MARGINAL NOTES

LOCATION AND ACCESS

The map area is bounded by Latitudes 49°45'N to 50°20'N and Longitudes 88°00'W to 89°00'W. In addition, Late Precambrian igneous rocks in the following areas were also investigated: the Eva and Kitto Townships area southwest of Beardmore (*see* Map P.2839, Figure 1); and the area west of Armstrong bounded by Latitudes 50°00'N to 50°30'N and Longitudes 89°00'W to 90°00'W (*see* Map P.2836, Figure 2).

Access to the map area is primarily by Lake Nipigon. Maintained access points to the northern part of the lake are located at Humboldt Bay on the eastern shore and at Gull Bay on the western shore.

MINERAL EXPLORATION

Within the map area, mineral exploration has primarily been in areas of Early Precambrian rocks.

Exploration for gold and base-metals has been centred on Early Precambrian supracrustal rocks. North of Lake Nipigon the Caribou Lake - Pikitigushi River metavolcanic-metasedimentary belt has been investigated since the 1930s. The most recent exploration was from 1980 to 1982. In the Humboldt Bay area of Lake Nipigon at the western end of the Onaman Rivers metavolcanic-metasedimentary belt, sulphide mineralization within the metavolcanic rocks has been investigated as recently as 1975. During 1970 and 1971, the Canadian Nickel Company Limited examined lenses of pyroxene-hornblendite within gneissic granitoids east of Ombabika Bay of Lake Nipigon.

The area north of Lake Nipigon has been explored for rare-element spodumene bearing pegmatites (Pye 1968; Breaks 1981).

GENERAL GEOLOGY

Previous mapping of Lake Nipigon was reported by Wilson (1910). Collins (1906) mapped the area northwest of Lake Nipigon as part of a survey of the area adjacent to the railway. More recent work was done by Pye (1968) in the Crescent Lake area, northeast of Lake Nipigon, by Sage *et al.* (1974), west of Lake Nipigon and by Sutcliffe (1981) to the south of the present area.

EARLY PRECAMBRIAN

Early Precambrian rocks of the map area consist mainly of granitoid rocks and lesser metavolcanic and metasedimentary rocks of the Wabigoon Subprovince.

The Early Precambrian rocks occur around the margin of Lake Nipigon and are intruded by Late Precambrian Logan diabase sills and associated dikes. The Early Precambrian rocks are predominantly exposed under the sills but are also locally found on top of the sills.

Biotite tonalite to granodiorite is the most widespread Early Precambrian lithology in the area. The tonalite consists of several phases ranging in texture from gneissic to foliated and commonly contains amphibolite and pyroxene-amphibolite enclaves. Locally, such as on the Britannia Islands of Lake Nipigon, the tonalite is discordantly intruded by mafic dikes which have subsequently been deformed and metamorphosed. Hornblende diorite is locally associated with the tonalite and is particularly common on the northeastern shore of Ombabika Bay of Lake Nipigon.

Biotite granite and granite pegmatite dikes intrude the biotite tonalite throughout the area. East of Armstrong the biotite granite forms a late massive pluton which is intrusive into tonalite. Microcline megacrystic granodiorite forms a pluton peripheral to the supracrustal belt on the northeastern shore of Humboldt Bay of Lake Nipigon.

Early Precambrian metavolcanic and metasedimentary rocks within the map area are encountered mostly in the Humboldt Bay and East Bay area of Lake Nipigon. In this area, the metavolcanics consist of predominantly amphibolite facies mafic metavolcanics which display relict pillow, massive, flow breccia, and porphyritic textures. Minor units of interflow metasedimentary rocks are also locally preserved within the metavolcanic units.

Intermediate fragmental metavolcanic rocks are exposed on the eastern shore of Lake Nipigon north of Mungo Park Point and consist of andesitic flow breccia and debris flow material. Minor units of argillite and meta-wacke are associated with the intermediate metavolcanic rocks.

On the northeastern shore of Humboldt Bay a unit of meta-conglomerate with tonalite clasts occurs at what is interpreted to be the base of the supracrustal belt. Tonalite clasts in the conglomerate are similar in texture to outcrops of tonalite on the northwestern shore of the bay.

LATE PRECAMBRIAN

In the area investigated Late Precambrian rocks consist of: 1) felsic subvolcanic and volcanic rocks; 2) sedimentary rocks, probably of the Sibley Group; 3) a suite of predominately ultramafic intrusions; and 4) extensive diabase sills, sheets and dikes.

Felsic subvolcanic and volcanic rocks have not previously been reported within the Nipigon Plate. The volcanic rocks include debris flow, welded tuff and tuff-breccia. At present only sparse remnants are preserved, probably due to erosion during volcanism. Outcrops of the volcanic rocks occur on the western shore of Lake Nipigon south of Castle Bay and on the eastern shore of Lake Nipigon in Humboldt Bay. Numerous large blocks of tuff-breccia occur on the Mountain Islands and are probably not far removed from their source. A fluorite-bearing, quartz-feldspar porphyry to equigranular granite intrusion, centred on English Bay on the western side of Lake Nipigon is older than the diabase sills. This intrusion is considered to be the centre of felsic volcanism since it contains numerous inclusions of felsite, porphyry, flow banded, and pumiceous fragments. The felsic volcanic and subvolcanic rocks may have originally covered the northern part of Lake Nipigon and may still be preserved beneath the diabase.

In the northern part of Lake Nipigon, sedimentary rocks are present under the diabase sheet and consist predominantly of quartz arenite. Minor conglomerate is present at the base of the sequence in the vicinity of English Bay and contains clasts of porphyry and felsite in a quartz arenite matrix. The quartz arenite reaches a maximum thickness of 25 m as indicated by sections on Humboldt Bay of Lake Nipigon and Castle Lake. The quartz arenite consists of well sorted and rounded quartz grains. Cross-beds of up to 1.8 m in thickness are a conspicuous feature of the unit, along with ripplemarks.

The presence of ultramafic rocks within the Nipigon Plate was reported by Sutcliffe (1981). During the present mapping the ultramafic rocks were found to be intruded by the diabase sills, but the relationship with the Sibley sedimentary rocks was not established. The ultramafic intrusion in Kitto and Eva Townships (*see* Figure 1) is a circular ring dike or cone sheet, 6 km in diameter, which ranges in composition from olivine gabbro to peridotite (lherzolite). Within the map area an olivine gabbro intrusion of this suite occurs on Jackfish and Birch Islands in the western part of Lake Nipigon.

Diabase sills are the most extensive rock type in the area. In the northern part of Lake Nipigon evidence indicates that only 1 sill is exposed. Sections on the Barn Islands and Livingstone Point indicate that this sill has a thickness of approximately 200 m. This sill grades, from base to top as follows: a lower chill zone, coarse ophitic diabase, to medium-grained diabase, to medium-grained diabase with coarse pegmatitic patches. Locally the medium-grained zone displays igneous layering and contains zones of anorthositic diabase. The upper 2 m of the sill is fine grained to aphanitic with polygonal fractures and is locally vesicular. Minor late granophyre veins cross-cut the diabase sills.

Diabase dikes and cone sheets which appear to have been feeders for the sills are coarser grained and have less well developed chill zones than the sills.

On the Rabbit Islands, in central Lake Nipigon, a possible carbonatite diatreme, 20 m wide, was found to cross-cut the diabase.

STRUCTURE

EARLY PRECAMBRIAN

The Early Precambrian tonalite-granodiorite has been moderately to highly deformed. Two periods of deformation within the tonalitic rocks are indicated by the presence of amphibolite dikes which cross-cut the tonalite gneissosity and have subsequently been deformed.

The late granites are massive and have caused brittle fragmentation of the tonalitic rocks into which they were emplaced.

The presence of conglomerate with tonalitic clasts at the inferred base of the Onaman River supracrustal belt at Humboldt Bay suggests that the supracrustal rocks may unconformably overlie a tonalitic basement in this area.

LATE PRECAMBRIAN

The Nipigon Plate at the northern end of Lake Nipigon is a broad, shallow basin. In general, the diabase sill dips gently into the centre of the lake. Steeper dips and an abrupt flexure of the sill occur along the eastern shore, along the North and South Peninsulas, and to a lesser extent along the western side of the lake. These flexures in the sill are believed to reflect fault blocks in the basement extant prior to sill emplacement.

Mapping during this survey has shown that the diabase sills were fed by cone sheets which are on the order of 30 to 50 km in diameter. This relationship is well documented west of Armstrong (*see* Figure 2). A similar structure, inferred in the Macdiarmid area, contains the circular ultramafic ring dike in its centre. West of Armstrong, the dike forming the cone sheet has a minimum width of 100 to 150 m and dips inward at 50° to vertical. On the northern and western parts of the structure, the erosional level corresponds to the level at which the dike becomes more gently dipping and makes the transition to a sill.

Subsidence of the northern part of Lake Nipigon during emplacement of the diabase sheets may explain the preservation of a thicker Late Precambrian section in this area. Reverse faulting on western side of the South Peninsula in which Early Precambrian tonalite overlies Late Precambrian sedimentary rocks may be related to this subsidence.

ECONOMIC GEOLOGY

BASE METALS

Mineralization within the diabase sill was observed predominantly in the pegmatitic patches near the top of the sill. These zones contain sparsely disseminated chalcopyrite.

The ultramafic to mafic intrusions of the area are largely untested and warrant investigation for copper, nickel and possibly chrome and platinum group mineralization. In the Leckie Lake Intrusion (*see* Sutcliffe 1981) up to 5% disseminated chalcopyrite was found in a pegmatitic gabbro phase of the olivine melagabbro south of the ultramafic core of the intrusion.

In the Early Precambrian rocks north of Lake Nipigon, and outside of the map area a lense of massive pyrite with minor chalcopyrite was found immediately south of the bridge where the Pikitiguski road crosses the Pikitiguski River. The lens is over 4 m wide and has a strike length in excess of 50 m.

URANIUM

Uranium mineralization in the Sibley basin, documented by Franklin (1978), is associated with fractures in Early Precambrian - Late Precambrian unconformity. To the south of the present map area, mineralization of this type was found in the vicinity of the Black Sturgeon Fault (Sutcliffe 1981). Exploration in 1982 by Uranerz Exploration and Mining Limited has revealed several mineralized fractures in this area, the largest of which is 40 cm wide (John Scott, Resource Geologist, Ontario Ministry of Natural Resources, Thunder Bay, personal communication, 1982). The fault on the western side of the Ombabika South Peninsula and exposures of the unconformity near Humboldt Bay, Lake Nipigon, warrant investigation for this type of mineralization. Hematized fractures near the contact of the English Bay porphyry and overlying sedimentary rocks may also warrant investigation for uranium.

LITHOPHILE MINERALIZATION

Spodumene-bearing dikes with columbite-tantalite mineralization occur north of the map area and were not examined during the survey. The economic potential of these dikes has been recently assessed by Breaks (1981).

GOLD-MOLYBDENUM

The fluorite-bearing, subvolcanic porphyry to granite intrusion on English Bay has not been previously recognized and warrants exploration for gold.

In the Collins Lake area, west of Armstrong, numerous quartz veins are present in the tonalite-granodiorite. Some of these veins contain molybdenite mineralization and may also warrant investigation for gold.

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LEGEND[a]

PHANEROZOIC
CENOZOIC
QUATERNARY
PLEISTOCENE AND RECENT
Till, esker deposits, glaciolacustrine deposits, swamp, stream and lake deposits

UNCONFORMITY

PRECAMBRIAN[b]
LATE PRECAMBRIAN (PROTEROZOIC)[c]
MAFIC INTRUSIVE ROCKS
LOGAN DIABASE SILLS, SHEETS AND DIKES

9
- 9 Unsubdivided
- 9a Aphanitic to fine-grained diabase
- 9b Polygonally fractured diabase
- 9c Vesicular or amygdaloidal diabase
- 9d Quartz amphibole diabase, coarse-grained
- 9e Diabase with pegmatitic patches or veins
- 9f Medium-grained diabase
- 9g Layered diabase
- 9h Anorthositic diabase
- 9i Ophitic diabase
- 9k Granophyre veins related to diabase
- 9m Carbonate-diabase breccia

ULTRAMAFIC TO MAFIC INTRUSIVE ROCKS

8
- 8 Unsubdivided
- 8a Peridotite
- 8b Pyroxenite
- 8c Olivine melagabbro
- 8d Olivine gabbro

SEDIMENTARY ROCKS (SIBLEY GROUP)

7
- 7 Unsubdivided
- 7a Quartz arenite[d]
- 7b Conglomerate[d]
- 7c Calcareous mudstone[e]

FELSIC SUBVOLCANIC TO VOLCANIC ROCKS

6
- 6 Unsubdivided
- 6a Quartz-feldspar porphyry
- 6b Granite
- 6c Welded tuff and tuff breccia
- 6d Volcanic conglomerate (debris flow)

UNCONFORMITY

EARLY PRECAMBRIAN (ARCHEAN)[c]
FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

5
- 5 Unsubdivided
- 5a Tonalite to granodiorite, foliated
- 5b Tonalite to granodiorite, gneissic
- 5c Tonalite to granodiorite with amphibolite inclusions
- 5d Hornblende diorite
- 5e Microcline megacrystic granodiorite
- 5f Biotite granite
- 5g Pegmatite
- 5h Quartz-feldspar porphyry

MAFIC INTRUSIVE ROCKS

4
- 4a Amphibolite dikes
- 4b Pyroxene-amphibolite

METAVOLCANIC AND METASEDIMENTARY ROCKS
METASEDIMENTARY ROCKS

3
- 3 Unsubdivided
- 3a Conglomerate
- 3b Feldspathic wacke
- 3c Lithic wacke
- 3d Argillite and slate
- 3e Chert, siliceous interflow metasedimentary rocks
- 3f Iron stone (oxide facies)

INTERMEDIATE METAVOLCANIC ROCKS

2
- 2 Unsubdivided
- 2a Tuff-breccia
- 2b Schistose fragmental rocks

MAFIC METAVOLCANIC ROCKS

1
- 1 Unsubdivided
- 1a Pillowed flow
- 1b Massive flow
- 1c Flow breccia
- 1d Porphyritic flow
- 1e Plagioclase-hornblende gneiss
- 1f Foliated to schistose flow

NOTES
- a) This is a field legend and may be changed as a result of laboratory investigations.
- b) Plutonic rock classification follows the International Union of Geological Sciences Subcommission on the Systematics of Igneous Rocks (Streckeisen 1976).
- c) Subdivision of rock units does not imply age relations.
- d) Probably correlates with the Pass Lake Formation (Franklin *et al.* 1980).
- e) Probably correlates with the Rossport Formation (Franklin *et al.* 1980).
- G) The letter "G" preceding a rock unit number indicates that the interpretation is based on geophysical data.
- C) The letter "C" preceding a rock unit number indicates that the data is compiled from previous mapping.
- I) The letter "I" preceding a rock unit number indicates that the interpretation is based on extrapolation of data.
- / Rock unit numbers separated by a "/" indicates that the first rock unit overlies the second rock unit.

LIST OF PROPERTIES

1. Canadian Nickel Company Limited (1971)
2. Duval International Corporation (1975)
3. Zmudzinski, Jan and Clarke, Loen (1972)

METAL AND MINERAL ABBREVIATIONS

carb	carbonate
ep	epidote
hem	hematite
mo	molybdenite
po	pyrrhotite
py	pyrite
qv	quartz vein
serp	serpentine

Ontario
Ministry of Natural Resources
Hon. Michael Harris, Minister
Mary Mogford, Deputy Minister

Ontario Geological Survey
MAP P.2838
Geological Series – Preliminary Map

PRECAMBRIAN GEOLOGY
LAKE NIPIGON AREA
KELVIN ISLAND SHEET
DISTRICT OF THUNDER BAY

Scale 1:50 000
Metres 1000 0 1 Kilometre
Mile 1 0 1 Mile

NTS Reference: 52H/15
ODM-GSC Aeromagnetic Maps: 2121G
ODM Geological Compilation Map: 2102

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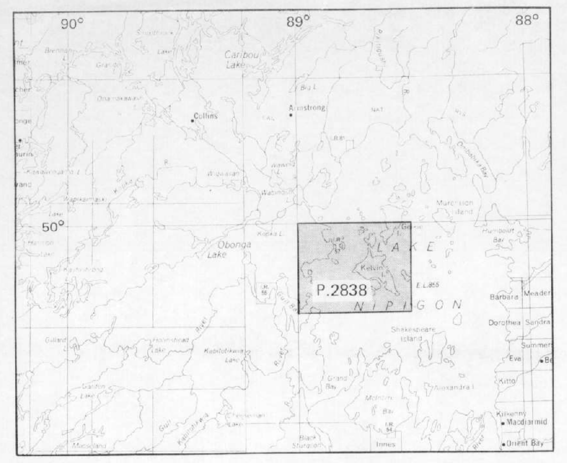

LOCATION MAP Scale: 1: 1 584 000 or 1 inch to 25 miles

SYMBOLS

- Glacial straie
- Small bedrock outcrop
- Bedding, top unknown; (inclined, vertical)
- Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned)
- Lava flow; top (arrow) from pillow shape and packing
- Schistosity; (horizontal, inclined, vertical)
- Gneissosity; (horizontal, inclined, vertical)
- Foliation; (horizontal, inclined, vertical)
- Banding; (horizontal, inclined, vertical)
- Lineation with plunge
- Strike and dip of diabase sheet from chill zone
- Geological boundary, position interpreted.
- Fault; (observed, assumed). Spot indicates downthrown side, arrows indicate horizontal movement
- Lineament
- Jointing; (horizontal, inclined, vertical)
- Drillhole; (vertical, inclined)

SOURCES OF INFORMATION

Base map was derived from Map 52H/15 (Kelvin Island) of the National Topographic Series.
Magnetic Declination: approximately 0°30'W in 1982
Contour Interval: 50 m
Metric Conversion Factor 1 foot = 0.3048 m

CREDITS

Geology by R.H. Sutcliffe, R.C. Greenwood, and assistants, 1982.

Technical editing and layout by D. Hoffer.

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

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

Sutcliffe, R.H., and Greenwood, R.C.
1985: Precambrian Geology of the Lake Nipigon Area, Kelvin Island Sheet, District of Thunder Bay; Ontario Geological Survey, Geological Series - Preliminary Map, Map P.2838, scale 1:50 000. Geology 1982.