MANITOBA

DEPARTMENT OF MINES, RESOURCES AND ENVIRONMENTAL MANAGEMENT

MINERAL RESOURCES DIVISION

MINERAL EVALUATION & ADMINISTRATION BRANCH

EXPLORATION OPERATIONS BRANCH

# REPORT OF FIELD ACTIVITIES 1976

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# THE MINERAL EVALUATION AND ADMINISTRATION BRANCH

## INTRODUCTION

This Branch has been in operation for nearly two years and its field activities have developed to the point where it can now report on some of its more significant activities.

The Branch comprises three sections: Mineral Evaluation, Mineral Administration and Mineral Economics. The Mineral Evaluation Section is concerned with the evaluation of the metallic and non-metallic mineral resources of the Province, including industrial minerals, and it is primarily with the activities of this section that this report will deal. These activities include detailed geological studies of mines and mineralized areas, mineral inventory, computerization of mineral deposit data and assessment data, and a study of aggregate resources in the Province. The program has received an impetus through two cost-shared Federal/Provincial Agreements: (1) the Non-Renewable Resource Evaluation Program (N.R.E.P.), and (2) the Mineral Exploration and Development Agreement, both of which commenced in April, 1975.

F.J. Elbers

## GOLD EVALUATION PROGRAM

*By J.W. Stewart*

Following a review of literature dealing with Manitoba gold occurrences, a geological reconnaissance was made of the principal auriferous areas of the northern part of the Province. These areas include the Lynn Lake and Flin Flon greenstone belts in the Churchill Province and several belts of Archaean volcanic rocks in the Superior Province within a radius of approximately 200 miles south and east of Thompson. Scattered throughout the areas are scores of gold prospects and a handful of former producing mines; of these the Nor-Acme mine at Snow Lake was by far the most important, yielding precious metals valued at $19,354,819 (Davies et al, 1962, p. 82). These occurrences have received little attention in recent years and published and unpublished accounts are largely restricted to routine descriptions of the mineralization, accompanied in some instances by opinions on the immediate structural controls of the ore shoots. Assays for precious metals, and to a lesser extent for base metals, are the only laboratory data consistently presented.

New concepts of gold metallogenesis which are enjoying increasing acceptance emphasize a genetic relationship between gold deposits and certain lithologies within the predominantly subaqueous volcanic accumulations with which the deposits so frequently are associated (e.g. Hutchinson, 1975). Observations made at various gold localities in northern Manitoba this summer indicate a genetic link between individual deposits and certain formations in the volcanic country rocks. At other localities, however, no such relationship can be discerned, possibly because it has been obscured by metamorphism or tectonism or simply because of limited outcrop.

Considering more specific aspects of stratigraphic control (Imreh, 1976; Pyke, 1976; Ridler, 1970) ultramafic effusives are not known to be present in the vicinity of any of the occurrences visited, and only at Island Lake Gold Mine (Phil Group) was stratified carbonate observed as part of the association. However, Russell (1957) shows that stratified carbonate rock occurs at many gold localities near Snow Lake which were not included in this summer's reconnaissance.

The clearest and most common gold association observed is with horizons of silicic rock ranging in aspect from felsitic to cherty. All of the gold prospects visited at North Knee Lake and Gods Lake — including former producers — are of this type, and representatives were found in other auriferous areas. These silicic horizons occur within sequences of mafic volcanic rocks and in some cases have been observed to persist for a minimum strike distance of several kilometres; only locally does thickness exceed two metres.

Clearly, further investigation of the relationship between gold mineralization and volcanic stratigraphy could prove a valuable aid to regional mineral exploration, and facilitate estimation of gold resources. Several difficulties are apparent, of which the most serious is poor exposure. At the sites of known gold occurrences none of the old underground workings are accessible, outcrop is extremely restricted or covered by waste, and drill core has mostly long since disappeared. On the positive side, it is generally possible to identify in the dumps adjoining the old shafts most or all of the rock types described in earlier geological accounts of the associated deposit.

After consideration of the data collected during the field season, areas where more detailed investigation can most profitably be directed will be selected for future study.

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## MEA-2

## URANIUM EVALUATION PROGRAM

*By J.W. Stewart*

Activities were confined to the Kasmere Lake region in the extreme northwest of the Province, where a G.S.C. uranium reconnaissance program was carried out in the summer of 1975 under the Federal/Provincial Agreement on Mineral Exploration and Development. The results of the Skyvan radiometric survey and of a lake sediment geochemical survey were released in March of 1976. Considerable exploration activity has resulted from this stimulus. Early in the season 10 exploration permits were taken out, and between mid March and mid September groups of claims were staked at more than 30 localities. As practically all of the areas characterized by anomalously high uranium are presently staked, or covered by exploration permits, this account must avoid reference to specific anomalies and mineralized areas, except where the data are already published or in open assessment files.

The results of the Manitoba Mines Branch Kasmere Project, in the form of a geological report and accompanying 1:50 000 maps (Weber et al, 1975) have provided a useful introduction to the geology of the region. Inevitably, new outcrops have been discovered during prospecting, and in a region where exposure on average does not exceed 2% these outcrops are not always of the lithology predicted by extrapolation from distant known outcrops. The geological units referred to by number in the following text are those described by Weber et al (1975) — see legend of accompanying map.

Field work in the region this summer was mainly directed toward familiarization with the geology, and examination of the known uranium occurrences. In addition, most of the principal areas of radiometric and geochemical anomaly revealed by the 1975 G.S.C. reconnaissance were visited with a view to determining their characteristics and cause.

Geological environments favourable for the concentration of uranium have been comprehensively described by Weber et al, 1975, p. 141. With minor modification, these might be listed as follows:

(a) unconformities between bodies of Archaean granite (units 1-4) and adjacent metasediments
(b) unconformities between metasedimentary units
(c) certain metasedimentary horizons — particularly calc-silicate-rich layers in units 7 through 10
(d) lits, veins, dikes, and larger cross-cutting bodies of leucocratic granite (alaskite), locally pegmatitic, derived by partial anatexis of comparatively aluminous metasediments, particularly units 7 and 10; typically these anatexites are white
(e) anatectic granitic mobilizates similar to those of (d) but generally pink or red, derived from arkosic rocks of unit 12 and other quartzo-feldspathic rock types
(f) faults and other structural traps

During exploration activity in 1968-69 various examples of uranium mineralization were found associated with environments (c), (d) and (e).

Most of the present permit areas and claim blocks fall into one or other of two groups. *The first group*, which includes the majority of the claim blocks and three of the permit areas, is concentrated within a metasedimentary belt which trends northeast through Snyder, Kasmere, and Putahow Lakes; about 115 km of the belt is within Manitoba. Unit 7 is dominant in the belt, and areas of units 10, 12 and 14 are also present. Anatexis has been widespread, particularly in the northeast towards Nahili Lake, where granites of unit 17 form large masses. Almost all of the known uranium occurrences lie in what conveniently may be called the Snyder-Putahow belt, and are associated with (c) and (d) environments. Important characteristics of the belt are (1) sizable zones of radiometric anomaly characterized by a high U:Th ratio, occurring south and southwest of Kasmere Lake and on the north and west sides of Snyder Lake, and (2) a high incidence of anomalous uranium content in lake sediments.

*The second group* is mainly represented by five permit areas which lie on a NNE-trending line about 85 km long which passes just east of Lac Brochet. Granitic rocks, including Archaean plutons (units 2c, 3, 4 and 4a) and a Hudsonian granite-migmatite association (units 19 and 12) occupy the greater part of each of the areas. The airborne radiometric expression of extensive areas of this granitic terrain is strong to very strong, and the uranium anomalies are near-coincident with substantial thorium anomalies. Compared with the Snyder-Putahow belt, the U:Th ratio of the radiometrically anomalous zones is low; also, lake sediment samples with high uranium content are uncommon, except in the vicinity of Lac Brochet.

On the basis of geological observations throughout the Kasmere Lake region, it is considered quite likely that uranium mineralization of environment (e) type may be found within the radiometrically anomalous granitic areas with which the second group of mineral dispositions is associated. The presence of narrow belts of rocks of unit 7 disposed around and between the plutonic masses raises the possibility of mineralization related to environments (c) and (d). As in the Snyder-Putahow belt, fault-related mineralization — environment (f) — is a possibility to be watched for. Still at the level of conceptual geology, uranium mineralization might occur in association with unconformities overlying the Archaean granitic bodies (environment "a").

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## NON-RENEWABLE RESOURCE EVALUATION PROGRAM

## (N.R.E.P.)

N.R.E.P. is a four year Federal/Provincial program aimed at an evaluation of the known and potential mineral resources of Manitoba, and the economic aspects of their development. The program commenced in April, 1975 and a full account of the first year's activities is published as a separate report (MRD open file report 76/1).

During the summers of 1975 and 1976, field work for the massive sulphide project was carried out by J. Koo in the Lynn Lake and Ruttan Lake areas (MEA-3), and by G. Gale in the Flin Flon and Snow Lake areas (MEA-4). Field work for the project on disseminated base metal environments was carried out by D. Baldwin in the Flin Flon and Snow Lake areas (MEA-5), while evaluation of nickel environments was started by R. Pinsent in the Lynn Lake area (MEA-6), and by P. Theyer in the Thompson nickel belt and the Superior Province. In addition to detailed observations of present Ni-producing mines, P. Theyer has undertaken a geological reconnaissance of potential Ni-environments both in the Superior and Churchill province. An age dating program was initiated by him in the Thompson nickel belt with the aim of either directly or indirectly arriving at the age of the mineralization.

# EVALUATION OF MASSIVE SULPHIDE ENVIRONMENTS IN THE LYNN LAKE — LEAF RAPIDS REGION

*By J. Koo*

**Introduction:**

Under the joint Federal and Provincial Non-renewable Resource Evaluation Program (N.R.E.P.), the present work has been conducted to evaluate massive sulphide environments in the Precambrian Wasekwan volcanic-sedimentary belt. This belt extends over an area of approximately 180 km long and up to 30 km wide from the Fox mine to the Ruttan mine in the Lynn Lake — Leaf Rapids region (Figure 1). The regional geology of Lynn Lake — Leaf Rapids is known largely from the comprehensive reviews made by Milligan (1960), Roy and Haugh (1971), Coats et al (1972) and McRitchie (1974).

Since the earliest known geological work during the 1930's, some 70 massive sulphide deposits have been found within the Wasekwan volcanic-sedimentary belt in the Lynn Lake — Leaf Rapids region. During the 1960's, the Ruttan and Fox massive Cu-Zn sulphide deposits were discovered and have been operating since as the only combined Cu-Zn producers in the Lynn Lake — Leaf Rapids region. Proven reserves of Cu-Zn ore in the Ruttan and Fox mines at the end of 1975, according to Sherritt Gordon Mines Ltd. 1975 annual report, were 43.6 million tons (1.45% Cu and 1.45% Zn) and 8.7 million tons (1.92% Cu and 2.08% Zn), respectively.

During the summers of 1975 and 1976, field work was carried out to examine the Ruttan and Fox Cu-Zn mines and the other massive sulphide deposits in the region. Underground and/or surface investigations were conducted at the two mines and the other deposits with significant amounts of outcrops. Drill core examinations were crucial to obtain the field data on some deposits with sparse or no outcrops. The cooperation offered by Sherritt Gordon Mines Ltd. is gratefully acknowledged.

**Distribution of "High Cu-Zn" and "Low Cu-Zn" Massive Sulphide Deposits:**

The terms "high Cu-Zn" and "low Cu-Zn" define massive sulphide deposits with "Cu $>$ 0.5% and/or Zn $>$ 1%" and "Cu $<$ 0.5% and/or Zn $<$ 1%" respectively, as encountered in the major portions of the massive sulphide bodies. The "high Cu-Zn" massive sulphide deposits are polymetallic (i.e. chalcopyrite-sphalerite-pyrite-pyrrhotite assemblages), whereas the "low Cu-Zn" massive deposits are largely barren (i.e. pyrite-pyrrhotite assemblages).

The "high Cu-Zn" massive sulphide deposits are clustered interestingly in four different segments of the Wasekwan belt centered near Fox mine, Lynn Lake, Barrington Lake, and Ruttan mine respectively (called "centres" hereinafter). These four "centres" of "high Cu-Zn" mineralization are approximately equally spaced at intervals of 50 km. Cu-Zn mines have not yet been discovered in the two "centres" near Lynn Lake and Barrington Lake.

The "low Cu-Zn" massive sulphide deposits are widely distributed within and outside the four "centres" of "high Cu-Zn" mineralization.

**Stratigraphic Controls of the Massive Sulphide Deposits:**

The massive sulphide lenses are in many cases confined to felsic tuffaceous strata. Discontinuous, lensoid layers of siliceous and/or pelitic rocks occur near the tuffaceous units in the stratigraphic sequences. The "high Cu-Zn" massive sulphide layers, including the massive Cu-Zn sulphide ore lenses at the Ruttan and Fox mines, tend to occur preferentially within the tuffaceous strata. In detail, the "high Cu-Zn" massive sulphide bodies occur within or directly above or below the tuffaceous host units which in places display quartz and/or feldspar "eyes". However, the "low Cu-Zn" massive sulphide lenses occur not only in the tuffaceous units but also in the siliceous and/or pelitic units.

Even though the massive sulphide lenses are essentially conformable with the enclosing wall rock layers, some massive sulphide deposits (e.g. Ruttan and Fox) in detail display complex structural settings and considerable cross-cutting relationships. These structural complexities are due to post-ore folding, faulting and metamorphic mobilization relative to their enclosing wall rocks. These deformational and metamorphic aspects of the massive sulphide deposits will be reported in detail in a subsequent report.

The "high Cu-Zn" massive sulphide deposits commonly show a mineralogical zoning in which the sphalerite (Zn)-rich zone stratigraphically overlies the chalcopyrite (Cu)-rich basal zone. This conforms with the widely accepted volcanogenic massive sulphide deposit model (Sangster, 1972).

The "high Cu-Zn" massive sulphide layers and the tuffaceous host units are in many cases stratigraphically underlain by thick (up to 1500 m) piles of coarse-grained, polymictic volcaniclastic rocks together with volcanic flows of mafic to intermediate composition. The volcaniclastic piles are commonly thin or virtually absent in the footwall sequences of the "low Cu-Zn" massive sulphide deposits. The clasts in the footwall volcaniclastic units are conspicuously larger (up to 3 m across) and more densely populated in proximity to the "high Cu-Zn" massive sulphide deposits than the "low Cu-Zn" massive sulphide deposits.

The Wasekwan volcanic-sedimentary sequences comprise localized felsic volcanic piles composed of flows, sills, dykes and breccias (e.g. Steeves and Lamb, 1972; Zwanzig, 1974; Gilbert, 1976). These felsic volcanic piles are localized predominantly in the four "centres" of "high Cu-Zn" mineralization within the Wasekwan belt. Felsic volcanic intrusions with quartz and/or feldspar phenocrysts commonly occur in the volcanic-sedimentary sequences stratigraphically underlying the "high Cu-Zn" massive sulphide deposits (e.g. Ruttan and Fox).

The "high Cu-Zn" massive sulphide zones are stratigraphically overlain by and/or laterally transitional into the "low Cu-Zn" massive sulphide zones within the "centres" of "high Cu-Zn" massive sulphide mineralization. The "low Cu-Zn" massive sulphide zones are also mutually connected at or near the same stratigraphic horizons, in many cases through "low Cu-Zn" disseminated sulphide zones, and form widespread massive Fe-sulphide formations extending beyond the four "centres".

In places such as Hughes Lake (Zwanzig, 1974), the massive Fe-sulphide layers are stratigraphically overlain by and/or laterally transitional into massive Fe-carbonate and Fe-oxide layers. According to Goodwin and Ridler (1970), these types of Fe-rich layers can be considered as iron formations of the sulphide, carbonate and oxide facies indicative of a basin-to-shelf transition.

Graphite occurs in a majority of the "low Cu-Zn" massive sulphide zones. In contrast, the "high Cu-Zn" massive sulphide zones themselves are virtually devoid of graphite. However, a complicating factor is that graphite can be expected to occur in proximity to the "high Cu-Zn" massive sulphide zones since both the "high Cu-Zn" and "low Cu-Zn" types of massive sulphide zones are mutually transitional within the same or narrow stratigraphic horizons in many places.

**Wall Rock Alteration:**

The "high Cu-Zn" massive sulphide deposits, including the Ruttan and Fox mines, show chloritization (or the metamorphic equivalent anthophyllite-cordierite), sericitization, silicification, carbonatization and sulphidation in their stratigraphic footwall rocks. The chloritic alteration increases in intensity towards the massive Cu-Zn sulphide layers and is closely associated with semi-massive and/or stringer mineralization composed mainly of chalcopyrite and pyrrhotite. Sericitic and silicic alteration occurs around the chloritized zone stratigraphically below the massive Cu-Zn sulphide zone. The wall rock alteration and stringer sulphide zones cross-cut overall sequences of the volcaniclastic piles underlying the massive Cu-Zn sulphide bodies. Such footwall alteration and stringer sulphide zones have not been identified in the "low Cu-Zn" massive sulphide deposits.

**Metallogenic Model:**

The volcanic exhalative model (eg. Sangster, 1972) accounts for most features characteristic of the massive sulphide deposits in the Wasekwan belt. During quiescent periods in the Wasekwan volcanism and sedimentation, metalliferous fumarolic exhalations were precipitated as massive sulphide bodies penecontemporaneously with the tuffaceous, silicic (cherty) and/or pelitic sediments. Genetically important to massive sulphide deposits are, among others, the thick polymictic volcaniclastic piles as metal source rocks, and the localized felsic volcanism as driving mechanism for exhalative activity (Franklin, 1976). Significantly, the "high Cu-Zn" massive sulphide deposits, including the Ruttan and Fox mines, are all associated with hydrothermal alteration and stringer sulphide mineralization which have affected the thick piles of polymictic volcaniclastic rocks within the four "centres" of "high Cu-Zn" mineralization and felsic volcanism. It is conceivable that local felsic volcanism would have generated local anomalous heat flow patterns resulting in convection of interstitial water which leached metals (ie., Fe, Cu, Zn) mainly from the mafic components of the thick volcaniclastic piles.

Since the "high Cu-Zn" massive sulphide layers in many places are transitional into the "low Cu-Zn" massive sulphide layers (Fe-formations) at or near the same stratigraphic horizons, both "high Cu-Zn" and "low Cu-Zn" massive sulphide layers apparently have been deposited penecontemporaneously. It is therefore, suggested that the "high Cu-Zn" massive sulphide layers have resulted from proximal precipitation of Cu-and Zn-sulphides together with abundant Fe-sulphides largely at or near the exhalative vents. Further away from the vent areas however, the "low Cu-Zn" massive sulphide layers were formed due to distal precipitation of almost entirely Fe-sulphides.

**Recommendations:**

The four "centres" of "high Cu-Zn" mineralization have high-rated potential for new, volcanogenic massive Cu-Zn sulphide orebodies within the Wasekwan belt. Accordingly, it is recommended that further detailed exploration be concentrated inially within the four "centres" of "high Cu-Zn" mineralization. Additional "centres" may be present in other localities of the Wasekwan belt and should be searched for in regional mapping and exploration.

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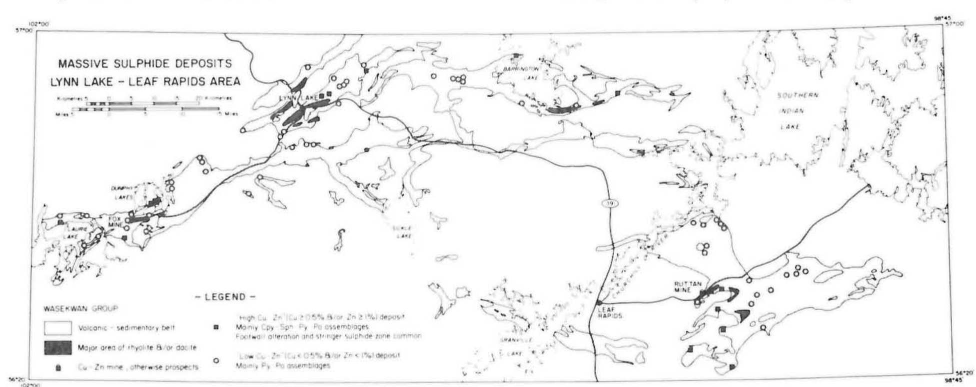


**Figure MEA-3-1: Location of Field Activities.**

**MEA-4**

## INVESTIGATION OF MASSIVE SULPHIDE ENVIRONMENTS IN THE FLIN FLON — SNOW LAKE GREENSTONE BELT

*By G.H. Gale*

Selected massive sulphide deposits and prospects were investigated in order to document the geological environments in which they formed. The main emphasis has been on determining: (a) the hanging wall and footwall lithologies; (b) the nature and extent of visible alteration when present; (c) the relationship of sulphides to enclosing rock units; (d) the stratigraphic position of the mineralized units and the regional extent of these horizons. Sample suites of sulphides and host rocks have been collected for petrological, mineralogical and geochemical studies.

Although in detail each deposit has some features such as mineralogy and chemistry that set it apart from others in the area, there are a number of features which are common to most if not all of the massive sulphide deposits in the region. Some of the most common features are:

(1) the deposits are of the stratabound type. However local crosscutting relationships due to deformation and mobilization are present in some deposits.

(2) the majority of the deposits consist of a massive sulphide lens and a stratigraphically underlying zone of stockwork mineralization, and/or alteration. Occasionally the metal content of the stockwork zone is of ore grade (Flin Flon Mine).

(3) the sulphide deposits occur within volcanogenic rock sequences and usually in the upper portions of a volcanic cycle which, in general, consists of a basal lava unit containing pyroclastic rocks overlain by a sequence of volcaniclastics interbanded with volcanogenic sediment. The immediately overlying* rocks to the massive sulphides are, where not extensively altered, distinguishable as fine grained volcanogenic sediments. The rocks immediately overlying the polymetallic sulphide are fine grained sediments (including argillite and earthy pyrite), fine to coarse volcaniclastics or lavas. The start of a new volcanic cycle may be indicated by renewed extrusion of mafic to intermediate lavas (Flin Flon Mine) or the influx of volcanic sediment (Chisel Lake Mine).

(4) the present configuration of the deposits, i.e. elongated, often ruler shaped, ore lenses is a result of tectonism. Fold structures are commonly present in the sulphide bodies (eg. Chisel Lake and Anderson Lake Mines). In the majority of the deposits minor mobilization of sulphides has occurred both during tectonism and late stage brittle deformation.

(5) metamorphic grade in the vicinity of mines in the Flin Flon area is middle greenschist facies. Pyrite is generally the dominant sulphide mineral in the alteration zone; however, pyrrhotite is also common in the Pine Bay deposit alteration zone. Sphalerite and/or chalcopyrite stringers are also present in the alteration zones but are less extensive than the pyrite $\pm$ pyrrhotite stringer mineralization and tend to be restricted to small zones within a much larger pyrite $\pm$ pyrrhotite envelope. Chlorite, quartz and carbonate are more abundant in the alteration zones than in the surrounding country rocks and appear to have been formed by pre-metamorphic introduction of constituents during the mineralizing activity; in several places (eg. Schist Lake Mine and the Baker Patten deposit) a distinctive black magnesian chlorite is present. In the Snow Lake area (where the metamorphic grade is almandine — amphibolite facies) the sulphide mineralogy of alteration zones is similar to that of the Flin Flon area; the silicate phases include kyanite, garnet and chlorite. The chlorite minerals are of syn-deformation age, and like those in the Flin Flon mining camp, they define a well developed mineral fabric whereas the kyanite and garnets are the result of post-deformational static growth. In the Joannie deposit garnets enclosing chalcopyrite provide evidence for the presence of sulphides in the rock prior to the end of the regional metamorphism. Chalcopyrite veins in the Joannie deposit and Stall Lake Mine postdating the regional penetrative deformation attest to the local mobilization of sulphides into fractures during a late stage brittle deformation.

* Overlying and underlying are used to reference the stratigraphically overlying and stratigraphically underlying rocks to a deposit regardless of its present structural position.

Preliminary analysis of collected data indicates that the economic sulphide deposits are not restricted to a single stratigraphic level throughout the Flin Flon — Snow Lake area. The major sulphide deposits in the Snow Lake area appear to be contained within a single volcanic cycle; the stratigraphic position of the Osborne Lake Mine is still considered problematic even though it has been suggested that it could be close to the same stratigraphic horizon as deposits in the Snow Lake area (Moore & Froese, 1973). The absence of well established regional correlations of lithological units in the Flin Flon area precludes a definite correlation among the rock sequences or stratigraphic horizons containing the Flin Flon, Schist Lake, West Arm, White Lake, Cuprus, Pine Bay and Centennial Mines (Fig. MEA-4-1).

The Flin Flon and West Arm deposits are both overlain by lava and fragmental sequences. However the stratigraphic equivalence of these overlying sequences has not been definitely established. On the other hand the Schist Lake and Mandy Mines are situated within a volcaniclastic sequence that is overlain by highly calcareous cherty sediments, siltstones and grits; these rocks may be laterally equivalent to the Flin Flon hanging wall sequences.

In the Pine Bay — Centennial Mine area a thick pile of volcanic rocks represents a number of volcanic cycles which comprise dominantly silicic lavas and fragmentals, with minor mafic lava, greywacke and graphitic argillite. The sequence is westward younging and mineralization has been identified within at least seven different stratigraphic units from the Don Jon Mine in the east to the Centennial Mine in the west. Since three mines have been established and one deposit developed on different stratigraphic horizons in the volcanic pile it is apparent that polymetallic mineralizing activity was not limited to one stratigraphic horizon.

The Centennial deposit is located near the top of the volcanic pile and is stratigraphically overlain by mafic sandstones, graphitic and argillitic siltstones and sandstones, a barren pyrite formation and highly calcareous silicic rocks that are interpreted by the author as being of sedimentary origin. These rocks are overlain by, and are considered to grade into the Missi Group conglomerates, arkoses and siltstones. The highly calcareous silicic rocks at Centennial resemble the calcareous cherty rocks (Units 5C and 5 of Heywood, 1964) in the hanging wall of the Schist Lake Mine. The presence of outcrops of Missi Group rocks along the west shore of the northwest arm of Schist Lake suggests that the Schist Lake and Mandy Mines are also situated close to the Missi-Amisk contact and could therefore lie on or close to the same stratigraphic horizon as the Centennial Mine (Fig. MEA-4-1).

Although correlation of the silicic sediments to the east of the Cuprus Mine with the calcareous silicic sediments of the Centennial and Schist Lake Mines is tempting, it is unwarranted at this time in view of the unknown stratigraphic and structural position of the White Lake — Cuprus area in relation to other parts of the Flin Flon region.

In the Snow Lake region the zinc-bearing mineralized unit in the Anderson — Stall Lake area has been delineated and its approximate position on the limbs of a major early fold established at several localities.

In the Anderson Lake — Stall Lake area, copper-bearing massive sulphide deposits are contained within a thick sequence of dominantly silicic fragmental rocks which have been deposited, at least in part, as sediments. These are stratigraphically overlain by layered mafic sediments which are in turn overlain by pillow lava. A unit of predominantly silicic rocks stratigraphically underlying the mineralized horizons at the east end of Anderson Lake, mapped as pelitic and psammitic rocks by Moore and Froese (1973), is considered by the author to belong to the Amisk Group. This unit, which contains extensive areas with disseminated and stringer sulphides and local areas containing kyanite and chlorite that are similar to the rocks in the alteration zone underlying the Anderson Mine, has probably undergone alteration during the mineralizing activity that formed the massive sulphide deposits.

In the Chisel Lake area the Chisel and Ghost Lake Mines occur in fine grained silicic sediments at the top of a unit of silicic volcaniclastics and lavas and below a thick unit of mafic sediments that consist mainly of mafic sands and grits that are interbanded with coarser fragmentals, including pebble conglomerates and pyroclastics (?). Higher in the unit, the footwall silicic unit is underlain by a thick sequence of mafic rocks, the base of which has not been determined, that consist mainly of pillow lava, massive lava, and pyroclastics. At the top of the mafic unit there are water transported mafic fragmentals that exhibit a gradational and interbanded (probably sedimentary) relationship to the overlying silicic clastic rocks. A tightly folded local unit of bimodal (both mafic and silicic clasts) fragmentals may represent a fluviatile deposit in a major erosion channel.

A preliminary interpretation of the regional volcanic stratigraphy and the position of the major sulphide deposits is presented in Figure MEA-4-2. Further detailed mapping and structural studies are needed in the Flin Flon — Snow Lake region before a complete assessment of its massive sulphide potential can be made.

**References:**


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Heywood, W.W.
1964: Ledge Lake Area. *Geol. Surv. Can.* Map 1167A.

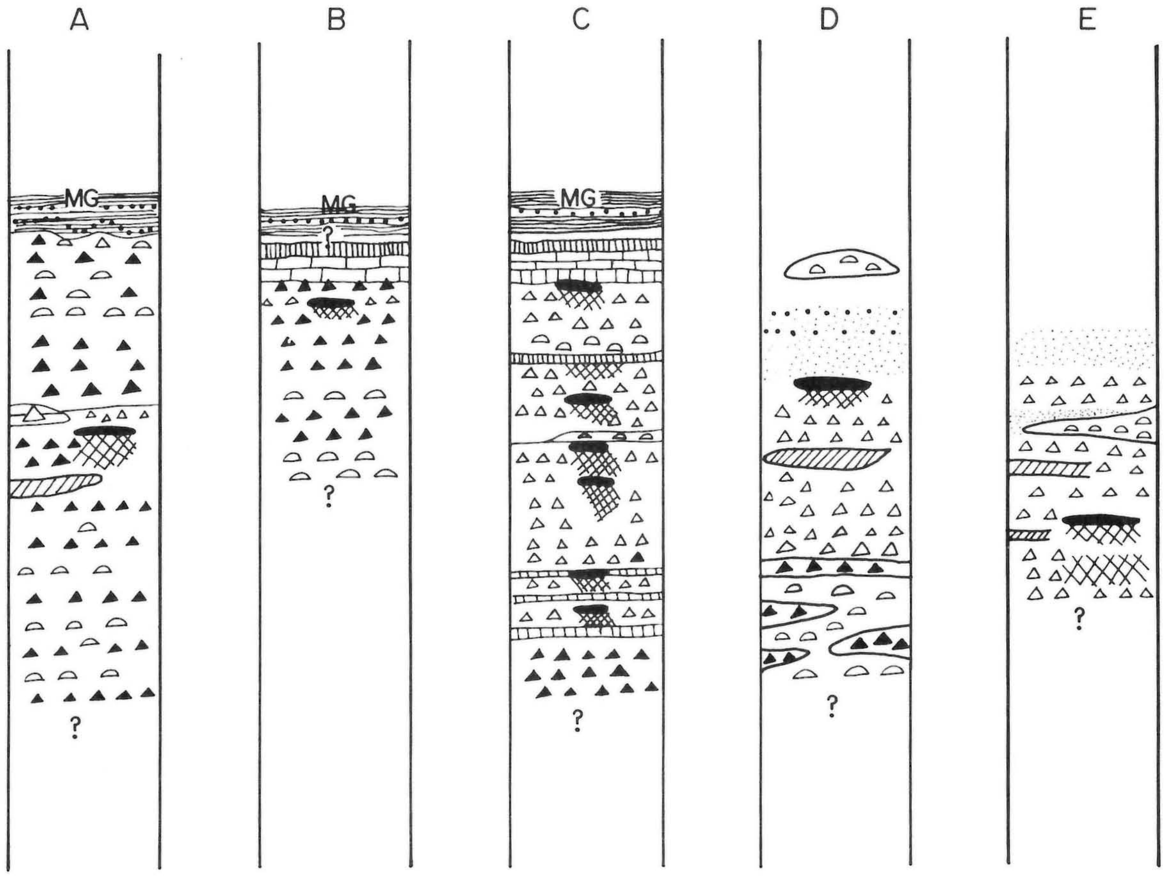




**Figure MEA-4-1: Generalized stratigraphic sketch of some mineralized horizons in the Flin Flon Mine Area; B. Schist Lake Mine Area; C. Pine Bay — Centennial Mine Area; D. Chisel Lake Mine Area; E. Stall Lake Mine Area.**

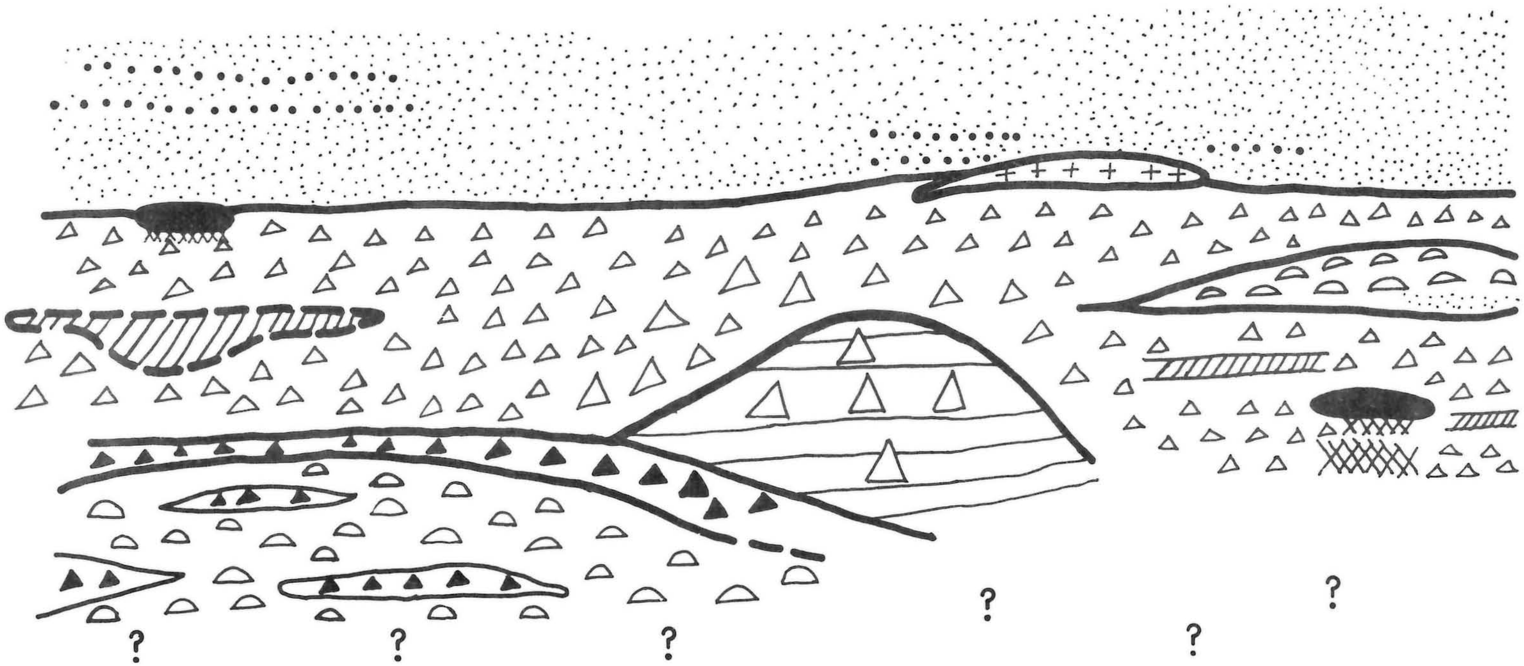
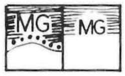


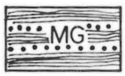
**Figure MEA-4-2: Schematic sketch to illustrate relative stratigraphic position of ore deposits in the Snow Lake region.**

## Legend for Figures MEA-4-1 and MEA-4-2

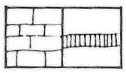

Massive sulphide deposit with alteration zone

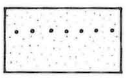


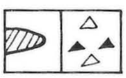
Unconformity with regolith; conformable (probably gradational) contact

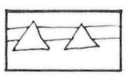


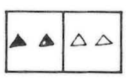
Conglomerate, arkose, psammite and pelite (Missi Group)

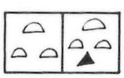

Calcareous silicic sediments; argillite, siltstones and grits (in part graphitic)

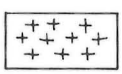

Mafic sediments and fragmentals


Bimodal fragmental; interbanded mafic and silicic fragmental


Silicic lava and coarse pyroclastic


Mafic fragmental; silicic fragmental. Partly or wholly water transported


Mafic pillow lava and lava; with pyroclastic and minor tuff


Quartz porphyry, probably intrusive

## DISSEMINATED BASE METAL ENVIRONMENTS

*By D. Baldwin*

### Introduction:

The project objective for the 1976 field season was to investigate areas in the Flin Flon — Snow Lake belt that may have a potential for large tonnage, low grade mineral deposits. The belt was chosen for this study because it is an active mineral producing area, outcrop is generally abundant and most of the area is easily accessible by road and/or river systems.

Intrusive granitic bodies of possible high level sub-volcanic emplacement were examined for disseminated copper and molybdenum mineralization, and associated contact metasomatic mineralization.

The intrusive bodies examined were: 1. the Cliff Lake Porphyry (Tanton, 1941; Stockwell, 1960); 2. a small porphyry body north of Whitefish Lake (Bateman and Harrison, 1945); 3. the quartz-eye granites south and northeast of Alberts Lake (Bateman and Harrison, 1945; Kalliokoski, 1953); 4. the quartz-eye granites near Nisto Lake (Buckham, 1944); 5. the Elbow Lake stock (McGlynn, 1959; Hunt, 1970); 6. the tonalite on Fourmile Island at Reed Lake (Harrison, 1949; Rousell, 1970); 7. the quartz-eye granite west of Chisel lake (Williams, 1966) and 8. the quartz-eye granites east of Wekusko Lake (Stockwell, 1937). Locations of these intrusive bodies are shown on the accompanying map (Fig. MEA-5-1).

### Geology:

The intrusive bodies at Cliff Lake, Elbow Lake, west of Chisel Lake and east of Wekusko Lake are similar in composition, texture, contact relationships and alteration. The rocks are quartz diorites, have granitic texture (hypautomorphic granular), are massive to faintly foliated, have characteristic quartz-eyes and weather white to buff-pink.

Quartz, plagioclase, biotite and hornblende are the main minerals. Quartz occurs as 1 to 4 mm clusters of anhedral crystals forming distinct "quartz-eyes" which are blue to white in colour. Plagioclase usually occurs in euhedral to subhedral crystals. Biotite forms individual flakes and hornblende poorly developed crystals.

The contact relationships with the enclosing volcanic country rock are clearly intrusive. Chilled margins have been observed locally and abundant inclusions of country rock occur near the contacts and decrease in number toward the centers of the bodies. The inclusions are sub-angular to angular and range in size from 2 cm up to several metres across. The xenoliths generally have a parallel alignment that reflects the bedding attitude of the enclosing volcanic rocks.

Chloritization and propylitization are the most obvious forms of alteration in hand specimen. Alteration appears to be fairly homogeneous throughout the bodies.

A small body of massive porphyritic syenodiorite occurs north of Whitefish Lake. Scattered, 3 to 5 mm, euhedral, zoned plagioclase phenocrysts occur in a matrix of 1 to 2 mm euhedral plagioclase and hornblende crystals; the plagioclase is pale green. Potassium feldspar, where present, occurs as 1 mm euhedral crystals. The outer margins of this intrusive body contain angular xenoliths of the greenstone country rock. Some xenoliths have been brecciated. Contact metamorphism to hornblende hornfels facies has been imposed upon the country rocks.

The quartz-eye granite between Twin Lakes and Nisto Lake, and the quartz-eye granite south and northeast of Alberts Lake are medium to fine grained, massive, and quartz diorite to quartz monzonite in composition. Plagioclase and potassium feldspar are euhedral and equigranular. Quartz forms 1 to 2 mm euhedral crystals. Biotite and/or hornblende are present in variable amounts. The rocks appear fresh and unaltered in hand specimen. Quartz veins up to 1.5 cm are abundant.

Contact relationships with the volcanic country rocks are not exposed but xenoliths up to ten centimetres across have been observed.

Harrison (1949) described "quartz-eye" granite on Fourmile Island; Rousell (1970) described the same rocks (his unit 7) as sheared and silicified tonalite and associated rocks. The present author visited the island and found outcrops of pink to grey, medium grained massive tonalite on the south shore and chloritic schists outcropping inland and along the northern shoreline. These chloritic schists comprise the majority of the rocks in Rousell's unit

7. They probably represent altered tuffaceous volcanic rocks. The tonalite on the south shore of the island is probably a thin sill intruded into a layered sequence of volcanic rocks.

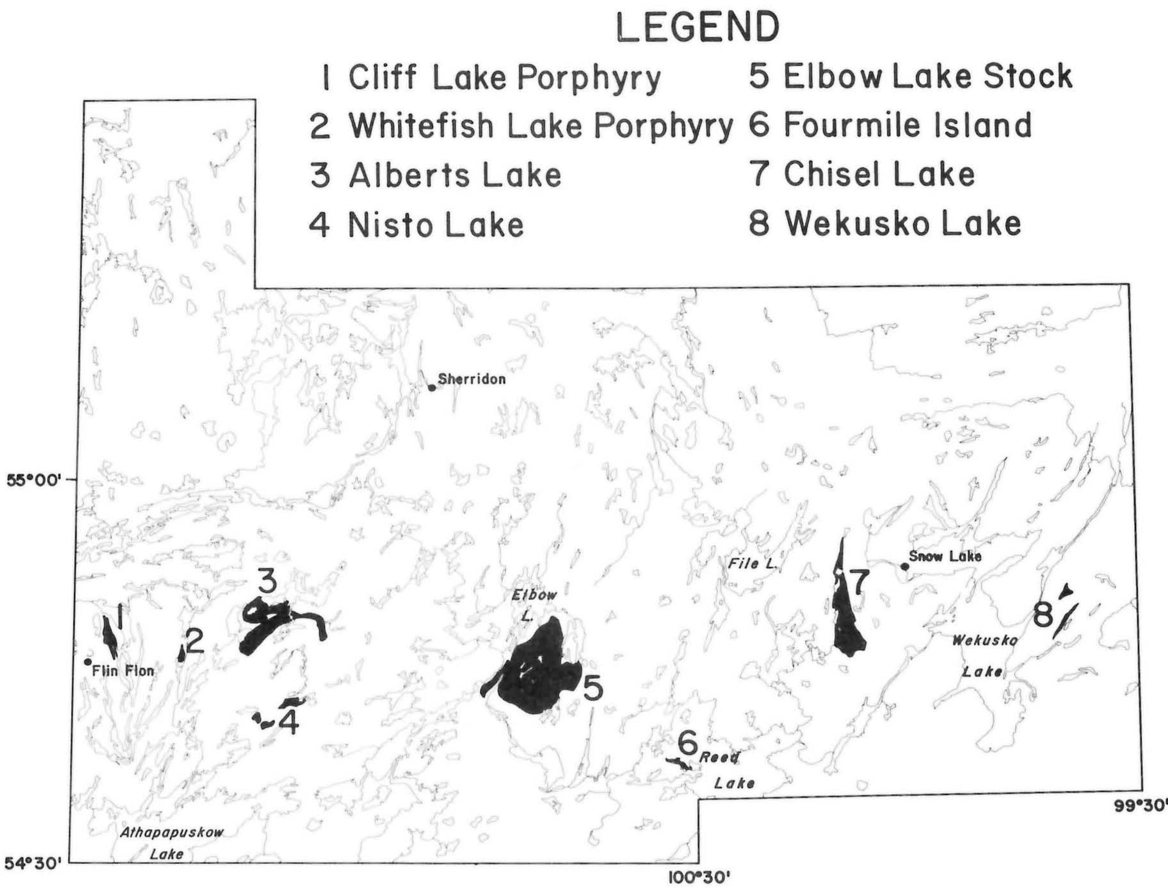



Figure MEA5-1: Location map of the intrusive bodies that were examined during the 1976 field season

**Figure MEA-5-1: Location map of the intrusive bodies that were examined during the 1976 field season.**

### Mineralization:

Disseminated pyrite is present in all the intrusive bodies investigated, occurring as fine disseminations and/or on fracture surfaces.

*Chalcopyrite* is finely disseminated in the rock and also occurs on fractures in the Cliff Lake Porphyry and the Whitefish Lake body. In the quartz monzonite between Twin Lakes and Nisto Lake, chalcopyrite accompanies pyrite in thin quartz stringers.

*Molybdenite* is present as flakes on fractures in the Whitefish Lake body.

*Gold* in the Cliff Lake Porphyry occurs in late fracture controlled quartz-tourmaline veins.

*Sulphide zones* in volcanic host rocks are parallel to intrusive margins, and cross-cut the volcanic stratigraphy around the Cliff Lake Porphyry, the Whitefish Lake body and the Elbow Lake Stock. These zones consist predominantly of pyrite, with minor chalcopyrite and gold.

Assay results from the mineral occurrences are incomplete. Those that are available show low base metal values (e.g. 900 ppm Cu, 24 ppm Mo).

**Preliminary Conclusions:**

With the exception of the tonalite sill at Fourmile Island all the granitic bodies investigated are discordant intrusions into volcanic and/or volcanic derived rocks. They are interpreted to have crystallized from magmas that stoped their way into the volcanic rocks possibly through the volcanic plumbing system. The alteration and mineralization in the granitic bodies is similar to that associated with some "porphyry type" mineral deposits. The contact metasomatic mineralization may possibly be related to "porphyry type" mineralizing processes. The intrusions and their associated mineralization are tentatively interpreted to be of a high level sub-volcanic nature.

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Stockwell, C.H.
1960: Flin Flon — Mandy. *Geol. Surv. Can.* Map 1078A.

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1966: Geology and Mineral Deposits of the Chisel Lake Map-Area, Manitoba *Geol. Surv. Can.* Memoir 342.

## MEA-6

## THE LYNN LAKE Ni-Cu DEPOSIT (64C/14)

*By R.H. Pinsent*

The Sherritt Gordon Mine at Lynn Lake in northern Manitoba came to the end of its productive life in 1975. During its most active period (1953-1973) the mine produced over 444 million pounds of Ni, 202 million pounds of Cu and 8 million pounds of Co from thirteen pipe shaped orebodies. Twelve occur within a plug of altered post-Wasekwan "gabbro", the "A" plug, and one occurs in a similar, but smaller neighbouring stock, the "EL" plug. The present study was undertaken under the Federal/Provincial Non-Renewable Resource Evaluation Program with the aim of establishing an inventory of geological facts, updating these, and thus refining the knowledge of these deposits. This program is also concerned with the development of a model for the genesis and emplacement of the ore. Such knowledge can guide exploration for comparable Ni-Cu deposits in similar environments elsewhere. Sherritt Gordon Mines Ltd. provided access to:

a) parts of the mine during the period of salvage,

b) mine plans and cross-sections,

c) diamond drill logs and core.

In addition, Company personnel contributed much useful information gained from individual experience.

### General Geology

Various aspects of the geology of the deposit have been discussed by Allan (1950), Hunter (1950), Dornian (1950), Ruttan (1955), Milligan (1960), Macauley (1962), Emslie and Moore (1961), and Vellet (1963). They show a general agreement on the main features of the deposit, but not on its genesis.

A preliminary examination of the more recently mined south end of the "A" plug, which includes the "O" and "N" orebodies, shows many of the characteristics described by the above authors. Although the plug has been strongly fractured and has undergone differing degrees of hydrothermal alteration, original igneous textures are extensively preserved. The rocks have been widely serpentinized and amphibolitized but the less altered portions indicate that the primary intrusion contained peridotite, pyroxenite, gabbro, norite and diorite. Internal contact relationships are obscure but the presence of plutonic breccias in several of the orebodies indicates that there must have been more than one intrusive episode. The mineralization occurs in near vertical pipes which are found along a belt which is subparallel to, and approximately 500 m inside the western contact of the plug. Lithologic units within the plug are also orientated parallel to this contact, which has an irregular but near vertical dip. Although they are continuous to depths of as much as 1000 m the pipes are of limited cross-sectional area and diameters rarely exceed 150 m. Locally the pipes are cut by faults which contain dykes that clearly pre-date regional metamorphism. The metamorphism has been dated at around 1714 m.y. by Turek (1967).

On the 2200 ft level in the "O" orebody a metamorphosed basic dyke was observed to cut a plutonic breccia. The breccia fragments, which are subrounded and largely barren, consist of peridotite, gabbro, diorite and an aphanitic, "cherty", felsite. These are cemented by mineralized "amphibolite". A similar, but inclusion free "amphibolite", thought to be derived from norite, is found in the "N" orebody. In both localities the sulphides (pyrrhotite, pentlandite and chalcopyrite) occur interstitialy as blebs and disseminations. In more massive, feldspathic, gabbroic rocks the sulphides occur in stockwork veinlets which exploit pre-existing fractures. The veinlets pass into veins of massive sulphide which give the impression of having impregnated the gabbro as a pervasive liquid. Locally, as was also observed on the 2200 ft level in the "O" orebody, sulphides form the cement of the polymictic breccias instead of "amphibolite". These sulphides may either have been injected into the breccia as a silicate contaminated fluid or they may have formed by the selective replacement of an earlier, fine grained, silicate cement of unknown composition. Where the ore is massive the principal sulphide is pyrrhotite which is cut by "flames" of exsolved pentlandite and fracture-fill veinlets of pentlandite and chalcopyrite.

It is thought that the orebodies suffered metamorphism in situ with no major redistribution of sulphide. Further, the occurrence of polymictic breccias cemented by both "amphibolite" and sulphide suggests that mineralization (whether hydrothermal or magmatic) post-dates or, more likely, occurs late in the intrusive cycle.

**References:**


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## FEDERAL/PROVINCIAL AGREEMENT ON

## MINERAL EXPLORATION AND DEVELOPMENT

Industrial Minerals Projects under the above agreement consist of a follow-up study of aggregate resources in the Winnipeg region (MEA-7), a study of sand and gravel resources in the The Pas area (MEA-8) and a survey of peat resources in southeastern Manitoba (MEA-9).

## MEA-7

# PLEISTOCENE GEOLOGY OF THE WINNIPEG REGION

## (E½ 62I-1)

*By P. Large and S. Ringrose*

Continuing work in the Winnipeg region was undertaken following the submission to the Department of the report "Aggregate Resources of the Winnipeg Region" by Underwood, McLellan and Associates Limited. In this report certain areas were recommended for more detailed work. These include portions of the provincial forest areas and the southern interlake region. During the past summer a portion of the Agassiz Provincial Forest was mapped (E½ 631-1), and the Pleistocene stratigraphy established as a basis for a sand and gravel resource inventory. This area is commonly referred to as the Milner Ridge-Seddons Corner area.

Quaternary deposits of the Beausejour area were studied by McPherson, 1970. Two drift sequences were identified, the earlier Belair Drift and later Libau Drift. An initial period of ice advance from the north resulted in deposition of the Belair and Milner Ridge end moraines. A second period of ice advance from the northwest influenced deposition on the Milner Ridge moraine. A generalized regional geology of the area is shown as Figure MEA-7-1. A two week geological analysis in Tp. 13, 14, and 15 and Ranges 9 and 10 EPM, on the Milner Ridge end moraine resulted in the generalized stratigraphy shown as Figure MEA-7-2.

Drill holes by the UMA Group and the present authors failed to penetrate the Lower Belair Till. Ample evidence of the Belair Drift, however, was provided in gravel pits in the vicinity of Seddons Corner. The drift at this location mainly comprises thicknesses of proglacial outwash in deltaic sequences mapped as Unit 1a with paleoflow directions from WNW to NW.

At certain locations, large foreset beds were found in thick, homogeneous, coarse cobble to pebble gravel sequences. The upper and lower coarse pebble gravel is frequently interbedded with layers of current bedded silty-sand which range in thickness from 0.5 to 2.0 m. This, and the presence of till towards the top of the deltaic outwash sequence suggest the close proximity of the ice margin during deposition into a localized proglacial (or possibly subglacial) lacustrine environment.

The deltaic sequence consists of rounded to subrounded clasts mainly (up to 95%) of Precambrian origin. Minor carbonates (of pebble-granule size) were found in the drift, and carbonates of detrital origin are present in the silt. The high proportion of crystalline clasts is the main basis for ascribing the sequence to the Belair advance which deposited drift derived mainly from the northeastern Precambrian sources.

The main feeder channels for the outwash sequence were mapped as Unit 1b. The deep, localized curvilinear sand and gravel features were examined in the vicinity of Aneda. These are initially interpreted as esker type features mainly on the basis of morphology.

Localized deposits of Libau Till were examined in the vicinity of the village of Milner Ridge where these deposits directly overlie (without an obvious subaerial interval) coarse Belair sands. The till is very compacted with minor fissility. It contains clasts of Paleozoic origin with some evidence of a boulder pavement with the upper sides of the boulders striated in a NW to SE direction (Unit 2a).

Associated with the second ice retreat is the deposition of outwash sand and gravel. Carbonate rich outwash sequences were examined to the east of Lac du Bonnet in the so-called Milner Ridge gravel pit. The outwash sequence consists of unsorted cobbles, pebbles and sand, mapped as Unit 2b. The sequence is vertically continuous with Unit 3b littoral sediments at the base of which is a coarse cobble lag layer.

As the NW ice retreated from the area, the periphery of the Milner Ridge end moraine was submerged by glacial lake sediments of the Lake Agassiz sequence. The silt, clay and associated sands are described in detail by McPherson (1970).

Effects of the glacial lake interval on the pre-existing morainic and outwash sediments were reworking and secondary deposition. The resultant shoreline deposits (Unit 3b) are noticeably thinner and contain finer sediments than the underlying outwash sediments. The shoreline sequence consists mainly of horizontally bedded sand, pebbles and granules, some of which are graded.

Adjacent to the shoreline sequences are large areas of reworked littoral sand, on which has developed a relatively coarse pebble lag (3c and 3d). Much of the remaining area is

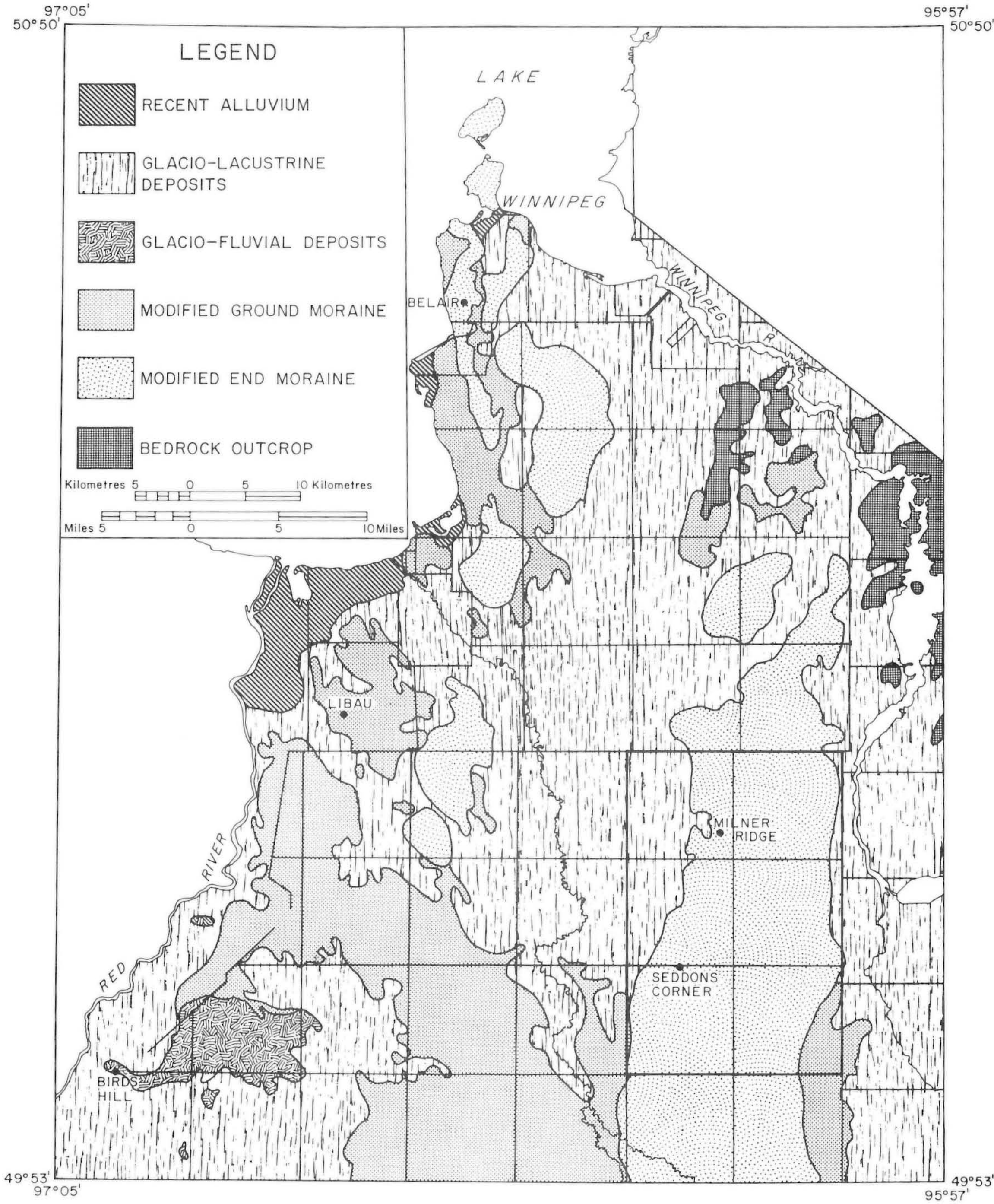
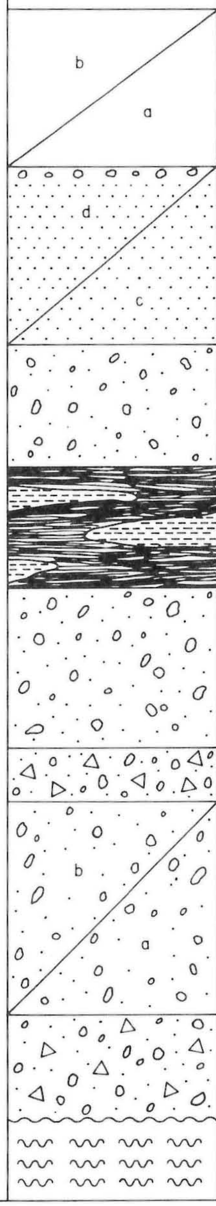



**Figure MEA-7-1: Generalized surficial geology of the Beausejour Area (after McPherson, 1970).**



| THICKNESS | UNIT NO. | COLUMN | MATERIAL | ORIGIN | ESTIMATED AREAL EXPOSURE |
|---|---|---|---|---|---|
| 0-2m. | 4 b | b | FEN | ORGANIC | 7 % |
| | 4 a | a | BLACK SPRUCE BOG | | 30 % |
| 0-12m. | 3 d | d | SAND, WITH PEBBLE LAG | LITTORAL | 17 % |
| | 3 c | c | SAND | | 11 % |
| 0-3m. | 3 b | | SAND AND GRAVEL | LITTORAL-SHORELINES | 7 % |
| 0-5m. | 3 a | | SILT AND CLAY | LACUSTRINE | 12 % |
| | | | LIBAU DRIFT | | |
| 0-5m. | 2 b | | SAND AND GRAVEL | PROGLACIAL-OUTWASH | 6 % |
| 0-1m. | 2 a | | TILL | GLACIAL TILL FROM N.W. | 2 % |
| | | | BELAIR DRIFT | | |
| 0-5m. | 1 b | b | SAND AND GRAVEL | GLACIOFLUVIAL-ESKER | 2 % |
| 0-12m. | 1 a | a | SAND AND GRAVEL | PROGLACIAL-OUTWASH | 6 % |
| UNKNOWN | | | TILL | GLACIAL TILL FROM N.E. | NOT EXPOSED |
| —— | | | BEDROCK | PRECAMBRIAN | NOT EXPOSED |

**Figure MEA-7-2: Stratigraphic column of the Milner Ridge — Seddens Corner Area.**

covered by black spruce bog, with thicknesses of peat, and floating bog, referred to as fen. (Units 4a and 4b).

### Economic Geology:

Analysis and mapping of sand and gravel deposits in the Milner Ridge-Seddons Corner area has resulted initially in the following evaluation (Table MEA-7-1). This area may be capable of producing up to 250 million metric tonnes of gravel to the Winnipeg region, the major centre of construction in the province. Most of this material is estimated as being of medium or low quality gravel, defined as being fine pebble to sandy gravel. The remainder, amounting to about 10 million metric tonnes, is regarded as high quality gravel containing sufficient amounts of coarse material to be suitable as concrete aggregate.

### Reference:

McPherson, R.A.
1970: Pleistocene Geology of the Beausejour Area, Manitoba. Unpubl. Thesis, *University of Manitoba,* 159 p.

## TABLE MEA7-1 — RESERVE AND QUALITY POTENTIAL*

| Location | LOW QUALITY | | MEDIUM QUALITY | | HIGH QUALITY | | TOTALS | |
|---|---|---|---|---|---|---|---|---|
| | Millions Short Tons | Millions Metric Tonnes | Millions Short Tons | Millions Metric Tonnes | Millions Short Tons | Millions Metric Tonnes | Millions Short Tons | Millions Metric Tonnes |
| Township 12, Range 9E | | | | | | | | |
| Provincial Forest | 32.2 | 29.2 | 18.8 | 17.1 | 2.7 | 2.5 | 53.7 | 48.8 |
| Non-Forest | | | 8.0 | 7.3 | | | 8.0 | 7.3 |
| Township 12, Range 10E | | | | | | | | |
| Provincial Forest | 4.4 | 4.0 | 4.4 | 4.0 | | | 8.8 | 8.0 |
| Non-Forest | | | | | | | | |
| Township 13, Range 9E | | | | | | | | |
| Provincial Forest | 25.6 | 23.2 | 20.4 | 18.5 | 5.1 | 4.6 | 51.1 | 46.3 |
| Non-Forest | | | 1.7 | 1.5 | | | 1.7 | 1.5 |
| Township 13, Range 10E | | | | | | | | |
| Provincial Forest | 20.1 | 18.3 | 19.1 | 17.4 | 0.8 | 0.7 | 40.0 | 36.4 |
| Non-Forest | | | | | | | | |
| Township 14, Range 9E | | | | | | | | |
| Provincial Forest | 21.2 | 19.2 | 24.9 | 22.6 | 1.0 | 0.9 | 47.1 | 42.7 |
| Non-Forest | | | 1.4 | 1.3 | | | 1.4 | 1.3 |
| Township 14, Range 10E | | | | | | | | |
| Provincial Forest | 33.4 | 30.4 | 32.0 | 29.1 | 1.4 | 1.3 | 66.8 | 60.8 |
| Non-Forest | | | | | | | | |
| TOTALS | 136.9 | 124.3 | 130.7 | 118.8 | 11.0 | 10.0 | 278.6 | 253.1 |

* Data taken from the report "Aggregate Resources of the Winnipeg Region" by Underwood, McLellan and Associates Limited.

## MEA-8

# PLEISTOCENE GEOLOGY OF THE THE PAS AREA

*By V. Singhroy*

### Introduction:

The objectives of this project are:

(1) to provide a Pleistocene map, and establish the stratigraphy of the The Pas area,

(2) to provide sand and gravel data for aggregate resources management.

The project area lies between 53° 15′ and 54° 30′ N latitude, and between 100° 30′ and 101° 51′ W longtitude. This includes eighteen NTS 1:50 000 sheets. The following are available in this series: 63K/3, 63K/4, 63K/5, 63K/6, 63K/7, 63F/11, 63F/12E, 63F/13E, 63F/14.

Township mosaics, on a scale of 1:31 680 were used as bases for field data. Hammer seismic data were collected on 54 sites and electrical resistivity on 112 sites. These were used to determine approximate depths of sand and gravel deposits in the area. An Atlas Copco Minuteman soil drill was used to obtain samples from 25 holes and 81 test pits were dug with a backhoe to estimate sand and gravel reserves. A total of 335 sites were sampled in the study area.

### Surficial Geology:

*Figure MEA-8-1 summarizes the deposits in the area. Dolomitic limestone occupies* approximately 3 percent of the area. Outcrops predominate in the Rocky-Atik Lakes and the Dolomite-Yawningstone-Cormorant Lakes areas (Unit 1).

| DEPTH (METRES) | UNIT NO. | COLUMN | MATERIAL | ORIGIN | ESTIMATED AREAL EXPOSURE EXCLUDING LAKES |
|---|---|---|---|---|---|
| 0–5 | 5 | | ORGANIC DEPOSITS | SWAMP, BOG FEN. | 40% |
| 0–15 | 4 | | a) SAND & GRAVEL<br>b) SAND, SILT & CLAYS | a) BEACH RIDGES<br>b) ALLUVIAL | 5%<br>15% |
| 0–38 | 3 | | a) CLAYS<br>b) CLAY, SILT, SAND & GRAVEL<br>c) SAND & GRAVEL | a) LACUSTRINE<br>b) GLACIOLACUSTRINE<br>c) GLACIOFLUVIAL | —<br>6%<br>1% |
| 0–15 | 2 | | a) ABLATION TILL<br>b) BASAL TILL | GLACIAL | 30% |
| | 1 | | BEDROCK | PALEOZOIC | 1–3% |

**Figure MEA-8-1: Stratigraphic column of The Pas Area.**

Basal till (Unit 2b), characterized by strongly aligned pebbles, parallel to striations on the bedrock is found on the eastern slope of the The Pas moraine. The till is characteristically reddish-brown, strongly calcareous and stony in a sand-clay matrix in which Precambrian clasts constitute 2 to 3 percent. A depth of one metre is recorded at 6.5 kilometres south of Wanless off Highway 10. Similar deposits were found in the Pasquia area at 150 metres below the surface (Pedersen, 1973).

The Paleozoic rocks are overlain by a fluted ground moraine (Unit 2a), consisting of a weakly developed ablation till. This is characterized by non aligned fabrics, forming a thin veneer in the northeast and increasing in depth at the The Pas moraine. The material forms a clay till rich in angular to subangular Paleozoic clasts derived from the local bedrock and 5 to 10 percent Precambrian material.

Lacustrine deposits (Unit 3a) are found in the Pasquia area and are overlain by alluvial deposits. These occur at depths of 4 to 30 metres in the Carrot River basin.

Glaciolacustrine deposits (Unit 3b) consisting of clay, silt, sand and gravel are typical in the Wanless-Atik Lake areas (Singhroy and Ringrose, 1976).

Glaciofluvial deposits (Unit 3c), consisting of sand and gravel occupy approximately one percent of the land area. These are outwash areas south of Clearwater Lake, drumlinoidal features 3 to 15 metres high in the Pasquia area, and small eskers west and south of Kelsey Lake.

Shoreline sediments (Unit 4a), consisting of sand and gravel are found on the western edge of the The Pas moraine. These consist of three successive ridges occurring at intervals of approximately 15 metres. To the northeast of Root Lake the beach ridges follow a northeast to southwest orientation and are associated with reworked sand plains and lag pebble accumulations. Beach sand also occurs at 1.7 kilometres south of The Pas, along Highway 10, and on the western edge of Big Eddy Reserve.

Alluvial deposits (Unit 4b) occupy approximately 15 percent of the land area. These are composed of sand, silt and clay deposited by the Saskatchewan River. In the Pasquia area, alluvial deposits are over 20 metres in depth (Ehrlich et al, 1960). Other alluvial areas occupy the entire southeast portion of the study area, including east of Kelsey Lake and south of Mawdesley Lake.

Organic deposits (Unit 5) occupy the major depressions in the The Pas area. These are essentially bogs and fens of different types (Tarnocai, 1975) occupying 40 percent of the land area.

**Glacial History:**

The limit of the latest ice advance in the area is the The Pas moraine. This moraine formed approximately 10 800 years B.P. (Prest, 1969), ranges in thickness from 10-30 metres, and is the highest topographic feature of the area. It constitutes a ridge of bouldery till that is bedrock controlled (Craig, 1965).

Glacial striations throughout the area, particularly near the Wanless area, along the Clearwater-Cormorant Lakes road and east of Goose Bay suggest different ice directions, the latest being from the northeast. As the ice melted Lake Agassiz deposited sediments in the Pasquia basin. Later the lake level dropped, probably owing to the opening of new outlets (Elson, 1967), and three successive levels of beach ridges were formed along the western edge of The Pas moraine.

The Saskatchewan River flows into the Pasquia basin and has deposited alluvial sediment over lacustrine clays, and initiated deltaic deposition in the Cedar Lake area.

Organic deposits are the most recent, occupying depressions in the The Pas area.

**Economic Geology:**

Sand and gravel deposits are confined to beach ridges and glaciofluvial deposits in the area. There are 51 sand and gravel pits in the study area, of which 26 are found within a twenty-five mile radius (43 kilometres) of the town of The Pas. With the exception of four major areas, all the sand and gravel pits within the twenty-five mile radius are near depletion. Reserves are either below the water table or contaminated by overburden. The four major remaining source areas are: (Figure MEA-8-2)

(i) the Root Lake Deposit,

(ii) Prospector Deposit,

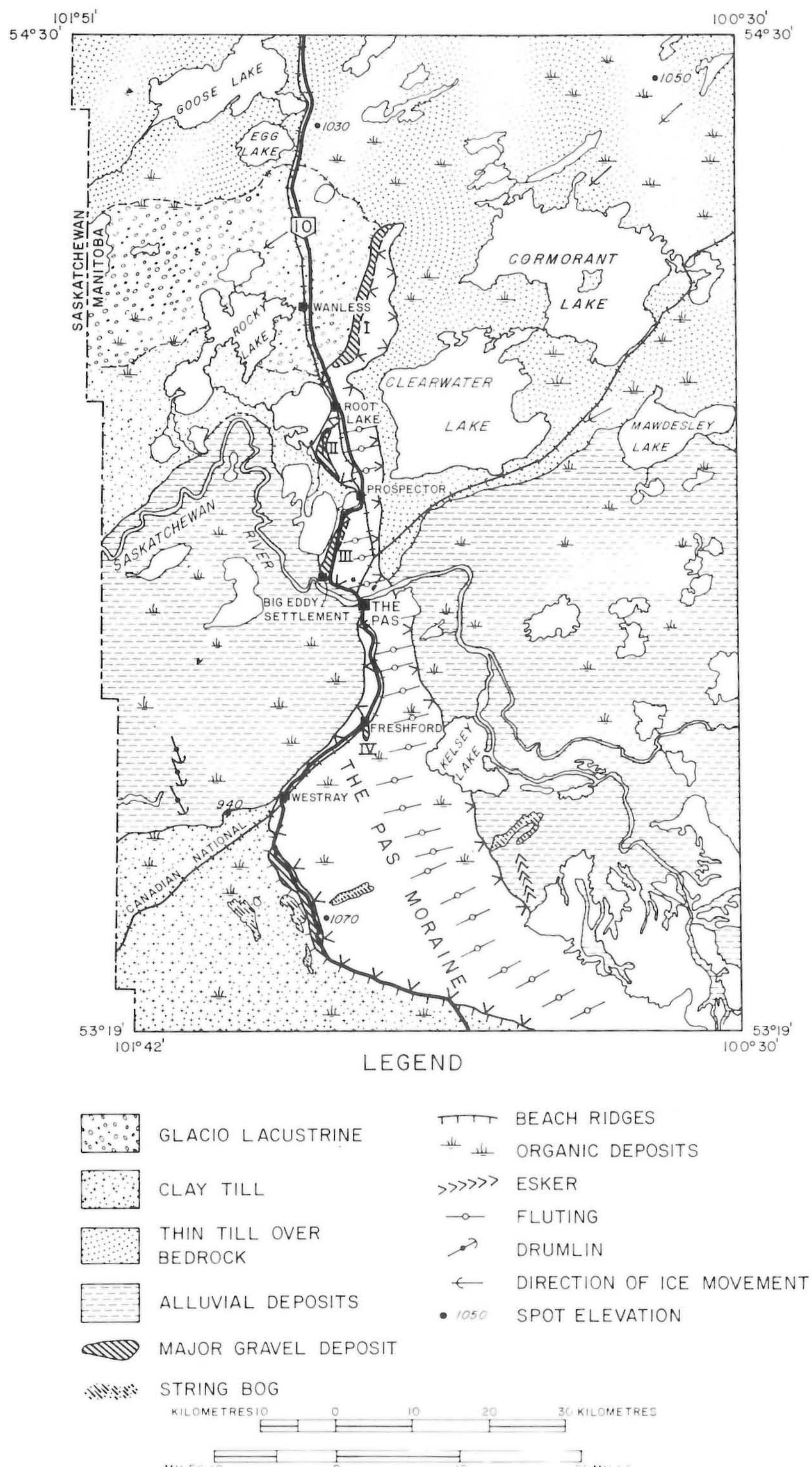



**Figure MEA-8-2: Glacial features of The Pas Area**

(iii) Big Eddy Reserve.

(iv) Freshford Deposit.

Each of the first three deposits exceed 200000 cubic yards of sand and gravel, in contrast to the Freshford deposit, which as approximately 35000 cubic yards in reserve. Other major deposits over 100000 cubic yards outside the 43 kilometre radius are found at 10.5 kilometres (mile 6), along Mitchell Lake road, east of Highway 10, and between 50 and 60 kilometres south of The Pas, along Highway 10.

Because the The Pas moraine is essentially clay till, clay fill can be obtained within easy reach of the town of The Pas.

There are four limestone quarries within the study area. Limestone can easily be obtained because outcrops are accessible by roads.

**Surficial Geology Mapping Using Multispectral Techniques:**

The study area was used to test the use of multispectral techniques in surficial mapping. Field data were used to verify information generated by the automatic data processing of Landsat MSS data (Scene I.D. 10803-17041, October 4, 1974). This technique produced a series of preliminary surficial geology maps on the basis of "supervised" and "unsupervised" biophysical classifications.

The digital technique was used to depict areas of glacial, alluvial and organic deposits on scales of 1:250 000 and 1:50 000. Detailed comparison between digitized data and conventional field mapping will take place at a later date. Initial conclusions indicate that themes produced from Landsat data closely coincide with lithological units developed in the field. Lineament data also showed up clearly on the imagery; earlier and later glacial advances were detected from fluted ground moraine and other drumlinoidal patterns. Prior knowledge of such details enabled the author to map a large area within a limited field season.

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# MEA-9

## PEAT PROJECT

*By B.B. Bannatyne*

### Introduction

Current production of peat moss in Manitoba is about 25 000 tons annually, valued at close to two million dollars. Assessment of market conditions indicates additional production is feasible. The objective of the present project is to identify bog areas in southern Manitoba that contain abundant quantities of high quality (slightly humified or non-humified) sphagnum moss.

Identification of bogs with a surface growth of sphagnum moss is possible using remote sensing methods, as they have a distinctive response on infrared photographs. These were obtained for southeastern Manitoba (townships 1 to 18, ranges 8 to 17 EPM) on July 27th, 1975. In addition, a thermal scanner recorded the temperature of the ground surface.

Ground truthing of selected bog areas in the fall of 1975 confirmed the interpretations made from the infrared photographs, and numerous target areas were selected. Five botany students were hired as summer assistants in 1976, and cored samples of the bogs were obtained from 258 locations within 52 bogs. (This total includes 56 locations in 14 bogs in the Washow Bay — Matheson Island area; a soil report published in 1975 outlined numerous sphagnum peat bogs there.) The samples are being tested to determine the quality of the peat moss.

### Southeastern Manitoba

The bogs tested in southeastern Manitoba are shown in Figure MEA9-1. This area is underlain by hummocky ground moraine deposited on Precambrian bedrock. The sphagnum peat bogs have developed either in hollows on the glacial deposits or in domed bog areas where through drainage does not occur.

Test results of the best holes located in each bog (based on results obtained to date) are listed in Table 1. All the bogs have a more or less continuous surface growth of sphagnum moss, with variable amounts of tree cover and typical bog plants (eg. Chamaedaphne, Ledum, Kalmia, Andromeda, Eriophorum, and Carex). The absorptive value is the weight of water the moss will abosrb divided by the weight of the moss, calculated for both the dry weight of the peat and peat containing 25% moisture (close to that of the marketed product). Absorptive values vary within the bog, and the bogs are shallower towards their edges.

Of the bogs tested, the Caribou Cluster contains the highest quality, the greatest depth, and the largest area (considering the combined area of the five lobes). It contains sufficient moss to produce several millions of short tons of processed moss.

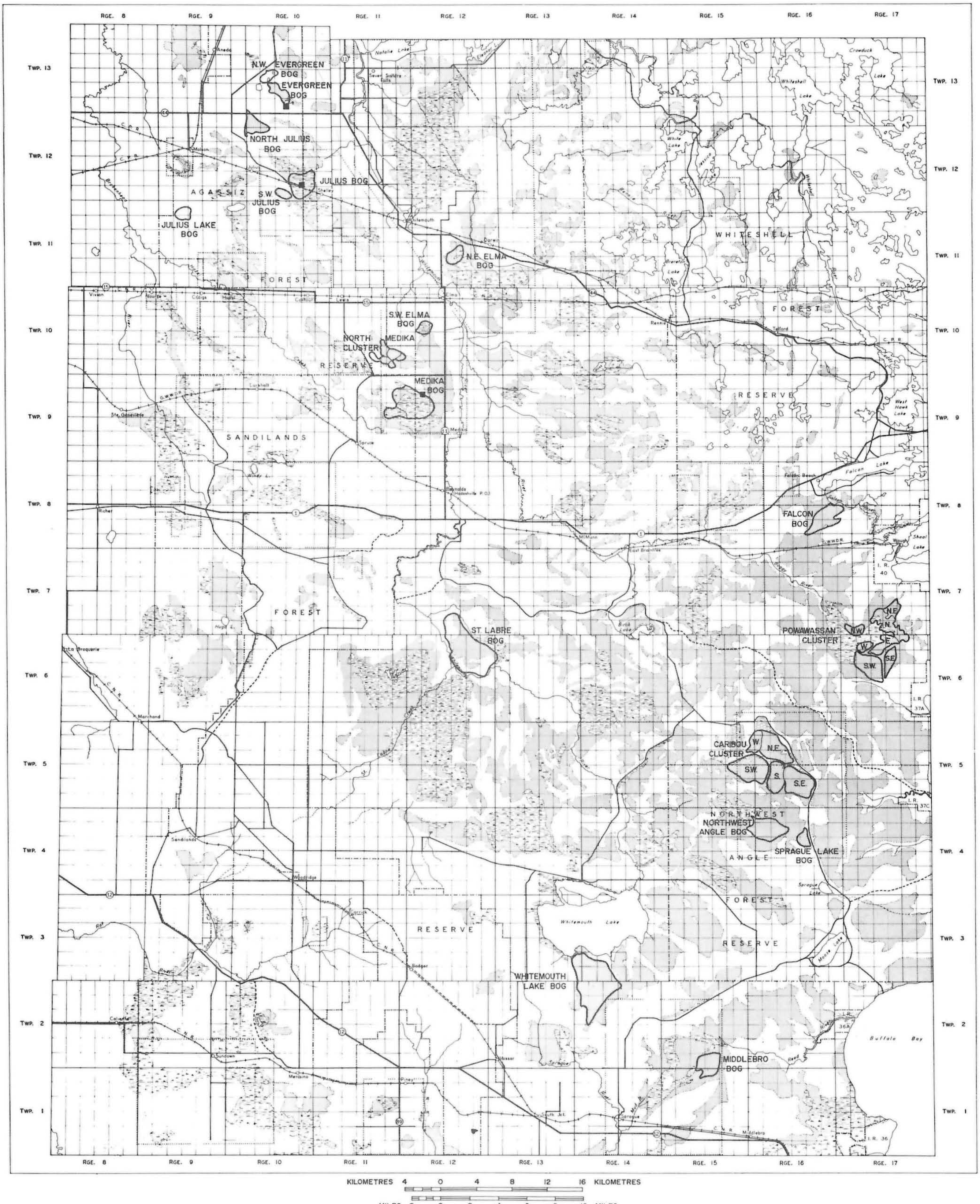



**Figure MEA-9-1: Sampled bogs in southeastern Manitoba.**

## TABLE 1

### Sphagnum peat bogs in southeastern Manitoba

| Bog (see Figure 1) | Area sq. km. | Average absorptive value[1] Dry basis | 25% moisture | Tested depth (m) | pH (top to bottom) | Nitrogen[2] (dry basis) (%) |
|---|---|---|---|---|---|---|
| Middlebro | 5.4 | 19.73 | 14.63 | 2.5 m | 4.5 — 5.6 | — |
| Whitemouth Lake | 22.2 | 16.65 | 12.24 | 2.4 | 5.2 — 5.8 | — |
| Northwest Angle | 8.4 | 23.48 | 17.37 | 3.5 | 4.3 — 6.2 | 1.05 — 1.17 |
| Sprague Lake | 1.8 | 20.72 | 15.29 | 4.0 | 4.5 — 5.6 | — |
| Caribou Cluster: | | | | | | |
| S.W. | 7.2 | 24.40 | 18.05 | 4.0 | 4.4 — 5.6 | 0.94 — 1.26 |
| S. | 5.4 | 26.60 | 19.70 | 4.5 | 4.1 — 5.8 | 1.0 — 2.49 |
| S.E. | 9.4 | 24.24 | 17.93 | 4.8 | 4.3 — 6.0 | 0.73 — 2.04 |
| N.E. | 8.0 | 24.05 | 17.93 | 4.0 | 4.1 — 5.4 | 0.83 — 1.98 |
| W. | 3.9 | 27.00 | 20.04 | 4.0 | 4.2 — 5.9 | — |
| Powawassan Cluster: | | | | | | |
| N.W. | 1.7 | (densely treed; not sampled) | | | | |
| W. | 1.4 | 24.05 | 17.78 | 4.0 | 4.2 — 5.6 | 0.80 — 1.53 |
| S.W. | 7.5 | 23.38 | 17.55 | 3.0 | 4.4 — 5.4 | 0.64 — 1.48 |
| S.E. | 1.7 | 17.34 | 12.75 | 2.35 | 4.0 — 5.9 | — |
| E. | 3.9 | 19.55 | 14.38 | 2.5 | 4.0 — 4.9 | 0.80 — 0.92 |
| N. | 5.4 | 22.06 | 16.29 | 2.3 | 4.2 — 5.7 | 0.87 — 1.25 |
| Falcon | 6.6 | 24.88 | 19.38 | 3.0 | 4.2 — 5.5 | 0.67 — 0.83 |
| St. Labre | 22.7 | 18.67 | 13.75 | 3.0 | 4.4 — 5.3 | 1.10 — 1.92 |
| North Medika | 2.8 | 14.78 | 10.84 | 2.4 | 4.0 — 5.4 | — |
| N.E. Elma | 3.5 | 20.29 | 14.97 | 3.0 | 4.1 — 5.6 | 1.17 — 2.32 |
| S.W. Elma | 1.4 | 18.22 | 13.42 | 2.0 | 4.2 — 5.1 | — |
| Julius Lake | 1.8 | 24.80 | 18.36 | 2.5 | 4.1 — 5.6 | — |
| S.W. Julius | 2.9 | 20.50 | 15.12 | 2.3 | 4.4 — 4.2 | 0.84 — 1.68 |
| North Julius | 3.9 | 19.60 | 14.45 | 4.0 | 4.4 — 6.4 | — |
| N.W. Evergreen | 1.0 | 25.01 | 18.51 | 3.5 | 4.0 — 5.6 | — |
| Producing bogs | | | | | | |
| Medika[3] | 10.1 | 23.10 | 17.50 | 2.8 | 4.4 — 5.7 | 0.65 — 0.87 |
| Evergreen[3] | 2.6 | 16.50 | 12.10 | 3.7 | — | — |
| Evergreen | 2.6 | 25.40 | 18.80 | 4.0 | 4.2 — 5.3 | 0.51 — 1.20 |
| Julius[3] | 4.0 | 19.80 | 14.40 | 4.5 | 4.0 — 4.5 | 0.6 — 1.2 |

[1] Based on best hole tested; may not be representative of entire bog.
[2] Nitrogen analyses courtesy of Canadian Grain Commission, Grain Research Laboratory, Winnipeg.
[3] Previously published results.

In addition to the bogs included in Figure 1 and Table 1, 12 other bogs in the Pine Falls — Lac du Bonnet — Pointe du Bois area were sampled. These were generally of small area and shallow depth, although sphagnum moss forms the surface in many of them.

**Washow Bay — Matheson Island Area**

Of the 14 bogs tested in the Washow Bay — Matheson Island area, good results were obtained from a reconnaisance sampling of 10 bogs. Results from test work completed to date are listed in Table 2.

## TABLE 2

### Selected sphagnum peat bogs, Washow Bay area

| Bog | Location[1] sec.-tp.-rge. | Average absorptive value[2] Dry basis | 25% moisture | Tested depth (m) | pH | Nitrogen[3] (dry basis) (%) |
|---|---|---|---|---|---|---|
| Grassy Narrows | 17-25-5EPM | 26.92 | 19.90 | 3.0 | 4.3 — 5.5 | 0.58 — 0.94 |
| Washow Bay | SE 5-26-5EPM | 26.74 | 20.68 | 2.5 | 4.5 — 5.5 | — |
| Black Point | SW 14-26-5EPM | 23.00 | 17.00 | 2.0 | — | — |
| Ramsay Point | 3-28-4EPM | 25.47 | 18.77 | 3.0 | 4.0 — 6.1 | 0.73 — 1.37 |
| Beaver Point | 30-28-5EPM | 28.08 | 20.84 | 3.5 | 4.0 — 5.4 | 0.59 — 1.73 |
| W. of Biscuit Harbour | NE 13-30-4EPM | 23.60 | 17.45 | 3.0 | 4.2 — 5.5 | — |
| N. of Moose Lake | SW 14-30-4EPM | 26.07 | 19.30 | 3.5 | 4.4 — 5.7 | — |
| W. of Birch Lake | SE 2-31-4EPM | 28.51 | 21.14 | 3.0 | 4.3 — 5.5 | — |
| South Bullhead | 20-31-5EPM | 25.41 | 18.81 | 3.5 | 4.3 — 5.2 | — |
| South Doghead | 31-31-5EPM | 22.15 | 16.86 | 3.5 | 4.1 — 5.4 | 0.54 — 1.66 |

[1] Shown on map in Soils Report No. 15, Manitoba Soil Survey (1975) as "Julius complex".

[2] Based on best hole tested to date; may not be representative of entire bog.

[3] Nitrogen analyses courtesy of Canadian Grain Commission, Grain Research Laboratory, Winnipeg.

## MEA-10

## PLEISTOCENE GEOLOGY OF THE WEKUSKO LAKE AREA

*By S. Ringrose*

The Wekusko Lake area comprises the following Map Sheets: 63J, 1, 2, 3, 6, 7, 8, 9, 10, 11, 14, 15, 16 and 63G, 14, 15, 16. Mapping began in the area in 1970 and was completed during the summer of 1976. The area was mapped and stratigraphy established in order that sand and gravel sources might be identified (Figure MEA10-1).

Unit 1: Approximately 50% of the area is underlain by Precambrian crystalline bedrock, the remaining 50% by Paleozoic dolomitic limestone. Precambrian bedrock crops out to the northeast of the area and has a predominant northeast to southwest structural alignment. Dolomitic limestone crops out in irregular ridges to the southwest of the study area. (See Figure MEA10-2).

Unit 2: The major till sheet in the area is found exposed in the southwest in association with the Paleozoic limestone outcrop belt. Thicknesses of till occur in depressions between the bedrock ridges. A veneer of till was observed on top of limestone plateaux. This has been locally reworked into pebble rich shoreline features. Till clasts are mainly carbonates, with minor crystalline pebbles, in a highly calcareous silty-clay matrix. A similar till, containing fewer but distinctive carbonate clasts was observed in association with the Axis Lake esker (1) and Manibridge esker (2) in addition to beach ridge features along Highway 6. The carbonate till is assumed to have been derived from the Labradorean centre of ice dispersal, and to have derived its dolomitic limestone content (in exposures overlying the Precambrian Shield) from the Hudson Bay Lowlands. This evidence is substantiated by striations and overall esker alignment.

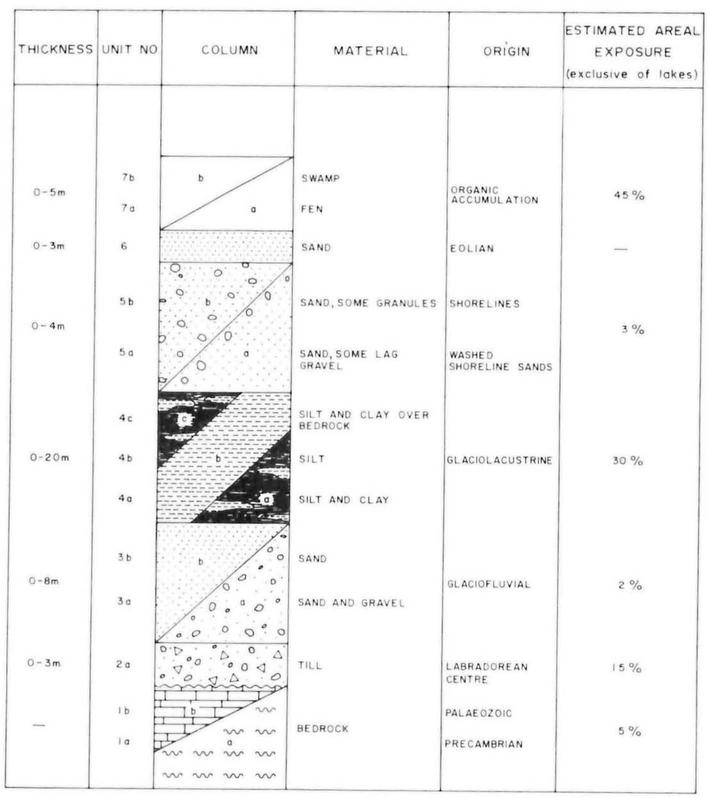



**Figure MEA-10-1: Stratigraphic column of the Wekusko Lake Area.**

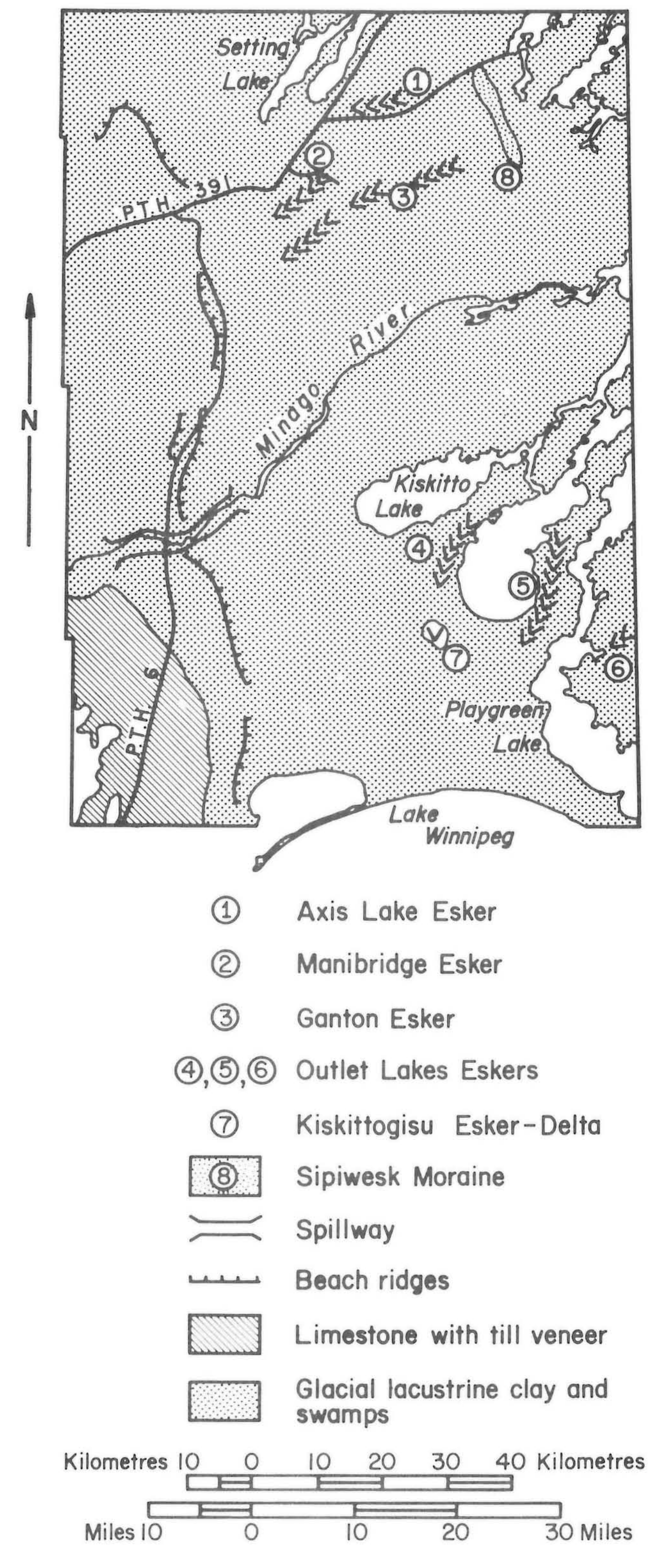



**Figure MEA-10-2: Glacial features in the Wekusko Lake Area.**

Unit 3: Glaciofluvial features were deposited during a major period of ice retreat. Three eskers identified in the vicinity of the outlet lakes (4, 5 and 6) are composed mainly of sand with intermittent pebble horizons and are largely overlain by lacustrine clay. Associated with these features is a large kame-delta complex (7) the periphery of which is composed mainly of medium-fine sand which has been modified into irregular shorelines. The central portion of the feature is composed of coarse granules at the surface. The Ganton Lake (3) and Manibridge (4) eskers are composed mainly of fine pebble gravel, and associated sand. The margins of the features are subdued due to a partial cover of lacustrine clay. A number of exposures in the Axis Lake esker revealed thicknesses of coarse cobble to pebble gravel, with some interbedded sandy-silt and carbonate rich till.

Unit 4: Evidence suggests that either the glaciofluvial features were deposited directly into a large proglacial lake or glaciolacustrine conditions immediately followed ice-melt from the area. At a number of locations, sand and gravel beds are directly overlain by silt-clay rhythmites. Unit 4 silt and clay comprises large areas of horizontal rhythmites which occur as coarse (up to 1 m silt thickness) proximal varves grading upwards into finer (to 1 cm clay and silt) distal varves, for instance, in the Lower Minago valley, by Cross Lake. At other locations, mainly in the vicinity of eskers, the rhythmites are convoluted and slumped. There is evidence of turbidity flow in the vicinity of the Axis Lake esker. Large areas of massive calcareous silt were found deposited in the vicinity of the Minago River spillway. Most of the map area is covered by massive dark brown clay of glaciolacustrine origin.

Unit 5: The large proglacial lake, probably representative of late stages of glacial Lake Agassiz initially covered almost the entire area and gradually diminished in size before finally draining into Hudson Bay. The action of lake waters modified pre-existing deposits forming shoreline accumulations on till veneered bedrock and glaciofluvial features. In many areas reworked sand was deposited on the margins of eskers; the action of water being evidenced by a lag gravel layer at the surface. The latest known shoreline of Lake Agassiz occurs along Highway 6. This shoreline, known as Minago Beach, is composed of sand with interbedded granules. An early C-14 date on the molluscan content of the shoreline suggests the lake was prevalent up to 8300 years ago (Ringrose, 1975).

Unit 6: Much of the shorelines and glaciofluvial sequences were modified at a later stage by wind action. Eolian activity selectively removed fine sand, re-depositing it in linear dune-like forms.

Unit 7: Much of the area is lowlying and poorly drained. Hence, large areas are characterized by string-bog (fen) or other floating vegetation including reed and sedge growth. Slightly better drained areas consist of thicknesses of peat, much of which contains permafrost, which is partially melted on the surface.

**Economic Geology:**

Sand and gravel resources are not abundant in the Wekusko Lake area. The Axis Lake esker is approximately 50% depleted. Earlier, good quality gravel was extracted from this source and used in the construction of the Hudson Bay railway and Highway 391. The esker has since been used for highway maintenance and as mine backfill in Manibridge.

Continued exploitation of the granular resources is expected by Manfor Ltd. from the Ganton Lake Esker, Manibridge Mines, from the Axis Lake and Manibridge eskers, and general construction companies in Wabowden who use the Axis Lake esker. The Department of Highways and their contractors will continue to use gravel from the Axis Lake esker for general maintenance and crushed limestone from the railway crossing south of Ponton, and occasionally the limestone in the Minago spillway. Continued use of sand and gravel from the eskers and beach ridges at greater distances from the highway is foreseen. Crushed limestone will continue to be used where there is no other viable alternative.

Drift prospecting in central and eastern portions of the area is not considered very favourable because of the abundance of glaciolacustrine clay in which elements are readily dispersed, and which obscures surface exposures of glacial till. The exposed till in the south of the study area may provide a valuable drift prospecting medium since it was derived from the north east (from the Thompson nickel belt). The till, however, is rich in locally derived Paleozoic carbonates. In the absence of till, eskers in the vicinity of the outlet lakes and Manibridge, in addition to shoreline features by the Minago River, provide reworked sediments of some value in drift prospecting. Pebble counts of these features indicate a relatively high mafic and ultramafic content.

**Reference:**

Ringrose, Susan
1975; A Re-evaluation of Late Lake Agassiz Shoreline Data from North-Central Manitoba. *The Albertan Geographer,* No. 11, p. 33 - 41.

# MEA-11

## PLEISTOCENE GEOLOGY OF THE LYNN LAKE AREA

## (64C 14 and 15)

*By N. O'Donnell*

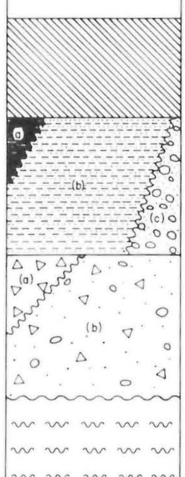
Quaternary mapping in the Lynn Lake area was undertaken to establish the stratigraphic succession in order to evaluate the suitability of relatively low cost drift prospecting techniques and to note the granular resources in the area.

An eight week field mapping program revealed the following general geology, as summarized in Figure MEA-11-1.

Unit 1: Bedrock comprises only 1 — 2% of the map area. At numerous locations the bedrock has a thin drift veneer, comprising boulder rich till or occasionally fine sand and silt.

Unit 2: The basal till is homogeneous in texture, consisting of boulder size clasts in a sand or silt rich matrix. The clasts are subangular to subrounded, with local volcanics in the former and granitic-gneissic rocks in the latter category. Minor ablation and melt out till were also observed. In texture the till is generally friable.

Unit 3: The three subunits, clay, silt, sand and gravel (3a, b, c) are defined on the basis of granulometric type. Massive clay was probably deposited in a restricted pro-glacial lake environment. Silt and fine sands are more extensive and appear to have been deposited in subglacial lakes or ponds associated with the final phases of esker deposition. Coarse sand and gravel are found at the top of esker crests. The coarse rounded clasts are predominantly granitic and gneissic in composition reflecting further transport distance than clasts in the till and indicating incorporation by glaciofluvial processes from ablation material. Unit 3 sediments are the thickest Quaternary deposits in the area. Several auger holes indicated at least 13 m of fine sands and silt. The Eileen Lake esker complex (see Figure MEA-11-2) has a relief of up to 35 m while the Vandekerckhove Lake esker in places shows relief up to 50 m. It is assumed that these heights can be considered as true thicknesses.



| THICKNESS | UNIT NO. | COLUMN | MATERIAL | ORIGIN | ESTIMATED AREAL EXPOSURE (exclusive of lakes) |
|---|---|---|---|---|---|
| 0-7m | 4 | | ORGANIC DEPOSITS | SWAMP, BOG, FEN | 50 % |
| 0-50m | 3 | | (a) CLAY<br>(b) SILT AND FINE SAND<br>(c) SAND AND GRAVEL | GLACIOLACUSTRINE<br>GLACIOLACUSTRINE<br>GLACIOFLUVIAL | (a) 1 %<br>(b) 5 %<br>(c) 1 % |
| 0-7m | 2 | | TILL (a) ABLATION<br>(b) BASAL | GLACIAL - KEEWATIN CENTRE | 40 % |
| —— | 1 | | BEDROCK | PRECAMBRIAN | 1-2 % |

**Figure MEA-11-1: Schematic diagram — stratigraphic column, Lynn Lake Area.**

Unit 4: Deposits of peat, usually associated with swamp and fen development, generally exist in zones of poor drainage between bedrock highs. Till is thought to extend across the floor of the basins as it appears exposed on the bedrock margins. The deposits are up to 7 m thick and occasionally contain pingo-like frost heave features. Widespread permafrost occurs within the organic areas. Ice advance indicators show a single direction of ice movement, generally from north to south and related to the Keewatin dispersal centre. The ice movement changes from slightly east of north at Hughes Lake (eastern margin of area) to slightly west of north at Zed Lake (western margin of area). Evidence supporting this conclusion was derived from pebble counts, striations, fluted ground moraine and esker alignment.

**Economic Geology:**

The Lynn Lake area presents extremely favourable conditions for drift prospecting, because of the ubiquitious and generally thin drift cover and relatively simple Quaternary stratigraphy. Only one direction of glacial transport has been identified, generally from north to south. Glaciogenic anomalies, both megascopic and microscopic may be traced 'up ice' with some certainty. The direction of glacial transport is mainly transverse to the strike of the greenstone belts.

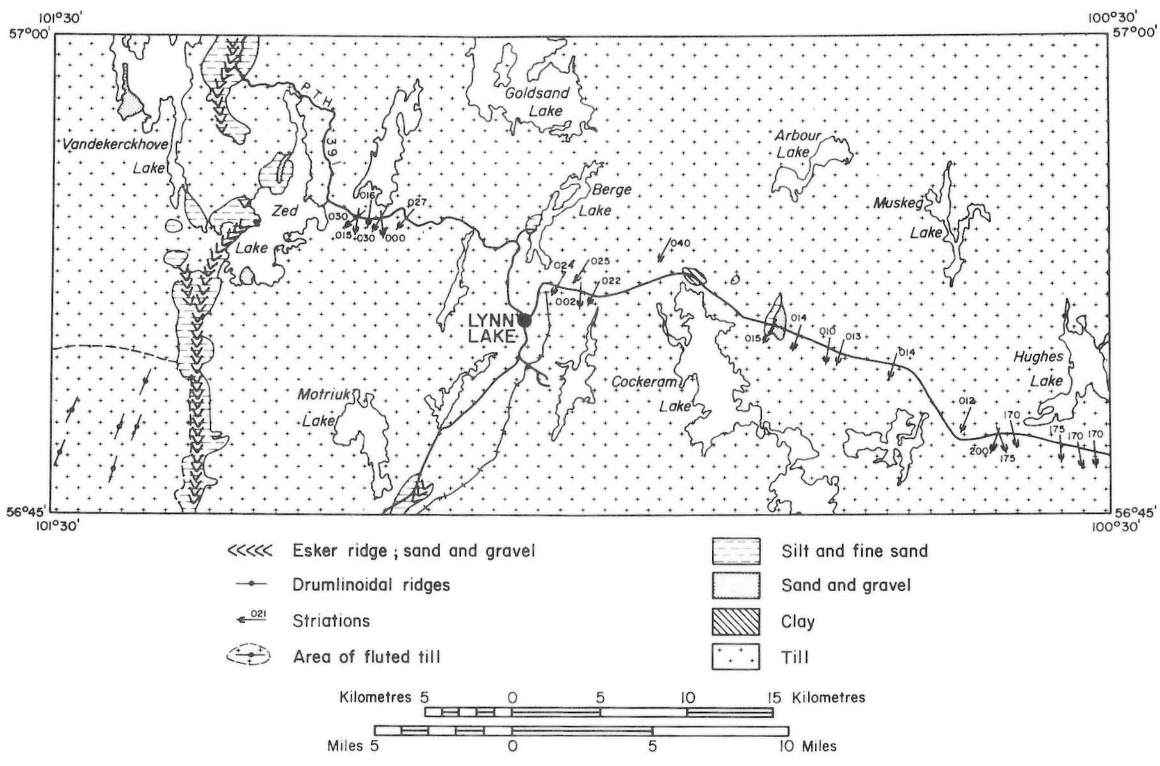
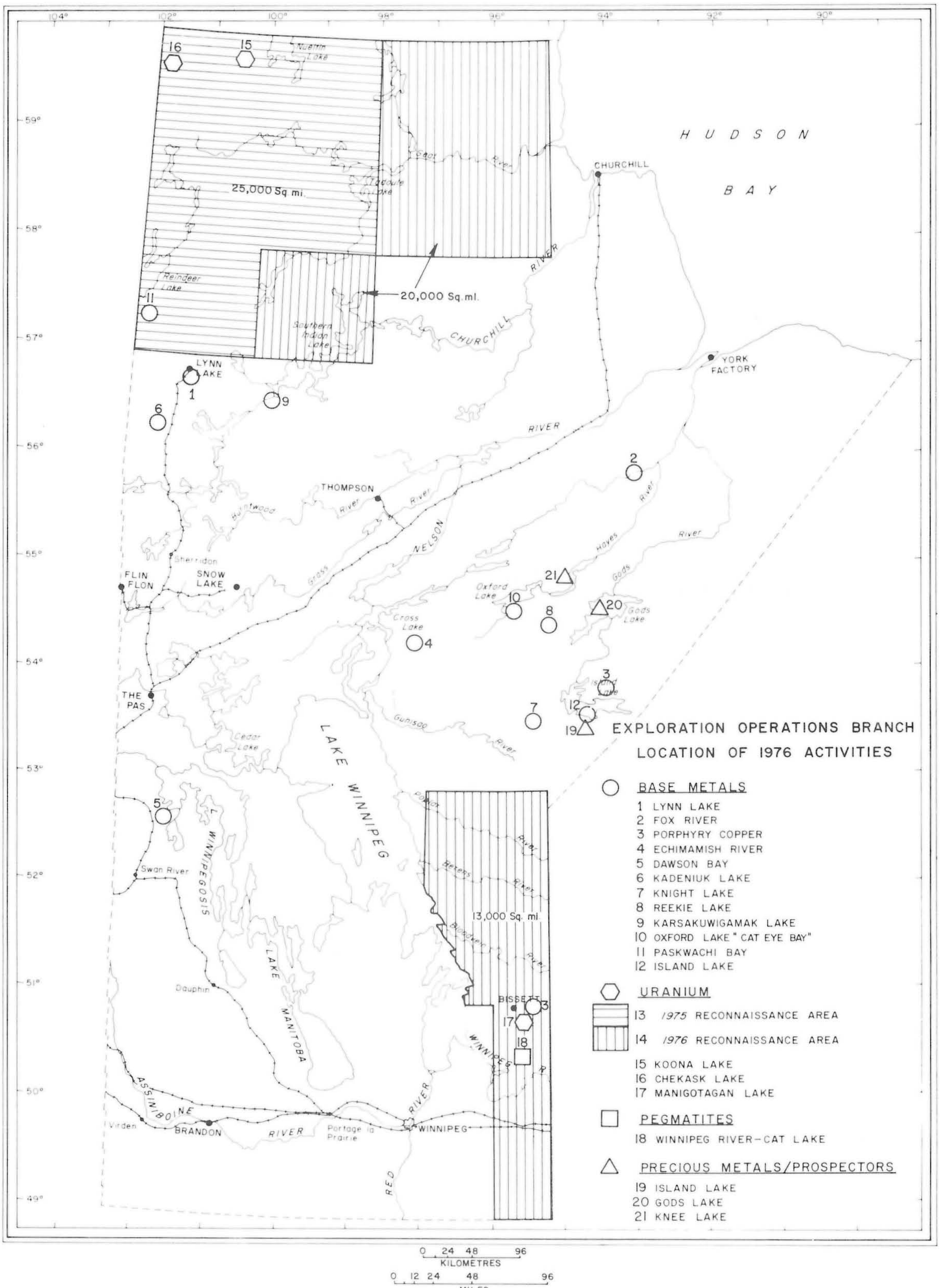



**Figure MEA-11-2: Glacial features in the Lynn Lake Area.**

Supplies of sand and gravel so far have presented no problem in the area. As a rule, drift is excavated near the location needed for use, and demand has not been great. The most favourable sources of coarse gravel are the large eskers, especially the Vandekerckhove Lake esker. This feature can be traced from Russell Lake northward to Vandekerckhove Lake, a distance of some 80 km. Less voluminous sources remain in the Eileen Lake esker, and in localized kame and kame delta deposits.

Borrow pits along the highways involved the removal of sandy silt till often overlain by outwash sands and gravels to an average depth of 2.0 m. The drift has been removed down to the bedrock surfaces, leaving wide areas of outcrop. Thus, the pits are large in areal extent, but relatively low in volume of material involved.

# EXPLORATION OPERATIONS BRANCH




**Location of Field Activities.**

## EXPLORATION OPERATIONS BRANCH

## INTRODUCTION

*By J.F. Stephenson*

The Exploration Operations Branch, now in its second year of operation, conducted eighteen exploration projects throughout Manitoba in 1976. Most of the activity was concentrated in the northern part of the province in the search for base metal and uranium deposits. The location map on the facing page shows the name and location of each project.

Twelve base metal projects were undertaken primarily to search for copper, nickel and zinc in a variety of different geological environments, mainly in the Island Lake-Oxford Lake region in the northeast and the Lynn Lake region of northern Manitoba. Seven projects were a continuation of the previous year's work, while five were initiated this year.

Uranium follow-up exploration projects were initiated in the extreme northwestern part of the province as a result of the Geological Survey of Canada's Uranium Reconnaissance Program conducted in this region last year. A uranium exploration survey was also conducted in southeastern Manitoba.

A re-evaluation of pegmatite mineral resources in the Winnipeg River region is being carried out by the Centre for Precambrian Studies, University of Manitoba under a four year agreement between the province and the University. In 1976, a full field season was devoted to mapping and sampling of known pegmatite deposits in the area for a detailed and comprehensive mineralogical and geochemical analysis in order to ascertain their economic significance.

Abandoned gold properties were investigated for their precious metal potential in the Knee Lake and Gods Lake areas.

The highlights of this year's activities involving the Branch indirectly were the release of the Uranium Reconnaissance Program data on March 24, 1976 and release of the INPUT airborne geophysical survey for the Lynn Lake region on June 22, 1976. The earlier release resulted in the acquisition of ten exploration permits totalling approximately 552 000 acres and a total staked area of approximately 80 000 acres. At Lynn Lake 20 809 acres of ground have been staked which, together with previously held ground, covers virtually all significant airborne electromagnetic anomalies within the survey area.

The bulk of this "grassroots" and detailed exploration activity is funded under a four year Canada-Manitoba Subsidiary Agreement for Mineral Exploration and Development in Manitoba. The agreement, now in its second year, was negotiated on a 50/50 cost-shared basis between the provincial and federal governments. Except for the precious metal project, all other projects described in the following pages of this report were funded under this agreement.

A report on the Porphyry Copper project has not been included here since the search for, and the investigation of known porphyry copper mineralized areas has been largely negative. The four areas investigated, Oxford Lake, Red Cross Lake, Bella Lake (Island Lake) and Rice Lake all revealed subeconomic copper and molybdenum mineralization.

The projects with greatest potential to date are the Koona Lake uranium project and the "Cat Eye Bay" project. Uranium mineralization caused by enrichment of leucogranites in the Koona-Putahow Lakes region of northern Manitoba may have potential as a large, low-grade uranium deposit. At "Cat Eye Bay" on Oxford Lake, a Zn-Cu-Ag-Au mineralized horizon in sheared and altered metavolcanic rocks is returning interesting, although as yet sub-economic, assays. It is intended that both projects will be followed up in 1977.

## EO-1 LYNN LAKE

## (64 C/10, 11, 14, 15)

*By P. Wielezynski*

During early 1976, Questor Surveys Limited conducted an airborne INPUT survey in the Lynn Lake area on behalf of the Province of Manitoba. A total of 6290 line kilometres were flown at a line spacing interval of 200 metres over two adjoining blocks. Block I was flown N 10 W and Block II at N 40 E (Figure EO-1-1).

Electromagnetic and magnetic data at a scale of 1:20 000 was released to the public on June 22, 1976. Following the release, mining companies and private individuals staked the following acreage:

| | |
|---|---|
| Sherritt Gordon Mines Ltd. | 5840 acres |
| Manitoba Mineral Resources Ltd. | 4280 acres |
| Hudson Bay Exploration and Development Co. Ltd. | 4078 acres |
| Granges Exploration Aktiebolag | 4051 acres |
| Huston and Dunlop | 2560 acres |
| Total | 20 809 acres |

On the completion of staking virtually all significant anomalies depicted by the survey were covered.

# EO-2 FOX RIVER

## (53 N and 53 M)

*By J. Clue*

### Introduction:

During the 1976 winter and summer field seasons, the Exploration Operations Branch completed geochemical and geophysical surveys over the western portion of the layered mafic-ultramafic Fox River Intrusion in northeast Manitoba.

The program was carried out in three parts:

(1) a winter overburden drilling program to obtain basal till samples at or near the overburden/bedrock interface for heavy mineral separation, identification and geochemical analyses;

(2) detailed magnetic and vertical loop electromagnetic surveys to establish bedrock conductors in areas covered by the geochemical survey; and

(3) regional and detailed glacial stratigraphic studies to assist in the interpretation of geochemical results and provide guidelines for future overburden drilling programs.

The overburden drilling and geochemical sampling survey were carried out under a contract awarded to Adcura Ltd., Ottawa, Ontario. Vertical loop electromagnetic, magnetic and glacial stratigraphic surveys were completed by crews of the Exploration Operations Branch.

### General Geology:

The Fox River Intrusion comprises an easterly trending series of mafic and ultramafic rocks extending from 150 kilometres west of Shamattawa into the Hudson Bay Lowlands. The geology of the intrusion and environs has been studied and reported by Scoates, 1975b (Figure EO-2-1). The ultramafic units and Upper Central Layered series are regarded as potential hosts for base and precious metals mineralization.

### Geochemical and Geophysical Results:

Anomalous concentrations of sulphide minerals in basal till and corresponding geochemical analyses for Cu, Ni and Cr have been plotted, as have vertical loop conductors (Figure EO-2-1). Table EO-2-1 lists anomalous stations as to the percentage of sulphides, sulphide mineralogy and metal levels found in the heavy mineral separates.

### Glacial Stratigraphic Studies

A helicopter was employed for regional glacial stratigraphic studies along the Fox, Bigstone, Sipangio, Stupart and Hayes River systems. Three distinct glacial advances have been identified by study and examination of till characteristics, outwash and lacustrine deposits.

The detailed study area appears to be completely blanketed by the youngest till sheet.

### Further Work and Recommendations:

VLEM bedrock conductors have been found to coincide with anomalous concentrations of sulphide minerals with little or no enrichment in Cu, Ni and Cr. It is postulated that this pattern reflects the presence of barren sulphide-bearing horizons in the immediate study area.

No further work is proposed.

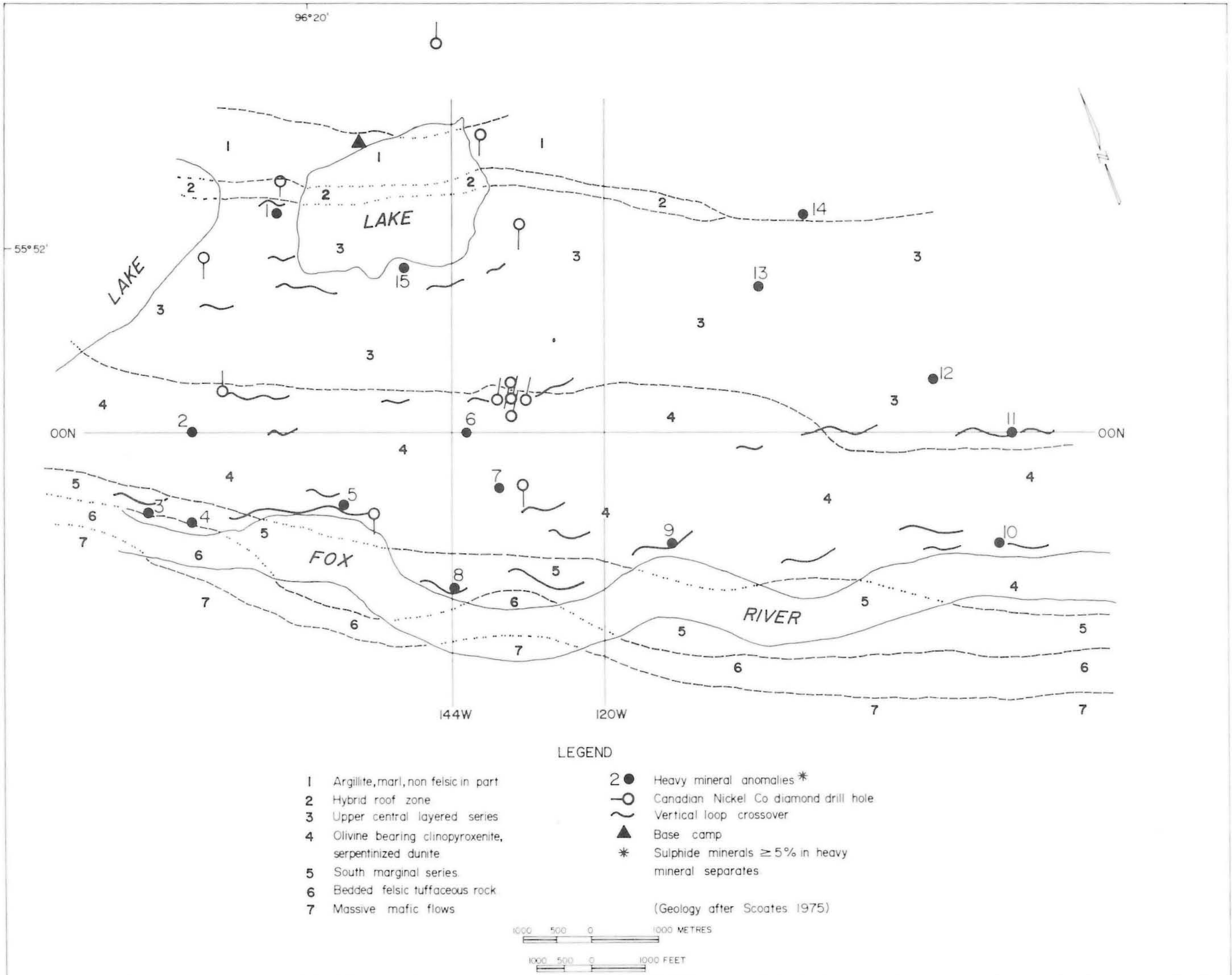



**Figure EO-2-1: Compiled geophysical and geochemical results, Fox River Area.**

**TABLE EO-2-1**

**Anomalous Heavy Mineral Sample Sites**

| Anomaly No. | % Sulphides | Geochemical Analysis* (in ppm) | | | | Coincident Low Frequency[1] Vertical Loop Crossover | Coincident Magnetic Anomaly |
|---|---|---|---|---|---|---|---|
| | | Cu | Ni | Cr | Co | | |
| 3 | 80 | — | 760 | 109 | — | Yes | Yes |
| 9 | 50 | 985 | — | 130 | — | Yes | No |
| 4 | 50 | — | — | 105 | — | Yes | Yes |
| 15 | 30 | — | 210 | 335 | — | No | No |
| 11 | 15 | — | 159 | 359 | — | Yes | Yes |
| 6 | 10 | 140 | 180 | 860 | — | No | No |
| 7 | 10 | 290 | — | — | — | No | Yes |
| 5 | 7 | — | 112 | 696 | — | Yes | Yes |
| 12 | 5 | 120 | 160 | 400 | 140 | — | — |
| 8 | 7 | 213 | — | — | — | Yes | Yes |
| 10 | 5 | — | — | 120 | — | Yes | Yes |
| 2 | 8 | — | — | — | — | No | Yes |
| 13 | 6 | — | — | — | — | — | — |
| 14 | 6 | — | — | — | — | — | — |
| 1 | 5 | — | — | — | — | Yes | Yes |

* Mean Values
Cu 40 ppm
Ni 130 ppm
Co 80 ppm
Cr 190 ppm

[1] 1000 Khz

**Reference:**


Potter, R.R.
1962: Gods River Map-Area, Manitoba; *Geol. Surv. Can.* Paper 62-8.

Sanford, B.V., Norris, A.W., and Bostock, H.H.
1968: Geology of the Hudson Bay Lowlands; *Geol. Surv. Can.* Paper 67-60.

Scoates, R.F.J.
1971: The Mineral Potential of Ultramafic Rocks of manitoba; *Man. Mines Br.,* Geol. Paper 3/71.

1975a: Ultramafic Rock Project; **in** Summary of Geological Field Work, 1975; *Man. Min. Res. Div.,* Geol. Paper 2/75.

1975b: Preliminary Map of Fox River Greenstone Belt (East), 1975 G-2.

## EO-3 ECHIMAMISH RIVER

## (63 I)

*By W.B. McDonald*

**Introduction:**

The Echimamish River project area is 80 kilometres northeast of Norway House and bounded by 96°54′ and 97°04′ west longitude and 54°24′ and 54°28′ north latitude. The objectives of the project in 1976 were to evaluate electromagnetic and magnetic anomalies outlined during an earlier winter program; to examine and evaluate all known and discovered sulphide occurrences; and to compile a geological map of the area of interest at a scale of one inch to ¼ mile (one centimetre to 150 metres). (Figure EO-3-1).

**Previous Work:**

The most recent mapping in the area was completed by Bell (1962) at a scale of one inch to four miles. The area has received sporadic attention over the past 50 years, primarily for gold and silver. In 1975, six claim blocks were staked for the Crown and preliminary mapping and prospecting were completed during the summer field season. Proton magnetometer and horizontal loop electromagnetic surveys totalling 150 line kilometres were conducted during February and March of 1976. Two additional claim blocks were staked at this time.

**Geology:**

The area of interest lies within a narrow band (500 to 6000 metres) of metavolcanic and metasedimentary rocks of Archean age classified as the Hayes River Group. The rocks comprise basalts, andesites, gabbros, dacites, and rhyodacites or sheared equivalents and minor undifferentiated metasedimentary interbeds.

**Economic Geology:**

Ten electromagnetic anomalies were followed up during the course of the mapping and sampling. Numerous massive, semi-massive and disseminated sulphide occurrences were located and sampled. Most are syngenetic pyrite or pyrrhotite assemblages with or without minor chalcopyrite of local or limited economic significance.

The most promising occurrence was found south of Loon Lake. A massive sulphide zone is exposed for approximately 9 metres and contains pyrite, sphalerite, galena, chalcopyrite, and arsenopyrite over a width of 0.45 metres. Five grab samples of this zone averaged 3% zinc and 1% lead.

Although the area has had a previous history of precious metals exploration and development, no encouraging Au or Ag results have been found.

**Recommendations:**

No further work will be undertaken in this area.

**Reference:**

Bell, C.K.

1962: Cross Lake Map-Area, Manitoba; *Geol. Surv. Can.* Paper 61-22.

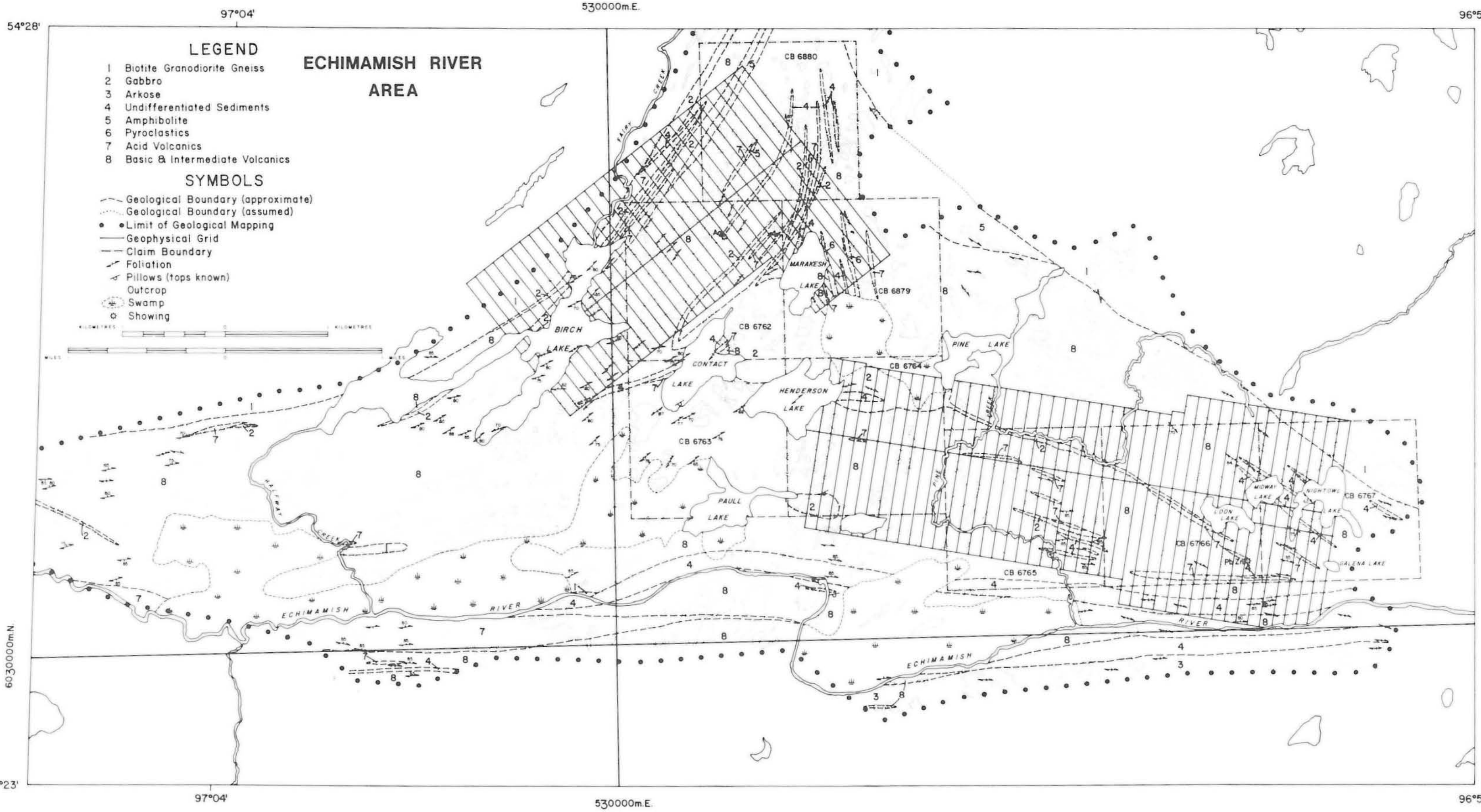



**Figure EO-3-1: Geology of the Echimamish River Area showing geophysical grids.**

# EO-4 DAWSON BAY

## (63 C/13, 14, 15)

*By D.S. Evans*

**Introduction:**

The Dawson Bay area is located in west central Manitoba at the northwest end of Lake Winnipegosis. The area is underlain by Devonian limestones and dolomites. The purpose of the project is to search for Mississippi Valley type lead-zinc massive sulphide deposits employing geophysical and geochemical techniques supported by shallow exploratory drilling. Base metal mineralization has not been reported in Devonian strata of Manitoba.

**Previous Work:**

In 1973, naturally-flowing brine springs were sampled in the Dawson Bay area and analyzed for major, minor and trace elements to search for possible geochemical expressions of hidden Mississippi Valley type sulphide deposits (Stephenson, 1973).

In 1975, a seismic reflection survey was completed under contract to the Department of Earth Sciences, University of Manitoba to define strata and structural features that may be favourable loci for massive sulphide deposits (Stephenson, 1976). Limited diamond drilling was also completed along the seismic profile for correlation purposes. No visible Pb-Zn mineralization has been encountered to date from the stratigraphic drilling.

**1976 Field Season:**

In 1976, renewed geochemical studies were undertaken in the Red Deer River area and two additional drillholes were completed to assess a geochemical anomaly and a reefal structure. No sulphide mineralization was encountered in either drillhole.

**Economic Geology:**

"Brine Springs Analyses"

Results of the brine anlyses have indicated that the Devonian carbonate section in the Dawson Bay area may host Mississippi Valley type Pb-Zn deposits. Encouraging base metal anomalies have been recognized in the Salt Point and Red Deer River areas.

"Seismic Reflection Survey"

Seismic reflection was selected to investigate regional and detailed strata and structural features that may be favourable for the localization of massive or semi-massive carbonate-hosted Pb-Zn deposits. The final results of this work were recently received and are currently being examined. Diamond drilling may be undertaken in areas of reefal doming and faulting related to reefal domes.

"Soil and Twig Sampling"

In May of 1976, an orientation pedogeochemical and biogeochemical survey was undertaken to determine the effectiveness of near-surface sampling as an exploration aid in the Red Deer River area. Soil sampling ($A^1$ horizon) and twig sampling (Birch, *Betula papyrifera)* were selected for the survey. Enrichments of Pb and Zn in both soils and twigs were identified at two locations along a 2750 metre traverse employing a sampling interval of 120 metres. These results, and the general applicability of geochemical techniques, are currently under review.

"Diamond Drilling Program"

A combined stratigraphic/exploration drilling program was undertaken in 1975 in cooperation with the Geological Services Branch. This program was continued in 1976. However, no Pb-Zn mineralization or alteration zones which may be indicators of mineralization have been encountered in four drillholes completed to date. Diamond drilling results and geology of the Red Deer River area are discussed by H.R. McCabe in the Report of Field Activities, 1976, Geological Survey; Mineral Resources Division.

**Summary:**

Results of geophysical and geochemical surveys are currently being re-assessed in the light of the negative drilling results encountered to date.

**References:**

McCabe, H.R.
1976: Stratigraphic Mapping and Core Hole Program; in Report of Field Activities, 1976; Geological Survey, *Man. Min. Res. Div.*

Stephenson, J.F.
1973: Geochemical Studies; in Summary of Geological Field Work, 1973; *Man. Mines Br.*, Geol. Paper 2/73.

Stephenson, O.
1976: Seismic Reflection Survey of the Dawson Bay Area, Lake Winnipegosis; Unpublished Internal Report.

# EO-5 KADENIUK LAKE

## (64 C/6)

*By D. Robertson*

### Introduction

The Sickle Group of metasedimentary rocks in the Kadeniuk Lake area south of Lynn Lake was investigated during the 1976 field season as a continuation of 1974 and 1975 evaluation and exploration activities. Work was concentrated within claim blocks C.B. 6684 and 6685 (Figure EO-5-1). The area of interest has been mapped at a scale of one centimetre to 60 metres in an attempt to define the relationships between the metasedimentary rocks and disseminated copper mineralization.

Prospecting, trenching, and sampling has extended the previously known strike length of mineralization (Baldwin, 1976). Six diamond drill holes totalling approximately 170 metres were completed during 1975 and 1976 to intersect at depth the surface lateral extension of the mineralization.

### General Geology

The exposed rocks within the claim blocks are a folded and faulted sequence of highly metamorphosed greywackes (1); an amphibolite (2); and a metagreywacke/arkose sequence (3).

The metagreywacke appears to be the oldest formation and is overlain by amphibolites and the metagreywacke/arkose sequence. Polyphase deformation and metamorphism (upper amphibolite grade) have obscured primary features. Limited outcrops have made structural interpretation difficult.

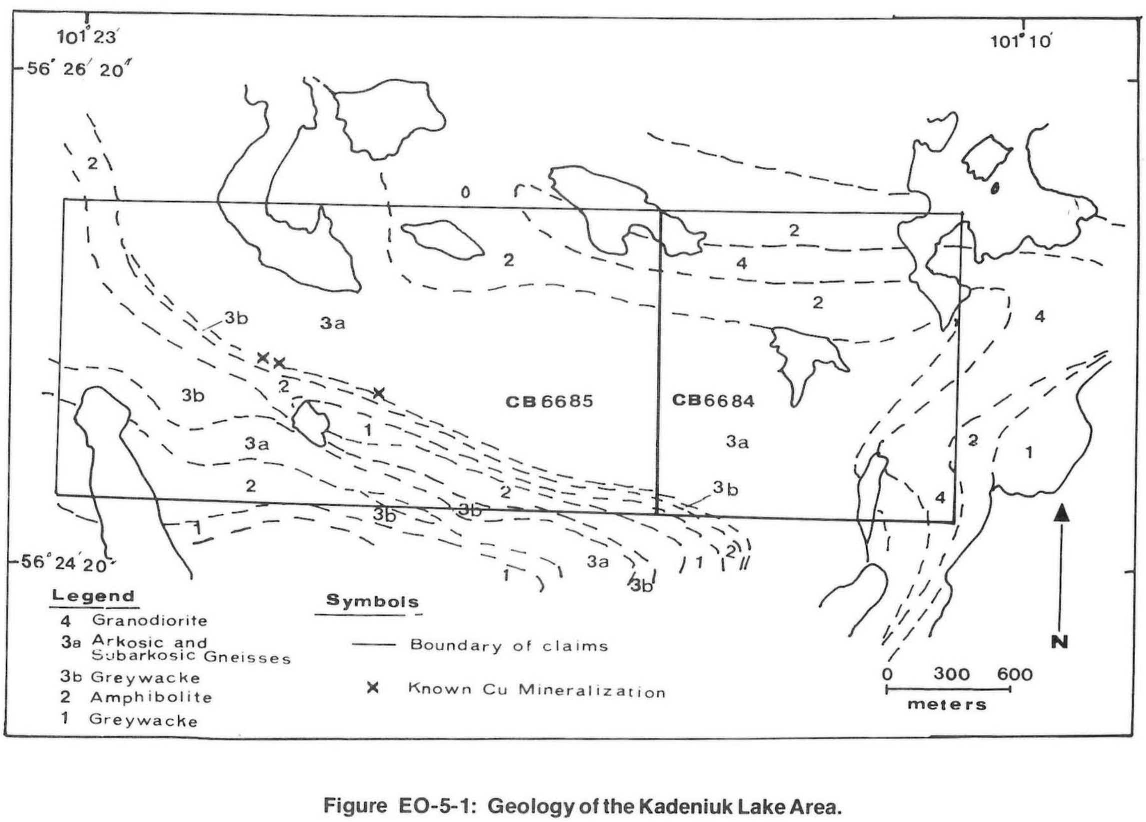



Figure EO-5-1: Geology of the Kadeniuk Lake Area.

## Mineralization

An environment for potentially economic copper mineralization has been recognized from known occurrences within the claim blocks. A disseminated sulphide horizon or bed occurs in the basal part of the Sickle Group metagreywackes and meta-arkosic rocks. Primary ore mineralogy includes chalcopyrite, bornite, native copper and magnetite. Malachite, chalcocite and hematite are secondary ore minerals. Pyrite is ubiquitous throughout the mineralized horizon.

The primary minerals occur as disseminated equigranular grains uniformly distributed throughout the mineralized rocks, except for native copper which occurs as a thin skin or film coating plagioclase feldspar and quartz grains.

The zone of disseminated copper mineralization shows evidence of a syngenetic sedimentary origin, occurring as a concordant bed or horizon at or near the meta-greywacke/arkose contact. The most consistent zone of mineralization has been observed over a strike length of 60 metres with a true thickness of 0.6 metres. A second zone of disseminated mineralization has been observed 600 metres along strike near the same geological contact (Figure EO-5-1).

Detailed examination of the drill core revealed that the copper mineralization shows no preference for rock type except for native copper which is only found in association with biotite arkose. Various ore mineral assemblages are seen in the drill core:

(1) iron sulphides occurring in two modes, alone and with chalcopyrite.
(2) chalcopyrite.
(3) bornite, alone and with chalcopyrite.
(4) native copper.

It should be noted that bornite and the iron sulphides have not been found in the same rock.

Copper was determined on all collected surface and trench samples and mineralized drill core intersections. Copper values of the trench samples range from less than 0.2% up to 3.0%, the average being 1.8%. However, copper values are highly erratic along strike. The average grade across the 0.6 metre thickness is 1.6%.

## Summary

Copper mineralization of sedimentary origin has been identified in the Kadeniuk Lake area. Individual assays are encouraging, but the observed strike length and thickness of the occurrence appear to be insufficient to warrant continued exploration.

The type of geological environment in which the copper mineralization is found appears to be unique to the Churchill Province. It is hoped that results of this work will aid exploration programs in metasedimentary domains of the Precambrian Shield.

## References


Baldwin, D.A.

1974a: The Geology of the Kadeniuk Lake Area; **in** Summary of Geological Field Work, 1974; *Man. Mines Br.*, Geol. Paper 2/74.

1974b: Kadeniuk Lake; *Man. Mines Br.*, Prelim. Map 1974R.

1976: Disseminated Copper Mineralization Along the Sickle Group — Laurie River Group Contact Zone at Kadeniuk Lake; *Man. Mines Br.*, Unpubl. Interim Report.

Downie, D.L.

1936: Granville Lake Sheet (West Half); *Geol. Surv. Can.* Map 343A.

# EO-6 KNIGHT LAKE

## (53 E/11 NW)

*By C. McGregor and H.W. Petak*

### Introduction

In 1975 four claim blocks totalling 2080 acres were staked in the name of the Crown over the west central part of Knight Lake. A horizontal loop electromagnetic survey was carried out over the northern portion of the claim blocks and the area was mapped. Seven electromagnetic conductors were tested by diamond drilling. The most encouraging results are from hole 142-1 with 1.57% and 0.59% Cu over 0.5 feet and 2.5 feet, respectively.

The main objective during 1976 was to extend detailed geological mapping, sampling and electromagnetic coverage into the southern sections of the claim blocks. VLF-EM was used to locate conductors and geological boundaries.

### General Geology

The Knight Lake area is underlain by the eastern extension of the Bigstone Lake greenstone belt (Ermanovics, I. et al., 1975). The major rock types are massive rhyolite flows, tuffs and minor pillowed flows overlain by flows of andesitic composition in the northeastern part of the peninsula (Figure EO-6-1). Flows of dacitic composition are interlayered with andesitic flows in the northwest. Arkose and minor siltstone occur in several localities on the south shore of the peninsula. A quartz diorite dyke (average width 90 - 120 metres) intrudes the south central portion of the peninsula. The south shore of Knight Lake is underlain by massive rhyolite flows and basalts in contact with the granite flanking the greenstone belt on the south.

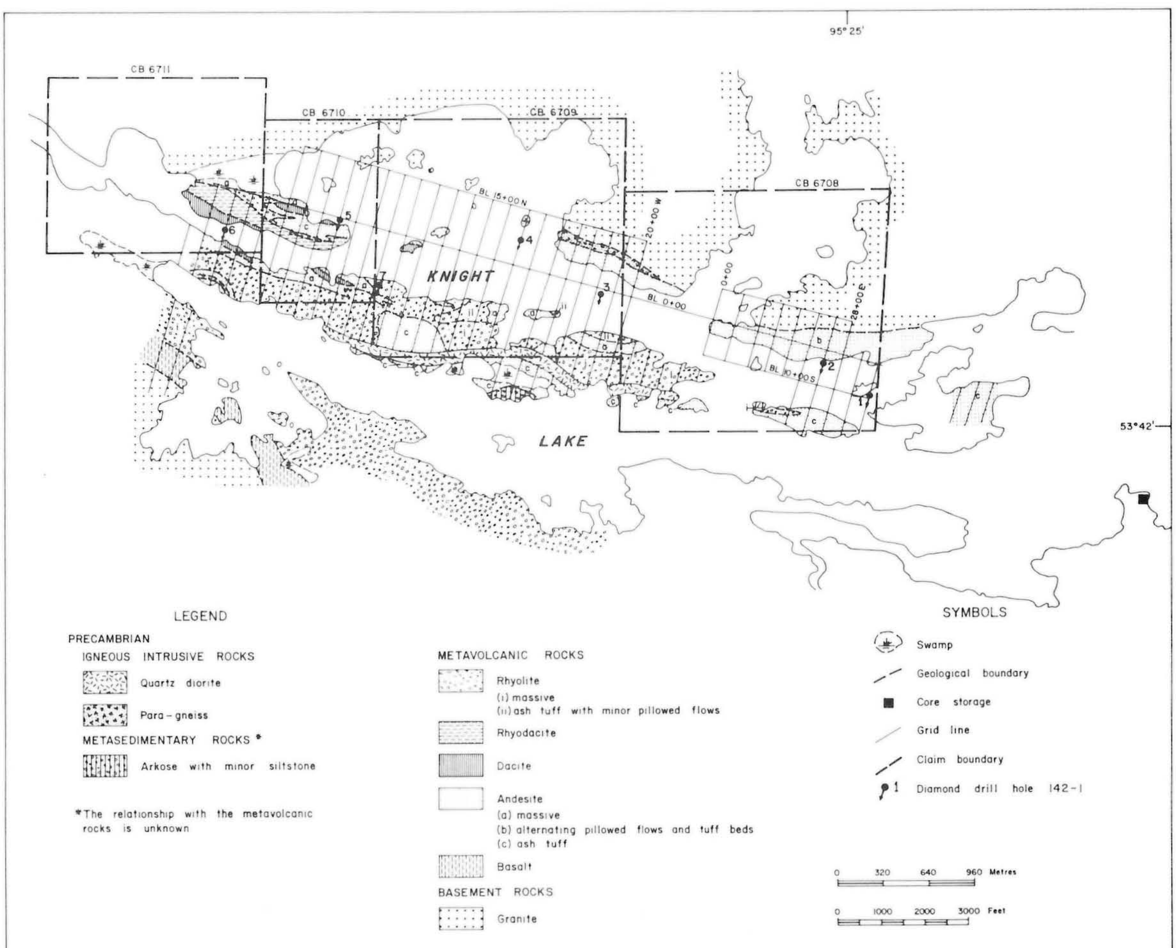



**Figure EO-6-1: Geology of the Knight Lake Area, showing geophysical grid and diamond drill locations.**

In general, the greenstone rocks reflect low-grade regional metamorphism (lower greenschist facies). The basalts along the granite contact, however, have been subjected to contact metamorphism and are altered to amphibolite.

Within the mapped area, the greenstone rocks strike east-west. A weak to moderate schistosity indicates shearing in the same direction.

### Economic Geology

The electromagnetic anomalies tested by diamond drilling proved to be mainly barren massive pyrite and pyrrhotite and/or graphite. Two sections in drillhole 142-1 contained minor chalcopyrite and assayed 1.57% Cu over 0.16 metres and 0.59% Cu over 0.75 metres.

Finely disseminated sulphides were found in numerous outcrops. Most occurrences were pyrite and pyrrhotite with occasional traces of chalcopyrite. These occurrences are considered to be of little economic significance.

### Geophysical Results

A VLF electromagnetic survey was completed over the central peninsula extending into Knight Lake (Figure EO-6-2). Line spacing was 120 metres with 30 metres between stations. One conductor has been found to be barren massive pyrite. Most of the other electromagnetic responses can be attributed to either conductive overburden, faulting or geological contacts.

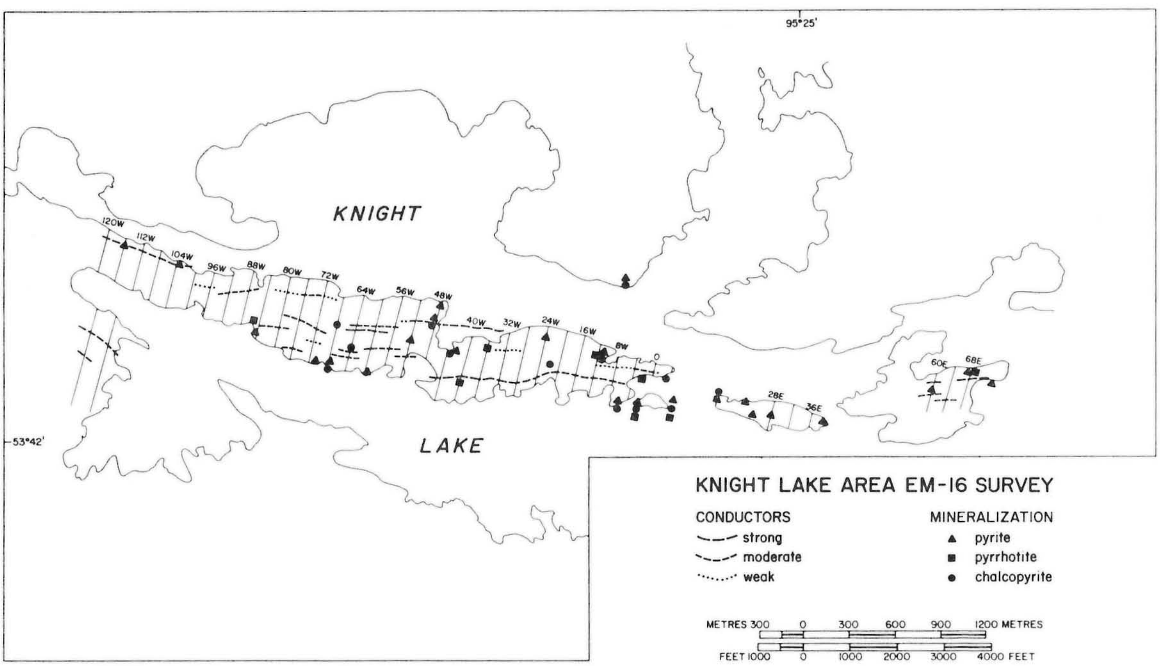



**Figure EO-6-2: Geophysical Survey Results, Knight Lake Area.**

### Summary

During the course of a follow-up program in the Knight Lake area, massive and disseminated sulphide occurrences were found and investigated. None appears to be of economic significance. As a result, the economic potential of the area has been rated as poor and no further work is planned.

### Reference


Ermanovics, I., Park, G., Hill, J., and Goetz, P.
1975: Geology of Island Lake Map-Area (53 E), Manitoba and Ontario; *Geol. Surv. Can.*, Paper 75-1, Part A.

# EO-7 REEKIE LAKE

## (53 L/11 SW & SE)

*By C. McGregor and H.W. Petak*

### Introduction

In 1972, the Geological Services Branch collected rock samples from the west end of Reekie Lake and established the presence of sparsely disseminated concentrations of scheelite. Confirmation samples were collected from the same area in October, 1975. Molybdenite was also discovered at this time.

The main objective of this project in 1976 was to systematically explore for scheelite and base metals along a contact zone encompassing a greenstone environment and a tonalitic paragneiss. This contact zone is exposed along the south shore of Reekie Lake and the north shore of Colen Lakes. An EM-16 electromagnetic survey was carried out to locate conductors and define geological contacts.

### General Geology

The Reekie Lake area (Figure EO-7-1) is within the Munro greenstone belt with tonalitic paragneiss to the south, overlain by massive basaltic flows to the north and by basalt crystal tuff to the east (Elbers and Gilbert, 1972). At the west end of Reekie Lake, a "skarn zone" (F.J. Elbers, pers. comm., 1975) occurs along the contact between tonalitic paragneiss and basaltic flows.

Both the tonalitic gneiss and the greenstones were subjected to high-grade regional metamorphism. In most places, the basalts have been altered to fine-grained amphibolites.

The structural trends in the mapped area are northwest and southeast with several local variations. All the rocks exhibit slight schistosity in an east-west direction.

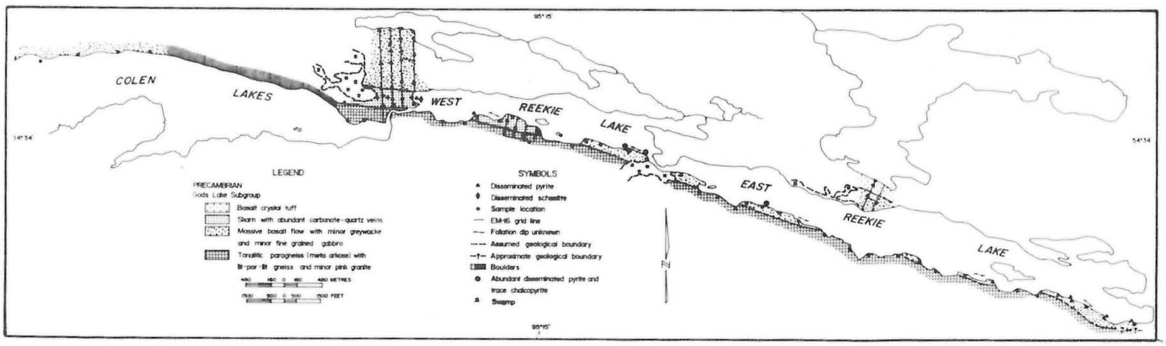



**Figure EO-7-1: Geology of the Reekie Lake Area showing geophysical grids and bedrock sample locations.**

### Economic Geology

The scheelite occurrence was discovered within an apparent skarn zone at the west end of Reekie Lake. The mineralization occurs with carbonate-quartz alteration or replacement and is localized as disseminated layers and segregations that are parallel to the tonalitic paragneiss-basalt contact. It should be noted that scheelite occurs in amounts less than 1% by volume of the host rocks. The skarn also carries some disseminated pyrite. The greenstone tonalite contact zone is characterized by minor occurrences of disseminated pyrite with traces of chalcopyrite.

### Geophysical Results

A VLF electromagnetic survey (EM-16) was completed in the area of the scheelite occurrence. Line spacing was 120 metres and station spacing was 30 metres.

Most electromagnetic responses can be attributed to conductive overburden, water table effects, faulting and geological contacts. A weak anomaly to the north of the occurrence area may be related to weakly disseminated chalcopyrite and pyrrhotite mineralization observed in greenstone rocks.

## Summary

Weakly disseminated occurrences of scheelite and chalcopyrite mineralization have been evaluated in the Reekie Lake area of northern Manitoba. The economic potential of the explored area has been rated as poor, and no further work is recommended.

## References

Elbers, F.J., and Gilbert, H.P.
1972: Munro Lake Area (53 L/11); **in** Summary of Geological Field Work, 1972; *Man. Mines Br.,* Geol. Paper 3/72.

# EO-8 KARSAKUWIGAMAK LAKE

## (64 B/12)

*By C. Cutforth and D. Robertson*

### Introduction

Upper Wasekwan metasedimentary and volcanic rocks and minor Sickle Group metasedimentary rocks were investigated and evaluated for their economic potential in the Churchill River, Rusty Lake and Opachuanau Lake areas. The area was previously mapped by Steeves and Lamb in 1972.

### General Geology

The exposed rocks in the Opachuanau and Rusty Lakes area are an isoclinally folded sequence of metamorphosed argillites and amphibolites with minor basic and intermediate volcanic flows (Figure EO-8-1). Limited exposures have made structural interpretation difficult.

Pre-Sickle intrusive rocks occur in the area and are usually emplaced along fold hinges.

The Sickle conglomerate unconformably overlies Wasekwan sedimentary rocks along the Churchill River.

### Mineralization

A number of sulphide occurrences were examined in the Opachuanau and Rusty Lakes area (Figure EO-8-1). A discontinuous and disseminated zone of pyrite, arsenopyrite and pyrrhotite mineralization south of Opachuanau Lake is thought to be associated with folding in both the amphibolitic rocks and the intruding diorite.

Poorly exposed and sparsely disseminated iron sulphide mineralization occurs on the south shore of Opachuanau Lake. Disseminated arsenopyrite was found in metasedimentary rocks and disseminated pyrite and pyrrhotite in andesites.

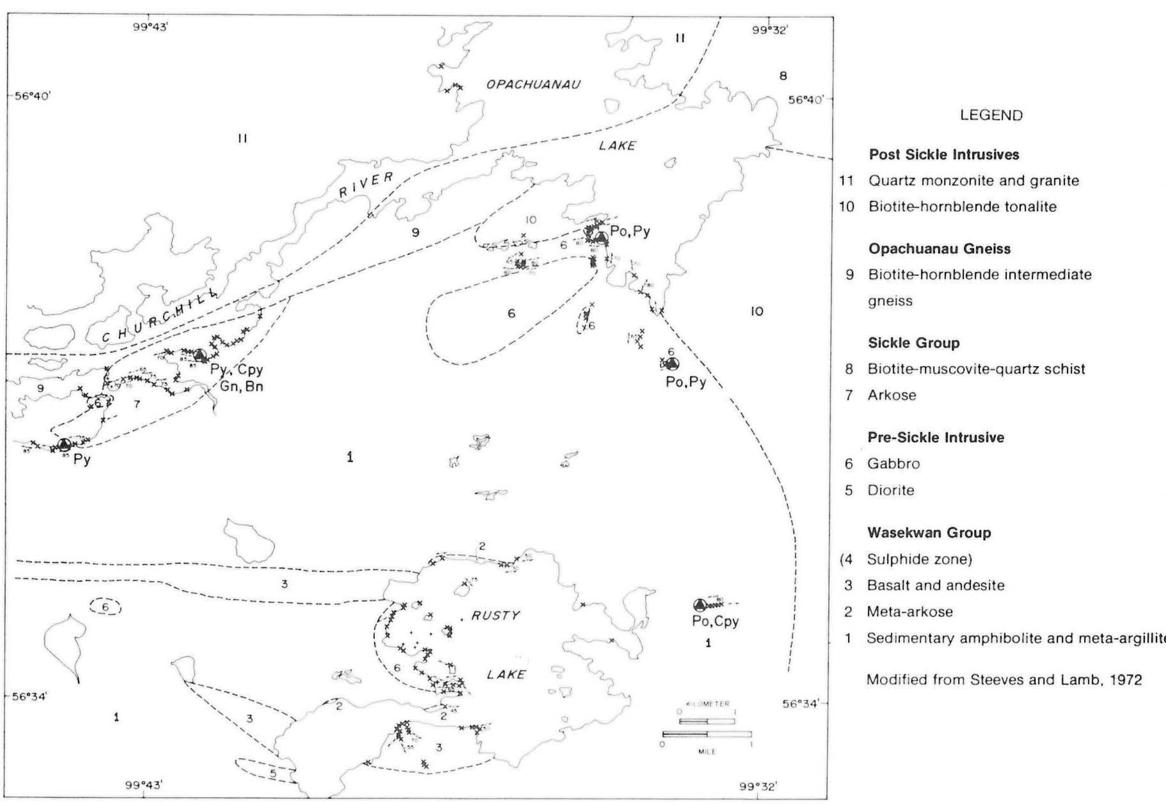



**Figure EO-8-1: Generalized geology of Churchill River and Opachuanau Lake Area indicating sulphide mineral occurrences.**

Northeast of Rusty Lake, a massive pyrite and pyrrhotite occurrence assayed 500 ppm Cu, 550 ppm Ni, 830 ppm Zn. Malachite and pyrite mineralization was found near the contact between a diorite intrusive and Upper Wasekwan metasedimentary rocks and intermediate to basic volcanic rocks. The best assay was 2400 ppm Cu, 27 ppm Ni, 51 ppm Zn.

A single occurrence of sparsely disseminated bornite, chalcopyrite, galena, pyrite and native copper was found in the Sickle conglomerate unit on the Churchill River (Figure EO-8-1).

## Summary

Subeconomic disseminated sulphide occurrences have been evaluated in the Opachuanau-Rusty Lake area. The limited degree and extent of mineralization throughout the map area, together with discouraging assay results, indicate that no further work is warranted at this time.

## References

Steeves, M.A., and Lamb, C.F.
1972: Issett-Opachuanau-Pemichigamau-Earp Lakes Area; *Man. Mines Br.,* Publ. 71-2F.

Gilbert, P.
1975: Karsakuwigamak Lake Project; *Man. Mines Br.,* Interim Report.

# EO-9 "CAT EYE BAY"

## (53 L/13)

*By R. Haskins and D.S. Evans*

### Introduction

The "Cat Eye Bay" base and precious metals occurrence is located on the south shore of Oxford Lake at latitude 54°47'N, longtitude 94°38'W. Access is by float plane from Thompson or by winter road from Jenpeg, a distance of 177 kilometres from Thompson, and 160 kilometres from Jenpeg.

### Previous Work

In the past, various companies have examined the occurrences at "Cat Eye Bay", primarily for gold and silver mineralization. Previous disposition holders include Cominco Ltd. (1929), Oxford Lake Gold Mines Ltd. (1934), Sherritt Gordon Mines Ltd. (1950), and Selco Exploration Company Ltd. (1970). The ground was acquired in March, 1976 by the Crown under C.B. 7530 and C.B. 7531.

The area has been mapped by Hubregtse (1973).

### Geological Setting

Sulphide mineralization at "Cat Eye Bay" is confined to a concordant mylonite zone within a remnant of the Hayes River Group, a greenstone sequence approximately 275 metres wide and of unknown length. This unit is tectonically bounded on the southwest by a large tonalite batholith and on the northeast by a small granodiorite pluton (Hubregtse, op. cit.).

The presence of garnets, cordierite and anthophyllite indicates an intense hydrothermal alteration event.

### Sulphide Mineralization

The sulphide mineralization at "Cat Eye Bay" includes massive, semi-massive and disseminated concentrations of sphalerite, chalcopyrite, galena and pyrite. Sphalerite is the major ore mineral and is characterized by geochemically abundant concentrations of Cd and Hg. Sulphides are contained within a silicified zone consisting of smoky quartz "veins" within and parallel to the mylonite zone. These "veins" are highly folded and broken.

Three separate and subparallel mineralized horizons have been identified (Figure EO-9-1). The southernmost, Zone "A", consists of massive pyrite, minor chalcopyrite and disseminated to semi-massive sphalerite. This zone is continuous along strike and has an average width of 1.5 metres. The northernmost, Zone "B", consists of semi-massive to massive sphalerite, accessory chalcopyrite and pyrite and minor segregations of semi-massive galena, and is 0.3 to 1.0 metres wide. Zone "C" lies between Zone "A" and Zone "B" and is a discontinuous bifurcation of Zone "B". Along the shoreline the three zones are confined to a total apparent width of 4.5 metres. Further east, 100 metres along strike, the three zones expand to an apparent width of 7.5 metres and eventually merge into a single highly silicified horizon containing disseminated Cu-Zn-Pb sulphides.

### Geophysics and Geochemistry

A VLEM broadside survey was undertaken along 60-metre lines with station readings at 8 metres. A weak bedrock conductor was observed over Zone "A".

A soil survey was completed with samples collected from the "B" horizon at 25-foot stations. The results of this survey indicate the mineralization subcrop is confined to the area of trenching (Figure EO-9-1).

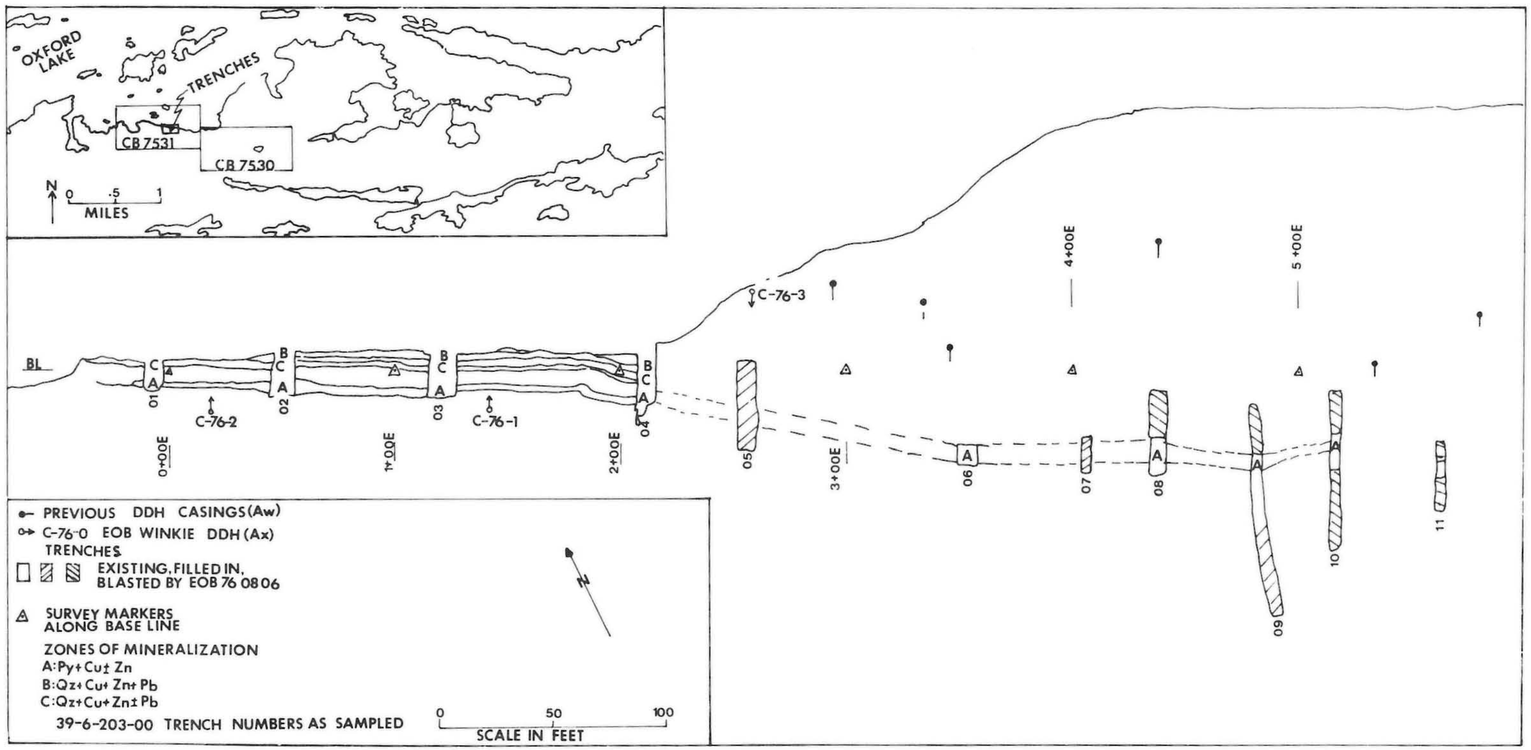



**Figure EO-9-1: Plan of Mineralized Zones, Trenches and Diamond Drill Holes at "Cat Eye Bay".**

### Diamond Drilling

A "Winkie" diamond drill was used to test mineralization at shallow depths. Three holes were completed yielding a total of 59 metres of AX core (see Figure EO-9-1 for hole locations). Assay results are presented in Table EO-9-2.

**TABLE EO-9-1**

**"CAT EYE BAY"**

| Trench No. | Width in metres | Cu % | Zn % | Pb % | Au oz/t | Ag oz/t | Cd ppm | As ppm | Hg ppb |
|---|---|---|---|---|---|---|---|---|---|
| 203-1 | 3.81 | 0.08 | 0.37 | 0.07 | Tr | 0.57 | 25 | 3 | 197 |
| 203-2 | 4.57 | 0.20 | 1.10 | 0.19 | 0.03 | 0.43 | 65 | ND | 604 |
| 203-3 | 4.29 | 0.16 | 1.22 | 0.23 | 0.07 | 0.62 | 147 | 1 | 911 |
| 203-4 | 5.79 | 0.22 | 1.00 | 0.22 | 0.02 | 0.35 | 64 | 3 | 575 |
| 203-6 | 1.83 | 0.63 | 1.22 | 0.03 | 0.11 | 0.71 | 81 | 3 | 600 |
| 203-8 | 1.22 | 0.41 | 0.88 | 0.20 | 0.18 | 0.59 | 70 | 4 | 680 |
| 203-9 | 1.52 | 0.30 | 0.21 | 0.34 | 0.09 | 0.65 | 11 | 4 | 980 |
| 203-10 | 1.83 | 0.26 | 0.41 | 0.07 | 0.05 | 0.31 | 32 | 4 | 405 |

ND — Not Detected

**TABLE EO-9-2**

**DIAMOND DRILLING ASSAY RESULTS — "CAT EYE BAY"**

| DDH # | True Width (metres) | Au oz/t | Ag oz/t | Cu % | Zn % | Pb % |
|---|---|---|---|---|---|---|
| C-76-1 | 0.61 | 0.07 | 0.82 | 0.13 | 1.63 | 0.26 |
| C-76-1 | 1.52 | Nil | 0.30 | 0.04 | 0.95 | 0.40 |
| C-76-3 | 0.55 | Nil | 0.62 | 0.06 | 1.09 | 0.28 |
| C-76-3 | 1.53 | 0.09 | 0.70 | 0.44 | 0.99 | 0.08 |
| C-76-4 | 1.76 | 0.10 | 0.48 | 0.37 | 2.15 | 0.04 |

### Analyses

Nine old trenches expose the occurrence along strike (see Figure EO-9-1). Trench numbers 203-1, 2, 3, 4 and 6 were resampled while trench numbers 203-8, 9, 10 and 11 were reblasted and extended to provide fresh material for analyses. The results of channel sampling are summarized in Table EO-9-1. Trenching has not penetrated below the zone of weathering and all material has been subjected to moderate to heavy leaching.

### Summary

The "Cat Eye Bay" base and precious metal occurrence appears to be a hydrothermal "vein" complex. Sulphide mineralization is confined to a 4.5 to 7.5 metre wide silicified zone, deformed by both the mylonitization and a later folding event. Sulphides exhibit re-crystallization features and metals appear to have been preferentially mobilized and redistributed.

### References

Hulwegtse, J.J.M.W.

1973: Carghill Island; *Man. Mines Br.*, Prelim. Map 1973H.

## EO-10 PASKWACHI BAY

## (64 F/4, 5)

*By P. Wielezynski*

### Introduction

Paskwachi Bay, located 75 kilometres northwest of Lynn Lake, is a southeast extention of Reindeer Lake and is about 25 kilometres north of the existing Lynn Lake-Reindeer Lake road.

In 1964, Hudson Bay Exploration and Development Co. Ltd. drilled six holes on the Saskatchewan side of Paskwachi Bay. Two holes intersected mineralization assaying 5.1% Zn and 0.2% Pb over 0.5 feet, and 3% Zn and 0.2% Pb over three feet. On this basis, the Exploration Operations Branch undertook further investigations on the Manitoba side of Paskwachi Bay.

The objectives of the 1976 field work were to investigate known sulphide occurrences in the area, and to identify rock units of possible economic interest.

### General Geology

The area is underlain by Precambrian metasedimentary and metavolcanic rocks consisting of gneisses, migmatites and amphibolites. The gneissic rocks are comprised of metagreywackes, meta-arkoses and hornblende-bearing gneisses probably originating from metamorphosed andesites, basalts and tuffaceous rocks. The contact between the migmatitic and non-migmatitic gneisses is gradational and irregular. The amphibolites were possibly derived from metamorphosed sedimentary and intrusive rocks including gabbro, peridotite and pyroxenite.

The metagabbro is the only significantly mineralized rock in the explored area and occurs as sill-shaped masses in the greywackes (unit 4a) in the trench (Figure EO-10-1) and also in the granodiorite and porphyritic granodiorite in the southern extension of the area. Much of this area comprises irregular bodies of granitic rocks of various sizes.

The distribution of the granitic rocks is related to the composition of the host rocks. In the central part of the area the hornblende gneisses and migmatites contain small bodies and sills of white hornblende tonalite. A large body of white to pinkish granodiorite occupies a portion of the southern part of the investigated area. Sills of foliated granodiorite commonly occur within greywackes and amphibolites (unit 2). The porphyritic granodiorite has been found just west of the granodiorite containing several partially digested amphibolitic inclusions. A small body of magnetite-bearing quartz monzonite appears on an island just west of the Manitoba-Saskatchewan border. There are numerous sills of quartz monzonite within arkosic gneisses.

### Economic Geology

Sulphide mineralization is located on the west shore of Paskwachi Bay just west of the Manitoba-Saskatchewan border (Figure EO-10-1). Here, an easterly-trending zone of mineralization dips 40° to the north and is mainly confined to a metagabbro sill. The sulphide assemblage includes pyrrhotite, pyrite, sphalerite, chalcopyrite and galena. The semi-massive mineralization occurs as irregular-shaped bodies impregnating and replacing the metagabbro and as mineralized stringers. This zone has been traced for approximately 800 feet along strike and is up to 20 feet wide. Grab samples collected at the occurrence average 3% Zn, 0.5% Cu, 0.07% Pb, with traces of Ag and Au. The metagabbro is enclosed within greywackes (unit 4a) which are often garnet-bearing and intruded by numerous granodioritic and pegmatitic sills.

No significant economic mineralization was observed at other known sulphide occurrences in the study area. Disseminated ($< 1\%$) pyrite and pyrrhotite occur in the amphibolites (unit 2) and metagabbro (unit 5).

Two claim blocks (Figure EO-10-1) have been staked in the name of the Crown.

### Geophysical Results

A reconnaissance EM-16 survey in the area of the Crown-owned claim blocks has indicated the presence of a conductor extending into Manitoba from the Saskatchewan occurrence.

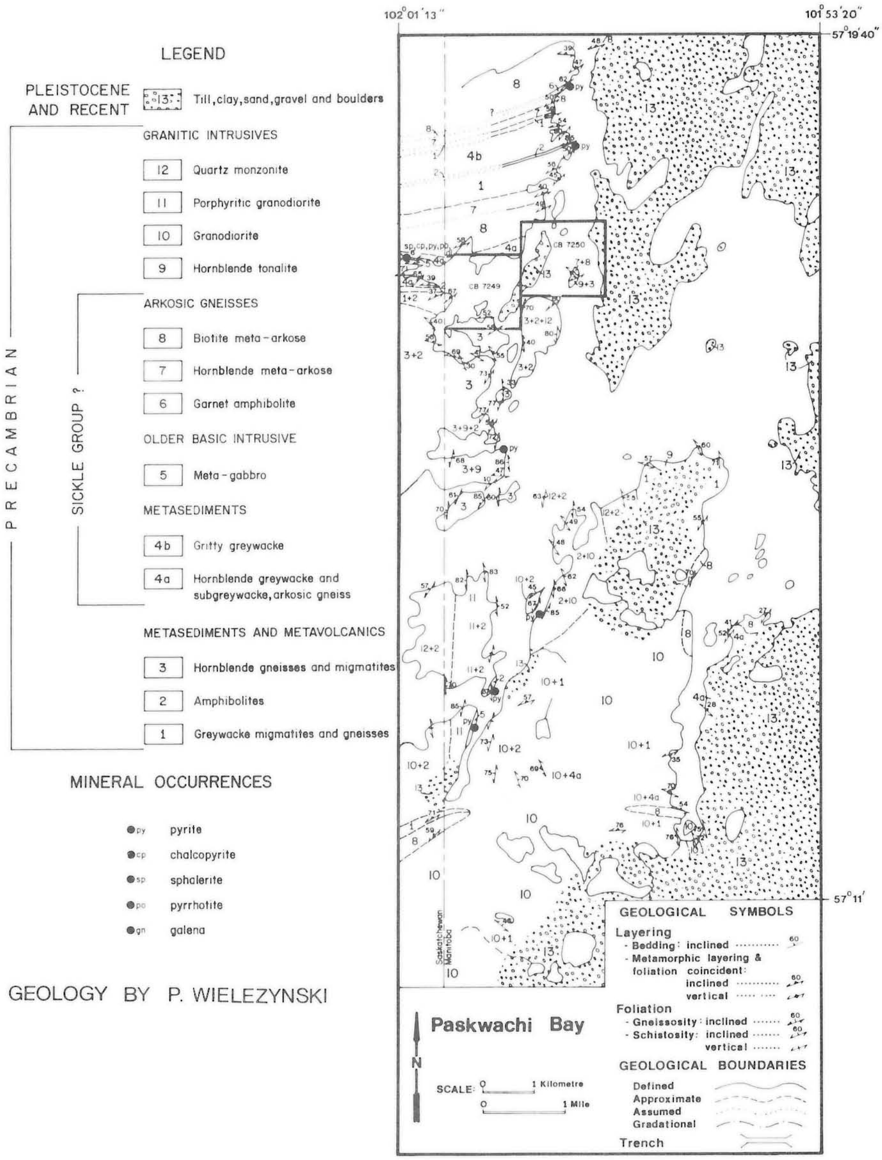



**Figure EO-10-1: Geology of the Paskwachi Bay Area.**

## Recommendations

A detailed vertical loop electromagnetic survey will be carried out to confirm the bedrock extension of the conductor. Significant or promising bedrock conductors will be drilled.

## References


Gadd, N.R.
1948: *Geol. Surv. Can.* Map 1001A.

McRitchie, W.D.
1976: Unpubl. Field Notes.

Rice, H.M.A.
1950: *Geol. Surv. Can.* Map 1016A.

Stockwell, C.H.
1928: *Geol. Surv. Can.* Summ. Rept., Part B, pp. 46-72 (Map 233A).

# EO-11 ISLAND LAKE

## (53 E/15 SE, 16 SE & SW and 53 F/12 NW)

*By H.W. Petak*

### Introduction

During 1976, the Exploration Operations Branch conducted a base metal exploration program in the Island Lake area. Field assistance and support was provided by 20 prospector trainees of the Manitoba Prospectors Training and Field Program. Activities included prospecting, sampling, geophysical surveys and trenching.

The objective was to explore selected areas in the Island Lake greenstone belt and delineate target areas for detailed follow-up programs.

The area examined includes the central and eastern Island Lake area. Figure EO-11-1 is an index map showing the location of the explored areas. The Island Lake area has been previously mapped by J.D. Godard (1963 and 1964).

### General Geology

The geology of the Island Lake greenstone belt is a tightly folded sequence of volcanic and sedimentary rocks intruded by rocks of gabbro to diorite composition. The volcanic rocks range from mafic to felsic in composition and consist of pillowed units, massive flows, and a variety of pyroclastic rocks (from ash to large bomb size). Flow rocks of intermediate composition are predominant.

Sedimentary rocks occur throughout the stratigraphic succession and primarily overlie the volcanic sequences. A regional conglomerate containing fragments of volcanic rocks as well as cobbles of older sedimentary rocks and granitic material is the most prominent sedimentary formation. Locally, minor amounts of sedimentary rocks, mostly greywacke, are interbedded with volcanic rocks.

The regional strike is east to southeast and the dip is uniformly vertical or near vertical. A weak to moderate schistosity is parallel to bedding planes. Volcanic and sedimentary rocks have been subjected to weak to moderate regional metamorphism.

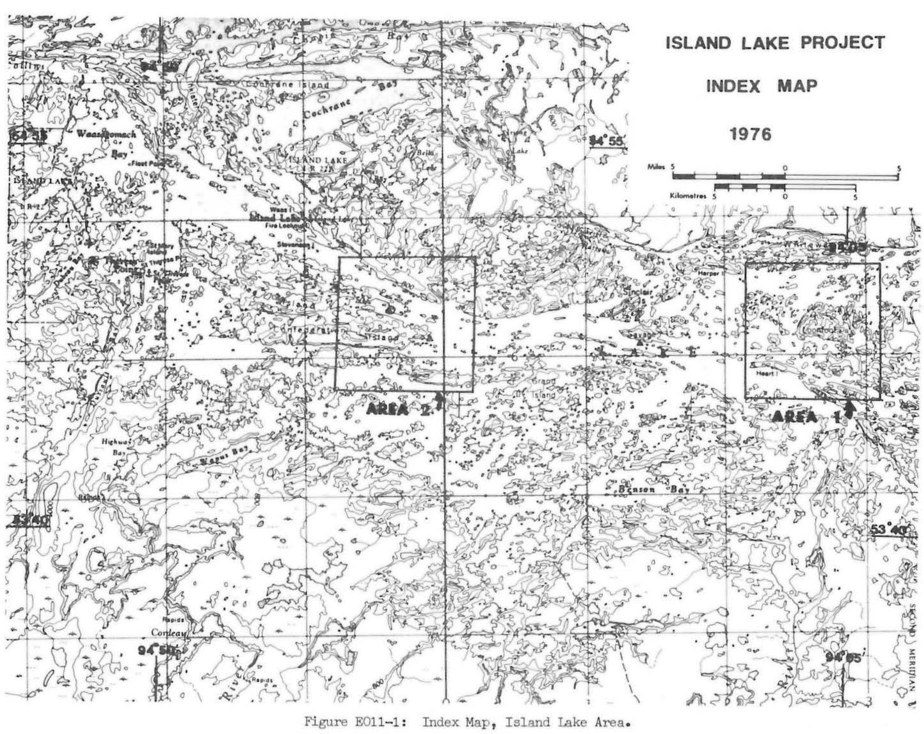



Figure E011-1: Index Map, Island Lake Area.

**Figure EO-11-1: Index Map, Island Lake Area.**

## Economic Geology

Disseminated, semi-massive and massive sulphide mineralization including pyrite, pyrrhotite, chalcopyrite, galena, sphalerite and molybdenite was found throughout the explored area. The significant occurrences are shown in Figures EO-11-2 and EO-11-3. The mineralization is usually confined to the intermediate to felsic volcanic environment. Copper values up to 2.85% have been recorded on samples collected in the Island Lake area.

## Geophysical Results

A VLF electromagnetic survey (EM-16) was completed over three separate grids (Figures EO-11-2 and EO-11-3). In two instances, the objective was to confirm airborne electromagnetic conductors. Trenching across the VLF conductors exposed barren massive sulphide mineralization. A third survey was carried out to delineate the extension of a newly discovered semi-massive sulphide occurrence. A bedrock conductor was detected on three additional lines but heavy overburden prevented examination of the occurrence.

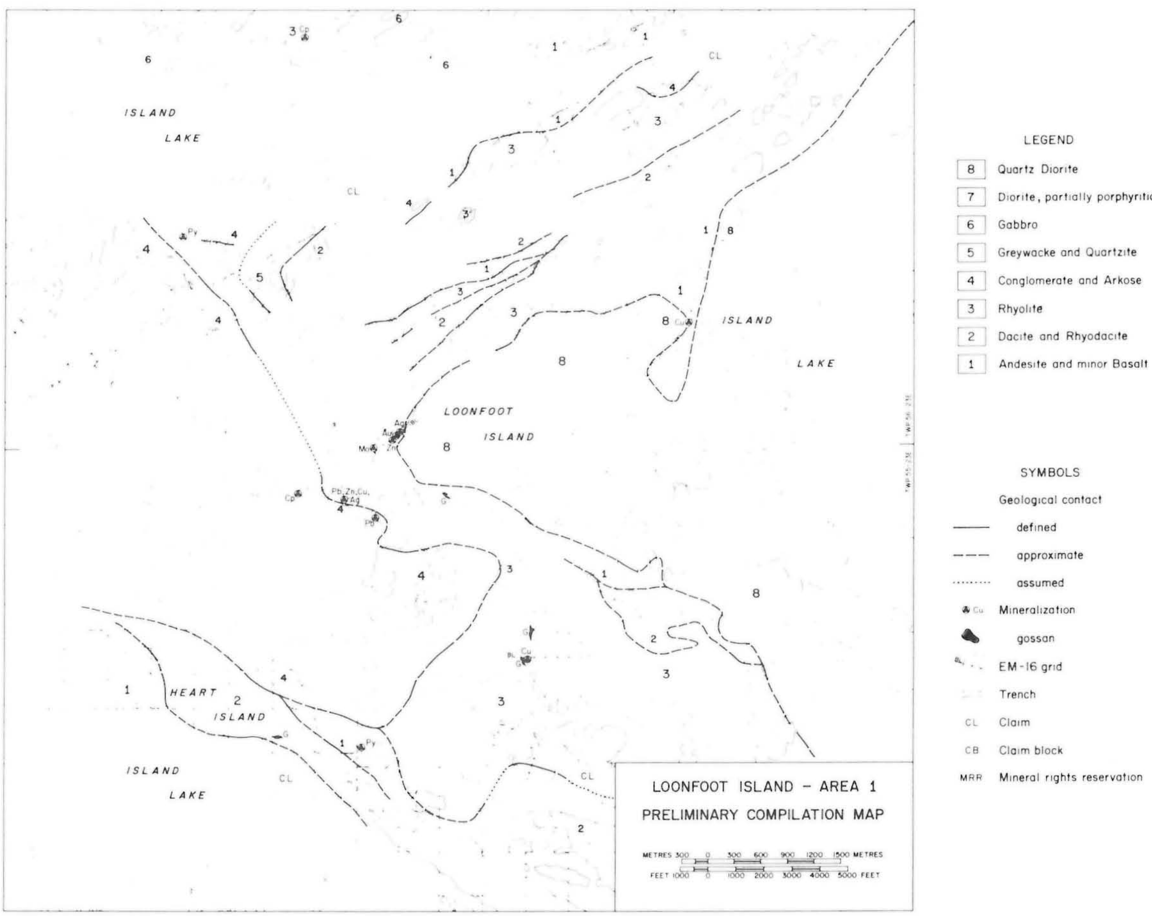



**Figure EO-11-2: Generalized geology showing geophysical grids, Loonfoot Island, Island Lake Area.**

## Summary

Disseminated, semi-massive and massive sulphide mineralization has been found to occur through the central and eastern Island Lake area. Most occurrences are of little economic significance. The occurrences shown on the maps in Figures EO-11-2 and EO-11-3 are believed to warrant follow-up work.

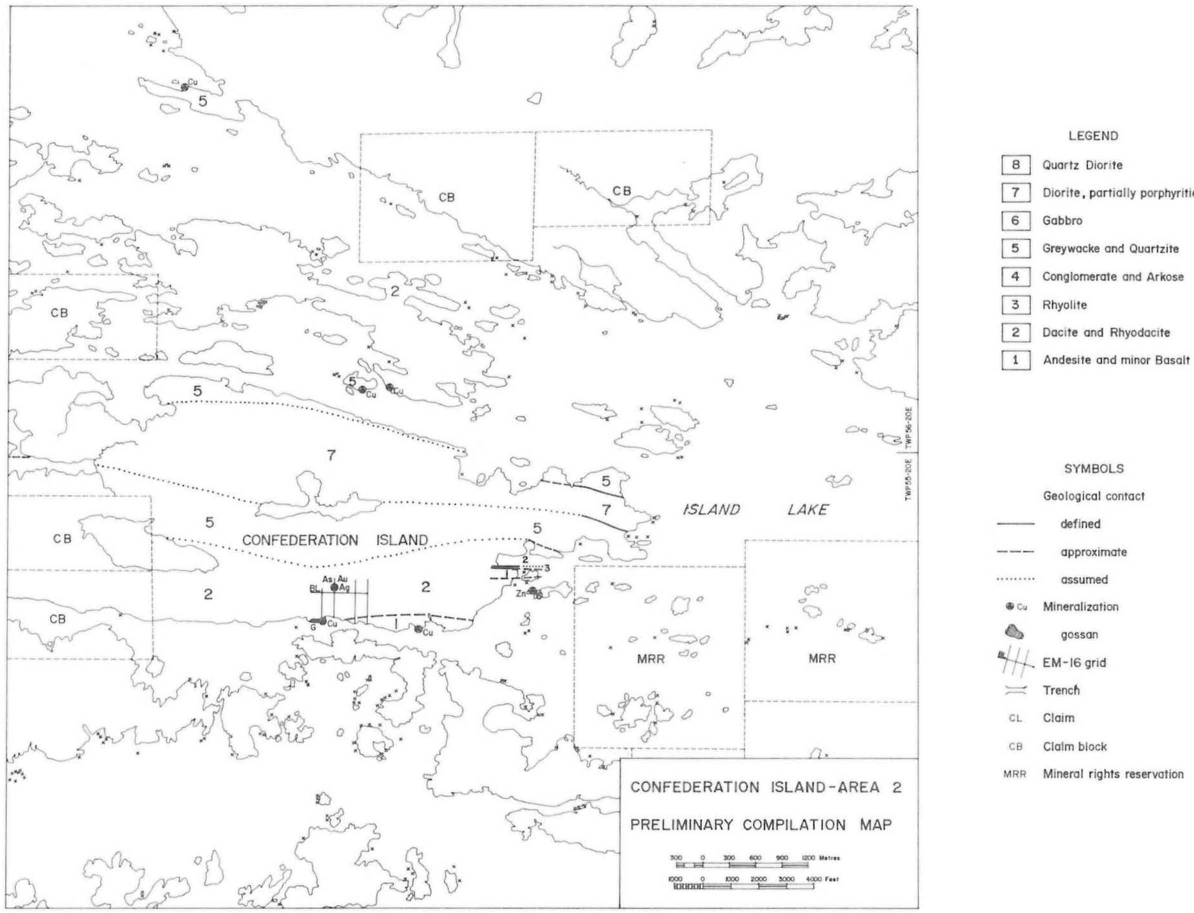



**Figure EO-11-3: Generalized geology showing geophysical grids, Confederation Island, Island Lake Area.**

## References


Godard, J.D.

1963: Geology of the Island Lake-York Lake Area (NTS area 53 E/15 and 53 E/16); *Man. Mines Br.*, Publication 59-3.

1964: Geology of Sagawitchewan Bay Area (NTS 53 F/12); *Man. Mines Br.*, Publication 60-2.

# (EO-12) PRECIOUS METALS EXPLORATION

## NTS 53 E and 53 L

*By L.C. Chastko and J.C. Gibson*

### Introduction

Precious metals exploration, mainly for gold, was conducted in three areas during the 1976 field season:

(1) Island Lake (Gold Island)
(2) Gods Lake (Jowsey Island)
(3) North Knee Lake (former Amalgamated Knee Lake Mines).

All three areas host significant gold occurrences, with previous development and/or production. These areas served as logical focal points for conducting precious metals exploration.

Exploration activities were confined to geological examination, mapping, prospecting and evaluation of known and new gold occurrences.

### Conclusion

No new or significant precious metals prospects or extensions of known occurrences have been discovered. All three areas have been previously explored in considerable detail. No new "insights" have arisen from re-examination of these areas.

Although some occurrences are relatively high-grade, the erratic nature and probable limited low tonnage potential coupled with high exploration and development costs render these type of deposits uneconomical at the present time.

### Recommendations

No further exploration work is proposed in these properties at the present time.

### General Observations

At the Gods Lake and Knee Lake properties, the general and local structure is considered "tight" and widespread development of ore grade gold mineralization appears unlikely. However, if future exploration work is contemplated, the following observations may be of assistance:

(1) Gods Lake Gold Mines (Elk Island) is located within sedimentary rocks and may represent a remobilized and concentrated exhalative volcanogenic deposit. Tracing the ore-bearing horizon may prove fruitful.
(2) Jowsey Island Gold Mines appears to be a pipe-like structure. Possible extensions may occur beneath the waters of Gods Lake. Mineralization may occur within a "porphyry-type" environment.
(3) Knee Lake Gold Mines mineralization appears confined within a tuffaceous horizon and is possibly of syngenetic origin. Disruption of this horizon may provide focal points for concentration of mineralization.

To facilitate discussion, the three areas are included under separate sections following this.

## EO-13 ISLAND LAKE

### Introduction

Exploration activities were centered on Gold Island and the Jack of Diamonds Gold Mines property (Figure EO-13-1).

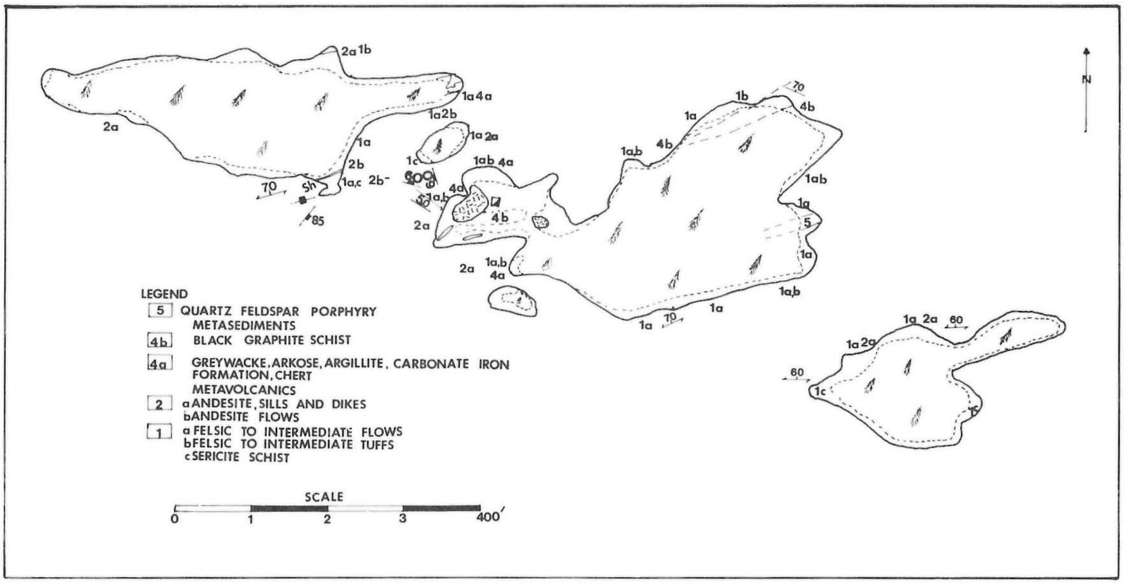



**Figure EO-13-1: Detailed geology of Gold Island, Island Lake.**

### General Geology

The geology of the area is primarily comprised of intermediate volcanic rocks with interlayered pyroclastic horizons and sedimentary units. These rocks are sheared, faulted, and intruded by younger rocks.

### Economic Geology

Gold, silver, pyrite, chalcopyrite mineralization occurs in quartz veins within highly sheared volcanic and sedimentary rocks. No encouraging or promising gold assays were obtained.

# EO-14 GODS LAKE

## Introduction

Exploration activities were centered on Claim Blocks C.B. 6781 and C.B. 6780 (Figure EO-14-1). This property has been previously explored by diamond drilling, a shallow shaft, and drifting (Jowsey Island Gold Mines, 1936).


**Figure EO-14-1: Detailed geology of Jowsey Island, God's Lake.**

## General Geology

The rocks in the area are primarily mafic to felsic volcanics which have been intruded by minor gabbro, granodiorite, quartz porphyry and quartz feldspar porphyry dykes.

## Economic Geology

Gold, pyrite, pyrrhotite and arsenopyrite mineralization occurs in quartz-filled fractures. The host rock is a fine-grained, sericitized felsite. The only available mineralized samples are from a stock pile. No in situ mineralized material was observed.

A 150 metre wide shear zone in pillowed mafic volcanics is intruded by a number of "fresh" quartz porphyry and quartz feldspar porphyry dykes and is concordant with shearing. No alteration and fracturing similar to mineralized samples were observed in surface exposures.

## Conclusions

The fractured mineralized "felsite" may extend to the north or west beneath the waters of Gods Lake. The fracture zone forms a localized pipe structure with erratic high-grade shoots.

## (EO-15) KNEE LAKE

### Introduction

Exploration activities were centred on contiguous Crown-owned Claim Blocks C.B. 6768 to C.B. 6779 inclusive (Figure EO-15-1). This property was previously explored by diamond drilling, a shallow shaft and drifting (Knee Lake Gold Mines and Johnston Knee Lake Gold Mines, 1936).

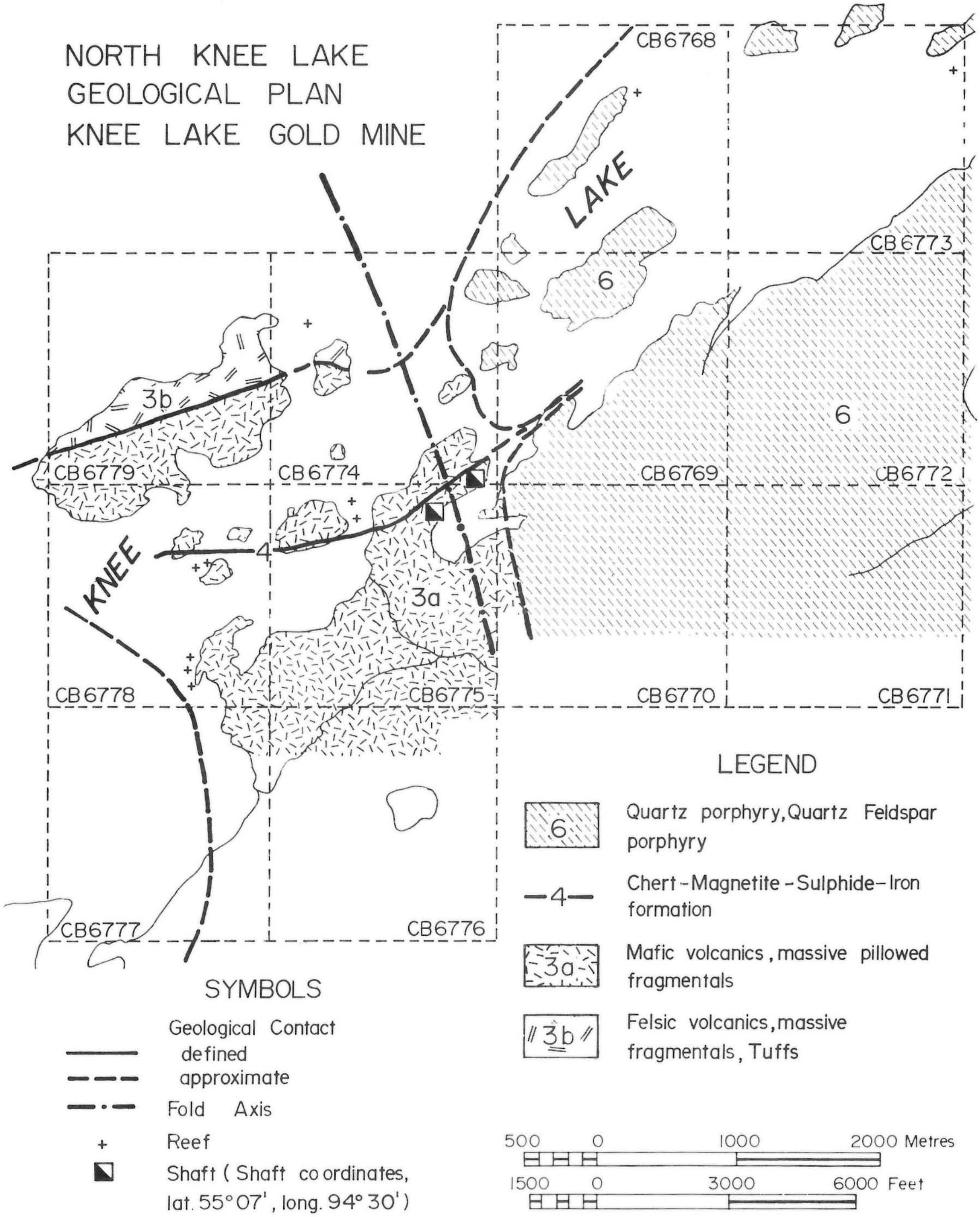



**Figure EO-15-1: Geology of the Knee Lake Area.**

## General Geology

The rocks in the area are primarily mafic and felsic volcanics and tonalites with minor intercalated sedimentary rocks intruded by minor diabase, diorite, quartz porphyry and quartz feldspar porphyry dykes.

The regional strike is east-west and dipping 75°-85° to the south.

## Economic Geology

Gold, arsenopyrite, galena, sphalerite, pyrite and pyrrhotite mineralization occur in quartz stringers within a felsic tuff. The tuff is flanked by mafic metavolcanic rocks to the north and an intrusive quartz feldspar porphyry dyke to the south. Considerable trenching has been completed between the two shafts indicating that the tuff zone has been explored in some detail.

Regional mapping indicates a possible north-northwest striking cross fold, located approximately between the two shafts. The proximity of the porphyry dykes, coupled with a cross fold axis, may have been responsible for remobilizing and concentrating mineralization into erratic high-grade shoots. Gold may have been syngenetically deposited in the tuff and remobilized by later events.

## References

Barry, G.S.
1964: Geology of the Parker Lake Area; *Man. Mines Br.,* Publ. 62-1.

Barry, G.S.
1961: Geology of the Gods Narrows Area; *Man. Mines Br.,* Publ. 60-1.

Godard, J.P.
1963: Geology of the Island Lake Area; *Man. Mines Br.,* Publ. 59-3.

# URANIUM EXPLORATION

## (64 N and 52 L)

*By N.M. Soonawala and R.A. Whitworth*

### General

Areas for uranium exploration in 1976 were selected after a study of cancelled assessment files, geological reports and data from the Uranium Reconnaissance Program of the Geological Survey of Canada. The bulk of the effort was concentrated in the Kasmere Lake region (NTS 64 N) where six separate areas, which have been designated as the Koona, Paquin, Putahow, Chekask, Bagg and Finner Lakes, were investigated (see Figure EO-16-1). A seventh area was investigated in the Manigotagan Lake region, NTS 52 L (See Figure EO-20-1).

Roughly the same exploration sequence was followed over all areas. The first step was a helicopter-borne scintillometer survey using a single-channel recorder and a sensor of volume 1850 cubic centimetres, at an altitude of 40 metres and line spacing of 250 metres. In the Putahow Lake area, a lake sediment geochemical survey at a sample density of one sample per square kilometre was also performed. The samples have been analyzed in the field by the radium method, and were also analyzed for uranium by the neutron activation method. The next step consisted of a combination of the following ground surveys: scintillometer, gamma-ray spectrometer, radon, magnetometer, VLF-EM, and rock sampling with the portage GSC drill. In the case of the Koona Lake showing, the exploration sequence was carried to the final stages of diamond drilling and gamma-ray logging.

# EO-16 KOONA LAKE

## Introduction

The Koona Lake occurrence (coordinates 59° 48'N; 100° 36'W) was outlined by an airborne scintillometer survey done over the Putahow Lake area (Figure EO-16-1). A claim block was staked over it in early July on behalf of the Crown.

Three significant surveys were conducted prior to 1976 over a much larger area which includes the occurrence. These in chronological order are: (1) airborne geophysics and ground follow-up by Dynamic Petroleum Products Ltd., Calgary, in 1969, (2) geological mapping by the Province of Manitoba in 1971 and 1972, and (3) airborne gamma-ray spectrometry and lake sediment geochemistry in 1975 by the Geological Survey of Canada under the auspices of their Uranium Reconnaissance Program. All three surveys indicated that the general area was favourable for uranium mineralization. However, none carried the screening process far enough to locate this particular occurrence. The predominant rock types in the area are pelitic biotite gneiss and leucogranite.

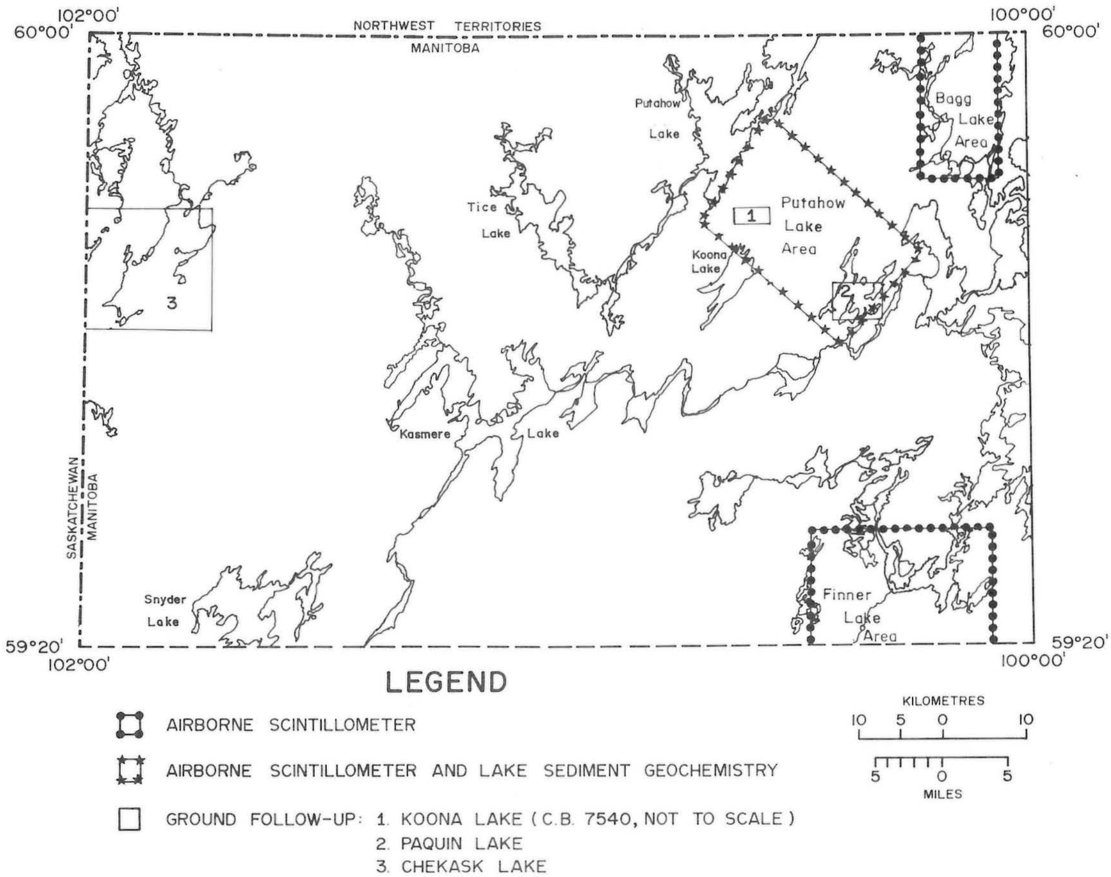



**Figure EO-16-1: Location of survey areas in the Kasmere Region.**

## 1976 Field Operations

A grid of flagged lines was established over the one square mile claim block which includes the showing. A ground scintillometer survey was done over the entire grid. This was followed by gamma-ray spectrometer, radon gas, VLF-EM and magnetometer surveys over smaller areas. Subsequently, 43 rock samples were collected by a chain saw motor powered portable drill and sent for uranium analysis by the neutron activation method. Finally, three shallow diamond drillholes totalling 550 feet (165 metres) were drilled. These holes were logged with a down-hole gamma-ray probe. Figure EO-16-2 summarizes the results of the surveys to date.

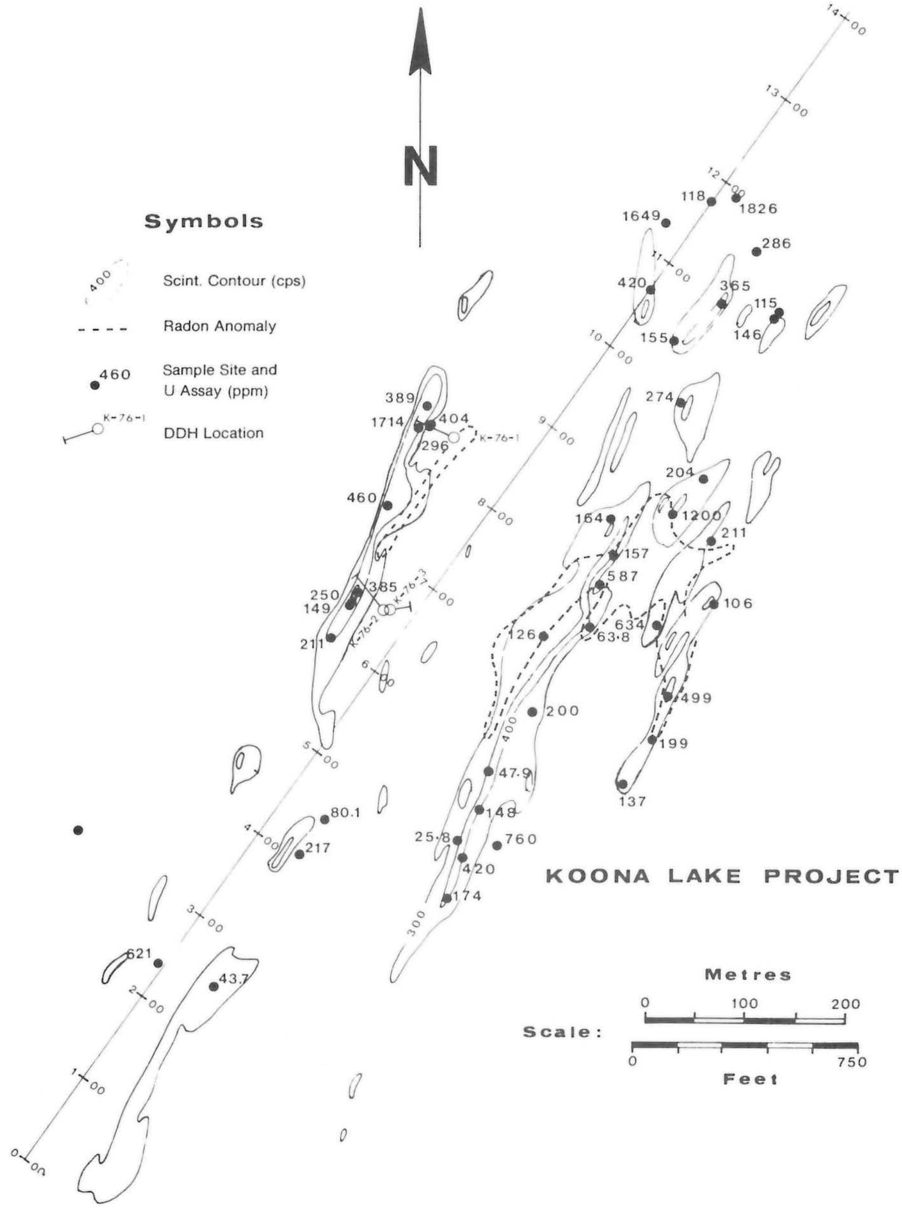



**Figure EO-16-2: Scintillometer contours, uranium assay results and DDH locations — Koona Lake occurrence.**

## Results

The significant results of the surveys are as follows:

(1) An area of about 1.5 by 0.3 kilometres has been delineated, over which there is a concentration of anomalously radioactive granitic boulders. Of the 43 assay values three exceed 1500 ppm, and ten others exceed 400 ppm.

(2) By means of 165 metres of exploratory drilling, the presence of uranium mineralization in bedrock has been established. In the first hole of depth 65 metres, the best intersection can be construed to be any of the following: 1005 ppm over 1 metre, 479 ppm over 2.5 metres, or 249 ppm over 8 metres. A second hole 200 metres to the south, returned values of 450 ppm over 3 metres or 250 ppm over 7.6 metres.

## EO-17 CHEKASK LAKE

### Introduction

The Chekask Lake area showed a good correlation with lake sediment uranium anomalies of the Uranium Reconnaissance Program (URP) survey done in 1975 and a previous airborne gamma-ray spectrometer survey done by Yukon Antimony Limited in 1969. This airborne survey was flown at an altitude of 40 metres and a line spacing of 0.27 kilometres. Six well-defined uranium anomalies were observed in this area. These anomalies also coincide with localized aeromagnetic anomalies obtained from GSC maps.

A ground geophysical survey was implemented to examine the six anomalies in the Chekask Lake area. Ground work consisted of establishing a base line parallel to strike. Grid lines 50 metres apart were marked off perpendicular to the base line and geophysical readings were taken at 17 metre intervals along the grid lines. The following geophysical systems were used: VLF-EM, magnetometer, and scintillometer. Special attention was paid to delineating boulder fans by means of the scintillometer.

### General Geology

The Chekask Lake area lies within a fluorite-bearing quartz monzonite plug, as previously mapped by Weber et al. (1974) (Figure EO-17-1). The six anomalies, forming a circular pattern around the quartz monzonite plug, possibly reflect uranium mineralization due to late stage hydrothermal solutions.

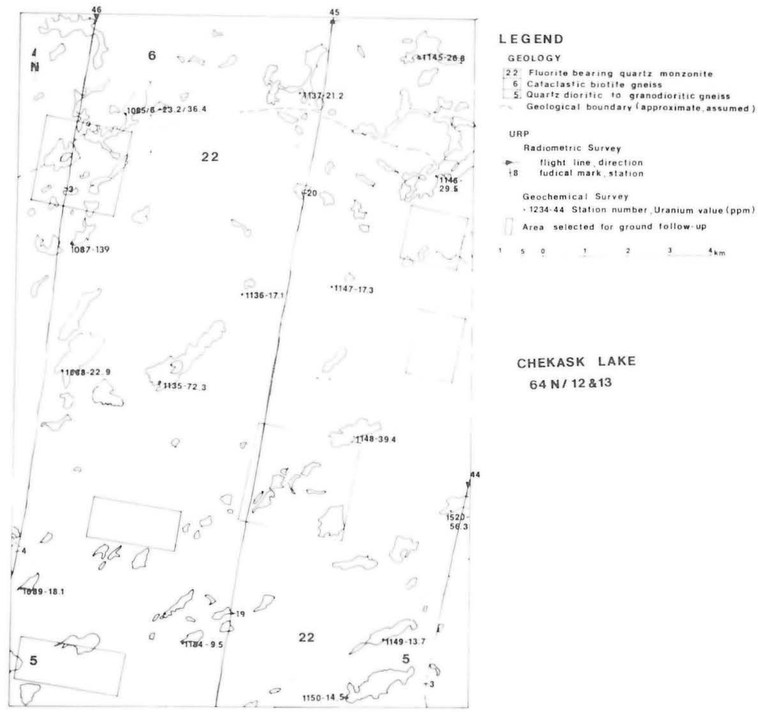



**Figure EO-17-1: Location map and general geology of areas surveyed around the Chekask Lake pluton.**

### Results and Conclusions

The six anomalies studied result from boulder fields. Each anomalous zone studied was represented by one of a series of closely grouped boulder fields. The boulders were 95 to 98% quartz monzonite, while the remaining fraction was composed of biotite-quartz-plagioclase gneiss, pegmatitic material and dolomite. Assay results showed negligible uranium mineralization (less than 2 ppm) in all rock types other than the quartz monzonite. Assays of the latter rock type gave values of up to 19 ppm, which is two to four times the average granite. This contrast in uranium content is the most probable cause for the airborne anomalies. As no economic concentrations of uranium mineralization were found within the Chekask Lake area, further work is not warranted.

## EO-18 PAQUIN LAKE

### Introduction

The Paquin Lake area is located within NTS area 64 N/9 and is centered approximately at 100° 20'W; 59° 43'N.

This area was featured as a prominent uranium anomaly on the URP maps (1975) and responses had also been obtained in the 1969 airborne surveys by Dynamic Petroleum Products Ltd.

### 1976 Field Operations

On the basis of the above data, seven grids were laid out within a radius of 3.5 kilometres, the largest of which was about 1200 metres by 600 metres. These areas were surveyed primarily with the scintillometer, although a limited amount of work was done with the spectrometer, the radon emanometer and VLF-EM.

### Results and Conclusions

Several radioactive boulder trains were detected with numerous boulders having radiation levels of 400 cps against a background of about 80 cps on a BGS-1SL scintillometer. The calibrated gamma-ray spectrometer indicated that the best uranium concentration in the leucogranite boulders was only about 20 ppm. 25 rock samples from the area were analyzed for uranium by the neutron activation method, and the uranium content ranged from 0.7 ppm to 16.9 ppm.

No further work is recommended in this area.

## (EO-19) PUTAHOW, BAGG AND FINNER LAKE AREAS

### Introduction

These three areas, all located within NTS area 64 N (Figure 1), were selected for a detailed reconnaissance survey with the airborne scintillometer. A lake sediment survey was also done over the Putahow Lake area.

The Putahow Lake area was selected because of favourable geology and encouraging results from the Uranium Reconnaissance Program. The geology consists of pelitic biotite gneiss (unit 7 of Weber et al.) and white granite (unit 17). On the URP maps, this is part of the main northeast-southwest trending zone, which has been identified as being enriched in uranium on the basis of both the geophysical and the geochemical surveys. The Bagg Lake area was chosen because of a similar geological setting. The Finner Lake area had positive responses on the URP surveys, and further, it is located at the edge of a younger granitic pluton (unit 20) whose edges could be considered to be favourable for a concentration of uranium.

### Results

The results from this detailed reconnaissance phase of the exploration sequence were most encouraging in the Putahow Lake region and resulted in the discovery of the Koona Lake occurrence described earlier. Preliminary follow-up of another anomaly at Widlake Lake has indicated radioactive boulders of the same nature as at the Koona Lake occurrence.

A preliminary study of the airborne surveys in the Bagg Lake and Finner Lake areas does not indicate any prominent anomalies. However, it is possible that after a careful analysis of the results some significant trends may be detected.

## EO-20 MANIGOTAGAN LAKE

### Introduction

Ground investigations during 1975 of uranium mineralization occurring along contacts of the intrusive rocks and the metamorphic complex of the Manigotagan Gneissic Belt prompted the development of an exploration program for 1976. A helicopter-borne scintillometer survey of approximately 1300 line kilometres was conducted over an area extending from Quesnal Lake to Flintstone Lake to investigate possible uranium occurrences along contact features (Figure EO-20-1).

Two areas were selected for ground follow-up investigations on the basis of the strength and strike length of the anomaly responses resulting from the survey. The peaks of both anomaly responses were between 1.75 and 2.5 times the background values and continued over a strike length of approximately 1.5 kilometres.

A two-man party examined the anomalies. The investigation consisted of prospecting using a scintillometer, mapping and a small sampling program.

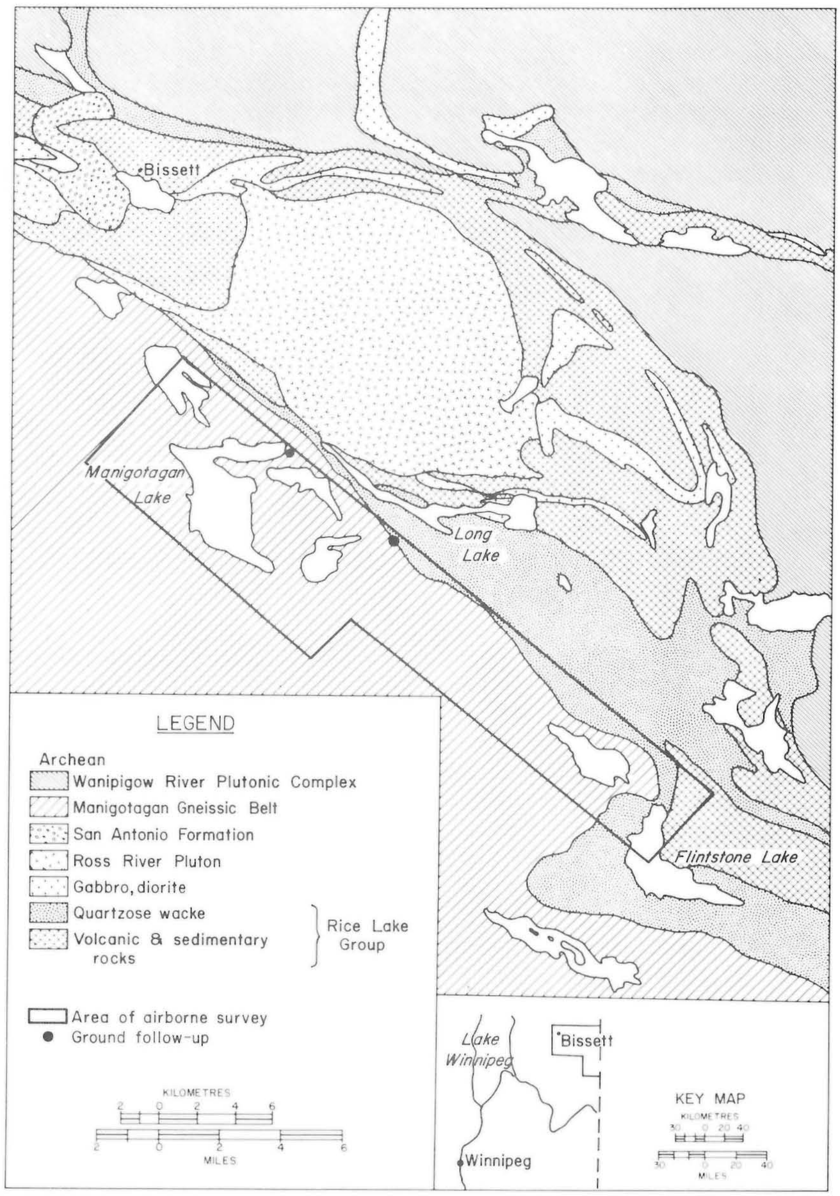



**Figure EO-20-1: Location map and general geology.**

## General Geology

The region under study is a portion of the area examined by the Manitoba Mines Branch during 'Project Pioneer'. The Manigotagan Gneissic Belt lies south of the Rice Lake-Beresford Lake greenstone belt and is mainly a suite of intrusive rocks ranging from quartz monzonites and granodiorites to pegmatitic complexes and a metamorphic complex of paragneisses, granites and a series of metasedimentary rocks.

## Results

The first anomaly was a large outcrop measuring approximately 2100 metres by 200 metres of fine-grained syenodiorite wedged between fine-grained metasedimentary gneisses with minor granitic layering. The second anomaly outcrop consisted of a medium-grained quartz monzonite intruding a sillimanite-bearing metasedimentary gneiss.

The first anomaly yielded an average reading of 180 to 200 cps (using a BGS-1SL scintillometer) over the entire outcrop with no relationship of radiation to the various rock types. The surrounding heavily wooded or swampy areas give an average background count of 50 to 75 cps, while smaller adjacent outcrops give an average of 100 to 125 cps. The substantial size of the outcrop and the consistently higher than average readings can account for the anomaly.

The second anomaly was also accounted for by the large mass effect of the rock and its higher than average readings as compared to the surrounding region. Also, there was no apparent relationship of the readings and the rock units encountered.

## Recommendations

Although the initial ground follow-up of the airborne survey did not yield successful results, the project still holds considerable potential. Of the anomaly responses obtained, only two have been examined. These two anomalies were chosen because of the strike length and the strength of the responses and the easy accessibility. Known areas of uranium mineralization within the survey have been identified and it is therefore possible that other gamma-ray anomalies correspond to the occurrence of uranium. A complete study of the airborne survey to locate all potential regions and a ground program such as was performed on the previous two anomalies is necessary before a final decision is reached on the economic significance of uranium mineralization in the Manigotagan Lake area.

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