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# MARGINAL NOTES

LOCATION AND ACCESS

The map-area covers approximately 276 km<sup>2</sup>, comprising Cascaden, Dowling and Trill Townships. The eastern extremity of the map-area is located about 23 km west of Sudbury. Mapping was done at a scale of 1:15 840 (1 inch to 1/4 mile), with more detailed examinations in areas of extensive bedrock exposure. Major and secondary roads, logging roads,

power lines, the Canadian Pacific Railway track, lakes, rivers and trails, provide access to all parts of the

## MINERAL EXPLORATION

the Resident Geologist's Files, Ontario Ministry of Natural Resources, Sudbury, or from the Source Mineral Deposit Record Files, Ontario Geological Survey. To-Mineral exploration in the map-area, during the latter part of the last century, led to the discovery of two major showings, the Sultana and Trillabelle Pro-

Information on exploration activity was obtained from

perties, in Trill Township, along what is now known as the nickel-copper-bearing sublayer zone. Early work on both properties consisted of trenching and the sinking of exploratory shafts within the main gossan zones. Both properties are presently held by Inco Lim-

Most of the recorded base-metal exploration in the map-area was done in the 1950s and 1960s, by Falconbridge Nickel Mines Limited and Inco Limited. Both companies have undertaken extensive geological and geophysical surveys, and diamond drilling in all three townships. Falconbridge completed more than 16 500m (total length) of drilling from 1951 to 1972 (last year submitted), whereas Inco completed more than 29 000m from 1950 to 1973. However, since the 1920s, other companies and individuals submitted results from diamond drilling, assay sampling, and geophysical and/or geological surveys from the Sudbury Irruptive Complex and the Onaping Formation

During the 1981 field season, diamond drilling by Inco was in progress in Trill Township (concession V,

## GENERAL GEOLOGY

Published geological maps of the map-area consist mostly of compilation maps by Collins (1938). Cook (1946). Thomson (1956). Card (1969, 1978). Burwasser (1977), and Card and Lumbers (1977). The oldest rocks (basement rocks) are Early Precambrian in age and comprise the Levack Gneiss Complex, the Birch Lake Batholith and the Cartier "Granite". The Levack Gneiss consists of moderately to nightly deformed and metamorphosed para- and or-

tho-gneisses with migmatitic affinities (commonly garnet and/or pyroxene bearing), containing leucosome fractions composed of coarse-grained dioritic to trondhjemitic material. In addition, there is the presence of weakly foliated to gneissic, leucocratic quartz diorite to tonalite (containing xenoliths of the former), and amphibolite as metamorphosed supracrustal remnants (metavolcanic in origin) and/or mafic intrusive bodies

(amphibolitized gabbro) The Birch Lake Batholith is a leucocratic massive to weakly foliated, medium- to coarse-grained, microcline porphyroblastic body ranging in composition from monzonite to syenite. It contains xenoliths of amphibolite and gneissic to migmatitic material, possibly from the Levack Gneiss. The Cartier "Granite" resembles, and appears to be genetically related to, the Birch Lake Batholith, but is notably less porphyroblastic and more equigranular, lacks a syenitic phase, and averages granodiorite in composition. The basement rocks have been crosscut by pegmatitic, aplitic and felsite dykes, which were, in turn, intruded by equi-

granular to plagioclase porphyritic diabase. The Early Precambrian rocks are crossout by Sudbury type breccias (pseudotachylite breccias) from veinlets to dykes in size, with no preferred orier tation and often exceeding 30 m in exposed surface width. The breccias are prominent in proximity to the Sudbury Irruptive Complex and to well-defined linea-

ments in the basement rocks. The breccias consist of an aphanitic to fine-grained glassy-looking matrix which may in part be crushed rock derived from the milling of local and foreign fragments. In places, the matrix appears to have flowed around fragments, and the presence of breccia dykes with a granular, coarser-grained matrix suggests recrystallization of primary igneous material. The fragments show evidence of not only brittle fracturing and rotation, but are plastically deformed

age is entirely located within the Sudbury Basin and verlies the Irruptive Complex It consists of the Onapng. Onwatin and Chelmsford Formations. Muir (1981) distinguished four phases of mainly byroclastic breccias in the Onaping Formation, these

are the Basal Grey. Green and Black Members. The volcanic classification is also adopted here for correla- DD Diamond Drilling tion purposes with Muir's North Range mapping, since there is continuity of the major phases across the present map area. Thus, the Onaping Formation is subdi-a) A discontinuous Basal Member (lowermost)

phase) which consists of coarse breccias with variations in fragment matrix proportion across and along strike. The fragments are mostly grani

toid in origin, although quartzite (bedded), gabbro, and rhyolite (flow banded) are also present The matrix is in part composed of fine-grained pulverized breccia material from the larger fragments, and in part of granular, fine-grained (ac cular) amphibole-rich material of igneous appear ance representing either granophyre from the

Irruptive Complex or recrystallization products from the pulverized portion of the matrix. b) A discontinuous Grey Member occurs within the lower portions of the Formation. Outcrop dis-

tributions particulary in Dowling Township form lobe-like projections extending into the Sasin Based on the fragment/matrix composition there are at least two varieties of this phace. The first consists of massive, igneous-termed fine

grained, siliceous grey flows containing mostly whitish quartzite (?) fragments (cm to more than 40m in diameter). The second variety equivalent in part to Muir's Green Member, is classified as a Tapilli tuff, with minor coarse breccias, containing irregularly shaped aphanitic volcanic glass fragments, shards, cored bombs, accretionary a

pilli and a mixture of accidental fragments range ing from quartzite to volcanic or subvolcanic rock of felsic and mafic compositions. c) A Green Member, and d) a Black Member They are interlayered, and consist of crystal and lapilli tuffs. lapillistone, and coarse breccias containing simple and complex

(multi-generation) volcanic glass fragments, vesicular numice, shards, cored bombs, and accidental fragments of varying types. The main difference between the phases is the siliceous green to greenish grey matrix of the Green Member as opposed to the carbon-rich black matrix of the Black Member.

The Onwatin Formation is present in only a few small outcrops, and consists of finely laminated black slate. The Chelmsford Formation consists of a repetitive sequence of thinly to thickly bedded wacke and thinly laminated siltstone (turbidite sequence) containing abundant primary sedimentary structures and secondary carbonate-rich concretions.

The Sudbury Irruptive Complex of Middle Precambrian age was emplaced between the basement rocks and the Onaping Formation. It is divided into a discontinuous Sublaver Zone breccia. locally containing Ni-Cu-Fe mineralization, and texturally and mineralogically varied norite and granophyre. The granophyre is locally hybridized along its contact with the

The leucocratic and gabbroic-noritic breccias are the most common Sublayer Zone breccias, and field evidence suggests a younger age for the latter. The leucocratic breccia consists of partially remobilized basement rock fragments set in a heterogeneous. leucocratic, igneous textured matrix; whereas the gabbroic-noritic sublayer contains inclusions ranging from ultramafic to dioritic in composition, including anorthosite, set in an equigranular gabbro-diorite matrix. The sublayer offshoot breccia (Ministic Lake Offset), in Cascaden Township, is a dyke-like body of similar composition to the gabbroic-noritic breccia.

Late Precambrian, northwest trending, rusty weathering, olivine diabase dykes crosscut the map-Quaternary deposits of till, ice contact deposits. glaciofluvial and glaciolacustrine material, and alluvium overlie central and northwestern Dowling Township, northeastern Cascaden Township, and west

# STRUCTURAL GEOLOGY

The gneissic and migmatitic rocks of the Levack Gneiss Complex feature recumbent and upright isoclinal folds, and an upper amphibolite to granulite grade of metamorphism as indicated by the garnet-pyroxene mineralogy. The gneissosity strikes northeast to southeast, and dips subhorizontally to vertically.

The contacts between the Irruptive and the Gneiss Complex, and the Irruptive with the Onaping Formation, are generally considered to dip inwards. towards the Sudbury Basin. The Onaping Formation possesses a gross internal layering, but primary depositional attitudes cannot be accurately determined because of a lack of local bedding structures.

ford Formation have been compressed to form open folds whose axes approximately parallel the northeast trend of the Basin. Bedding dips, in both the Onwatin and Chelmsford Formations, average less than 35°. whereas dips from the subparallel schistosity are gen-Two major fault-lineaments transect the map-

Bedding attitudes in the sediments of the Chelms-

area: the north-trending Fecunis Lake Fault, in Dowling Township, and the northeast-trending Cameron Creek Fault, in Trill Township. Considerable offset has occurred on both faults, particularly along the latter. where the observed lateral displacement exceeds 3

have been the target of mineral exploration in the maparea. All significant showings and occurrences are associated with the Sublayer zone and the Onaping For-Mineralization in the Sublayer zone includes pyrrhotite, pentlandite, chalcopyrite, pyrite and minor

Nickel-copper and copper-lead-zinc mineralizations

gave assay values of trace to 8.88% Zn. trace to 1.80% Pb, and trace to 0.42% Cu (analyses by the Geoscience Laboratory, Ontario Geological Survey.

members of the Onaping Formation, although the Black Member contains a greater abundance (up to 5%). Identifiable fragments include chalcopyrite, pyr-

phide mineralization (<0.5 mm to 1.5 cm) occur in all 7. New Fortune Mines Limited

The Onwatin Formation features abundant pyrite 11. Sudbury Exploration and Mining Limited

North- to northwest-trending, rather continuous, narrow quartz veins in the Onaping Formation, com
1. Aird. J.B. monly contain disseminated chalcopyrite galena, sphalerite, pyrrhotite and pyrite. Samples taken by field party personnel from two quartz veins within an \*3. Arcadia Nickel Mines old adit in Dowling Township (concession IV. lot 8).

In addition, very fine to coarse fragments of sul-

cubes, some with carbon-rich (anthraxolite) cores. and stratabound pyrite-rich lenses.

## zation has been found in the brecciated granitic gneisses of Levack Township, (Dressler 1981) there is no mineralization of this type observed on the surface

1977: Sudbury, Quaternary Geology; Map 2397. Ontario

Survey. Scale 1:126 720 or 1 inch to 2 miles. Card, K.D. and Lumbers, S.B. 1977: Sudbury-Cobalt. Map 2361. Ontario Geological Sur-

1938: Copper Cliff Sheet: Map 292A. Canada Department of Mines and Resources, Scale 1:63 360 or 1 inch to 1

1946: Chelmsford; Map 871A. Canada Department of Mines and Resources, Scale 1:63 360 or 1 inch to 1 mile 1981: Precambrian Geology of Levack Township, Sudbury

District: Ontario Geological Survey Preliminary Map P 2428, Geological Series. Scale 1:15 840 or 1 inch to 14 mile. Geology 1979 and 1980

of Mines, Scale 1 inch to 1 mile.

## TABLE 1 - Summary of Assessment Work

NAME	PROPERTY NO. ON MAP	LAST YEAR WORKED	TOWNSHIP	TYPE OF WORK	ROCK UNIT	REFERENC
Aird, J.B.	1	1954	Trill	Mag	SZ, Bas	AF
Airnorth Mines Ltd.	2	1967	Cascaden	Mag,DD,Em	sz	AF
Arcadia Nickel Mines	3	1957	Cascaden	DD,Em	Bas	
Callinan Flin-Flon Mines (1939) Ltd. (includes Trans- Northern Nickel & Copper Mines Ltd.)	4	1957	Trill	Mag,DD,Geol	SZ,Bas	AF
Eastview Mines (1957) Ltd. (includes Mining Corporation of Canada Ltd.)	5	1957	Cascaden, Dowling	DD,Geol, Res, As	sz	AF
Hollinger Consolidated Gold Mines Ltd.	6		Dowling	Geol	OF	AF
New Fortune Mines Ltd.	7	1955	Trill	Mag,Em,Res	OF	AF
Nickel Rim Mines Ltd. (Martin, H.E.)	8	1956	Trill	DD	sz	AF
Noranda Mines Ltd. (includes Cryderman, J.R.)	9	1956	Cascaden Trill	Mag,DD,Geol	SZ,Bas	AF
Rosen, A.E.	10	1957	Cascaden	Em	Bas	AF
Sudbury Exploration				_		

Res Resistivity Survey As Assay analysis SZ Sublayer Zone OF Onaping Formation

PATENTED and LEASED MINING CLAIMS (Licences of Occupation Under Water) CASCADEN, DOWLING and TRILL TOWNSHIPS. District of Sudbury, Sudbury Mining Division. FALCONBRIDGE NICKEL CO. INCO, Ltd. ONAPING MINES LTD. SANDCHERRY MINES LTD. WESTFIELD MINERALS 7 only present in Dowling Twp.

The Levack Gneiss contains numerous pyritiferous gossan zones, and even though copper minerali-

## REFERENCES

Geological Survey. Scale 1:50 000. 1969: Sudbury Mining Area: Map 2170. Ontario Department of Mines. Scale 1:63 360 or 1 inch to 1 mile. 1978: Sudbury-Manitoulin: Map 2360. Ontario Geological

vev. Scale 1:253 440 or 1 inch to 4 miles.

1981: Geology of the Capreol Area District of Sudbury: On-

tario Geological Survey. Open File Report 5344 168p... 4 figures, 21 photographs, 6 tables and 4 maps 1956. Sudbury Basin Area: Map 1956-1. Ontario Department

## LIST OF PROPERTIES

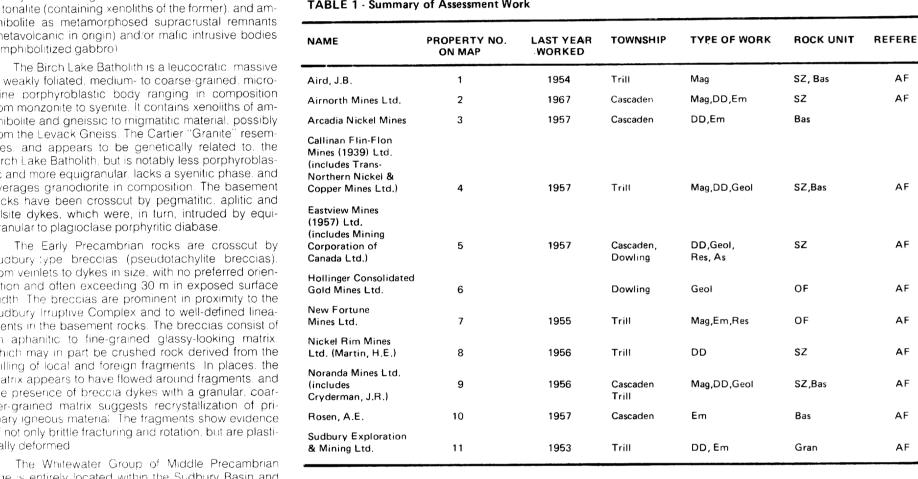
\*2. Airnorth Mines Limited

4. Callinan Flin-Flon Mines (1939) Limited (includes Trans-Northern Nickel and Copper Mines Limited) \*5. Eastview Mines (1957) Limited (includes Mining Corporation of Canada Limited)

8. Nickel Rim Mines Limited (Martin, H.E.)

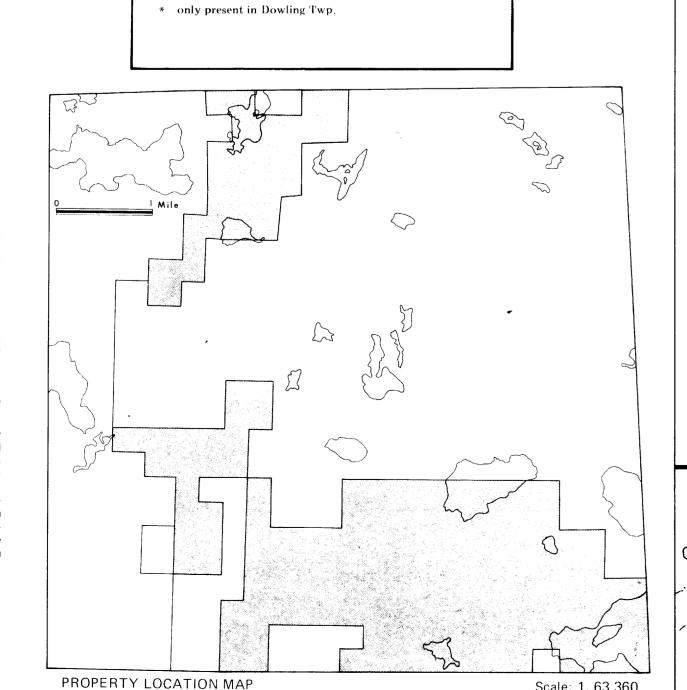
West

\*Only these properties are present in Cascaden Township



Bas Basement rocks Gran Granophyre

 $^{-1}$ Falconbridge Nickel Mines Ltd. (includes Sandcherry Mines Ltd. and Westfield Minerals Ltd.) and Inco Ltd. are not included.



CASCADEN TP. P. 2525

10b,3a,13 10b,1e,4a,3a,13 Vermilion

PHANEROZOIC CENOZOIC QUATERNARY RECENT 16a Swamp, bog, and mud deposits 16b Alluvium, silt, sand, gravel

15a Glaciolacustrine deposits: sand, silt, and sandy 15b Glaciofluvial sand, minor gravel; outwash channel deposits and deltaic deposits transitional to lacustrine deposits 15c Till: bouldery sand and gravelly, silty sand; ice contact deposits: gravel, sand, moraines, eskers UNCONFORMITY

PRECAMBRIAN LATE PRECAMBRIAN MAFIC INTRUSIVE ROCKS 14a Olivine diabase INTRUSIVE CONTACT MIDDLE PRECAMBRIAN FELSIC DYKES 13 13 Aplite, felsite INTRUSIVE CONTACT

GRANOPHYRE 12 Unsubdivided 12a Granophyre, leucocratic granophyre 12b Transitional granophyre 12c Hybrid granophyre 11 Unsubdivided 11a Norite, leucocratic norite 11b Transitional norite

11c Melanocratic norite Sublayer Zone Unsubdivided 10a Leucocratic breccia 10b Mixed breccia 10c Gabbroic - noritic sublayer breccia 10d Sublayer offshoot ("Offset") breccia 10e Megabreccia

INTRUSIVE CONTACT WHITEWATER GROUP® CHELMSFORD FORMATION<sup>©</sup>

SUDBURY IRRUPTIVE COMPLEX

9 Unsubdivided 9a Wacke, locally with concretions 9b Interbedded wacke and siltstone; locally with any combination of concretions, rip-up clasts, convolute bedding, flame structures, scour channels, and cross bedding ONWATIN FORMATION

8a Slate ONAPING FORMATION Green Member<sup>c</sup> 7f Lapilli-tuff 7h Tuff breccia, pyroclastic breccia

> 7i Lapilli-tuff 7) Tuff breccia, pyroclastic breccia 7j Tuff breccia, pyroclastic breccia 7k Siliceous, massive flows Basal Member 71 Fragment-supported, annealed felsic breccia 7m Matrix-supported felsic breccia SUDBURY TYPE BRECCIA

6a Dykes (pseudotachylite) 6b Large, irregularly shaped breccia bodies, pseudotachylite matrix INTRUSIVE CONTACT MAFIC INTRUSIVE ROCKS Unsubdivided

6 Unsubdivided

5a Gabbro diorite (Nipissing type) INTRUSIVE CONTACT EARLY PRECAMBRIAN

METAMORPHOSED MAFIC INTRUSIVE ROCKS 4b Plagioclase-porphyritic diabase INTRUSIVE CONTACT

3a Gabbro amphibolitized

tier "Granite"

METAMORPHOSED MAFIC ROCKS

3b Anorthositic gabbro METAMORPHOSED FELSIC TO INTERMEDIATE GRANITIC Unsubdivided 2a Microcline porphyroblastic, hornblende-quartz monzonite, monzonite, syenite (massive to weakly foliated), termed Birch Lake Batholith 2b Hornblende-quartz monzonite, granodiorite

2c Pegmatite, aplite, felsite METAMORPHOSED GNEISSIC COMPLEX (LEVACK GNEISS<sup>9</sup>)

> 1a Biotite-hornblende-quartz-plagioclase gneiss 1b Hornblende-quartz-plagioclase gneiss (orthog-1d Biotite-hornblende-quartz diorite, diorite, tron-

dhjemite, tonalite (weakly foliated to gneissic)

a) This is a field legend for Cascaden. Dowling and Trill Townships, and may be changed as a result of subsequent laboratory investigations b) Not all lithologic types are found on this map sheet. c) Rocks in these units are subdivided lithologically and order does not imply age relationships within these units or members. d) Order implies lithologic age relationships among these formations.

1e Amphibolite (metavolcanic)

e) The Sublayer Zone is locally poorly defined. It is composed of up to several ages and types of breccia which contain fragments of many different rock types; its complexity cannot be fully indicated at this map-scale. f) Found as inclusions within rocks of units 1 and 2. g) Lithologic subdivision not only applies to the Levack Gneiss, but may also describe other gneisses in the map-area h) Contains greater than 40% leucocratic mobilizate of dioritic - trondhjemitic composition: the material may be derived from in situ melting, and/or injection

from an external source. Outcrops that have been examined have been coded appropriately. All others are shown from air photograph interpretation and are coded singly or in groups as "unsubdivided". Where more than one rock type is listed (separated by a comma), the order is in decreasing predominance and (or) decreasing age as the appropriate case



Natural

Hon. Alan W. Pope

Resources Deputy Minister ONTARIO GEOLOGICAL SURVEY

**MAP P.2527** GEOLOGICAL SERIES—PRELIMINARY MAP PRECAMBRIAN GEOLOGY

Ministry of

# TRILL TOWNSHIP

NTS Reference: 41 I/5.6.11.12 ODM-GSC Aeromagnetic Map: 7067G OGS Geological Compilation Map: 2361 ©OMNR-OGS 1982

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# **ABBREVIATIONS**

Scale 1:1 584 000

LOCATION MAP

. Carbonate . Chalcopyrite ..Pentlandite . Pyrite . Quartz-carbonate

Not all minerals will be present in this township **SYMBOLS** 

Lineation with plunge Geological boundary \_\_\_\_ Geological boundary Lineament nown; (inclined, verti-Jointing: (horizontal.

□¹50' Shaft: depth in feet

Gneissosity: (horizontal. inclined, vertical) Foliation: (horizontal, inclined, vertical)

# Not all symbols may be present on this map sheet. **SOURCES OF INFORMATION**

Base maps derived from the Forest Resource Inventory maps. Lands and Waters Group, Ontario Ministry of Natural Resources, with additional information by J. Lafleur. Assessment work data obtained from the Regional Geologist's Files. Ontario Ministry of Natural Resources. Sudbury, and from the Source Mineral Deposit Records files. Ontario Ministry of Natural Resources, Toron-Sudbury. Quaternary Geology: Ontario Geological Survey. Map 2397 by G.J. Burwasser. 1977 Scale 1:50 000. Sudbury Mining Area, Sudbury District: Ontario Department of Mines, Map 2170, by K.D. Card, 1969. Scale 1:63,360 or 1 inch to 1 mile Sudbury - Manitoulin, Sudbury and Manitoulin Districts; Ontario Geological Survey. Map 2360. by K.D. Card. 1978. Scale 1.126 720 or 1 inch to 2 Sudbury-Cobalt. Geological Compilation Series; Ontario Geological Survey, Map 2361, by K.D. Card and S.B. Lumbers, 1977. Scale 1:253 440 Copper Cliff Sheet. Sudbury District; Canada Department of Mines and Resources. Map 292A. by W.H. Collins. 1938. Scale 1:63 360 or 1 inch to granite (massive to weakly foliated). termed Car-Chelmsford Sheet. Sudbury District: Canada Department of Mines and Resources. Map 871A, by H.C. Cooke, 1946. Scale 1:63 360 or 1 inch to

Schistosity. (horizontal. inclined. vertical)

No. 1, by W.V. Peredery, 1972, Scale 1 inch to 800 feet. Sudbury Basin Area. Sudbury District; Ontario Department of Mines. Map 1956-1, by Jas. E. Thomson, 1956. Scale 1 inch to 1 mile. Sudbury. Ontario: Geological Survey of Canada. Aeromagnetic Map 7067G. 1965. Scale 1:253 440 or 1 inch to 4 miles.

Geology is not tied to survey lines.

Magnetic declination in the area was approximately 7°45' West in 1981. **CREDITS** 

Dowling Area, Sudbury District; Ph.D. Thesis, University of Toronto. Map

Geology by Jean Lafleur, N. Maerz, B.O. Dressler, and assistants, 1980. 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 ences listed here, and information on file at the Resident or Regional

Geologist's office and the Mining Recorder's office nearest the map

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commended that reference be made in the following form: Lafleur. Jean. Maerz, N., and Dressler, B.O. 1982: Precambrian Geology of Trill Township. Sudbury District; Ontario Geological Survey Map. P.2527. Geological Series Preliminary Map. Scale 1:15 840 or 1 inch to 1/4 mile. Geology 1980, 1981.

Information from this publication may be quoted if credit is given. It is re-