ONTARIO DEPARTMENT OF MINES
AND NORTHERN AFFAIRS

# SUMMARY OF FIELD WORK, 1970
## by the
## GEOLOGICAL BRANCH

Edited by
E.G. Pye

MISCELLANEOUS PAPER 43

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by the

GEOLOGICAL BRANCH

ONTARIO DEPARTMENT OF MINES AND NORTHERN AFFAIRS

## INTRODUCTION

by

E.G. Pye[1]

In 1970 the Geological Branch of the Ontario Department of Mines and Northern Affairs placed 29 geological survey parties, 2 geochemical survey parties, and 2 geophysical survey parties, in the field. This involved the services of 151 persons who worked on 36 different projects. Most projects were under the direction of members of the Geological Surveys Section. Seven were conducted by members of the Industrial Minerals Section; and three, by members of the Resident Geologists' Section.

The locations of the areas investigated during the field season are shown on the map of the Province, Figure 1, page 2. The results of the work are outlined in this summary, which contains reports prepared by each of the project leaders. In the reports, 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 selection of favourable areas for prospecting and so will be a valuable aid to mineral exploration 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 geological maps with comprehensive marginal notes, will be released for distribution mostly during the winter of 1970-1971. These will be published at the field scale of 1 inch to 1/4 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 Department of Mines and Northern Affairs notification list, and will be published in the technical journals and other media.

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[1]Chief Geologist, Geological Branch, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

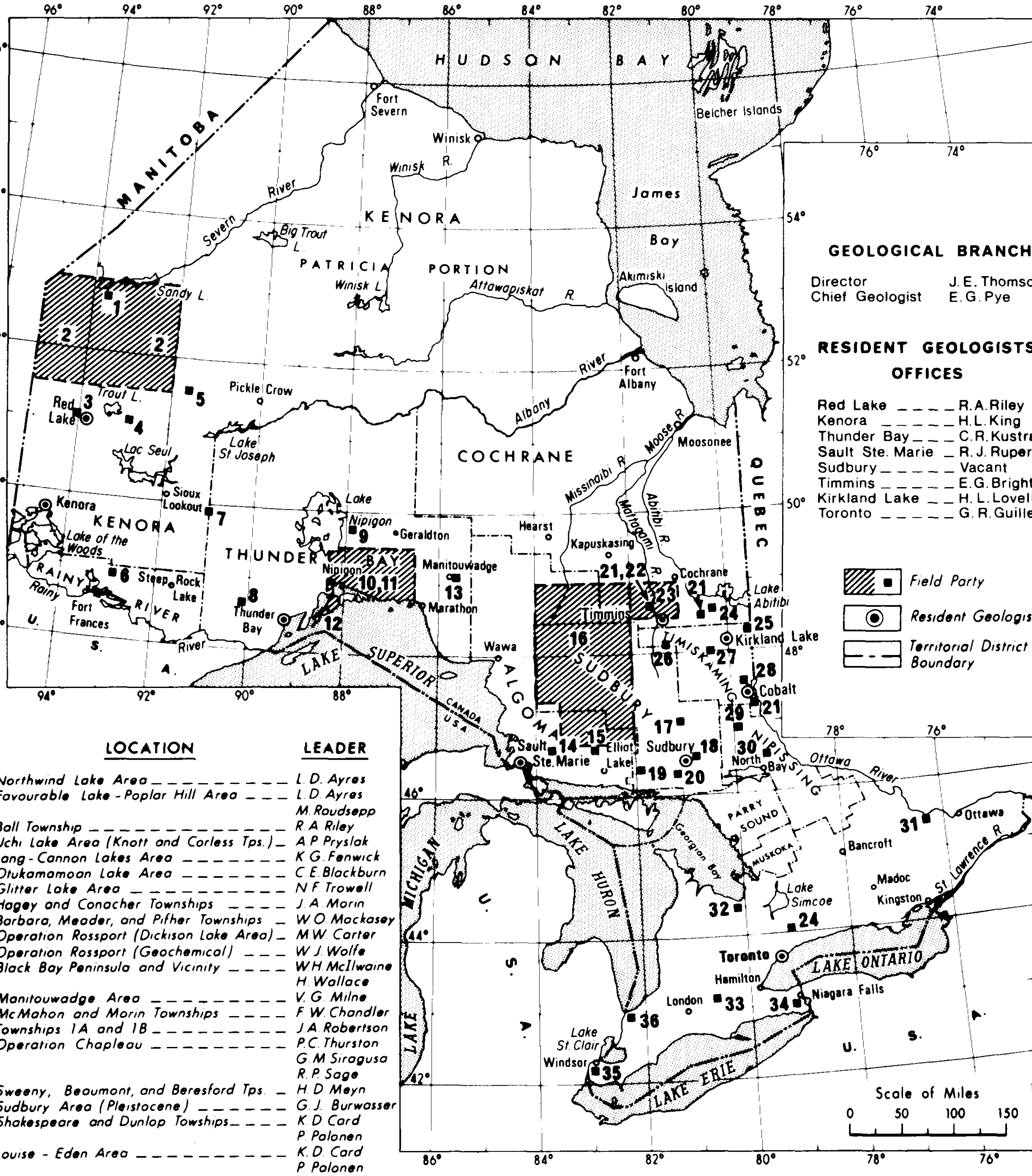


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Figure 1

**LOCATION OF FIELD PARTIES, 1970**

GEOLOGICAL BRANCH

ONTARIO DEPARTMENT OF MINES AND NORTHERN AFFAIRS

ODMNA 4653, MP. 43

# No. 1 NORTHWIND LAKE AREA

## DISTRICT OF KENORA (PATRICIA PORTION)

by

L.D. Ayres[1]

Location: The Northwind Lake area, bounded by latitudes 52°41' and 52°51' and by longitudes 93°22' and 93°34' covers the southeastern part of the Favourable Lake metavolcanic-metasedimentary belt in northwestern Ontario. The area is about 120 miles north of Red Lake and access is by float-equipped aircraft. About half of the area was mapped during the field season and, in addition, unmapped areas shown on Ontario Department of Mines Preliminary Map P.538 were examined. Mapping will be completed in 1971. Previous mapping to the north and west of the area is shown on Ontario Department of Mines Preliminary Maps P.422, P.439, and P.538.

Mineral Exploration: Recorded mineral exploration of the Favourable Lake belt began in 1927, and the belt is now known to contain molybdenum, gold, silver, lead, zinc, copper, iron, asbestos, uranium, and thorium mineralization. Anomalous features of the belt are (1) high concentration of molybdenum, and (2) high silver:gold ratio in many precious metal occurrences. The only mineral production from the belt came from the Berens River Mine, now owned by Golsil Mines Limited, 3 miles west of the map-area. From 1939 to 1948, this mine produced 157,341 ounces of gold, 5,676,486 ounces of silver, 6,105,872 pounds of lead, and 1,797,091 pounds of zinc from 560,707 tons of ore; value of production was $9,479,694[2].

During the field season, Minorex Limited and Newconex Canadian Exploration Limited carried out surface exploration within the metavolcanic belt on previously discovered showings and on anomalies located by geophysical surveys; both of these companies hold large blocks of claims. Smaller claim groups within the belt are held by North Rock Explorations Limited, Conwest Exploration Company Limited, and K. Koleff, but no work was done on these claims during the past year.

The area north of Setting Net Lake has been sporadically explored for gold and copper since 1927. The main copper showing, currently covered by nine leased claims held by K. Koleff, has been tested by diamond drilling by at least three companies: Kega Mines Limited (3,541 feet in 1944 to 1945), Peteque Mines Exploration Limited (627 feet in 1952), and Senet Copper Mines Limited (8,690 feet in 1956 to 1957).

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[1]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

[2]Statistical files, Ontario Dept. Mines and Northern Affairs.

The Keevil Mining Group Limited holds several blocks of claims covering radioactive anomalies in the granitic batholith south and east of Setting Net Lake. These anomalies are part of a west-northwest-trending zone of radioactive anomalies extending from Favourable Lake to Whiteloon Lake. The western part of this zone has been actively explored by the Keevil Mining Group Limited and CAM Mines Limited since 1967.

General Geology: The map-area covers the southeastern end of a 7-mile wide southeast-trending, Early Precambrian metavolcanic-metasedimentary belt that extends from Northwind Lake to west of the Ontario-Manitoba border. The belt is widest near Setting Net Lake at the west boundary of the map-area and gradually narrows northwestward; to the southeast, it is abruptly terminated near Northwind Lake by a granitic batholith.

South of the main belt within the southern batholith, are two narrow southeast-trending, metavolcanic belts. The northern belt, composed predominantly of felsic tuff and minor sandstone, is about 2,000 feet wide and extends from Favourable Lake to the southwestern corner of the map-area where it pinches out. The southern belt, which is 4,000 feet wide and composed of gneissic mafic metavolcanics, is the western end of the wide metavolcanic-metasedimentary belt exposed at North Spirit Lake.

The main belt is composed largely of a complex metavolcanic sequence containing local intercalations of clastic and chemically precipitated metasediments; the metasediments are rare in the eastern part of the belt but increase in abundance westward. The metavolcanic sequence comprises a lower intermediate to felsic formation and an upper mafic flow sequence that contains several thick tongues and lentils of felsic to intermediate flows and pyroclastic rocks.

Within the map-area the lower intermediate to felsic formation forms most of the metavolcanic sequence and appears to be at least 10,000 feet thick. Intermediate lapilli-tuff and tuff predominate although amygdaloidal, locally porphyritic flows occur in several parts of the sequence. Felsic tuff, lapilli-tuff, and minor flows are locally present in the formation, especially in the northern part of the area.

The overlying mafic formation is exposed in the western part of the map-area where it has a maximum thickness of about 4,000 feet although thicker sections are found further west. Two major felsic units occur in this part of the formation: (1) a 2,000-foot thick sequence of flows immediately south of Setting Net Creek and (2) a 400-foot thick pyroclastic unit east of Setting Net Lake.

The only metasediments found to date in this part of the belt are: (1) several thin ferruginous chert and iron formation units in both metavolcanic formations and (2) a greywacke and slate unit that occurs between the two metavolcanic formations in the northwestern part of the area but rapidly pinches out southward; this unit has a maximum thickness of 2,000 feet.

The main belt was intruded by many minor intrusions ranging in composition from ultramafic to felsic. Most of these have been subsequently metamorphosed and are probably related to volcanism. The most abundant of the minor intrusions are metagabbro and metadiorite dikes, sills, and small stocks that are generally less than 100 feet wide, although some are as much as 1,000 feet wide. Metagabbro is most abundant near Twinpeaka Lake where it forms about 30 percent of the metavolcanic sequence, and this may be near a volcanic centre. Serpentinized ultramafic rocks are locally present in the sequence and form narrow dikes, sills, and one small stock. The stock is northeast of Setting Net Lake and is about 6,000 feet long and 2,000 feet wide. Numerous feldspar and quartz-feldspar dikes and sills and one small feldspar porphyry stock are in the west-central part of the area where they are associated with a small, equigranular to porphyritic, metamorphosed, biotite trondhjemite intrusion.

The metavolcanic sequence was intruded by granitic batholiths that form the boundaries of the belt. On the southwest and north sides of the belt, the batholiths are generally conformable to metavolcanic formations and contacts are sharp and relatively straight. On the southeast side, however, the batholith cuts across stratigraphic units in the belt, and the contact is irregular because of many granitic sills intruded into the metavolcanic sequence and resultant metavolcanic screens projecting into the batholith; migmatite is common along this contact.

The batholiths are composite intrusions composed of many discrete intrusive phases that form stocks and dike swarms ranging in composition from quartz diorite to quartz monzonite. The batholiths are described in more detail on Ontario Department of Mines Preliminary Maps P.439 and P.538. Most of the granitic rocks mapped to date in the map-area are hornblende-bearing phases.

Post-batholith intrusions comprise several lenticular syenite sills related to fault activity, one narrow diabase dike, one narrow ultramafic dike, and one thin, subhorizontal quartz diorite sheet.

Structural Geology: The metavolcanic sequence has been isoclinally folded with fold axes generally trending northwest parallel to the boundaries of the belt. The major structure is a gently northwest-plunging anticline.

Many faults have been recognized in the area and greatly hamper stratigraphic correlation. Three major fault systems predominate:
(1) East to east-northeast-trending faults in the northern part of the area that produced large stratigraphic displacements.
(2) Southeast to south-southeast-trending faults with right-hand strike separation that appear to merge southward with
(3) Southeast to east-southeast-trending faults in the southwestern part of the area that have large vertical components of movement with the south side moved up.
The east-southeast-trending fault system has been traced from Favourable Lake to North Spirit Lake and is a major structural boundary in this part of the Superior Province (see No. 2, this paper). Study of the granitic batholith through which the fault system passes indicates that there has been at least 2 miles of vertical displacement along this system. Small syenitic and ultramafic intrusions were emplaced during this major fault activity.

Economic Geology: Fifteen chalcopyrite occurrences were located during the field season and eight of these are associated with east-northeast-trending, carbonate- and quartz-cemented breccia zones in the northwestern part of the area. Chalcopyrite grains, blebs, and veinlets occur in the carbonate and quartz cement and in quartz veins that fill subsidiary fractures adjacent to the breccia zones. Grab samples collected by the author from these occurrences and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, contained as much as 1.16 percent copper. Most of the breccia zones are poorly exposed, and chances of finding more and possibly larger occurrences are good. East-northeast-trending, schistose fault zones in this area appear to lack chalcopyrite mineralization.

A similar chalcopyrite occurrence was found north of Northwind Lake in a northwest-trending, carbonate-cemented breccia zone that ranges in width from 1 to 30 inches. Grab samples collected by the author contained up to 0.85 percent copper.

Chalcopyrite also occurs disseminated and as veins in a 400-foot thick felsic to intermediate tuff unit northeast of the southern part of Setting Net Lake. The main showing is on claims KRL33407 and KRL33410 held by K. Koleff and has been traced by diamond drilling and trenching for a strike length of 900 feet. The zone is irregular in outline but trends approximately N30W; maximum horizontal width is 70 feet. Copper content ranges from 0.2 to 0.4 percent with local higher grade sections (analyses provided by K. Koleff).

At two localities east of the Koleff showing, chalcopyrite was observed as fracture fillings, commonly associated with quartz veinlets, in hornblende-biotite trondhjemite. In one of these showings, the chalcopyrite is associated with arsenopyrite, galena, and sphalerite, and grab samples collected by the author's assistant were found on analysis by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs to contain up to 0.52 percent copper, 1.36 percent lead, 1.52 percent zinc, 0.54 ounces per ton gold, and 2.18 ounces per ton silver.

Narrow chalcopyrite-bearing quartz veins were found in intermediate metavolcanics 3 miles north of Setting Net Lake and on the Flanagan River north of Northwind Lake. Two grab samples collected by the author from these veins were found by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs to contain 0.25 and 0.41 percent copper respectively. The vein north of Setting Net Lake also contains minor gold and silver.

Much of the ferruginous chert in the map-area contains pyrite and pyrrhotite rather than iron oxide minerals. These chert units are most abundant interlayered with mafic flows in the northwestern part of the area and have a maximum thickness of 125 feet. Seventeen grab samples collected by the author from the chert and associated black slate units in various parts of the area were found by the Laboratory and Research Branth, Ontario Department of Mines and Northern Affairs to contain only traces of economically important elements.

Pyrite and minor pyrrhotite were also locally found disseminated in felsic metavolcanics, in metagabbro, and rarely in mafic metavolcanics, whereas narrow pyrite veinlets were found in several minor faults. Grab samples collected by the author from many of these showings contained only traces of economically important elements.

Quartz veinlets containing minor molybdenite were found at five localities in the granitic batholiths but seem to be most abundant north of Northwind Lake. The veinlets are in several different phases of the batholiths.

Thirteen areas of abnormal radioactivity were found in the granitic batholith south of the major fault zone. Eight of these are in the map-area whereas the others are in the unmapped area of Ontario Department of Mines Preliminary Map P.538. Most of the showings are only a few feet long and have radioactivity 3 to 5 times background; they are similar to showings described on Ontario Department of Mines Preliminary Map P.538.

## No. 2 FAVOURABLE LAKE-POPLAR HILL AREA

## DISTRICT OF KENORA (PATRICIA PORTION)

by

L.D. Ayres[1] and M. Raudsepp[2]

Introduction: A compilation sheet bounded by latitudes 51°30' and 53°00' and by longitude 92°00' and the Manitoba boundary is currently being prepared. As an aid in preparation of this map, reconnaissance mapping of selected areas was undertaken in 1968 and 1970. Areas examined in 1970 include previously mapped metavolcanic-metasedimentary belts at North Spirit, McCoy, Perreault, and Coathup Lakes, and south of Petownikip Lake; previously mapped migmatite and hybrid gneiss zones at Willis, Whitelaw, Sparling, and Berens Lakes, and east of Onepine Lake; mafic intrusions at McCoy Lake and northeast of Pierson Lake; linear aeromagnetic patterns north of Old Shoes Lake; circular to oval structures and aeromagnetic anomalies at Hambrooke, Matchett, Stout, and Moar Lakes, south of Favourable Lake, west of Herod Lake, and south of Spoonbill Lake; diabase dikes near Kennedy Lake; and several major faults in various parts of the area. Areas examined in 1968 were metavolcanic-metasedimentary belts at Mackay, Favourable, McInnes, and Hornby Lakes[3].

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[1]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

[2]Undergraduate student, McMaster University, Hamilton.

[3]Averill, S.A., and Ayres, L.D., 1968: Favourable Lake-Poplar Hill area, District of Kenora (Patricia Portion); in Pye, E.G. (ed.), Summary of field work, 1968, ODM,Misc. Paper 22, p.6-10.

Mineral Exploration: Mineral exploration has been sporadically carried out in the area covered by the compilation sheet since the 1920's, but most of the exploration has been confined to the Favourable Lake-Setting Net Lake and North Spirit Lake metavolcanic-metasedimentary belts.

In the Favourable Lake-Setting Net Lake belt exploration has been concentrated on gold, silver, lead, zinc, copper, and molybdenum deposits and details of the exploration have been summarized elsewhere[1,2,3]. The only mineral production from the area covered by the compilation sheet was from the Berens River Mine, now owned by Golsil Mines Limited, near Setting Net Lake (see No. 1, this paper for production statistics).

In recent years, the North Spirit Lake area has been closely examined by many companies using geophysical surveys and diamond drilling to search for iron and base metal deposits; gold is also present in the area and was an earlier exploration target. Companies active in the area during the past several years include Dickenson Mines Limited, Madsen Red Lake Gold Mines Limited, Pickands Mather and Company, and a consortium composed of T.J. Day, J.H. Low, M.C. Gardiner estate, and J.W. McBean on iron properties, and Cochenour Explorations Limited, Madsen Red Lake Gold Mines Limited, Noranda Exploration Company, and Scurry-Rainbow Oil Limited on base metal showings.

An extensive zone of radioactive anomalies extending from Favourable Lake to North Spirit Lake, immediately south of the Setting Net Lake belt has been explored by CAM Mines Limited and the Keevil Mining Group Limited since 1967. Both diamond drilling and airborne geophysical surveys have been carried out. Other uranium showings have been recently discovered south of Kennedy Lake.

Other areas within the compilation sheet that have received some attention are the Hornby Lake[1], McInnes Lake[1], and McCoy Lake belts.

General Geology: The North Spirit Lake belt is about 8 miles wide and is composed predominantly of metamorphosed sandstone. Bateman's[4] twofold stratigraphic subdivision comprising a lower mafic metavolcanic formation exposed mainly in the northeastern part of the area and containing thick iron formation members, and an upper sandstone and conglomerate formation containing several mafic metavolcanic flow members is still valid although the mafic flow members are more extensive than previously shown and contain local felsic units. The narrow northwestern extension of the belt between North Spirit and Mattless Lakes consists of an eastern metasedimentary unit and a western mafic metavolcanic unit that are in fault contact near Pakeagama Lake. The belt does

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[1]Averill, S.A., and Ayres, L.D., 1968: op. cit.

[2]Ayres, L.D., 1970: Setting Net Lake area, District of Kenora (Patricia Portion); ODM, Prelim. Map P.538 (revised).

[3]Ayres, L.D., 1970: Northwind Lake area, District of Kenora (Patricia Portion); No. 1, this paper.

[4]Bateman, J.D., 1938: Geology of the North Spirit Lake area; ODM, Vol. 47, pt.7, p.44-78.

not extend to Favourable Lake as shown by Donaldson[1], and it is not migmatitic. A metavolcanic prong of the belt also extends southeasterly into the eastern part of MacDowell Lake.

The narrow belt at McCoy Lake is composed predominantly of gneissic, mafic to intermediate metavolcanics rather than metasediments as previously shown[2].

Metavolcanic belts at Perreault Lake[3] and south of Petownikip Lake[1,2] are essentially as shown on existing maps except for the discovery of a serpentinite sill southwest of Petownikip Lake.

At Coathup Lake the previously mapped hybrid gneiss unit[4] was found to consist of metasediments with interlayered felsic metavolcanics and iron formation; migmatite was found only northwest of the lake adjacent to the granitic batholith. The sequence is intruded by a small granitic-syenitic stock southwest of Coathup Lake.

Migmatite and hybrid gneisses of proposed sedimentary origin had been mapped at several localities[1,4,5] but not all of these occurrences could be verified. Migmatitic metasediments do occur at Whitelaw Lake and at several places near Berens Lake, but in both areas migmatitic metavolcanic units are also present and at Whitelaw Lake are more abundant than metasediments. Several of the units near Berens Lake are also narrower than shown by Donaldson[4]. Hybrid gneisses previously mapped at Willis Lake[4] are complex mixtures of granitic rocks of intrusive origin whereas three gneissic zones east of Onepine Lake[5] are composed of intrusive gneissic trondhjemite, probably the oldest phase of the granitic batholith in this area.

Two migmatitic metavolcanic belts were mapped by Donaldson[4] north of Berens Lake. The southern belt, composed of migmatitic intermediate to felsic metavolcanics, is essentially as shown by Donaldson, but the northern belt near Sparling Lake, composed of non-migmatitic mafic flows and interlayered felsic pyroclastic rocks, does not extend as far west as previously thought.

The mafic intrusion west of McCoy Lake[1] is a hornblende-rich quartz diorite and seems to be a phase of the granitic batholith. The mafic intrusion northeast of Pierson Lake[4] is more extensive than previously shown and seems to be diorite; age relations to surrounding granitic rocks are unknown.

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[1]Donaldson, J.A., 1969: Geology, North Spirit Lake, Ontario; GSC,Map 1201A.

[2]Satterly, J., 1939: Geology of the Windigo-North Caribou Lakes area; ODM, Vol. 48, pt.9, 32p.

[3]Kirwan, L.D., 1959: Deer Lake (east half), Kenora District, Ontario; GSC, Map 26-1958.

[4]Donaldson, J.A., 1969: Geology, Trout Lake, Ontario; GSC,Map 1200A.

[5]Chown, E.H., 1959: Carroll Lake (east half), Kenora District, Ontario; GSC, Map 25-1958.

Several traverses were made across areas characterized by linear aeromagnetic patterns north of Old Shoes Lake[4] to check for the possible presence of migmatitic metasediments; only intrusive granitic rocks were found.

Nine circular to oval, positive, aeromagnetic anomalies ranging in long dimension from 3 to 16 miles are present in the area covered by compilation sheets[1,2,3,4] and several of these anomalies are as much as 2,000 gammas above background. Only the anomalies at Hambrooke, Matchett, Stout, and Moar Lakes, west of Herod Lake, and south of Spoonbill Lake are readily accessible and could be examined in the limited time available. Each anomaly seems to represent a distinct granitic intrusion.

The anomaly centred at Matchett Lake is 16 miles long and reflects a zoned oval intrusion comprising a diorite rim about 1.5 miles wide and a porphyritic quartz monzonite core. The Stout Lake anomaly is produced by numerous quartz diorite dikes and sheets that possibly reflect a larger quartz diorite intrusion at depth. At Moar Lake, the anomaly-producing intrusion is a medium-grained, porphyritic, hornblende-biotite granodiorite containing 5 to 10 percent hornblende. Similar intrusions but containing only sparse hornblende cause the anomalies at Hambrooke Lake and west of Herod Lake whereas a texturally similar, porphyritic, biotite granodiorite in which hornblende is absent is the source of the anomaly south of Spoonbill Lake.

The intrusions at Matchett and Stout Lakes intruded the granitic rocks of the batholith, and the Stout Lake quartz diorite has chilled contacts against the granitic country rocks. Both of these intrusions are late events and may be part of a widespread, post-batholith, magmatic episode which has been recognized elsewhere in this part of the Superior Province[5,6]. Contacts of the other four intrusions have not been observed but their circular to oval shape and distortion of country rocks suggest that these intrusions may also be late. A small late stock of porphyritic biotite granodiorite which does not have any aeromagnetic expression has been mapped in the granitic batholith south of the west arm of Favourable Lake.

Except for the Matchett Lake diorite, all of these intrusions have compositional and textural counterparts in the granitic batholiths, and positive identification of the late intrusions will require detailed mapping.

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[1]ODM-GSC, 1963: Trout Lake, 7011G.

[2]ODM-GSC, 1963: North Spirit Lake, 7012G.

[3]ODM-GSC-Manitoba Dept. Mines and Natural Resources, 1967: Carroll Lake, 7266G.

[4]ODM-GSC-Manitoba Dept. Mines and Natural Resources, 1967: Deer Lake, 7267G.

[5]Ayres, L.D., 1968: Trout Lake area, Rathouse Bay Sheet, District of Kenora (Patricia Portion); ODM,Prelim. Map P.439.

[6]Ayres, L.D., 1969: Geology of the Muskrat Dam Lake area, District of Kenora; ODM,GR74, p.44-45.

Structural Geology: The major structure in the area is an east-southeast-trending fault zone that has been mapped from Favourable to North Spirit and MacDowell Lakes and is probably much longer. Near Favourable Lake, the zone consists of two faults about 1,000 feet apart with most of the movement concentrated along the southern fault. South of Pennock Lake, a third fault is about 1,500 feet south of the main fault and intensity of movement along this fault increases eastward. Near Tallrice Lake, the centre and south faults diverge with the centre fault trending through North Spirit Lake and the south fault through MacDowell Lake.

This fault zone is probably a major structural boundary in this part of the Superior Province. Study of the granitic batholith through which the fault zone passes and investigations of nearby metasedimentary units indicate that there has been at least 2 miles of vertical movement along the faults with the south side moved up.

Several other major faults also were identified.

Economic Geology: No systematic examination of mineral deposits was attempted and the following discussion is generally confined to those deposits that are not discussed elsewhere[1,2,3].

Iron: Iron formation occurs in many of the metavolcanic-metasedimentary sequences but the thickest and most extensive units are near North Spirit Lake. Here T.J. Day, J.H. Low, M.C. Gardiner estate, and J.W. McBean have outlined 12 zones ranging in length from 1,100 to 8,400 feet and in width from 120 to 1,100 feet. These zones are estimated to contain 1,300,000 tons per vertical foot grading 33.94 percent iron[4]. East of Coathup Lake iron formation containing about 50 percent magnetite is at least 100 feet thick, and aeromagnetic anomalies south of the lake possibly reflect thicker iron formation units.

Sulphides: The Favourable Lake-Setting Net Lake and North Spirit Lake metavolcanic-metasedimentary belts seem to have a much higher concentration of sulphide mineralization than other belts in the area. Mineralization in the Favourable Lake-Setting Net Lake belt is described elsewhere[2,3]. At North

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[1]Ayres, L.D., Bennett, G., and Riley, R.A., 1969: Geology and mineral possibilities in northern Patricia district, Ontario; ODM, Misc. Paper 28.

[2]Ayres, L.D., 1970: Setting Net Lake area, District of Kenora (Patricia Portion); ODM,Prelim. Map P.538.

[3]Ayres, L.D., 1970: Northwind Lake area; No. 1, this paper.

[4]Shklanka, R., 1968: Iron deposits of Ontario; ODM, Min. Res. Circular 11, p.234.

Spirit Lake sulphide mineralization is generally confined to the eastern part of the belt near the contact between the lower mafic metavolcanic and upper metasedimentary formations. Pyrite, pyrrhotite, chalcopyrite, galena, sphalerite, and molybdenite occur disseminated and as veinlets in both metasediments and mafic metavolcanics. Minor silver has been reported from some of the sulphide showings[1].

At McCoy Lake minor chalcopyrite has been found in silicified shear zones in mafic metavolcanics and also disseminated in mafic metavolcanics. This area is currently being prospected. Minor chalcopyrite also was found in a quartz vein in mafic metavolcanics north of Coathup Lake.

Radioactivity: The major zone of radioactive showings south of the Favourable Lake-Setting Net Lake belt has been previously described[2]. The only other showing known in the area is 3 miles south of Kennedy Lake and was explored during the past summer by the Kostynuk brothers. One trench was examined by the senior author and exposed narrow, irregular pegmatite dikes in biotite trondhjemite. Uranothorite, thorite, and allanite were tentatively identified in the pegmatite.

## No. 3 BALL TOWNSHIP

## DISTRICT OF KENORA (PATRICIA PORTION)

by

R.A. Riley[3]

Location: Ball Township is centred at the west end of the Red Lake metavolcanic-metasedimentary belt about 18-1/2 miles northwest of the town of Red Lake. Access from Red Lake is possible by either boat or float-equipped aircraft.

Mineral Exploration: Since 1926, most of the township, particularly that part north of Trout Bay and west of Pipestone Bay, has been extensively prospected for gold by numerous companies and individuals. These programs culminated in the sinking of four shafts: a two-compartment, 205-foot shaft on the property of West Red Lake Gold Mines Limited in 1935; a three-compartment, 375-foot shaft on the May-Spiers Gold Mines Limited property in 1936; a two-compartment, 530-foot shaft on The Cole Gold Mines Limited property in 1937; and a three-compartment, 300-foot shaft on the property of Miles (Red Lake) Mines Limited in 1946.

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[1]Assessment files (diamond drill hole logs) at ODMNA, Resident Geologist's office, Red Lake.

[2]Ayres, L.D., 1970: Setting Net Lake area, District of Kenora (Patricia Portion); ODM,Prelim. Map P.538.

[3]Resident Geologist, Ontario Department of Mines and Northern Affairs, Red Lake.

In 1963, Cochenour Willans Gold Mines Limited undertook a program of surface exploration and limited diamond drilling for base metals both southwest and northeast of Trout Bay. Ground follow-up by Cochenour Explorations Limited, by a 1965 airborne magnetometer and electromagnetic survey program, has been concentrated west and south of the northwest end of Pipestone Bay and the southern and eastern parts of Pipestone Bay. Ground follow-up is presently underway northwest of the Miles (Red Lake) Mines Limited shaft and west of Bridget Lake.

Geology: Metavolcanics and metasediments southwest of Trout Bay are the northwest continuation of similar units mapped in Mulcahy Township[1] and consist of a northeast-facing sequence of massive to pillowed mafic flows, intermediate tuff breccia and lapilli tuff, and several mixed units of siltstone, chert-magnetite iron formation, argillite, and minor sandstone.

North of Trout Bay the predominant metavolcanics are felsic and comprise: flows, tuff breccia, and lapilli tuff north of Dean Creek; tuff, lapilli tuff, and some reworked phases thereof south of Dean Creek and northwest of Trout Bay; and foliated feldspar and quartz-feldspar porphyry with subordinant lapilli tuff and rarely, tuff breccia in the Middle Bay-Sadler Bay area. Intermediate pyroclastics are common south and west of the west end of Middle Bay. Units of foliated to massive and rarely pillowed mafic flows averaging about 250 feet thick and units of interbedded chert-magnetite iron formation, ferruginous chert, and siltstone up to 200 feet thick and of variable length are intercalated with the felsic pyroclastics. A unit of interbedded ferruginous marble, chert, and minor argillite up to 1,000 feet thick lies north of Trout Bay and an interbedded diopside skarn-pyrrhotiferous chert unit, up to 200 feet thick, occurs near the contact with granitic rocks on the northeast side of Pipestone Bay.

Southwest of Trout Bay, the metavolcanic-metasedimentary sequence has been intruded by numerous sills of equigranular metagabbro up to 1,000 feet thick. A medium-grained, frequently brecciated metagabbro occurs on most of the islands and, rarely, on the mainland west of West Narrows. North of Sadler Bay an equigranular, fine- to medium-grained carbonatized metagabbro cuts the metavolcanics. The southern part of Pipestone Bay is underlain by a highly altered ultramafic unit, 12,000 feet thick and at least 16,000 feet long in an easterly direction. Sections of the ultramafic unit are highly serpentinized, carbonatized, and(or) talcose. Several smaller ultramafic bodies are present in the Middle Bay area and another at the west end of Pipestone Bay. Mafic dikes consist of metadiorite, metagabbro, lamprophyre, and small irregular bodies of a mafic rock cut and, in places, almost wholly replaced by massive ferruginous carbonate.

Five small subvolcanic, equigranular to porphyritic granitic bodies occur within the metavolcanic-metasedimentary sequence, four in the vicinity of Biron Bay, one on the west side of Phillips Channel. Narrow fine-grained feldspar and quartz-feldspar porphyry dikes are common west of Pipestone Bay.

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[1]Riley, R.A., 1969: Mulcahy Township, District of Kenora (Patricia Portion); ODM,Prelim. Map P.567.

The Douglas Lake stock[1], a leucocratic biotite trondhjemite, underlies the southwestern part of the map-area. A coarse-grained to porphyritic biotite-hornblende granodiorite underlies most of the northern quarter of the township except for a small area near the township boundary where it is intruded by a body of fine-grained, leucocratic biotite granodiorite and quartz monzonite. A medium-grained hornblende granodiorite underlies the extreme southwestern part of the map-area. All the major granitic units are intruded by numerous dikes of fine- to coarse-grained, occasionally porphyritic trondhjemite and quartz monzonite.

Structural Geology: South of Trout Bay the rocks form a north-facing monoclinal sequence[1]. Pillow tops from a thick mafic unit on the west side of Phillips Channel indicate that these rocks are overturned to the south suggesting a synclinal axis in Trout Bay.

A north-northeast-trending fault, with at least an 800 foot left-hand strike separation, cuts the metavolcanic-metasedimentary sequence west of Douglas Creek but cannot be traced into the felsic metavolcanic sequence northwest of Trout Bay. Faults have been defined west of Trout Bay, south of Bridget Lake, in the vicinity of The Cole Gold Mines Limited shaft, on the west side of Phillips Channel, and on the islands west of and in West Narrows. The linear nature of, and a depression along, the granitic contact north of Pipestone Bay indicates the possibility of an east-trending fault occurring along the contact. Foliation trends are generally west to northwest south of this contact, but northeast in the granitic area to the north.

Economic Geology: Within metavolcanic-metasedimentary rocks gold occurs with quartz, with or without sulphide mineralization, in shear zones or tension fractures in practically all rock types. Of 183 samples collected by the field party during the field season and assayed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, 68 samples returned values in excess of 0.01 oz./ton Au, and 11 samples, all collected from trenches, returned values greater than 0.20 oz./ton Au. One sample collected from an iron formation unit about 300 feet southeast of the small lake 2,500 feet southwest of Biron Bay assayed 2.20 oz./ton Au. A sample from a trench near the shaft on the Miles property returned a value of 2.32 oz./ton Au. Visible gold was noted in two trenches on the Piper Red Lake Mines Limited property west of Bridget Lake.

Silver, occurring with gold in quartz veins and with sulphide mineralization, has been found in 44 of 183 samples analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs to date. In the gold-quartz association, the highest assay returned is 0.43 oz./ton Ag, but assays from galena-rich sulphide zones average considerably higher. Trenches on two narrow sulphide veins about 1,000 feet west of Middle Bay yielded samples which assayed as high as 23.48 oz./ton and six samples collected from these veins averaged 6.31 oz./ton Ag. A sample of intermediate metavolcanics containing an estimated 2 percent sulphides, mainly chalcopyrite, and collected from a trench about 500 feet north of Bridget Lake gave values of

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[1] Riley, R.A., 1969: op. cit.

7.64 oz./ton Ag and 2.10 percent Cu upon analysis.

Minor amounts of copper-nickel mineralization are associated with pyrrhotite in a narrow schistose metagabbro sill adjacent to an iron formation unit near the portage between Douglas Lake and Trout Bay. Analyses from grab samples up to 1.60 percent Ni and 0.45 percent Cu have been reported by Cochenour Willans Gold Mines Limited[1] but diamond drilling indicates the mineralization to be very localized.

Pyrite, pyrrhotite, minor chalcopyrite and rare sphalerite occur as disseminations, lenses, and stringers in the argillite-iron formation-siltstone units in and south of Trout Bay and in the iron formation-siltstone units west of Pipestone Bay.

Galena, sphalerite, and chalcopyrite, associated with widespread pyrite, and minor quartz and fibrous amphibole, occur in veins, in places up to several inches thick, about 1,000 feet west of Middle Bay. Two zones about 50 feet apart have been traced northwesterly for 120 and 170 feet respectively by trenching and diamond drilling. Four selected grab samples taken by the author and analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs averaged 8.5 percent Zn, 3.06 percent Pb, 0.18 percent Cu, 0.21 oz./ton Au and 9.01 oz./ton Ag. Similar but smaller zones of mineralization are known to occur south of Middle Bay.

Several trenches on the south side of Galena Island expose quartz veins up to 2 inches thick containing galena and minor sphalerite, pyrite, and chalcopyrite. A selected grab sample is reported by Chisholm[2] to have analyzed 0.13 oz./ton Au, 19 oz./ton Ag, and 8 percent Pb while Shklanka[3] reports analyses as high as 0.45 oz./ton Au and 12 oz./ton Ag.

Several samples of quartz-feldspar porphyry collected from the waste dump near the Miles (Red Lake) Mines Limited shaft were noted to contain stringers and disseminations of chalcopyrite. Four representative samples of the relatively abundant mineralized porphyry were analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs and were found to average 0.02 oz. Au per ton and 0.49 oz. Ag per ton, and 1.10 percent Cu.

Several airborne electromagnetic conductors within the Pipestone Bay ultramafic body have been drilled by Cochenour Explorations Limited and are attributed to conductive magnetite and poorly conductive serpentinite.

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[1]Fisher, D.E., 1963: Geophysical prospecting results, Ball Township properties; Cochenour Willans Gold Mines Limited, Unpublished report, 34p.

[2]Chisholm, E.O., 1949: Report on a galena occurrence on Galena Island, Ball Township, Red Lake Mining Division; ODM, Unpublished report, 4p.

[3]Shklanka, R. (ed.), 1969: Copper, nickel, lead and zinc deposits of Ontario; ODM, Min. Res. Circular 12, p.143-144.

## No. 4 UCHI LAKE AREA (KNOTT AND CORLESS TOWNSHIPS)

## DISTRICT OF KENORA (PATRICIA PORTION)

by

A.P. Pryslak[1]

Location: Knott and Corless Townships are located 42 air miles east of Red Lake. Construction of a 51-mile access road from Ear Falls to the South Bay Mines Limited property on Confederation Lake was completed in the spring of 1970. The road transects the south part of Knott Township.

Mineral Exploration: Prospecting for gold in the Birch-Uchi Lakes metavolcanic-metasedimentary belt began in the early 1920's. Seven properties within the belt have recorded production of gold and silver in excess of $9,000,000 for the period from 1929 to 1952[2]. None of the past-producing mines lie within the map-area.

In 1968, Phelps Dodge Corporation of Canada Limited drilled 4 holes in sulphide-bearing graphitic metasediments located in the northeastern part of Corless Township.

C.C. Huston and Associates staked a group of 28 claims in Corless Township during 1968. The company subsequently conducted an airborne geophysical survey covering Corless Township, Skinner Township, and the northern part of Knott Township.

Since the initial discovery in 1968 of the Cu-Zn-Ag deposit in Dent Township by Selco Exploration Company Limited, numerous companies have been active in exploration for base metals throughout the Birch-Uchi Lakes area. Hanna Gold Mines Limited did a geophysical survey over a block of claims located in the southeast part of Corless Township. Conwest Exploration Company Limited carried out a geophysical survey over a group of claims located in the southeast part of Knott Township. Dome Explorations (Canada) Limited conducted an airborne electromagnetic survey over a 30 claim group located in Knott and Mitchell Townships. Cochenour Explorations Limited carried out a geological and geophysical survey over a group of claims located in the southeast corner of Knott Township and adjacent area to the south. South Bay Mines Limited has continued exploration work on various parts of the Birch-Uchi Lakes area, including part of Knott Township, by geological mapping, geophysical surveys, and diamond drilling.

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[1]Geologist, Ontario Department of Mines and Northern Affairs, Red Lake.

[2]Statistical files, ODMNA.

General Geology: Previous mapping by Greig[1] and Bruce[2] indicate that the east parts of Corless and Knott Townships are underlain by metavolcanics and metasediments whereas the west parts are underlain by predominantly felsic intrusive rocks. All rocks are of Precambrian age.

Goodwin[3] states that the thickness of the original stratigraphic sequence in the Birch-Uchi Lakes metavolcanic-metasedimentary belt is in the order of 40,000 feet. Volcanic components are arranged in two cycles with each cycle displaying a progression from mafic metavolcanics to felsic metavolcanics. Metasediments are preferentially associated within the intermediate to felsic phases. As a result of this summer's mapping, a third and lower cycle has been established by the subdivision of Goodwin's lower mafic metavolcanic component.

Pillowed to massive phases predominate in mafic metavolcanics whereas the intermediate and felsic phases are predominantly of pyroclastic origin.

The lower mafic phase is in the order of 4,500 feet thick and trends north-south through the centre of Corless Township. Clastic metasediments, 1,000 to 4,000 feet thick, overlie this sequence to the east. The upper component of this cycle consists of approximately 9,000 feet of intermediate tuffs intercalated with minor mafic flows. Mafic metavolcanics of the second cycle underlie the extreme northeastern part of Corless Township and extend southeast into Dent Township.

Dikes, sills, and irregular bodies of metamorphosed gabbro and diorite have intruded the metavolcanic-metasedimentary sequence. The dikes vary in width from less than 1 foot to 800 feet, are approximately vertical, and have a regional northeast-southwest trend.

Granitic rocks, varying in composition from quartz monzonite to granodiorite, underlie about 65 percent of the area.

Structural Geology: The metavolcanic-metasedimentary sequence trends north-south, dips vertically to steeply east, and has been isoclinally folded with a synclinal fold axis located near the east boundary of Dent Township.

An arcuate fault occurs through Bear Lake in Knott Township with a right-hand strike separation of approximately 1 mile. Minor faults and shear zones, with a regional northeasterly to easterly trend, are found in many outcrops.

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[1]Greig, J.W., 1927: Woman and Narrow Lakes area, District of Kenora (Patricia Portion); ODM, Vol. 36, pt.3, p.85-110.

[2]Bruce, E.L., 1928: Gold deposits of Woman, Narrow and Confederation Lakes, District of Kenora (Patricia Portion); ODM, Vol. 37, pt.4, p.51.

[3]Goodwin, A.M., 1967: Volcanic studies in the Birch-Uchi Lakes area of Ontario; ODM, Misc. Paper 6, 96p.

Economic Geology: The known gold occurrences in the area are in quartz veins, generally containing minor amounts of sulphides. Pyrite is most common but chalcopyrite, sphalerite, and galena may also be present. Seven quartz veins, 2 inches to 7 feet in width and containing up to 2 percent chalcopyrite with minor pyrrhotite or pyrite, were mapped in the vicinity of Bear Lake. Native copper was observed along the contact between one quartz vein and the host mafic metavolcanics. This occurrence is located 1,000 feet north of Woman River in the north-central part of Knott Township. Results of analyses are pending.

Minor occurrences of disseminated chalcopyrite with pyrrhotite or pyrite were found in six localities. The total sulphide content of any given occurrence is less than 2 percent.

Less than 1 percent chalcopyrite was found along fractures in a felsite dike intruding mafic metavolcanics. The dike is located 1,000 feet north of Woman River in the north-central part of Knott Township. It is exposed over a length of 55 feet, is 6 feet in width, trends N60E and dips vertically.

Massive sulphides occur in graphitic metasediments along the east shore of Narrow Lake in the northeastern part of Corless Township. The base metal potential of this zone was examined in 1968 by Phelps Dodge Corporation of Canada Limited. Three trenches and four diamond drill holes indicate the presence of sulphides over a length of 2,600 feet and widths up to 225 feet. The zone trends approximately north-south, dips 75E, and is transected by northeast-trending faults. Disseminated and massive pyrite and pyrrhotite form approximately 20 percent of the zone. Minor magnetite also is present, particularly in the upper siliceous phase.

Molybdenite was found in a quartzo-feldspathic vein in metasediments on the peninsula on the southwest shore of Corless Lake. The vein is 1 inch in width and is exposed for several feet along strike. Molybdenite constitutes less than 1 percent of the vein.

## No. 5 LANG-CANNON LAKES AREA

## DISTRICT OF KENORA (PATRICIA PORTION)

by

K.G. Fenwick[1]

Location: Cannon Lake is situated in the Patricia Portion of the District of Kenora about 120 miles east-northeast of Red Lake and 45 miles west-northwest of Pickle Lake. The map-area is accessible by float-equipped aircraft. The area mapped during the 1970 field season covers approximately 180 square miles; it is bounded by north latitudes 51°30' and 51°40' and west longitudes 91°08' and 91°30'.

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[1]Geologist, Ontario Department of Mines and Northern Affairs, Thunder Bay.

Mineral Exploration: In 1929, H.C. Laird[1] and in 1960, R.F. Emslie[2] made reconnaissance geological surveys of the map-area.

Bochawna Copper Mines Limited and Card Lake Copper Mines Limited[3] jointly hold a copper-nickel property (27 claims) in an area 2 miles west of Wetlaufer Lake. In 1969, a magnetometer survey was conducted and three holes were drilled (750 feet). Magnetometer and electromagnetic surveys are planned for 1971.

Amax Exploration, Incorporated has 88 claims in the Card Lake-Gitchie River area.

Card Lake Copper Mines Limited has 98 claims in the Card Lake area. Electromagnetic and magnetometer surveys were conducted over a large portion of the property. They drilled four holes in 1969.

Chellew Gold Mines Limited[4] in 1950, worked a gold occurrence in the central south bay of McVicar Lake. Extensive surface prospecting was conducted and seven holes were drilled (787 feet).

Kenlew Mines Limited[4] in 1959, had a copper showing in the vicinity of the east shore of McVicar Lake. They drilled four holes (726 feet). They also drilled in 1959, five holes (1,175 feet) in the area south of the central south bay of McVicar Lake.

Kenlew Mines Limited[4] had a copper-nickel property 2 miles east of McVicar Lake. This 58 claim property was optioned to Kerr-Addison Gold Mines Limited in 1961. Magnetometer and electromagnetic surveys were conducted and two holes were drilled (435 feet). New Jersey Zinc Exploration Company (Canada) Limited[4] now has the property (70 claims). In 1969 and 1970, magnetometer, electromagnetic, geological, and geochemical surveys were conducted.

Kenlew Mines Limited[4] in 1961 had 21 claims in the area 1 mile southeast of Semia Lake. In 1962, the claims were optioned to Pickle Patricia Explorers Limited who conducted a geological survey and drilled five holes (four holes totalled 2,244 feet). The ground is currently not privately held.

General Geology: All bedrock in the map-area is of Precambrian age. The Lang-Cannon Lakes area is underlain by metavolcanics and metasediments that form a narrow belt which is approximately 30 miles long and varies in width

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[1]Laird, H.C., 1930: Geology of the Shonia Lake area, District of Kenora (Patricia Portion); ODM, Vol. 39, pt.3, p.1-21.

[2]Emslie, R.F., 1961: Geology, Lake St. Joseph, Districts of Kenora and Thunder Bay; GSC, Map 51-1960.

[3]Northern Miner, Feb. 12, 1970, p.6.

[4]Assessment work files, ODMNA, Resident Geologist's office, Red Lake.

from 1/4 to 7 miles. The western part of this belt[1] was mapped in 1969, the central part in 1970, and the eastern part will be mapped in 1971.

The metavolcanics are predominantly mafic to intermediate lavas, tuffs, and amphibolites on the north and south sides of the belt and felsic to intermediate lavas and pyroclastics in the central part (south side of Andy Lake, east half of the south shore of Lang Lake, east half of north shore of McVicar Lake and south shore of Gitchie River to the islands in Cannon Lake) of the belt.

The metasediments in the vicinity of Cannon and Card Lakes are up to 3 miles wide. They consist of conglomerate, greywacke, argillite, iron formation, and their derived schists and gneisses. The conglomerate band is 35 chains (2,310 feet) wide west of Cannon Lake. The mafic metavolcanics are found to be 1 mile wide to the north of the metasediments.

The belt is completely surrounded by granitic rocks.

A stock or sill of gabbro, diorite, anorthosite, and anorthositic gabbro extends from the east shore of Sor Lake to 3 miles east of McVicar Lake. Inclusions of the gabbro and anorthosite have been found in the mafic metavolcanics.

A quartz porphyry stock (high level intrusion) is in the central area of McVicar Lake. This stock seems to be related genetically to the felsic pyroclastics in the area.

Drumlins and drumlinoid ridges, striking S70W, are abundant in the area.

Structural Geology: The major structure in the western part of the area is a syncline that trends about N70E and plunges 40E to 60E. The syncline is isoclinally folded and its axis is located between Boyes and Lang Lakes. Lack of top determinations in the central part of the area has made it necessary to tentatively place the extension of the fold axis through Card Lake.

Two distinct foliations were noted: one closely parallel to primary features such as bedding and volcanic banding, and one trending approximately N30W and dipping steeply. The latter foliation is related to the quartz porphyry intrusion.

Several prominent lineaments were noted.

Economic Geology:

Gold: Prospecting for gold in the area has been carried on since 1928. The original discovery, on the east side of Shonia Lake, proved to be disappointing. The gold in this area occurs in the quartz in miarolitic cavities in a quartz porphyry.

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[1]Fenwick, K.G., 1970: Lang-Cannon Lakes area (west half); ODM,Prelim. Map P.581.

Iron: Iron formation has been found throughout the map-area intercalated with mafic metavolcanics and metasediments. Fifty feet is the maximum width observed.

Sulphides: On the property of New Jersey Zinc Exploration Company (Canada) Limited, pyrrhotite and chalcopyrite are found as rusty streaks, bands, and patches of disseminated sulphides at or close to the contact breccia zone between the diorite and mafic metavolcanics. Analyses[1] of the best mineralized material varied from a high of 0.96 percent copper across 3.2 feet to a low of 0.13 percent copper across 5.0 feet and from 0.08 percent nickel across 3.2 feet to 0.26 percent nickel across 5.0 feet.

Suggestions to Prospectors: The felsic pyroclastic zones in the vicinity of the south shore of Gitchie River (at the mouth) and also 1 mile northeast of east shore of Sor Lake, should be prospected for base metals.

The contact between the gabbro-diorite complex and the mafic metavolcanics should be prospected for copper mineralization.

## No. 6 OTUKAMAMOAN LAKE AREA

## DISTRICT OF RAINY RIVER

by

C.E. Blackburn[2]

Location: Otukamamoan Lake is situated in the Rainy River District about 35 miles northeast of Fort Frances. An area bounded by north latitudes 48°47' and 49°04' and west longitudes 92°45' and 93°15' and covering approximately 300 square miles, was mapped at a scale of 1 inch to 1/4 mile. No roads enter the area but all parts are accessible by float-equipped aircraft.

Mineral Exploration: There has been little sustained mineral exploration in the area.

In 1955, a geological and scintillometer survey was carried out by Pioneer Consultants Limited for Bunker Hill Extension Mines Limited and in 1957 geological mapping followed by a total of 1,170 feet of drilling over 12 holes was done by Rainy Lake Mining Limited, both on claim groups located near Otter Bay of Mainville Lake[3]. No radioactive anomalies of any

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[1]Assessment work files, ODMNA, Resident Geologist's office, Red Lake.

[2]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

[3]Assessment work files, ODMNA, Resident Geologist's office, Kenora.

significance were discovered on the former property. On the latter property, disseminated molybdenite and chalcopyrite were found in granitic rocks, and fairly strong radioactivity was noted in pegmatite dikes. A grab sample taken by Rainy Lake Mining Limited from one of the pegmatite dikes was found on analysis to contain 0.45 percent $U_3O_8$.

During the summer of 1970, Phelps Dodge Corporation of Canada Limited carried out geophysical surveys on a number of claim groups in the vicinity of Otukamamoan, Big Sawbill, and Grimshaw Lakes.

General Geology: Previous mapping was carried out toward the end of the 19th century by Lawson[1] and Coleman[2].

All bedrock is of Archean age. Metavolcanics and metasediments appear to be the oldest rocks in the area. Mafic to intermediate metavolcanics predominate, whereas felsic metavolcanics occur in minor amounts. Basaltic and andesitic lavas and intermediate tuff breccias have been metamorphosed to hornblende schists and amphibolites. Felsic metavolcanics are derived from tuffs, lapilli tuffs, tuff breccias, and possibly minor rhyolitic flows. Metasedimentary quartz-biotite schists, with some narrow bands of magnetite iron formation, occur both within the volcanic sequence and as an independent sequence in the vicinity of Otter Bay in the southwest.

Granitic rocks of several ages underlie at least two-thirds of the map-area, including most of the country north of Porter Inlet and south of Otukamamoan Lake previously designated as metavolcanics[3]. The oldest, a monzonite-diorite complex, may or may not intrude the volcanic-sedimentary sequence. The complex is intruded by the granites responsible for both the major granitization and the widespread migmatization of the volcanic-sedimentary sequence. Pegmatites and aplites intrude these granites, and also the monzonite-diorite complex. A stock of porphyritic granitic rocks, with a more mafic marginal zone, intruded the volcanic-sedimentary sequence.

Structural Geology: The area is structurally complex. Intense deformation, accompanied by metamorphism under amphibolite facies conditions, has made stratigraphic correlation difficult. Intermediate and felsic metavolcanics and quartz-biotite metasediments within a predominantly mafic metavolcanic sequence occupy a northerly-plunging antiform (Tupman Lake antiform) in the western half of the area. A similar sequence of intermediate and felsic metavolcanics and metasediments occupies the core of a rather complex fold structure in the vicinity of Crowrock Bay of Otukamamoan Lake.

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[1]Lawson, A.C., 1888: Report on the geology of the Rainy Lake region; GSC, Ann. Rept., Vol. 3, pt.1, p.F1-F182.

[2]Coleman, A.P., 1895: Map 5b, South eastern part of the Rainy River District accompanying Second report on the gold fields of western Ontario; Ont. Bur. Mines, Ann. Rept., Vol. 5, Sec. 2, p.47-106.

[3]Davies, J.C., and Pryslak, A.P., 1967: Kenora-Fort Frances Sheet; ODM, Geological Compilation Series, Map 2115.

Southwards toward the Quetico Fault zone, which lies immediately to the south of the present map-area, deformation and granitic intrusion increase in intensity, so that pillow lavas clearly recognizable in the north can be traced southward along strike into sheared hornblende schists and finally into coarsely banded migmatites.

Economic Geology: Rusty pyrite gossans occur on the small island immediately north of Cliff Narrows in Redgut Bay. The island appears to lie in an intensely brecciated zone which may be related to a fault extending northward from Farrington Creek to Spawn Inlet. A pyrite gossan is present in hornblende schist on the south bank of Turtle River at the entrance to Redgut Bay, and a sulphide (pyritiferous) iron formation interbanded with metavolcanics can be traced along strike for some 200 feet on the northwestern shore of the south bay of Otukamamoan Lake.

Magnetite occurs in a massive mafic intrusive or metabasaltic flow on a small group of islands at the east end of Crowrock Bay of Otukamamoan Lake, and also in a banded quartz-magnetite rock on a small peninsula jutting from the shore of Otukamamoan Lake immediately south of the main island in the lake. The magnetite iron formation interbanded with quartz-biotite schists on the flanks of the Tupman Lake antiform is quite lean, but may in part be responsible for anomalies delineating the fold structure on airborne magnetic survey maps[1,2]. A very pronounced anomaly coincides with the somewhat richer iron formation in the vicinity of Otter Bay.

Uranium in pegmatite dikes and molybdenite and minor chalcopyrite in granitic rocks have been reported in 1957 in the Otter Bay-Macdonald Inlet area by Rainy Lake Mining Limited.

## No. 7 GLITTER LAKE AREA

## DISTRICT OF THUNDER BAY

by

N.F. Trowell[3]

Location: The Glitter Lake map-area is bounded by west longitudes 90°36' and 90°56' and north latitudes 49°48' and 49°55'; it covers approximately 120 square miles. The author also spent two weeks in detailed mapping around the site of the Mattagami Lake Mines Limited base metal deposit 1 mile west of the west boundary of the area. The area is located approximately 45 miles

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[1]ODM-GSC, 1961: Little Turtle Lake, Map 1151G.

[2]ODM-GSC, 1962: Mainville Lake, Map 1159G.

[3]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

northeast of Ignace. Access to the area is at present limited to float (ski)-equipped aircraft, whereas the northern portion of the area also may be reached by boat from Sturgeon Lake. A drill road provides winter access to Glitter Lake.

Mineral Exploration: Until two years ago little mineral exploration had occurred in the area. With the discovery in October, 1969, of the Mattagami Lake Mines Limited copper-zinc-lead-silver deposit, however, almost the entire area has been staked and several companies have initiated extensive exploration programs. Because of the paucity of outcrop because of the thick cover of glacial material, airborne and ground geophysical surveying has been the primary exploration method; and follow-up diamond drilling has been used to determine the nature of the geophysical anomalies.

General Geology: The map-area is underlain by Keewatin-type metavolcanics and Timiskaming-type metasediments. The bedrock is extensively overlain by glacial drift and by recent accumulations of swamp and muskeg.

In the area, the metasediments form two southeast-trending belts and consist dominantly of interbedded greywacke, siltstone, argillite, conglomerate, and iron formation. The metasediments possess gradational to interfingering contacts with tuffaceous rocks.

Mafic to intermediate metavolcanics consist of an assemblage of massive, porphyritic, pillowed, and amygdaloidal flows with minor amounts of tuff and pyroclastics. The mafic metavolcanics have locally been intruded by metagabbro-metadiorite bodies associated with the mafic volcanism. These rocks have been predominantly metamorphosed under greenschist facies conditions whereas near their contacts with the granitic intrusive rocks exposed in the area they have been metamorphosed under almandine-amphibolite facies conditions.

Felsic tuffs, pyroclastics, and minor flows are extensively exposed. The Mattagami Lake Mines Limited base metal deposit lies in a rhyolitic agglomerate unit on the north limb of an east-plunging antiform. The felsic, predominantly pyroclastic, assemblage seems to have attained its greatest thickness in the general area of the deposit, and consequently it thins to the east into the map-area. Flexural-slip folding and rapid facies changes both across and along strike have made it difficult to determine the stratigraphy of this assemblage. The presence of graphitic tuff bands, locally containing pyrrhotite stringers, and the interfingering of this assemblage with mafic to intermediate metavolcanics indicates a different environment of deposition for its thinner eastward extension.

Another pyroclastic assemblage is exposed north of Lyon Lake, along the shore of Sturgeon Lake. It has not yet been determined whether this is the folded equivalent of the above-mentioned assemblage or whether it formed during a separate volcanic cycle.

In the southern portion of the area a granitic gneiss-migmatite terrain is exposed. In the northeastern part of the area a (biotite-)hornblende syenite is exposed. This syenite possibly is a hybrid metasomatic rock produced by contamination of the mafic volcanic rocks by an invading granitic magma.

Structural Geology: The sedimentary and volcanic rocks in the map-area have been flexurally slip folded about west- to northwest-trending fold axes. The regional west to northwest strike of these rocks locally has been deflected about the intrusive granitic bodies. A few strong lineaments indicate major faults in the area, but only minor offsets were noted.

Economic Geology: The companies now engaged in this area are primarily concerned with the search for base metal sulphide bodies similar to that discovered by Mattagami Lake Mines Limited. Several observable features of this deposit might be pertinent in future exploration.

The orebody is located in a rhyolitic agglomerate unit of a thick succession of ash-fall(?) pyroclastic rocks, and does not specifically lie along the contact between this felsic pyroclastic assemblage and the overlying mafic to intermediate pillowed metavolcanics.

The rocks in the general area of the deposit appear to have been flexurally slip folded about west-trending axes. The orebody itself seems to lie in the above-mentioned rhyolitic agglomerate unit on the north limb of an east-plunging antiform. It has not been determined whether the orebody itself has been folded.

The rocks have been weakly metamorphosed, probably under middle to upper greenschist facies conditions. Chloritoid metacrysts are conspicuously developed in several of the felsic metavolcanic units, but it has not yet been determined whether they formed as a result of metasomatic "wall-rock" alteration, or whether they merely reflect the original composition of these rocks.

The orebody possesses a negative topographic expression due to its differential erosion with regards to the more highly resistant host rocks; it is now covered by glacial drift and swamp.

Possible wall-rock alteration in the host rhyolite is indicated by the presence of chlorite seams and stringers, hematitic staining, chloritoid metacrysts(?), and local silicified and carbonatized zones.

Although the orebody does occur in a felsic pyroclastic succession, the mafic and intermediate volcanic rocks cannot be ruled out as possible prospecting targets until more studies are made. Because of the variable thickness of the drift it would be advisable to use a combination of geophysical and perhaps geochemical techniques, rather than relying on only one method.

The Mattagami Lake Mines Limited base metal deposit is approximately 1,800 feet long by up to 300 feet wide, with the upper portion having the best grade[1]. The deposit consists of 12.4 million tons of ore grading 7.6 percent Zn, .91 percent Cu, .82 percent Pb, 3.04 oz. Ag, and .007 oz. Au[2]. It is

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[1]Northern Miner, July 16, 1970, p.1.

[2]Northern Miner, Aug. 13, 1970, p.3.

expected that 8,412,849 tons grading 9.38 percent Zn, 1.01 percent Pb, 4.01 oz. Ag, and .0095 oz. Au will be mined by open-pit methods.

A second deposit, referred to as the "F" zone was found approximately 3 miles west of the main deposit by Mattagami Lake Mines Limited in 1970. It consists of an ore shoot 400 feet long contained within a zone tested by diamond drilling over a strike length of 1,600 feet[1]. No ore calculations have as yet been presented for this body.

In the map-area, no highly mineralized zones were noted. Pyrite is ubiquitous while locally minor pyrrhotite and chalcopyrite occur in the felsic metavolcanics. Pyrite and pyrrhotite mineralization, generally less than 1 percent, occurs sparsely in the mafic metavolcanics. Iron formation is present in the metasedimentary belts as indicated by aeromagnetic data[2].

## No. 8 HAGEY AND CONACHER TOWNSHIPS

## DISTRICT OF THUNDER BAY

by

J.A. Morin[3]

Location: The area mapped comprises Hagey and Conacher Townships and the area north to latitude 48°42'. The centre of the area is approximately 50 miles west of Thunder Bay by Highway 11. The village of Shebandowan is located 1/2 mile off Highway 11 in Conacher Township. Lower Shebandowan Lake extends through the southern part of the area in an easterly direction. The Canadian National Railways and two H.E.P.C. transmission lines pass through the area.

Mineral Exploration: Early workers in the area prospected mainly for gold and iron ore. Recent workers have concentrated on copper and nickel. The most important deposit in the area is that of the Shebandowan Mine of The International Nickel Company of Canada, Limited. The area adjoins and partly includes the Kashabowie area to the west mapped by Hodgkinson[4]. Tanton[5] prepared a map that included the Shebandowan area at a scale of 1 inch to

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[1]Northern Miner, July 16, 1970, p.1.

[2]ODM-GSC, 1961: Bell Lake, Map 1117G.

[3]Graduate student, Department of Earth Sciences, University of Manitoba, Winnipeg.

[4]Hodgkinson, J.M., 1968: Geology of the Kashabowie area; ODM, GR53, 35p.

[5]Tanton, T.L., 1938: Geology, Shebandowan area, District of Thunder Bay, Ontario; GSC,Map 338A (Provisional Edition).

1 mile. Earlier geologists who commented on the area include W. McInnes[1], Cross[2] and Watson[3].

General Geology: The area is underlain by east-west-trending metavolcanics and metasediments that are Precambrian in age. The metavolcanics extend north and south of Lower Shebandowan Lake. They are mainly intermediate to mafic in composition, with only minor felsic rocks. There are few pyroclastic rocks in the sequence. South of Lower Shebandowan Lake, the older metavolcanic sequence contains an intraformational group of metasediments, about 3,000 feet thick, that consists of conglomerate, arkose, and argillite. Thin beds of iron formation occur interbedded with the metavolcanics. A thick sequence of greywackes overlies the metavolcanics in the northern part of the area. It was named the Kashabowie Group by Hodgkinson[4]. The grade of metamorphism ranges from the upper greenschist facies in the southern part to the almandine-amphibolite facies in the northern part of the area.

Narrow gabbro and peridotite sills intrude the metavolcanics and metasediments. A granodiorite-quartz diorite stock occurs in the western part of the area. The edge of a large granite body in the northern part of the area is in migmatite contact with the Kashabowie Group of metasediments. Quartz-feldspar porphyry dikes also occur.

Structural Geology: A major fault in the area is the southeast-trending Crayfish Creek Fault which is in the southwestern part of the map-area. This fault passes through the southern part of the Shebandowan Mine and might be related to the serpentinite and copper-nickel mineralization.

Economic Geology:

Copper-Nickel: The Shebandowan copper-nickel mine occurs on the southwest end of Lower Shebandowan Lake. The property was acquired in 1937 by The International Nickel Company of Canada, Limited. Small scale drilling was done up to 1965, after which drilling was done on a larger scale. Ground magnetic and electromagnetic surveys were done in the area during 1967 and 1968.

The mine is under development at present with two shafts, the No. 1 shaft at the original discovery point and the No. 2 shaft about 1 mile east of No. 1 shaft. The No. 1 shaft is 1,132 feet deep, whereas the No. 2 shaft is about 2,400 feet deep. The shafts are connected at the 600-foot, 800-foot, and 1,000-foot levels. Full production is expected to begin in the fall of 1972,

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[1]McInnes, Wm., 1897: Report on the geology of the area covered by the Seine River and Lake Shebandowan map-sheets comprising portions of Rainy River and Thunder Bay Districts, Ontario; GSC, Vol. 10, pt.H, p.1H-65H.

[2]Cross, J.G., 1920: in Windy Lake and other nickel areas; ODM, Vol. 29, pt.1, p.225-234.

[3]Watson, R.J., 1928: Platinum-bearing nickel-copper deposit on Lower Shebandowan Lake, District of Thunder Bay; ODM, Vol. 37, pt.4, p.128-149.

[4]Hodgkinson, J.M., 1968: op. cit.

at a rate of 2,900 tons of ore per day. The ore concentrates will be shipped to Copper Cliff, Ontario.

The orebody is associated with a serpentinite and occurs at the contact between mafic volcanic rocks and a granodiorite-quartz diorite stock. The southeast-trending Crayfish Creek Fault is a few hundred feet south of the orebody. The orebody has an east-west trend and is vertical. The ore is mainly a breccia with inclusions of serpentinite, metavolcanics, and granite porphyry. The inclusions range in size from less than an inch to several feet. In areas where the inclusions are small and minor in quantity, the ore appears massive. Pyrrhotite, pentlandite, chalcopyrite and pyrite are the main sulphide minerals. A consistent Cu:Ni ratio is present in both the high and low grade ores.

Gold: Gold occurs in shear zones in a feldspar porphyry in the vicinity of Swamp Bay. The shear zones are reported to contain quartz stringers with pyrite, chalcopyrite, sphalerite, and values in gold. The width of the shear zones varies from 2.5 feet to 3 feet. Diamond drilling by Freeport Canadian Exploration Company in 1945 yielded gold values ranging from 0.06 oz. Au/ton over 1.0 feet and 0.24 oz. Au/ton over 3.4 feet. Band-Ore Gold Mines Limited and Lobanor Gold Mines Limited hold claims in the area.

Gold-bearing mineralization also has been reported in the area around Pistol Lake. The gold occurs in quartz stringers and veins within quartz-feldspar porphyry dikes. The dikes are intrusive into andesites and basalts. One vein has been reported traced for 140 feet with the width varying from 1 inch to 24 inches. The gold occurs with the sulphide minerals (pyrite, chalcopyrite) which are erratically distributed within the veins[1]. Gold has also been reported south of Lower Shebandowan Lake in the southwestern part of Conacher Township. Twenty-nine trenches were dug by Ourgold Mining Company Limited in 1939, and the gold was reported found in some of the quartz veins which filled fault planes and tensional fractures in mafic metavolcanics[1].

## No. 9 BARBARA, MEADER, AND PIFHER TOWNSHIPS

## DISTRICT OF THUNDER BAY

by

W.O. Mackasey[2]

Location: Barbara, Meader, and Pifher Townships are located on the east shore of Lake Nipigon and form part of the "Sturgeon River Gold Belt". Mapping during the 1970 field season was concentrated in Barbara and Meader

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[1]Assessment work files, ODMNA, Resident Geologist's office, Thunder Bay.

[2]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

Townships with Pifher Township and the southeastern part of Meader Township scheduled to be completed during the 1971 field season.

Highway 11, a line of Canadian National Railways, and the natural gas pipeline of Trans-Canada Pipe Lines Limited pass through the town of Beardmore which is about 10 miles south of the map-area. Meader Township is accessible by means of bush roads and Barbara Township is best reached by fixed-wing aircraft. The city of Thunder Bay is located 120 miles to the southwest of Beardmore via Highway 11.

Mineral Exploration: Gold and copper have been the main interests for exploration. Several quartz veins along the Lake Nipigon shoreline have been tested for gold. The bulk of the activity in the map-area has been in the southeastern part of Meader Township where trenching, geophysical surveying, and diamond drilling has been undertaken by several individuals in the examination of a system of sulphide veins straddling the Meader-Sandra township boundaries.

General Geology: The oldest rocks in the area are Keewatin-type mafic, intermediate, and felsic volcanic rocks. Granitic rocks with porphyritic phases and pegmatitic zones intrude the volcanic rocks and underlie most of the northern half of Meader Township. North-striking diabase dikes cut both the granitic and volcanic rocks. A flat diabase sheet overlies the volcanic rocks in the southern part of the area mapped.

Intermediate to felsic tuffs, tuff breccia, and pyroclastic breccia with related flows underlie the southern part of Barbara and Meader Townships and are similar to those mapped in Sandra[1] and Irwin[2] Townships. This unit continues westward to Lake Nipigon into an area previously thought to have mafic volcanic rocks.

Mafic volcanic rocks metamorphosed under amphibolite facies conditions and consisting of flows with zones of pillows, amygdules, and breccia, form a unit paralleling the Lake Nipigon shoreline in the northern half of Barbara Township.

Structural Geology: The volcanic rocks in the southern part of Barbara and Meader Townships form part of an east-west fold belt. Foliation in the mafic volcanic rocks in Barbara Township trends north to northwest paralleling the contact with granitic rocks. A west-northwesterly-striking fault along the southern border of Barbara and Meader Townships cuts the volcanic rocks and diabase sheet. Several northeast-striking linears are present in the granitic rocks.

Economic Geology: Sulphide deposits in the area mapped form two types: pyrrhotite-pyrite-chalcopyrite zones in mafic volcanic rocks (amphibolites), and quartz-sulphide veins and stringers occupying shears and fractures in intermediate to felsic volcanic rocks.

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[1]Mackasey, W.O., 1968: Sandra Township, District of Thunder Bay; ODM,Prelim. Map P.480.

[2]Mackasey, W.O., 1968: Irwin Township, District of Thunder Bay; ODM,Prelim. Map P.481.

The pyrrhotite, pyrite, chalcopyrite mineralization is finely disseminated and forms zones 1 to 5 feet wide which parallel the foliation. Several of these zones are along the Lake Nipigon shoreline south of Vint Bay. Grab samples collected by the field party were found on analysis by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, to contain traces of copper, nickel, gold, and silver.

Chalcopyrite, pyrite, and pyrrhotite are the main sulphides in the quartz-sulphide zones in the Pirum-Musca Lakes area on the Meader-Sandra township boundary. The veins and stringers are in zones ranging from a few inches to several feet wide and are located in intermediate to felsic metavolcanics, including feldspar porphyry flows and deformed pyroclastic breccia. A selected grab sample of a 1- to 2-foot wide quartz vein exposed in a test pit 1/2 mile west of Musca Lake and on a trail approximately 500 feet north of Littlelake River was collected by the field party and found by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, to contain 3.10 percent Cu, 0.10 oz. Au/ton, and 1.00 oz. Ag/ton. A series of shears in fractured massive and porphyritic lava has been traced for over 1,000 feet along the Meader-Sandra township boundary just north of Musca Lake. A chip sample collected by the field party across a width of 6 feet in one of the central trenches was found by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, to contain 0.33 percent Cu, 0.06 oz. Au/ton and a trace of silver. A grab sample collected by the field party from the rubble in the old workings of the Brennan and Kenty Bros. Prospecting Company Limited[1] was found to contain 2.53 percent Cu, 0.26 oz. Au/ton, and 0.64 oz. Ag/ton.

A trench on the H.M. Holm property west of the central part of Pirum Lake in Sandra Township has exposed a 3- to 6-inch wide, north-dipping, massive chalcopyrite-pyrite vein in foliated feldspar porphyry. A channel sample across the vein at a width of 4 inches was collected by the field party from a face in the trench and found by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, to contain 16.8 percent Cu, 0.09 oz. Au/ton, 3.55 oz. Ag/ton and traces of Co, Pb, Mo, Ni, and Zn. Diamond drilling and trenching has traced the mineralized zone a distance of 800 feet west of Pirum Lake[2].

All mineral occurrences in this area are located near a fault that trends west-northwest through Musca Lake and may be in related subsidiary shears and fractures. Exploration of the region along the strike of the fault may locate additional mineralized zones.

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[1]Laird, H.C., 1936: The western part of the Sturgeon River area; ODM, Vol. 45, pt.2, p.91-92.

[2]Oja, R.V., 1967: Unpublished report.

# No. 10 OPERATION ROSSPORT (DICKISON LAKE AREA)

## DISTRICT OF THUNDER BAY

by

M.W. Carter[1]

Location: The Rossport map-region is centred on Dickison Lake, northeast of Nipigon in the District of Thunder Bay and is bounded by the north shore of Lake Superior between west longitudes 86°30'00" and 88°15'00", and by north latitude 49°30'00". It is accessible by Highways 11 and 17, both of which pass through the region. Further access is by the Domtar Limited road network in the west and the Kimberly-Clark Pulp & Paper Company Limited road network in the east. The central part of the region, however, is accessible only by float-equipped aircraft.

Fieldwork was divided into two parts: helicopter and semi-detailed traverse mapping at a scale of 1 inch to 1/4 mile in the region outlined above and bounded by north latitudes 49°02'00" and 49°20'00" and by west longitudes 87°07'30" and 87°45'00"; and helicopter reconnaissance mapping of lakeshore outcrops over the remaining part of the region not previously examined by earlier workers. The semi-detailed area (Dickison Lake area) covers about 590 square miles and the remainder of the region, mapped by helicopter reconnaissance, about 540 square miles. The helicopter reconnaissance area was done at a field scale of 1 inch to 1 mile.

Mineral Exploration: In the area of semi-detailed mapping (Dickison Lake area) very little exploration work has been done. In 1954, Canadian Pacific Railway[2] carried out exploration by geological mapping in a search for base metal deposits. This was continued in 1955[3], when a contiguous region to the west, including part of the Gravel River, was similarly mapped. Two geological maps were prepared at a scale of 1 inch to 1/4 mile. Attention was directed principally to the metasedimentary belt exposed at Dickison Lake and extending southwest along the Gravel River. In the Dickison Lake area, galena, sphalerite, chalcopyrite, and pyrite were found. In the Gravel River area, only minor mineralization was encountered consisting of pyrite, and float containing chalcopyrite, pyrrhotite, and sphalerite.

In 1968, Anglo American Nickel Mining Corporation Limited[4] carried out exploratory drilling near the northwestern shore of Kabamichigama Lake on one of a group of 12 claims. Two diamond drill holes were sunk to a combined

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[1] Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

[2] Bartley, M.W., 1955: Dickison Lake area; Development Section, Canadian Pacific Railway, 10p.

[3] Bartley, M.W., 1955: Gravel River area; Development Section, Canadian Pacific Railway, 7p.

[4] Assessment work files, ODMNA, Resident Geologist's office, Thunder Bay.

depth of 758 feet. Chalcopyrite, pyrite, and sulphides were encountered throughout most of the core in both holes. These minerals occur variously in grey or green cherty material, diabasic or granitic rocks, or in quartzite or metagreywacke in an area underlain mainly by granitic rocks or granitized gneiss.

During 1969, prospectors were actively examining the Croon Lake-Dinkin Lake, and the Greenhedge Lake-Northpine Lake Faults for mineralization.

In 1970, a prospecting party on behalf of Dome Mines Limited was examining showings in the Dickison Lake area.

General Geology: The bedrock in the region is of Precambrian age. The main lithological units are (a) an unmigmatized northeast-trending metasedimentary-metavolcanic belt centred about Dickison Lake, (b) migmatite along the northeast and southwest extension, and to the northwest and southeast of this belt, (c) a pink, sheared intrusive granite within the metavolcanic-metasedimentary belt, and (d) younger mafic diabase.

The metasediments consist predominantly of greywacke and quartzite. The greywacke contains pink garnet and has a mineralogical composition characteristic of the almandine-amphibolite facies of regional metamorphism. All traces of primary structures have been obliterated. The quartzite is light coloured and shows a gneissic banding of biotitic material. This rock is predominant in the extreme southeastern part of the area.

The metavolcanics show no primary features but compositionally are mafic. In the field, the presumed mafic volcanic rocks are not easily distinguished from the greywacke as the weathering characteristics are similar.

The migmatite consists predominantly of granitized greywacke in which recognizable remnants of relatively unaltered greywacke are present. The migmatized greywacke grades imperceptibly into biotite granite. Associated with the migmatite are large areas of white and pink granite pegmatite and trondhjemite or alaskite. Much scattered magnetite is associated mainly with the pink granite pegmatite. Sharp boundaries between these rock units are not present. The presumed mafic volcanic rocks are likewise migmatized and grade into massive hornblende granite. In such areas, the granitic rocks are generally pink.

The pink, biotite granite in the metasedimentary-metavolcanic rocks about Dickison Lake has sharp intrusive contacts and is not a part of the migmatite suite. It is well sheared.

The diabasic rocks are rare. Some of them have been sheared and chloritized, and, in places, are mineralized with pyrite and minor chalcopyrite. These are usually associated with the major faults and shear zones. The fresh relatively unaltered diabase is unsheared and unmineralized.

Glacial drift covers much of the lower lying areas, occurring dominantly in the north-central part and the eastern margin of the map-region. The material consists of fine yellow sand and gravel.

Structural Geology: The major structural feature of the area is the Gravel River-Kamuck River Fault. This feature extends diagonally across the area from northeast to southwest and is 34 miles long in the map-area. It has a marked physiographic expression, that of a steep-walled trench up to 200 feet across, and is associated with a shear zone which, at Dickison Lake, is up to 1 mile wide. No other similar trench-like features parallel to this occur. The secondary dominant feature is a set of northwest-southeast lineaments which are the loci of shearing. Two prominent examples are the Croon Lake-Dinkin Lake-Greenhedge Lake-Northpine Lake feature and the Little Aguasabon Lake-Aguasabon River feature.

Foliation and gneissosity trends are dominantly northeast-southwest in the Dickison Lake area and in the area to the northwest of it. To the south and southeast of Dickison Lake the trend is west-northwest to east-southeast. Shearing in the Dickison Lake area is generally parallel to the foliation. The same is true in the southeastern part of the region. Minor shear directions deviate markedly from the main trends, which are parallel to the faults.

Because of the absence of primary features in the metasediments and metavolcanics, the pattern of folding could not be determined.

Economic Geology: The field party does not know of any major deposit of base or precious metals in the region.

Chalcopyrite is the most important ore mineral. The most significant occurrence is that near the northwest shore of Kabamichigama Lake. The chalcopyrite occurs in a fine-grained brecciated mafic rock occurring as a dike trending N60W and cutting granitic-migmatitic rocks. The fractures in the brecciated rock are healed by ramifying quartz veins. The mafic rock shows a sharp contact with the granitic rocks and mineralization occurs only in the former. The exposed area of mineralization extends along a strike length of over 150 feet. The dike is about 5 feet wide. The only other occurrence of importance is one located between Flicker and Chapman Lakes on the east side of the Greenhedge Lake Fault. It consists of disseminated chalcopyrite in a quartz body about 100 feet wide by 200 feet long. A little chalcopyrite (1-2 percent) was found across a width of 1 foot in sheared quartzite or granitic rock on the northeast shore of Northpine Lake.

The most important pyrite deposit is in a dark mafic brecciated rock in a bluff along the western shore of Dinkin Lake. The brecciated and mineralized rock contains up to about 40 percent pyrite across a width of 3 feet and along a strike length of 3/4 mile. Pyrite in amounts up to 10 percent also occurs in satellitic shear zones off the Gravel River-Kamuck River Fault in the Dickison Lake area, irrespective of the nature of the host rock. Otherwise it is present in background amounts in mafites.

Magnetite occurs in the migmatite areas and is preferentially associated with pink granite pegmatite. Its presence is responsible for the anomalies located in ODM-GSC aeromagnetic surveys and the mineral is particularly abundant in regions enclosed by the 60,500 gamma aeromagnetic contour. The magnetite occurs in large crystals up to 3/4 inch across in the pegmatite and can constitute up to 20 percent of the rock in places. Its greatest development is in the pink granite pegmatites, in the vicinity of the middle and southern parts of Gravel Lake, enclosed by the 60,500 gamma aeromagnetic contour[1,2].

A few grains of molybdenite were noted in white granite pegmatite about 1 mile west of the Chorus Lake bridge along the road to Long Lake, in a road cut. Another occurrence was noted in greywacke along the north shore of Dickison Lake.

Sphalerite and galena have been reported by M.W. Bartley[3] from a showing on a small island in the extreme western part of Dickison Lake. The locality mentioned by Bartley was visited but the occurrence was not found.

## No. 11 OPERATION ROSSPORT (RECONNAISSANCE GEOCHEMICAL SURVEY)

### DISTRICT OF THUNDER BAY

by

W.J. Wolfe[4]

Geochemical sampling programs in the Operation Rossport region were designed to establish the effectiveness of geochemical procedures in locating mineralized breccia zones associated with regional fault systems or linear features that traverse mainly granitic and migmatitic terrain and displace Algoman granitic rocks and Late Precambrian diabase dikes[5]. These breccias often contain low-grade pyrite or pyrite-chalcopyrite mineralization and are typically composed of fine-grained mafic rock fragments cemented by a network of milky vein quartz.

Seepage soils, spring sediments, and stream silts were collected at 250 sites in drainage systems associated with a northwest-trending fault zone passing through Chapman, Flicker, Greenhedge, and Dinkin Lakes. A parallel northwest-trending fault zone passing through the east end of Kabamichigama Lake was similarly sampled at 60 sites. Results to date show that low-grade copper mineralization of limited extent in the Greenhedge Lake Fault zone gives

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[1]ODM-GSC, 1963: Dickison Lake, Map 2140G.

[2]ODM-GSC, 1963: Wintering Lake, Map 2141G.

[3]Bartley, M.W., 1955: Dickison Lake area; Development Section, Canadian Pacific Railway, p.2.

[4]Geochemist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

[5]Pye, E.G., 1970: Current activities and trends in exploration in Ontario; ODM, Misc. Paper 37, p.19.

a moderate geochemical response over distances up to 500 feet down drainage from the source. Breccia-type mineralization in the Kabamichigama Lake Fault zone produces a much more localized geochemical response. A highly pyritized breccia zone on the west side of Dinkin Lake contains no visible economic mineralization and did not respond to geochemical tests for Cu, Pb, and Zn in the surficial soil.

Drainage within a 65 square-mile region of the Glacier Creek-Barbara Lake-Kabamichigama Lake area was systematically tested at a mean sample density of 10 samples per square mile. The -80 mesh sieved fraction of all samples was tested in the field for cold ammonium citrate soluble total heavy metals and anomalous samples were further tested for cold extractable copper. Samples were also analyzed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, for hot $HCl-HNO_3$ extractable Cu, Pb, Zn, and Mn.

A detailed orientation survey was completed in the vicinity of low-grade, fault-associated, chalcopyrite-pyrite mineralization on Glacier Creek about 2 miles north of its junction with the Jackpine River. Samples of $A_1$ horizon soil, B horizon soil, and black spruce needles, twigs, and lower bark were collected at 90 sites located at 100-foot intervals on 5 picket lines and a base line. These samples are currently being analyzed for Cu, Pb, and Zn.

Field tests for cold extractable metal in samples from the Glacier Creek drainage failed to produce the geochemical response expected from mineralized zones in the area. Copper dispersion is complicated by the presence of extensive groundwater zones of relatively low pH (5.0 to 6.0) and Eh (+200 to +300 mv) which inhibit copper precipitation in seepage soils and springs. Total heavy metal determinations on 50 samples of surface and groundwater in the Glacier Creek drainage basin produce a pattern of metal distribution that is strongly influenced by pH, Eh and other local environment variables.

## No. 12 BLACK BAY PENINSULA AND VICINITY

## DISTRICT OF THUNDER BAY

by

W.H. McIlwaine[1] and Henry Wallace[2]

Location: Black Bay peninsula and the adjacent islands are about 46 miles (74 kilometers) east-northeast of Thunder Bay; the map-area is bounded by north latitudes 48°18' and 48°47' and by west longitudes 88°00' and 88°40'. Access is by boat or float-equipped aircraft. Boats may be launched from

[1]Geologist, Ontario Department of Mines and Northern Affairs, Thunder Bay.

[2]Graduate student, Department of Geological Sciences, University of Toronto, Toronto.

several places on the adjacent Sibley Peninsula or from Hurkett or Nipigon, about 40 miles (64 kilometres) to the north. Aircraft are available for charter from Thunder Bay, Hurkett, and Pays Plat.

Mineral Exploration: Over the years several companies and individuals have been active in reconnaissance exploration for native copper deposits similar to those found in the Keweenaw Peninsula of Upper Michigan. Numerous pits are found, especially along the Black Bay side of the peninsula.

Exploration for silver has been carried out on Edward and Porphyry Islands in areas approximately on strike with the Silver Islet deposits.

Monarch Gold Mines Limited put down four diamond drill holes totalling 1,018 feet to investigate a calcite vein at the southern end of Edward Island in 1962. Little more than traces of silver were found in assays.

General Geology: The oldest rocks of the area belong to the Sibley Group of sedimentary rocks. Red, fine-grained sandstone is exposed on Grey Island and at the base of an escarpment of quartz-feldspar porphyry about 3/4 mile (1.2 kilometres) from Nipigon Bay.

Most of the area is underlain by the overlying Osler Group. This is a monotonous sequence of flood basalts with flows ranging in thickness from 1 foot (30.5 centimetres) to 100 feet (30.5 metres) pyroclastics, breccias, and red sedimentary lenses are intercalated with the flows. Projections from the upper part of the sequence, which is relatively well exposed, indicate a total thickness of about 5,240 feet (1,597 metres).

A typical flow consists of a basal amygdaloidal portion, commonly containing pipe amygdules, followed by a central massive section of mainly fine-grained, greenish grey basalt and followed by an upper amygdaloidal flow top, commonly oxidized red.

Amygdule minerals include zeolites, quartz, agate, calcite, epidote, and chlorite.

The northeastern section of the map-area is partly underlain by red and grey quartz-feldspar, feldspar, and quartz porphyries, most of which are of rhyolite-dacite composition. Evidence indicates that most of the porphyries are extrusive.

In Agate Cove, "Thunder Eggs" occur abundantly in the red and black porphyritic rhyolite. The origin of these spheres, which seem to be of similar composition to the host rock, is not known. They range in size from about 1/2 inch to 2 feet (1.2 centimetres to 61 centimetres) and average about 1 inch (2.5 centimetres) in diameter.

For the most part, sedimentary rocks are present as small red, interflow lenses. A conglomerate unit, up to 30 feet (9.2 metres) thick, is exposed on Puff Island. Extensive grey feldspathic sandstone, and siltstone outcrop on the shores of Osler Bay and Edward Harbour on Edward Island. Sedimentary structures including crossbedding, ripples, and primary current lineation indicate a fluvial environment with southeasterly flowing currents.

Diabase sills, possibly related to the Osler volcanism, provide very rugged topography on Fluor Island and to a lesser extent on Spar Island.

Intruding the Osler Group is the subcircular Moss Lake gabbro which is about 7 miles (11.3 kilometres) in diameter. The most abundant rock type is medium- to coarse-grained pyroxene gabbro. Other rock types present are fine-grained gabbro, pegmatitic gabbro, granophyre, anorthositic gabbro, gabbroic anorthosite, and foliated gabbro. Whether the foliation is primary or secondary in origin is not yet known.

Intruding all rocks in the area are diabase dikes, of which there seem to be two ages: an older coarse-grained ophitic variety and a younger fine-grained type. Northeast and northwest are the two dominant strike directions for the dikes.

Structural Geology: The Osler Group strikes N25E to N40E and dips 4-25SE.

There seem to be no major faults in the Osler Group; although faulting may have occured between the islands. This is difficult to determine.

A possible extension of the Gravel River Fault across Nipigon Bay from the northeast may separate the Osler Group from the Sibley Group along the escarpment which trends southwest across the top of the peninsula. This fault may be further extended along Black Bay.

Economic Geology: The area has been periodically subjected to prospecting for native copper deposits similar to those of the Keweenaw Peninsula where similar volcanic rocks are found. Many of the large copper deposits there are found in fragmental flow tops[1]. Fragmental flow tops in the Black Bay area are not common and it is probably because of this that exploration has not been successful. Minor amounts of finely disseminated copper have been observed in boulders of "red-beds" along the beach on the Black Bay side of the peninsula.

At the north end of Porphyry Island is a series of calcite veins 4 to 6 inches (10 to 15 centimetres) thick and striking N74E parallel to a diabase dike. No mineralization was observed during mapping but Tanton[2] reports disseminated chalcocite and chalcopyrite.

On the southeast shore of Edward Island are two old shafts, one of which (No. 1) is reported to be 35 feet (10.7 metres) deep[2]. Tanton[2] reports that some native arsenic came from this shaft. Both of these shafts were put down on calcite veins which trend close to north and contain chalcopyrite, galena, sphalerite, and local argentite and native silver[2]. No mineralization of economic importance was observed by the field party.

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[1] Butler, B.S., and Burbank, W.S., 1929: The copper deposits of Michigan; USGS, Prof. Paper 144, 238p.

[2] Tanton, T.L., 1931: Fort William and Port Arthur, and Thunder Cape map-areas, Thunder Bay District, Ontario; GSC, Mem. 167, 222p.

Agates of excellent quality and suitable for lapidary work are found locally in amygdules of the basalt.

## No. 13 MANITOUWADGE AREA

## DISTRICT OF THUNDER BAY

by

V.G. Milne[1]

Introduction: In 1968, the Ontario Department of Mines, with the co-operation of Noranda Mines Limited, Willroy Mines Limited, and Willecho Mines Limited, began mapping a 37 square-mile area in Gemmell and Mapledoram Townships at a scale of 1 inch to 800 feet. Much of the mapping was completed by 1969 and Preliminary Geological Map No. P.548[2], Gemmell Township, has been published. A few weeks in 1970 were spent in checking some of the earlier mapping.

Location: The area lies within Gemmell and Mapledoram Townships, extending west from Mose Lake to Nama Creek, and north from the south township lines to Rabbitskin Lake. The town of Manitouwadge lies just south of the map-area and is connected with Highway 17, 35 miles to the south, by Highway 614. The town is also linked to Highway 11, 80 miles to the north, in part by an industrial road, and in part by Highway 625.

Mineral Exploration: A detailed account of the exploration in the area to 1957 has been given by E.G. Pye[3]. In 1957, two mines were in operation, the Willroy Mine and the Geco Mine. The Willecho Mine was brought into production in 1965; the Big Nama Creek Mine in 1970. A number of new ore zones have been encountered in development and exploration work in the mines, but since 1957 no new orebodies have been discovered outside the mine areas. Deep drilling by Willroy Mines Limited and Noranda Mines Limited, Geco Division in 1965 and 1969, respectively, in the granitic area north of the mines has indicated that the ore-bearing horizons of the east-plunging regional syncline continue under the granitic rocks. Some mineralization was encountered in this drilling. Since 1957, Willroy Mines Limited, in conjunction with Willecho Mines Limited and Big Nama Creek Mines Limited, has conducted ground magnetometer and electromagnetic surveys of much of the patented claim area in Mapledoram Township west, north, and southeast of Garnet Lake. Geochemical soil sampling and exploration drilling has been carried out in parts of this area also. In 1965, McIntyre Porcupine Mines Limited drilled four holes totalling 1,468 feet

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[1]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

[2]Milne, V.G., 1969: Gemmell Township; ODM,Prelim. Map P.548.

[3]Pye, E.G., 1957: Geology of the Manitouwadge area; ODM,Vol. 66, pt.8, 114p.

on the Man-Echo property north of Cracknell Lake. In 1967, the same company drilled a further four holes totalling 1,379 feet in the area around Cracknell Lake.

General Geology: The geology of the area was previously described by J.E. Thomson[1] and E.G. Pye[2]. An accumulation of mafic metavolcanics is overlain by well-bedded biotitic, quartzo-feldspathic metasediments. These are superseded in turn by an iron formation interbedded with quartzo-feldspathic metasedimentary sequence in which minor felsic metavolcanic units have been recognized. These rocks have been intruded by metagabbro and by at least four major granitic phases. Subsequently all these rocks were intruded by diabase dikes. Rocks throughout the area have been metamorphosed to amphibolite facies rank. The availability of more detailed information has permitted subdivision of the stratigraphy to a greater extent than was previously possible. In addition to an apparent thickening due to structural plunge there is a real thickening of sedimentary units from Gemmell Township in the east to Mapledoram Township in the west, and new stratigraphic units are encountered as one traverses westwards. Whether this thickening continues around the nose of the Manitouwadge Syncline is difficult to determine because of the extreme folding and flat dip of the rocks, the migmatitic nature of the rocks along the north limb, the presence of large intrusive dioritic bodies, and the absence of mafic metavolcanics on the north limb of the fold. The southern iron formation units seem to thin and disappear around the nose of the syncline whereas the more northerly units seem to thin and disappear along the north limb of the syncline north of Cracknell Lake.

Structure: The Manitouwadge Syncline is the dominating structure in the map-area. This syncline plunges from 10E to 40E, steepening generally from west to east. The core of the syncline and the surrounding area are granitic gneisses but, as indicated by drilling, the metavolcanic and metasedimentary rocks plunge beneath the granitic rocks in the core. Mineral lineation and minor structures conform to the main regional structure over most of the area, but a second stage deformation is localized along a muscovite-quartz schist zone which has been traced a distance of about 3 miles, from the east edge of the map-area through the Geco Mine to the Willroy Mine[3]. It has not been possible to trace this muscovite-quartz schist zone in Mapledoram Township. However, muscovite-bearing schist is present adjacent to the Big Nama Creek Mines Limited orebody, which is located in an equivalent stratigraphic position to the Willroy Mines Limited No. 2 orebody, which in turn seems to lie in an extension of the main muscovite-quartz schist zone. Muscovite-bearing schist also was observed in metasediments and intrusive rocks along the claim line between claims TB47031 and TB47032 and in sillimanite gneisses west of the northwestern end of Garnet Lake.

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[1]Thomson, J.E., 1932: Geology of the Heron Bay-White Lake area; ODM, Vol. 41, pt.6, p.34-52.

[2]Pye, E.G., 1957: op. cit.

[3]Milne, V.G., 1969: op. cit.

Economic Geology: There are four copper-zinc-silver mines in production in the area. Along the strike, the orebodies are roughly lenticular in form and all plunge eastward following the structural trend of the region. However the orebodies are not conformable stratigraphically, there being many examples of massive sulphides cutting fold structures, host rock foliation, and intrusive rocks. The Geco orebody and the Willroy No. 1 and No. 6 orebodies are in or closely associated with muscovite-quartz schist. The host rock of the Big Nama Creek Mines Limited orebody is mainly pegmatite. The remaining orebodies are generally associated with quasi-conformable felsic intrusive sheets in iron formation or silicic gneisses related to iron formation. The orebodies may consist of massive or disseminated sulphides or both, the important sulphide minerals in these being pyrite, pyrrhotite, sphalerite, chalcopyrite, and galena. The ratios of zinc to copper, and pyrite to pyrrhotite are generally higher in the massive ore than in the disseminated ore. The disseminated ore consists mainly of pyrite, pyrrhotite, and chalcopyrite with minor sphalerite. There are several phases of massive ore and all may be present in a single orebody. Types observed include:

a) pyrite-rich ore, consisting mainly of coarse pyrite with interstitial sphalerite and pyrrhotite and minor chalcopyrite,
b) sphalerite-rich ore, with minor pyrite, pyrrhotite and chalcopyrite,
c) medium- to fine-grained sphalerite-pyrrhotite ore with subsidiary pyrite and chalcopyrite,
d) very fine-grained pyrrhotite-chalcopyrite ore with minor pyrite.

Ore types (a) and (b) seem to be end members with gradational relationships giving rise to various intermediate sphalerite-pyrite mixtures. Ore type (d) generally occurs as veins and ramifying veinlets with sharp contacts transecting the other ore types and resembles the disseminated pyrrhotite-chalcopyrite type of ore. The grain size of the sulphide minerals ranges from coarse to fine within any one orebody but, in general, the smaller and narrower orebodies, and narrower parts of large orebodies are finer grained than the thick orebodies. In any orebody, sphalerite-rich ore tends to be the coarsest ore type. A streaky lamination is sometimes evident in sphalerite-rich ore because of a streaky concentration of pyrite grains. This lamination parallels the ore contacts and in the Willecho Mine Limited open-pit, ore of this type crosscuts the country rock foliation. Inclusions of pegmatite, granodiorite, and muscovite-quartz schist, and metamorphic rocks containing cordierite, garnet, and sillimanite are present in the sulphide ore. Pegmatite intrusion postdates the main regional tectonism, and the formation of the muscovite-quartz schist postdates the pegmatite intrusion and main regional metamorphism. Thus the orebodies have been localized in their present positions after the main regional tectonism and metamorphism.

# No. 14 McMAHON AND MORIN TOWNSHIPS

## DISTRICT OF ALGOMA

by

F.W. Chandler[1]

Location: The two townships are approximately 30 miles east of Sault Ste. Marie and are between west longitudes 83°35' and 83°50' and north latitudes 46°32' and 46°37'. The area is hilly and bush covered and may be reached by gravel road east along Highway 638 from Sault Ste. Marie or north via Highway 561 along 25 miles of gravel road from Bruce Mines. In the area, all-weather road access is limited to a gravel road following the Thessalon River and another to Pattern Lake. Both townships were mapped during the summer of 1970 at a scale of 1 inch to 1/4 mile.

Mineral Exploration: Since the beginning of the century copper prospects have received attention. After discovery of the Blind River uranium deposits[2] interest also has been focused on uranium.

In 1956, Romar Mines Limited carried out ground self-potential and magnetometer surveys in the vicinity of the copper prospect in lot 1, concession III of McMahon Township. Drilling was recommended on a weak self-potential anomaly approximately 1,300 feet west of the prospect. In 1956, Romar Mines Limited also drilled seven diamond drill holes, the longest being 464 feet, to test the copper prospect in McMahon Township. Analyses show copper percentages up to 0.18 over a core length of 12 inches[3].

In 1968, magnetometer surveys of parts of the south of McMahon Township were flown by The British American Oil Company Limited. W.D. Sutherland and associates, also in 1968, ran airborne magnetometer and radioactivity surveys of the southeastern part of Morin Township. Higher radioactivities are in general confined to Huronian sedimentary rocks as opposed to the granitic basement.

In 1955, McIntyre Porcupine Mines Limited drilled four holes in the Matinenda Formation in lot 5, concession II of Morin Township. The deepest hole (325 feet) passed through two "poor" quartz pebble conglomerate beds, 2 and 3 feet thick. Analyses of drill cores from these beds indicate $U_3O_8$ values of 0.014 percent over 1.2 feet and 0.018 percent over 3.0 feet respectively[1]. In 1968, W.D. Sutherland and associates drilled six holes,

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[1]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

[2]Roscoe, S.M., 1969: Huronian rocks and uraniferous conglomerates in the Canadian Shield; GSC, Paper 68-40, 205p.

[3]Assessment work files, ODMNA, Resident Geologist's office, Sault Ste. Marie.

mostly started in the Mississagi Formation on lots 2, 3, concession I in Morin Township[1]. A quartz pebble conglomerate several feet thick and sandwiched between two volcanic units contains a significant concentration of uranium. Lack of proof of sufficient areal extent prevented development[2].

In the summer of 1970, Gulf Minerals Company was mapping in the southern part of McMahon Township.

General Geology: The northern and greater part of the area is underlain by granitic rocks of Archean age. Banded gneisses occur in the northern part of the map-area but most of the Archean terrain is underlain by massive granitic rocks, large parts of which are porphyritic.

Huronian sedimentary rocks rest nonconformably upon the dissected and weathered Archean surface. They occur as outliers in northern and eastern Morin Township and occupy large areas in the southern part of both townships. The lower part of the succession, dominantly feldspathic sandstones with subordinate ortho- and paraconglomerates, has been placed by earlier workers in several stratigraphic positions[3,4,5]. Recognition of a previously unmapped continuous massive sandy paraconglomerate in the lower sandstones permitted separation of these hitherto undivided rocks into lower and upper sandstone units. The order of stratigraphic succession and field appearance of these sandstones and the enclosed conglomerate permit tentative correlation with the Matinenda, Ramsay Lake, and Mississagi Formations of the Elliot Lake area[6]. These rocks are succeeded by the mixed clastic assemblage of the Gowganda and sandstone of the Lorrain Formations[6].

In southwestern McMahon Township, mafic to intermediate amygdaloidal volcanic rocks have been faulted up against rocks of the Gowganda and Lorrain(?) Formations which lie to the northeast. In Morin Township, small outcrops of mafic volcanic rocks occur intermittently at or near the base of the Matinenda Formation.

Large irregular bodies of Nipissing-type quartz diabase are concordant or discordant intrusions within Huronian and Archean rocks. Many small mafic dikes trend west-northwest. A few olivine diabase dikes and one of mica

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[1]Assessment work files, ODMNA, Resident Geologist's office, Sault Ste. Marie.

[2]Sutherland, W.D., 1970: Personal communication.

[3]Collins, W.H., 1925: North shore of Lake Huron; GSC, Mem. 143, 160p.

[4]Frarey, M.J., 1959: Geology, Echo Lake, Ontario; GSC,Map 23-1959.

[5]Giblin, P.E., and Leahy, E.J., 1966: Sault Ste. Marie-Elliot Lake Sheet; ODM, Geol. Comp. Series Map 2108.

[6]Robertson, J.A., Frarey, M.J., and Card, K.D., 1969: The Federal-Provincial committee on Huronian stratigraphy: progress report; Can. J. Earth Sci., Vol. 6, No. 2, p.335-336.

peridotite (possibly kimberlite) cut the Gowganda Formation. Though pyrophyllite has been observed locally in aluminous sandstones[1] signs of regional metamorphism were not visible in the field.

Structural Geology: Although the overall dip of Huronian rocks is moderate and toward the south or southwest, the Archean topography has locally influenced the attitude of the strata. A combination of Archean and present topography and the relatively gentle dip has produced an outcrop distribution complicated by outliers and inliers and sinuous boundaries. Faulting has affected the area to a minor extent. West-northwest-striking foliation occurs in the Archean rocks particularly in the north. Some argillaceous rocks of the Gowganda Formation and mafic volcanic rocks are sheared in the southern part of the map-area.

Economic Geology: Sandstones in the lower part of the Matinenda Formation and in the Gowganda Formation contain disseminated pyrite. Quartz veins bearing pyrite and minor chalcopyrite have been found to contain traces of gold and a little silver. These veins were the sites of many small exploratory excavations. A grab sample of one vein, located 1/4 mile southwest of Hugli Lake, McMahon Township, was assayed by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, and found to contain 0.4 ounces silver per ton.

Copper mineralization occurs in chalcopyrite-bearing quartz-carbonate-specularite veins which are either in or close to diabase intrusive rocks[2].

At the turn of the century shafts were sunk by The Copper Queen Mining Company Limited (Copper Queen Mine, parts of lots 3 to 8, concessions IV, V, Morin Township) and by The Sault Gray Copper Company Limited (lot 5, concession I, McMahon Township) to examine several of these copper-bearing veins[3,4,5]. A later discovery (1956) was the Bruce Mines prospect of Romar Mines Limited on lot 2, concession III of McMahon Township.

In the Elliot Lake area, workable uranium occurs only in pebble

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[1]Chandler, F.W., Young, G.M., and Wood, J., 1969: Diaspore in Early Proterozoic quartzites (Lorrain Formation) of Ontario; Can. J. Earth Sci., Vol. 6, pt.2, p.337-340.

[2]Carter, W.E.H., 1902: The mines of Ontario; Ontario Bur. Mines, Vol. 11, No. 5, p.273-274.

[3]Gibson, T.W., 1903: Statistics for 1902; Ontario Bur. Mines, Vol. 12, p.8.

[4]Carter, W.E.H., 1904: Mines of western Ontario; Ontario Bur. Mines, Vol. 13, pt.1, p.79-81.

[5]Assessment work files, ODMNA, Resident Geologist's office, Sault Ste. Marie.

conglomerates of the Matinenda Formation[1,2]. If the stratigraphic subdivisions and correlations suggested above are valid, then the surface target for uranium exploration in the vicinity of McMahon and Morin Townships is more closely defined. This view is reinforced by the recent discovery of uranium in pebble conglomerates in the lowermost sandstone formation in Morin Township[3,4].

Thick terraces of gravel sand and varved clay are present in river valleys particularly that of the Thessalon River.

## No. 15 TOWNSHIPS 1A AND 1B

## DISTRICT OF ALGOMA

by

J.A. Robertson[5]

Location: Mount Lake in Township 1A is about 20 air miles north of Elliot Lake. It is accessible by Highway 546 from Iron Bridge on the Trans Canada Highway (No. 17). Highway 639 connects Highway 546 in the southwestern part of Township 1A to Highway 108 at Quirke Mine, 10 miles north of Elliot Lake.

Mount Lake and the larger lakes in Township 1A and Sandpiper Lake in Township 1B are suitable for light aircraft. Lands and Forests access roads, lumber and drill roads, trails and portages facilitate travel throughout much of the area.

Preliminary geological maps of Townships 1A[6] and 1B[7] have recently been published by the Ontario Department of Mines and Northern Affairs and may be obtained from the Publications office.

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[1]Pienaar, P.J., 1963: Stratigraphy, petrology, and genesis of the Elliot Group, Blind River, Ontario, including the uraniferous conglomerate; GSC,Bull. 83, 140p.

[2]Roscoe, S.M., 1969: Huronian rocks and uraniferous conglomerates in the Canadian Shield; GSC, Paper 68-40, 205p.

[3]Assessment work files, ODMNA, Resident Geologist's office, Sault Ste. Marie.

[4]Sutherland, W.D., 1970: Personal communication.

[5]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

[6]Robertson, J.A., 1970: Township 1A; ODMNA,Prelim. Map P.610.

[7]Robertson, J.A., 1970: Township 1B; ODMNA,Prelim. Map P.609.

Mineral Exploration: The area lies to the north of the area mapped by Collins[1], but reconnaissance surveys were carried out by Emmons[2] and Harding[3] and the area was visited by Roscoe[4,5]. A copper showing at Cobre Lake, Township 1A, and base metal showings along the valley of the Little White River have encouraged prospecting over a considerable period. The Cobre Lake property was brought into production by Bi-Ore Mines Limited in 1949 and 1950. The discovery of the Blind River uranium deposits led to intense exploration in the mid-1950s. This revealed thorium-bearing conglomerates in Township 1A and, to a lesser extent in Township 1B, and chalcopyrite-pitchblende mineralization associated with altered granophyric diabase east of Cobre Lake.

Township 1A, apart from the northwestern part, and that part of Township 1B southeast of Highway 546 were included in the Mississagi Provincial Park and withdrawn from staking. This ground was reopened to staking leading to a staking rush in early 1968. Since then some diamond drilling and geophysical surveys (aeromagnetic and radiation) have been undertaken particularly in south-central Township 1A and southern Township 1B. A 1 mile-wide strip across Township 1B is withdrawn from staking to protect the proposed route of a possible extension of Highway 639.

In 1967, the area to the east was mapped by the Ontario Department of Mines[6]; in 1969, the area to the south was mapped[7,8].

General Geology The rocks of the area can be put into four classes: (1) the Archean basement, (2) the Huronian sedimentary rocks, (3) the post-Huronian mafic intrusive rocks, and (4) the Pleistocene and Recent unconsolidated sediments. In the map-area the sedimentary units strike west to west-southwest and dip gently to the south, the sequence being broken and repeated by east-striking, south-dipping thrust faults.

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[1]Collins, W.H., 1925: North shore of Lake Huron; GSC, Mem. 143, 160p.

[2]Emmons, R.C., 1926: Wakomata Lake map-area, Algoma District; GSC, Summ. Rept. 1926, pt.C, p.1C-15C.

[3]Harding, W.D., 1939: Geology of the Flack Lake area; ODM, Vol. 48, pt.11, 12p.

[4]Roscoe, S.M., 1969: Huronian rocks and uraniferous conglomerates in the Canadian Shield; GSC, Paper 68-40, 205p.

[5]Roscoe, S.M., and Steacy, H.R., 1958: On the geology and radioactive deposits of the Blind River region; Atomic Energy of Canada Limited, publication A Conf. 15/P/222.

[6]Wood, J., 1968: Township U; ODM,Prelim. Map P.468.

[7]Robertson, J.A., 1969: Township 163; ODM,Prelim. Map P.560.

[8]Robertson, J.A., 1969: Township 157; ODM,Prelim. Map P.561.

The Archean rocks consist of granitic rocks enclosing blocks of schists and gneisses metamorphosed from greywackes; and chloritic, biotitic, and amphibolitic mafic rocks representing mafic igneous, pyroclastic, and volcanic rocks. Other than bedding, the primary structures in these rocks have been obliterated. The rocks have been folded about northwest-trending axes which trend characterizes both bedding and foliation. The granitic rocks generally range from granite to quartz monzonite in composition, pink to red in colour and may be gneissic, massive equigranular, or porphyritic in texture. In areas of numerous inclusions, the granitic rocks are richer in mafic minerals and are more markedly foliated. Simple pegmatite dikes are common. In these areas, there is also some indication of an early white granite and pegmatite which cuts the inclusions but is itself cut by the pink-red granite.

The Archean basement rocks are cut by a swarm of northwest-trending diabase dikes. These are fine grained and, depending on sulphide content, weather black to rusty-brown. A few dikes contain scattered small feldspar phenocrysts. As diabase dikes almost never cross the Archean-Huronian contact and as there are few dikes within the Huronian, it may be assumed that the majority of the dikes cutting the basement are pre- rather than post-Huronian although dikes of the later age have the same trend and similar lithology.

The Archean basement is overlain by the Gowganda Formation, the basal formation of the Cobalt Group. The contact is normally sharp with little or no weathering of the basement rocks. The Gowganda Formation comprises a sequence of densely packed boulder conglomerate and arkose adjacent to the basement grading laterally and vertically into a sequence of sparsely packed conglomerate, feldspathic quartz, and greywacke, and in some areas in Township 1A, a well-laminated purple argillite with thin interbeds of fine- to medium-grained sandstone showing the graded bedding and flame structures characteristic of distal turbidites.

The thickness of the Gowganda Formation varies with basement topography from 0 to 500 feet or more. Drill hole evidence also indicates that the formation thickens southwards. Bedding and structures such as imbrication and long axis orientation of the boulders in the conglomerates indicate that the conglomerates were laid down in elongate basins controlled by the basement topography and that they had a moderate primary dip. Flash floods passing into turbidity currents were the probable transport mechanism. Away from the basement contact area the presence of greywacke with rafted pebbles and cobbles indicates glacial or near glacial conditions. The lack of a reduction weathering zone at the Archean surface and the preservation of considerable iron oxide in the Gowganda Formation indicates oxidizing rather than the reducing conditions which prevailed during the deposition of the Lower Huronian sediments elsewhere in the Algoma District[1,2].

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[1]Robertson, J.A., 1969: Geology and uranium deposits of the Blind River area, Ontario; Bull. CIM, Vol. 62, No. 686, p.619-634.

[2]Roscoe, S.M., 1969: op. cit.

The contact of the Gowganda and Lorrain Formations is not exposed in the map-area but it is believed to be conformable.

Several units have been mapped in the Lorrain Formation as follows:
1. Flaggy arkose, feldspathic quartzite, and siltstone. This unit marks the transition from the underlying Gowganda Formation. Where the quartzites and siltstones are hematitic, weak radioactivity may be observed.
2. Coarse-grained green arkose grading upwards into unit 3.
3. Yellow-green to pink-weathering yellow green arkose with much of the feldspar retaining its pink colour and streaks of hematite and heavy minerals defining the base of the beds and poorly developed crossbedding. Where these streaks are present the rock is weakly to moderately radioactive. This radioactivity is due to thorium.
4. Unit 3 grades into a gritty buff quartzite to feldspathic quartzite at the top of which it is interbedded with unit 5.
5. A conglomerate consisting of angular to subrounded quartz pebbles up to 1-1/2 inches across but typically less than 1 inch, in a radioactive matrix comprising siltstone to sandstone rich in hematite (specularite) and heavy minerals such as zircon and monazite. The radioactivity is due to the thorium and traces of uranium in these heavy minerals. Feldspar may be present in minor amounts. This unit is up to 50 feet thick in Township 1A but is less well developed in Township 1B where it ranges from 0 to 30 feet in thickness (thickness figures include the interbedded buff quartzite)[1].
6. Unit 6 consists of well-bedded, buff, pink and cream quartzites, weathering white to buff, interbedded with quartz-jasper-chert pebble conglomerate. The conglomerate beds comprise well-sorted and well-rounded pebbles, typically 1 to 3 inches across in a buff to white orthoquartzite matrix carrying trace amounts of kaolinitic clay minerals. In much of Township 1A the basal bed of the unit is a conglomerate bed 8 to 15 feet thick. In Township 1B a basal conglomerate bed is less well developed and is probably not ubiquitous. The conglomerate beds range in thickness from a few inches to five feet and are thickest and best developed in Township 1A north of Mount Lake and also south of Tenfish Lake; they are less well developed east of Tenfish Lake and in Township 1B. The interbedded quartzites are pebbly in northern Township 1A but are without pebbles elsewhere. The pinker beds may have streaks of hematite and heavy minerals and consequently are weakly radioactive. Clay minerals rather than feldspars are in minor amounts in the quartzites and indicate an origin under warm rather than frigid conditions. The clay minerals are kaolinite, pyrophyllite, and diaspore[2].
7. This unit, the uppermost of the Lorrain Formation, is poorly exposed and consists of light coloured, generally white orthoquartzite. Pebbles are rare, but poorly preserved crossbedding indicates shallow-water deposition conditions.

The Gordon Lake Formation which has a sequence of well-bedded siltstone, argillite, chertstone, and fine- to medium-grained sandstone seems to overlie

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[1]Robertson, J.A., 1968: Uranium and thorium deposits of northern Ontario; ODM, Min. Res. Circular 9, 106p.

[2]Chandler, F.W., Young, G.M., and Wood, J., 1969: Diaspore in Early Proterozoic quartzites (Lorrain Formation) of Ontario; Can. J. Earth Sci., Vol. 6, No. 2, p.337-340.

the Lorrain Formation conformably. Drill hole data indicate that there are three members: 1) a lower member of reddish sandstone and siltstone with anhydrite and gypsum nodules (and salt casts?); 2) a middle member of dark green siltstone, argillite, chert, and minor sandstone, and 3) an upper member of reddish siltstone, argillite, and chert. The lower member (1) outcrops in Township 1A near Highway 639 and at Cobre Lake; the middle member (2) outcrops along the southern side of the Boland River valley where it forms a slight escarpment near the boundary between Township 1A and Township 157. The formation is characterized by current ripples, micro-crossbedding, slumpage structures, and dessication cracks indicating deposition in very shallow water.

The post-Huronian structural and intrusive events are as follows: 1) tilting and faulting, 2) intrusion of the Nipissing diabase particularly the Rawhide Lake-Mount Lake body, 3) further faulting and intrusion of diabase dikes with a northwest trend, 4) thrust faulting, 5) intrusion of the northeast-striking strongly differentiated diabase dikes of the Abitibi swarm, and 6) the intrusion of northwest-striking olivine diabase dikes of the Sudbury swarm.

The Rawhide Lake-Mount Lake body is a thick south-dipping sheet of "diabase" differentiated from diorite to granophyre and with sharply chilled margins. Southwest of Mount Lake it passes into a near vertical dike trending southwest to Cobre Lake where it turns sharply southeast and strikes east-southeast to a point some 2 miles east of Cobre Lake where it again becomes a south-dipping differentiated sheet forming the high ground to the north of the Boland River. Granophyric segregations south of Rawhide Lake in Township U[1] at the east end of the dike section east of Cobre Lake and possibly in the sheet along the Boland River are characterized by epidote, chalcopyrite, and pitchblende.

Quartz-carbonate-specularite-sulphide veins have been found at and near Cobre Lake. These veins are between the dike and sill parts of the intrusive body and probably represent the confluence of the mineral-charged fluids migrating outwards from the two bodies of cooling magma. The quartzites adjacent to the diabase body are albitized taking on a red coloration and the more argillaceous rocks show spotted aggregates of chlorite and mica with or without carbonate and sulphide. On the north shore of Vasseau Lake such spotting with carbonate and chalcopyrite is well developed. The mineralization is similar to that of the Stag Lake deposit in Township 151[2].

Faults in the basement may be of several ages and follow northwest or northeast trends. Such faults may have controlled the elongate basins of sedimentation during the deposition of the Gowganda Formation. An ancient fault zone may control the valley in which the Little White River now flows. Quartz veins, with or without specularite and minor sulphide, are also found with northeast and northwest trends cutting basement rocks. Many of these veins are probably Archean although similar veins do cut the Gowganda Formation

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[1]Wood, J., 1968: op. cit.

[2]Wood, J., 1969: Township 151; ODM,Prelim. Map P.531.

and are thus post-Huronian.

Major thrust faults are found in the Mount Lake area of Township 1A and striking west-southwest across south-central Township 1B. The sheet-like portion of the Rawhide Lake-Mount Lake body is intruded along a thrust fault and the dike-like portions of the same body are probably in vertical fault fractures. Because of the thrust faults the radioactive unit of the Lorrain Formation outcrops on three zones: 1) to the north of Mount Lake; 2) below the talus slopes on the hill south of Mount Lake, and 3) in the vicinity of Tenfish Lake and eastward. In central Township 1B, the thrust faults twice repeat the outcrop of the basement, and at least one cuts the Nipissing diabase. These thrust faults thus represent a period of compression which started prior to the intrusion of the Nipissing diabase and continued after. They were probably related to the Flack Lake Fault, a major fault crossing the southern parts of Townships 157 and 163[1,2]. The recognition of the faults disproves the earlier theory that the radioactive deposits at Tenfish Lake were a younger unit than those north of Mount Lake[3].

In the Pleistocene, the area was glaciated and such soil as had formed was removed. The glacial striae indicate that the principal ice movement was S15W. During and after ice retreat, lacustrine deposits were formed in the Little White River valley. These are well-bedded gravels and sands. River action or lake levels have resulted in a series of well-defined terraces. South of the map-area the deposits in the river valley are crossbedded sands and gravels with some minor clay; these represent valley train deposits.

Economic Geology: Several types of mineralization have been found in the map-area. These have been described above and may be summarized as follows:

1. Quartz-specularite-sulphide veins of uncertain or several ages in the basement.
2. Similar veins cutting the Huronian sedimentary rocks.
3. Minor sulphide mineralization associated with the diabase dike swarm the basement.
4. Thorium (uranium) specularite, and heavy minerals of detrital origin mainly in unit 5 of the Lorrain Formation. This unit has been mapped, trenched, and drilled by various companies in the 1950s and again in 1968-1969 notably by International Bibis Tin Mines Limited and by Armore Mines Limited. Exploratory drilling was carried out by Atlantic Richfield Company.
5. Sulphide and sulphide-pitchblende mineralization associated with late-stage alteration of granophyric sections of the Rawhide Lake-Mount Lake-Cobre Lake Nipissing intrusion. Drilling was carried out and a 200-foot adit driven by

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[1]Robertson, J.A., 1969: Township 163; ODM,Prelim. Map P.560.

[2]Robertson, J.A., 1969: Township 157; ODM,Prelim. Map P.561.

[3]Roscoe, S.M., 1969: op. cit.

Harvard Uranium Mines Limited some 2 miles east of Cobre Lake[1,2].
6. Quartz-carbonate-specularite-sulphide veins and alteration zones adjacent to the Nipissing diabase particularly in south-central Township 1A and in the southwestern part of Township 1B.

Some data on types 4, 5, and 6, from diamond drill logs, and from aeromagnetic and radiometric surveys are available from the departmental assessment files[1].

At Cobre Lake, quartz-carbonate-specularite-sulphide veins cut sediments of the Gordon Lake Formation. The two principal veins are the East vein and the West vein. The East vein strikes N80W, is vertical, and has been traced for at least 850 feet. The West vein strikes N70E, is vertical, and has been traced for 1,368 feet. In 1929 to 1931 the veins were trenched and adits driven (east 1,040 feet; west 1,368 feet) by White Lakes Mines Limited. In 1947 to 1949 the property was developed by Bi-Ore Mines Limited who developed stopes on the West vein and constructed a mill which was damaged by fire in 1950.

Production was 2,726 tons of concentrate containing 1,647,079 lbs. of copper. The company was reorganized as Consolidated Bi-Ore Mines Limited and a Mace smelter was installed in 1956. No subsequent production data are available.

## No. 16 OPERATION CHAPLEAU

## DISTRICT OF SUDBURY

by

P. Thurston, G. Siragusa, R. Sage[3]

Introduction: Location and generalized geology of the region mapped are shown in Figure 3, and the aeromagnetic data are shown in Figure 2. The region comprises approximately 13,400 square miles and was mapped by helicopter-supported reconnaissance and ground traverse crews. The outcrop density varies from very poor in the northern part of the region to good toward its southern margin. Previous ODM and GSC mapping covers parts of the area.

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[1]Assessment work files, ODMNA, Resident Geologist's office, Sault Ste. Marie.

[2]Shklanka, R. (ed.), 1969: Copper, nickel, lead and zinc deposits of Ontario; ODM, Min. Res. Circular 12, 394p.

[3]Geologists, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

General Geology: Rocks of mafic to intermediate composition are the predominant metavolcanics. They include strontly foliated and chloritized rocks, massive pillowed and amygdaloidal rocks, and minor agglomerate and tuff. Gradational variations of massive into the foliated types occur. In general the metamorphic grade of these rocks is greenschist facies. Locally, contacts between the metavolcanics and the granitic rocks are migmatitic, with conspicuous development of thin elongate and lensoid amphibolite xenoliths embedded in leucocratic granitic rocks. Felsic metavolcanics occur as relatively thin bands in the mafic metavolcanics, and as discrete units having estimated thicknesses of several thousand feet (Heenan and Marion Townships). They include massive to foliated flows, volcanic breccia, agglomerate, and tuff. The metasediments are spatially associated with, and may in part have been derived from, the metavolcanics. They include conglomerate, greywacke, arkose, iron formation and slate, and paragneisses derived from these metasediments. Bodies of dioritic, gabbroic, and peridotitic composition are found as intrusions in the metavolcanics.

The granitic rocks include massive to gneissic rocks varying in composition from granite to trondhjemite, with dioritic rocks and minor syenite. Due to the reconnaissance nature of the present mapping, the granitic rocks could not be subdivided into mappable units. However, in general, migmatites and poorly foliated rocks of quartz monzonitic to trondhjemitic composition occur in the northern two-thirds of the area. Conversely, massive red granite predominates in the southern part of the region. Pegmatite is common as a local phase in granitic rocks, as a component of the migmatites, and as discrete dikes up to a few feet in thickness.

The geological boundaries delimiting the rocks associated with the "Kapuskasing structure"[1] (Figure 3), reflect a generalized interpretation of the available aeromagnetic data[2]. These data show steep magnetic gradients, particularly along the northern and southern margins of the delimited area (Griffin, Belford and Lemoine, Lincoln Townships). The predominant lithologic type found in the anomalous zone is brown to reddish plagioclase-pyroxene-garnet gneiss. This rock is probably the product of high-grade metamorphism (granulite facies)[3]. In Belford Township there is evidence of a northeast-trending fault separating the granulite gneisses from the metavolcanics. The Shenango complex (see Figure 2) occurs within the southeastern segment of the Kapuskasing structure. On the basis of presently available evidence, alkaline syenite and carbonatite do not occur at Shenango; therefore it is classified as a "mafic syenite complex" to distinguish it from the alkalic-carbonatite complexes occurring elsewhere in the region.

A large body of anorthosite (275-300 square miles in exposed area) was found northwest of the Ridout volcanic belt (Figure 3). The massif extends

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[1]MacLaren, A.S., Anderson, D.T., Fortescue, J.A.C., Gauche, E.G., Hornbrook, E.H.W., and Skinner, R., 1968: A preliminary study of the Moose River Belt, northern Ontario; GSC, Paper 67-38, 48p.

[2]ODM-GSC, 1965: Missinaibi Lake; Map 7086G.

[3]Turner, F.J., and Verhoogen, J., 1960: Igneous and metamorphic petrology; McGraw-Hill Book Company, Incorporated, Toronto, p.533-557.

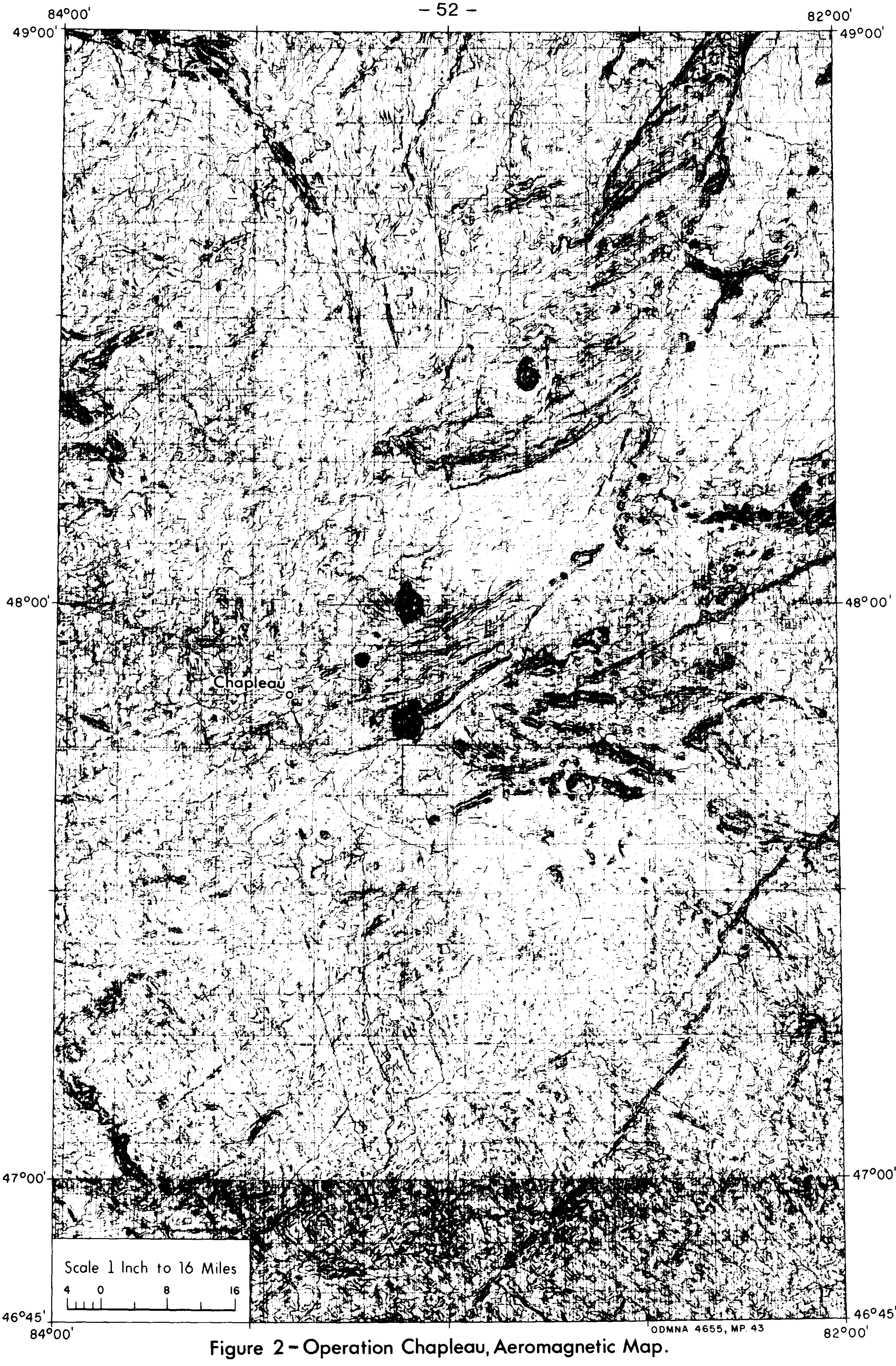


Figure 2 – Operation Chapleau, Aeromagnetic Map.

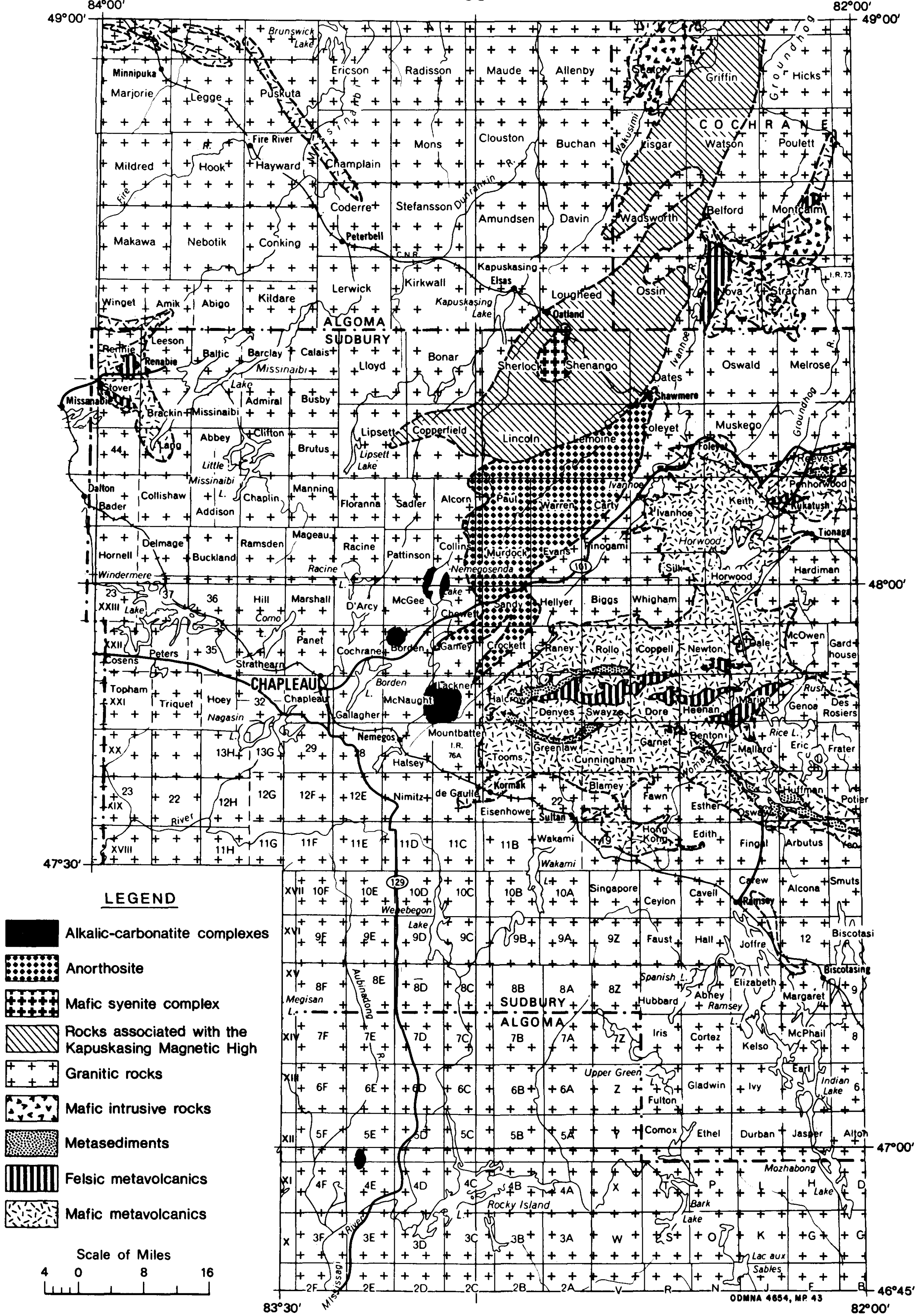


Figure 3 - Operation Chapleau, Geological Map.

south-westward from the Canadian National Railway west of Foleyet to a point east of Nemegosenda Lake, a distance of 30 miles. It has a maximum width of 15 miles. The anorthosite is massive to foliated and consists of medium-grained to very coarse grained plagioclase with 5 to 25 percent femic minerals. The femic mineral content and grain size vary greatly. The eastern contact between the anorthosite and the granitic rocks is migmatitic. Good exposures of migmatite also occur along the north shore of Carty Lake (Carty Township), where the anorthosite is intimately admixed with garnet-bearing amphibolite.

Alkalic-carbonatite complexes occur at Nemegosenda Lake (Pattison, Collins, Chewett, and McGee Townships), at Lackner Lake (Lackner and McNaught Townships), at Seabrook Lake (Townships 5E, 4E), and possibly in Borden Township. Alcalic syenite, carbonatite, ijolite, and fenitized rocks are generally found in the complexes. The Lackner, Nemegosenda, and Seabrook complexes were mapped in detail by G.E. Parsons in 1961[1].

Post-granite diabase dikes with a north-northwest or northwest trend are common in the area. The dikes are sub-vertical to vertical, have thicknesses up to 150 feet, and in places, are weakly pyritized.

Structural Geology: In the largest metavolcanic-metasedimentary belt a general east-west trend is shown by foliation in the volcanic rocks and by the axes of major folds such as the Woman River Anticline in Marion and Heenan Townships. In the Walls Township belt and the Missinaibi Lake belt, foliation trends east to southeast, and within the Nova Township metavolcanic belt it trends northeasterly. In the northeastern part of the area the deviations from the Superior Province east-west structural trend are probably due to disruption caused by the uplifting of the crustal block forming the Kapuskasing structure[2].

Southeasterly-trending faults occur in the central and southern parts of the region and are emphasized by rivers and elongated lakes. The faulting associated with the Kapuskasing structure is indicated by the development of ultra-mylonite zones for some distance away from the assumed fault zone.

Economic Geology: Mineral exploration in the map-region has been in progress since shortly after the turn of the century. Interest has been concentrated in the metavolcanic-metasedimentary belts of the Ridout-Swayze, Jerome, Horwood Lake-Foleyet, and Renabie areas.

Initial staking in the region was for iron in Marion, Heenan, and Genoa Townships in 1906 to 1907. Some diamond drilling of these deposits was done by the Jefferson Mining Company as early as 1910. In 1962, work along this belt by Stackpool Mining and Holding Limited (formerly Stackpool Mining Limited)

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[1]Parsons, G.E., 1961: Niobium-bearing complexes east of Lake Superior; ODM, GR3, p.46.

[2]Bennett, Gerald, 1969: Geology of the Belford-Strachan area, District of Cochrane; ODM, GR78, 30p.

indicated an estimated 5,100,000 tons of nearly 40 percent iron in three zones[1,2]. Prospecting for iron in this area has disclosed some lead, zinc, and copper mineralization associated with the iron formation at the eastern extremity of the belt.

In 1903, iron was reported from the Groundhog River area in Keith Township. Prospecting of this occurrence remained relatively dormant until the late 1950s and early 1960s when Kukatush Mining Corporation (1960) Limited undertook considerable diamond drilling and trenching in Keith and Kenogaming Townships. Results of this work have indicated 158,000,000 tons of magnetic iron ore grading 27.8 percent acid soluble iron which can be concentrated to 67 percent iron[3,4]. Attempts are being made to bring this deposit into production[3,4].

The most intensive period of mineral exploration activity took place during the 1930s when the metavolcanic-metasedimentary belts were examined for gold. This activity resulted in the underground development of more than 10 gold properties. Of these properties, only two have produced gold in significant quantities and one underwent considerable development to delineate a potential ore reserve.

The Jerome Mine in Osway Township is reported to have produced 56,878 ounces of gold and 15,104 ounces of silver from 335,060 tons of ore before termination of operations in 1945[5]. Reserves are estimated at 345,000 tons grading 0.19 ounces of gold per ton after dilution[6]. The mine was developed by a shaft 1,138 feet deep, 6 levels, and lateral workings extending 1,200 feet or more east, and 1,500 feet or more to the west.

Another former gold producer in the project area is the Renabie Mines Limited in Leeson Township. This mine has reached a depth of 3,455 feet with 20 levels. All gold production has been from above the 2,625 level. Reserves as of December 31, 1968 were 157,704 tons grading 0.211 ounces[7]. Operations at this property terminated during the summer of 1970.

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[1]Goodwin, A.M., 1965: Geology of Heenan, Marion, and northern Genoa Townships; ODM, GR38, p.39.

[2]Moore, E.S., 1926: Sahkatawich (Rush) Lake section, Woman River iron range, District of Sudbury; ODM, Vol. 35, pt.2, p.91.

[3]Canadian Mines Handbook, 1969-1970: Northern Miner Press Limited, Toronto, p.202.

[4]Milne, V.G., 1969: Geology of the Reeves-Kenogaming area, District of Sudbury; ODM, Open File Rept. 5040 (Folder 2), p.201A,139.

[5]Brown, W.L., 1948: Jerome Mine; in Structural geology of Canadian ore deposits; CIMM Symposium, p.438.

[6]Moorhouse, W.W., 1949: Geology of Osway Township; ODM, Vol. 58, pt.5, p.22.

[7]Canadian Mines Handbook, 1969-1970: op. cit., p.304.

Close to the Renabie property is the site of the operations of Nudulama Mines Limited. Development consists of a shaft 1,065 feet in depth with 7 levels. Operations were terminated in 1951 before production was commenced. Reserves are given as 579,325 tons grading 0.194 ounces proven ore and 1,000,000 tons possible[1].

Asbestos fibre in serpentinized ultramafic intrusions occurs at several places in the map-region and one deposit is currently in production. In Reeves Township Canadian Johns-Manville Company Limited operates an open-pit for asbestos fibre. The plant is designed to handle 5,000 tons of ore per day but has been running at 4,000 tons per day[2]. As of 1969, Milne[3] quotes estimated reserves as 20,000,000 tons grading 3.0 to 3.5 percent fibre. This operation is currently the only operating mine in the project area.

Of the four alkalic-carbonatite complexes occurring in the region, two have potential economic significance.

Dominion Gulf Company in the late 1950s developed a columbium-bearing zone in the Nemegosenda complex in Chewett Township. The company did extensive diamond drilling and drove a 600-foot adit into the mineralized zone. This work has delineated one potential ore zone of 20,000,000 tons grading 0.47 percent columbium oxide[4]. By-products of uranium, thorium, rare earths, zirconium, apatite, and magnetite may possibly be produced from this deposit. The property has been inactive in recent years.

Multi-Minerals Limited in Lackner and MacNaught Townships did extensive diamond drilling during the late 1950s on the Lackner Lake alkalic syenite-carbonatite complex for iron, apatite, columbium, rare earths, and thorium. They have outlined three zones of potential economic interest. Zones 3 and 4 contain an estimated 37,000,000 tons grading 21.3 percent apatite, 13.77 percent magnetite, and 0.198 percent columbium oxide; zone 6 contains 5,024,250 tons grading 69.6 percent magnetite, 21.9 percent apatite and 0.173 percent columbium oxide; and zone 8 contains 80,000,000 tons grading 0.25 percent columbium oxide[5]. The property has been dormant in recent years. Recently, Multi-Minerals Limited is reported to have leased the No. 6 zone to Fetio Industrial Development Limited[6].

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[1]Files: Mineral Resources Branch; Dept. Energy, Mines and Resources, Ottawa.

[2]Canadian Mines Handbook, 1969-1970: op. cit., p.71.

[3]Milne, V.G., 1969: op. cit., p.139.

[4]Parsons, G.E., 1961: op. cit., p.46.

[5]Canadian Mines Handbook, 1969-1970: op. cit., p.241.

[6]Northern Miner; July 23, 1970, p.1.

There has been no base metal production in the region, but base metal mineralization is widespread. Consolidated Shunsby Mines Limited has a copper-lead-zinc occurrence in brecciated cherty iron formation in Cunningham Township which is presently undergoing evaluation. Statistics regarding any potential ore zone have not been released by the company.

In Rennie Township, Westfield Minerals Limited has diamond drilled a shear zone cutting pyroclastic metavolcanics containing base metal mineralization and silver. Drilling has indicated a zone 350 feet long and 4.3 feet wide grading 14.8 percent zinc and 10.6 ounces silver. Values in copper, lead, and gold are also reported[1].

Exploration activity this summer by Parr Mines Limited initiated a staking activity in the Rush Lake area, Genoa Township, after the announcement of the discovery of disseminated chalcopyrite mineralization in a quartz diorite associated with sheared mafic inclusions[2].

At the close of the field season, a second copper discovery in the map-region was made by prospectors in Muskego Township[3]. This property is now under option to Kam-Kotia Mines Limited.

During this past summer Newmont Mining Corporation of Canada Limited, Noranda Exploration Company, Falconbridge Nickel Mines Limited, United States Smelting Refining and Mining Company, and Gunnex Limited have been reported to be active in the region.

Showings of iron, copper, asbestos, gold, lead, zinc, molybdenum, antimony, uranium, niobium, and rare earths are known to occur in the map-region.

## No. 17 SWEENY, BEAUMONT, AND BERESFORD TOWNSHIPS

## DISTRICT OF SUDBURY

by

H.D. Meyn[4]

Location: The three townships form an east-west strip approximately 18 by 6 miles. The southeastern corner of Beresford Township lies approximately 33 miles due north of Sudbury. Access is provided to the east side of

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[1]Riley, R.A., 1969: Geology of the Glasgow-Rennie area, Districts of Algoma and Sudbury; ODM, Open File Rept. 5030, p.89.

[2]Northern Miner; July 23, 1970, p.1.

[3]Northern Miner; Sept. 10, 1970, p.1.

[4]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

Beresford Township by the service road to the new transmission line of the Hydro-Electric Power Commission of Ontario. The western part of Beaumont Township and the eastern part of Sweeny Township can be reached by the service road of the old power transmission line, and by the Canadian National Railways. The remainder of the area can be reached from numerous lakes suitable for float-equipped aircraft.

The area was first mapped by W.H. Collins[1] as part of a regional reconnaissance survey. Roberts and Creelman Townships, to the south of the area, were mapped by the author in 1967[2]; Grigg and Stobie Townships, to the east, were mapped by the author in 1968[3,4]; the Maple Mountain region, to the northeast, was mapped in 1969 by K.D. Card, W.H. McIlwaine, and H.D. Meyn[4].

Mineral Exploration: No information is available on mineral exploration in Sweeny and Beresford Townships. Over the last three years, some exploration for uranium was carried out by Murgor Explorations Limited, Gordon Leliever, and Nordic Industries Limited in the southern part of Beaumont Township on the extension of rocks of the Mississagi Formation and the overlying Bruce Formation found in Roberts Township. This work consisted of geological mapping combined with radiometric surveying.

General Geology: The area is underlain by Precambrian rocks of various ages with a discontinuous cover of Pleistocene to Recent deposits of sand, gravel, clay, and organic matter.

The oldest rocks of the area are metavolcanic flows, hypabyssal intrusions, and iron formation. Only remnants of these rocks are still found. The above rocks were intruded by granitic rocks and assimilated to a large extent. The granitic ones vary in colour from pink to dark grey and in composition from granite and quartz monzonite to granodiorite. The granitic rocks are intruded by dikes of diabase, gabbro, and amphibolite.

The above assemblage forms the basement for the Huronian sedimentary rocks. In the southern part of Beaumont Township, outcrop areas of Mississagi and Bruce Formations are present. In other parts of the area, the Gowganda and Lorrain Formations lie directly and unconformably on the basement.

The above rocks were intruded by sills and dikes of Nipissing diabase. The youngest rock of the map-area is a northwest-trending dike of olivine diabase in southern Beaumont and Beresford Townships.

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[1]Collins, W.H., 1917: Onaping map-area; GSC, Memoir 95, 157p.

[2]Meyn, H.D., 1969: Geology of Roberts, Creelman, and Fraleck Townships, District of Sudbury; ODM, Open File Rept. 5033, 60p.

[3]Meyn, H.D., 1970: Geology of Grigg and Stobie Townships, District of Sudbury; ODM, Open File Rept. 5047, 47p.

[4]Card, K.D., McIlwaine, W.H., and Meyn, H.D., 1970: Operation Maple Mountain, Districts of Timiskaming, Nipissing and Sudbury; ODM, Open File Rept. 5050, 275p.

The Vermilion River was once a major glacial drainage channel and extensive deposits of sand and gravel are found in the flood plain of the glacial valley which was much wider than the present river valley.

Structural Geology: The metavolcanics generally possess a well developed, steeply dipping to vertical foliation.

Abundant pegmatite dikes are present in the granitic rocks, especially in Beresford Township. Tension and shear joints are well developed. Gneissossity is the dominant minor structure near the northern border of the area.

The contact between the Huronian sedimentary rocks and the basement is seldom found undisturbed. Generally the contact is in a near vertical position, indicating rotation of both the cover and underlying rocks. Shearing is evident in many places along the contact. The dip of the sedimentary rocks through the map-area varies from 5 degrees, probably original, to vertical. The rocks of the Gowganda Formation are tectonically quite incompetent and also devoid of stratigraphic marker beds. The highly complex tectonic history of the area is thus difficult to elucidate. The whole area has been abundantly faulted. Block faulting appears to be the predominant style.

Economic Geology: In Hutton Township to the south and Cotton Township to the north, large bodies of iron formation are present. Only one very small lens of iron formation was observed in northern Beaumont Township. No sulphide stains were observed on the metavolcanics. Some minor rust-stained patches were observed in the granitic rocks in southeastern Beresford Township, northern Beaumont Township, and north-central Sweeny Township. The pegmatitic dikes do not seem to carry any mineralization of economic interest, although in Marconi Township[1] some were reported to be slightly radioactive.

The contact between the Huronian sedimentary rocks and the basement is a favourable horizon for uranium mineralization, but none was observed in the area. Single cubes of pyrite and disseminated magnetite, sometimes concentrated into very small seams, are present locally in the argillites of the Gowganda Formation. A vein about 1 inch by 2 feet of nearly massive pyrite and chalcopyrite in Gowganda argillite was seen in McNamara Township.

No metallic mineralization of any kind was found in the Nipissing Diabase.

Placer gold has been reported from a number of places in the Vermilion River sediments from outside the map-area. These river sediments were not investigated during the present program. Some deep pits on the portage between Post Lake and Graveyard Lake suggest some exploration for placer gold has been carried out in the area.

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Card, K.D., McIlwaine, W.H., and Meyn, H.D., 1970: op. cit.

# No. 18 PLEISTOCENE GEOLOGY AND INDUSTRIAL MINERAL RESOURCES OF THE SUDBURY AREA

## DISTRICT OF SUDBURY

by

G.J. Burwasser[1]

Location: The map-area is bounded by north latitudes 46°30' to 46°45' and west longitudes 80°45' to 81°30'. The city of Sudbury is located at west longitude 81°00' on the south boundary of the area. Mapping of the area was completed during the 1970 field season.

General Geology: The area mapped includes the Sudbury volcano-tectonic basin, bounded on the northwest by Archean felsic intrusions and on the southeast by Proterozoic sedimentary rocks. The entire area has been glaciated and the southeastern two-thirds modified by subsequent lake action.

Sandy till occurs in every township in the map-area, although thickness and extent are extremely variable. Where bedrock is exposed, there are striae and grooves caused by ice moving from the north and northeast. A spillway, presently occupied by the Onaping River and its tributaries, extends into the area from a kame-moraine complex to the northwest. Extensive lacustrine sediments are in the Sudbury basin. These are thickly bedded silts and clays in the central and southern parts of the basin grading into silts and sands on the northern and eastern margins. An ice-choked kame-esker complex with kettles up to 75 feet deep occupies parts of Maclennan and Falconbridge Townships.

Economic Geology: Present industrial mineral production is most heavily concentrated in the eastern one-third of the basin. Extensive sand and gravel reserves exist in the glacio-fluvial deposits of Maclennan and Falconbridge Townships on the basin's eastern margin. These occur along a 2-mile wide belt extending from Bowland Bay to the Falconbridge townsite. At the west end of the basin, the Onaping River valley north of Levack has supplied emergency fill for the local mines for several years but available sand and gravel exist on both sides of the river throughout Levack Township. Extensive sand and some gravel deposits are found along the entire length of the Vermilion River from Capreol to Vermilion Lake.

Numerous stone and sand and gravel pits have been opened around the Sudbury Basin. Producing pits are located in the townships of Maclennan, Falconbridge, Capreol, Garson, Hanmer, Balfour, Levack, and Dowling.

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[1]Geologist, Industrial Minerals Section, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

[2]Statistical files, ODMNA, Toronto.

Structural mineral production during 1968 for the Sudbury area was as follows: 3,668,769 tons of sand and gravel valued at $1,822,314; 1,205,796 tons of quartz valued at $564,430; 94,417 tons of crushed rock valued at $165,781.

## No. 19 SHAKESPEARE AND DUNLOP TOWNSHIPS

## DISTRICT OF SUDBURY

by

K.D. Card[1] and P. Palonen[2]

Location: Mapping of Shakespeare and Dunlop Townships, an area of about 70 square miles located approximately 44 miles west of Sudbury and immediately north of Webbwood, Ontario, on Highway 17, was carried out during July and August, 1970. Access to the area is provided by Highway 17, gravel roads extending northward from this highway, and by the waters of the Spanish River-Agnew Lake system.

Mineral Exploration: Exploration for gold, base metals, and uranium has been carried out in the townships from about 1900 to the present. Numerous occurrences of these metals were discovered, but there has been production of only minor amounts of gold from the Shakespeare gold mine in the early 1900s. Further exploration was carried out on this occurrence by Ensign Gold Mines Limited in 1936, by Greenray Mines Limited in 1950 to 1956, and by Vermont Mines Limited in 1959 to 1961. Copper and copper-nickel mineralization occur at a number of localities, the most important of which are the Sudbury-Shakespeare copper-nickel occurrence in northeastern Shakespeare Township which was investigated by Falconbridge Nickel Mines Limited in the 1940s and 1960s, and a copper occurrence on the north shore of Agnew Lake in northeastern Shakespeare Township which was tested by Noranda Mines Limited in 1956, and Broulan Reef Mines Limited in 1968 to 1969. Uranium mineralization is found in the lower part of the Huronian sequence around Agnew Lake, north of Webbwood on the southern boundary of the area, and in southwestern Shakespeare Township, Exploration by numerous companies, including Dominion Gulf Company in 1953 to 1954, Shakespeare Uranium Mines Limited in 1954 to 1956, Broulan Reef Mines Limited in 1968 and 1969, Moncrief Uranium Mines Limited in 1969, and Falconbridge Nickel Mines Limited in 1969 and 1970 showed the presence of widespread, low-grade uranium mineralization over narrow widths.

General Geology: The map-area is located at the contact between the Southern and Superior Provinces of the Canadian Shield. Early Precambrian granitic rocks and mafic intrusions are unconformably overlain by Middle Precambrian

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metasediments and metavolcanics of the Huronian Supergroup. Middle Precambrian mafic igneous rocks of several ages intrude the older rocks. Bedrock is partly covered by unconsolidated deposits of clay, sand, and gravel of the Cenozoic.

Granitic rocks of the Birch Lake batholith underlie much of Dunlop Township, and part of Shakespeare Township. The batholith consists mainly of pink, leucocratic, equigranular or porphyritic, quartz monzonite with subordinate amounts of grey granite, diorite, migmatite, and pegmatite.

A layered mafic intrusion, the Dunlop intrusion, occupies approximately 12 square miles in southern Dunlop and northern Shakespeare Townships and smaller bodies of similar rock occur in northern Dunlop and eastern Shakespeare Townships. These belong to a suite of gabbro-anorthosite intrusions which occur along the southern boundary of the Superior Province in this region; another has been described in Drury Township by Card[1]. The intrusions consist of medium-grained to very coarse-grained gabbro and anorthositic gabbro and granophyre. The contact zone between the intrusion and the older granitic rocks is fine- to medium-grained gabbro with numerous inclusions of granite. Magmatic layering, ranging in thickness from a few inches to possibly several hundred feet, is present. Layering is expressed by variations in the proportions of mafic and felsic minerals, by grain size variations, by changes from equigranular to porphyritic or glomeroporphyritic texture, and by preferred orientation of the constituent minerals. Layering is best developed or preserved in the western part of the area whereas in the east it has been practically obliterated by metamorphic recrystallization. Layering generally dips southward at low angles, although there is some evidence that it dips northward near the southern contact. The age of the intrusion relative to the Huronian sequence has not been definitely established, although available field evidence indicates that it is pre-Huronian.

A swarm of narrow, mafic dikes intrudes the Birch Lake and Dunlop intrusions. Some seem to be the fine-grained equivalents of the Nipissing-type metagabbro bodies which intrude the Huronian Supergroup, but most are probably pre-Huronian. They consist of fine- to medium-grained, equigranular and porphyritic metagabbro and amphibolite.

The Huronian Supergroup consists of a lower sequence, approximately 2,500 to 3,500 feet thick, of interbedded metasediments and metavolcanics. The metasediments include mainly metamorphosed feldspathic and micaceous sandstone, with lesser amounts of argillite, siltstone, oligomictic quartz pebble conglomerate, and polymictic conglomerate. Metavolcanics include metamorphosed extrusive and intrusive phases of basaltic and andesitic composition, amygdaloidal basalt, and agglomerate. Metavolcanics constitute about 30 percent of the unit in northeastern Shakespeare Township, 80 percent in southeastern Shakespeare, and 25 percent in southwestern Shakespeare.

The next formation in the sequence, the McKim, consists of metamorphosed argillite, siltstone, fine-grained greywacke, and micaceous sandstone. In northern Shakespeare, this formation is probably no more than a few hundred

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[1]Card, K.D., 1965: Hyman and Drury Townships; ODM, GR34, p.6.

feet thick, whereas in the southern part of the township, south of the Murray Fault, it is probably several thousand feet thick. One hundred to two hundred feet of pelitic metasediments in eastern Dunlop Township lying directly on basement rocks may also belong to the McKim Formation.

The Ramsay Lake Formation in northeastern Shakespeare Township consists of 150 to 200 feet of polymictic paraconglomerate and feldspathic sandstone, and is overlain by approximately 300 feet of metamorphosed argillite, siltstone, and micaceous sandstone of the Pecors Formation.

Medium- to thick-bedded feldspathic sandstone, micaceous sandstone, and minor argillite of the Mississagi Formation occur in the eastern part of the map-area. Thickness of the formation is estimated to be a minimum of 1,500 feet in northeastern Shakespeare and 1,000 feet in eastern Dunlop Townships. In the formation, there are cyclic repetitions of a sequence beginning with medium-bedded micaceous sandstone with argillaceous interbeds, succeeded by thicker bedded feldspathic and micaceous sandstones, and by very thick bedded, feldspathic sandstones. Planar crossbedding is typical of the lower parts of these cycles, festoon-type crossbedding of the upper parts.

In southeastern Dunlop Township, there is an outcrop of Nipissing-type gabbro surrounded by interbedded polymictic paraconglomerate, sandstone, and argillite. These metasediments could belong to either the Bruce or Ramsay Lake Formations.

Nipissing-type metagabbro with remnants of the original pyroxene gabbro intrude the Huronian and older rocks.

Unmetamorphosed, northwest-trending diabase dikes up to 300 feet wide are the youngest rocks in the area.

Structural Geology: Major structural elements are northeast-trending faults of the Murray system and folds with northeast-trending axes. The faults probably dip steeply southward for the most part, and were probably periodically active over a long time. There is evidence, in the form of abrupt thickening of Huronian formations, that faulting was initiated prior to Huronian sedimentation, and that down-faulting to the south provided depositional basins. During Middle Precambrian orogenic events, these faults were reactivated and reverse dip-slip (south side up) and strike slip (south side west) movements occurred. The folds are part of a system of major upright, subisoclinal, doubly plunging, synclinoria and anticlinoria which are probably the result of polyphase deformation during repeated deformational events. Several generations of minor structures, such as foliations and lineations, also provide evidence of repeated deformation.

Metamorphism: Grade of regional metamorphism, as deduced from studies of metamorphic porphyroblasts developed in Huronian argillaceous rocks, increases rapidly from mid-greenschist facies (biotite grade) in Dunlop and northern Shakespeare Townships to lower almandine-amphibolite facies (staurolite grade) in the southern Shakespeare Township.

Economic Geology: Copper, nickel, gold, and uranium mineralization occurs in the map-area, mainly in the Huronian rocks and Nipissing-type gabbroic intrusions.

At the Sudbury-Shakespeare property of Falconbridge Nickel Mines Limited in lots 1 and 2, concession V, Shakespeare Township, disseminated chalcopyrite, pyrrhotite, and pentlandite occur in Nipissing metagabbro in an east-west zone approximately 2,500 feet long and 25 to 150 feet wide. Analyses of diamond drill core and trench samples indicate an average grade of about 0.40 percent nickel, 0.40 percent copper, and minor vanadium, platinum, palladium, rhenium, and gold[1].

On the north side of Agnew Lake, lots 1 and 2, concession V, Shakespeare Township, disseminated pyrite, pyrrhotite, and chalcopyrite occur in metamorphosed Huronian micaceous sandstone and argillite in a northeast-trending zone approximately 1,800 feet long and 4 to 20 feet wide. Mineralization also occurs on the south side of Agnew Lake and possibly under the lake as magnetic and electromagnetic surveys have outlined several underwater anomalies. Analyses by the Laboratory and Research Branch, Ontario Department of Mines and Northern Affairs, of well-mineralized grab samples collected by the field party, range from 1.55 percent to 8.45 percent copper. Average grade is undoubtedly much lower as the distribution of sulphides is erratic.

Sulphide mineralization also occurs in lot 2, concession III, Shakespeare Township in sheared, quartz-veined basal Huronian metasediments; in lots 4 and 5, concession IV, in quartz-veined granite and Huronian metasediments; in lot 7, concession III, in a mafic dike intruding granite; in lots 2 and 3, concession V, in Huronian metavolcanics, and in southeastern Dunlop Township in Huronian metasediments at their contact with Nipissing-type metagabbro.

Minor amounts of gold are found with the sulphides, in the foregoing deposits, but the main occurrence is at the Shakespeare gold mine, lot 5, concession I, Shakespeare Township. This deposit was developed by two adits and a shaft with 6 levels at 25-foot intervals and produced a small amount of gold during the period 1903 to 1905. Gold occurs with minor amounts of chalcopyrite, pyrrhotite, and arsenopyrite in schistose, quartz-veined metamorphosed Huronian argillite and micaceous sandstone. Recent exploration has shown that the mineralization is very erratic but assays of up to 2.40 ounces per ton of gold over narrow widths have been obtained[1].

Uranium mineralization occurs in oligomictic quartz pebble conglomerate and sandstone in basal Huronian metasediments in lots 2, 3, 4, 5, and 6, concession V; lots 1 and 2, concession IV; lot 8, concession I, and lot 12, concession I, Shakespeare Township. Exploration has outlined numerous, narrow zones of uranium mineralization. Analytical results ranging from 0.005 percent $U_3O_8$ to 0.56 percent $U_3O_8$ across thicknesses of 0.75 to 2.0 feet have been reported[1].

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[1]Assessment work files, ODMNA, Resident Geologist's office, Sudbury.

## No. 20 LOUISE-EDEN AREA (EDEN AND NORTHERN PART OF BEVIN TOWNSHIPS)

## DISTRICT OF SUDBURY

by

K.D. Card[1] and P. Palonen[2]

Location: Eden and the northern part of Bevin Townships, an area of about 35 square miles bounded by latitude 46°15' and township boundaries, were mapped during part of the 1970 field season. This completes the mapping of the Louise-Eden area begun by Card[3] and continued by Palonen[4]. Access to the northern part of the area is provided by Highway 543 extending south from Highway 69 at Sudbury and by gravel roads around Long Lake and Wavy Lake. The southern part of the area is conveniently accessible only by float-equipped aircraft.

Mineral Exploration: The Long Lake gold mine, located between Long and Luke Lakes in western Eden Township, was operated from about 1911 to 1939 and a total of $1,352,164 worth of gold was produced[5]. There is no record of any recent exploration activity in the area.

General Geology: The map-area is located in the Southern Province of the Canadian Shield, immediately north of the Grenville Front, the zone of contact between the Southern and Grenville Provinces. The rocks northwest of the Grenville Front consist of Huronian metasediments, Nipissing-type metamorphosed gabbroic intrusions, granitic to gabbroic intrusions of the Eden Lake complex and Chief Lake batholith, and late olivine diabase dikes. These rocks have been faulted and metamorphosed during several successive orogenic events.

The Pecors Formation, the oldest Huronian formation in the area, occurs as isolated blocks in the Eden Lake complex in western Eden Township. It consists of thinly bedded, metamorphosed (under greenschist and lower almandine-amphibolite facies conditions of regional metamorphism) siltstone, argillite, and impure sandstone. Feldspathic and micaceous sandstones and siltstones of the Mississagi Formation conformably overlie the Pecors. Crossbedding of the festoon and planar types characterize this formation. Up to 1,200 feet of polymictic paraconglomerate of the Bruce Formation, approximately 400 feet of thinly bedded, metamorphosed calcareous siltstone and limestone of the

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[1]Geologist, Ontario Department of Mines and Northern Affairs, Sudbury.

[2]Graduate student, Department of Geology, University of Calgary, Calgary, Alberta.

[3]Card, K.D., 1968: Louise Township and the north part of Dieppe Township; ODM, Prelim. Map P.498.

[4]Palonen, P., and Mills, D.H., 1969: Whitefish Lake Indian Reserve No. 6, Louise-Eden area; ODM, Prelim. Map. P.597.

[5]Statistical files, ODMNA, Toronto.

Espanola Formation, and about 600 feet of sandstone and siltstone of the Serpent Formation occur in the northern and central parts of the map-area. The Gowganda Formation is represented by approximately 2,000 feet of metamorphosed greywacke and siltstone with minor polymictic paraconglomerate. The Lorrain Formation, which occurs mainly as isolated inclusions in the Chief Lake batholith in the eastern part of the area, consists of feldspathic sandstone and white and green orthoquartzite.

Metamorphosed Nipissing-type gabbros intrude the Huronian metasediments and are, in turn, intruded by the Eden Lake complex and Chief Lake batholith.

The Eden Lake complex, which underlies much of the western part of the area, consists of a number of sills, dikes, and small plutons which range in composition from trondhjemite, through diorite, to gabbro. The Chief Lake batholith underlies much of the eastern part of the area. It is a composite body, consisting of intrusions of several ages and compositions, including equigranular and porphyritic quartz monzonite and quartz diorite, pegmatite, and aplite. Evidence for the intrusive, magmatic nature of the Chief Lake batholith and Eden Lake complex includes crosscutting dikes, stoped inclusions of Huronian metasediments and Nipissing metagabbro, and agmatitic and migmatitic border zones.

The youngest rock-type in the area, the late diabase, forms narrow, northwest-trending dikes.

Structural Geology: In the western part of the map-area, the main tectonic elements, including faults, fold axes, foliations, and lineations, trend approximately east-west. In the east, the main tectonic elements trend northeast parallel to the Grenville Front. This change in orientation of regional tectonic elements occurs mainly in a zone about 3 miles wide of northeast-trending faults in the central part of the map-area. The nature of the northeast-trending faults is not definitely known, but it is probable they are thrust faults which dip steeply southeastward and that the dominant movement has been reverse dip-slip. There is also evidence that they were active both before and after emplacement of the Eden Lake and Chief Lake intrusions.

The sequence of events in the area can be summarized as follows:
(1) Deposition of the Huronian sediments
(2) Intrusion of the Nipissing-type gabbros about 2,150 million years ago[1]
(3) Deformation and metamorphism, possibly during pre-Nipissing and post-Nipissing orogenic events
(4) Initial development of the Grenville Front zone and northeast-faulting in the adjacent Southern Province
(5) Intrusion of the Eden Lake complex and Chief Lake batholith, probably

[1]Fairbairn, H.W., Hurley, P.M., Card, K.D., and Knight, C.J., 1969: Correlation of radiometric ages of Nipissing diabase and Huronian metasediments with Proterozoic orogenic events in Ontario; Can. J. Earth Sci., Vol. 6, No. 3, p.489-497.

about 1,750 million years ago[1]
(6) Later deformation and metamorphism along the Grenville Front zone and in the adjacent Grenville Province.

Economic Geology: The Long Lake gold mine in western Eden Township produced $1,352,164 worth of gold from 221,070 tons of ore during the period 1911 to 1939[2]. The ore occurred in a large block of metamorphosed sandstone, probably of the Mississagi Formation, which is included in Nipissing-type metagabbro and in intrusions of the Eden Lake complex. The inclusion is bounded on the west by a fault which strikes about N40E and dips 45 to 60E. The inclusion is impregnated with gold and minor amounts of arsenopyrite and pyrite. The main ore shoot was elliptical in cross-section with its major axis parallel to the fault plane; the fault cut off the orebody at depth. The deposit was mined from an open-pit and underground workings.

Quartz veins and stockworks are common in the area between Eden, Luke, and Long Lakes. It is possible that gold is present in some of these, although indicator minerals such as pyrite and arsenopyrite are rare. Several of the quartz veins are of sufficient size and purity to be quarried for building stone, but access is difficult.

A large deposit of gravel on the north shore of Long Lake is presently being utilized and there are numerous small deposits in the area suitable for local road construction.

## No. 21 GRAVITY SURVEY IN NORTHEASTERN ONTARIO

by

R.S. Middleton[3]

Introduction: Detailed gravity work in the Timmins, Matheson, and Cobalt regions in northeastern Ontario was started in June, 1970. The purpose of the investigation was to establish a gravity control network in the region, and evaluate the use of gravity in mapping geological structures such as faults, intrusive bodies, and thickness and shape of Archean metavolcanic-metasedimentary belts. A Worden (Master model) gravimeter lent to the Ontario Department of Mines and Northern Affairs by the Gravity Division, Earth Physics Branch, Department of Energy, Mines and Resources, Ottawa, was used. Data was recorded on forms provided by the Gravity Division. The

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[1]Davis, G.L., Hart, S.R., Aldrich, L.T., Krogh, T.E., and Munizaga, F., 1967: Geochronology of the Grenville Province in Ontario, Canada; in Annual Report of the Director, 1965-1966, Geophysical Laboratory, Carnegie Institution, Washington, D.C., p.383-386.

[2]Statistical files, ODMNA, Toronto.

[3]Geophysicist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

readings will be computer-processed by the Gravity Division.

Elevation control was furnished by the Ontario Department of Highways offices in New Liskeard and North Bay and by the Hydro-Electric Power Commission of Ontario. Other elevations were obtained from the Geodetic Survey of Canada, Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa.

The gravity survey will be continued in 1971 and will be extended to other parts of the province in the future.

The Survey: Profiles were obtained over the Kamiskotia gabbro-anorthosite complex, the Mattagami River Fault and the Porcupine-Destor Fault[1,2]. A control network was started in the Cobalt region to extend the profile study to the Timiskaming rift valley system[3]. Highways, roads, trails, and powerlines were used for traversing to establish profiles over the geological structures. On transmission lines, readings were taken at the base of every tower, giving a reading interval ranging from 600 to 1,620 feet. Culverts, bench marks, and other easily located structures with elevations along highways provided good station locations. Readings along the highways were taken at 1/4- to 1/2-mile intervals. Secondary roads and trails were spirit leveled by the field crew and readings were taken at 500-foot intervals. In the vicinity of known faults, the readings were taken at 200-foot intervals. A base line was cut across the Kamiskotia gabbro-anorthosite complex and relative elevations of stations established by using a spirit level. Readings were taken at 100- and 200-foot intervals. Sampling of all rock types exposed along the traverse lines was carried out for specific gravity analysis.

## No. 22 MAGNETIC SURVEY OF LOVELAND AND MACDIARMID TOWNSHIPS

## DISTRICT OF COCHRANE

by

R.S. Middleton[4]

Location: Loveland and Macdiarmid Townships are located 20 miles northwest of Timmins. Access to Loveland Township is provided by the Mespi Mines Limited

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[1]Pyke, D.R., and Middleton, R.S., 1970: Distribution and characteristics of the sulphide ores of the Timmins area; ODM, Misc. Paper 41, 24p.

[2]Ginn, R.M., Savage, W.S., Thomson, R., Thomson, J.E., and Fenwick, K.G., 1964: Timmins-Kirkland Lake sheet; ODM, Geol. Comp. Series, Map 2046.

[3]Lovell, H.L., and Caine, T.W., 1970: Lake Timiskaming rift valley; ODM, Misc. Paper 39, 16p.

[4]Geophysicist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

road which joins Highway 576, 1/4 mile north of Kamiskotia Lake. Macdiarmid Township may be reached by the Mattagami River or the Sturgeon Falls powerline road.

Magnetic Survey: A ground, vertical component magnetic survey of Loveland and Macdiarmid Townships was carried out using one Sharpe MF-1-100 and two McPhar M-700 (Fluxgate) magnetometers. Diurnal changes in the earth's magnetic field were recorded to an accuracy of $\pm$ 10 gammas utilizing one of the McPhar magnetometers and a Rustrak, Model 88 recorder. A Sharpe A-2 magnetometer was used to monitor diurnal changes on occasions when the recording McPhar magnetometer was needed for traversing.

Magnetic surveys filed with the Ontario Department of Mines and Northern Affairs by companies for assessment credit, as well as surveys donated to the project were utilized in making the magnetic map. Relative differences between company survey values and the present survey values were obtained by reoccupying a number of company stations. An arithmetic average of the differences was applied to reduce the company surveys to common base-level. Grids that could not be tied-in with an accuracy of $\pm$ 25 gammas were resurveyed. An assumed base value of + 1,000 gammas was assigned to the Bristol-Ogden magnetic base station on Highway 101 to insure positive values for all field readings.

Areas not covered by company surveys were traversed by the field party at 600- to 800-foot line intervals. Readings were taken every 100 feet. A compass-chain technique was used to run the lines and air photographs were used to locate the traverse positions. Chainage errors averaged between 50 and 100 feet in a mile and were distributed between known location points on the traverse. Base lines were cut in the northwestern part of Loveland Township to provide better location control for the traverses.

Magnetic susceptibility tests will be run on diamond drill core and outcrop samples from the area to aid in the interpretation of the magnetic maps.

Mineral Exploration: Early exploration was limited due to the low percentage of outcrop. However the townships have been extensively explored by many companies since the discovery of the Kidd Creek Mine of Ecstall Mining Company Limited in 1964. Four boulders of nickel-copper float in southwestern Loveland have provided an explorative incentive for the past 30 years. Thick varved clay that covers most of Macdiarmid Township has made most electromagnetic prospecting techniques applied ineffective.

Hollinger Mines Limited and Noranda Mines Limited are presently the only companies active in the area.

General Geology: Loveland and Macdiarmid Townships were mapped by L.G. Berry[1] in 1940. The largest number of outcrops (approximately 5 percent of the area) are in Loveland Township. Diamond drill holes provide most of the geological knowledge of Macdiarmid Township. The underlying rocks are mafic, intermediate

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Berry, L.G., 1944: Geology of the Robb-Jamieson area; ODM, Vol. 53, pt.4, p.1-16.

and felsic metavolcanics, iron formation (oxide facies), metasediments, mafic and ultramafic intrusive rocks (stocks and sills), granitic rocks, and diabase (dikes).

Most of the volcanic rocks which are exposed in central Loveland and Macdiarmid Townships are intermediate in composition. Felsic rocks appear as thin flows or pyroclastic beds in the southern part of the map-area, in some places with the intermediate rocks in the central part, and along the northern boundary. Iron formation (magnetite-hematite), associated with felsic tuffs, outcrops in southwestern Loveland Township. This unit has a low magnetic susceptibility and, therefore, does not provide a good geophysical marker horizon.

Metasediments and associated graphitic beds occur in the northeastern part of Loveland Township and extend to the southeast into northern Macdiarmid Township.

A large stock of serpentinized diorite occurs in central Macdiarmid Township. This body becomes sill-like to the northwest and reflects the strike of the metavolcanics. Numerous sills and small stocks of gabbro occur throughout the metavolcanics. A felsic stock intruding the metavolcanics occurs in northwestern Loveland Township. In this locality felsic intrusive rocks are granitic and are made up of approximately 20-25 percent albite, 30-35 percent microcline, and 40 percent quartz. Because miarolitic cavities were not observed and granophyric textures were not seen in thin-sections, these granitic rocks may be different from the "high level" felsic intrusive rocks that occur in Godfrey, Turnbull, Robb, and Jamieson Townships[1,2].

All the rocks in the map-area are cut by a swarm of diabase dikes that trend N20W.

Structural Geology: In the western part of the map-area the metavolcanics strike N50W to N60W. In the central part the strike changes to N30W and is about N60W near the Mattagami River. All determinations indicate that tops now face northeast. East of the Mattagami River, the strikes (interpreted from the magnetic data) are variable due to numerous strike-slip faults that parallel the Mattagami River Fault.

In northeastern Macdiarmid Township the strike of the metavolcanics seems to be east-west but is southeast near the Kidd Township boundary.

Faults of various ages and directions probably occur in the map-area as indicated by earlier work in townships to the south[2]. The only obvious fault

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[1]Pyke, D.R., and Middleton, R.S., 1970: Distribution and characteristics of the sulphide ores of the Timmins area; ODM, Misc. Paper 41, p.2.

[2]Middleton, R., 1968: Magnetic survey of Robb, Jamieson Townships, District of Cochrane, in Summary of field work by the Geological Branch, E.G. Pye (ed.); ODM, Misc. Paper 22, p.42-44.

system identified by the magnetic survey work is the N20W system that parallels the Mattagami River Fault and coincides with the diabase dike swarm. Regional faults striking N45W occur and seem to merge with those of the N20W system.

Economic Geology: Massive pyrrhotite-pyrite mineralization has been found in two localities in northwestern Loveland Township: one in lot 12, concession IV, and the second in lot 10, concession VI. The occurrences are in the mafic metavolcanics close to bodies of granitic rocks. A third occurrence of pyrrhotite is along the contact between gabbro and intermediate metavolcanics in Loveland Township, lot 3, concession II. Disseminated pyrrhotite occurs throughout all of the intermediate volcanic rocks.

Four float boulders containing copper-nickel mineralization are in lot 11, concession II, on top of a sand esker. Analyses obtained by local prospectors from samples of the boulders indicated on the average 1.5 percent nickel and 0.3-0.5 percent copper[1]. The boulders are angular, possibly indicating local derivation, but ice rafting from a distant source cannot be discounted.

## No. 23 OPERATION PAMOUR

## DISTRICT OF COCHRANE

by

E.G. Bright[2]

During 1970, a helicopter-supported field mapping and drill core collection survey was carried out in a block of 45 townships lying immediately north of Timmins. This regional block, collectively designated the Pamour topographical district comprises approximately 1,800 square miles and is bounded by longitudes 81°00' to 82°00' and latitudes 48°30' to 49°00'.

Except for the southern boundary of this area, the majority of the townships examined lie within the northern Ontario Clay Belt. This deeply buried bedrock region is characterized by a featureless expanse of dense spruce, cedar, and tamarack forests and poorly drained swamp and muskeg. The average depth of overburden is 100 to 125 feet; depths up to 500 feet are often found along present major drainage courses as well as along unsuspected and ancient buried ones. Bedrock exposure is less than 5 percent throughout the area and is absent in many of the townships included within the area under study.

In 1964, the Texas Gulf Sulphur Company discovered over 60 million tons of rich zinc-copper-silver ore beneath the muskeg and clay in Kidd Township, 16 miles north of Timmins. This discovery was a direct result of diamond

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[1]Assessment work files, ODMNA, Resident Geologist's office, Timmins.

[2]Resident Geologist, Ontario Department of Mines and Northern Affairs, Timmins.

drilling an anomaly situated near a few outcrops of exceptionally favourable geology which surprisingly were the only areas of bedrock exposure in Kidd Township. Since this discovery, Kidd and the surrounding townships within the Pamour sheet have been covered by numerous airborne and ground magnetic and electromagnetic surveys and well over 2,000 diamond drill holes have been put down to test many of the indicated anomalies.

Operation Pamour was designed to gather for permanent storage as much of this geological data heretofore not available to the public at large. During the summer all known outcrop areas were examined as well as a few previously unknown exposures. Where access could be gained to a known drill core cache, the site was visited and representative samples of the drill core were gathered for permanent storage at the Resident Geologist's office in Timmins.

The results of this mapping and sampling program are to be combined with all other available geological and geophysical information to produce data series maps for as many of the 45 townships as is feasible. Geology from outcrops from drill holes and from ground geophysical anomalies (including AEM responses) will be indicated on the main maps at a scale of 1 inch to 1/4 mile. Aeromagnetic anomalies and interpreted geology will be shown on inset maps at a scale of 1 inch to 1 mile. Accompanying these inset maps will be a reference table which will indicate the various companies who have worked in the areas, where and when the work was done, what type of work was done and with what type of instruments.

Published data series maps in the process of revision are:

1. Wark Township, ODM, Preliminary Map P.478
2. Kidd Township, ODM, Preliminary Map P.486
3. Crawford Township, ODM, Preliminary Map P.487.

## No. 24 AIRBORNE GEOPHYSICAL SURVEYS IN NORTHERN AND SOUTHERN ONTARIO

by

R.S. Middleton[1]

Northern Ontario: Airborne geophysical surveys were flown in the Matheson and Kamiskotia regions in northeastern Ontario. The purpose of the surveys was to test a multicomponent geophysical system as an airborne geological mapping method.

At Matheson six townships, Coulson, Warden, Beatty, Munro, Hislop, and Guibord, were mapped using a combination of magnetic, gamma-ray spectrometer, and VLF EM techniques. The area was covered by north-south lines flown at 800-foot line spacing with 150- to 200-foot terrain clearance. A Barringer proton precession magnetometer, an Explorium gamma-ray spectrometer, and a Radiophase VLF EM system were mounted in an Alouette II helicopter. The

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[1]Geophysicist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

sodium iodide crystal detector was mounted on the ski of the helicopter. The proton precession head was contained in a towed bird. A pilot, navigator, and instrument operator carried out the flights. Barringer Research Limited of Toronto did the work on a contract basis.

Four maps per township will be prepared by Barringer Research Limited for publication by the Ontario Department of Mines and Northern Affairs. These are a magnetic map, a gamma-ray spectrometer map (total count), a Radiophase horizontal electric field map, and a Radiophase (in-phase and quadrature) map.

Nine flight lines at various azimuths were flown in the Kamiskotia region to further evaluate the geophysical system. The gamma-ray spectrometer and Radiophase components were primarily tested here. Maps of the results of these nine lines will be published at a scale of 1 inch to 1/2 mile and will cover Godfrey, Turnbull, Robb, Jamieson, Loveland, and Macdiarmid Townships.

Southern Ontario: A test area, 2-1/2 miles wide by 5 miles long in Uxbridge Township, was flown by Barringer Research Limited for the Ontario Department of Mines and Northern Affairs to test the use of the VLF EM technique in mapping Pleistocene geology and delineating gravel deposits. Use of the horizontal electric field was made to map ground resistivity variations. Results of the flights will be studied in the near future, bearing in mind the electrical properties observed on the ground.

Ground geophysical work was carried out in Uxbridge and Whitchurch Townships by the author in the fall of 1969, and in the spring and fall of 1970. Seismic refraction, resistivity, and VLF EM tests were made. Results of the hammer seismic refraction work showed that the 'P' wave velocities of sand ranged between 900 and 1,800 feet per second, whereas the velocity of gravel ranged between 1,800 and 4,000 feet per second. A velocity contrast of 700 feet per second between the average velocity of sand and the average velocity of gravel was determined.

Ground VLF EM results to date are inconclusive. Broad decreases of 10 to 15 percent in the field strength (magnetic field H) were noted over some known gravel beds. Resistivity tests found the resistivity of sand to be 100-400 ohm-metres. Gravel had resistivities between 300 and 2,200 ohm-metres.

## No. 25 PONTIAC AND OSSIAN TOWNSHIPS

## DISTRICT OF TIMISKAMING

by

L.S. Jensen[1]

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[1]Graduate student, Department of Geology, University of Saskatchewan, Saskatoon, Saskatchewan.

Location: The map-area comprises two 30 square-mile townships along the Ontario-Quebec boundary between mile posts 43 and 56. The centre of the area is 24 miles east-northeast of Kirkland Lake and 26 miles west of Noranda.

The area is accessible by roads leading north from Highway 66 from North Virginiatown and Cheminis. Float-equipped aircraft are used to gain access to the northern part of Pontiac Township.

Mineral Exploration: Ossian Township, because of its proximity to Virginiatown, was explored for gold from 1910 to 1950 by mining companies and numerous prospectors. Since 1950 the emphasis has shifted to base metal deposits and the whole area has received the attention of various mining companies. No orebody of economic importance has been found to date.

During 1925 and 1926, in the north-central part of Ossian Township, Ossian Gold Mines Limited sank a shaft 100 feet deep and did 600 feet of lateral work on the 90-foot level. Prior to sinking the shaft, surface work consisted of 10 trenches totalling 4,400 feet and a diamond drilling program of 19 holes totalling 5,500 feet. In 1927 the shaft was deepened to 210 feet, and 500 feet of lateral work was done on the 200-foot level. In 1947, Minedel Mines Limited acquired the property and in 1949, Paymaster Consolidated Mines Limited examined the property. Because only low erratic concentrations of gold were indicated, development ceased.

In 1945, Natjo Gold Mines Limited acquired patented claims L53226 to L53252, in Ossian Township adjoining the Ontario-Quebec boundary. In 1946, some geological and geophysical work was done and, in 1950, six diamond drill holes totalling 4,285 feet were put down. Mineralization consisting of narrow pyrite stringers was found on patented claim L53227.

In 1950, Tresdor Larder Mines Limited sank two diamond drill holes totalling 1,316.5 feet southwest of Grover Lake, Ossian Township. No mineralization was reported.

In 1965, Jayco Mines Limited carried out geological, magnetometer, and electromagnetic surveys in an area north of Sunrise Lake, Pontiac Township. No mineralization was reported.

In 1967, Barbi Lake Copper Mines Limited diamond drilled one hole 163 feet deep, 1/2 mile north of Wawagoshe Lake, Ossian Township. Only a few quartz-carbonate veins containing minor pyrite were encountered.

In 1968, Candore Explorations Limited did a magnetometer and electromagnetic survey on an area northeast of Grover Lake, Ossian Township. Following the geophysical survey, three holes totalling 1,297 feet were diamond drilled. Small 'blebs' of chalcopyrite were found in a quartz vein over a width of 0.8 feet.

In 1969 and 1970, Twentieth Century Explorations Limited did an electromagnetic and magnetic survey northwest of Waterhen Lake, Ossian Township. In 1970, a 382.5-foot diamond drill hole was put down. Mineralization intersected consists of 0.01 percent copper over a 2.5-foot width, associated with pyrite and carbonate[1].

In 1970, Noranda Mines Limited conducted a geophysical and geological mapping program in the northern part of McGarry Twonship and part of Ossian Township.

In 1970, Amax Exploration, Incorporated and other mining companies and individual prospectors staked a large part of Pontiac Township.

General Geology: All bedrock is of Archean age, except diabase considered to be of Keweenawan age. The bedrock consists of mafic, intermediate, and felsic volcanic rocks intruded by stocks and sills of gabbro, diorite, granodiorite, and syenite. Dikes of leucophyre, feldspar porphyry, and diabase cut the volcanics. Metamorphic effects, representing the lower greenschist facies, occur only along shear zones and near some intrusive contacts.

Mafic volcanic rocks occur in the southern part of Ossian Township. They are massive and pillowed flows, black to dark grey and have a diabasic texture. The intermediate volcanic rocks, the most abundant volcanic rock type in the area, consist of massive, pillowed and flow-breccia flows and agglomeratic and tuffaceous pyroclastic units. Felsic fragments are abundant in some intermediate pyroclastic rocks.

Felsic volcanic rocks consisting of massive quartz-feldspar porphyry, flow breccia, pyroclastic tuff-breccia, tuff, and agglomerate occur in Pontiac and the northern part of Ossian Township. The massive quartz-feldspar porphyry in the central part of Pontiac Township is a shallow intrusive body of rhyolite and rhyodacite composition. The body is 5-1/2 miles long and 1-1/2 miles wide. Flow breccias are found in and along the margins of the intrusion. Felsic pyroclastic rocks enclose the felsic intrusion. They also occur interlayered with the intermediate volcanic rocks in the southwestern part of Pontiac Township and in the northern part of Ossian Township. In Ossian Township, they occur in a west-trending belt 4 miles long and 1/2 mile wide that contains also leucophyre dikes. Gabbro and diorite stocks and sills 1,000 feet to 2-1/2 miles in diameter intruded the volcanic rocks. A sill of hornblende gabbro with pegmatitic and magnetite-rich phases outcrops north of Wawagoshe Lake, Ossian Township. At Clarice Lake, Pontiac Township, there is a stock of quartz diorite and granodiorite with marginal microdiorite. A syenite stock extends east from Katrine Township into Ossian Township, and dikes of feldspar porphyry cut the volcanic rocks in both townships. Northeast-striking diabase dikes 100 feet wide occur in Ossian Township.

Structural Geology: In Pontiac Township, the volcanic flows and pyroclastic rocks are wrapped around the rhyolite intrusion. Northeast of the rhyolite intrusion they dip 5 to 20SW; southeast of the intrusion they dip 40 to 50SW, indicating the area is a dome which is tilted southwest. Farther south in Ossian Township, the volcanic rocks are folded into a series of east-plunging folds that southward are folded more tightly.

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[1]Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake.

A regional set of northeast-striking faults extend across both townships.

Economic Geology: Gold and pyrite-bearing quartz veins occur at the Ossian Gold Mine. The veins occur in sheared felsic fragmental rocks, along with leucophyre dikes. The largest vein (shaft vein) is traceable for 600 feet eastward, and attains widths as great as 20 feet. The shaft vein dips 45N, and extends to a depth of 200 feet. Grab samples have assayed as high as $2.60 Au per ton (gold at $35.00 per ounce)[1].

Minor chalcopyrite occurs with pyrite in quartz veins associated with feldspar porphyry, in the southeastern and southwestern parts of Ossian Township, and in shear zones mineralized with quartz, pyrite, and carbonate in the southern part of Ossian Township. Traces of chalcopyrite occur with pyrite in dacite tuff at Wawagoshe Lake, Ossian Township. Traces of copper and silver occur 1,000 feet south of Clarice Lake, 1,000 feet west of the Ontario-Quebec boundary. The metals occur in massive pyrrhotite replacing pillow selvages and are in a zone extending from the Quebec boundary west to the massive rhyolite. In places in the massive rhyolite, pyrrhotite is disseminated; south of Clarice Lake, pyrrhotite has replaced the volcanic rocks.

Exploration should be done to check whether the magnetic anomaly at Clarice Lake results from massive sulphides or from magnetic microdiorite and diorite existing at depth.

The esker which extends throughout the length of the two townships would provide an excellent road bed for future access to the area, and a major source of sand and gravel.

## No. 26 McARTHUR AND DOUGLAS TOWNSHIPS

## DISTRICT OF TIMISKAMING

by

D.R. Pyke[2]

Location: The area is located approximately 15 miles south of the town of Timmins. The western and southern parts of McArthur Township are readily accessible by an all-weather road from Timmins; access to the remainder of the area is best via float-equipped aircraft or helicopter.

Mineral Exploration: Prospecting activity dates back to the early 1900s following the discovery of gold in the Porcupine area. Much of the early prospecting was confined to the area between Triple and McArthur Lakes, as

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[1]Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake.

[2]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

attested by the multiplicity of trenches and pits, many of which are now overgrown. At this time two notable gold discoveries were made: (1) on the east-central shore of Triple Lake (Triple Lake Porcupine Gold Mines Limited)[1], and (2) near the south shore of McArthur Lake (Alcide Porcupine Mines Limited)[1]. Although samples from both these showings returned favourable assays, and received considerable, though sporadic, prospecting until the 1940s, no economic deposits were outlined.

Since the early 1950s exploration work has been primarily directed toward the discovery of nickel and copper mineralization. In this regard, much of the area underlain by ultramafic rocks and felsic volcanic rocks in the southeastern quadrant of McArthur Township has been geologically and geophysically surveyed by various companies. Only minor diamond drilling has been done.

No nickel values higher than the general background level of 0.2 to 0.3 percent have been reported from the ultramafic rocks of McArthur Township. Nevertheless, these ultramafics appear to form part of the same zone in which the nickel orebody occurs at the Texmont Mines Limited, about 2 miles south of McArthur Township on the Bartlett-Geikie township boundary.

Minor, spotty, and disseminated chalcopyrite mineralization has been found associated with the siliceous sulphide-facies iron formation in the southern part of McArthur Township. Extensive drift covers this part of the area, and to date only minor drilling has been done.

In 1970, Falconbridge Nickel Mines Limited did detailed geological mapping on a group of 77 claims in southeastern Douglas Township in the vicinity of Bologna and Swamp Lakes. Other activity during the summer of 1970 consisted of minor staking in the vicinity of McArthur Lake.

General Geology: The map-area is almost entirely underlain by Early Precambrian rocks. Pleistocene to Recent deposits of gravel, sand, and clay form a discontinuous mantle over much of the bedrock.

The general stratigraphic sequence progressing in a northeasterly direction from the southwestern quadrant of McArthur Township to the northeastern quadrant of Douglas Township consists of the following: (1) massive to pillowed mafic volcanic rocks, with minor mafic sills; (2) felsic volcanics, largely fragmental, with numerous layers of iron formation, minor associated subvolcanic felsic intrusions and several thick sills of diorite and gabbro; and (3) serpentinized peridotite and pyroxenite which, in many places, show a "chicken-track" or "lath"-type structure due to chilling, similar to that in Langmuir Township[2]; (4) pillowed to massive mafic volcanic rocks; (5) felsic volcanic rocks, largely fragmental.

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[1]Assessment work files, ODMNA, Resident Geologist's office, Timmins.

[2]Pyke, D.R., 1970: Geology of Langmuir and Blackstock Townships; ODM, GR86, p.13-17.

The southeastern end of a large batholith of coarse-grained, massive, porphyritic granodiorite underlies the northern half of McArthur Township, and a large part of the northwestern quadrant of Douglas Township. A similar granodiorite extends into the southwestern quadrant of Douglas Township from Geikie Township. Medium-grained granodiorite intruded the volcanic rocks and mafic intrusions in the southwestern part of McArthur Township, and forms part of a large batholith extending westward into Musgrove and Fripp Townships.

Diabase dikes are intrusive into all the rock-types in the area, and range in age from Early to Late Precambrian.

Structural Geology: The felsic volcanic rocks in the northeastern quadrant of Douglas Township occur at the top of the stratigraphic sequence outlined in the general geology section, and are in the axis of a major northwest-trending synclinal structure.

Major recognizable faults in the area trend northeast and northwest.

Economic Geology:

Gold: Gold mineralization occurs in quartz veins and lenses generally associated with feldspar porphyry dikes in a felsic, subvolcanic intrusion near the south shore of McArthur Lake. Visible gold has been reported from many of the veins[1]. Minor pyrite and lesser chalcopyrite and galena are common accessories. Although numerous trenches have beenbblasted in the veins, there still seems to be justification for further work. From information available in the assessment work files of the Ontario Department of Mines and Northern Affairs[1], there seems to have been little work done to test the continuity of values between trenches for any one vein. In addition, some of the veins have only been very superficially sampled. Only minor diamond drilling has been done, and the records for much of this have been lost. Related quartz and feldspar porphyry veins occur a few hundred feet north in the serpentinized ultramafic rocks along the south shore of McArthur Lake. Visible gold has been reported from one of these veins[2].

Triple Lake Porcupine Gold Mines Limited sunk a two-compartment shaft to a depth of 55 feet on a quartz vein near the east shore of Triple Lake. Visible gold, and channel samples assaying up to $50.00 per ton (gold probably at $20.67 per ounce)[1], were reported, but no commercial deposit was outlined. However the vein has only been explored with two diamond drill holes, which, in effect, is the only feasible means of evaluating the showing because of the extensive drift cover.

Copper: Minor and trace amounts of copper mineralization are associated with the siliceous sulphide-bearing iron formations in the south-central part of McArthur Township.

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[1]Assessment work files, ODMNA, Resident Geologist's office, Timmins.

[2]Hopkins, P.E., 1912: Notes on McArthur Township; Ontario Bur. Mines, Vol. 21, pt.1, No. 4, p.278-280.

Minor copper mineralization is associated with the gold-bearing quartz and feldspar porphyry veins in the felsic subvolcanic intrusion near the south shore of McArthur Lake. No copper mineralization has been reported from the main intrusive body, but any further work done on the property should not overlook the possibility of low-grade economic concentrations in the main intrusion.

Nickel: No anomalously high nickel values have been reported from either of the townships. The background nickel for most of the ultramafic rocks is approximately 0.2 percent[1], which is about average for these rocks in the Timmins area.

Iron: Cherty, magnetite-rich iron formation is common in the south-central part of McArthur Township. Sections from 10 to 30 feet in width can contain up to 30 percent magnetite. The best recorded assay[1] is 27.4 percent iron for a drill hole intersection of 29 feet. If a grade of 25 percent iron is acceptable, none of the known magnetite-rich bands are of sufficient width to be economic.

## No. 27 GEOCHEMISTRY OF SYENITIC INTRUSIVE STOCKS IN CAIRO AND OTTO TOWNSHIPS

### DISTRICT OF TIMISKAMING

by

W.J. Wolfe[2]

Approximately 700 fresh samples of bedrock were collected at regular intervals of 800 to 1,000 feet (outcrop permitting) over syenite stocks in Cairo and Otto Townships as part of a continuing study of the geochemistry of felsic intrusions in Ontario. The project is designed to detect primary syngenetic chemical patterns in the syenitic rocks and samples were, therefore, selected to provide representative coverage of the syenite and to avoid contamination by younger vein and dike material. Occurrences of chalcopyrite, pyrite, galena, specular hematite, purple fluorite, and barite were noted in the Cairo Stock (particularly in the well-exposed western half of the body) but most of these minerals seem to be related to later quartz and quartz-carbonate veins. Nepheline occurrences have been recorded in parts of the Otto Stock, but no significant base metal mineralization has so far been discovered. Samples from the two intrusions are currently being analyzed for Cu, Pb, Zn, Mn, Mo, Li, Ba, Na, K, and Si.

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[1]Assessment work files, ODMNA, Resident Geologist's files, Timmins.

[2]Geochemist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

## No. 28 KERNS, HARLEY, HUDSON, AND DYMOND TOWNSHIPS

## DISTRICT OF TIMISKAMING

by

H.L. Lovell[1]

Location: The map-area borders on the north shore of Lake Timiskaming, 7 miles north of the silver mines at Cobalt, and includes the town of New Liskeard and adjacent farmland and cottage-recreation areas. Access in the map-area is excellent, by means of Highways 11 and 65, bush and cottage roads, and, in the farmland, a grid pattern of township roads.

Kerns, Harley, Hudson, and Dymond Townships were mapped during 1970. To contribute to the planning of the use of land around all communities of the Little Clay Belt, the map-area was extended to include the Englehart and Earlton areas. Evanturel, Ingram, Pense, Armstrong, Hilliard, and Brethour Townships will be mapped during 1971.

Mineral Exploration: Since the discovery of silver at Cobalt in 1903, the map-area has been prospected sporadically for silver. A few small silver-bearing veins were found, as well as copper in Nipissing diabase and granophyre, and uranium in Cobalt sedimentary rocks near Nipissing diabase. Exploration expenditures and resultant success were minimal, however, and no metallic mineral production was recorded.

Sand and gravel are produced from the western part of Hudson Township, when required, and in the early days of settlement, limestone kilns and a brickworks were active.

General Geology: The oldest rock in the map-area is the iron formation of Archean age. Proterozoic rocks are well represented by Gowganda and Lorrain Formations of the Cobalt Group of sedimentary rocks, as well as Nipissing diabase and granophyre. Paleozoic rocks are represented by Ordovician and Silurian limestone, shale, and sandstone.

Soil in the map-area consists mainly of silt and clay east of the Cross Lake Fault. The silt and clay are bottom deposits of glacial Lake Barlow-Ojibway, and provide the Little Clay Belt farmland. The sand and gravel were deposited in the delta of a Pleistocene stream, with most of the sand in the apron of the delta and much of the gravel near the upstream (northern) edge of the delta.

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[1]Resident Geologist, Ontario Department of Mines and Northern Affairs, Kirkland Lake.

Structural Geology: The Lake Timiskaming Rift Valley[1] is represented in the map-area by two prominent faults, the Cross Lake Fault and the Lake Timiskaming West Shore Fault.

The extension of the Cross Lake Fault, which seems to contain the feeder for the Nipissing diabase cone-shaped intrusion most productive of the Cobalt area's silver ore, traverses Hudson Township. A similar feeder in Hudson Township is indicated by the presence of diabase that is relatively more mafic (contains hypersthene), and one of the two highest gravity anomalies in the Sudbury-Cobalt nickeliferous region, the other being at Sudbury itself.

The Lake Timiskaming West Shore Fault has undergone post-Paleozoic movement, whereby the Paleozoic formations on its northeast side were displaced 770 to 1,000 feet down and now underlie the Wabi River Valley. One result of the faulting is a limestone escarpment about 22 miles long, of which 18 miles are in the map-area.

Economic Geology: Total mineral production of the map-area is small, and consists mainly of sand and gravel, clay for tiles and bricks, and lime. Potential exists also for production of limestone, particularly from the "Harley Township Ridge", and for peat.

River water suitable for industrial purposes is plentiful, from Lake Timiskaming (the Ottawa River) and the Wabi and Blance Rivers. Spring-fed kettle lakes are numerous in the sandy Pleistocene delta in the southwestern part of Hudson Township. The spring water can be considered as a future high-purity source for municipal requirements.

## No. 29 TIMAGAMI AREA (STRATHY AND CHAMBERS TOWNSHIPS)

## DISTRICT OF NIPISSING

by

G. Bennett[2]

Location: Strathy Township lies about 65 miles north of North Bay. Highway 11 passes through Strathy Township. Chambers Township is immediately west of Strathy Township and is accessible by a gravel road from Goward.

Mineral Exploration: Although the iron deposits of the Timagami area have been known since 1898, it was not until 1968 that modern mining and beneficiation methods made mining profitable.

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[1]Lovell, H.L., and Caine, T.W., 1970: Lake Timiskaming rift valley; ODM, Misc. Paper 39.

[2]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

Most of the mineral exploration has been concentrated in Strathy Township where prospecting for gold and silver began around the turn of the century. Prospecting was very active in the area during 1934 to 1935 and encouraging deposits of gold and copper were found in Strathy Township. In 1954, the discovery of high-grade copper deposits currently being mined by Copperfields Mining Corporation Limited on Timagami Island renewed interest in the Timagami area.

There was little activity in the area during the past field season. Some old properties were given cursory examinations by mining companies and some prospecting was carried out in central Chambers Township but no new claims were recorded.

General Geology: The oldest rocks in the area are pillowed, porphyritic basalts in northwestern Strathy Township. South of Chambers Lake in Chambers Township a mixed assemblage of dacitic flows and volcanic breccias with intercalated basalts and rhyolite probably overlie the porphyritic basalts. A thick unit of pale rhyolitic rocks extends from central Strathy Township to Ferrim Lake in western Chambers Township. Banded chert-magnetite iron formation units up to 500 feet thick delineate the limbs of the Tetapaga Syncline. Overlying the iron formation are variolitic and amygdaloidal mafic metavolcanics with interbedded volcanic greywacke, argillite, and rhyolitic tuff.

The metamorphic grade of the metavolcanics is commonly greenschist facies except near the granitic intrusions where it is epidote-amphibolite facies and hornblende-hornfels facies. Local zones of intense ankeritization in the metavolcanics generally, but not always, coincide with major shear zones.

Thick sills of metadiorite are in the metavolcanics. A copper- and nickel-bearing intrusion varying in composition from quartz diorite to peridotite, and related bodies of diorite, are in central Strathy Township. Several thick sill- or stock-like bodies of diorite to gabbro (locally magnetic) intrude the metavolcanics in Chambers Township.

A pink porphyritic granite intrudes the metavolcanics found in south-central Chambers Township. Granitic intrusions also underlie much of the northern part of the area.

The most common dike rocks are brownish weathering northwest-trending diabase dikes up to 150 feet wide. Biotite lamprophyre and fine-grained mafic dikes also were noted.

Much of the northern part of Strathy Township is overlain by Nipissing diabase. Cobalt Group siltstone and conglomerate are found near the town of Timagami.

Structural Geology: The metavolcanics and metasediments of the Timagami area have been folded into a northeast-trending, shallow-plunging syncline. Top determinations on pillow lavas and grain gradations in greywacke-type sedimentary rocks indicate that the axis of the syncline lies much nearer the south limb than the north limb. Steeply dipping, northeast-trending shear zones near the town of Timagami are extensions of shear zones under the Northeast Arm of Lake Timagami. Similar shear zones occur along Tasse Creek in western Chambers Township between Iron Lake and Net Lake. These shear zones probably indicate major strike-slip faults.

Economic Geology: Iron ore is currently being mined from the three open-pits of the Sherman Mine. The Sherman Mine is a joint venture of Dominion Foundries & Steel Limited (Dofasco) and the Tetapaga Mining Company, and is operated by Cliffs of Canada Limited. The plant has a capacity of 1,000,000 long tons of pellets per year and can handle about 10,700 long tons of crude ore per day. The iron formation is banded chert-magnetite with local sulphide facies. The iron formation ranges in width from 150 to 500 feet in the vicinity of the three open-pits presently in production. Although the overall grade is only about 25 percent iron, the proximity to markets makes the project profitable.

Numerous small vein-type occurrences of base metals, gold and silver, and molybdenum have been uncovered by prospectors during the past 70 years. The more important prospects are briefly described below.

The Cuniptau Mine in central Strathy Township is centred around a zone of disseminated pyrite, pyrrhotite, and chalcopyrite. The zone extends for about 1,000 feet, with a width of 200 to 400 feet, and is in serpentinite which forms the northwestern edge of a differentiated mafic intrusion. It contains an estimated 732,000 tons of material averaging 0.65 percent copper and 0.38 percent nickel[1]. Values in gold, silver, and platinum metals also are reported. The only production from the underground workings was 3,318 tons milled in 1936. The property is now held by Ajax Minerals Limited.

Irregular impregnations of pyrrhotite and seams of chalcopyrite occur on the northeast shore of Net Lake and have long been known as the Norrie prospect. The country rocks are recrystallized mafic volcanic rocks, cut by granite and quartz veins. Ten pits and several drill holes predate 1920; the last exploration was in 1941. Analyses up to 3.5 percent copper are reported from old dumps[2].

In 1953 and 1955, Mayfair Mines Limited carried out geological mapping, geophysical surveys, and diamond drilling over pyrite facies iron formation lying stratigraphically below and northwest of the North Pit of the Sherman Mine. Minor chalcopyrite and sphalerite were reported[3].

The Beanland prospect in central Strathy Township consists of a quartz-vein network in mafic metavolcanics about 5 feet wide and 560 feet long striking N50E to N70E and dipping vertically. The vein has seams of pyrite, chalcopyrite, and galena. Early work on the surface indicates a zone 160 feet by 4.6 feet which averages 0.31 oz. of gold per ton and 1.8 oz. of silver per ton[2]. Underground development was carried out on three levels but there

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[1]Shklanka, Roman, 1969: Copper, nickel, lead and zinc deposits of Ontario; ODM, Min. Res. Circular 12, 394p.

[2]Moorhouse, W.W., 1942: The northeastern portion of the Timagami Lake area; ODM, Vol. 51, pt.6, 46p.

[3]Assessment work files, ODMNA, Resident Geologist's office, Kirkland Lake.

is no record of production. The property is held by Alex E. Perron.

The Hermiston-McCauley prospect is located about a mile north of the Beanland and is a vein-type gold deposit in quartz diorite. Gold values are said to range from trace to over 1.15 oz./ton over 8.8 feet. Underground development totals 4,000 feet on two levels, but there is no record of production[1]. The property is held by Cominco Limited.

A number of narrow silicified and altered zones in mafic metavolcanics near the east end of Arsenic Lake contain veins and stringers of massive pyrite, arsenopyrite, pyrrhotite, and chalcopyrite. Considerable surface and underground development was carried out in the search for gold and silver ore prior to the cessation of operations in 1937. The property is held by Penrose Gold Mines Limited.

Occurrences of molybdenite in mafic metavolcanics along the west shore of Net Lake have been known for many years. Most of the molybdenite showings now lie within the limits of the Goward (Timagami North) townsite and are closed to staking. A few flecks of molybdenite and associated chalcopyrite were noted in small pegmatitic patches in the pink granite along Highway 11 north of Net Lake.

## No. 30 TOMIKO AREA

## DISTRICT OF NIPISSING

by

S.B. Lumbers[2]

Location: The Tomiko area covers about 1,500 square miles between latitudes 46°30' and 47°00', and extends east from longitude 80°00' to the Ontario-Quebec Interprovincial Boundary through Lake Timiskaming and the Ottawa River. Reconnaissance mapping of the area at a scale of 1 inch to 1 mile was started during the 1969 field season[3] and was completed during the 1970 field season.

Mineral Exploration: Deposits of iron, copper, lead, kyanite, vermiculite, industrially useful rocks, and sand and gravel have been explored and utilized in the Tomiko area. During 1969 and 1970, exploration work was carried out by Cononaco Mines Limited and by Morris J. MacWilliam and other prospectors on

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[1]Moorhouse, W.W., 1942: op. cit.

[2]Geologist, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

[3]Lumbers, S.B., 1969: Tomiko area, District of Nipissing; in Summary of field work, 1969, E.G. Pye (ed.); ODM, Misc. Paper 32, p.61-64.

iron, vermiculite, and kyanite deposits, but present production is confined to building stone and to sand and gravel.

General Geology: The Grenville Front, a tectonic zone marking the northwestern margin of the Grenville Province and separating rocks of the Grenville Province from those of the Southern and Superior Provinces, trends northeastward across the Tomiko area from the west-central boundary in northwestern McCallum Township to the northern boundary in the vicinity of Maxam Lake in eastern Eldridge Township. The region northwest of the Grenville Front is underlain by Early Precambrian rocks of the Superior Province, in places overlain unconformably by Middle Precambrian sedimentary rocks of the Cobalt Group. All of these rocks are intruded by sills and dikes of Middle Precambrian Nipissing diabase. The Grenville Province in the area is underlain by a regional metamorphic complex of paragneiss and minor orthogneiss which, in part, are migmatitic. Late Precambrian and possibly younger dikes of diabase, lamprophyre, and alkalic rocks cut across the Early and Middle Precambrian rocks northwest of the Grenville Front, and late diabase dikes are present in the Grenville Province rocks. A small outlier of Middle Ordovician limestone overlies Cobalt Group rocks near a fault zone in northeastern Law Township. The area was subjected to Pleistocene continental glaciation, and much of the bedrock in the southeastern quarter of the area is covered by a thick mantle of drift.

The Early Precambrian succession consists mainly of granitic rocks containing small inclusions of metavolcanics and, rarely, metasediments, but two relatively large metavolcanic and metasedimentary remnants are present. A relatively thick sequence of mafic and felsic metavolcanics is preserved along the northern boundary of the area from the Northeast Arm of Lake Timagami to Upper Twin Lake in western Riddell Township. This sequence, which was recently mapped by Bennett[1,2,3], locally displays the effects of greenschist facies regional metamorphism, but near intrusions the volcanic rocks were metamorphosed under albite-epidote and hornblende-hornfels facies conditions. A second sequence of mafic and intermediate to felsic metavolcanics and minor intercalated metasediments occurs near the south end of Cross Lake in Torrington and northwestern McCallum Townships. This sequence, which is largely covered by rocks of the Cobalt Group, was metamorphosed by granitic and mafic intrusions; the grades of metamorphism attained were albite-epidote and hornblende-hornfels facies. Five types of Early Precambrian intrusions are present: 1) small gabbroic and dioritic stocks near the south end of Cross Lake; 2) epizonal or subvolcanic albite granite stocks and related mafic, porphyritic felsic, and rhyolitic dikes in the metavolcanic sequence along the northern boundary of the area in Briggs and Strathcona Townships; 3) a mesozonal trondhjemitic batholith which extends from east of Cross Lake into the

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[1]Bennett, G., 1969: Timagami area (Briggs and Strathcona Townships), District of Nipissing; in Summary of field work, 1969, E.G. Pye (ed.); ODM, Misc. Paper 32, p.58-60.

[2]Bennett, G., and McNally, N.K., 1969: Strathcona Township; ODM Prelim. Map P.596.

[3]Bennett, G., and McNally, N.K., 1970: Briggs Township; ODM Prelim. Map P.595.

Grenville Province and north to southern Strathcona, Riddell, and Eldridge Townships; 4) mesozonal quartz monzonite stocks and batholiths partly exposed south of Cross Lake and in Briggs Township north of Northeast Arm of Lake Timagami; and 5) a syenitic stock in northwestern Law Township. In addition, a few ultramafic dikes generally no more than a few hundred feet across are present in the trondhjemitic batholith within 1/2 mile of the Grenville Front. The epizonal albite granite stocks and the mafic stocks are the oldest intrusions, whereas the quartz monzonite and syenitic stocks are among the youngest intrusions. The trondhjemitic batholith, which intrudes the epizonal albite granite stocks, contains widespread dikes of pink quartz monzonite and granite pegmatite as late phases, and all the granitic and syenitic intrusions contain contaminated border phases of tonalitic and dioritic rocks.

About 30 percent of the area of Early Precambrian rocks northwest of the Grenville Front are overlain unconformably by rocks of the Cobalt Group, which consist of the Gowganda Formation and the lower part of the Lorrain Formation. Within a few miles of the Grenville Front rocks of the Cobalt Group are intensely sheared by folding and faulting and in places overturned towards the southeast, but elsewhere, they are generally flat-lying to gently dipping and only slightly metamorphosed. The Gowganda Formation in the area ranges in thickness from zero to several thousand feet with the thickest sections east of Rabbitt Lake in Riddell Township (about 2,500 feet) and in Yates and western Torrington Townships (possibly more than 8,000 feet). A rubbly boulder conglomerate up to 100 feet thick is common at the base of the Gowganda Formation and contains a high proportion of boulders to coarse grained feldspathic sandstone or greywacke matrix. The basal conglomerate commonly grades upward into a rock containing a high ratio of greywacke matrix to boulders and pebbles. Such rocks commonly form units up to 300 feet thick with poorly developed internal stratification and are intercalated at several horizons with laminated to thinly bedded argillite, siltstone, and sandstone. No criteria diagnostic of a glacial origin for the Gowganda Formation were found. The Lorrain Formation occurs only near Rabbit Lake in Riddell, Eldridge, and Askin Townships where it is about 800 to 1,000 feet thick and consists of coarse-grained arkose with lenses of well-rounded granitic pebbles. Near the south end of Rabbit Lake, fine-grained arkose and feldspathic sandstone form the base of the Lorrain Formation, and the latter grades into the underlying Gowganda Formation by a gradual increase in the number of intercalated argillite and poorly sorted sandstone beds.

Nipissing diabase intrusions are abundant within and nearby the Cobalt Group rocks. Many of the intrusions contain poorly developed igneous layering and granophyric phases. Rocks of the Cobalt Group are generally steeply dipping next to the diabase intrusions and display narrow contact metamorphic aureoles up to a few hundred feet wide.

Major features of the Grenville Province rocks have been described[1]. High-rank, regionally metamorphosed rocks (gneisses) of the Grenville Province are separated from low-rank regionally metamorphosed Early and Middle Precambrian rocks to the northwest by a fault zone up to about 200 feet wide of crushed and mylonitized rocks. This fault zone marks the only mappable

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[1]Lumbers, S.B., 1969: op. cit.

northwestern boundary of the Grenville Front tectonic zone, but granulation and mylonitization effects extend up to 3 miles northwest of the zone into the Early and Middle Precambrian rocks. The Early Precambrian trondhjemite batholith of the Superior Province extends up to 4 miles into the Grenville Province, where it has been regionally metamorphosed to the same rank as other rocks of the metamorphic complex and is unconformably overlain by a sequence of coarse metasediments, i.e., conglomerate and coarse grained sandstone[1]. In southern Torrington and northern McCallum Townships, this coarse clastic sequence locally extends to the northwestern boundary of the Grenville Front tectonic zone; east of Surveyor Lake in McCallum Township, Early Precambrian quartz monzonite intrusions with some remnants of Early Precambrian metavolcanics and metasediments extend into the Grenville Province where they are also overlain unconformably by the coarse clastic sequence. This sequence has now been traced southwest beyond the Tomiko area to southern Hobbs and northern McWilliams Townships, and is continuously exposed over widths up to 6 miles near the western boundary of the area in the vicinity of Red Cedar Lake. Northeastward, the sequence appears to thin and is only about 1/2 mile wide in southeastern Hartle Township but is exposed over widths up to 2 miles near the northern boundary of the area in western Hebert Township. A few relatively thin units of conglomerate and coarse sandstone similar in lithology to the main unit are intercalated with finer grained sandstone overlying the main unit in Hebert, Burnaby, Flett, Gladman, and McLaren Townships. The main coarse clastic unit forms the base of the metasedimentary accumulation dominating the Grenville Province, and this accumulation is probably Middle Precambrian in age[1].

In the Grenville Province within a few miles of the northwestern boundary of the Grenville Front tectonic zone, recrystallized and deformed granite pegmatite dikes are common, and within 1/2 mile to the northwest and southeast of this boundary, relatively late, leucocratic, quartz monzonite dikes cut across the Early and Middle Precambrian rocks. These dikes were recrystallized within the Grenville Province and were crushed and mylonitized to the northwest.

Structural Geology: Major structural features of the area were described previously by the author[1], but completion of the mapping shows some additional features previously unrecognized. The southern boundary of the Grenville Front tectonic zone is marked by two regional synforms. One synform axis trends northeast from North Spruce Lake in Hammell Township through southeastern Gooderham, northwestern LaSalle, southeastern Angus, and northwestern Parkman Townships to Lake Timiskaming in the southeastern part of Burnaby Township. This structure seems to be folded by a second synform whose axis trends eastward from McLaren Township, south of Marten Lake in Gladman Township, and intersects the first axis in central Hammell Township. Fold patterns are extremely complex within the Grenville Province, but recognition of these regional structures may help to clarify the structural history.

The fault zone marking the northwestern boundary of the Grenville Front tectonic zone is displaced by numerous faults forming two major systems: 1) a north to northeast system, and 2) a west to northwest system. Faults of both

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[1]Lumbers, S.B., 1969: op. cit.

systems are marked by prominent zones of granulation and mylonitization and all have undergone late movement relative to the culmination of the Grenville regional metamorphism. Many of the faults extend several miles northwest of the Grenville Province, and next to some of the faults, Cobalt Group rocks and Nipissing diabase show up to 1 mile apparent lateral displacement. Faults of the north to northeast system rarely extend south of the Grenville Front tectonic zone and most extend for only short distances north of the map-area. In contrast, faults of the west to northwest system have a greater regional extent and can be traced across the Grenville Front tectonic zone. Faults of this system in the northeastern part of the area are continuous with a regional zone of northwest-trending faults that can be traced over 100 miles northwest of the Tomiko area and that displace Paleozoic rocks at the north end of Lake Timiskaming. As mentioned above, a small Paleozoic outlier is associated with a fault of this system in the map-area. Most of the Late Precambrian diabase dikes are associated with faults of the west to northwest system, but lamprophyre and alkalic dikes are associated with faults of both systems, and relative age relations between the two systems appear to be complex.

Economic Geology: To the northwest of the Grenville Province, disseminated copper and lead mineralization in the form of chalcopyrite and galena are found in quartz and quartz-carbonate veins containing some disseminated pyrite. The veins are associated with faults of the north to northeast system and all the known mineralized veins are either in rocks of the Cobalt Group, in Nipissing diabase, or in Early Precambrian metavolcanics. Traces of gold and silver are present in some of the mineralized veins, but the mineralization found to date seems to be too irregularly distributed and too small to be of economic value.

The Early Precambrian epizonal or subvolcanic albite granite stock in Briggs and western Strathcona Townships lies just east of the high-grade copper deposits of Copperfields Mining Corporation Limited on Timagami Island, Lake Timagami. The stock contains numerous, irregularly distributed fractures and breccia zones healed by fine grained chloritic and quartzose material in which traces of chalcopyrite are rarely visible. The stock contains several intrusive phases including a variety of fine-grained and porphyritic felsic dikes. The copper mineralization on Timagami Island possibly is related to one or more phases of this stock. In the search for additional copper deposits in this area, exploration of the stock itself should be considered as well as the surrounding mafic and felsic metavolcanics.

Mineralization within the Grenville Province part of the Tomiko area was discussed previously[1].

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[1]Lumbers, S.B., 1969: op. cit.

## No. 31 PALEOZOIC GEOLOGY OF THE ARNPRIOR AREA

## SOUTHERN ONTARIO

by

B.A. Liberty[1]

The mapping of the Paleozoic formations underlying the area included in the Arnprior National Topographic Sheet was completed during the month of June and the first week of July, 1970. Basically the work of Alice E. Wilson of the Geological Survey of Canada was corroborated with respect to mapping, faults, and faunal sequence. More outcrops were found, however, which permitted refinement and definition of map-units. The Ottawa Formation is now being subdivided on a lithologic basis in the Ottawa Valley.

Despite an abundance of pits in the map-area, there are no operating quarries in the Paleozoic bedrock formations.

The work was carried out as part of a mineral resource survey of the Regional Municipality of Ottawa-Carleton.

## No. 32 INDUSTRIAL MINERAL RESOURCES OF NOTTAWASAGA TOWNSHIP

## SOUTHERN ONTARIO

by

G.J. Burwasser[2]

Location: Nottawasaga Township, covering approximately 203 square miles, is located at the south end of Georgian Bay in the northwestern part of Simcoe County. Most of the area lies in the eastern half of the Collingwood Map Sheet (41 A/8) of the National Topographic Series. Small parts of the township are in the western half of the Collingwood and the eastern and western halves of the Nottawasaga Map Sheet (41 A/9).

General Geology: Formations of Ordovician age comprise most of the bedrock in the area. The oldest formation in the township is the Verulam dolomitic limestone (Trenton Group). The Ordovician-Silurian contact lies along the Niagara Escarpment from 5 miles north of Singhampton to 4.5 miles west of Glencairn (Sunnidale Township). Bedrock is exposed in re-entrants along the Escarpment and in a few roadcuts in the southern half of the township.

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[2]Geologist, Industrial Minerals Section, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

Most of the area is covered by Pleistocene deposits. The main shoreline of Lake Algonquin trends southeast across the township from 3.5 miles west-southwest of Collingwood to 4.5 miles north of Creemore. The Nipissing shoreline generally parallels the present shore of Nottawasaga Bay from 4 miles west of Collingwood to the eastern township boundary 3 miles north of Stayner. The Lake Algonquin plain consists of till masked by lacustrine deposits of clay, silt, and sand. South of the Algonquin plain are the Singhampton, Gibralter and Corn Hill till moraines. These are separated by spillways and lie against and atop the Niagara Escarpment.

Sand and gravel reserves in the northern half of the township are located along the two abandoned shorelines mentioned above. Further undeveloped deposits exist in a triangle formed by Glen Huron, Creemore, and Maple Valley. This area contains spillway terraces as well as numerous kame complexes. Sand for a variety of industrial purposes may be found in the lacustrine plains along a strip from 2 to 4 miles wide paralleling the present shoreline of Nottawasaga Bay. Reserves of stone for crushing are limited to the Niagara Escarpment in the area west of a line through Duntroon and Glen Huron where overburden is thin or absent.

Economic Geology: There are numerous machine sand and gravel pits in the township. The few active pits are located in the abandoned beaches and on the Escarpment. Limestone is quarried from the top of the Escarpment for crushed rock. The combined production of sand and gravel and crushed rock from Nottawasaga Township reported in 1969 was 326,070 tons valued at $280,890[1].

## No. 33 QUATERNARY GEOLOGY, WOODSTOCK AREA

## SOUTHERN ONTARIO

by

W.R. Cowan[2]

Location: The map-area is bounded by latitude 43°00' to 43°15' north, and by longitude 80°30' to 82°00' west. The city of Woodstock is located near the geographic centre of the map sheet. Mapping was initiated during the 1969 field season and was completed during 1970.

General Geology: Surface deposits consist mainly of Late Wisconsinan tills and sand of glaciolacustrine or glaciofluvial origin. The oldest till observed at the surface is the sandy Catfish Creek Till of Late Wisconsinan age; it occurs as small inliers or outliers and is frequently associated with stratified drift (mainly sand or gravel). Much of the southeastern and

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[1]Statistical files, ODMNA, Toronto.

[2]Graduate student, University of Colorado, Boulder, Colorado.

eastern part of the area is mantled by the silty Port Stanley Till (Erie Lobe) occurring as ground moraine plains or end moraine. It is frequently veneered with glaciolacustrine silt or fine sand. Much of the western and northwestern part of the area is overlain by a silty to silty fine sand till (Huron Lobe) occurring as ground moraine plains or ground moraine with many drumlins. This till apparently correlates with tills 'H' and 'I' of Westgate and Dreimanis[1] and with Karrow's till 'T'[2,3]. It is often veneered in low areas by lacustrine silt or fine sand, or on higher ground, by windblown silt and fine sand. The outer margin of this till sheet is marked in many instances by ice contact stratified drift or outwash gravels which may have been overridden. Much of the Woodstock drumlin field is believed to be erosional in nature; drumlins often consist of stratified sand or gravelly sand, or older tills, capped by the above-mentioned till (some of the drumlins cored by older tills may be overridden drumlins of depositional origin). This till overlies the westernmost part of the Port Stanley Till sheet whereas, at its southeastern extremity, it seems to have been penecontemporaneous with the retreating or fluctuating Port Stanley ice sheet.

Tills older than Late Wisconsinan are only in river valleys or in excavations opened during quarry excavations (see Westgate and Dreimanis, 1967).

Economic Geology: Till stratigraphy and textures strongly influence the nature and availability of granular materials in the area. Outwash associated with the slightly stony fine-grained Port Stanley Till consists mainly of stony fine sand containing lenses of gravel which provide local sources of gravel.

Gravels are frequently associated with the Catfish Creek Till reflecting the coarse texture. Because of the limited surface extent of this till, exploration for associated gravels will require drilling or geophysical work in areas where overlying younger tills are believed to be thin.

The bulk of the gravel presently being extracted in the area is associated with, or overlain by, the Huron Lobe till described above, mainly near its eastern margin. Some of this gravel may be considerably older than the overlying till, but much of it represents outwash and ice contact deposits laid down at or near the ice margin. This in part reflects the increased stone and sand content of this till eastward compared to a more silty texture in the northwest. Exploration in the area should be concentrated near the outer margin of this till sheet where more gravels with a thin till cap may occur.

Clay of glaciolacustrine origin is being extracted from a pit south of Burgessville by Norwich Brick and Tile Limited.

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[1] Westgate, J.A., and Dreimanis, A., 1967: The Pleistocene sequence at Zorra, southwestern Ontario; Can. J. Earth Sci., Vol. 4, No. 6, p.1127-1143.

[2] Karrow, P.F., 1968: Surficial geology, Stratford-Conestoga area (40 P/7, P/10); GSC, Paper 68-1, pt.A, p.169-171.

[3] Karrow, P.F., 1968: Pleistocene geology, Stratford-Conestoga area, Ontario; Field trip notes, September 7 and 8, 1968, 8p.

Mineral Production: Reported production of sand and gravel during 1968 exceeded 375,000 tons valued at more than $440,000. A number of small pits and a few major pits are not included in this figure. Paleozoic rocks yielded more than 500,000 tons of cement valued at more than $9,000,000; more than 400,000 tons of quicklime and more than 40,000 tons of hydrated lime exceeding $5,000,000 in combined value, and more than 1,000,000 tons of limestone valued in excess of $1,500,000[1]. Oil and gas are also being recovered from the Paleozoic rocks; gypsum in the Salina Formation has drawn some prospecting attention in recent years.

## No. 34 PLEISTOCENE GEOLOGY AND INDUSTRIAL MINERAL RESOURCES OF THE NIAGARA AND WELLAND AREA

## SOUTHERN ONTARIO

by

B.H. Feenstra[2]

Location: The map-area (National Topographic Series, Niagara Sheet, 30M/3W) is bounded by north latitudes 43°00' to 43°15' and west longitudes 79°15' to 79°30', and is located to the west and northwest of the cities of St. Catharines and Welland in the Niagara Peninsula.

The project is designed to prepare surficial geology, bedrock topography, drift thickness, and industrial mineral resource maps of part of the Regional Municipality of Niagara to assist in regional planning.

Mapping of the Pleistocene deposits and landforms at a scale of 1:50,000 is nearly completed and water wells have been field-checked.

General Geology: The Ordovician Queenston Shale outcrops along the base of the Niagara Escarpment as well as in the Lake Iroquois Plain between Vineland and the western boundary of the map-area for distances up to 1 mile north of the Lake Iroquois shore bluff. Good exposures of the rocks of the Clinton and Cataract Groups of the Silurian are found in the face of the Niagara Escarpment. The Lockport Dolomite of the Silurian forms the resistant cap rock of the Niagara Escarpment and significant outcrops of this dolomite occur also to the southwest of Campden.

Glacial erosional features in bedrock of the Niagara Escarpment area from St. Catharines westward indicate the latest ice flow direction to be mainly to the southwest.

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[2]Geologist, Industrial Minerals Section, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

A silt to clayey silt till, which is exposed in the Lake Ontario shore bluff, outcrops in much of the Town of Lincoln (Clinton and Louth Townships). This exposed till sheet extends southward into the Vinemount Moraine and slightly beyond it. The Vinemount Moraine, which can be traced as a distinct ridge following the Niagara Escarpment just south of it in Clinton Township, was built by glacier ice advancing to the southwest out of the Lake Ontario basin. Silt till found in the Fonthill Kame may be correlated with this advance.

Southward from the Vinemount Moraine and the top of the Niagara Escarpment to the east of it, the towns of Lincoln, West Lincoln, Pelham, and Thorold are largely covered by proglacial lake clays including extensive areas of massive to laminated till-like clay of uncertain origin (water-laid till?) and good exposures of which are found in the Twelve Mile Creek valley.

The Fonthill Kame protrudes approximately 200 to 250 feet above the surrounding lake plain and consists of as much as 350 to 360 feet of drift deposited in and on top of a bedrock valley. The stratified sand and gravel with interbedded silt till in the upper 60 feet is possibly of glaciofluvial, deltaic, and ice-contact origin. Short beach ridges of sand and gravel are found on top at higher elevations (825 to 850 feet) in the northeastern part.

The Lake Iroquois Plain is underlain by weathered Queenston Shale, silt to clayey silt till, stratified fine silty sands and some clay and silt. The Lake Iroquois shoreline at Highway 8 is mainly an erosional bluff cut into the Queenston Shale and the till. However shallow beach sand and gravel is found at several localities between St. Catharines and Beamsville at an elevation of 350 to 360 feet.

Economic Geology: Commercial sources of sand and gravel in the area mapped are limited to the Fonthill Kame. Present commercial operations are confined to the Telephone City Gravel Company Limited and Moyer Sand (1965) Limited.

The Lockport Dolomite is presently being quarried by Vineland Quarries and Crushed Stone Limited south of Vineland and MacLachlan Quarries Limited south of Beamsville.

The total production of aggregates in 1968 amounted to 1,501,912 tons valued at $1,593,811[1].

## No. 35 PLEISTOCENE GEOLOGY OF THE WINDSOR-ESSEX REGION

## SOUTHERN ONTARIO

by

U.J. Vagners[2]

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[1]Statistical files, ODMNA, Toronto.

[2]Geologist, Industrial Minerals Section, Ontario Department of Mines and Northern Affairs, Parliament Buildings, Toronto.

Location: The region mapped is bounded by Lake Erie, Detroit River, Lake St. Clair and west longitude 82°30'. The city of Windsor is located in the northwestern part of the region. Detailed mapping was completed in the northern half of the region with reconnaissance mapping carried out in the remainder.

General Geology: The region is underlain by bedrock of Devonian age found exposed in quarries and excavations in the southwestern part. In the rest of the region thick sediments of the Quaternary overlie the bedrock.

The most common Pleistocene sediment is a silt till. Locally, glacio-fluvial sand-gravel and glaciolacustrine sand-silt-clay overlie the till. Recent alluvial and lacustrine (sand-gravel) sediments are associated with the present streams and shorelines of Lake St. Clair and Lake Erie. Some of the sands of lacustrine and glaciolacustrine origin have been reworked by wind in the Point Pelee and Leamington areas.

Mineral Production: The total value of mineral production for Essex County in 1968 was $16,850,521 representing 1.24 percent of the total value of mineral production for the whole Province. The following is a more detailed breakdown of this production: 1,886,936 tons of salt valued at $11,878,494; 265,259 tons of lime valued at $2,261,393; 1,358,089 tons of limestone valued at $1,620,161; 1,417,494 tons of sand and gravel valued at $907,006; and clay valued at $121,866[1].

The salt is produced from Silurian age bedrock by underground mining at Windsor and from brine wells at Amherstburg and Windsor. Lime and limestone are produced from quarries in the Devonian rocks. These are situated in Anderdon and Malden Townships where the Quaternary sediment cover is thinner. Sand and gravel are extracted from pits in glaciofluvial and glaciolacustrine sediments and dredged from Recent deposits of Lake Erie in Mersea Township. Clay is obtained from pits in till in Gosfiel South and Tilbury West Townships.

## No. 36 SALT IN ONTARIO

## SOUTHERN ONTARIO

by

M.A. Vos[2]

During the months of August and September, 1970, visits were made to the various salt mining operations in southwestern Ontario. The purpose of

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these visits was to update information contained in Ontario Department of Mines, Industrial Mineral Report No. 6: "Salt in Ontario", by D.F. Hewitt.

Salt is mined in Ontario by the conventional method as well as by pumping of a salt solution in brining operations. In brining, either fresh water is introduced into the salt beds from the surface or use is made of groundwater draining down into the salt beds. About 4,000,000 tons of salt is produced annually in Ontario at a value of approximately $20,000,000; or well over 50 percent of the value of minerals classified as nonmetals.

Salt beds occur in the Upper Silurian Salina Formation. The thickness of this formation ranges from 365 feet near Dunnville, to 1,180 feet near Sarnia, 1,060 feet near Goderich and 650 feet near Windsor. In these areas, with the exception of Dunville, salt is produced from salt beds in units $A_2$, B, D, and F of the Salina Formation. Salt in unit $A_2$ reaches a thickness of 140 feet near Sarnia and 80 feet near Goderich. Combined thicknesses of salt beds in the upper units reach a maximum of about 600 feet near Sarnia.

Windsor Area: Operations of The Canadian Salt Company Limited, previously Windsor Salt Company, include mining at the Ojibway Mine, 2 miles southwest of Windsor city limits, on the shore of the Detroit River, and brining from properties east of the plant at Sandwich, Ontario. The Canadian Brine Limited, a subsidiary company, produces brine which is piped directly to the Detroit plant of the Solvay Process Division of Allied Chemical and Dye Corporation.

Operations in the mine continue in the northwestern part of the property, along the International Boundary. Upon completion, operations will be moved eastward, continuing horizontally along the same salt bed in the F unit of the Salina Formation.

Pillars are now 60 feet wide between 50-foot wide rooms, with 30- to 40-foot wide crosscuts occurring at 70-foot intervals. A height of approximately 19 feet is maintained. Mucking machines are being replaced with front-end loaders in the underground operations.

In the mill a Sortex machine has been installed which sorts the 1/2-inch to 3/8-inch crushed salt on the basis of colour.

Brining in the Windsor area is also carried out by Allied Chemical Canada Limited, in Anderdon Township, north of Amherstburg. Five groups of wells numbering 3 to 6 wells each are operated at present; new wells are scheduled to be added to different groups.

Sarnia: The only active salt mining operation in Sarnia is that of Dow Chemical of Canada Limited. Seven pairs of wells draw brine from two salt layers.

Goderich: Salt mining in Goderich is controlled by Sifto Salt (1960) Limited, a wholly owned subsidiary of Domtar Chemicals Limited. Upon closing of the Sarnia plant in 1964, the company expanded production facilities in the Goderich brining operation. A fourth vacuum pan, 12 feet in diameter, was installed in series with and ahead of the three existing pans. Conversion to oil burners for these pans took place in July of 1970. Brine is drawn from two wells in a series of three. At the time of visiting in September a small crusher was being installed for the production of microsalt, having an average grain size of 40 microns. This product is in demand in the food processing industry.

Mining continues on a 42-foot face in approximately 20 working places. The pattern has been changed to provide improved stability of the roof. Rooms are now 45 feet wide leaving square pillars 150 feet long along the side. At every intersection of rooms, one of the four pillars is extra wide on both sides, jutting out into the intersection for added roof support. Loading at the face is done by front-end loaders. Hoisting has been speeded up to a 2,500 feet per minute capacity, although it is generally used at a speed of 2,200 feet per minute.