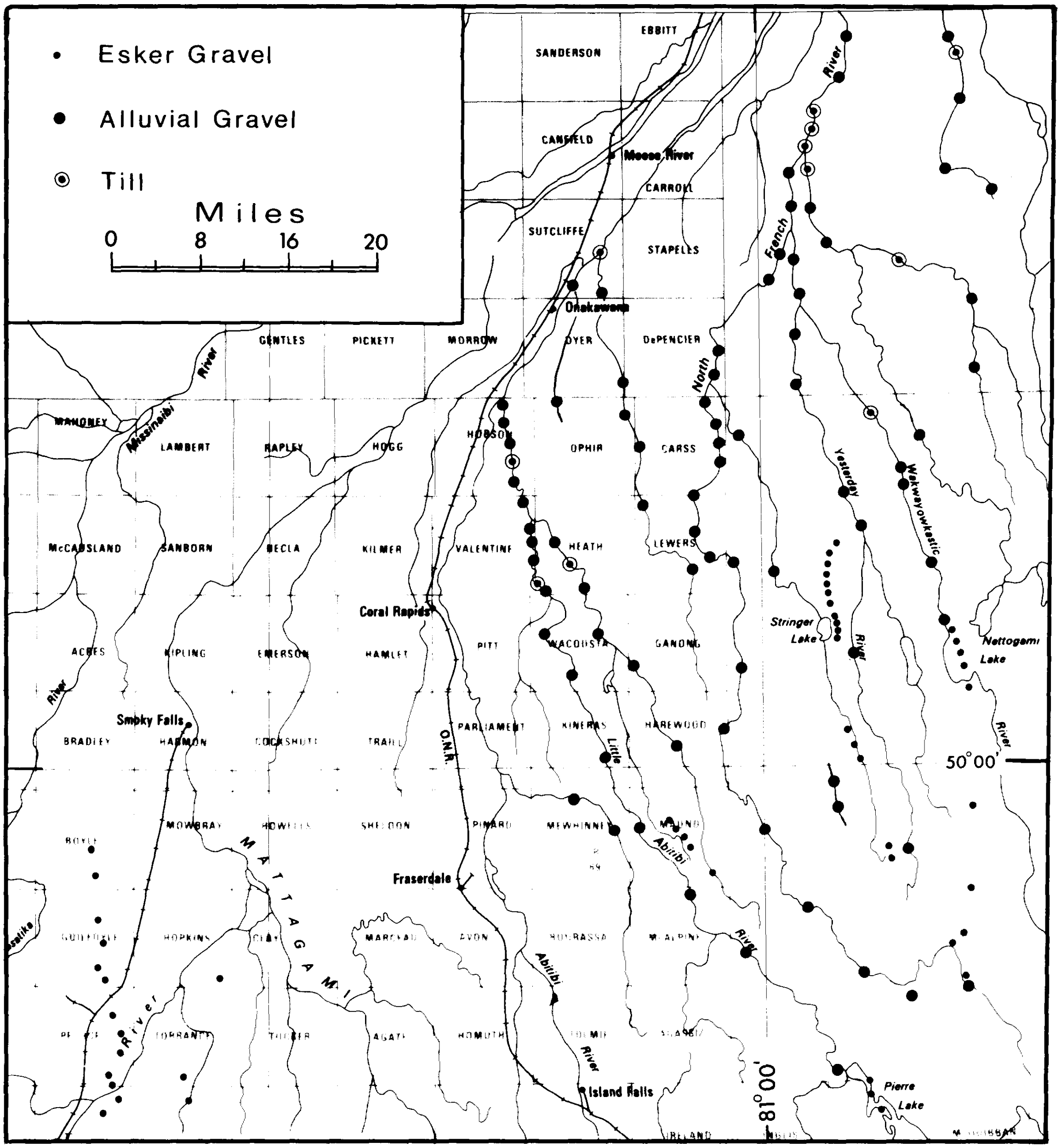
Sampling and Analysis of Alluvial and Esker Gravel: One cubic foot bulk samples of alluvial gravel were collected from riffled sand and gravel bars spaced at intervals of 2 to 8 miles along the major north-flowing drainage systems between Longitude 80°30'W and the Abitibi River (see sketch map). Samples were reduced in volume by wet screening at the sample site and heavy minerals in the size range of 0.5 mm to 1.23 mm were concentrated by a gravitation procedure at a field base camp. The field concentrates were shipped to laboratories of the Ontario Division of Mines, Mineral Research Branch, where clean heavy mineral concentrates were prepared using diluted methylene iodide (specific gravity = 3.1). Heavy minerals were identified and sorted visually under a binocular microscope and selected kimberlite indicator minerals (e.g. pyrope garnet, chrome diopside, ilmenite) were investigated further using indices of refraction, x-ray determinations of lattice cell dimensions, and electron microprobe analysis.

Similar procedures were followed in the recovery and examination of heavy mineral concentrates obtained from pits excavated along esker nodes or crests at ½- to 4-mile intervals. In addition, a second bulk sample was collected at each esker site, and a rough heavy mineral concentrate was obtained by panning. The pan concentrate was later screened to isolate the -30 to +250 mesh fraction and the heavy minerals were recovered from this material using terabromethane (specific gravity ≐ 2.96). These heavy mineral concentrates were pulverized and analyzed for Cu, Zn, Pb, Ni, Co, Ag, by atomic absorption spectroscopy.

At each esker site, a volume sample of approximately 200 clasts in the size range of 8 to 16 mm was collected. These clasts were later identified, classified, and counted according to lithology. Selected clasts from eskers located south of the Kesagami Lake 'greenstone' belt were analyzed for SiO_2, total Fe, CaO, MgO, K_2O, Cu, Zn, Ni, and Ag. An additional 57 clasts were analyzed for one or more of Cu, Zn, Pb, Ni, Ag, Mo, Fe, Ti, and U.

Heavy minerals were also investigated in 11 bulk samples of till collected from river bank exposures. These included samples from till sheets overlying and underlying the Missinaibi interglacial beds.

A new occurrence of the Coral Rapids-type 'kimberlite'-lamprophyre was discovered intruding highly sheared granulite gneisses along the Little Abitibi River in south-central Wacousta Township. The dark, ultramafic rock is apparently dike-like in form, contains sub-rounded xenolithic fragments of granitic basement rocks, and has the following chemical analysis:



Sketch map – Site locations for samples of esker gravel, alluvial gravel and glacial till in the Moose River Basin.

Oxides in weight percent;

SiO_2 - 38.9; Al_2O_3 - 7.88; Fe_2O_3 - 4.26; FeO - 7.68; MgO - 16.4; CaO - 14.7; Na_2O - 2.64; K_2O - 0.43; H_2O^+ - 2.73; H_2O^- - 0.74; CO_2 - 0.18; TiO_2 - 2.21; P_2O_5 - 0.79; MnO - 0.22.

trace elements in ppm;

Ba - 630; Sr - 800; Cu - 100; Ni - 440; Co - 70; Cr - 950; V - 300; Zn - 95; Zr - 190.

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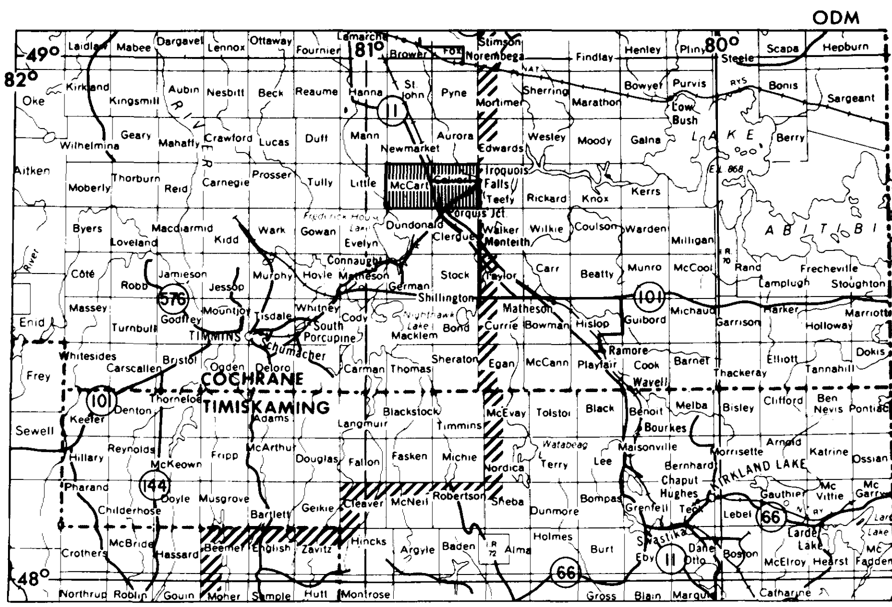
No.25 MAGNETIC SURVEY OF CALVERT AND McCART TOWNSHIPS

DISTRICT OF COCHRANE

by

J.A. McCance[1] and D.R. Wadge[2]

LOCATION: Calvert and McCart Townships are located 40 road miles northeast of Timmins. Access is provided by Highways 11, 67, 578, and 577. Gravel concession roads and other unpaved roads are readily accessible by 4-wheel drive vehicles.



LOCATION MAP

Scale: 1 inch to 25 miles

The Ontario Northland Railroad from North Bay to Cochrane passes through Calvert Township. A spur line from Porquis Junction services the town of Iroquois Falls.

MAGNETIC SURVEY: As during previous years (Middleton 1973; Moon 1972b; McCance 1972) a relative, vertical field ground magnetic survey was carried out. Instrumentation included Scintrex MFD-2 and MF-2 fluxgate magnetometers and a

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McPhar M-700 magnetometer. All unsurveyed ground within the overall 72-square mile area was surveyed using traverses spaced at 880-foot intervals. Magnetic readings were taken every 100 feet along pace-and-compass traverse lines, controlled by the location of prominent topographic features recognized on aerial photographs at a scale of 1 inch to 880 feet. Diurnal variations were monitored to an accuracy of 10 gammas using the McPhar M-700 magnetometer and a Rustrak model 288 recorder powered by a 12-volt automobile battery. All survey results were compiled with various ground magnetic surveys filed by companies with the Ontario Ministry of Natural Resources for assessment work credit, and survey results donated to the project. Relative differences between company survey values and present survey values were obtained by reoccupying several company base stations located in areas having low magnetic gradients. All results were arithmetically adjusted to the magnetic base-level established during this survey. The base level value used was 875 ± 10 gammas for the Alexo magnetic base station (Moon 1972a).

Where feasible an ABEM Kappameter KT3 was used to measure magnetic susceptibilities in-situ. However, susceptibility data is lacking, a result of the extremely low percentages of outcrop within the area. All values obtained will be used as a controlling factor in any qualitative interpretation of rock type or structure.

MINERAL EXPLORATION: Early exploration efforts in McCart and Calvert Townships indicated the presence of a pyrrhotiferous serpentine area identical to the nickeliferous Alexo ore body in adjoining Dundonald Township (Baker 1917, p.270-272). Geophysical, geological, diamond drilling, and trenching programs have been carried out intermittently in the area since that time.

In the late 1940s and early 1950s The International Nickel Company of Canada Limited, Canadian Johns-Manville Company Limited, Dominion Gulf Company, The Arrow Timber Company Limited, and the Quebec Asbestos Corporation Limited continued exploration for base metals and asbestos. Most of this work was concentrated on the search for asbestos in serpentinized ultramafic bodies.

During the 1960s several scattered geophysical surveys and diamond drill programs were conducted outside of the main ultramafic areas.

At present Noranda Exploration Company Limited is conducting detailed ground electromagnetic and magnetic surveys in McCart Township as follow-up work to an airborne geophysical and staking program; Canadian Johns-Manville Company Limited has recently completed a magnetometer survey on claims held by M. Montfort in Calvert Township (Assessment Files Research Office, Ontario Division of Mines, Toronto).

Prospector R. Allerston (personal communication, 1973) holds several claim blocks in McCart Township.

GENERAL GEOLOGY: The area lies in the Northern Clay Belt and outcrops are scarce, comprising only 2 to 4 percent of the area. The terrain between the few prominent outcrop ridges is a relatively flat clay plain with numerous areas of muskeg and peat bog. A prominent esker ridge roughly parallel to the boundary between the two townships is one of the outstanding topographical features in the whole area (Boissonneau 1965). To the east in Calvert Township the Abitibi River and its tributary streams cut the clay plain.

Preliminary mapping at a scale of 1 inch to ¼ mile was compiled for McCart Township by Satterly in 1953 (Satterly 1959) and completed for Calvert Township by Ginn in 1961 (Ginn 1962).

Present information obtained from surface geology and diamond drilling indicate that the bedrock comprises Archean metavolcanics, gabbros, ultramafic intrusive rocks, and granites. Outcropping metavolcanics range from mafic to intermediate in composition. Diamond drill results indicate the presence of some felsic metavolcanics in west-central and central McCart Township. The metavolcanics exhibit pillowed, massive, and fragmental structures. Granite and syenite outcropping along the Abitibi River intrude the metavolcanics north and west of Iroquois Falls (Ginn 1962). Gabbroic sills, lenses, and dikes intrude pillowed metavolcanics in northern and northwestern Calvert Township, north-central and northeastern McCart Township and along the southern boundary of McCart Township (Ginn 1962). Lenses and sill-like bodies of serpentinized ultramafic rocks intrude the metavolcanics in northern McCart Township and northwestern Calvert Township. Where noted in outcrop, north-trending diabase dikes cut all Archean rocks.

STRUCTURAL GEOLOGY: Several synclinal and anticlinal axes striking roughly east-west have been indicated in the area (Pyke *et al*. 1973). Several faults and shear zones of various trends were observed by Ginn (1962). During the present survey no other structural features were observed.

ECONOMIC GEOLOGY: Disseminated pyrrhotite occurs close to a sharp contact between serpentine and andesite in lot 7, concession V, McCart Township (Baker 1917). Baker (1917) further reported that associated small stringers of massive sulphide mineralization contain as much as 3 percent nickel.

Minor, as yet uneconomic, sulphide (pyrrhotite, pyrite, some chalcopyrite) mineralization has been reported from various drill holes across the northern and central parts of the townships.

In lot 9, concessions III and IV, Calvert Township, quartz, quartz-carbonate, and quartz epidote veins, pyritiferous in some places, have been opened by old trenches and diamond drilling, with unencouraging results (Ginn 1962). Similar calcite and quartz veins were observed by D.R. Wadge in the metavolcanics of lots 5 and 6, concession I, McCart Township.

Exploration test pitting and drilling programs within the serpentinized peridotites of the area have located minor occurrences of asbestos (Vos 1971). Fibre lengths seldom less than 1/8 inch have been reported by Ginn (1962).

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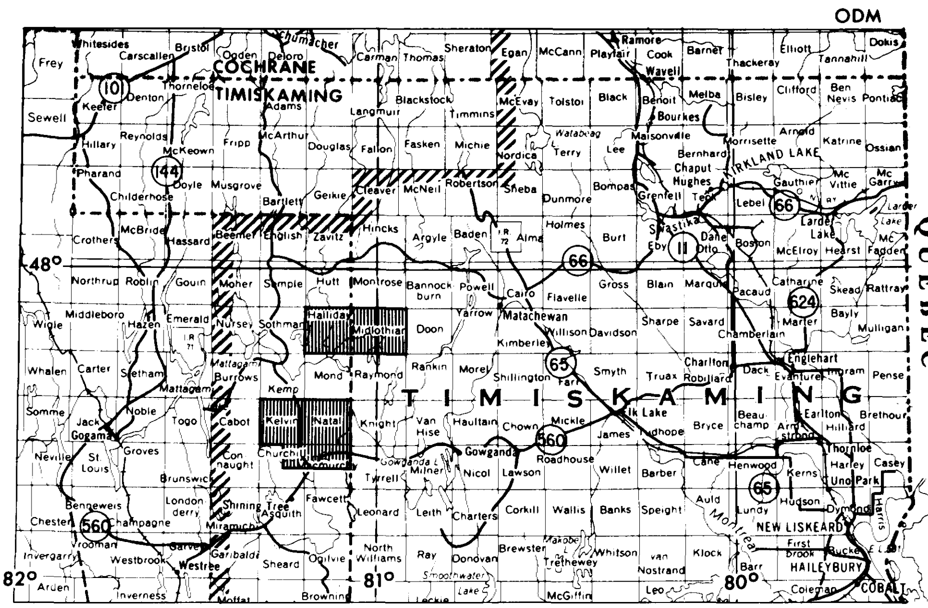
No. 26 RECONNAISSANCE EXPLORATION GEOCHEMISTRY-QUATERNARY GEOLOGY RESEARCH WITHIN FELSIC CENTRES OF THE ABITIBI GREENSTONE BELT DISTRICTS OF SUDBURY AND TIMISKAMING

by

L.G. Closs[1] and E.V. Sado[2]

INTRODUCTION: Combined reconnaissance exploration geochemistry-Quaternary geology surveys were carried out in areas underlain by Archean intermediate to felsic metavolcanics within Halliday, Midlothian, Kelvin, Natal, Churchill,



LOCATION MAP

Scale: 1 inch to 25 miles

and Macmurchy Townships. The purpose was to investigate metal dispersion in Quaternary deposits overlying and down-ice from known base metal showings, with a view to applying these results to the problem of detecting this type of mineralization within areas blanketed by glacial sediments. The principal

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criteria for project area selection were: (1) presence of geological environments suitable for the formation of stratiform volcanogenic massive sulphide deposits; (2) known occurrences of sub-economic Zn-Cu-Pb-Ag-Au mineralization; (3) reasonably thin glacial overburden cover; and (4) adequate outcrop exposure.

Halliday and Midlothian Townships are located approximately 40 miles south of Timmins and 20 miles west of Matachewan within the south-central part of the Abitibi 'greenstone' belt. Geological mapping by Bright (1970) revealed that this region is largely underlain by a volcanic dome, which has a dacitic to rhyolitic core and an intermediate, andesite to dacite, margin. The northern edge of the Halliday metavolcanic dome is flanked by Timiskaming-type metasediments. Mafic and ultramafic stocks and sills intrude marginal rhyolitic units of the dome. Archean metavolcanics and metasediments in the eastern half of Midlothian Township are overlain unconformably by flat to gently dipping sedimentary strata of the Huronian Cobalt Group.

Recent exploration activity in these townships, has largely focused on the base metal potential of the interstratified felsic and intermediate metavolcanic pyroclastics.

Kelvin, Natal, Churchill, and Macmurchy Townships are located approximately 50 miles south of Timmins and 30 miles southwest of Matachewan. The geology of these townships is not well known and the distribution of felsic metavolcanics outlined by Pyke et al (1973) at a scale of 1 inch to 4 miles is mainly based on early reconnaissance surveys of Gledhill (1926) and Laird (1934). More recently Carter (1972; 1973) has mapped the geology of Macmurchy and Churchill Townships at a scale of 1 inch to ¼ mile.

QUATERNARY GEOLOGY: Till of Wisconsinan Age (Boissonneau 1968) overlies the bedrock in the Halliday-Midlothian area and because of the generally high outcrop density, the till thickness is extremely variable and exhibits a morainic form east of Lloyd Lake. The till is mainly a stony, silty sand till, which is locally gravelly or silty. North-south-trending deposits of ice contact stratified drift occur east of Campbell Lake and at a second locality bisected by the northern arm of Lloyd Lake. A sandy outwash plain in Halliday Township forms a continuous body to the southwest, which grades into a discontinuous veneer to the north and east. Striated bedrock surfaces in the Halliday-Midlothian area indicate ice flow direction between 170° and 185°.

Till deposits in Kelvin, Natal, Churchill, and Macmurchy Townships are similar in most respects to the till in the Halliday-Midlothian area, the drift cover in the former area is variable but generally thinner than in the northern project area. Striae, glacial grooves and crag and tail features indicate a southerly glacial advance between 170° and 210°. However, locally rugged bedrock topography has substantially influenced the direction of ice flow in specific locations.

The margin of a kame moraine complex occurs along the southern edge of the map-area parallel to Highway 560. Ponding of glacial meltwaters has produced a discontinuous lacustrine deposit of medium sand to silty fine sand overlying till. The widespread outwash plain in Halliday Township extends in a southwesterly direction and covers the northwest and central parts of

Kelvin Township (Boissonneau 1965). Lacustrine facies along the margins of this outwash were deposited during the same geologic event. A gritty sand, till-like material, is encountered overlying the outwash sediments in a few places. This unit represents ablation sediments derived from melting ice blocks in a proglacial lake and care should be taken in geochemical sampling to avoid confusing this material with the lower till unit.

GEOCHEMICAL SAMPLING AND ANALYSIS: In Halliday and Midlothian Townships, soils, till, and bedrock material, were collected from within a block measuring approximately 6 miles (east-west) by 5 miles (north-south) that included the western two-thirds of Midlothian and the eastern one-fifth of Halliday Townships. Reconnaissance overburden sampling consisted of the collection of upper 'B' horizon soils and glacial till material at sites spaced 1,000 feet apart along east-west traverses normal to the regional ice flow direction and spaced at 2,000-foot intervals north-south. Where possible, grid lines of the Glen Copper Mines Limited, the Newmont Mining Corporation of Canada Limited, and The Hanna Mining Company, were utilized; elsewhere, sites were located by pace and compass traverses tied to prominent landmarks on 1 inch to ¼ mile air photographs. More detailed surveys south of the Patricia Lake showing of Glen Copper Mines Limited and near Marshall Lake south of the United Asbestos Incorporated development pits, consisted of overburden sampling at 500-foot intervals along north-south picket lines spaced 400 feet apart. Additional samples of upper 'B' horizon soil were collected at intermediate locations. One site in ten was sampled in duplicate to determine sampling variability. Two hundred and sixty-six till samples and three hundred and ninety upper 'B' horizon soil samples were collected from this project area.

Chips of unweathered bedrock were collected at 552 sites within the Halliday-Midlothian survey block. These were obtained from exposures spaced approximately 1,000 feet apart, with this interval being shortened near known base metal showings.

Similar survey procedures were used for a second reconnaissance examination of a 24-square mile area located in parts of Kelvin, Natal, Churchill, and Macmurchy Townships. Till and soil samples were collected at 216 sites situated at ¼ mile intervals along east-west pace and compass traverses separated by 1 mile north-south intervals. Representative samples of bedrock were collected at 237 locations along traverse lines oriented approximately normal to the regional east-west strike of the layered metavolcanic-metasedimentary sequence.

Soil and till samples were oven-dried at $80^{\circ}C$. Tills were passed through a nest of sieves containing 20, 80, 120, and 250 mesh screens whereas soils were only passed through an 80-mesh screen. The minus 80-mesh 'B' horizon soils, the heavy mineral separate (using tetrabromethane, specific gravity 2.96) of the minus 80 plus 250-mesh fraction of the till, and the minus 250-mesh fraction of the till were analyzed for hot HNO_3-HCl extractable Cu, Zn, Pb, Ni, Co, Mn, and Cr by atomic absorption spectrophotometry. The rock samples were analyzed for Zn, Cu, Pb, Ni, Co, and Mn by identical atomic absorption procedures and for SiO_2 and total Fe by X-ray fluorescence. Sample preparation was done by the field party and the chemical analysis was undertaken by the Mineral Research Branch, Ministry of Natural Resources.

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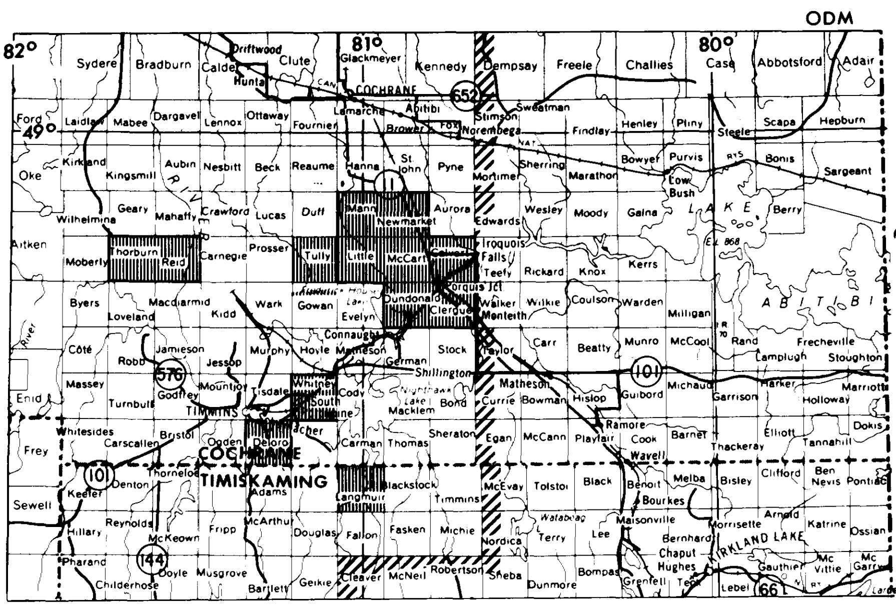
No.27 GEOCHEMISTRY OF ULTRAMAFIC ROCKS IN THE ABITIBI GREENSTONE BELT DISTRICTS OF COCHRANE AND TIMISKAMING

by

W.J. Wolfe[1]

This study is supplementary to the project that commenced during the summer of 1972. In 1972, samples of ultramafic rocks were collected from Skead, Catharine, McElroy, and Munro Townships, to determine the distribution of Cu, Ni,



LOCATION MAP   Scale: 1 inch to 25 miles

Co, and S within and between the ultramafic bodies (Wolfe 1972).

A total of 271 ultramafic rock samples were collected during the field season in 1973. The survey included the following Townships: McCart, Calvert, Clergue, Dundonald, Mann, Newmarket, Tully, Deloro, Whitney, Langmuir, Reid, and Thorburn. Where possible, the samples were obtained in the field but quite often, this was not possible due to the poor outcrop exposures. Hence, a number of samples were obtained from the logged drill cores of a few mining companies who had conducted diamond drilling through the ultramafic bodies in the area.

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The sampling included:

(1) unclassified ultramafic lenses. (2)A differentiated sill of ultramafic and gabbroic rocks in Dundonald and Clergue Townships which Naldrett and Mason (1968), classified as a "stratiform intrusion". The sill was intruded as a conformable sheet, 4 by 2 miles in extent, the ultramafic part of which is 1,500 feet thick.

(3) Highly serpentinized peridotite sills in McCart and Deloro Townships (Naldrett 1966).

The samples are being examined petrologically and will be analyzed by total decomposition and partial leaching techniques to determine sulfur content and copper-nickel-cobalt distributions.

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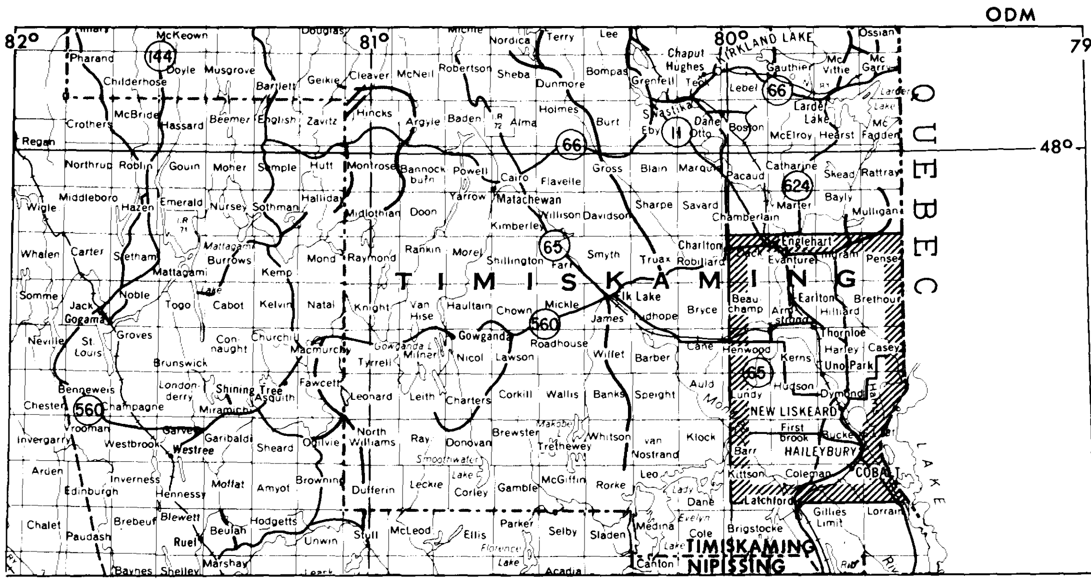
No.28 GRAVITY SURVEY OF THE LAKE TIMISKAMING-ENGLEHART REGION DISTRICT OF TIMISKAMING

by

John A. McCance[1]

LOCATION: The survey area is bounded by Latitudes 47°20' and 47°50'N and by Longitudes 79°30' (Quebec boundary) and 80°10'W. Its 29 townships cover an area of approximately 900-square miles. Located between the Towns of Latchford,



LOCATION MAP

Scale: 1 inch to 25 miles

Elk Lake, and Englehart and extending to the Quebec border it excludes the waters of Lake Timiskaming and that section of the area southwest of the Montreal River.

External access is provided by Highways 11 and 65 while a large network of secondary and other roads facilitate travel within the area. The Ontario Northland Railroad main line from North Bay to Cochrane passes through several townships within the area. Spur lines to Charlton and Elk Lake also exist.

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Accessibility by water is limited to the southern and northern sections of the survey area. Where such access exists it is generally of excellent quality particularly travel along the Montreal River and on Lake Timiskaming.

Numerous landing sites are present throughout the area making access by helicopter feasible. However, the extensive agricultural activity in the central sector and rugged relief in the southwestern sector restrict such travel to a minimum. Access by fixed-wing, float-equipped aircraft is limited to the southern and northwestern sectors. Scheduled air service is available to Earlton from which point chartered aircraft can be hired.

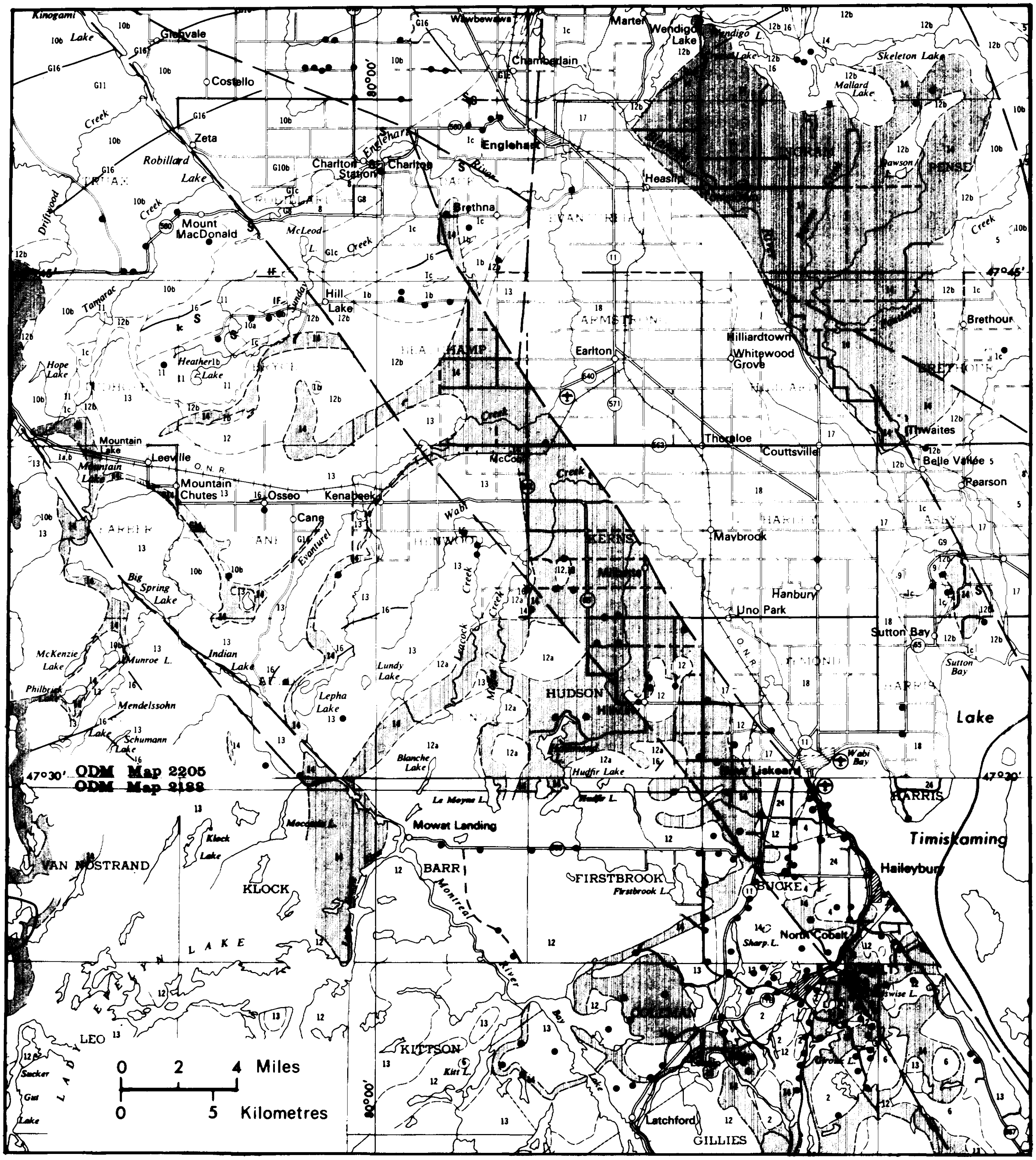
THE GRAVITY SURVEY:

Gravity Survey Procedure: The gravity survey was conducted and the observations reduced according to National Standards as defined by the Earth Physics Branch, Gravity Division, (1973). In the regional phase of the project about 750 gravity stations were established with the station interval not exceeding 1.0 mile (1.6 km) in areas having adequate accessibility. In poor access areas stations were occupied at intervals no greater than 2.0 miles (3.2 km). In each of the two detailed phases of the project, the Kerns-Hudson gravity high investigation, and the Peterson Lake 'basin' survey, several traverses were completed, with about 250 gravity measurements being recorded at station intervals of 0.25 mile (0.4 km).

Field Instrumentation: The gravity observations were made using two LaCoste and Romberg Model G Geodetic Gravity Meters. Station elevations (above mean sea level) were measured to an accuracy of 3 feet (1 m) using two Wallace and Tiernan Surveying Altimeters (Type FA-181). Dry air temperature and relative humidity were also measured using Wallace and Tiernan sling psychrometers. Station positions during detail traversing were recorded to an accuracy of 1 percent using a Nu-Metrics digital measuring instrument.

Gravity Control Stations and Corrections: Survey control on the gravity measurement program was accomplished by occupying previously established control stations tied to the primary gravity control network established by Middleton (1972) and by the Earth Physics Branch , Gravity Division (1973). As Model G Gravity Meters have a range of over 7,000 Milligals, a reading accuracy of $\pm$.01 Milligal, and a drift rate of less than 1 mgl per month, only morning and evening control station checks were found necessary. The average maximum daily closure error was 0.1 mgal. The usual Latitude, free air, and Bouguer corrections were applied to the gravity data (Buck and Tanner 1972). Terrain corrections will be applied.

Most of the control stations had exact elevations secured by bench marks of the Geodetic Survey of Canada or profiles from the Ontario Ministry of Transportation and Communications. Elevations of the control stations in the interior parts of the area were determined by Wallace and Tiernan altimeters. Elevations of the control stations on Lake Timiskaming were determined relative to lake water level. Looping procedures were used in all instances, tying altimetry values to known elevations every hour where possible. Air temperature, relative humidity, and network adjustment corrections, were applied to all altimetry data.



Geologic Plan of the Lake Timiskaming Englehart Region showing sampling sites

ROCK SAMPLING AND DENSITY ANALYSIS: The primary purpose of the gravity survey was to map the regional features of the gravity field that correspond to the larger geological units and structures. In order to assign mean density values to the major geological formations, a total of 1,200 rock specimens were selected for bulk specific gravity determinations using a Mettler balance. These specimens represented 550 samples collected from outcrop near gravity stations during the 1973 field season, and 650 samples previously collected and identified by Dr. Robert Thomson, former Resident Geologist for the Cobalt area (Lovell 1971). The raw data from the rock density program were reduced and punched onto paper tape using the computer facilicies of the School of Mines, Haileybury Campus of the Northern College of Applied Arts and Technology. The distribution of the surface sampling sites and probable location of any Nipissing diabase as presently known within the map-area are shown in the accompanying geologic map. All rock densities will form part of a more detailed study of the probable origins of the interesting gravity anomalies in the Lake Timiskaming-Englehart Area.

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Phanerozoic Geology Section

PHANEROZOIC GEOLOGY SECTION SURVEYS

by

D.F. Hewitt[1]

In 1973 there were five Quaternary field parties mapping in Southern Ontario in the St. Marys, Palmerston, Collingwood, Dunnville, and Alexandria areas. One Quaternary sub-party was attached to the geochemical field party in Northern Ontario, south of Timmins. One Paleozoic field mapping party was working along the Niagara Escarpment from Hamilton to Collingwood.

The Waterloo-Wellington Aggregate Study was completed by Professors McLellan and Bryant of the University of Waterloo.

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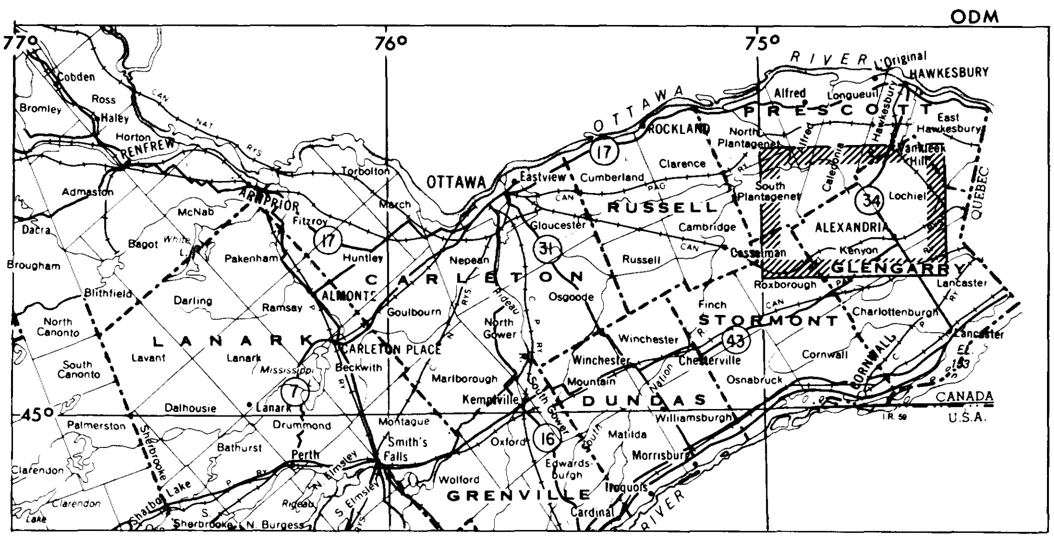
No.29 QUATERNARY GEOLOGY OF THE ALEXANDRIA AREA SOUTHERN ONTARIO

by

Q.H.J. Gwyn[1] and H. Lohse[2]

LOCATION: The map-area is bounded by Latitudes $45^{\circ}15'$ and $45^{\circ}30'$ and Longitudes $74^{\circ}30'$ and $75^{\circ}00'$W. The area comprises the Alexandria Topographic Sheet (NTS 31G/7).



LOCATION MAP Scale: 1 inch to 25 miles

PHYSIOGRAPHY: The Alexandria map-area covers the drainage divide between St. Lawrence and Ottawa Rivers. Approximately 60 percent of the area is within the drainage basin of Ottawa River. Elevation ranges from 175 feet (53m) to 375 feet (114m) above sea level. The area can be divided into a lowland plain and an upland area. The lowland covers the northwestern part of the map-sheet. It is underlain by deposits of the Champlain Sea and the ancestral Ottawa River into which channels have been cut by the river. It has a generally flat topography and a local relief of 10 m (33 feet). The upland area has rolling topography and a local relief of 25 m (83 feet).

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[2]Student, University of Waterloo, Waterloo, Ontario.

GENERAL GEOLOGY: The bedrock units include sandstone, limestone, dolostone, and shales, and range in age from Cambrian to Upper Ordovician. The oldest unit is the Nepean Formation (Cambrian) composed of cream coloured orthoquartzite that is typically crossbedded and contains ripple marks. This is overlain by the March Formation (Lower Ordovician) consisting of alternating grey fine- to medium-grained sandstone, sandy dolostone, and dolostone. The March Formation grades up into the Oxford Formation of thick bedded dark grey dolostone. It is overlain by the Rockcliffe Formation (Middle Ordovician) consisting of friable green and black shale and sandstone lenses, but is not exposed in the area. Conformably overlying this is the St. Martin Formation of grey shaly or dolomitic limestone. It is poorly exposed in the area. The Ottawa Formation overlies the St. Martin limestone and is the most extensive and best exposed unit. It is dominantly limestone, thick bedded with nodular horizons and shale partings. It has been subdivided into biostratigraphic zones by Wilson (1946). The youngest bedrock units present are the Eastview and Billings Formations (Upper Ordovician). The Eastview Formation consists of interbedded shale and fine-grained dark grey limestone, and the Billings Formation of black shale.

One till unit, consisting of pebbly (10-30 percent by weight) silt to sandy silt till, is present in the map-area. It is compact, has a blocky to fissile structure and is olive to olive-brown colour (5Y4/4 to 2.5Y4/4, Munsell System) when oxidized, and very dark grey (5Y3/1) when unoxidized. The till is contiguous with the surface silt till in the Cornwall map-area (NTS: 31G/2) which Terasmae (1960) correlated with the Fort Covington Till (MacClintock 1958).

Following the retreat of the Fort Covington ice the whole map-area was inundated by the Champlain Sea. Four types of marine sediments were deposited in it. The most widespread is clay, slightly sandy clay, and silty clay. The second type consists of massive or flat bedded medium to fine silty to slightly silty sand. Stratigraphically and compositionally intermediate between the first two types of sediments is a deposit of rythmically interbedded sandy clay and fine sand or slightly sandy clayey silt. These three deposits contained few fossils. The fourth deposit is bouldery to cobbly gravel found in beaches, spits, or offshore bars, which occur at any elevation ranging between 200 feet, (61 m) and 375 feet (114 m). The gravel is seldom more than 5 m (15 feet) thick and of limited aerial extent. The abundant boulders have been measured up to 3.5 m (10 feet) in diameter. In all but the largest deposits it can be demonstrated that the gravel was derived from the underlying till. The gravel usually contains fossils including most commonly Hiatella artica and Macoma balthica and in a few places Mytilus edulis and barnacles identified by Terasmae (1960) as Balanus Sp.

As the Champlain Sea receded the ancestral Ottawa River deposited an extensive delta (Chapman and Putnam 1966, p.48-49) part of which occurs in the northwest corner of the map-area. The deltaic materials consist of fine to medium sands showing ripple drift cross-lamination with flow direction to the east. During further recession of the Champlain Sea, the Ottawa River eroded channels into the deltaic deposits and into the underlying marine sediments, formed mid-channel bars, and cut terrace scarps.

MINERAL RESOURCES: Bedrock, gravel, and sand are all utilized in the map-area. Three quarries are in operation: one each in Caledonia, Kenyon, and Roxborough Townships. At all the sites, the Ottawa Formation, where it consists of thick-bedded medium-grained crystalline limestone, is being quarried. It is being used as crushed aggregate in concrete, asphalt, and cement treated base. In view of the abundant outcrops and generally thin (less than 25 feet; 8 m) cover of overburden in many areas, bedrock should be available in several townships including Caledonia, Kenyon, Lochiel, Roxborough, and West Hawkesbury.

There are approximately 50 gravel and sand pits operating in the area. Nearly half of these are in Kenyon Township and a second concentration was found in the northern part of Lochiel Township and the southern part of West Hawkesbury Township. No pits were found in Caledonia and South Plantagenet Townships within the map-area. In all pits the gravel was deposited as marine beaches.

HAZARD LANDS: Apart from the obvious hazard lands of bogs and flood plains the present area includes a potentially very serious hazard in the form of sensitive marine clays that lose nearly all of their strength once they have been disturbed (remoulded). Thus in road and house construction they provide very poor and potentially disasterous foundation qualities. The clays are also prone to form earthflows in areas of high gradients such as along river banks. Seven landslide scars were found in the map-area, the largest of which covered 20 acres. Considerably larger landslides have occurred outside the map-area along the ancestral Ottawa River and along South Nation River as recently as 1971 (Eden *et al*. 1971).

A common factor at each of the sites is the stratigraphy of the sediments. Typically, 4 to 5 m (13 to 17 feet) of fine silty deltaic sand overlie 1.5 m (5 feet) of interbedded silty sand and clayey silt that grade down into the sensitive clays. The sediments have an apparently low porosity. It is suggested that when the deltaic sands become water saturated they form a considerable load at the top of slopes and may be a contributing factor causing the landslides.

Mr. Lohse began a thesis project to study several properties of the clays on a regional basis. The project included mapping the deposits in Scotch River basin, the bedrock topography, the description of stratigraphy at 23 sites, and sample collection. Textural and certain mineralogical analyses will be made, as well as the measurement of Atterberg Limits, plasticity, sensitivity, and shear strength.

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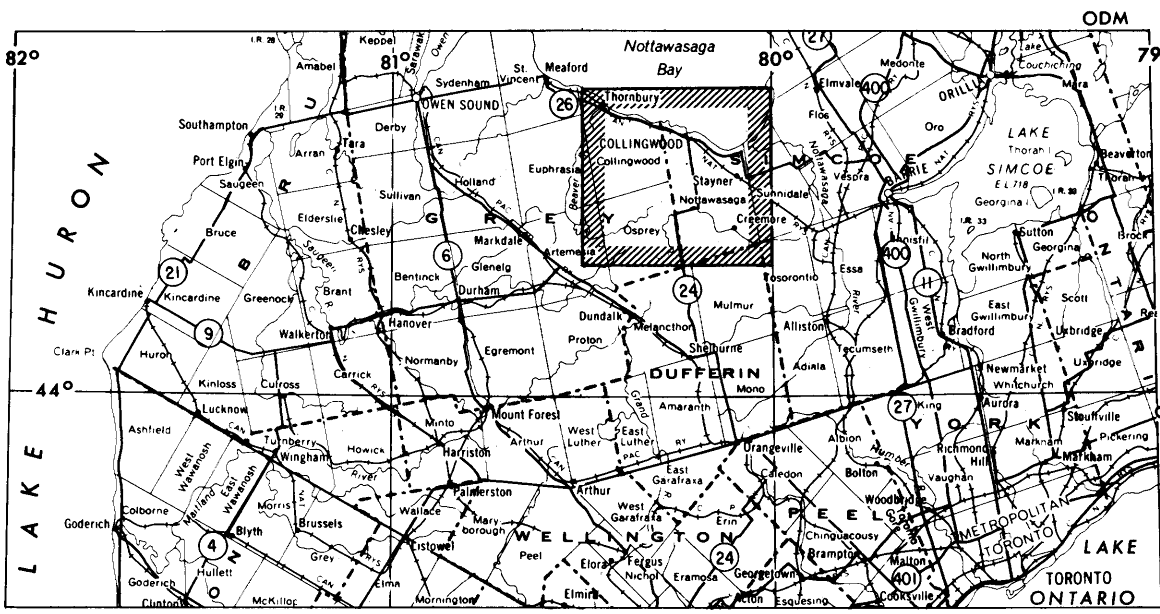
No. 30 QUATERNARY GEOLOGY OF THE COLLINGWOOD AND NOTTAWASAGA AREA SOUTHERN ONTARIO

by

G.J. Burwasser[1]

LOCATION: The Collingwood map-area (NTS 41 A/8) is located between Latitude 44°15' and 44°30'N, and Longitude 80°00' and 80°30'W. The Nottawasaga map-area (NTS 41 A/9) is bounded by the same Longitudes but extends northerly to



LOCATION MAP

Scale: 1 inch to 25 miles

Latitude 44°45'N. The Town of Collingwood (pop. c. 10,000) is in the north-central part of the area on the shore of Nottawasaga Bay. Mapping of the area was carried out during the summer of 1973.

PHYSIOGRAPHY: The Collingwood-Nottawasaga area is dominated physiographically by the Niagara Escarpment, which divides the area from northwest to southeast. Maximum relief above the Escarpment is 375 feet (115 m) although local relief rarely exceeds 100 feet (30 m). Surface elevations generally drop toward the

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southwest from c.1775 feet (541 m) a.s.l. near Singhampton on the eastern edge of the Escarpment to c.1400 feet (427 m) a.s.l. at Eugenia Lake near the head of the Beaver Valley. Moraines and spillways all have a southwesterly trend. The drift cover (sandy till and coarse-grained ice-contact stratified material) is thin and the topography is strongly controlled by the bedrock surface.

Below the Escarpment the land surface drops to the northeast and southeast in the Collingwood area and to the north in the Nottawasaga area. The total relief is 700 feet (213 m). Local relief at the Escarpment base exceeds 300 feet (91 m) in many places but in areas farther removed it is generally less than 50 feet (15 m). Drift thickness varies widely with the nature of the deposits. The major physiographic features are the raised beaches, bluffs, and dunes formed along the shores of the glacial lakes which leveled the till plain deposited by the Georgian Bay ice lobe. The lowest elevation throughout the entire map-area is 580 feet (177 m) a.s.l., the present level of Nottawasaga Bay.

GENERAL GEOLOGY: Dolostone of the Middle Silurian Amabel Formation, which caps the Niagara Escarpment, underlies most of the west half of the Collingwood area and the southeast corner of the east half. The Lower Silurian Cataract Group (dolostone and sandstone), and the Upper Ordovician Queenston shale and Georgian Bay limestone and shale form the face of the Escarpment. These formations underlie the remainder of the west half of the Collingwood area, about one-third of the Collingwood East area and most of the Nottawasaga West area. Numerous outcrops occur in the Beaver Valley, on Blue Mountain, Osler Bluff and Osprey Bluff (south of Pretty River valley), and in the valleys of the Mad and Noisy Rivers.

The Upper Ordovician Whitby shales and limestones and the Lindsay and Verulam limestones of Middle Ordovician age underlie the northeast half of the Collingwood East area, the east half of the Nottawasaga area and a narrow strip along the bay in the Nottawasaga West area. Outcrops of these rocks are limited to the lakeshore between Brocks Beach and Camperdown. Further bedrock information is given in Summary Number 31 (Telford, this volume).

Till is the principal surficial material that occurs in this area. There are also extensive sand deposits of glaciofluvial, lacustrine, and aeolian origin. Ponded clay and silt is preserved at several isolated localities throughout the map-area. All the Quaternary deposits are Middle or Late Wisconsinan Age.

Four tills can be distinguished in the area, although they may represent only three ice advances, all from the Georgian Bay ice lobe. The oldest till with any significant areal exposure is a fissile, compact, slightly pebbly, sandy silt till. A radiocarbon analysis (BGS 182 A)[2] from plant detritus below this till yielded a date of 31,500± 1000 years B.P. The age and texture suggest possible correlation with the Catfish Creek Till but this is speculative at present. The till is exposed above the Escarpment in the Banks Moraine and is the surface till throughout most of the map-area below the Escarpment.

[2] Analysis supplied by Dr. Jan Terasmae, Department of Geological Sciences, Brock University, St. Catharines, Ontario.

The next oldest till is a silt till containing a very high percentage of Queenston shale in both the matrix and the clast fraction. It directly overlies the sandy silt till in the Beaver Valley and forms a small moraine on Osprey Bluff (south of Pretty River valley).

A clayey silt till is the surface till in the vicinity of Sunnidale Corners. It is a waterlaid till and incorporates varved sediments of clay and clayey silt. The till is compact, blocky and contains less than 2 percent clasts. It is younger than the sandy silt till but its relationship to the silt till (Queenston matrix) is not clear.

Above the Escarpment the surface till is a massive, pebbly, silty sand till, loosely compacted and generally reworked by meltwater. This till (along with considerable ice-contact deposits) forms the Singhampton and Gibraltar Moraines.

Outwash sands and gravels occur along the Beaver and Mad Rivers. The face of the Escarpment from Smithdale to Pretty River Valley is masked with outwash sand and minor amounts of gravel related to spillways that paralleled the Escarpment during the last glacial retreat. Large quantities of outwash sand were reworked by Lake Algonquin east of Avening (UTM 740065 Collingwood East) during the cutting of the main bluff (c.760 feet (232 m) a.s.l.). The bluff and associated deposits can be traced across the entire map-area to Lora Bay northwest of Thornbury where its elevation is c.780 feet (238 m) a.s.l. The main Nipissing Bluff, which crosses the map-area sub-parallel to the modern shore, maintains an elevation of approximately 630 feet (192 m) a.s.l. Extensive dune sands have developed over the Nipissing lagoonal sediments in the northeast corner of the map-area.

ECONOMIC GEOLOGY: Few quarries exist within the map-area, but sand and gravel pits are numerous. The Georgian Bay shale is not quarried at present but could be used for brick manufacture or light aggregate. Queenston shale is also suitable for brick and tile products manufacture but is not actively extracted within the map-area. Guillet (1967, p.31-100) gives the properties of these formations. Whirlpool sandstone (Cataract Group) has been quarried for ashlar and coursing stone. Amabel dolostone is presently being excavated for crushed stone and concrete aggregate. Pits producing crushable gravel have been opened in the spillway southwest of Feversham (UTM 500095 Collingwood West), in the Algonquin beaches south of Clarksburg (UTM 425325 Nottawasaga West) and northeast of Avening, in the Nipissing beaches south of Springhurst Beach (UTM 735255 Collingwood East), and in the ice-contact deposits east of Gibraltar (UTM 525200 Collingwood West) and between Dunedin and Glen Huron (UTM 660050, 650110 Collingwood East). Till has been excavated near McIntyre (UTM 565065 Collingwood West) for township roads built through swamp areas on the Escarpment.

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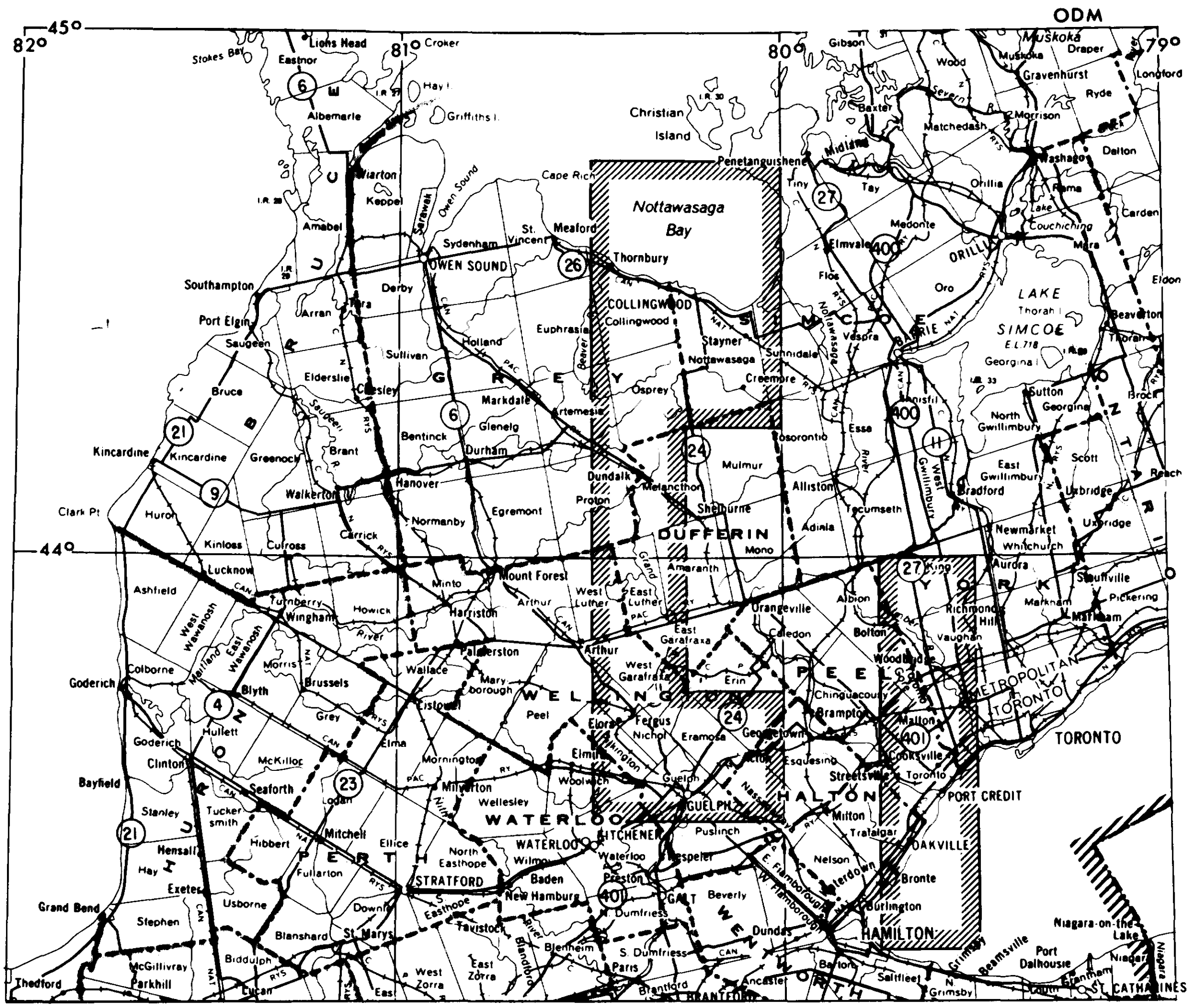
No.31 PALEOZOIC GEOLOGY OF THE NIAGARA ESCARPMENT SOUTHERN ONTARIO

by

P.G. Telford[1]

LOCATION: During the summer of 1973 geological mapping of the Paleozoic rocks was completed for the Hamilton East, Brampton East, Bolton East, Guelph East and West, Orangeville West, Dundalk West, Collingwood East and West, and



LOCATION MAP

Scale: 1 inch to 25 miles

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[1]Geologist, Phanerozoic Geology Section, Geological Branch, O-tario Division of Mines, Parliament Buildings, Toronto

Nottawasaga East and West, National Topographic Series map-sheet areas. This continued a program of mapping and defining the Niagara Escarpment and environs; the Escarpment is now mapped at 1:50,000 scale from Hamilton to Blue Mountain in the Collingwood region.

HAMILTON EAST, BRAMPTON EAST, BOLTON EAST: Two Paleozoic rock units, the Upper Ordovician Georgian Bay and Queenston Formations, are exposed in these map-sheet areas. The Georgian Bay Formation is mainly grey or bluish grey shale with thin grey siltstone and fossiliferous limestone beds in its upper part. It is conformably overlain by the Queenston Formation though the boundary between the units is gradational. The boundary is usually placed at the first appearance of red shales, which typify the upper unit.

Good exposures of these rock units occur in the high banks along Bronte, Oakville, and Etobicoke Creeks, and the West Humber River near Woodbridge. The gradational boundary between the units is well displayed in Oakville Creek about 0.25 mile west of the Queen Elizabeth Way.

GUELPH EAST AND WEST: Paleozoic rock units cropping out in this area include Lower to Middle Silurian Cabot Head, Reynales, Amabel (including Eramosa Member) and Guelph Formations. A small part of the Niagara Escarpment is present east of Acton, near the eastern margin on the Guelph East map-area.

Green shales of the Cabot Head Formation and brown, very finely crystalline, dolostone of the Reynales Formation occur at only one locality in this map-area, along an access road into the Indusmin quarry east of Acton. The remaining outcrops in the eastern half of the Guelph East map-area consist of massive, grey dolostones of the Amabel Formation. These outcrops usually occur as low mounds, possibly representing the eroded remnants of small reef or biohermal structures. Thin bedded, brown bituminous dolostones of the Eramosa Member form a distinct mappable unit trending approximately north-northeast and separating the outcrop belts of the reefal part of the Amabel Formation from the Guelph Formation in the west. Best exposures of the Eramosa dolostones occur along the Eramosa River in the vicinity of Everton, Rockwood, and Eden Mills. Up to 50-feet high cliffs of reefal Amabel dolostones also occur in the Everton and Rockwood area.

Massive, buff coloured dolostones of the Guelph Formation outcrop along the Speed and Eramosa Rivers within the City of Guelph and are exposed in the Canada Gypsum Company Limited quarry on the southwestern edge of the city. They are also well exposed along the Grand River between Fergus and Elora, forming the walls of Elora Gorge.

ORANGEVILLE WEST, DUNDALK WEST: Few Paleozoic outcrops occur in these map-areas. Medium- to massive-bedded dolostones of the Guelph Formation are exposed intermittently along the Grand River between Belwood and Colbeck. The crest of a low hill on the southern edge of Corbetton, about 3 miles southeast of Dundalk, contains a glacially striated, flat outcrop of dark grey sandy dolostone possibly referable to the lower part of the Guelph Formation.

COLLINGWOOD EAST AND WEST, NOTTAWASAGA EAST AND WEST: These map-areas contain the most complete Paleozoic sequence of the regions mapped. The lithostratigraphic units with their approximate ages are listed below (in descending order):

Formation	Age
Guelph	Middle Silurian
Amabel	
Fossil Hill	
Cabot Head	Early Silurian
Manitoulin	
Whirlpool	
Queenston	Late Ordovician
Georgian Bay	
Whitby	
Lindsay	

Descriptions of some of these units have been provided earlier in this report and all have been described by Bolton (1957), Liberty (1969) and Liberty and Bolton (1971).

The Niagara Escarpment is prominent in this region, extending north through the Collingwood East map-area, and curving to the west and southwest through the Nottawasaga West and Collingwood West map-areas respectively. For much of its length the Escarpment has a step-like form with a lower scarp formed by the Manitoulin Formation and an upper one of massive Amabel dolostone. Between Singhampton and The Caves (Southwest of Collingwood) the Escarpment attains its highest elevation of about 1,700 feet above sea level, and the most extensive outcrops of Manitoulin and Amabel dolostones occur in this region.

The Lindsay and Whitby Formations do not form part of the Escarpment and outcrop mainly along or near the shore of Nottawasaga Bay. A notable feature of the lower Whitby Formation is its rich trilobite fauna that may be observed in recently excavated culverts along Highway 26 near Craigleith. The Georgian Bay and Queenston Formations commonly are the basal units of the Escarpment. Sandstones of the Whirlpool Formation wedge out beneath the Manitoulin Formation; their most northerly exposure is on the northern side of Osler Bluff, about 5 miles west of Nottawa. Very fossiliferous dolostones and limestones of the Fossil Hill Formation and shales of the Cabot Head Formation are rarely exposed. They are displayed best in several roadcuts east of Ravenna. The Guelph Formation outcrops only in the vicinity of Feversham, in the southern part of the Collingwood West map-area.

ECONOMIC GEOLOGY: Three major quarries are presently operating in the mapped regions. These include the Indusmin Limited Quarry, Acton (described by Hewitt and Vos 1972), Canadian Gypsum Company Limited Quarry at Guelph (Hewitt 1960), and the McKean Quarry of Collingwood Sand and Gravel Limited, near Duntroon

(Hewitt and Vos 1972). The Indusmin and McKean Quarries are utilizing Amabel dolostone and the Canadian Gypsum quarry is in Guelph dolostone. The Amabel Formation has proven particularly suitable for aggregate production and large areas exist where further quarrying of this unit could be developed if necessary.

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No.32 QUATERNARY GEOLOGY

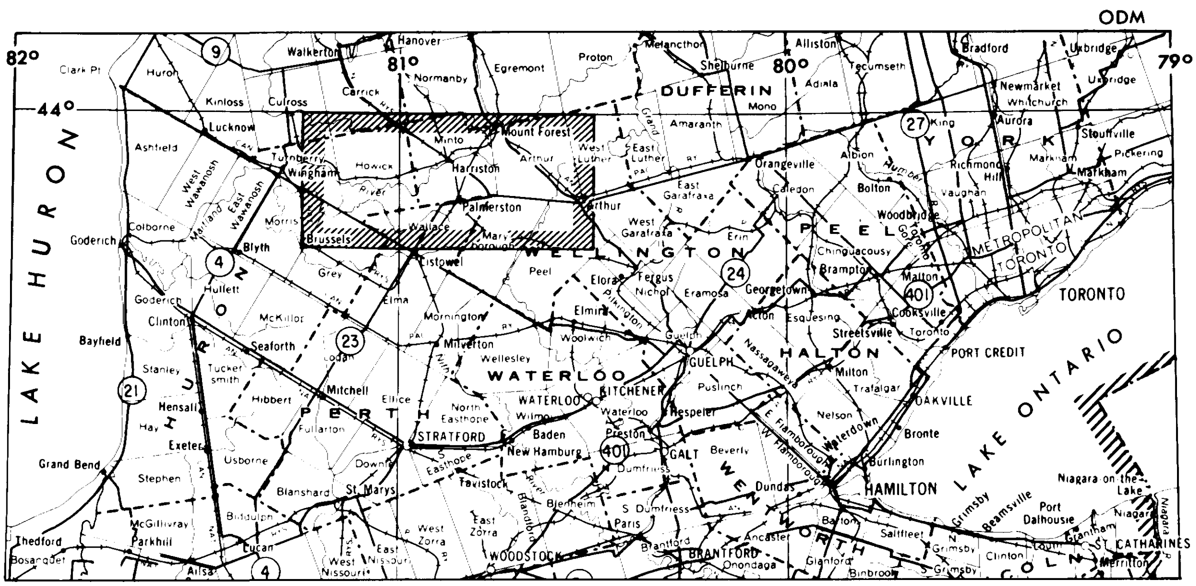
PALMERSTON (40P/15) AND WINGHAM (40P/14 EAST) AREAS

SOUTHERN ONTARIO

by

W.R. Cowan[1]

LOCATION: The Palmerston map-area is bounded by Latitude 43°45' to 44°00' north and Longitude 80°30' to 81°00' west. The east half of the Wingham map-area is bounded by the same Latitudes but extends westerly to 81°15' Longitude (see key map).

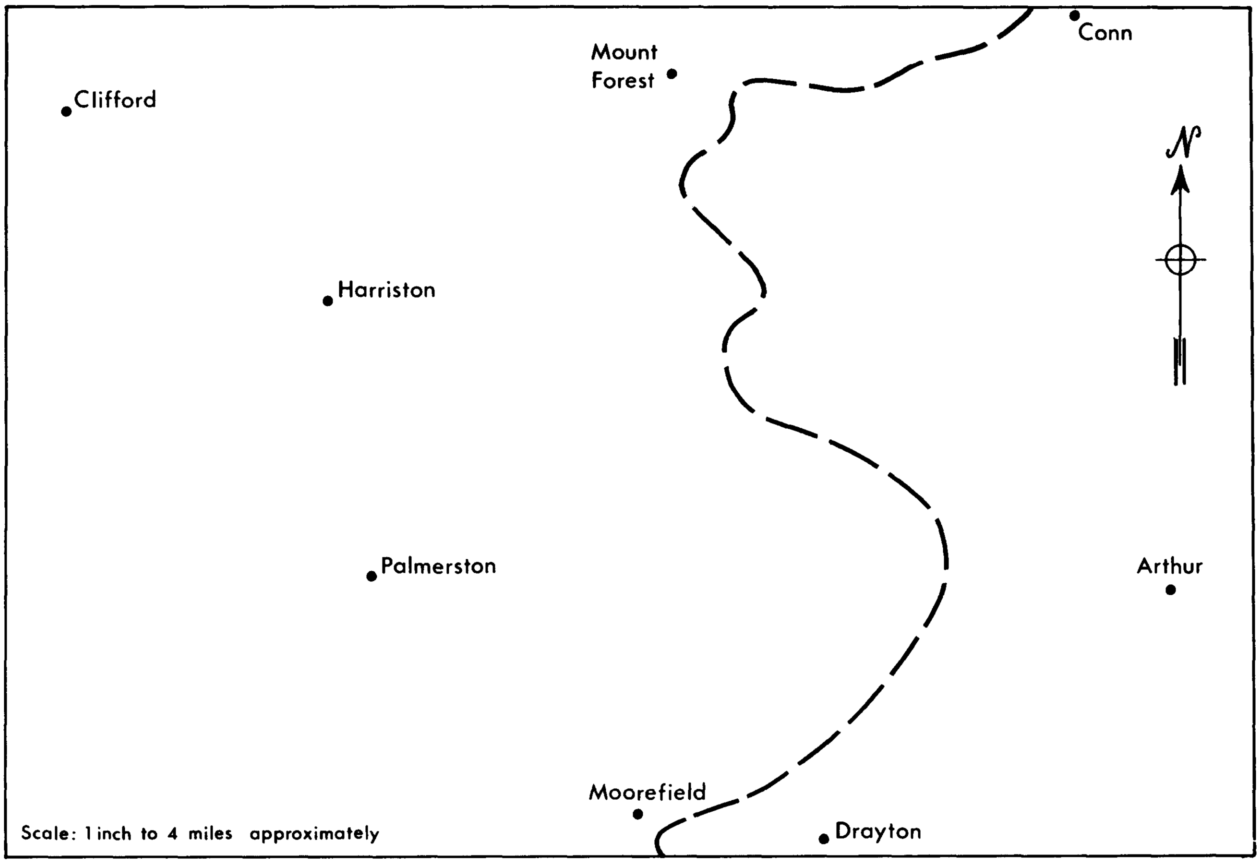


LOCATION MAP

Scale: 1 inch to 25 miles

Mapping of the Palmerston area was completed in 1973 as was much of the east half of the Wingham map-area. Brief reconnaissance was carried out in the west half of the Wingham map-area and in the Lucknow map-area (just west of the Wingham map-area).

[1]Geologist, Phanerozoic Geology Section, Geological Branch, Ontario Division of Mines, Parliament Buildings, Toronto



Sketch map – Approximate eastern limit of Karrow's (1971) till 'N' as found in the Palmerston map area.

GENERAL GEOLOGY: The area is underlain by predominantly carbonate rocks of Silurian and Devonian age (Liberty and Bolton 1971). The only bedrock exposed in the Palmerston map-area is thin-bedded dolostone of the Salina Formation (Upper Silurian) that outcrops in the Saugeen River valley near the northern limit of the map-area. In the part of the Wingham map-area mapped to date rock outcrops are present along the Maitland River between Fordwich and Gorrie. These consist of cherty carbonate rocks of the Bois Blanc Formation (Devonian).

Quaternary deposits consist mainly of till, outwash gravel, and ice-contact stratified drift. The till sequence is the same as described previously (Cowan 1972) and no new till sheets have been identified. Two surface tills predominate; these are a silt to clayey silt till outcropping over much of the east half of the Palmerston map-area (till 'C' of Karrow 1971) and a sandy silt to silt till (till 'N' of Karrow 1971) outcropping over much of the remaining area. This latter till is generally more sandy toward the north and northwest and more silty towards its eastern margin, which is approximately located as shown in the sketch map. Extensive outwash gravels are present southwest of Mount Forest in the Palmerston map-area and near Lakelet Lake, Fordwich, and Gorrie in the Wingham map-area. Ice-contact stratified drift occupies broad belts between Mount Forest and Clifford and between Redgrave and Carrick triangulation station. Outwash sands occur as sheet deposits east of Harriston and in meltwater channels throughout the area. Lacustrine sediments and bog deposits occupy low lying areas throughout the map-area; these are of limited extent.

ECONOMIC GEOLOGY: No rock quarrying is being carried out within the map-area. Natural gas is being obtained from Ordovician rocks in the Arthur Gas Field.

Large quantities of granular materials are present in the northern part of the area in the form of outwash or terrace deposits or in localized pockets of good material within the ice-contact stratified drift. Consequently crusher-run road gravel is plentiful. Good commercial prospects are present immediately west of Pike Lake in the Palmerston map-area and in the vicinity of Lakelet Lake.

The area south of Highway 9 and 23 in the Palmerston area has only minor reserves of granular materials.

Chert becomes deleterious in granular materials occurring in the south-western part of the Palmerston map-area.

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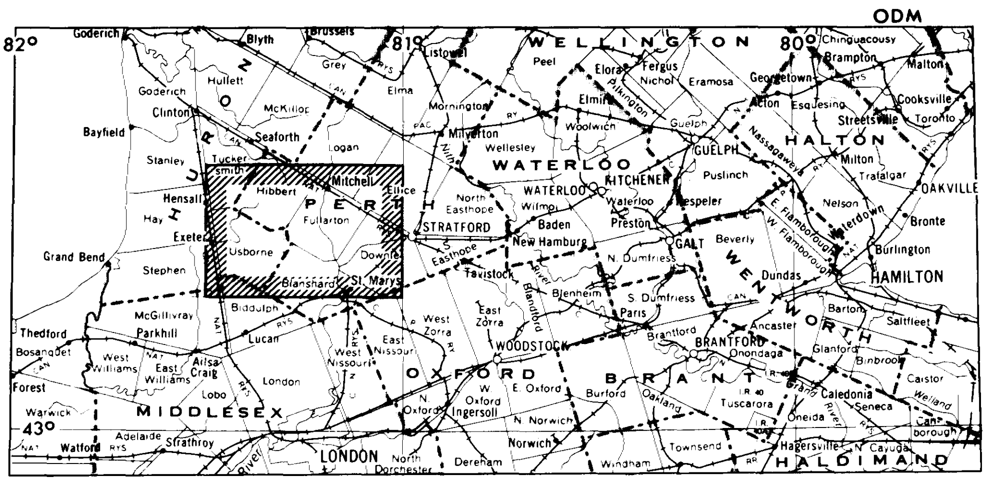
No.33 QUATERNARY GEOLOGY OF THE ST. MARY'S AREA SOUTHERN ONTARIO

by

P.F. Karrow[1]

LOCATION: The area is bounded by Latitudes 43°15'N and 43°30'N and by Longitudes 81°00'W and 81°30'W (National Topographic Series sheet 40P 6).



LOCATION MAP

Scale: 1 inch to 25 miles

GENERAL GEOLOGY: Bedrock outcrops only in the south-central part of the area along the North Thames River near Motherwell, the mouth of the Avon River, and near St. Mary's. Bedrock is close to the surface along the floor of Trout Creek valley east of St. Mary's and southwest of Staffa. All bedrock under the area is of Devonian age and consists of limestone of the Amherstburg, Lucas, and Dundee Formations (Sanford 1969).

The landforms of the area are all rather subdued. The Milverton, Mitchell, Lucan, and Seaforth Moraines all cross the area. Numerous minor moraines are found southwest of Stratford trending nearly east-west. The larger moraines have local relief of up to 50 feet and are generally not prominent. Between the end moraines, gently undulating till plain alternates with level areas of lacustrine sediments. The most widely distributed

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surface material is glacial till with lacustrine silt and clay second in importance areally. Several kame and esker deposits occur between Exeter and Staffa and northeast of St. Mary's. Small areas of outwash sand and gravel are concentrated along the Avon River, Trout Creek, North Thames River, Flat Creek, and Fish Creek valleys.

The Quaternary deposits can be considered under two areal divisions: the area east of the Mitchell Moraine and the area from the Mitchell Moraine westward.

East of the Mitchell Moraine, most of the area is similar to that previously mapped to the east and northeast (Karrow 1971). Sandy to silty till identified as Catfish Creek Till, occurs along the lower walls of the North Thames, Black Creek, Avon, Otter Creek, and Trout Creek valleys. This till is generally higher in dolomite in the matrix than any other tills in the area and is the oldest till so far observed outcropping in the area.

Overlying the Catfish Creek Till is till T, a gritty silt to clayey silt till. It is the surface till east of St. Mary's and occurs along the sides of valleys that cut through overlying deposits. Overlying till T and forming the surface till between St. Mary's and the Milverton Moraine is till S, a thin sandy silt till. Both tills, S and T, are derived from the northwest.

The Milverton Moraine consists of clay till M, which is the surface till only along the moraine itself and is presumed to overlie till S. North of the Milverton Moraine, silt till N is the surface till. This till was deposited by ice moving southeast.

North of St. Mary's stiff stony clay overlies till S and till T. This material is interpreted as a lacustrine deposit and grades northward into more usual lacustrine silts. Stratification is rare in the lacustrine deposits of the area.

The Mitchell Moraine, deposited by eastward-moving Huron lobe ice, consists of clayey silt till, not unlike some of till T. Along the North Thames River valley an underlying clay till is of unknown origin. As yet no consistent distinction can be made between the Mitchell Moraine till and tills of the younger Lucan and Seaforth Moraines. No stratigraphic sections are available in the area so their vertical relationships remain unstudied. Tills in the western part of the area vary from silty and stony to clayey and stonefree. A small arcuate moraine trends through Centralia and consists of clay till; some flutings apparently associated with this advance trend south of east.

All surface tills of the area are believed to have been deposited during the Port Bruce Stadial (Dreimanis and Karrow 1972). Over 100 till samples were collected and analysed, by members of the field party, for texture and carbonate content.

ECONOMIC GEOLOGY:

Limestone: Devonian limestone is quarried for cement manufacture just outside the area south of St. Mary's. Former quarries also exist at the north edge of St. Mary's.

Clay: Lacustrine clay was formerly used for brick manufacture near Dublin and Mitchell.

Sand and Gravel: Active sand and gravel pits occur in kame deposits near Staffa and south of Stratford, the latter occurring as buried deposits under tills S and T. Eskers are worked intermittently north of Exeter, Mitchell, and St. Mary's. Outwash gravels are worked intermittently east of Exeter and Hensall, near Kirkton, Mitchell, and along the North Thames River valley near St. Mary's. Some of the deposits along the North Thames River valley are very coarse boulder gravels. Gravels west of the North Thames River valley are mostly composed of limestone, whereas to the east dolomite, chert, and Precambrian rock types are more commonly present.

On the whole, gravel resources in the area are quite limited. Reserves are only sufficient for local use and will likely soon be exhausted. The largest single deposit occurs in the southeast part of the town of St. Mary's, an area rapidly being urbanized.

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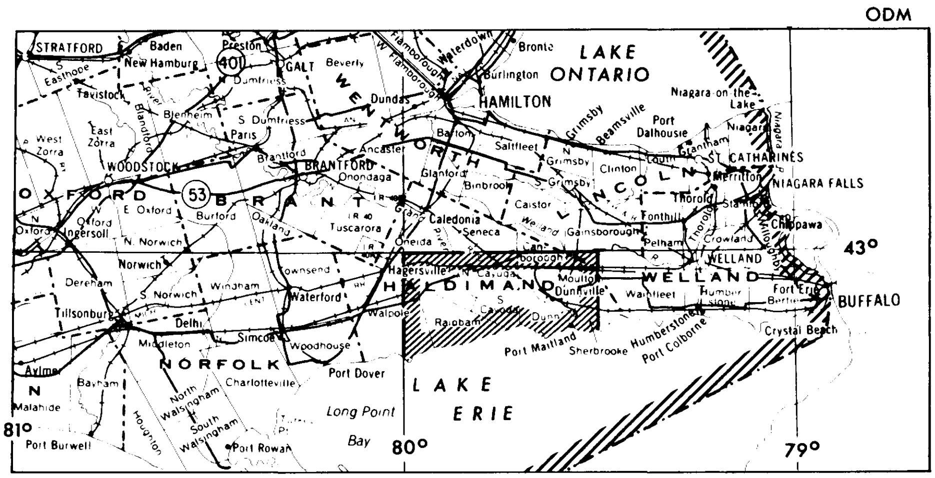
No.34 QUATERNARY GEOLOGY OF THE DUNNVILLE AREA SOUTHERN ONTARIO

by

B.H. Feenstra[1]

LOCATION: The Dunnville map-area (NTS 30L/13) extends from Latitude 43°00'N southward to Lake Erie and from Longitude 79°30'W to 80°00'W.

The surficial geological mapping at a scale of 1:50,000 has been completed.



LOCATION MAP

Scale: 1 inch to 25 miles

GENERAL GEOLOGY: The Paleozoic bedrock is exposed along parts of the Onondaga Escarpment, along the Lake Erie shoreline, and in the area between the escarpment and the shoreline, along stream courses, and in a few bedrock mounds such as Mount Olivet. Bedrock consists essentially of Silurian dolomites to the north and Devonian cherty, fossiliferous limestones to the south of the crest of the escarpment. The Onondaga Escarpment crosses the map-area south of the Grand River in a west to northwesterly direction from a point near Port Maitland, consists of Silurian dolomite capped by Devonian sandstones and cherty limestone, and is generally drift-covered except for the area to the north of Nelles Corners.

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The bedrock is nonconformably overlain by a sequence of mappable Quaternary sedimentary units consisting of the Wentworth Till, Halton Till, glaciolacustrine clay, silt, and sand, beach and offshore-bar gravel and sand, deltaic sand, eolian sand, and alluvial deposits.

The Wentworth Till is a gravelly silt till and was found exposed only in the western half of the map-area and there predominantly in the form of drumlins protruding through a mantle of glaciolacustrine sediments. This drumlin field extends from a point 6 miles southeast of Cayuga in a northwesterly direction to the northwest corner of the map-area and beyond, and the drumlins occur mainly in front of the north-facing Onondaga Escarpment. The contact between the Wentworth Till and the Devonian bedrock is sporadically exposed in the area south of the escarpment.

The younger Halton Till is a clay to clayey silt till and is exposed only in the southern part of the east half of the map-area and there predominantly in and near the bluffs along the Lake Erie shoreline. The bluff along Mohawk Bay provides a section through the northern tip of a moraine, 3 miles east of Port Maitland, which consists of Halton Till having a hummocky surface smoothed by a blanket of glaciolacustrine sand. The mappable margin of this till is found 6 to 8 miles west of Port Maitland and Dunnville. The Wentworth and Halton Tills were deposited by separate advances of the Ontario-Erie ice lobe moving generally in a southwesterly direction across the eastern and southwestern parts of the Niagara Peninsula. The earlier advance (Wentworth Till) was predominantly over bedrock, extended beyond the western boundary of the map-area, and was in a slightly more westerly direction (orientation of striations and drumlins) than the later advance. This later advance (Halton Till) overrode glaciolacustrine clay and silt in the area south of the Niagara Escarpment and extended in the Dunnville map-area to a position paralleling the Grand River just east of Caledonia and Cayuga, south of which it transects the river and extends to Evans Point at Lake Erie.

The map-area is covered most extensively by glaciolacustrine clay and silt; north and east of Dunnville as well as at the moraine east of Port Maitland these sediments are mainly sand and silt.

Glaciolacustrine beach deposits (sand and gravel) are very scarce, of limited extent, rest predominantly on till (moraine, drumlins) or in a few places on bedrock, are probably younger than Lake Warren, and were found at the following approximate elevations (in feet above sea level): 750, 712-715, 655-670, 620-630, and 600. Part of the lake having its shoreline at 600 feet covered parts of the Dunnville (East Half), the Welland, and southern half of the Niagara map-areas. Its waters were shallow here and an ancestral Grand River deposited deltaic sands in the vicinity of Dunnville. When the lake level dropped (probably more than 20 feet) these deltaic-shallow lake sands became a source for a field of inland dunes, formed by prevailing westerly winds, between Dunnville and Wainfleet.

The bluff along the modern Lake Erie shore consists of Devonian limestones and Quaternary drift (predominantly Halton Till, and glaciolacustrine clay and silt). Five to ten feet above the present Lake Erie beach deposits, at the base of the bluff, an older beach deposit was found at the top of the bluff (578-583 feet) in the eastern part of the Dunnville map-area. Dunes are scarce along the shoreline.

ECONOMIC GEOLOGY: The Berti and Bois Blanc Formations are presently being quarried 3½ miles west of Cayuga (Cayuga Materials and Construction Company Limited) and ½ mile south of Byng (Dunnville Rock Products Limited). Products are Granular "A" and "B" for road construction, aggregate for concrete and asphalt plants, railroad ballast, agricultural lime, and silica sand for use in cement production.

The sand and gravel resources (Quaternary) are very limited.

OUTLINE OF MINERAL RESOURCE SURVEYS, 1973

by

D.F. Hewitt[1]

During the 1973 field season, numerous Mineral Resource Surveys were conducted by R.A. Brinsmead[2] outlining the production potential of sand, gravel, and quarry stone resources in the respective areas. Mineral resource reports were completed for the following areas in the Province of Ontario:

North Wellington Area, Tay Valley Planning Area, Central Rideau Planning Area, St. Lawrence Planning Area, and the Township of South Monaghan.

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