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Geology of the

Bruin Lake-Edison Lake Area

District of Kenora

By

A. P. Pryslak

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1000 72-b

CONTENTS

Tables

Figures

Photographs

Geological Maps

(back pocket)

Chart A

(back pocket)

ABSTRACT

The Bruin Lake-Edison Lake map-area consists of the townships of MacNicol, Tustin, Bridges and Docker in the District of Kenora and covers some 144 square miles (373 km^2).

Early Precambrian volcanic and sedimentary rocks, metamorphosed under almandine-amphibolite and hornblende-hornfels facies conditions, form an east-trending metavolcanic-metasedimentary belt that ranges in width from 100 feet to 4 miles (30 m-6.4 km). The rocks in the northern part of the belt dip subvertically; dips in the southern part of the belt average 30° to 60°N.

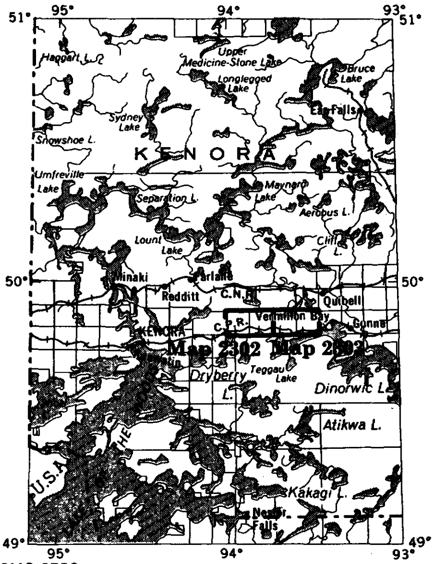

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Figure 1–Key map showing location of the Bruin Lake-Edison Lake area, scale 1 inch to 50 miles (1:3,168,000).

The metavolcanics vary in composition from mafic to intermediate, and consist of flows and pyroclastic deposits. Metavolcanics form about 75 percent of the east-trending belt. Metasediments form about 20 percent of the belt, and are mostly of clastic origin, except for minor amounts of metamorphosed iron formation.

A sill-like body of quartz-feldspar porphyry, which was metamorphosed under amphibolite facies conditions, and an elliptical mass of porphyritic syenite of uncertain age, have been mapped by the author in the area.

Mafic to ultramafic intrusive rocks form about 5 percent of the metavolcanic-metasedimentary belt. All rocks of this group, except amphibolite, were intruded after the regional metamorphism took place.

Granitic intrusive rocks that range in composition from granite to granodiorite underlie about 50 percent of the map-area. The English River Belt comprises granitic rocks, underlies the extreme northern part of the map-area, and has sharp intrusive contacts with the metavolcanic-metasedimentary belt. A composite batholith, known as the Dryberry Dome, underlies the southern part

of the map-area, and its contacts with the metavolcanic-metasedimentary belt are generally migmatitic. Numerous dikes and irregular bodies of pegmatite and granodiorite intrude the metavolcanic-metasedimentary belt.

A thin mantle of Pleistocene glaciolacustrine and Recent deposits covers much of the bedrock.

A variety of metallic and non-metallic mineral deposits are present but to date the only production is stone. Concentrations of sulphide minerals are relatively abundant in the metavolcanic-metasedimentary assemblages although these have not been found to contain appreciable amounts of economically important elements. Uranium mineralization associated with pegmatite is widespread, and surface enrichment by secondary uranium-bearing minerals is common. Pegmatite bodies containing significant amounts of uranium mineralization also contain appreciable amounts of accessory magnetite or apatite. Non-metallic mineral deposits include beryl, mica, and industrially useful rocks.

Geology

of the

Bruin Lake-Edison Lake Area

District of Kenora

by

A. P Pryslak[1]

INTRODUCTION

The map-area comprises the townships of MacNicol, Tustin, Bridges, and Docker, an area of 144 square miles (373 km^2) in the District of Kenora. The west boundary of MacNicol Township lies about 29 miles (46 km) east of Kenora and the east boundary of Docker Township lies about 12 miles (19 km) west of Vermilion Bay.

The map-area is in the Kenora Mining Division. The Octopus Lake sulphide zone in Tustin Township attracted the first mining interests into the map-area (the north part of Octopus Lake was previously called Lacourse Lake). Three claims A273, A274 and A257, were staked before 1907 on the sulphide zone that is located near the southeast shore of Octopus Lake. The exact date of staking and ownership could not be traced, but Fraleck (1907, p.175) mentions that the sulphides were examined for sulphur content by a series of test pits and a 20-foot (6 m) shaft. Four claims, S772 to S775 inclusive were staked by D. Guthrie. Again the date of staking could not be traced but Janes (1952, p.53) describes the claims as 'lying east and south of Octopus Lake'. However, old claim maps show that the Guthrie claims actually lie immediately west of Octopus Lake.

Old claim maps also show that seven claims, S330, S331, S339, S344, S345, S286 and S287 were staked in the vicinity of the south end of Bruin Lake in MacNicol Township, but no record of date of staking or ownership could be traced by the author.

In 1949 E. Sobiski discovered beryl in the Medicine Lake area (Tustin Township) and in the same year S. Cranston discovered a radioactive outcrop near Willard Lake (MacNicol Township). Since this initial discovery of uranium, numerous occurrences of it have been found and many have been investigated by trenching and diamond drilling.

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[1]Resident Geologist, Ontario Ministry of Natural Resources, Red Lake. Manuscript approved for publication by the Chief Geologist, 4 February, 1972.

Several sulphide-bearing zones have been investigated to determine their base-metal content.

From 1966 to 1970, Falconbridge Nickel Mines Limited conducted a detailed geological, geophysical, and diamond drilling program in the Medicine Lake-Cobble Lake area with the objective of locating nickel mineralization associated with ultramafic rocks.

From 1967 to 1969 Noranda Mines Limited investigated a sulphide zone in west-central Bridges Township, containing lead, zinc, and silver mineralization.

ACKNOWLEDGMENTS

Assistance in the field during 1967 was provided by J. Power, A. Higgens, J. Morin and M. Steeves; and during 1968 by B. Stutsky, A. Garson, G. Rivers and N. Duke. Power and Stutsky acted as senior assistants and carried out about half of the mapping in the area.

The members of the 1968 field party are indebted to Mr. and Mrs. E. Schussler of the Panorama Motel, Vermilion Bay for many courtesies extended during the field season.

Whole-rock analyses of mafic and ultramafic rocks were done by K. Ramlal, Department of Earth Sciences, University of Manitoba. Assays were done by the Mineral Research Branch, Ontario Division of Mines.

Professor W. C. Brisbin, Department of Earth Sciences, University of Manitoba, aided the author in the structural studies of Tustin and Bridges Townships that formed the basis for a Master's thesis dissertation (Pryslak 1971).

MEANS OF ACCESS

The Trans-Canada Highway (Highway 17) runs approximately east-west and passes through the centre of the map-area. The Gordon Lake Development Road crosses the northeast part of Tustin Township and connects the village of McIntosh, seven miles (11 km) north of the map-area on the main line of the Canadian National Railway, with the Trans-Canada Highway (Highway 17). Numerous small roads provide access to tourist camps and private cottages. Roads that were constructed for logging operations provide additional access.

The main lines of the Canadian Pacific Railway cross east-west through the southern part of the map-area. The stations at Pine (Tustin Township) and Edison (Docker Township) are no longer in existence.

The transmission line of The Hydro-Electric Power Commission of Ontario and The Trans-Canada Pipelines Limited natural gas pipeline are approximately parallel to one another, and lie south of the Trans-Canada Highway (Highway 17), except near the west boundary of MacNicol Township and in the east part of Docker Township where they cross to the north side of Highway 17. Service roads associated with the two utility lines are impassable to normal vehicles.

FIELD METHODS

Geological mapping was carried out during the 1967 and 1968 field seasons. Mapping was done by pace-and-compass methods, except along roads and lake shores. In areas where volcanic and sedimentary rocks are exposed, traverses were spaced at intervals ranging from 500 to 1,000 feet (150-300 m); and were mostly set at right angles to the strike of the rocks. Traverses in areas underlain predominantly by granitic rocks were spaced about 1,500 feet (450 m) apart. All outcrops investigated were plotted on acetate overlays on vertical air photographs; this information was subsequently transferred to base maps that had been prepared by the Cartography Section, Surveys and Mapping Branch, Ministry of Natural Resources. All air photographs and base maps are at a scale of 1 inch to 1,320 feet (1:15,840).

Uncoloured preliminary maps showing the geology of MacNicol and Tustin Townships, P.471 and P.472 were issued in 1968 (Pryslak 1968a and b); and uncoloured preliminary maps showing the geology of Bridges and Docker Townships, P.505 and P.544 in 1969 (Pryslak 1969a and b). The preliminary maps are at a scale of 1 inch to ¼ mile (1:15,840).

NATURAL RESOURCES

Trees in the map-area consist mostly of a mixed growth of spruce, jack pine, balsam fir, birch, and poplar. Cedar is prominent in many of the swamp areas and along lake shores, particularly in the northeast part of the area. Mountain ash, mountain maple, and alder are locally abundant.

Northern pike and pickerel are the main game fish. Bass and lake trout inhabit some of the lakes.

Wildlife observed during the two field seasons include moose, deer, bear, wolf, red fox, skunk, mink, otter, beaver and squirrel. Birds, including grouse, are numerous throughout the map-area.

PHYSIOGRAPHY

The maximum relief is some 300 feet (90 m) between Eagle Lake, which has an elevation of 1,192 feet (363.3 m) above sea level, and the area east of Cobble Lake, which locally is over 1,500 feet (460 m) above sea level. In general, the topography is moderately rugged throughout most of the map-area. Locally relief seldom exceeds 150 feet (46 m).

Drainage in the map-area is fairly well developed. A watershed extends in a northeasterly direction through the centre of Tustin Township. West of this watershed surface water flows into the Lake of the Woods and the Winnipeg River, while to the east the lakes and streams drain into Eagle Lake and Cobble Lake which form part of the Wabigoon River system.

Exposures of bedrock in the map-area are abundant. The outlines of bedrock exposures on the accompanying maps (Maps 2302 and 2303, back pocket) more correctly show areas of higher ground with or without a light cover of unconsolidated Pleistocene drift and Recent organic deposits.

PREVIOUS GEOLOGICAL WORK

An early geological map of the Lake of the Woods area shows a small belt of 'Huronian' rocks in the vicinity of Hawk Lake, MacNicol Township (Bell 1883). The remainder of the area is shown as granite. E. O. Chisholm described radioactive occurrences in the Kenora area (Chisholm 1950). The geological map accompanying Chisholm's preliminary report shows a small 'greenstone' belt in the vicinity of Medicine Lake. Two radioactive occurrences were mapped by Satterly in 1954 (Satterly 1955). Reconnaissance work and compilation of geological data by mining companies enabled Davies and Pryslak (1967) to show the approximate extent of the Tustin-Bridges 'greenstone'.

GENERAL GEOLOGY

All the bedrock of the map-area is Early Precambrian (Archean) in age. Volcanic and sedimentary assemblages, regionally metamorphosed under almandine-amphibolite facies conditions and locally under hornblende-hornfels facies conditions (Turner and Verhoogen 1960), form an east-trending belt that varies in width from 100 feet to 4 miles (30 m-6.4 km). The belt is 1¾ miles (2.8 km) in width at the east edge of the map-area. A reconnaissance survey by the author, with additional information from Aeromagnetic Maps 1179G and 1171G (ODM-GSC 1962a and b), shows that the belt extends at least 15 miles (24 km) east of the map-area. At the west edge of the map-area the belt is ½ mile (0.8 km) wide. Reconnaissance mapping by King (1969, p.24) indicates that the belt continues as a narrow unit in a westerly direction for a distance of 6 miles (9.6 km) to the southeast shore of Silver Lake in Jackman Township. The belt is bordered to the north by the English River Belt (Stockwell 1964, p.1) and to the south by a composite granitic batholith referred to by Goodwin (1965, p.13) as the Dryberry Dome which is part of the Wabigoon Belt.

The metavolcanic sequence varies in composition from mafic to intermediate and includes flows and pyroclastic material (Table 1). Metasediments are intimately associated with the metavolcanics and consist predominantly of greywacke and minor amounts of calc-silicate gneiss, massive calc-silicate rocks of uncertain origin, and iron formation.

The metavolcanic-metasedimentary sequence is intruded by sills, dikes, and irregular bodies of rock that vary in composition from felsic to ultramafic. The batholiths adjacent to the metavolcanic-metasedimentary belt comprise several intrusive units, and range in composition from felsic to intermediate. Contact relationships between the intrusive units, and structural features common to the intrusive units and the metavolcanic-metasedimentary rocks indicate that the batholiths have had a complex history.

Pleistocene glacial deposits, largely unsorted sand, gravel and boulders cover a large amount of the bedrock in the northern part of the map-area.

Table 1 — TABLE OF LITHOLOGIC UNITS FOR THE BRUIN LAKE-EDISON LAKE AREA

CENOZOIC

QUATERNARY

RECENT

Organic deposits; lacustrine and fluvial clay, silt and sand

PLEISTOCENE

Till, lacustrine sand, gravel, and clay

Unconformity

PRECAMBRIAN

EARLY PRECAMBRIAN (Archean)

LATE FELSIC INTRUSIVE ROCKS

FELSIC INTRUSIVE ROCKS

Pegmatite, pegmatitic granite, and aplite; porphyritic biotite granodiorite; granite; migmatite; equigranular quartz monzonite, and granodiorite

Intrusive Contact (?)

ENGLISH RIVER BELT ROCKS

Equigranular, massive to foliated, quartz monzonite and granodiorite; porphyritic granodiorite; equigranular granodiorite gneiss

Intrusive Contact (?)

SYENITIC ROCKS

Porphyritic syenite

Intrusive Contact (?)

MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

Gabbro, pyroxenite, peridotite, and amphibolite

Intrusive Contact

EARLY FELSIC INTRUSIVE ROCKS

Quartz-feldspar porphyry

Intrusive Contact (?)

METAVOLCANICS AND METASEDIMENTS

METASEDIMENTS

Greywacke, calc-silicate gneiss, massive calc-silicate rocks, and iron formation

INTERMEDIATE METAVOLCANICS

Pyroclastic rocks; hornblende-biotite-quartz-plagioclase schists and gneisses of uncertain origin

MAFIC METAVOLCANICS

Massive, pillowed, and amygdaloidal flows; pyroclastic rocks; hornblende-plagioclase schists and biotite-hornblende-plagioclase gneisses of uncertain origin

PRECAMBRIAN

Early Precambrian (Archean)

METAVOLCANICS

The metavolcanics form approximately 75 percent of the metavolcanic-metasedimentary sequence. On the basis of colour index they can be subdivided into mafic metavolcanics, with more than 35 percent mafic minerals, and intermediate metavolcanics, with 15 to 35 percent mafic minerals. The mafic and intermediate types each form approximately 50 percent of the metavolcanic sequence.

MAFIC METAVOLCANICS

Mafic metavolcanics are found in MacNicol Township and in the northern parts of the metavolcanic-metasedimentary belt east of MacNicol Township. Regional and contact metamorphism has produced mineral assemblages and textural features, characteristic of the almandine-amphibolite facies and the hornblende-hornfels facies (Turner and Verhoogen 1960).

Rocks included in this group are considered by the author to be the altered equivalents of basalt and andesite. Massive, pillowed, and amygdaloidal flows, rocks of pyroclastic origin, and hornblende-bearing schists and gneisses of uncertain origin are present. Some of the rocks that have been mapped as massive mafic metavolcanics may be pyroclastic in origin; others may represent mafic sills.

Massive hornblende schist and gneiss compose most of the mafic metavolcanic sequence. These rocks are dark grey to black, fine to medium grained, and commonly have well-developed foliation. Locally the foliation is less strongly developed and may be difficult to detect. A pronounced lineation is developed, particularly in the medium-grained rocks, by the parallel alignment of prismatic hornblende crystals in the foliation plane. The typical mineral assemblage of the almandine-amphibolite facies rocks in order of abundance is:

Hornblende + intermediate plagioclase ± quartz ± epidote. Common accessory minerals include magnetite, pyrite, calcite, sphene, zircon and garnet. Garnetiferous hornblende schist is found north of the west end of Willard Lake, and north of Lift Lake. Dark red garnets, up to ⅓ inch (0.8 cm) in diameter, locally form as much as 10 percent of the mafic metavolcanic rocks.

In contrast to mafic volcanic rocks recrystallized under almandine-amphibolite facies conditions, rocks recrystallized under hornblende-hornfels facies conditions are medium grained and massive to weakly foliated. The dominant mineral assemblage consists of:

Intermediate plagioclase + hornblende ± epidote ± quartz ± biotite. Minor accessory minerals include microcline, calcite, sphene, chlorite and zircon.

Mafic metavolcanics lying adjacent to granitic batholiths may have a gneissic character. Gneissosity is best developed in the area south of Willard Lake in MacNicol Township and east to the vicinity of Bee Lake.

Layering in the gneiss is characterized by differences in mineralogy. The layers vary in thickness from a fraction of an inch (cm) to 3 inches (7.6 cm). The mafic layers are composed of 40 to 60 percent hornblende, 40 to 60 percent intermediate

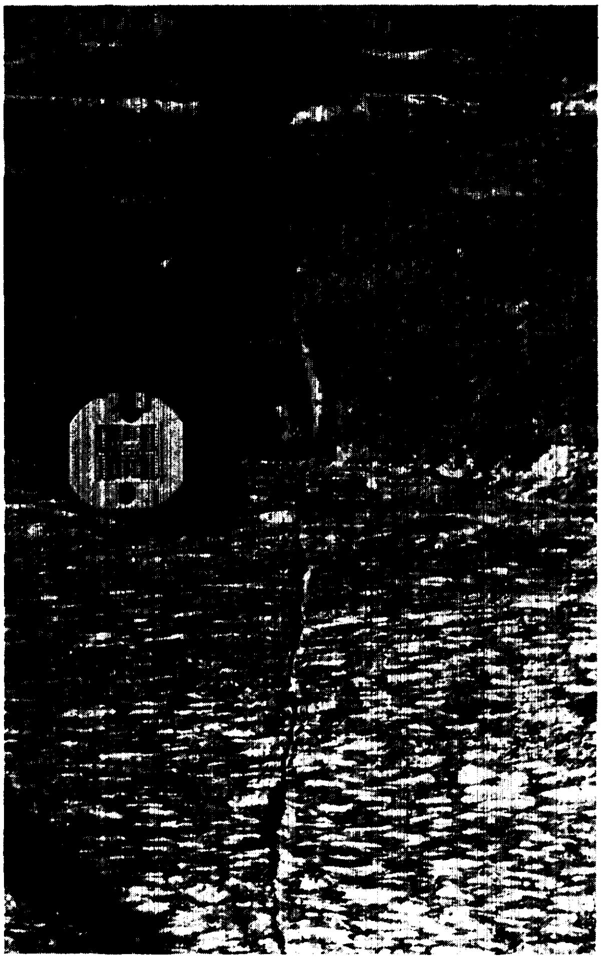
ODM9219

Photo 1–Highly deformed pillow basalt with quartz-epidote segregations; about ¼ mile (0.4 km) south of the west end of Medicine Lake, Tustin Township.

plagioclase and minor quartz. The felsic layers are composed of intermediate plagioclase, quartz, biotite, hornblende, and microcline. Mafic minerals constitute 10 to 20 percent of the felsic layers, with hornblende generally predominating over biotite. Minor accessory minerals include epidote, calcite, sphene, chlorite and zircon.

At a few localities a variation in the content of epidote was noticed in mafic volcanic rocks metamorphosed under hornblende-hornfels facies conditions. The variation in epidote content is spatially related to the distance from the granitic batholith and such a variation can be seen in rock-cuts along Highway 17 in the southwest corner of MacNicol Township. The contact between granodiorite and mafic metavolcanics occurs at the MacNicol-Jackman township line. Epidote is absent in the mafic metavolcanics adjacent to the contact. Eastward, epidote first appears in the mafic metavolcanics lying approximately 50 feet (15 m) from the contact and reaches a maximum content between 150 and 500 feet (46-150 m) from the contact. The epidote content then decreases between 500 feet (150 m) and 800 feet (240 m) east from the contact where the mineral assemblages are representative of the almandine-amphibolite facies.

Pillowed flows form approximately 10 percent of the mafic metavolcanics in Tustin, Bridges and Docker Townships. The pillow structures are generally deformed and are rarely sufficiently well preserved to give dependable top determinations. Highly stretched pillows are converted into a laminated hornblende schist (Photo 1). The least deformed pillows, measuring about 10 inches by 24 inches (25 cm by 61 cm) in a horizontal plane, vertical extent was not observed, indicate



ODM9220

Photo 2–Metamorphosed intermediate lithic lapilli-tuff and mafic tuff; east shore of Medicine Lake, about 100 feet (30 m) south of the English River Belt, Tustin Township.

that the top of the stratigraphic sequence faces south. The pillowed mafic metavolcanics weather dark grey, are fine grained, and are similar in mineralogy to the massive hornblende schist. The selvages are black, are composed of medium-grained hornblende and average $\frac{1}{2}$ inch (1.2 cm) in thickness.

Amygdaloidal flows are rare, and where observed are associated with pillowed flows. Vesicles are filled with quartz or calcite.

Relict pyroclastic textures in the mafic metavolcanics are partly preserved in places. The narrow north-trending belt in the southwest corner of MacNicol Township is composed predominantly of tuff-breccia. The tuff-breccia that is mafic in composition in the western part of MacNicol Township grades into rocks of more intermediate composition east of Foot Lake. Mafic to intermediate tuff-breccia, in the area between Bruin Lake and the east end of Linklater Lake, locally grades into hornblende-bearing schist and gneiss and are shown mainly as 1c on Map 2302 (in back pocket). The tuff-breccias are composed of felsic to intermediate fragments embedded in an amphibolite matrix. The fragments are highly deformed (see section on 'Intermediate Metavolcanics') and constitute up to 50 percent of the rocks.

Several units of mafic tuff were mapped. The largest unit is 400 feet (120 m) thick, and occurs along the north limit of the metavolcanic-metasedimentary belt between Bruin Lake and the southwest end of Balmain Lake. The mafic tuff is well layered. The felsic layers range from a fraction of an inch (cm) to about two inches (5 cm) thick. Individual layers are relatively constant in thickness and show good continuity along strike in any one outcrop. A high epidote content in the felsic layers results in these layers having a pale green weathered surface. The presence of two beds of lithic lapilli-tuff (Photo 2) in this unit in the vicinity of Medicine Lake indicates that the sequence is pyroclastic in origin and that the layering is primary.

INTERMEDIATE METAVOLCANICS

Metavolcanics of intermediate composition form about 50 percent of the metavolcanic-metasedimentary sequence and consist largely of metamorphosed pyroclastic breccia and minor tuff and lapilli-tuff (classification according to Fisher 1961).

The metamorphosed intermediate pyroclastic rocks commonly grade into metamorphosed mafic pyroclastics and can be distinguished from them by a lower colour index (see section on 'Mafic Metavolcanics').

The contact between metamorphosed intermediate pyroclastic rocks and metasediments typically is gradational. The main criterion used in field mapping to distinguish the two rock types from one another was the presence of relict felsic metavolcanic fragments in rocks of pyroclastic origin. Because of the mineralogical and textural similarities between these two units, some of the rocks that were mapped as metasediments may be pyroclastic in origin, and conversely, some of the metamorphosed pyroclastic rocks may have been included with the metasediments.

In the intermediate pyroclastic rocks metamorphosed under almandine-amphibolite facies, the major minerals present are, in order of abundance:

Intermediate plagioclase + hornblende + quartz ± biotite ± epidote. Minor minerals include calcite, sphene, magnetite, and rare apatite. Muscovite, zoisite, chlorite, microcline, and pyrite are present in some of the rocks. In the intermediate metavolcanics, the mafic mineral content of the fragments in lapilli-tuff and pyroclastic breccia is estimated to average about 5 percent, and that of the matrix is estimated to average about 35 percent; hornblende generally present in a greater amount than biotite.

Intermediate pyroclastic breccia is exposed mainly in the south part of the metavolcanic-metasedimentary belt in Tustin Township, and extends approximately 3.5 miles (5.6 km) east into Bridges Township where it interfingers with the metasediments. Good exposures can be seen along Highway 17 between a point 2¼ miles (3.2 km) east of the MacNicol-Tustin township line and another point 1¼ miles (2 km) east of the Tustin-Bridges township line. Pyroclastic rocks of inter-

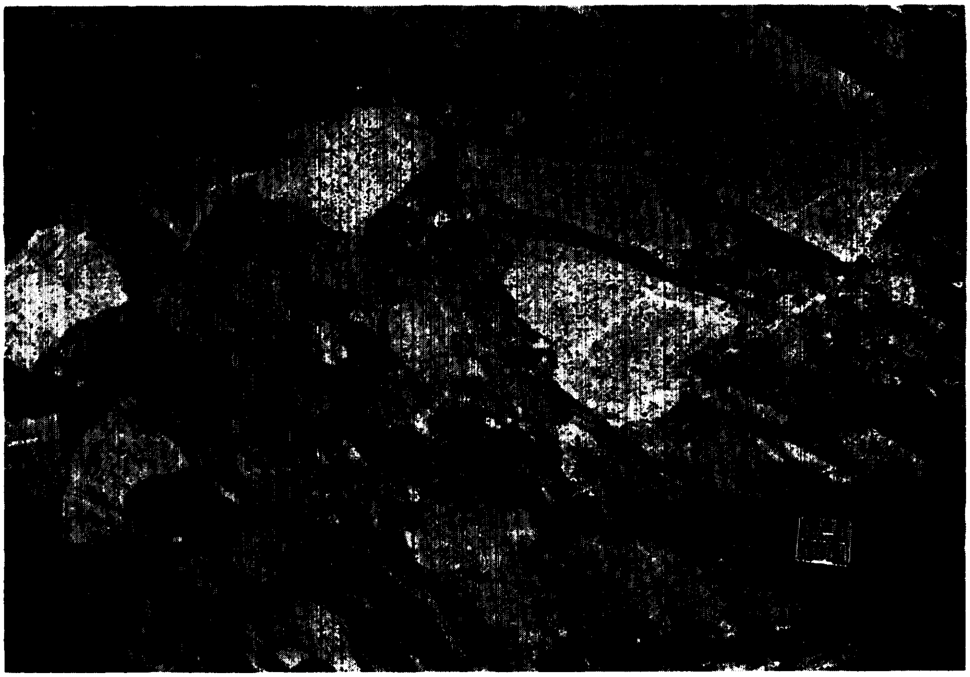


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Photo 3–Metamorphosed intermediate pyroclastic breccia (black spots are tar); north side of Highway 17, 200 feet (60m) west of the Tustin-Bridges township boundary.

mediate composition also form lenses up to about 800 feet (240 m) thick in the mafic metavolcanics and metasediments.

Intermediate pyroclastic breccia consists of felsic to intermediate fragments that are weathered light grey, and are embedded in a dark grey more mafic foliated matrix. Mafic fragments observed at several localities, are less conspicuous than the felsic fragments, and merge imperceptibly into the matrix. Fragments compose 5 to 75 percent of the pyroclastic rocks; the average fragment content is an estimated 50 percent. Although undeformed fragments are locally preserved (Photo 3), the majority of fragments have been deformed into three-dimensional ellipsoids with the long and intermediate axes lying in the plane of foliation. The long axes are oriented subparallel to the dip of the foliation planes (Photo 4). The ratio of fragment dimensions ranges from 1:2:3 to 1:20: unknown (the vertical dimension is not always measurable); the average is 1:7: about 15. The most highly deformed fragments are in the pyroclastic breccia adjacent to the granitic rocks of the Dryberry Dome in the vicinity of Stewart Lake (Photo 5).

ODM9222

Photo 4—Typical metamorphosed intermediate pyroclastic breccia; north side of Highway 17, 500 feet (150 m) east of the Tustin-Bridges township boundary.

Foliation is more pronounced in the matrix of the breccia than in the fragments owing to the higher proportion of mafic platy and prismatic minerals in the matrix. Foliation in the matrix generally wraps around the felsic fragments, but is penetrative in those fragments from highly deformed phases of the pyroclastic breccia.

Intermediate lapilli-tuff, exposed at two localities, ranges in thickness from 2 feet to 15 feet (0.6 m-4.6 m) and is interbedded with mafic tuff (see Photo 2). One occurrence is on the east shore of Medicine Lake, south of the contact between the metavolcanic and metasedimentary belt and the English River Belt.

The second occurrence is along the same stratigraphic horizon, and is about 400 feet (120 m) south of the southeast corner of Linklater Lake. White weathering, elliptical, felsic fragments composed largely of brecciated labradorite crystals constitute about 60 percent of the lapilli-tuff, and are embedded in a black, amphibole-rich matrix. Polycrystal porphyroblasts, spherical in shape, and up to ¾ inch (19 mm) in diameter and weathering white, locally comprise 10 percent of the lapilli-tuff. The polycrystal porphyroblasts consist mainly of zoisite and minor calcite, and are partially rimmed by chlorite.

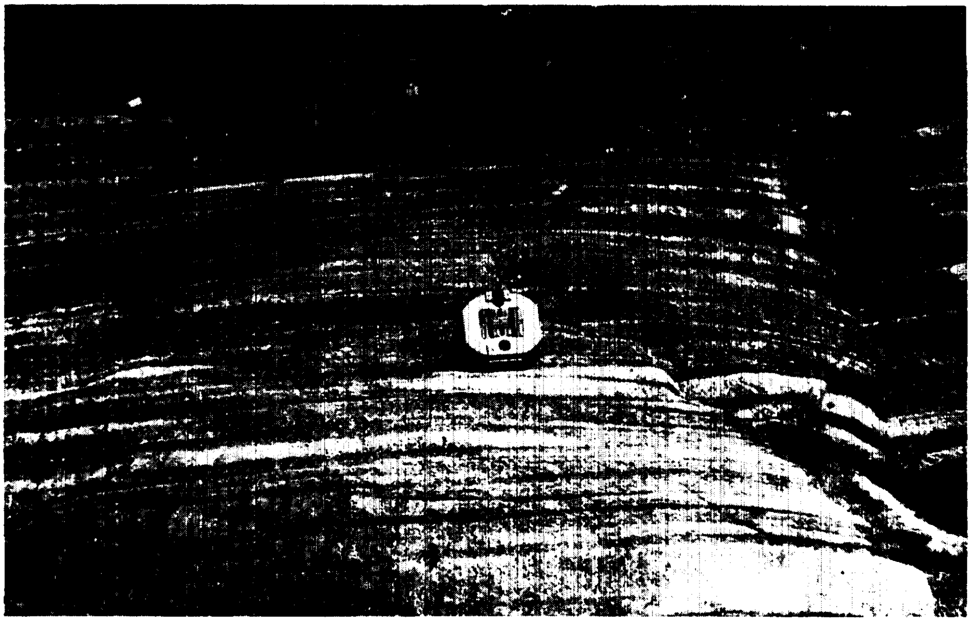

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Photo 5–Highly deformed metamorphosed intermediate pyroclastic breccia; north shore of Stewart Lake, Tustin Township.

METASEDIMENTS

Metasediments form about 20 percent of the metavolcanic-metasedimentary rocks in the map-area. The metasediments are of clastic origin and consist mainly of metagreywacke. Minor amounts of iron formation and calc-silicate gneiss are exposed. Small lenses of massive calc-silicate rocks of uncertain origin were found at several localities and have been included with the metasediments.

METAGREYWACKE[1]

In almandine-amphibolite facies rocks the major mineral assemblages for greywacke are:

1) Plagioclase (oligoclase-andesine) + quartz + biotite ± epidote.

[1]Metagreywacke, used as an imprecise term for sedimentary rocks, is composed essentially of sand-sized particles 1/16 to 2 mm in diameter. Minor silt may also be present (material ranging from 1/256 to 1/16 mm in diameter). The matrix boundary (Pettijohn 1957) cannot be easily distinguished. The quartz content ranges from 10 to 55 percent. Metagreywacke containing 35 to 55 percent quartz has been designated as quartz-rich greywacke and rocks containing at least 25 percent feldspar fragments are referred to as feldspathic greywacke.

2) Plagioclase (oligoclase-andesine) + quartz + biotite + muscovite ± microcline.
3) Quartz + plagioclase (oligoclase) + biotite ± muscovite ± microcline.
4) Plagioclase (oligoclase-andesine) + quartz + muscovite ± biotite ± sillimanite.
5) Quartz + plagioclase (oligoclase) + muscovite ± biotite.
6) Plagioclase (oligoclase-andesine) + quartz + biotite + hornblende ± epidote.
7) Plagioclase (oligoclase-andesine) + quartz + biotite + garnet ± muscovite ± sillimanite.

Accessory minerals present in most assemblages include pyrite, magnetite, sphene, zircon, tourmaline, apatite and carbonate. Minor chlorite (altered biotite), was observed in some thin sections of greywacke.

During field mapping the greywacke was subdivided into four types: (1) biotite-bearing, which includes assemblages 1, 2, and 3 listed above; (2) muscovite-bearing, assemblages 4 and 5 listed above; (3) hornblende-bearing, assemblage 6 listed above; and (4) garnet-bearing, assemblage 7 listed above. The four types are interbedded with each other in most places, but only the predominant types are indicated on the geological maps (Maps 2302 and 2303 in back pocket).

Biotite-bearing greywacke predominates in all metasediments, with the biotite content ranging from 5 to 30 percent. Muscovite is commonly present but generally constitutes less than 5 percent of this unit.

Muscovite-bearing greywacke, in which muscovite is more abundant than biotite, is rare and is commonly associated with intermediate tuff. Quartz-rich greywacke and feldspathic greywacke are also generally muscovite-bearing. Muscovite makes up 5 to 15 percent of the rock.

Hornblende-bearing greywacke is restricted to the metasediments occurring in the southeast part of the metavolcanic-metasedimentary belt. Hornblende composes about 5 to 20 percent of the rock and some biotite is generally present. Pyroclastic textures have been recognized in some of the rocks mapped as hornblende-bearing greywacke, particularly in the area north of Stewart Lake near the Canadian Pacific railway line, and in the area north of Kimber Lake. The relict pyroclastic textures indicate that a genetic relationship exists between hornblende-bearing greywacke and intermediate metavolcanics.

Garnet-bearing greywacke is not a common rock type, but is widely distributed among the metasediments. Individual beds range in thickness from several inches (cm) to about 50 feet (15 m) with red to dark red garnets, that vary from a fraction of an inch (cm) to one inch (2.5 cm) in diameter. Garnet constitutes as much as 25 percent of the garnetiferous greywacke.

Sillimanite-bearing greywacke does not constitute a significant rock unit. The localities of sillimanite occurrences are shown on the geological maps (Maps 2302 and 2303, back pocket) by the abbreviation 'sill'.

The metasediments form two major formations, and several small lenses in the metavolcanic sequence. One metasedimentary rock unit occurs along the northern part of the metavolcanic-metasedimentary belt in Tustin and Bridges Townships. This rock unit is 500 feet (150 m) thick north of Medicine Lake and gradually thins westward. Farther east, in the Augite Lake-Cobble Lake area, these metasediments have been injected by felsic intrusive rocks. The metasediments form a unit about ½ mile (0.8 km) wide. Greywacke predominates in this sequence. Minor feldspathic

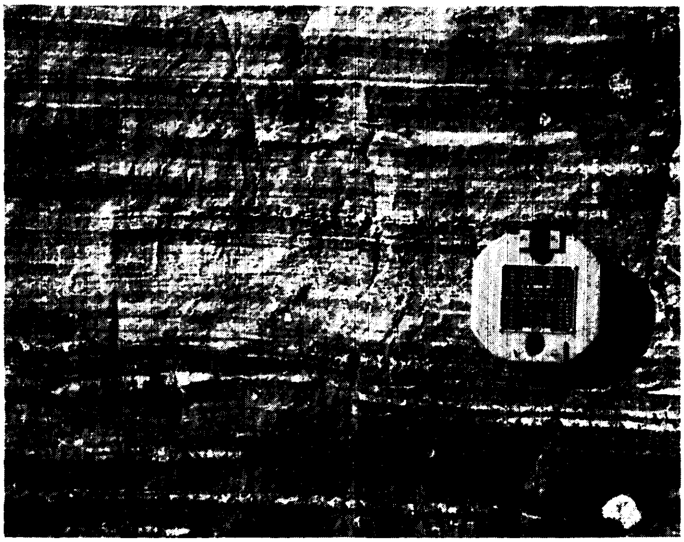

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Photo 6—Well-bedded metasediments; about ¼ mile (0.4 km) north of the east end of Medicine Lake, Tustin Township.

greywacke was found in the area north of Cobble Lake (see footnote 1). The metasediments are fine grained, weather grey or rusty brown, and are well bedded. Individual beds range in thickness from a fraction of an inch (cm) to 10 inches (25 cm); the average bed is 2 to 4 inches (5 to 10 cm) thick (Photo 6). Graded bedding is locally preserved and indicates that the stratigraphic top of the greywacke faces southward.

Metasediments are also exposed in the southern part of the metavolcanic-metasedimentary belt in Bridges and Docker Townships. The metasediments forming this second major map-unit are interlayered with mafic metavolcanics to the north, and are partly intertongued with, and grade into metamorphosed intermediate pyroclastic rocks. The rock unit dips steeply north and is exposed over a maximum width of 5,000 feet (1,500 m). The southern boundary is migmatitic, therefore a true stratigraphic thickness cannot be measured. The metasediments comprising this rock unit and the smaller lenses situated north of Stewart Lake, consist mainly of greywacke with minor amounts of quartz-rich greywacke. Lenticular units of pyroclastic breccia, up to about 800 feet (240 m) thick, are present in these metasedimentary units. In the field, the distinction between intermediate tuff and metasediments is difficult to make; the contacts between these two rock types shown on the geological map (Maps 2302 and 2303, back pocket) are necessarily approximate (see section on 'Intermediate Metavolcanics').

The metasediments bordering the Dryberry Dome are fine to coarse grained, with the grain size generally increasing toward the granitic batholith that underlies the area to the south. Bedding was rarely observed in this rock unit and where recognized, the beds are generally very thick. The nature of bedding and the high degree of metamorphism preclude a determination of the stratigraphic top for this sequence.

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Photo 7–Accretionary structures in metasediments. Note fine relict bedding in the metasediments and zoning in the accretions; north shore of Kimber Lake (about ¼ mile (0.4 km) east of the west end), Bridges Township.

Sub-elliptical structures with siliceous cores and distinct 1 inch (2.5 cm) thick light grey coloured rims, were observed in fine-bedded metasediments on the north shore of Kimber Lake, 2,300 feet (700 m) east of the west end of the lake (Photo 7). In a horizontal exposure these structures range in size from 3 to 12 inches by 6 to 24 inches (7.6-30 cm by 15-61 cm). Although bedding shows some distortion in the vicinity of each structure, the bedding planes pass through the structures rather than wrap around them; indicating that the structures are probably accretionary and are not boulders or the products of metamorphic processes.

IRON FORMATION

Iron formation was mapped in the map-area about ½ mile (0.8 km) northeast of Game Lake. The map-unit is less than 50 feet (15 m) wide trends approximately east-west, dips vertically and is discontinuously exposed over a length of about 2,000 feet (600 m). Dark magnetite-rich layers, varying in thickness from 1 to 4 inches

(2.5-10 cm) alternate with grey-weathering, garnet-rich feldspathic layers that vary from 6 to 14 inches (15-36 cm) in thickness. The garnets are pink to dark red and are most abundant in that part of the feldspathic layer that is adjacent to the magnetite-rich layers.

CALC-SILICATE GNEISS

A single unit of calc-silicate gneiss, a metamorphosed impure limestone, occurs in the centre of Bridges Township approximately 1,000 feet (300 m) north of Highway 17. The calc-silicate gneiss varies in thickness from 100 to 400 feet (30 to 120 m) and has been traced over a length of approximately two miles (3.2 km).

The gneiss is banded; green diopside-rich layers alternate with grey feldspathic layers. Individual layers vary in thickness from a fraction of an inch (cm) to several feet (m). Layering is generally discontinuous, especially where the layers are less than about one inch (2.5 cm) thick.

In almandine-amphibolite facies rocks, the calc-silicate layers contain variable proportions of diopside, hornblende, microcline, quartz, andesine, garnet, and epidote; the feldspathic layers contain variable amounts of andesine, quartz, biotite, hornblende and microcline. Sphene, zircon, pyrite, pyrrhotite and muscovite are common accessory minerals in the calc-silicate gneiss.

MASSIVE CALC-SILICATE ROCKS

Several small lenses of massive calc-silicate rocks of uncertain origin are exposed in the map-area.

One lens is about 30 feet (9 m) wide and 60 feet (18 m) long, occurs 1,800 feet (550 m) northeast of Bee Lake in Tustin Township and a second lens about 25 feet (7.6 m) thick and of undetermined length, occurs 1,800 feet (550 m) north of Petursson Lake. These occurrences are similar mineralogically to one another. The rocks are medium to coarse grained, weather green and consist mainly of diopside and epidote in approximately equal proportions with minor amounts of garnet and carbonate, and rare sphene.

Rocks consisting almost entirely of coarse-grained diopside, minor amounts of pyrrhotite, and traces of chalcopyrite are exposed along the south shore of Cobble Lake, 6,400 feet (1950 m) east from the west end of the lake. The calc-silicate rocks here consist of one six-foot (1.8 m) thick section and several smaller lenses in mafic metavolcanics.

EARLY FELSIC INTRUSIVE ROCKS

QUARTZ-FELDSPAR PORPHYRY

Only one early felsic intrusive body was mapped in the Bruin Lake-Edison Lake map-area. This body forms an east-trending unit of quartz-feldspar porphyry that is exposed for about 3 miles (5 km) from the southeast shore of Cobble Lake, and ranges in width from 200 to 400 feet (60-120 m).

The porphyry is concordant with regional stratigraphic layering. It is in sharp contact with foliated amphibolite to the north. Mafic metavolcanics are exposed to the south of the quartz-feldspar porphyry, but the contact with these rocks was not observed.

The quartz-feldspar porphyry weathers pale grey, about 10 percent of the feldspar phenocrysts weather pink. The feldspar phenocrysts are rounded to subhedral, randomly oriented, range in length from 0.5 to 8 mm, and are composed of either single crystals or aggregates of oligoclase. Elliptical quartz phenocrysts, ranging from ½ to 5 mm in diameter and 1 to 10 mm in length, constitute 8 to 10 percent of the porphyry. Potash metasomatism of oligoclase is indicated by the presence of sericite and by partial replacement by microcline. The groundmass of the porphyry consists of a fine-grained, recrystallized mosaic of quartz, oligoclase, microcline (most commonly rims the oligoclase phenocrysts), and biotite; trace amounts of garnet, carbonate, muscovite, and sphene occur. Biotite commonly occurs as small aggregates and is partly altered to chlorite.

The origin of the quartz-feldspar porphyry is uncertain. The quartz-feldspar porphyry may be a sill or a volcanic extrusive deposit. Mafic metavolcanic inclusions, or fragments, were found at several localities. Foliation in the mafic inclusions is parallel to the foliation surfaces in the host quartz-feldspar porphyry, indicating that the porphyry was emplaced before regional metamorphism. The porphyry is intruded by gabbro and pink pegmatite dikes.

MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

The metavolcanic-metasedimentary belt is intruded by dikes, sills, and irregular bodies of mafic and ultramafic intrusive rock. These rocks form about 5 percent of the belt. Several small bodies of mafic rocks were also found in felsic granitic rocks south of the metavolcanic-metasedimentary belt. The rocks forming this group were subdivided into the following types: amphibolite, peridotite, pyroxenite, gabbro and quartz diorite. The mineralogy of the amphibolite is consistent with the almandine-amphibolite facies of regional metamorphism. Intrusion of peridotite, pyroxenite and gabbro took place after regional metamorphism. The presence of primary olivine and prograde serpentine in peridotite, and of relict clinopyroxene in gabbro and pyroxenite indicate that rocks of this group were not regionally metamorphosed to the almandine-amphibolite facies.

Alteration effects shown by these rocks resulted from autometamorphism. Whole rock analyses of some mafic and ultramafic rocks are given in Table 2.

AMPHIBOLITE

Amphibolite forms predominantly sill-like bodies in the metavolcanic-metasedimentary sequence. Some irregularly shaped bodies, which are spatially related to metagabbro are also present. The largest sill, present in mafic metavolcanics south of Cobble Lake has an average thickness of 250 feet (76 m) and has been

Table 2 CHEMICAL ANALYSES OF MAFIC AND ULTRAMAFIC ROCKS[1] INTRUSIVE ROCKS FROM THE BRUIN LAKE-EDISON LAKE AREA

Specimen No.	67-A-33	67-A-38	67-A-57	67-A-69	67-P-107	67-A-108	67-A-162
Major Components in Percent							
SiO_2	41.45	44.20	36.80	48.40	39.60	38.70	51.05
Al_2O_3	4.52	7.76	2.49	5.36	3.39	3.59	7.82
Fe_2O_3	7.52	4.01	8.74	1.89	11.87	—[2]	1.03
FeO	6.84	6.72	5.00	10.28	6.32	4.76	9.48
MgO	26.70	21.45	34.45	24.65	23.40	30.35	19.60
CaO	4.98	9.42	0.94	3.53	6.06	3.20	6.74
Na_2O	0.43	0.30	0.89	0.11	0.34	0.12	0.40
K_2O	0.05	0.08	0.88	0.01	0.08	0.01	0.06
H_2O	6.38	4.48	8.54	4.58	6.26	8.32	2.16
CO_2	—	—	0.20	—	—	—	—
TiO_2	0.28	0.16	0.05	0.18	1.47	0.14	0.31
P_2O_5	0.17	0.16	0.12	0.13	0.25	0.17	0.15
S	0.04	0.07	0.03	0.04	0.09	0.03	0.00
Total	99.22	99.00	99.18	99.22	99.26	89.61[2]	98.96
Trace Elements in PPM							
Co	131	93	116	112	160	102	69
Cu	18	62	6	26	243	1	1
Cr	15	9	5	16	17	22	16
Ni	75	68	86	64	87	11	24
Pb	20	0	—	15	33	15	2
Zn	70	35	41	76	78	40	73

[1]Analyses by K. Ramlal, Department of Earth Sciences, University of Manitoba, 1967
[2]Data not available

Location of samples:

67-A-33, 67-A-38	Metaperidotite	West end of Willard Lake, MacNicol Township.
67-A-57	Metaperidotite	Southeast of Bruin Lake, MacNicol Township.
67-A-69	Metaperidotite	North of Medicine Lake, Tustin Township.
67-P-107	Schistose Metaperidotite	West of Windermere Lake, Tustin Township.
67-A-108	Metaperidotite	Gas Lake, Tustin Township.
67-A-162	Metagabbro	Island in Lift Lake, Tustin Township.

Abbreviations
— Not detected

traced over a length of 7 miles (11 km). A positive magnetic expression of 150 to 200 gammas is associated with this sill (ODM-GSC 1962b). The smaller sills and irregularly shaped bodies of amphibolite in the map-area do not show any characteristic magnetic expression.

Hand samples of amphibolite are medium to coarse grained, massive to well foliated, and weather dark grey to black. In the field it is difficult to distinguish the medium-grained, well foliated amphibolite from mafic metavolcanics, and the coarse-grained massive amphibolite from gabbro.

Hornblende forms 60 to 90 percent of the amphibolite. Plagioclase (An_{33} to An_{47}) and quartz form most of the remaining part; quartz generally forms less than 5 percent of the rock. Minor magnetite, and trace amounts of sphene and apatite are present.

The origin of the amphibolite is uncertain. However, the metamorphic texture and mineralogical similarity to mafic metavolcanics indicate that it may be genetically related to the mafic metavolcanics.

PERIDOTITE

Peridotite forms a minor part of the mafic and ultramafic intrusive sequence in the Bruin Lake-Edison Lake area. It generally occurs as small dikes or concordant elliptical bodies. The largest body of peridotite mapped in the field occurs on the group of small islands in the southeast part of Cobble Lake.

The larger peridotite bodies produce positive aeromagnetic anomalies of about 300 to 800 gammas (ODM-GSC 1962b). The smaller ultramafic intrusive bodies were not detected by this airborne magnetic survey; probably due to the scale of the survey. The flight lines were about ½ mile (0.8 km) apart and the flight altitude was 1,000 feet (300 m) above ground level.

In the field, peridotite is fine to coarse grained, and is generally massive, except for local shearing along narrow zones. Peridotite is readily recognized by its rusty brown weathering. The weathered surface is soft, generally pitted and highly fractured. The pits may be as much as ½ inch (1.3 cm) in diameter and ¼ inch (0.6 cm) deep. On a fresh surface the rock varies from dark grey to black to dark blue-green. A mottled appearance is common in the massive types with black knots and streaks embedded in a dark green serpentine matrix. A reddish hematite stain also gives a mottled appearance to some specimens of peridotite.

In thin section, olivine is not present in sheared peridotite, but forms up to 15 percent of the massive peridotite. Serpentine composes 10 to 50 percent of the peridotite; talc and tremolite, in varying proportions, form 30 to 80 percent; and magnetite and hematite form 2 to 10 percent. In one thin section, chlorite completely replaces tremolite.

The peridotite bodies have been intruded by dikes of pyroxenite and gabbro; inclusions of peridotite were found in porphyritic gabbro on the southeast shore of Bruin Lake (in MacNicol Township). The contacts between these intrusions are generally sharp. In the Cobble Lake-Augite Lake area, peridotite locally grades into pyroxenite, indicating that at least some of the pyroxenite may be equivalent in age to the peridotite. The gradational contact is irregular and generally is less than

3 feet (0.9 m) wide. Evidence indicating whether this contact was the result of magmatic differentiation or caused by intrusion of one rock type into the other was not found in the field. Late pink pegmatite dikes intrude the peridotite.

PYROXENITE

Pyroxenite forms a very minor part of the mafic and ultramafic intrusive sequence in the map-area. Two distinct types of pyroxenite are present. The first type is coarse grained, uniform in texture, and spatially associated with peridotite; contacts with peridotite may be sharp or gradational. This type of pyroxenite is best exposed on several of the small islands in Cobble Lake. The second type of pyroxenite is fine to medium grained, and is associated with a large gabbro mass east of Cobble Lake.

Both types of pyroxenite are essentially monomineralic, dark green and massive. In thin section they contain about 90 percent tremolite, pseudomorphic after clinopyroxene. Clinopyroxene is locally present as irregular patches in the core of large crystals. Talc and magnetite are minor constituents.

Intrusive relationships between pyroxenite and peridotite, and between pyroxenite and gabbro, suggest the pyroxenite may be of two ages; an older phase related to peridotite, and a younger phase related to gabbro. Both types have been intruded by late pink pegmatite dikes.

GABBRO

Gabbro forms about 50 percent of the mafic and ultramafic intrusions in the Bruin Lake-Edison Lake map-area. Using texture and feldspar content, the gabbro can be subdivided into two types: 1) porphyritic, with a plagioclase content varying from 20 to 45 percent; and 2) a fine- to medium-grained gabbro with plagioclase composing less than 20 percent of the rock. Although the two types are distinctive in the field they are closely related spatially and therefore, were not mapped by the author as separate units.

Porphyritic gabbro is generally massive, but may locally be foliated. Except where intrusive contacts were observed by the author foliated gabbro was hard to distinguish from amphibolite. Black hornblende phenocrysts, ranging from ½ to 6 mm in diameter, are embedded in a fine-grained, pale grey groundmass. Irregular patches of primary clinopyroxene occur in the cores of many phenocrysts. Euhedral plagioclase (andesine to sodic labradorite) forms the major part of the matrix with euhedral epidote present in amounts varying from one to five percent. Minor amounts of sphene and magnetite occur in most rocks of this group. Small clusters of biotite are also locally present.

Fine- to medium-grained gabbro varies in texture from massive to well foliated, and can best be observed along the south shore of the west end of Medicine Lake and in the area east of Cobble Lake. The gabbro weathers dark green to black, and locally grades into pyroxenite (see subsection on 'Pyroxenite'). The gabbro is composed mainly of tremolite and talc. Plagioclase is absent, or may form up to 20 percent of the intrusive rocks depending on the degree of alteration. The plagioclase composition is in the andesine-labradorite range.

Along the southeast shore of Bruin Lake (MacNicol Township), porphyritic gabbro contains inclusions of peridotite, indicating that the porphyritic gabbro is the younger of the two intrusive rocks. Intrusive relationships between coarse-grained pyroxenite and gabbro were not established, but in the area east of Cobble Lake the fine- to medium-grained pyroxenite is genetically related to gabbro. The gabbro is intruded by late pink pegmatite dikes.

Minor amounts of sheared mafic rocks, of uncertain origin were observed in the Medicine Lake-Lift Lake area (Tustin Township). Because of their mineralogical similarity to the fine- to medium-grained gabbro, they are included with the latter. These schistose rocks weather dark grey, and consist of a felty mass of tremolite and talc. Subhedral, black metacrysts of hornblende, up to 6 mm long, may form up to 5 percent of the rocks. A whole rock analysis of a specimen taken from the north part of the large island in Lift Lake is given in Table 2.

SYENITIC ROCKS

PORPHYRITIC SYENITE

An elliptical body of syenite, measuring about 5,000 feet by 3,000 feet (1,500 m by 900 m) occurs in the area immediately northeast of Willard Lake in MacNicol Township. Exposures of the syenite can be examined along the bush road that connects this area with Highway 17 near Richard Lake. Inclusions of syenite were found in pink granite about ½ mile (0.8 km) south of this main body.

The syenite is typically porphyritic, with pink feldspar phenocrysts embedded in a black matrix. The phenocrysts range in length from two mm to five cm, are subhedral in form, and have a subparallel orientation. They form 40 to 60 percent of the syenite. Black hornblende forms the major part of the matrix and occurs as single crystals and as irregularly shaped aggregates. Some biotite is locally present.

The northern part of the syenite body is migmatitic, with angular to irregularly shaped mafic inclusions forming from several percent to 50 percent of the rock. Pink feldspar phenocrysts also occur in the inclusions, but generally form less than 40 percent of these bodies. It is not certain whether the inclusions represent an early, more mafic phase of the syenite, or are volcanic in origin with metasomatic feldspar phenocrysts.

In thin section the phenocrysts are primarily orthoclase, twinned after the Carlsbad law. Microcline forms small irregular grains and occasionally forms phenocrysts. Plagioclase (An_{17} to An_{30}) is fine to medium grained, generally sericized, and forms 5 to 15 percent of the syenite. It also forms small inclusions in the orthoclase phenocrysts. Fine- to coarse-grained hornblende forms 5 to 20 percent of the typical syenite. Epidote is generally associated with the hornblende and varies in abundance from 1 to 5 percent. Euhedral sphene and subhedral apatite are intimately associated with hornblende and epidote and form about 2 percent of the syenite. The sphene grains are as much as three mm long and are twinned parallel to the length of the crystals. Rare pyrite and allanite are also present.

Pink pegmatite and aplite dikes, ranging in width from less than 1 foot (0.3 m) to over 200 feet (600 m), intrude the porphyritic syenite. The dikes have a general northeast trend and vertical dip. Contacts between the felsic dikes and the syenite are sharp.

LATE FELSIC INTRUSIVE ROCKS

Granitic rocks underlie about 60 percent of the map-area. They can be spatially sub-divided into two major groups: (1) the English River Belt, which occupies the area north of the metavolcanic-metasedimentary belt, and (2) granitic rocks of the Wabigoon Belt which lie south of the English River Belt, partly intruding the metavolcanic-metasedimentary belt and also forming part of the composite batholith (the Dryberry Dome) south of the metavolcanic-metasedimentary belt. The age relationship between these two groups of granitic rocks is uncertain.

ENGLISH RIVER BELT

Equigranular Granodiorite Gneiss

Equigranular medium- to coarse-grained biotite granodiorite gneiss and hornblende-biotite granodiorite gneiss underlie a major part of the English River Belt in the map-area. The gneiss is commonly grey on both fresh and weathered surfaces, but pink phases are locally present. Contacts between the pink and grey phases are gradational. The mafic mineral content is less abundant and gneissosity is less pronounced in the pink gneiss than the grey gneiss.

The mafic-rich layers in the equigranular granodiorite gneiss range in thickness from a fraction of an inch (cm) to 1½ inches (3.8 cm) and are generally discontinuous along strike. Grey to pink pegmatitic veins, with a maximum thickness of 4 inches (10 cm), form as much as 10 percent of the gneiss. The veins are generally concordant with gneissosity but are locally discordant (Photo 8).

Amphibolitic inclusions, representing rocks metamorphosed under almandine-amphibolite facies conditions, form as much as 10 percent of some outcrops. The inclusions are massive, fine to medium grained, and are highly irregular to lensoid in shape. A very weak foliation is present in a few places, particularly near the edge of the inclusions. The granodiorite gneiss shows laminar flow structure around the inclusions (Photo 9).

Plagioclase (oligoclase), quartz, microcline, biotite, and hornblende are the major mineral components of the equigranular granodiorite gneiss. Epidote, magnetite, sphene, zircon, and apatite occur in minor amounts and rare allanite is present. Biotite and hornblende form 15 to 30 percent of the grey granodiorite gneiss. Hornblende is generally absent from the pink gneiss. Biotite may constitute less than 15 percent of the pink gneiss.

Porphyritic Granodiorite

Pale pink to grey granodiorite occurs along most of the contact between the English River Belt and the metavolcanic-metasedimentary belt. This unit [shown in error as 7b porphyritic gneiss on Maps 2302 and 2303] ranges from several hundred feet (m) at the west end of Willard Lake to at least 5,500 feet (1670 m)

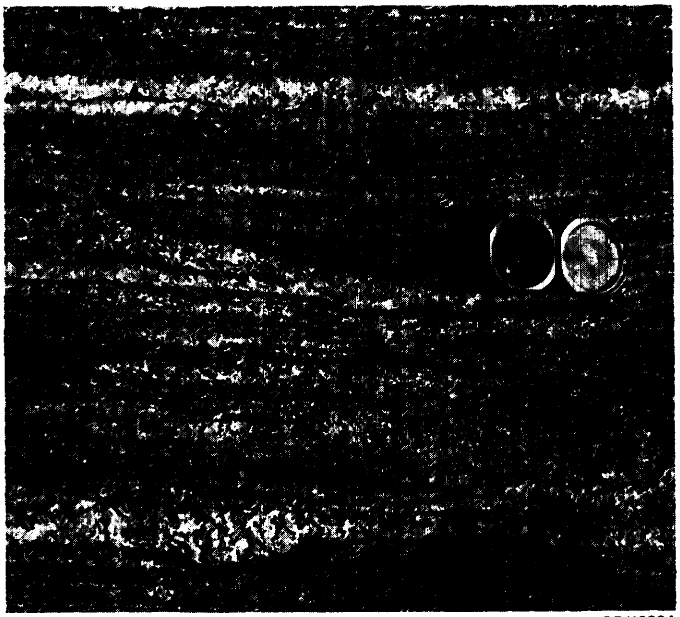

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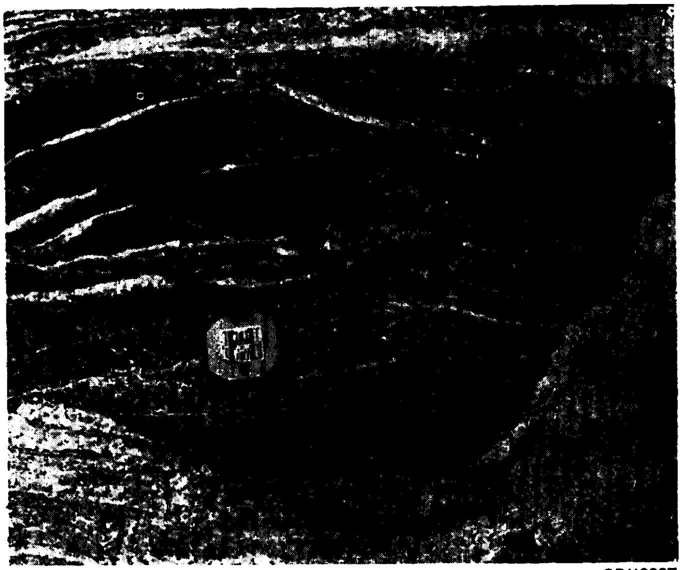
Photo 8–Hornblende-biotite granodiorite gneiss; about ¼ mile (0.4 km) northwest of Flegg Creek near the main logging road, MacNicol Township.



ODM9227

Photo 9–Mafic inclusion in hornblende-biotite granodiorite; southeast shore of Gordon Lake, Bridges Township.

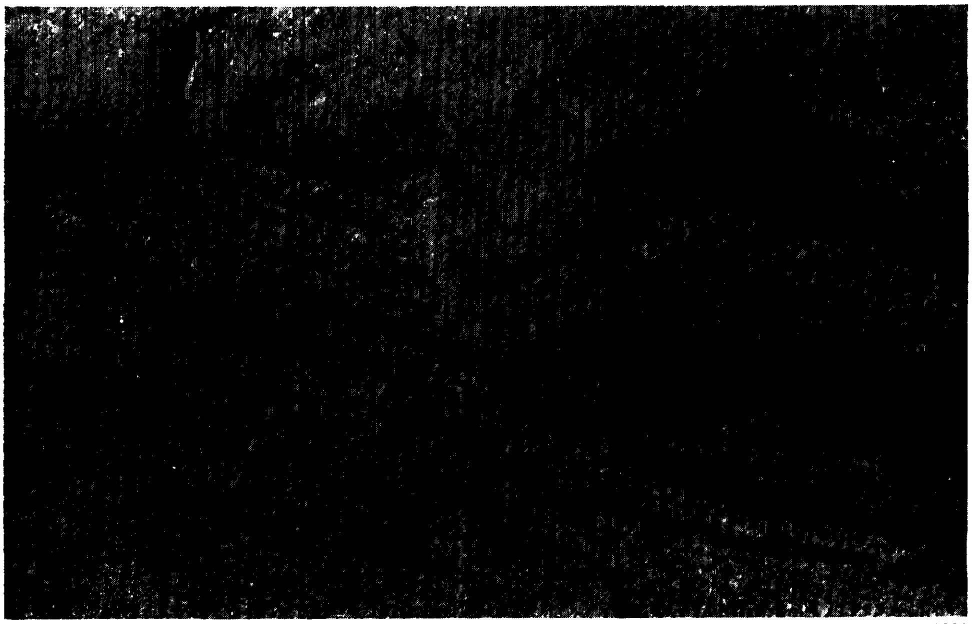


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Photo 10–Porphyritic granodiorite, English River Belt; about ¼ mile (0.4 km) east of the north end of Medicine Lake, Tustin Township.

in thickness in the vicinity of Linklater Lake. Near Gordon Lake and the area to the east, porphyritic granodiorite is interlayered with equigranular granodiorite gneiss. Individual layers have a minimum thickness of about 1 foot (0.3 m). The contact between porphyritic granodiorite and equigranular granodiorite gneiss is relatively sharp in the vicinity of Linklater Lake, but elsewhere is gradational.

The porphyritic granodiorite is massive in places but commonly is strongly foliated. Gneissic layering is pronounced in some outcrops (Photo 10). Foliation is defined by the subparallel arrangement of planar oriented biotite and small lenticular aggregates of biotite.

Mafic inclusions, similar in composition and texture to those found in the equigranular granodiorite gneiss, form as much as 20 percent of some outcrops. The inclusions are generally most abundant in those outcrops adjacent to lineaments that are characterized by topographic depressions, particularly in the area east of Linklater Lake.

Foliated metavolcanic inclusions are found in the porphyritic granodiorite. Their occurrence is restricted to areas near the contact between the English River Belt and the metavolcanic-metasedimentary belt. The inclusions are generally tabular in the horizontal plane with long axes approximately parallel to the abovementioned contact.

Small dikes of pink to grey aplite, pegmatite, and massive equigranular granodiorite intrude the porphyritic granodiorite and locally form as much as 25 percent of some outcrops (Photo 10).

The major mineral components of the porphyritic granodiorite are oligoclase, quartz, microcline, and biotite. Minor amounts of hornblende, magnetite, ilmenite, epidote, and chlorite are present, as well as trace amounts of hematite, apatite, sphene, zircon, and allanite. The phenocrysts consist primarily of oligoclase, but a few are microcline. Chlorite is associated with the biotite and is possibly a result of retrograde metamorphism.

Equigranular, Massive to Foliated Granitic Rocks

Medium-grained pink biotite quartz monzonite and biotite granodiorite form a minor part of the granitic rocks of the English River Belt in the map-area. They are most common in MacNicol Township and form lenticular bodies approximately conformable to the foliation of the surrounding rocks. The rocks forming these lenticular bodies are mostly well foliated; with foliation defined by the subparallel alignment of planar biotite.

Massive dikes of quartz monzonite and biotite granodiorite range in thickness from several inches (cm) to about 200 feet (60 m) and intrude porphyritic granodiorite and granodiorite gneiss. These dikes are generally concordant with the foliation of the host rocks but locally transect this foliation. Massive biotite-quartz monzonite dikes, with a characteristic reddish brown colour on both fresh and weathered surfaces, occur along the contact of the English River Belt with the metavolcanic-metasedimentary belt in the area north of Cobble Lake. The colour is caused by pervasive hematization.

Biotite forms 5 to 15 percent of the foliated granodiorite and quartz monzonite. The other major mineral components are oligoclase, quartz and microcline. Minor amounts of magnetite, sericite and hematite are present as well as trace amounts of apatite and sphene.

FELSIC INTRUSIVE ROCKS

Equigranular Quartz Monzonite and Granodiorite

Felsic intrusive rocks of this group form the major part of the batholith which lies south of the metavolcanic-metasedimentary belt. Small dikes and irregular bodies locally intrude the metavolcanic-metasedimentary belt.

Three ages of intrusion have been identified but owing to the lack of detailed information contacts cannot be defined on the maps (Maps 2302 and 2303, back pocket).

The oldest intrusive unit is a grey to pink, foliated and lineated, hornblende-biotite granodiorite. This unit is not shown on the map because of the scale. These rocks were found at two localities, each covering less than one square mile (2.6 km^2). One body occurs in the vicinity of Highway 17, from the pumping station to a point 15 miles (24 km) west in Bridges Township. The second body occurs along the metavolcanic-metasedimentary belt between Bee Lake and Feist Lake. The major mineral components are oligoclase, quartz, microcline, biotite and hornblende. Accessory minerals include sphene, zircon, apatite, magnetite and rare allanite. The mafic minerals form 10 to 20 percent of the grey granodiorite and have a preferred crystallographic orientation which imparts a strong foliation to the rocks. Pale pink to pinkish grey biotite granodiorite intrudes the foliated hornblende-biotite granodiorite. The younger granodiorite is massive and the contacts between the two units are generally sharp.

The most common granitic rock in the batholiths is equigranular granodiorite. Massive phases predominate. Foliated phases are common in the hybrid rocks that occur along the contact with the metavolcanic-metasedimentary belt.

The granodiorite is composed mainly of oligoclase; quartz forms 10 to 30 percent of the rock; microcline 5 to 15 percent; hornblende and biotite about 10 percent; and sphene, zircon, apatite and magnetite are accessory minerals. Myrmekite is extensively developed along the edges of plagioclase crystals.

Late pink, biotite quartz monzonite generally forms small, discrete, elliptical bodies that intrude the earlier equigranular granodiorite and migmatite. These bodies also grade locally into pale pink granodiorite, indicating that two separate ages of quartz monzonite intrusions probably occur in the area. The quartz monzonite is medium to very coarse grained, and massive to weakly foliated. Plagioclase and microcline in approximately equal amounts constitute most of the quartz monzonite. Quartz forms 15 to 35 percent and biotite 5 to 10 percent of the rock. Accessory minerals include apatite, zircon and magnetite.

Porphyritic Biotite Granodiorite

White to pale grey porphyritic biotite granodiorite intrudes metavolcanics and metasediments north and east of Cobble Lake, and south of Langton Lake. The granodiorite is massive to foliated, and locally is highly sheared, particularly near Augite Lake and the west end of Cobble Lake.

Subhedral oligoclase phenocrysts form 40 to 55 percent of the granodiorite. The phenocrysts vary in length from ½ mm to 8 mm. The larger phenocrysts are normally zoned with sericitized cores. Quartz forms 15 to 35 percent of the granodiorite, microcline generally less than 15 percent, and biotite less than 10 percent. Minor amounts of garnet and magnetite are present as well as rare sphene and zircon. Locally, radioactivity in the granodiorite is three times normal background.

Migmatite

Rocks mapped as migmatite consist of two components, one is granitic, and the other is a metasedimentary or a metavolcanic rock. The granitic component forms 50 to 90 percent of the total rock volume.

Two main types of migmatites occur in the map-area; those that contain massive metavolcanic-metasedimentary inclusions with mineral assemblages characteristic of the hornblende-hornfels facies; and those that contain foliated metavolcanic-metasedimentary inclusions with mineral assemblages characteristic of the almandine-amphibolite facies. The first type of migmatite is related to early granitic intrusions that were emplaced before regional metamorphism. The inclusions are angular to lensoid in shape, randomly oriented, but locally are highly assimilated, grading into gneissic granodiorite.

The second type of migmatite is common along contacts with the metavolcanic-metasedimentary belt. The metavolcanic-metasedimentary inclusions are generally tabular in the horizontal plane with the long dimension oriented approximately parallel to the contact of the metamorphic belt.

Granite

Pink, medium- to coarse-grained, equigranular to porphyritic granite forms elliptical bodies that cover less than one square mile (2.5 km^2). Contacts with other granitic rocks are relatively sharp. In outcrop, the granite is massive, but a weak horizontal layering was observed in vertical exposures at the quarry located on the south shore of Aaron Lake in Docker Township.

On the basis of one thin section, the granite is composed of about 60 percent microcline, 18 percent oligoclase, 15 percent quartz and 5 percent biotite. Minor amounts of magnetite, apatite and zircon are present.

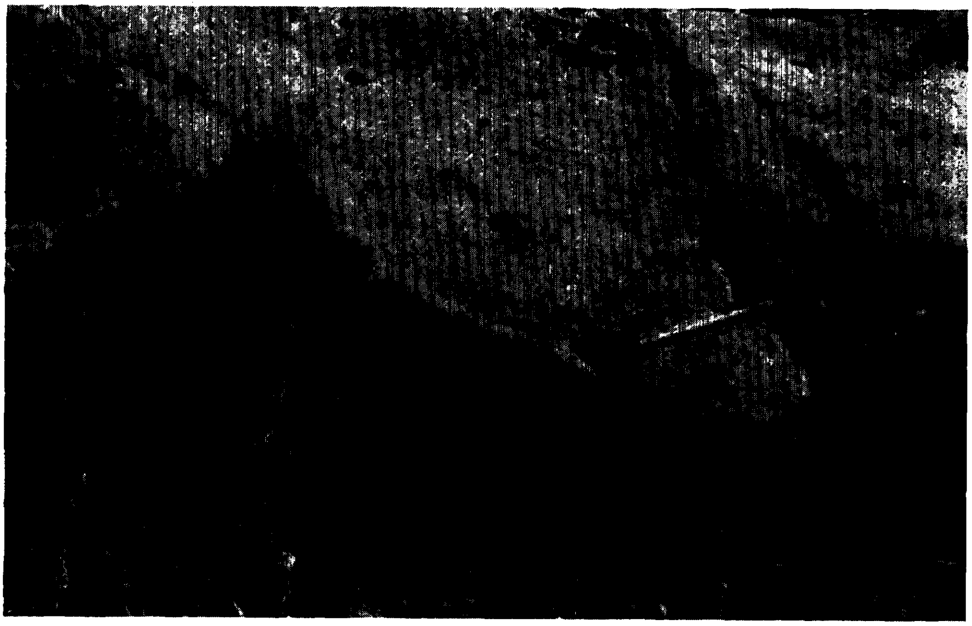
Pegmatite, Pegmatitic Granite, and Aplite

Pegmatite, pegmatitic granite and aplite have intruded the metavolcanic-metasedimentary sequence, the mafic to ultramafic intrusions and most of the felsic granitic rocks in the map-area, except for late quartz monzonite and granite.

Massive pink aplite dikes are not abundant, and occur mainly in felsic granitic rocks and in the porphyritic syenite. The dikes are generally less than 10 feet (3 m) thick, and have a subvertical orientation.

Pink pegmatite and pegmatitic granite are relatively common in the map-area and are most abundant in the southern part of the metavolcanic-metasedimentary belt, and in the hybrid granitic zone adjacent to the southern limit of the metavolcanic-metasedimentary belt. The pegmatite bodies vary greatly in size and shape. They range in length from several feet (m) to about 5,000 feet (1500 m) and in width from a fraction of an inch (cm) to over 1,000 feet (300 m). Many pegmatite intrusions form dikes, that branch often, which are regionally conformable with the foliation of the host rocks, but locally transect the foliation (Photo 11). Irregularly shaped pegmatite bodies are also common in the map-area. Pinch and swell structures were observed at several localities but this structure is restricted to dikes that are generally less than 1 foot (0.3 m) thick (Photo 12). The dip of pegmatite dikes ranges from about 30 degrees to vertical.

The pegmatite bodies are fine to coarse grained (as defined by Cameron *et al.* 1949, p.16), and are unzoned. The main mineral constituents are microcline, plagioclase, quartz and biotite. Muscovite and hornblende are locally present in some pegmatite bodies. Accessory minerals identified in the field include black tourmaline,



ODM9229

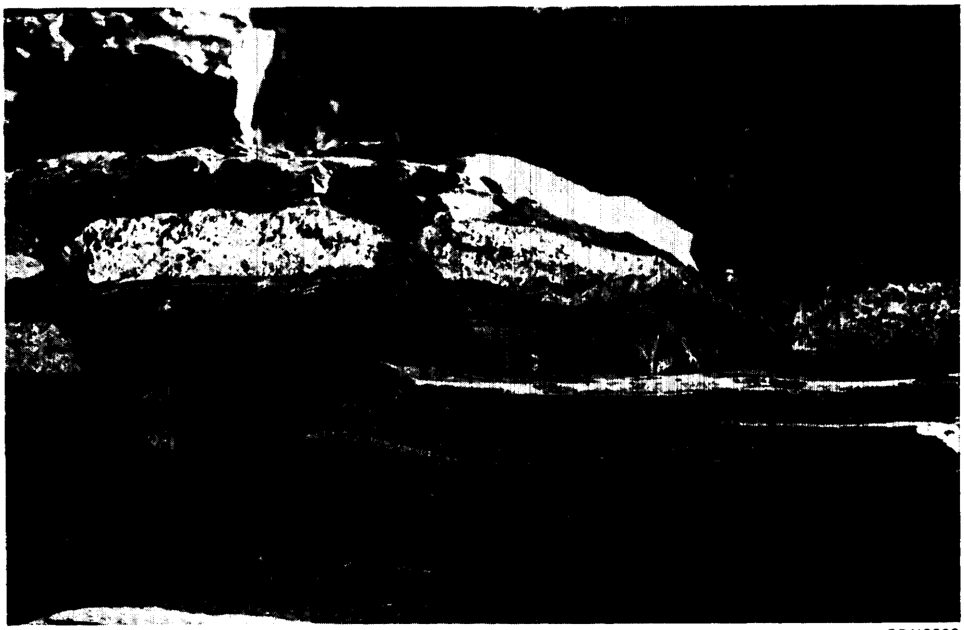
Photo 11–Pink pegmatite intrusive into metamorphosed intermediate pyroclastic breccia. Note the narrow chilled margin; power line north of Lacourse Lake, Tustin Township.

molybdenite, magnetite, and blue-green apatite. Many pegmatite bodies are radioactive. The radioactive minerals identified to date include uraninite, thorite, uranophane, beta-uranotile, boltwoodite, euxenite, uranothorite and monazite. The secondary uranium minerals occur along randomly oriented discontinuous fractures.

Irregular masses of pink pegmatite occur in granodiorite and quartz monzonite. These pegmatites are generally less than 2 feet (0.6 m) wide, and have gradational contacts with the host granitic rocks.

White pegmatite is not common in the map-area and occurs mainly in the vicinity of Medicine and Lift Lakes. The white pegmatite is in part spatially related to porphyritic granodiorite. The white pegmatite bodies are medium to coarse grained, massive, and locally are weakly radioactive. The major minerals are perthite, quartz, and biotite. Accessory minerals include black tourmaline, beryl, garnet and rare tantalite.

The close spatial relationship and similarity in mineral assemblages between white pegmatite and porphyritic granodiorite suggest a common genesis for these rocks.



ODM9230

Photo 12–Pinch and swell structure in pegmatite intruding highly deformed intermediate pyroclastic breccia; vertical exposure in rock-cut along the south side of Highway 17, 1,800 feet (550 m) east of Bee Lake, Tustin Township. Boudin about 18 inches (46 cm) long.

CENOZOIC

Quaternary

PLEISTOCENE AND RECENT

Pleistocene deposits in the map-area have been eroded largely by glacial lake action. Sandy ground moraine, with variable proportions of gravel and boulders, is found mainly along the flanks of topographic high areas of the consolidated bedrock. Small deposits of sorted sand occur in the extreme north part of the map-area. Clay deposits are rare and were found only in the vicinity of the east end of Langton Lake.

Glacial striae are not abundant but where observed have a general southwest trend.

Recent deposits include sand, silt and mud deposited in streams and lakes and organic mud deposited in swamps and muskegs.

STRUCTURAL GEOLOGY

Foliation and Gneissosity

Foliation is the dominant structural element of the metavolcanic-metasedimentary rocks. The foliation may be metamorphic in origin or may result from cataclastic slip and recrystallization. The foliation is defined by the parallel to subparallel orientation of planar oriented biotite and muscovite, and the linear alignment of prismatic hornblende. Where primary layering is preserved, the foliation and layering are almost always parallel. The regional orientation of the foliation is approximately parallel to contacts with the granitic batholiths, but locally the intrusive rocks cut across the foliation. Foliation is not well developed everywhere, but is most prominent along narrow shear zones and in exposures adjacent to the granitic batholith which underlies the south part of the map-area.

Foliation is present in many of the granitic rocks, and is defined by the subparallel orientation of biotite, hornblende, and rare quartz lenticles and is largely the result of primary flow.

Gneissosity was observed in mafic and intermediate volcanic rocks adjacent to granitic batholiths. Platy and prismatic minerals are moderately well aligned with the foliation that parallels the compositional layering.

Gneissosity is common in the granitic rocks of the English River Belt and in granitic rocks bordering the south side of the metavolcanic-metasedimentary belt (Photo 13) and appears to be a primary igneous structure.

Lineation

Secondary lineations are common in the metavolcanic-metasedimentary rocks and consist of mineral lineations, minor fold axes, and deformed volcanic fragments.

Mineral lineations are defined by the subparallel alignment of prismatic hornblende crystals, and by elongate tabular aggregates of biotite and hornblende in the plane of foliation.

Minor fold structures in bedding are found in the metasedimentary map-unit that is exposed in the vicinity of Medicine, Lift, Augite, and Cobble Lakes. Minor folds marked by deformation of foliation surfaces are not common, but are found throughout the map-area. Most minor folds display a right-handed asymmetry; disharmonic folds are also present.

Metavolcanic fragments have been deformed into triaxial ellipsoids with the long and intermediate axes lying in the plane of foliation; the long axes are oriented approximately in the direction of dip.

Primary flow lineations in granitic rocks are rare. In the area south of Bee Lake, feldspar crystals in the Feist Lake Pluton were found to have a subparallel orientation.

ODM9231

Photo 13–Contact between mafic metavolcanics and granodiorite; rock-cut along south side of Highway 17 near the Jackman-MacNicol township boundary.

Major Folds

Primary structures, used to determine the stratigraphic sequence of rocks, are mainly absent in the rocks of the map-area. Nevertheless, graded bedding in metasediments and pillow structures in metavolcanics in the northern part of the metavolcanic-metasedimentary belt indicate that tops face to the south. The entire belt is considered to be a homoclinal sequence, but this conclusion is only speculative because no top determinations were observed in the southern part of the metavolcanic-metasedimentary belt.

A major fold structure, marked by deformed foliation surfaces, occurs in the south-central part of the metavolcanic-metasedimentary belt. A statistical study of the geometry of lineations and foliation in the area of the fold indicates that the fold is conical in form, with the fold axis plunging about 70 degrees in a southwesterly direction (Pryslak 1971).

Faults

Faults identified by stratigraphic or structural offsets were not identified in the map-area. However, numerous shear zones and negative topographic lineaments are interpreted by the author to be faults.

Shear zones vary from several inches (cm) to about 20 feet (6 m) in width, and occasionally can be traced for several miles (km) along strike. The shear zones are generally parallel to the foliation but locally transect foliation at angles of about 15 degrees. Veins of quartz, epidote, garnet, and carbonate commonly occur along narrow shear zones.

Negative topographic lineaments are abundant in the map-area and most are probably the surface expression of faults. However, those occurring in predominantly granitic areas may represent migmatitic zones with more easily eroded metavolcanic-metasedimentary inclusions.

ECONOMIC GEOLOGY

The Bruin Lake-Edison Lake area contains a variety of metallic and non-metallic mineral deposits. The only recorded production is of industrial minerals; namely building stone (see 'Scotstown Granite Company Limited (26)'[1]) and crushed rock used for ballast by the Canadian Pacific Railway Company (1).

Metallic mineralization consists mainly of concentrations of uranium and sulphide minerals, minor iron, minor to trace amounts of precious metals, and a single occurrence of tantalite. Pyrrhotite and pyrite are the most common sulphide minerals. Minor concentrations of galena, sphalerite, chalcopyrite, molybdenite, and minerals containing nickel and cobalt occur in the map-area.

Non-metallic mineral deposits include beryl, mica, building stone and crushed rock.

History of Mineral Exploration

The early history of mineral exploration in the area is not known, the earliest prospecting activity in the area was recorded in 1949 with the discovery of uranium and beryl mineralization in pegmatites. Old claim maps of the map-area show the first claims staked were in the vicinity of the Octopus Lake sulphide deposit. A second group of claims was staked in the vicinity of the south end of Bruin Lake. The exact dates of staking, ownership, and record of any subsequent work could not be traced, but the small numbers assigned to the claims suggest that they probably were staked before 1910.

A ballast pit was opened in 1928 near the Canadian Pacific Railway station at Hawk Lake, and the plant has operated intermittently since then (*see* location on Map 2302 in back pocket).

From 1949 to 1957, MacNicol and Tustin Townships were extensively prospected for uranium. The most significant deposit discovered during this period is held by New Campbell Island Mines Limited in central MacNicol Township.

A granite quarry in Docker Township was operated intermittently from 1954 to 1960.

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[1]Number in brackets refers to property number on Maps 2302 and 2303 in back pocket.

Exploration work since 1966 has focused on:

1) The possibility of locating economic deposits of copper and nickel associated with ultramafic intrusions.
2) Uranium mineralization associated with pegmatite intrusions.
3) Base-metal deposits associated with sulphide facies iron formation.
4) Production of crushed rock for ballast from the Canadian Pacific Railway's quarry at Hawk Lake.

METALLIC MINERALS

Iron

Concentrations of magnetite are found in pegmatites and serpentinized ultramafic intrusions. Although magnetite may locally form up to 50 percent of these intrusions, the deposits are not considered to be an economic source of iron at the present time.

The iron formation unit mapped in Docker Township is too narrow to be a source of iron ore under current economic conditions. Aeromagnetic data indicate that large units of magnetite-bearing iron formation are not present in the map-area (ODM-GSC Maps 1962a and b).

Sulphide Minerals

Concentrations of sulphide minerals are confined to the metavolcanic-metasedimentary sequence, and are widespread in them.

Minor amounts of disseminated sulphides are commonly found in metasediments. Greywacke exposed along the north shore of the southwest bay of Bruin Lake, in MacNicol Township, contains an estimated 5 percent disseminated pyrite. A siliceous greywacke, containing an estimated 5 to 8 percent disseminated pyrite, is found west of the north end of Octopus Lake. Toward the north end of Octopus Lake the pyritiferous metasediments trend east-west, are about 300 feet (90 m) wide and can be traced along strike for 2,000 feet (600 m). A grab sample collected by the author was assayed by the Mineral Research Branch, Ontario Division of Mines, and was found to contain only trace amounts of gold and silver. Minor amounts of pyrrhotite and pyrite occur in the calc-silicate gneiss in Bridges Township (see 'Calc-silicate Gneiss').

Massive to disseminated stratabound sulphide deposits occur in the map-area. The Octopus Lake Occurrence (13), Noranda's zinc-silver deposit (19) in Bridges Township, the sulphides north of Medicine Lake (see 'Falconbridge Nickel Mines Limited (10) and (11)'), and the massive sulphides under Bruin Lake (see 'Kolak Occurrence (4)') are deposits of this type.

Minor amounts of pyrite, pyrrhotite and trace chalcopyrite occur along shear zones.

Small irregular zones of massive sulphides occur in intermediate pyroclastic rocks in the vicinity of Petursson and Lacourse Lakes (central Tustin Township). Pyrite and pyrrhotite form up to 75 percent of these bodies. The Heinz Occurrence (12) is typical of this type of deposit.

No nickel-bearing sulphides in association with peridotites have been reported to date.

Traces of molybdenite occur in most of the late pegmatite dikes. Only two occurrences are shown on Map 2302 (back pocket). One occurrence is the Bee Lake Occurrence (9). The molybdenite is associated with coarse-grained hornblende, and forms an estimated ½ percent of the pegmatite mass over an area about 7 feet (2 m) wide and 40 feet (12 m) long. The second molybdenite occurrence is on the Heinz property (12) in Tustin Township. Pegmatitic veins containing minor amounts of molybdenite occur in a zone 18 inches (46 cm) wide and 10 feet (3 m) long.

Uranium

All the uranium occurrences in the map-area are associated with pegmatites. Many of the occurrences have been examined by prospectors who used trenching and diamond drilling.

The deposit on the New Campbell Island Mines Limited (6) property has undergone a limited amount of underground exploration by means of two adits.

Thirteen previously unknown radioactive occurrences were found by members of the Ontario Division of Mines Field Party during field mapping. All the occurrences were found by noting the preference of yellow secondary uranium minerals on the weathered surface. The presence of radioactive minerals in samples was detected by using a geiger counter. In all cases the radioactive stain is patchy and irregular in distribution, and covers an area measuring several feet (m) to about 50 square feet (4.6 m^2). Four occurrences related to pink pegmatite dikes were located in the west-central part of Docker Township. Five occurrences related to white weathering pegmatite and granodiorite were located in the area to the north and west of Cobble Lake in Bridges Township. Four occurrences also related to pink pegmatite dikes were found in the southeast part of Tustin Township.

Most mineralized pegmatites can be recognized by yellow staining on the weathered surface. Trenching may expose yellow to yellow-green secondary uranium minerals that fill fractures in the pegmatite. Beta-uranotile and uranophane are the two most common secondary uranium minerals. Uraninite has been identified as the most common primary radioactive mineral. The most highly radioactive areas are biotite-rich zones, apatite-rich zones and magnetite-rich zones in pegmatites. However, except for the New Campbell Island Mines Limited property, none of the known occurrences have a consistent distribution of these zones.

Tantalite

Crystals of tantalite occur in a white pegmatite in the area that is immediately northeast of Medicine Lake in Tustin Township. The tantalite crystals occur along the northwestern contact of the pegmatite over an area measuring about 225 feet (68 m) by 50 feet (15 m). Quantitative data on the tantalum content is lacking. The mass of white pegmatite, which also contains some beryl, measures about 4,000 feet (1,200 m) by 1,500 feet (460 m) and should be further investigated for its tantalum content.

Columbium-tantalum mineralization also occurs on the Harrison Property (claim K16777) in Bridges Township. The mineralization is associated with pegmatite (Regional Geologist's Office, Ontario Ministry of Natural Resources, Kenora).

NON-METALLIC MINERAL DEPOSITS

Beryl

Three occurrences of beryl in pegmatite occur in the map-area. The Medicine Lake Occurrence (Falconbridge Nickel Mines Limited (11)) consists of two mineralized zones, one measuring about 120 feet (37 m) by 40 feet (12 m) and a second smaller zone located 300 feet (90 m) southeast of the first zone.

Green beryl has also been reported by M. Tew of Kenora (personal communication) about 5,000 feet (1,500 m) east of the Tustin-Bridges township boundary and about 3,000 feet (900 m) north on Highway 17. The beryl-bearing pegmatite was explored by several pits, but these were not located in the field by the author.

An occurrence of beryl in pegmatite has been reported by D. F. Parrott of Red Lake (personal communication) about four claims northwest of the Harrison Property (18) on Cobble Lake, Bridges Township. More precisely, the occurrence is on the north shore and one mile (1.6 km) east from the west end of Cobble Lake. The beryl mineralization was examined by several pits, circa 1955, but they were not located in the field by the author.

Mica

Muscovite is associated with a late intrusion of pink pegmatite in the Cobble Lake area of Bridges Township. This deposit is not presently of economic interest because of the erratic distribution and the structural imperfections of the mica.

Stone

An intrusion of pink granite, located in Docker Township, has been quarried for building stone. The quarrying operations were originally conducted by the Vermilion Pink Granite Company Limited, and later by the Scotstown Granite Company Limited (26). The granite is attractive and has characteristics that constitute good building stone. Highway 17 and the mainline of the Canadian Pacific Railway are close to the quarry; transportation of the granite to a processing plant should not be difficult.

A rock quarry near the Canadian Pacific Railway station of Hawk Lake has been used intermittently from 1928 to the present to produce crushed rock for ballast. The quarry is in massive to weakly gneissose equigranular granodiorite.

DESCRIPTION OF PROPERTIES

BEE LAKE OCCURRENCE (9)

A uranium occurrence located at the southwest end of Bee Lake in Tustin Township was held by R. J. Young of Kenora. The property was once held by M. Schack. In 1955, three diamond-drill holes, totalling 858 feet (261.5 m) were put down on claim K17783. In 1957, ground magnetometer and scintillometer surveys were conducted over a group of 12 claims (K17781 to K17792 inclusive) for Tustin Mines Limited (Sharpe 1958). A series of 12 trenches were located and mapped by the author in 1968 (Figure 2, back pocket). Most of the trenches had been sunk at an earlier date; several were cleaned and extended in 1968. Also in 1968, six diamond-drill holes, totalling 1,259 feet (383.7 m) were drilled (Figure 2) by Olympia Mines Limited for R. J. Young. The claims reverted to the crown in April, 1970.

Radioactive mineralization is associated with an irregular pegmatite mass that has a maximum thickness of 100 feet (30 m) and a length of 2,700 feet (820 m). Diamond drilling indicates that the pegmatite dike decreases in thickness with depth. The dike trends about N 80°W and dips 30° to 60°N. Intermediate to mafic metavolcanics, highly injected by concordant to discordant granitic dikes, are exposed to the north of the mineralized pegmatite. To the south, the pegmatite is in contact with gneissic granodiorite of the Feist Lake Pluton.

The radioactive pegmatite is coarse grained and composed of pink microcline and quartz, with minor amounts of biotite and hornblende, and rare molybdenite. Near Trench 12, coarse hornblende forms up to 20 percent of the pegmatite over an area measuring about 7 feet by 40 feet (2 m by 12 m). Molybdenite is intimately associated with the hornblende but forms less than 1 percent of the pegmatite.

CANADIAN PACIFIC RAILWAY COMPANY (HAWK LAKE BALLAST PIT) (1)

The Canadian Pacific Railway Company owns a rock quarry in MacNicol Township. Crushed rock (equigranular granodiorite) used for ballast, has been produced intermittently from this quarry since 1928.

Plant and equipment was first installed on the property in 1928 and 1929 by the Grenville Crushed Rock Company Limited. Operations were closed down in 1931, and reopened in 1936 and 1937, and then again in 1939 and 1940. In 1955 the quarry was operated by Mannix Construction Limited. In the period from May 1958 to August 1962, the quarry was operated by Simkins Construction Company Limited. The quarry remained closed until 1968, when it was reopened by British American Construction Limited who operated the plant for two consecutive seasons.

Complete production records are not available. King (1969) mentioned that the quarry operations ran from June 25 to December 13 in 1968, producing an estimated

2,000 tons (1,800 tonnes) per day of crushed rock (King 1969, p.23). In 1969 an estimated 295,496 cubic yards (225,924 m^3) of crushed rock was produced (King 1970, p.36).

COULEE LEAD AND ZINC MINES LIMITED (15)

In September 1967 an airborne radiometric survey was conducted over the major part of Docker Township north of Highway 17, and the east-central part of Bridges Township between Highway 17 and the north shore of Game Lake (Klein and Pemberton 1967a and b). The survey, totalling 286 line miles (460.2 km) was done on behalf of Coulee Lead and Zinc Mines Limited, who subsequently staked a number of claims in the area. Exploration work was confined to a block of 40 claims located between Game Lake and Highway 17 in Bridges Township. Ground radiometric and magnetometer surveys were carried out over part of this property during 1967 (Klein and Pemberton 1967b; Fleming 1967). In 1968, under an option agreement, Noranda Mines Limited conducted a geological survey of the property, blasted numerous trenches, and drilled four diamond-drill holes, totalling 1,384 feet (421.8 m).

Part of the ground held by Coulee Lead and Zinc Mines Limited was staked in 1955 by F. Mallery. A series of trenches and two diamond-drill holes, totalling 90 feet (27 m) were put down on claims K18407 and K18408, centered about 3,000 feet (900 m) east of the intersection between Highway 17 and Crabclaw Creek.

The property is underlain mainly by metasediments intimately injected by felsic granitic rocks. The extreme southern part of the property is underlain by granitic rocks of the Dryberry Dome. The contact between the granitic rocks and the metasediments is migmatitic.

The granitic rocks intruding the metasediments vary in composition from medium- to coarse-grained granodiorite to pink pegmatite. Uranium mineralization is associated with pegmatite. Although uranium mineralization is widespread over the property, uranium mineralization is also erratically distributed in the pegmatite bodies. Yellow secondary uranium minerals are concentrated along fractures near the surface. The fractures are discontinuous and are randomly oriented. The highest scintillometer readings were obtained from biotite-rich phases in the pegmatite. Robertson (1968, p.56) reports analyses from 0.04 to 8.4 pounds U_3O_8 per ton (16.3 g/t to 3456 g/t). Presumably these values were obtained from samples taken near the surface that contained abundant secondary uranium minerals.

Noranda Mines Limited reported radiometric and chemical values for U_3O_8 content in granitic rocks intersected in the four diamond-drill holes put down on the property. The highest radiometric value obtained was 0.08 U_3O_8 equivalent over a width of 5 feet (1.5 m). Most radiation values were less than 0.02 U_3O_8 equivalent. The highest chemical U_3O_8 content is given as 0.068 percent over a width of 1 foot (0.3 m) (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kenora). The U_3O_8 content in granitic rocks intersected in the four diamond-drill holes put down on the property. The highest radiometric value obtained was 0.08 U_3O_8 content of the rocks, as determined by the scintillometer method, is generally two to three times greater than the corresponding value obtained by chemical methods.

One diamond-drill hole in the metasediments intersected 13.5 feet (4.1 m) of sulphide-bearing rock, of which a 1 foot (0.3 m) section was described as 'massive pyrrhotite, pyrite and trace chalcopyrite'. The best analysis from a 2-foot (0.6 m) intersection indicated 0.29 ounce of silver per ton (9.9 g/t), 0.06 percent copper, 0.05 percent lead, and 0.10 percent zinc (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

FALCONBRIDGE NICKEL MINES LIMITED (10), (16), (17) AND (24)

In 1966, Falconbridge Nickel Mines Limited initiated an exploration program in the northern part of the metavolcanic-metasedimentary belt in the map-area. The main objective of this program was to investigate the ultramafic intrusions for copper and nickel mineralization. On December 31, 1970, the company held 41 claims in Tustin and Bridges Townships.

Ground follow-up work resulting from the airborne survey included geological mapping, ground geophysics, and diamond drilling. In the period from 1966 to 1970 inclusive, the following data had been submitted for assessment purposes:

1) Results of ground magnetometer and AFMAG-longwire surveys. These were conducted in 1966 over a 71-claim group in the northwest corner of Docker Township extending into Bridges Township (Harrison 1966) (Property 24 on Map 2303 in back pocket).
2) Five vertical diamond-drill holes, totalling 2,491 feet (759.3 m) were drilled on Medicine, Lift, Augite, and Cobble Lakes during the winter of 1968 to confirm or to disprove the presence of peridotite intrusions indicated by airborne geophysics (Property 10 in Tustin Township and Properties 16 and 17 in Bridges Township, Maps 2302 and 2303 in back pocket).
3) Results of electromagnetic and induced polarization surveys. These surveys were conducted in 1970 over three separate groups of claims. The electromagnetic surveys covered a 23-claim group situated in the vicinity of Medicine Lake and Lift Lake, a 12-claim group at the west end of Cobble Lake, and a 12-claim group at the southeast part of Cobble Lake (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora). The induced polarization survey was carried out over an area of about three claims in the first group, and the whole area of the 12-claim group at the west end of Cobble Lake (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).
4) Two inclined diamond-drill holes, totalling 1,234 feet (376.1 m), were drilled from the surface of Medicine Lake during the winter of 1970 (Property 10 in Tustin Township, Map 2302 in back pocket).

Some of the ground investigated by Falconbridge Nickel Mines had been subjected to earlier exploration work. In 1958 Conquest Exploration Limited blasted five trenches and drilled two diamond-drill holes, totalling 509 feet (155.1 m), on a zone of sulphide mineralization located about 1,400 feet (430 m) northeast of the east end of Medicine Lake (Figure 3). The sulphide zone strikes easterly, dips vertically, and has been traced for a length of 600 feet (180 m). At the west end of

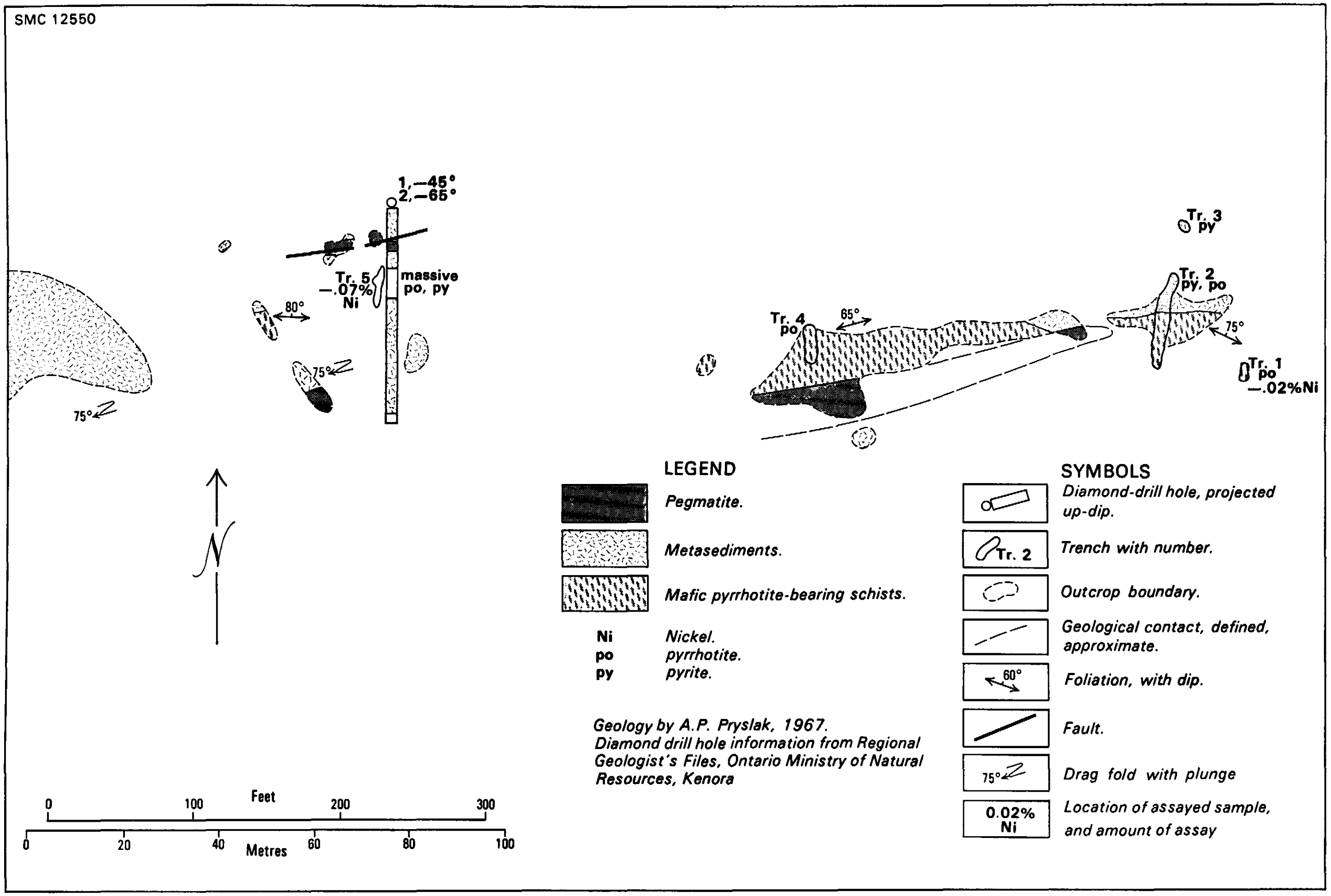

Figure 3–Plan of Falconbridge Nickel Mines Limited Property (10) Tustin Township.

the mineralized zone, massive and disseminated pyrrhotite and minor pyrite, in metasediments, are exposed over a width of 30 feet (9 m). A grab sample of massive sulphides collected by the author was found to contain 0.07 percent nickel, and trace amounts of copper, gold and silver. Mineralization at the east end of the zone consists of disseminated pyrrhotite in mafic schists. The mineralized zone has a maximum thickness of 40 feet (12 m) and is in sharp contact with garnetiferous metasediments. Some pyrite is present in the metasediments. Pyrrhotite forms 2 to 5 percent of the mafic schists and a grab sample collected by the author from trench number 1, was found on analysis by the Mineral Research Branch, Ontario Division of Mines to contain about 0.02 percent nickel and a trace of copper.

In 1956 H. M. Sharp drilled two diamond-drill holes, totalling 108 feet (32.9 m), on claim K23946. The claim is located on the large peninsula that extends northward into Cobble Lake from the south shore. The exact location of the diamond-drill holes is not known. Mineralization intersected in the diamond-drill holes includes magnetite, pyrrhotite, chalcopyrite, and sphalerite, but the amounts of these minerals encountered is not stated in the diamond-drill core logs (Resident Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

No nickel or copper mineralization related to the ultramafic intrusions in the Cobble Lake-Lift Lake-Medicine Lake area is known to have been found by Falconbridge Nickel Mines.

FALCONBRIDGE NICKEL MINES LIMITED (MEDICINE LAKE OCCURRENCE) (11)

In 1949, beryl in pegmatite was discovered at the east end of Medicine Lake in Tustin Township. The occurrence was initially found and staked by E. Sobiski. The original claim was numbered K12789. On December 31, 1969, this property was held by Falconbridge Nickel Mines Limited, who were examining peridotite intrusions in the area for nickel-copper mineralization.

Trenching and stripping were carried out in 1949 to determine the extent of beryl mineralization. Part of the pegmatite exposed by this work is presently covered by the Gordon Lake Development Road.

The pegmatite intrusion underlies the area between Medicine Lake and Lift Lake; it has an approximate width of 1,500 feet (460 m) and a length of 2,000 feet (600 m), and is oriented in a northeasterly direction. The pegmatite is white to grey in colour, with local areas that are pink. It is medium to very coarse grained, and is composed of feldspar and quartz with minor amounts of biotite and muscovite, and rare black tourmaline, red garnet, yellow to clear beryl and black tantalite. The accessory minerals generally have well-developed crystal shapes.

Beryl crystals at the main showing occur over an area 120 feet (37 m) long and 40 feet (12 m) wide. E. Sobiski reported that he also found small crystals of beryl about 300 feet (90 m) southeast of the main showing (personal communication).

E. O. Chisholm (1950) examined and described the Medicine Lake beryl occurrence as follows:

> 'Beryl crystals up to 2 inches [5 cm] in diameter and several inches [cm] long occur in a coarse-grained pegmatite to the west of the cabin . . . A total of 20 (beryl crystals) were observed in an area 25 feet long [7.6 m] and 5 feet [1.5 m] wide. The average diameter of the crystals was from half an inch to an inch [1.3 cm-2.5 cm].

'The beryl crystals appeared to be confined to a coarser phase of the pegmatite in this locality. Large crystals of white and grey perthitic feldspar up to a foot [0.3 m] across accompany the beryl mineralization. Thin sheets of biotite mica several inches [cm] in length often occur along the crystal faces of the feldspar. Small patches and crystals of black tourmaline up to an inch [2.5 cm] in diameter were noticed.

'A piece of one of the larger beryl crystals was sent to Beryllium Corporation for assay by the claim owner. It was reported to contain 13.6 percent beryllium oxide. A sample of the massive grey perthite was reported to contain 1 percent beryllium oxide (Statistical Files, ODM).'

Crystals of tantalite were found by E. O. Chisholm (1950) in a pit located 75 feet (22.8 m) northeast of the cabin (main beryl showing). The Gordon Lake development road lies immediately north of this pit. Chisholm also reported the presence of tantalite crystals in a 25-foot (7.6 m) long trench located about 100 feet (30 m) north of the above-mentioned pit (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora). Scattered crystals of tantalite, up to one inch (2.5 cm) in diameter, were observed by the author in an outcrop of white, medium-grained pegmatite along the north side of the Gordon Lake development road, about 225 feet (70 m) northwest of the above-mentioned pit. The tantalite crystals are estimated to form less than ½ percent of this outcrop. Metagabbro lies north of this exposure of pegmatite.

H. A. HARRISON (18)

H. A. Harrison of Eagle River holds one patented claim, K16777 (patented in 1961), in Bridges Township. The claim is located on a small peninsula that extends northeastward from the south shore of Cobble Lake and is partly covered by water. An adit was driven from the south side of the peninsula in a northward direction for a distance of 18 feet (5.5 m) (circa 1952). During 1953 and 1954, six diamond-drill holes, totalling 206 feet (62.8 m), were put down on the property. Some mica was shipped to General Electric in Toronto but the quantity or value of the shipment is not known. In 1955 Harrison and D. F. Parrott of Red Lake re-examined the property for tantalum and columbium (see 'Tantalite').

The peninsula is underlain by peridotite and pyroxenite intruded by pink, coarse-grained pegmatite dikes.

The muscovite-bearing pegmatite trends easterly through the centre of the claim, dips subvertically, and has a maximum width of 150 feet (46 m). Microcline, perthitic microcline, and quartz are the major mineral constituents, and biotite, muscovite and tourmaline occur in lesser amounts. Minor blue-green garnet and rare tantalite-columbite have also been identified by D. F. Parrott (personal communication).

Black tourmaline locally forms up to 10 percent of the pegmatite mass and can be readily observed in the dike, between 100 and 300 feet (30 and 90 m) west of the adit. Individual crystals range up to 10 inches (25 cm) in length and 2½ inches (5.3 cm) in diameter. Biotite books, up to 5 inches (13 cm) in diameter, and 2 inches (5 cm) thick, form about 5 percent of the pegmatite mass.

Muscovite is segregated in small lenses in the pegmatite. The largest muscovite zone occurs near the entrance of the adit, strikes easterly, and dips vertically. The zone has a maximum thickness of 2 feet (0.6 m) and can be traced on the surface for a distance of 30 feet (9 m). The east end of the zone is under water. A 50-foot (15 m) horizontal diamond-drill hole, located about 200 feet (60 m) west of the adit, intersected a muscovite-bearing zone about 20 feet (6 m) wide. The muscovite has a light greenish brown colour and forms books up to 18 inches (46 cm) in diameter, and up to 5 inches (13 cm) thick. Most of the larger books contain structural imperfections known as 'A' reeves and wedge structure.

In 1955, D. F. Parrott collected a sample of pegmatite near the entrance to the adit. The sample contained 1.85 percent Cb_2O_5 and 0.17 percent Ta_2O_2 (Assessment Files, Regional Geologist's Office, Kenora). Duplicate check samples sent to the Department of Mines Laboratory and Warnock Hersey, assayed 0.42 percent and 0.10 percent Cb_2O_5 and 0.01 percent and 0.04 percent Cb, respectively (assessment files).

HAWK LAKE OCCURRENCE (2)

This property is located in the southwest corner of MacNicol Township. The main showing is located 800 feet (240 m) south of Highway 17 and 700 feet (200 m) east of the MacNicol-Jackman township boundary.

The property was originally staked in 1949 by H. Byberg of Kenora. It was later acquired by C. A. Campbell, F. McFarlane, and G. R. Gibson, who sold the property in 1956 to M. Schack. In 1969 the claims were vested to D. Schack and on June 30, 1970, they were cancelled.

This property has been described by Chisholm (1950, location number 7, p.3), Huston (1951), and Satterly (1955, Hawk Lake showing, p.1-5).

Numerous dikes and irregular masses of pegmatite are found on the property. These intrude mafic to intermediate metavolcanics. Except for the mineralized pegmatite, all other dikes are pink, coarse grained, and are composed mainly of quartz, and microcline, with minor amounts of albite and biotite.

The radioactive pegmatite trends northerly, dips subvertically, has a maximum width of 70 feet (20 m) and a length of 280 feet (85 m). Trenching and stripping were done on this dike in the period between 1949 and 1954. This work was restricted to a length of 150 feet (46 m) over the southern part of the dike. The mineralized pegmatite is grey, and contains abundant quartz and albite, minor microcline and magnetite, and rare molybdenite. Magnetite-rich zones, up to 17 feet (5 m) wide, are exposed in the trenches and form about 10 percent of the pegmatite mass. These zones give much higher Geiger counter readings than the normal pegmatite. Satterly (1955, p.1) stated that:

> 'The magnetite zones, stringers or lenses are somewhat erratic in distribution but appear to be localized by shears at or near the west contact or footwall of the pegmatite mass.'

Chemical analyses of samples of magnetite-bearing pegmatite, collected by Satterly (1955), indicate a U_3O_8 content of about 0.10 percent. Twenty-three grab samples taken by W. E. Hale of the Geological Survey of Canada in 1950, from several pegmatite bodies in the vicinity of the main showing, averaged less than 0.05 percent U_3O_8 (chemical) equivalent. A chemical analysis on a composite of six samples showed a U_3O_8 content of 0.054 percent (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

Radioactive minerals identified by Huston (1951) are uraninite and euxenite. Secondary minerals are uranophane and beta-uranotile (Satterly 1955, p.3).

HEINZ OCCURRENCE (12)

In 1965 F. Heinz held two unsurveyed claims, K37103 and K37042 in Tustin Township. Four pits, two measuring about 20 feet (6 m) in diameter and up to 5 feet (1.5 m) in depth, and two about 5 feet (1.5 m) in diameter and up to 2 feet (0.6 m) in depth, were sunk on a zone of massive sulphides located 1,200 feet (360 m) south of Highway 17, and 1,000 feet (300 m) west of Petursson Lake.

The sulphides occur in intermediate metavolcanics and are exposed over an area about 60 feet (18 m) by 130 feet (40 m), that trends north, and dips vertically. Mineralization appears to be confined to the crest of a small fold in the metavolcanics. Pyrrhotite is the major sulphide mineral but some pyrite also occurs in the rock. Quartz, containing minor pyrrhotite and traces of chalcopyrite, forms irregular masses and veins up to 6 inches (15 cm) thick in the massive sulphides. A grab sample of massive sulphides, collected by the author, was found by the Mineral Research Branch, Ontario Division of Mines, to contain only trace amounts of copper, nickel and silver.

Forty-five feet (14 m) east of the massive sulphide zone, molybdenite occurs in grey siliceous pegmatite veins. The veins are up to 5 inches (13 cm) wide occur in a zone up to 18 inches (46 cm) wide and are exposed over less than 10 feet (3 m). The veins trend northerly, and dip vertically. The molybdenite is coarse grained, erratically distributed, and forms an estimated 1 percent of the pegmatite veins.

KENORATOMIC PROSPECT (3)

In 1957 Kenoratomic Mines Limited held a group of 40 unsurveyed claims in MacNicol Township, north of Richard Lake, some of which had been purchased in 1956 from Burning Rock Uranium Mines Limited and from Acko Mines Limited. The property adjoining to the northwest is held by New Campbell Island Mines Limited. Kenoratomic Mines' charter was cancelled in 1962.

Chisholm (1950) first described some of the uranium occurrences in the vicinity of this property (p.3-4, location numbers 8 to 11). Acko Mines Limited and Burning Rock Uranium Mines Limited put down ten diamond-drill holes, totalling 2,548 feet (776.6 m) on their properties in 1956. In 1957, Kenoratomic Mines Limited conducted ground magnetometer and scintillometer surveys over a block of twenty claims in the Richard Lake area (Parliment 1957a). A geological survey was conducted over the same group of claims, plus four additional claims located to the west (Parliment 1957b). The company put down 12 diamond-drill holes, totalling 2,500 feet (760 m), on this property.

The southern part of the occurrence is underlain by the Feist Lake Pluton; whereas the northern part is underlain by foliated to gneissic metavolcanics that are mafic to intermediate in composition. Dikes and irregular bodies of pink pegmatite are widespread. Uranium mineralization is associated with the pegmatite.

The scintillometer survey picked up 18 radioactive zones. One zone is the eastern extension of the deposit held by New Campbell Island Mines Limited. A diamond-drill hole intersected a magnetite-bearing pegmatite which was found on analysis to contain 0.098 percent U_3O_8 across 3.5 feet (1 m). A second drill hole, on claim K17607, located immediately west of the north end of Richard Lake, intersected two pegmatite dikes which contain 0.087 percent U_3O_8 across 2.5 feet (1 m), and 0.064 percent U_3O_8 across 5.0 feet (2 m), respectively (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

According to Parliment (1957a) uranium minerals on this property are uraninite, monazite, allanite, kasolite, uranophane and beta-uranotile.

KIMBER LAKE OCCURRENCE (25)

The account of the Kimber Lake Occurrence (25) (Figure 4, back pocket) is given under the heading 'Stephens, C. S. [1968] (22)'. The Kimber Lake occurrence is part of the Stephens Property which extends into Docker Township.

KOLAK OCCURRENCE (4)

In 1955, J. H. Kolak held a group of nine claims (K19561 to K19569 inclusive) in the vicinity of Bruin Lake in MacNicol Township. A magnetometer survey carried out over this property in 1955 by Campbell Island Mines and Explorations Limited, indicated a positive magnetic anomaly that is up to 1,000 feet (300 m) wide and 7,000 feet (2000 m) long, mostly under Bruin Lake (Northern Miner Press 1955).

Two diamond-drill holes, totalling 1,397 feet (425.8 m) were put down on claim K19561 and intersected 425 feet (129.5 m) of white to pink pegmatite containing numerous metavolcanic inclusions. No analytical results for uranium content are available. Two additional diamond-drill holes, one 700 feet (213 m) long and the second 112 feet (34.1 m) long, were put down under Bruin Lake. The first diamond-drill hole was inclined at −30 degrees, and intersected 10 feet (3 m) and 4.6 feet (1.4 m) of massive sulphides and 4.6 feet (1.4 m), 4.3 feet (1.3 m) and 8 feet (2.4 m) of red magnetite-bearing pegmatite. The second hole was inclined at −45 degrees and intersected 5 feet (1.5 m) massive sulphides at the bottom of the hole. The uranium content in the pegmatites or the base metal content of the massive sulphides have not been reported. Copper was noted in the intersections of massive sulphides.

B. MACHIN [1955] (5)

Claim K17343 is located at the west end of Willard Lake in MacNicol Township. Three diamond-drill holes, totalling 100 feet (30 m), were put down from a small island at the west end of Willard Lake in MacNicol Township in 1953; one hole was drilled to a depth of 246 feet (750 m) in 1955.

The small island is underlain by mafic metavolcanics, intruded by white pegmatite. Small patches of yellow uranium staining occur on the surface of the pegmatite. The diamond-drill hole drilled in 1955 intersected the pegmatite at 21 feet (6.4 m). The pegmatite was tested for lithium, but the results were negative.

NEW CAMPBELL ISLAND MINES LIMITED (6)

New Campbell Island Mines Limited held ten patented claims, K18756 to K18765 inclusive, southwest of Bruin Lake in MacNicol Township. The property was staked in 1954 by C. A. Campbell and F. McFarlane; it was optioned and then sold to Campbell Island Mines and Explorations Limited. This company was reorganized in 1958 and its name was changed to New Campbell Island Mines Limited.

Exploration work on the property was carried out during the period from 1954 to 1956. Thirteen trenches and minor stripped areas were located by the author. Seventeen diamond-drill holes, totalling about 5,000 feet (1,500 m) and located over a strike length of 1,300 feet (400 m) are indicated from maps provided by the company (Figure 5, back pocket). Underground exploration work includes 1,100 feet (335 m) of lateral development from two adits, and horizontal diamond-drill holes totalling about 255 feet (78 m).

Satterly (1955) examined the property in 1954 during the early stages of the exploration program. Grab samples taken from eight trenches by Satterly contained 0.02 to 0.19 U_3O_8 (radiometric equivalent). Chemical analyses on four samples showed a U_3O_8 content of 0.10 to 0.22 percent.

A. S. Bayne and Company consulting engineers, issued a progress report on this property in April, 1956 (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora). Much of the information given below is taken from this report.

Uranium mineralization is associated with a series of parallel magnetite-bearing pegmatite dikes. The dikes are commonly hematitized and intrude highly recrystallized, foliated to gneissic metavolcanics. Individual dikes vary in width from several inches (cm) to 30 feet (9 m) and occur in a zone that varies in width from 250 to 350 feet (76 to 110 m). The dikes trend N 70°E and dip 70°N.

According to Bayne (1956, p.2):

> 'Altogether there are five zones. The most southerly two zones contain dykes of low grade material over widths of from 5 to 7 feet [1.5 to 2.1 m] within a couple of hundred feet [about 60 m] of surface. The most southerly zone is proven to extend to a vertical depth of 840 feet [256 m] as shown in the intersection in Hole No. 16. This intersection indicates a slightly better grade which may run 0.10 percent U_3O_8 when opened up by mining.
>
> 'The largest and most persistent zones appear to be the two in the central part of the formation as shown on the section. These dykes range in width from 10 to 20 feet [3 to 6 m] as proven by surface trenching, diamond-drilling, and underground work. In addition, very thorough sampling both of the underground workings and the drill cores in these zones indicate a grade ranging from 0.08 percent to 0.14 percent U_3O_8, with a probable mineable average of about 0.10 percent U_3O_8.'

Robertson (1968, p.58) stated that the radioactive minerals are uraninite, uranothorite, allanite, and beta-uranotile.

In a report to Campbell Island Mines and Explorations Limited, dated March 28, 1956, A. S. Bayne and Company estimated ore reserves at 650,000 tons (589,550 tonnes) grading 0.10 percent U_3O_8 based on the following data, a length of 700 feet (210 m) a depth of 1,000 feet (300 m) and an assumed average width of 10 feet (3 m) (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

NORANDA MINES LIMITED (19)

In 1967, prospectors employed by Noranda Mines Limited, while investigating uranium-bearing pegmatite bodies in Bridges Township, located a zone of sulphide mineralization on claim K41112, 1,400 feet (430 m) north of Highway 17, and 1⅔ miles (2.7 km) east from the western boundary of the township (Figure 6). Two trenches were sunk on the original discovery. Two additional pits were sunk in 1968 about 900 feet (270 m) to the west, on what is believed to be the same sulphide-bearing formation.

In 1968, magnetometer, electromagnetic, and geochemical surveys were conducted over a group of 19 claims (K41111, K41112, K41553, K41555 to K41557 inclusive, and K41559 to K41567 inclusive). In 1969, five diamond-drill holes, totalling 1,656 feet (504.7 m), were put down on this group of claims and several adjoining claims located to the northeast.

The northern part of the property is underlain largely by sedimentary rocks and minor amounts of metamorphosed intermediate pyroclastic rocks. Granitic rocks of the Dryberry Dome underlie the southern part of the property. The contact between the metasediments and the granitic batholith is migmatitic, and is therefore poorly defined. Numerous concordant to discordant pegmatite dikes intrude the metasediments.

The metasediments include biotite greywacke, garnet-biotite greywacke, and calc-silicate gneiss. The original sulphide discovery lies 500 feet (150 m) north of the calc-silicate gneiss. Mineralization is largely disseminated in the siliceous rocks. The zone, which has a maximum width of 22 feet (6.7 m) contains 5 to 10 percent sulphide minerals. Segregations of massive sulphides, up to 12 inches (30 cm) wide, are concentrated along shears. Pyrite, pyrrhotite, and sphalerite are the major sulphide minerals. Minor amounts of galena and chalcopyrite were found and magnetite forms up to 10 percent of the mineralized zone.

A chip sample, taken by the author from trench No. 1 (see Figure 6) across a 22-foot (6.7 m) section gave on assay (assay done by the Mineral Research Branch, Ontario Division of Mines) 0.1 percent zinc, 0.05 percent lead and a trace amount of silver. A chip sample across a 15-foot (4.6 m) section from trench No. 2 was found to contain 0.1 percent zinc, 0.05 percent lead and 0.40 ounce of silver per ton (0.14 g/t). Chip samples collected by Davies (1968, p.8) across a 20-foot (6 m) width were found to contain about one-half percent zinc and one-half ounce of silver per ton (0.17 g/t).

Disseminated pyrite, pyrrhotite, and magnetite occur in metasediments east of trench No. 1, for a distance of 8,000 feet (2,400 m). These minerals form less than 5 percent of the metasediments. Minor disseminated pyrite and pyrrhotite also occur along the northern part of the calc-silicate gneiss. Diamond drilling of these sulphide-bearing zones by Noranda Mines Limited in 1969 indicated that sphalerite,

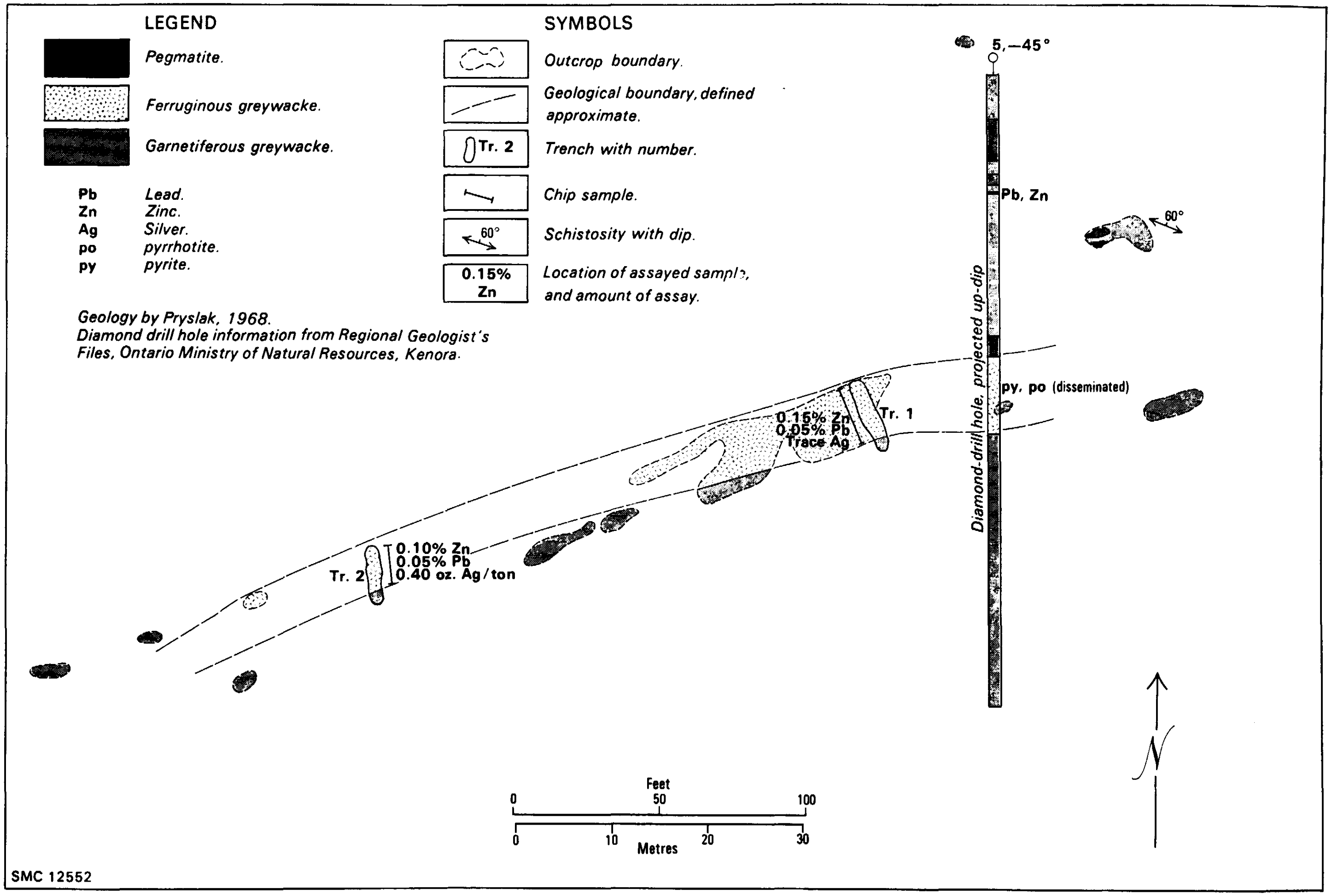

Figure 6–Plan of Noranda Mines Limited Property, Bridges Township.

galena, and chalcopyrite are present in minor amounts over narrow widths (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

NORANDA MINES LIMITED [1967] (20)

In 1967, prospectors employed by Noranda Mines Limited located several radioactive pegmatite dikes in Bridges Township. Data were not filed with the Ontario Ministry of Natural Resources for assessment credit on these uranium occurrences, but three trenches were sunk on one of the dikes.

Yellow secondary uranium minerals were observed in an outcrop of pink pegmatite located along the south side of Highway 17, about 5,700 feet (1,700 m) east from the west boundary of Bridges Township. The radioactivity is erratic in distribution and cannot be traced over any considerable distance.

The second radioactive pegmatite is located 700 feet (210 m) south of Highway 17 2¼ miles (3.6 km) east from the west boundary of Bridges Township. The radioactive pegmatite can be traced over a length of about 1,500 feet (460 m) and is well exposed along the rock cut of the natural gas pipeline of Trans-Canada Pipelines Limited. The dike here is about 25 feet (7.6 m) wide and contains abundant secondary uranium minerals along fracture planes. Three pits were sunk on the dike about 1,000 feet (300 m) west-southwest of the pipeline. Quantitative data on the U_3O_8 content of the pegmatite are not known.

OCTOPUS LAKE OCCURRENCE (13)

A crescent-shaped zone of massive sulphides, 30 to 60 feet (9 to 18 m) wide and approximately 1 mile (1.6 km) long, occurs in the area southeast of Octopus Lake, Tustin Township.

The sulphide deposit was first described by E. L. Fraleck (1907, p.179). The mining locations are given as claims A274, A257 and A273 (see Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora). No record of ownership or date of original staking was located by the author.

Janes (1952, p.52) referred to this property as the 'Guthrie claims'; however, these claims, S.772 to S.775 inclusive, were described as 'lying east and south of Octopus Lake' (Janes 1952, p.52), whereas old claim maps show these claims (Janes 1952) to lie immediately west of Octopus Lake.

In 1953, C. A. Alcock and N. R. Alcock staked the ground and did trenching, 'power drilling' and diamond drilling on the property. Three diamond-drill holes, totalling 164 feet (50 m) were put down by the Alcocks. The claims were allowed to lapse in 1955. Since this date, W. Thomas, N. Hanson, W. L. Pigeon, and M. Tew have successively held the property but no further work has been reported.

The sulphide zone occurs in metamorphosed pyroclastic rocks of intermediate composition. The southern part of the zone trends north, and appears to dip 35 degrees east. Excellent exposures of the sulphides can be observed in outcrops along Highway 17, where the sulphides form two parallel bands, about 15 feet (5 m) thick and 25 feet (8 m) thick, separated by about 20 feet (6 m) of biotite-quartz-feldspar schist. Twelve hundred feet (370 m) north of Highway 17, the strike of the siliceous sulphide formation changes abruptly to N 70°E and the dip 55°NW.

Pyrrhotite is the most common sulphide mineral. Some pyrite is present, generally as well developed cubes up to 2 inches (5 cm) along an edge; in places the pyrite forms up to 50 percent of the sulphides. In the area where the sulphide formation changes strike, pyrite appears to be the dominant sulphide mineral. A 20-foot (6 m) deep shaft was sunk in the following location; 1¼ miles (2 km) west of the east boundary of Tustin Township and 1,500 feet (460 m) north of Highway 17. The sulphides in the vicinity of the shaft were reported to contain about 45 percent sulphur (Fraleck 1907, p.176).

A qualitative spectrographic analysis of a grab sample, consisting of massive pyrrhotite and minor pyrite collected along Highway 17 by the author and analysed by the Mineral Research Branch, Ontario Division of Mines showed that the sulphides contain about 0.02 percent cobalt, 0.01 percent copper and 0.05 percent nickel. L. Pigeon of Wabigoon, Ontario, reported that he obtained 0.11 percent and 0.13 percent nickel from grab samples of sulphides taken from trenches located south of the Trans-Canada pipeline (personal communication).

QUEBEC ASCOT OCCURRENCE (7), (14)

Before 1956 Quebec Ascot Copper Corporation Limited was known as Ascot Metals Corporation Limited and held a block of 35 claims (K18363 to K18371, K17689 to K17693 and K17694 to K17714 inclusive) in Tustin and MacNicol Townships in the vicinity of Highway 17. Geological, magnetic and radiation surveys were carried out over the major part of the property in 1955 and 1956. One pack sack diamond-drill hole, just north of the outlet of Earngey Lake, was put down on claim K18363 to a depth of 51.5 feet (15.7 m).

Three major radioactive zones and numerous isolated radioactive anomalies, with radiation ranging from two to four times background, were located on the property (Coutts 1955).

The A-zone occurs 200 feet (60 m) south of Highway 17 and 700 feet (200 m) east of the west boundary of Tustin Township on claim K17696. The zone was explored by eight trenches. Radioactivity is associated with a pegmatite dike that varies in width from 4 to 18 feet (1.2 to 5.5 m), trends easterly, dips about 60°N and was traced over a distance of 400 feet (120 m). Quantitative results on the content of U_3O_8 in the pegmatite are not known.

The B-zone occurs in the southwest corner of claim K17697 200 feet (60 m) east of the south end of Gas Lake. Stripping exposed a white, fine-grained pegmatite dike, 4 to 15 feet (1.2 to 4.6 m) wide and 100 feet (30 m) long. Radioactivity up to 4 times background was reported and is erratic in distribution.

The C-zone is located at the northeastern corner of Earngey Lake, and consists of a white radioactive pegmatite exposed on a reef in the lake. The dike is 10 feet (3 m) wide and is exposed over a length of 25 feet (7.6 m). Quantitative results on U_3O_8 content of this zone are not known.

SELCO EXPLORATION COMPANY LIMITED (21)

In 1965, Selco Exploration Company Limited staked four claims, K37528 to K37531 inclusive, covering the central part of Augite Lake, Bridges Township. In 1967, one diamond-drill hole was put down on the property to a depth of 344 feet (104.9 m).

The island located in the centre of Augite Lake, which lies to the west of the diamond-drill hole location, is underlain by pyritiferous siliceous greywacke and minor pink pegmatite dikes. The diamond-drill hole intersected a 4-foot (1.2 m) section rich in sulphides and a 3-foot (0.9 m) section containing 75 percent pyrite which was found on an analysis to contain 0.06 percent zinc, 0.03 percent nickel and no gold (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

C. S. STEPHENS [1968] (22)

In 1968, C. S. Stephens held a group of 75 claims in the vicinity of Kimber Lake and Highway 17 in Bridges and Docker Townships. Several radioactive dikes were discovered in the course of prospecting and some were subsequently examined by trenching. In all, eight trenches were reported for assessment purposes. Four trenches were sunk on a dike located 1,200 feet (370 m) west of the Bridges-Docker township line and 200 feet (60 m) south of Highway 17 on claim K41429. Two trenches were sunk on each of the K41424 and K41421 claims located about 2,500 feet (760 m) east of the Bridges-Docker township line and 700 feet (210 m) north of Highway 17. None of the above-mentioned trenches were located in the field by the author.

In 1968, three newly blasted trenches were found by the author in the area 3,300 feet (1,000 m) west of the Bridges-Docker Townships line and 700 feet (210 m) north of Highway 17 on claim K41434. The trenches were blasted in a pink pegmatite dike intruding grey biotite granodiorite. The dike is about 6 feet (1.8 m) wide, is exposed over a length of 35 feet (10.6 m), trends easterly and dips steeply north. The trenching work was not submitted for assessment purposes and quantitative data on uranium mineralization is not available.

An easterly trending radioactive pegmatite dike occurs along the north shore of Kimber Lake, near the east end of the lake. The dike ranges from 100 to 250 feet (30 to 76 m) in width; and was traced over a length of approximately 4,000 feet (1200 m). A 1,200-foot (370 m) section of the western part of the dike was tested by eight trenches. These are located on claim K41414 and were not reported for assessment purposes. This showing was mapped by the author in the summer of 1968 (Figure 4 Chart A, back pocket). [The Kimber Lake Occurrence (25) is part of the C. S. Stephens [1968] (22) property].

The pink pegmatite is medium to coarse-grained, composed mainly of microcline and quartz, with minor amounts of biotite and blue-green apatite. Yellow secondary uranium oxides are abundant in most trenches and occur as fracture fillings. The highest radioactivity occurs in biotite-rich and apatite-rich phases of the pegmatite.

The apatite-rich zones are generally less than 5 feet (1.5 m) wide but in Trench 8 this zone is 18 feet wide (5.5 m). Apatite forms up to ten percent of the pegmatite mass in the above-mentioned zones. In Trench 8 chip samples were taken by the author across three 10-foot (3 m) sections.

The chip samples were found by the Mineral Research Branch, Ontario Division of Mines, to contain 0.02, 0.008 and 0.02 U_3O_8 equivalent from north to south. The northernmost and southernmost samples were found to contain 0.008 percent U_3O_8 by chemical methods. A grab sample of pegmatite, containing an estimated 15 percent, was collected from Trench 8. The radioactivity of this sample was determined by the Mineral Research Branch, Ontario Division of Mines, to be 0.17 U_3O_8 equivalent. By chemical methods, the sample was found to contain 0.17 percent U_3O_8. Although no primary uranium mineral was identified, the radioactivity in the grab sample would appear to be from a primary mineral because of the close agreement between radioactivity and chemical analysis.

A sample of the pale yellow secondary mineral, taken from Trench 8 was identified (Mineral Research Branch, Ontario Division of Mines), by X-ray diffraction as boltwoodite.

VICEROY URANIUM CORPORATION LIMITED [1956] (8)

In 1955 six diamond-drill holes were put down on claim K17664. This claim is located about 700 feet (200 m) west of the West Hawk Lake Ballast Pit, MacNicol Township. First staked in 1953 by W. M. Goodwin, the claim was transferred to W. M. Farlane in 1954, to J. N. Harshaw in 1955, and to Viceroy Uranium Corporation Limited in 1956. The claim was cancelled on January 8, 1957.

The diamond drilling was carried out across the contact between the metavolcanics and the Feist Lake Pluton. Several trenches were found by the author in the area just north of the road to the settlement of Hawk Lake. An irregular white pegmatite dike intrudes grey granodiorite in the vicinity of the trench which lies approximately on the metavolcanic-granodiorite contact.

The diamond drilling was carried out over a length of 200 feet (60 m) and the diamond-drill holes intersected a 'mineralized contact zone' up to 12 feet (3.6 m) wide. Qualitative and quantitative data on the drilling are not available (Regional Geologist's Files, Ontario Ministry of Natural Resources, Kenora).

A. L. WILSON [1955] (23)

In 1955, A. L. Wilson sank several pits and drilled one diamond-drill hole to a depth of 146 feet (44.5 m) on a mass of pegmatite on claim K18146. An old section of Highway 17 passes through the southern part of the property which is situated in the central part of Bridges Township (Robertson 1968).

The contact between metasediments and the felsic intrusive rocks of the Dryberry Dome trends approximately east-west through the centre of the claim. One pit was located in the field by the author. Pink pegmatite, containing secondary uranium minerals along fracture planes, is exposed in the pit. The dimensions of the pegmatite dike and quantitative information on uranium content are not known. Pink pegmatite dikes, up to several hundred feet (metres) thick, are common in the general vicinity of this occurrence.

SCOTSTOWN GRANITE COMPANY LIMITED (26)

In the period from 1954 to 1960, 4,819 tons (4,371 tonnes) of granite, valued at $395,000 were quarried from this company's property in Docker Township. The property was originally operated by the Vermilion Pink Granite Company Limited.

The property consists of two claims, K11804 and K11805 on the south shore of Aaron Lake. The quarry is situated 300 feet (90 m) north of Highway 17, six miles (9.6 km) west of Vermilion Bay. G. R. Guillet examined the property in 1962. His description is quoted here (Guillet 1964, p.45):

'The quarry is opened on the crest of a low east-west ridge and is being worked in steps down the gentle northern slope. The workings are spread over an area of 200 feet square [3720 m²] and the inclined sheets have an aggregate thickness of 39 feet [12 m] — Two small openings on the south side of the ridge just above the route of the natural gas pipeline were apparently the site of earlier operations.

'The rock is a uniform moderate orange-pink, medium-grained, biotite granite. It is typically granitic in texture and is composed of orange-pink feldspar and white to colourless quartz speckled with black mica. A faint gneissosity is apparent in the quarry face but is not readily seen in the hand specimen. It is due to slight relative enrichments of the three minerals in diffuse alternating bands an inch [2.5 cm] or so thick striking east-west and dipping about 12°N. Sheeting in the granite is parallel to the gneissosity and is frequently marked by a pegmatitic layer, 1 to 2 inches [2.5 to 5 cm] thick, of quartz and feldspar. Small pegmatitic patches within the mass of the rock are not sufficiently frequent to be deleterious. Staining was not observed on any of the rock surfaces and quartz segregations are absent.

'The thickness of sheets in the quarry area measured from top to bottom are 2, 2, 3, 4, 2, 12, 10, and 4 feet [0.6, 0.6, 0.9, 1.2, 0.6, 3.6, 3.0, and 1.2 m]. The two thick sheets form the major producing zone. Outcropping parts of the thin upper sheets are present as erosional remnants on the northern slope of the ridge and hence their thicknesses are not constant. Jointing is poorly developed in one direction — N.45°E., and the interval is wide. The jointing is usually tight, almost healed, and is often marked by a ¼-inch [0.6 cm] bleached zone. The rock breaks well in directions parallel to the jointing and sheeting, and "plug and feather", and black-powder blasting techniques, are used in these directions. The third direction is difficult and requires channelling methods to insure a square cut.

'The granite is well exposed in outcrops along highway No. 17 for more than half a mile [1 km]. Commonly its structure is massive and sparsely jointed as in the quarry area, but towards the eastern limits two joint systems are developed. One is in a direction N.50°W. at intervals of 8 inches to 6 feet [20 cm to 1.8 m]; the other is north-south at 2 to 20 feet [0.6 m to 6 m]. Westward the granite contains blocks of amphibolite and it grades finally into a contorted *lit-par-lit* gneiss by injection between the bands of the flanking dark paragneiss.

'Physical properties of the Vermilion pink granite are as follows: compressive strength, 26,600 p.s.i.; absorption, 0.22 percent; bulk specific gravity, 2.60; weight per cubic foot, 162 pounds; abrasive hardness, 80.8.'

SUGGESTIONS FOR FUTURE MINERAL EXPLORATION

Information regarding the economic potential of various metallic and non-metallic mineral deposits has already been given in the above sub-sections.

Concentrations of sulphide minerals in the map-area are known to contain minor amounts of silver, zinc, lead, copper, nickel and cobalt. These occurrences are associated mainly with metasediments and intermediate metavolcanics, and are also associated possibly with ultramafic rocks. The above-mentioned metals appear to occur in small amounts.

However, only a limited amount of exploration work has been done on the sulphide occurrences. Examination of the metavolcanic-metasedimentary belt for economic sulphides should be continued.

Uranium mineralization, which is associated with pegmatite dikes, is generally erratic in distribution; near-surface enrichment of secondary minerals is common. The New Campbell Island Mines Limited deposit (6) in MacNicol Township has significant dimensions and grade to warrant exploration for similar deposits. At this deposit uraninite is associated with accessory magnetite. Apatite-bearing pegmatite bodies also should be examined for uranium mineralization.

Many of the late granite and quartz monzonite intrusions appear to be suitable sources for building stone.

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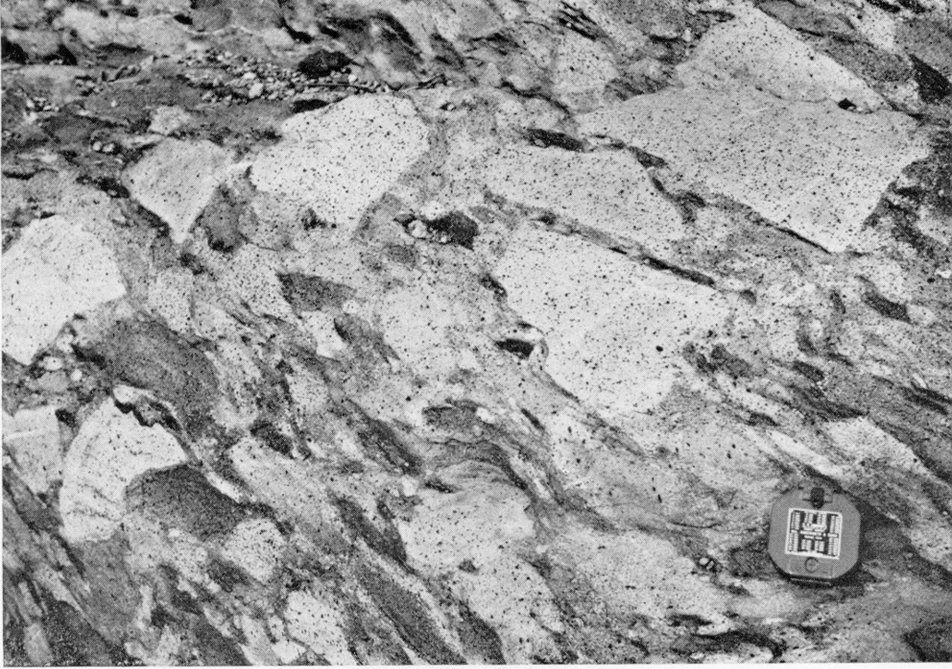
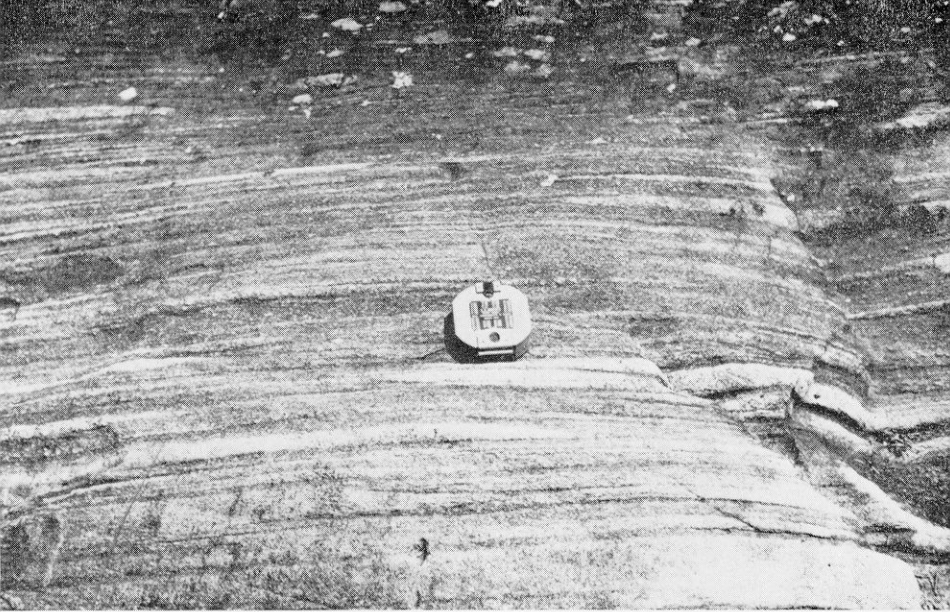
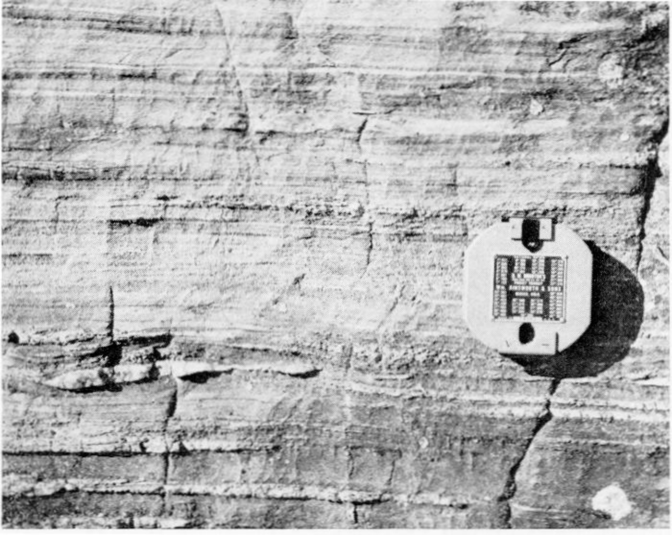
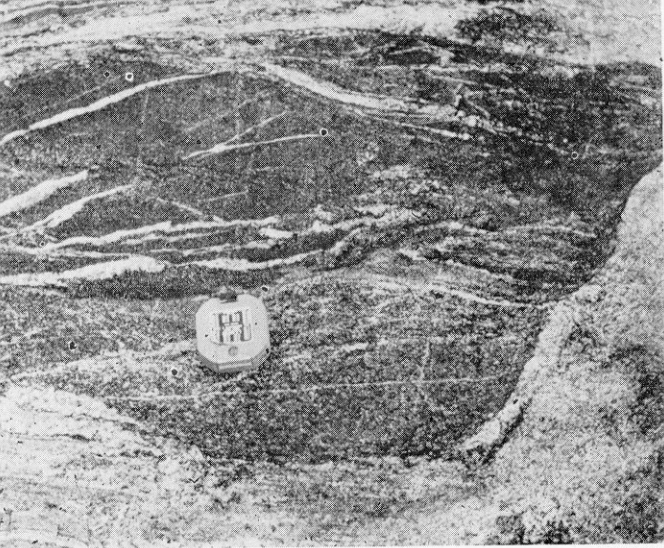
INDEX









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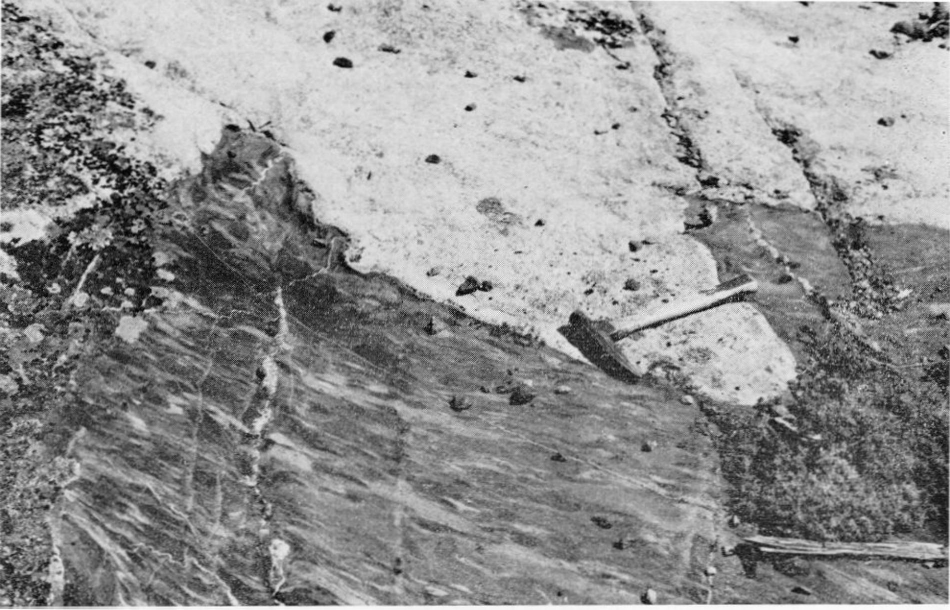
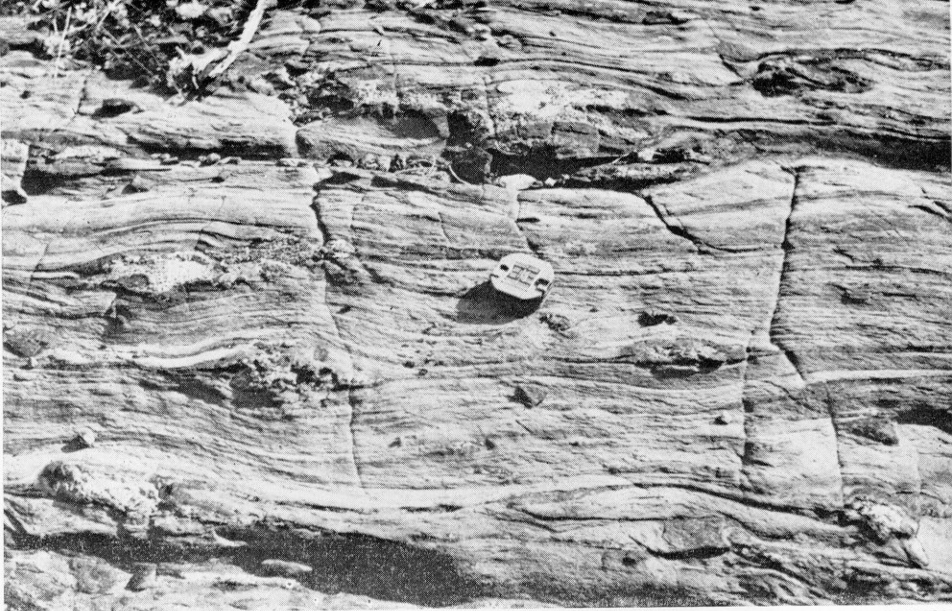




Bruin Lake—Edison Lake Area
Chart A
Figures 2, 4 and 5

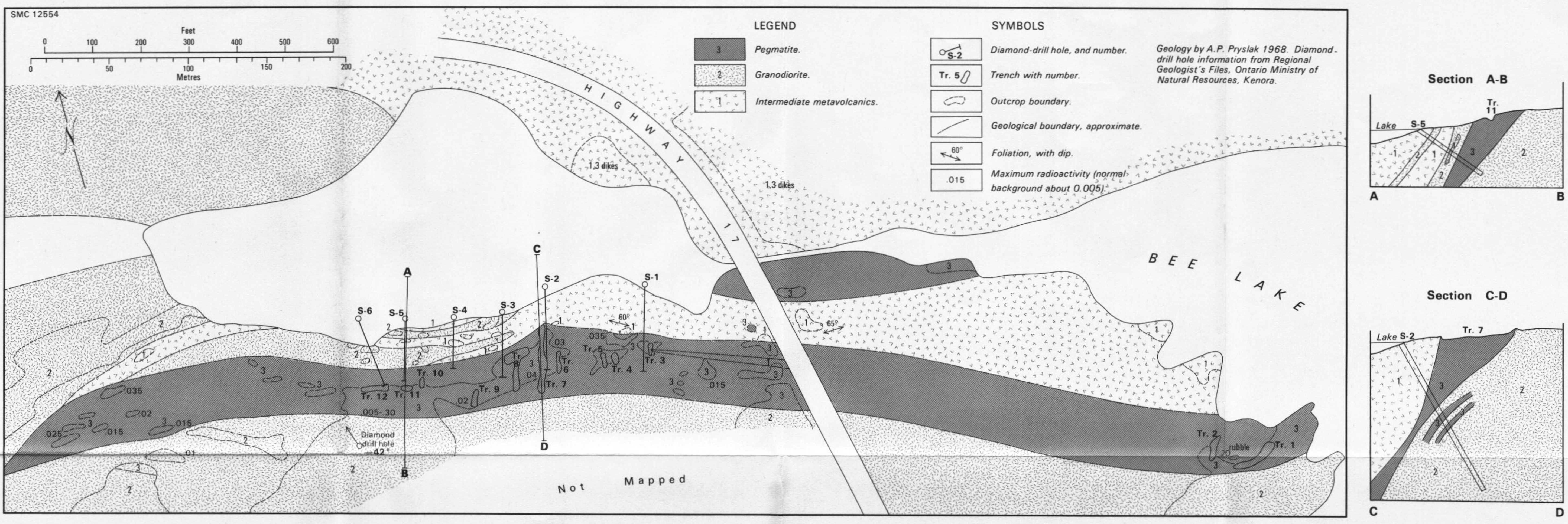


Figure 2—Plan and sections of Bee Lake Occurrence, Tustin Township.

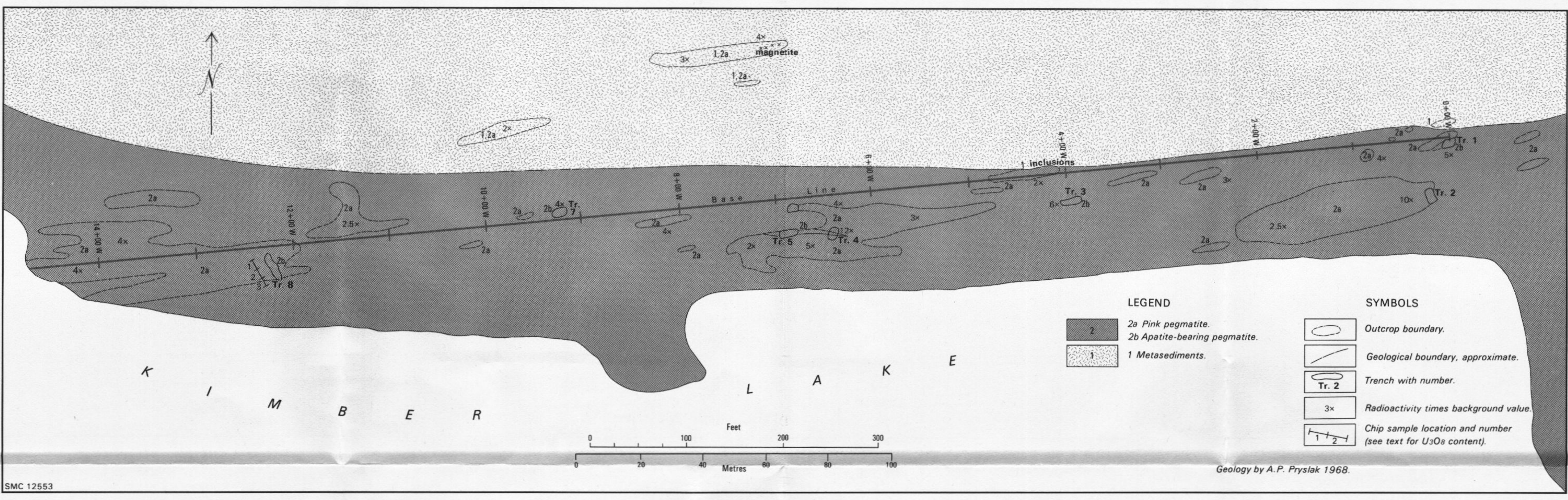


Figure 4—Geological sketch-map of the Kimber Lake Occurrence, Docker Township.

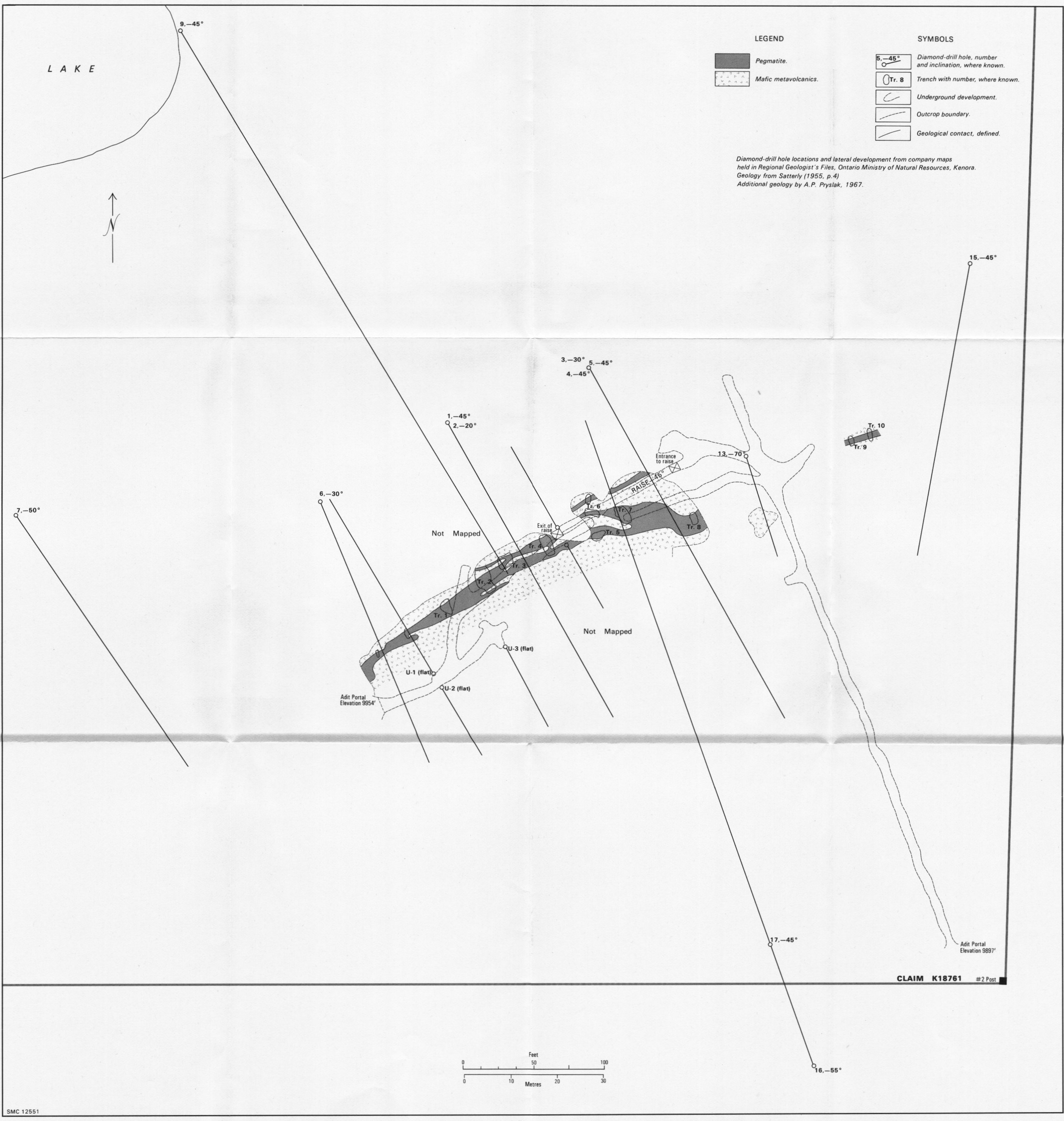


Figure 5—Plan of New Campbell Island Mines Limited Property, MacNicol Township.

ONTARIO
DIVISION OF MINES
HONOURABLE LEO BERNIER, *Minister of Natural Resources*
DR. J. K. REYNOLDS, *Deputy Minister of Natural Resources*
G. A. Jewett, *Executive Director, Division of Mines* E. G. Pye, *Director, Geological Branch*

Map 2302
MacNicol and Tustin Townships

SYMBOLS

- Glacial striae.
- Small bedrock outcrop.
- Area of bedrock outcrop.
- Bedding, top unknown; (inclined, vertical).
- Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).
- Lava flow; top (arrow) from pillows shape and packing.
- Schistosity; (horizontal, inclined, vertical).
- Gneissosity, (horizontal, inclined, vertical).
- Foliation; (horizontal, inclined, vertical).
- Lineation with plunge.
- Geological boundary, observed.
- Geological boundary, position interpreted.
- Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.
- Lineament.
- Drag folds with plunge.
- Anticline, syncline, with plunge.
- DH Drill hole; (vertical, inclined).
- RA Radioactivity.
- Swamp.
- (17) Motor road, provincial highway number encircled where applicable.
- Other road.
- Portage, trail, winter road.
- Township boundary, with milepost, approximate position only.
- Township boundary, unsurveyed, approximate position only.
- Property boundary, approximate position only.
- Surveyed line, approximate position only.
- 6 Location of property, surveyed. See list of properties and mineral deposits.
- (5) Location of property, unsurveyed, or mineral deposit. See list of properties and mineral deposits.

PROPERTIES, MINERAL DEPOSITS

MACNICOL TOWNSHIP

1. *Canadian Pacific Railway Co., (Hawk Lake ballast pit.)*
2. *Hawk Lake occurrence.*
3. *Kenoratomic prospect.*
4. *Kolak occurrence.*
5. *Machin, B. [1955].*
6. *New Campbell Island Mines Ltd.*
7. *Quebec Ascot occurrence.*
8. *Viceroy Uranium Corp. Ltd. [1956].*

TUSTIN TOWNSHIP

9. *Bee Lake occurrence.*
10. *Falconbridge Nickel Mines Ltd.*
11. *Falconbridge Nickel Mines Ltd., (Medicine Lake occurrence).*
12. *Heinz occurrence.*
13. *Octopus Lake occurrence.*
14. *Quebec Ascot occurrence.*

Information current to December 31st, 1970.
Only former properties on ground now open for staking are shown where exploration information is available. A date in square brackets indicates last year of unencouraging exploration activity. For further information see report.

SOURCES OF INFORMATION

Geology by A. P. Pryslak and assistants, Geological Branch, 1967.
Geology is not tied to surveyed lines.

Assessment work data on file with the Ministry of Natural Resources.

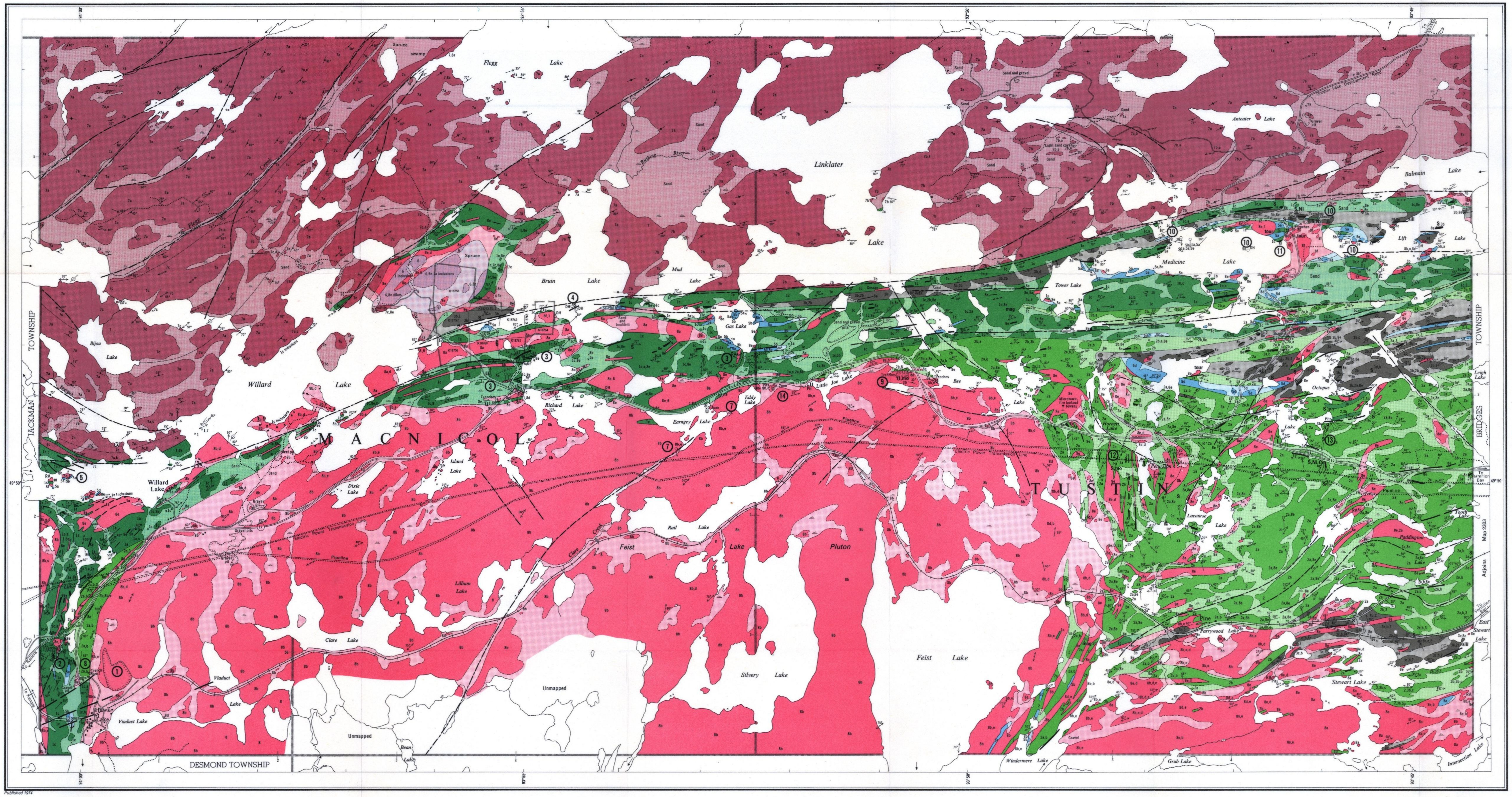
Aeromagnetic maps 1171G and 1179G; ODM-GSC.

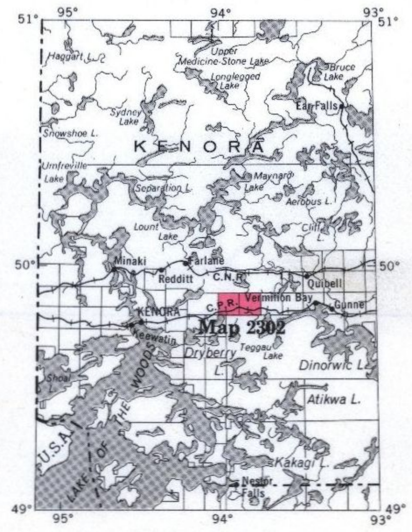
Preliminary maps P.471, MacNicol Township, and P.472, Tustin Township, scale 1 inch to ¼ mile, issued 1968.

Cartography by P. A. Wisbey, and assistants, Surveys and Mapping Branch, 1974.

Base maps derived from maps of the Forest Resources Inventory, Surveys and Mapping Branch, with additional information by A. P. Pryslak.

Magnetic declination in the area was approximately 6° East in 1967.





Scale, 1 inch to 50 miles
N.T.S. Reference 52E/16, 52F/13

LEGEND

CENOZOIC[a]

QUATERNARY

RECENT

Organic desposits; lacustrine and fluvial clay, silt, and sand.

PLEISTOCENE

Till; lacustrine sand, gravel, and clay.

UNCONFORMITY

PRECAMBRIAN[b]

LATE FELSIC INTRUSIVE ROCKS

FELSIC INTRUSIVE ROCKS

- 8 *Unsubdivided.*
- 8a *Granite.*
- 8b *Equigranular quartz monzonite and granodiorite.*
- 8c *Porphyritic biotite granodiorite.*
- 8d *Migmatite.*
- 8e *Pink pegmatite, pegmatitic granite, aplite.*
- 8f *White pegmatite.*

INTRUSIVE CONTACT (?)

ENGLISH RIVER BELT ROCKS

- 7 *Unsubdivided.*
- 7a *Equigranular granodiorite gneiss.*
- 7b *Porphyritic gneiss.*
- 7c *Equigranular, massive to foliated, quartz monzonite and granodiorite.*

INTRUSIVE CONTACT (?)

SYENITIC ROCKS

- 6 *Porphyritic syenite.*

INTRUSIVE CONTACT (?)

MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

- 5 *Unsubdivided.*
- 5a *Gabbro.*
- 5b *Peridotite.*
- 5c *Pyroxenite.*
- 5d *Amphibolite.*

INTRUSIVE CONTACT

EARLY FELSIC INTRUSIVE ROCKS

- 4 *Quartz-feldspar porphyry.*†

INTRUSIVE CONTACT (?)

METAVOLCANICS AND METASEDIMENTS

METASEDIMENTS

- 3 *Unsubdivided.*
- 3a *Muscovite-bearing greywacke.*
- 3b *Biotite-bearing greywacke.*
- 3c *Hornblende-bearing greywacke.*
- 3d *Garnetiferous greywacke.*
- 3e *Calc-silicate gneiss.*†
- 3f *Massive calc-silicate rocks.*

IF *Iron Formation.*†

INTERMEDIATE METAVOLCANICS

- 2 *Unsubdivided.*
- 2a *Pyroclastic rocks.*
- 2b *Hornblende-biotite-quartz-plagioclase schists and gneisses of uncertain origin.*

MAFIC METAVOLCANICS

- 1 *Unsubdivided.*
- 1a *Pyroclastic rocks.*
- 1b *Massive, pillowed, and amygdaloidal flows.*
- 1c *Hornblende-plagioclase and biotite-hornblende-plagioclase schists and gneisses of uncertain origin.*

Ag	*Silver.*†
be	*Beryl.*
Co	*Cobalt.*
mag	*Magnetite.*
mi	*Mica.*†
mo	*Molybdenite.*
Ni	*Nickel.*
Pb	*Lead.*†
S	*Sulphide mineralization.*
sill	*Sillimanite.*
st	*Stone.*†
ta	*Tantalite.*
tour	*Tourmaline.*
U	*Uranium.*
Zn	*Zinc.*†

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

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

†*Occurs on companion sheet only, Map 2303, Bridges and Docker Townships.*

Map 2302

MACNICOL and TUSTIN TOWNSHIPS

KENORA DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

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

ONTARIO
DIVISION OF MINES
HONOURABLE LEO BERNIER, *Minister of Natural Resources*
DR. J. K. REYNOLDS, *Deputy Minister of Natural Resources*
G. A. Jewett, *Executive Director, Division of Mines* E. G. Pye, *Director, Geological Branch*

SYMBOLS

- *Glacial striae.*
- *Small bedrock outcrop.*
- *Area of bedrock outcrop.*
- *Bedding, top unknown; (inclined, vertical).*
- *Bedding, top (arrow) from grain gradation; (inclined, vertical, overturned).*
- *Lava flow; top (arrow) from pillows shape and packing.*
- *Schistosity; (horizontal, inclined, vertical).*
- *Gneissosity, (horizontal, inclined, vertical).*
- *Foliation; (horizontal, inclined, vertical).*
- *Lineation with plunge.*
- *Geological boundary, observed.*
- *Geological boundary, position interpreted.*
- *Fault; (observed, assumed). Spot indicates down throw side, arrows indicate horizontal movement.*
- *Lineament.*
- *Drag folds with plunge.*
- *Anticline, syncline, with plunge.*
- DH — *Drill hole; (vertical, inclined).*
- RA — *Radioactivity.*
- *Swamp.*
- (17) — *Motor road, provincial highway number encircled where applicable.*
- *Other road.*
- *Portage, trail, winter road.*
- IV — *Township boundary, with milepost, approximate position only.*
- *Township boundary, unsurveyed, approximate position only.*
- *Property boundary, approximate position only.*
- *Surveyed line, approximate position only.*
- 18 — *Location of property, surveyed. See list of properties and mineral deposits.*
- (23) — *Location of property, unsurveyed, or mineral deposit. See list of properties and mineral deposits.*

PROPERTIES, MINERAL DEPOSITS

BRIDGES TOWNSHIP

15. *Coulee Lead and Zinc Mines Ltd.*
16. *Falconbridge Nickel Mines Ltd.*
17. *Falconbridge Nickel Mines Ltd. [1966]*
18. *Harrison, H. A.*
19. *Noranda Mines Ltd.*
20. *Noranda Mines Ltd. [1967]*
21. *Selco Exploration Co. Ltd.*
22. *Stephens, C. S. [1968]*
23. *Wilson, A. L. [1955]*

DOCKER TOWNSHIP

24. *Falconbridge Nickel Mines Ltd. [1966]*
25. *Kimber Lake occurrence.*
26. *Scotstown Granite Co. Ltd.*

Information current to December 31st, 1970. Only former properties on ground now open for staking are shown where exploration information is available. A date in square brackets indicates last year of unencouraging exploration activity. For further information see report.

SOURCES OF INFORMATION

Geology by A. P. Pryslak and assistants, Geological Branch, 1968. Geology is not tied to surveyed lines.

Assessment work data on file with the Ministry of Natural Resources.

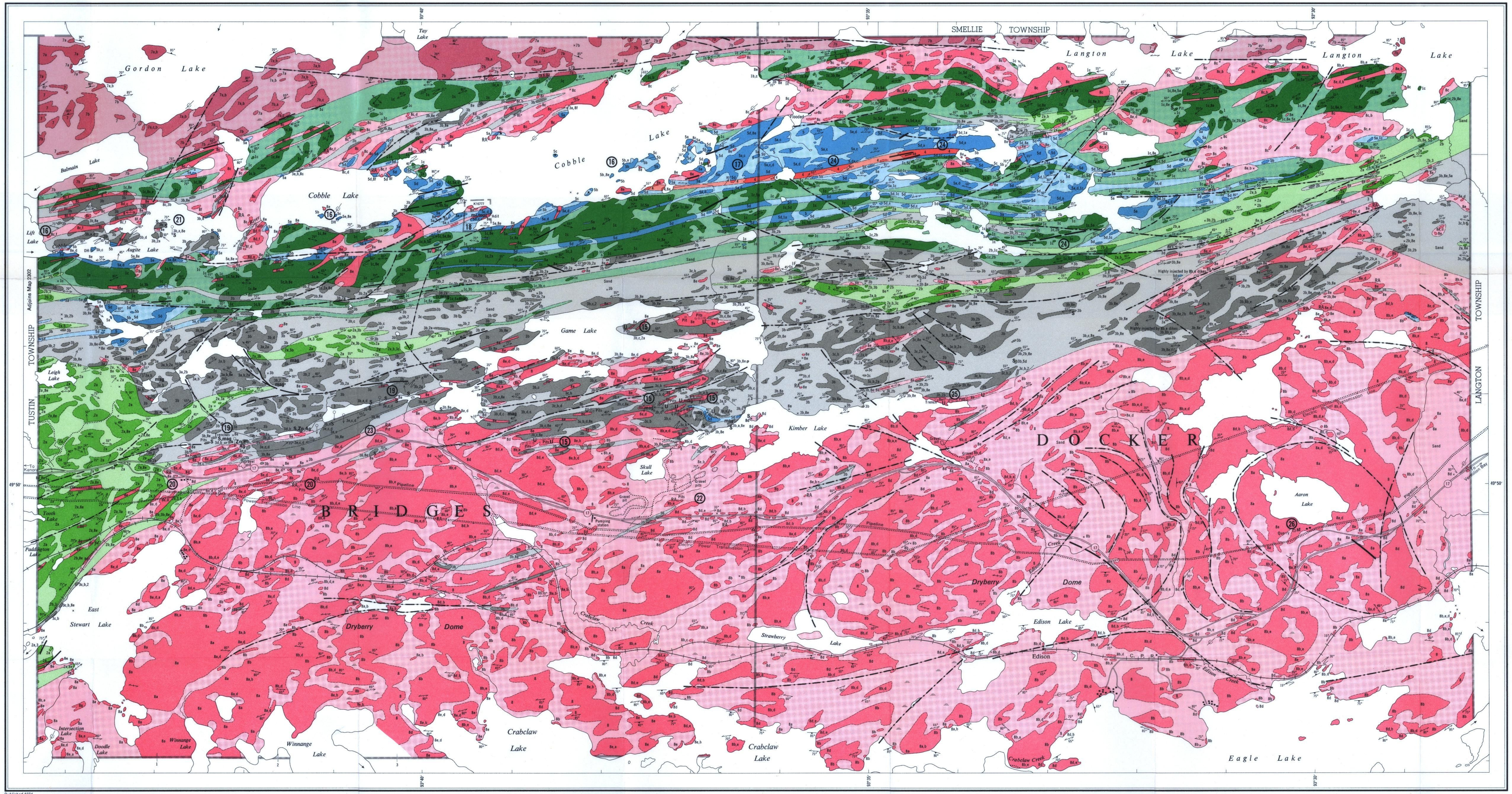
Aeromagnetic maps 1163G and 1171G; ODM-GSC.

Preliminary maps P.505, Bridges Township, and P.544 Docker Township, scale 1 inch to ¼ mile. issued 1969.

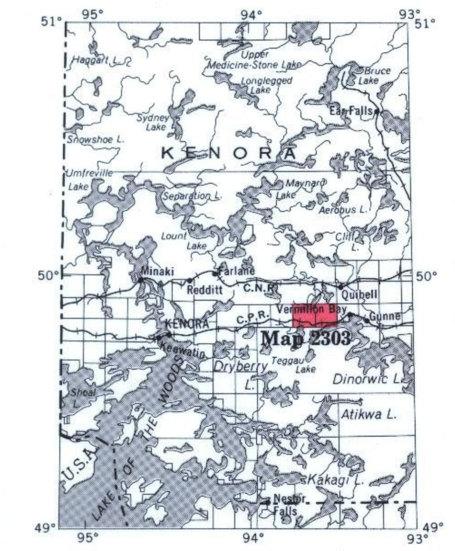
Cartography by P. A. Wisbey and assistants, Surveys and Mapping Branch, 1974.

Base maps derived from maps of the Forest Resources Inventory Surveys and Mapping Branch, with additional information by A. P. Pryslak.

Magnetic declination in the area was approximately 6° East in 1967.



Published 1974



Scale, 1 inch to 50 miles

N.T.S. Reference 52F/13, 52F/14

LEGEND

CENOZOIC[a]

QUATERNARY

RECENT

Organic desposits; lacustrine and fluvial clay, silt, and sand.

PLEISTOCENE

Till; lacustrine sand, gravel, and clay.

UNCONFORMITY

PRECAMBRIAN[b]

LATE FELSIC INTRUSIVE ROCKS

FELSIC INTRUSIVE ROCKS

- 8 *Unsubdivided.*
- 8a *Granite.*
- 8b *Equigranular quartz monzonite and granodiorite.*
- 8c *Porphyritic biotite granodiorite.*
- 8d *Migmatite.*
- 8e *Pink pegmatite, pegmatitic granite, aplite.*
- 8f *White pegmatite.*

INTRUSIVE CONTACT (?)

ENGLISH RIVER BELT ROCKS

- 7 *Unsubdivided.*
- 7a *Equigranular granodiorite gneiss.*
- 7b *Porphyritic gneiss.*
- 7c *Equigranular, massive to foliated, quartz monzonite and granodiorite.*

INTRUSIVE CONTACT (?)

SYENITIC ROCKS

- 6 *Porphyritic syenite.*†

INTRUSIVE CONTACT (?)

MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

- 5 *Unsubdivided.*
- 5a *Gabbro.*
- 5b *Peridotite.*
- 5c *Pyroxenite.*
- 5d *Amphibolite.*

INTRUSIVE CONTACT

EARLY FELSIC INTRUSIVE ROCKS

- 4 *Quartz-feldspar porphyry.*

INTRUSIVE CONTACT (?)

METAVOLCANICS AND METASEDIMENTS

METASEDIMENTS

- 3 *Unsubdivided.*
- 3a *Muscovite-bearing greywacke.*
- 3b *Biotite-bearing greywacke.*
- 3c *Hornblende-bearing greywacke.*
- 3d *Garnetiferous greywacke.*
- 3e *Calc-silicate gneiss.*
- 3f *Massive calc-silicate rocks.*

IF — *Iron Formation.*†

INTERMEDIATE METAVOLCANICS

- 2 *Unsubdivided.*
- 2a *Pyroclastic rocks.*
- 2b *Hornblende-biotite-quartz-plagioclase schists and gneisses of uncertain origin.*

MAFIC METAVOLCANICS

- 1 *Unsubdivided.*
- 1a *Pyroclastic rocks.*
- 1b *Massive, pillowed, and amygdaloidal flows.*
- 1c *Hornblende-plagioclase and biotite-hornblende-plagioclase schists and gneisses of uncertain origin.*

Ag	*Silver.*
be	*Beryl.*†
Co	*Cobalt.*†
mag	*Magnetite.*
mi	*Mica.*
mo	*Molybdenite.*†
Ni	*Nickel.*†
Pb	*Lead.*
S	*Sulphide mineralization.*
sill	*Sillimanite.*†
st	*Stone.*
ta	*Tantalite.*†
tour	*Tourmaline.*
U	*Uranium.*
Zn	*Zinc.*

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

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

† *Occurs on companion sheet only, Map 2302, MacNicol and Tustin Townships.*

Map 2303

BRIDGES and DOCKER TOWNSHIPS

KENORA DISTRICT

Scale 1:31,680 or 1 Inch to ½ Mile

Chains 80 60 40 20 0 1 2 Miles

Metres 1000 0 1 2 3 Kilometres

Feet 1000 0 5,000 10,000 Feet