MANITOBA

DEPARTMENT OF ENERGY AND MINES

Hon. Wilson D. Parasiuk
Minister

Marc Eliesen
Deputy Minister

MINERAL RESOURCES DIVISION
Ian Haugh
Assistant Deputy Minister

OPEN FILE REPORT OF81-4

MINERAL DEPOSITS IN THE RUTTAN LAKE, KAPSAKUWIGAMAK LAKE, MUSKAYK LAKE AREAS, MANITOBA
(Parts of NTS 64B/5, 6, 11 and 12)

by
D.A. Baldwin

Winnipeg, 1982

TABLE OF CONTENTS

FIGURES

MAP

MINERAL DEPOSITS IN THE RUTTAN LAKE, KARSAKUWIGAMAK LAKE, MUSKAYK LAKE AREAS, MANITOBA

OPEN FILE REPORT OF81-4

Introduction

This open file report is a documentation of the occurrence of metallic minerals in the area. The data presented were compiled from drill logs contained in the Cancelled Assessment Files of the Manitoba Mineral Resources Division, from field work by the author in 1978, 1979 and 1980 and from geological reports by Burwash, 1962; Pearce, 1964 and Steeves and Lamb, 1972. The description of the Ruttan Mine includes data from Speakman et al. (in press) as well as data collected by the author.

The majority of the mineralized localities are not exposed at surface, and the descriptions are based mainly on data contained in drill logs; however, the interpretations are based on the author's first-hand knowledge of the geology of the area.

Geophysical data presented in the text and depicted on Map OF81-4-1 are taken from Hosain (1980).

The deposit descriptions are arranged according to N.T.S. maps sheets. Each mineral locality is identified in the text with a locality number which corresponds to a locality number on the appropriate N.T.S. map sheet. The name of the property for most deposits is the claim number or claim block number for the claim or claim block on which the drill hole or holes were collated. There are no reports in the cancelled assessment files for localities which do not have a property name. The company designation is that of the last holder or operator of the property. NRD-CAF identified the file number in the Cancelled Assessment Files of the Manitoba Mineral Resources Division in which the original data submitted by the holder or operator is contained. This information is on file in the Geoscience Data Section, Manitoba Mineral Resources Division, 993 Century Street, Winnipeg, Manitoba, R3H OW4. The month and year in which the drill hole was drilled are indicated as "Date". Sources of information contained in the description are listed under "Data Source". The "Target" is the geophysical anomaly tested by the drill hole (VLEM refers to a vertical loop electromagnetic anomaly; HLEM refers to a horizontal loop electromagnetic anomaly).

It is recognized that the descriptions for many of the mineral localities are inadequate due to a lack of outcrop in the area around the deposit as well as the brevity and non-descriptive nature of the drill logs and a lack of precise data in the drill logs. The author has attempted, where possible, to merge information contained in the drill data together with his own observations on lithologies and stratigraphy in the field as well as the available geophysical data in order to present a unified account of the geological setting of the mineralization in the light of present knowledge of the area.

Classification of Deposits

The mineralization in the area is classified according to the nature of the occurrence of the metallic minerals. Except for one occurrence of gold in a quartz vein all known

* Muskayk Lake in previous reports on this project (Baldwin 1978, 1979, 1980) was called Eagle Lake.

mineralization includes disseminated to massive stratiform, and stratabound deposits, discordant disseminations, as well as vein and fault controlled deposits.

Stratiform sulphide mineralization is classified as sulphide stratum or as a massive sulphide lense (Gale et al., 1980). A massive sulphide stratum or lense contains more than 50 per cent sulphide minerals over a true thickness of more than 15 cm. A semimassive sulphide stratum contains 15 - 50 per cent sulphide minerals over the same thickness. In addition, disseminated sulphide stratum is used in this report for those sulphide strata with 5 - 15 per cent sulphide minerals regardless of the thickness of the mineralized zone.

In a few instances a massive sulphide stratum includes mineralized zones composed of numerous thin (2 - 5 cm) massive sulphide layers that have an aggregate thickness of more than 15 cm. Where two or three types of sulphide stratum occur in the same drill hole the mineralization at that locality is classified according to the highest ranking type in terms of per cent sulphide minerals present. For example, at locality 3, 64B/11, massive, semimassive, and disseminated sulphide stratum are present. The mineralization at this locality is therefore classified as massive sulphide stratum even though the other two types are present and together or separately, depending upon thickness, may contain as much total sulphide as the massive sulphide stratum.

Minor occurrences of pyrrhotite and/or pyrite in near solid graphite (commonly hosted by metasedimentary rocks), are classified as graphite zones.

Sulphides may occur as disseminations of iron formation. Pyrrhotite and/or pyrite in amounts of 1 to 5 per cent, but rarely up to 15 per cent, are present in oxide facies iron formation or in a rock that contains 45 - 50 per cent magnetite and 45 - 50 per cent quartz plus garnet. These are classified as oxide facies iron formation and silicate-oxide facies iron formation, respectively. Two to three centimetre thick bands of solid pyrrhotite and/or pyrite with trace amounts of sphalerite and/or chalcopyrite may occur within the iron formation.

Mineralization classified as discordant disseminations comprises discrete grains and/or stringers ($\leq$ 5 mm wide) of sulphide. This type of mineralization may occur in granitic intrusive rocks and country rocks where the two are in contact, especially where the contact is brecciated (intrusion breccia).

Pyrrhotite, pyrite and rare chalcopyrite $\pm$ sphalerite occur in quartz veins or as solid sulphide veins. In quartz veins the sulphide minerals may be disseminated or occur as solid sulphide within the vein. Mineralization with this habit is classified as vein sulphide.

Mineralization noted as shear and/or fault zones consists of disseminated sulphide grains and stringers, quartz stringers or as solid sulphide in shear zones of fault zones. Secondary sulphide minerals may also be present.

The mineralization at some localities is classified as massive or semimassive sulphide stratum or lenses because of a lack of precise data as to the nature of the deposit.

General Geology

Structural Geology

The main structural elements in the area are three major faults identified as Fault 1, Fault 2, Fault 3, in Figure 1. They divide the map area into four fault blocks; the Northern

Block, the Ruttan Block; the Karsakuwigamak Lake Block and the Eastern Block. The faults have not been observed in outcrop. Their position is inferred from discontinuities in the stratigraphy, lithological contrasts, conflicting facing directions and dips of bedding, and from a discontinuity of trends on the aeromagnetic maps. Fault 1 and Fault 2 are truncated by Fault 3. Displacement of Fault 1 after the emplacement of the plutons south of Esker Lake was left lateral and a minimum of 1 km. The sense of movement and displacements on Faults 2 and 3 is unknown.

Reliable younging directions and bedding in all but the Eastern Block indicates monoclinal structures that are steeply dipping. In the Northern Block strata dip steeply to the south and young to the south and southeast. The strata in the Karsakuwigamak Lake Block dip and young to the north. The facing direction of the Eastern Block is unknown.

Stratigraphic relationships between the fault blocks is unknown.

Geological relationships between the rocks in the southwest corner of the map area and the rocks in the Ruttan Block and the Karsakuwigamak Lake Block have not been determined because of the absence of reliable younging directions and the abundance of plutonic rocks.

Geology of the Fault Blocks

Northern Block

The rocks in this fault block are volcanic derived conglomerates, sandstones and siltstones, polymictic volcanic and plutonic derived conglomerates and greywackes. Two units of mafic volcanic flow rocks occur at different stratigraphic levels in the sedimentary succession. The sedimentary rocks and mafic flow rocks are intruded by mafic and intermediate sills and dykes. Effects of deformation and metamorphism are not observed in the outcrops except very locally where a strong shear foliation is developed in zones parallel to bedding and where clasts in conglomerate are flattened in the plane of bedding and foliation.

The rocks can be divided into three distinct map units that form a continuous north-facing stratigraphic succession. The base of the succession is truncated by Fault 3.

The lowermost map unit in this succession comprises volcanic derived conglomerates, sandstones and siltstones that are organized into Bouma divisions. Beds vary in thickness from 1.5 to 12 m. The composition of the rocks, clast size in the conglomerates, and bed thickness, change both vertically and laterally in the unit. From south to north and west to east the rocks intertongue and change in composition from mafic through arkosic metasediment to greywacke. Clast size and bed thickness in the conglomerate decrease from south to north and west to east. Bed thickness and areal distribution of siltstones increases from south to north and west to east. Conglomerate beds are characteristically reversely graded at their base followed by normal grading toward the top of the bed and in many cases pass upward into sandstone. They are both matrix or clast-supported, and/or grade from clast-supported to matrix-supported both vertically and laterally in individual beds. Clasts are angular to rounded and vary from 30 cm to less than 1 cm in diameter. The clasts in the conglomerates are undeformed. Sandstone beds have normal graded bedding and locally parallel laminations and cross-bedding have been

observed. The siltstones are thinly bedded and many have a 1 to 3 mm grit layer at their base. Primary sedimentary structures are numerous, particularly in the mafic siltstones, and are extraordinarily well preserved. Graded bedding, rip-ups, small-scale scours and abundant soft sediment load structures are present. Flame structures are numerous and their tips are all tilted or slightly bent toward the east. Concentrically zoned, spherical, 2 to 3 mm diameter structures in the rock are probably primary concretions. Locally they transect the bedding planes.

The stratigraphically lower mafic flow unit is characterized by plagioclase-phyric and aphanitic basalt. The flows are organized and grade from massive through pillow lava to pillow breccia and hyaloclastite. The unit is thickest in the west where pillow lava representa 60 per cent of the flows. To the east the flows are thinner and pillow breccia and hyaloclastite are dominant. Flow thickness varies from 1 m to about 25 m. The other flow unit is dominantly aphyric with subordinate plagioclase-phyric members. In this unit pillow lava is absent and the flows grade from massive lava to pillow breccia and hyaloclastite. In the west pillow breccia and hyaloclastite are subordinate to massive lava whereas in the east, massive lava is subordinate to pillow breccia and hyaloclastite.

Pillows and pillow breccia are little deformed (if deformed at all), and locally concentric cooling cracks are preserved. Vesicles are rounded to slightly elliptical and concentrated in the upper parts of pillows. Pillow breccia has angular, rounded and amoeboid shapes.

Dykes and sills are mafic to intermediate. They have sharp contacts with the sedimentary rocks and the contacts are commonly anastomosing. A zone of quartz-filled amygdales is characteristically developed next to the inner edge of chilled margins. Soft sediment folding and bedding dislocations, in the sediments against and close to the intrusive contacts, further support the concept that the dykes and sills were emplaced when the sediments were still soft, with minimal confining pressure.

These exceptionally well preserved, virtually undeformed and unmetamorphosed rocks in the lowermost map unit in the Northern Block have a minimum stratigraphic thickness of 3.5 km.

The next stratigraphically higher map unit in the Northern Block is a volcanic and plutonic derived polymictic conglomerate that is interbedded with subordinate arkosic-greywacke sandstone. Plutonic clasts are generally much larger than the volcanic clasts. They are rounded, 30 to 7 cm in diameter and are a foliated hornblende tonalite similar to the Opachuanau gneiss (Hinds, 1972) that outcrops on the northwest shore of the Churchill River west of Rusty Lake (Zwanzig, pers. comm., 1980). Volcanic clasts are, in order of abundance, intermediate, felsic and mafic in composition. They are generally elliptical and 15 to 0.5 cm in diameter. Quartz clasts are rounded and less than 4 cm in diameter. Clasts of chert and cherty iron formation are common, and rare clasts of sedimentary rock are present. Conglomerate beds are graded and generally matrix-supported, but clast-supported beds have been observed. The beds are thicker (up to 15 m) and coarser at the base of the unit and in the west of the area. Towards the top of the unit to the east the beds get progressively thinner (maxi-

mum of 4 m) and the clasts smaller. The matrix of the conglomerate is arkosic-greywacke. Beds of arkosic-greywacke sandstone are massive. Some are normally graded and contain clasts of volcanic rocks, less than 1.5 cm in diameter at the base of the bed. In the west these beds have a maximum thickness of 3 m and in the east a maximum thickness of 7 m. This interbedded unit of conglomerate and arkosic-greywacke sandstone is 800 m thick in the west and in the east has a minimum thickness of 1.6 km.

Overlying the interbedded polymictic conglomerate arkosic-greywacke sandstone unit is a unit of greywacke that contains two members of siliceous sulphide facies iron formation. Exposures of the unit are few in the west and only one exposure has been found in the east. The rocks in this unit have been much more deformed than those in either of the two lower stratigraphic units in the fault block. Although bedding is generally preserved, reliable younging directions have not been documented. The rock is grey to brownish-grey on weathered surface and dark grey on fresh surface. Alignment of biotite defines a foliation parallel to bedding. The siliceous sulphide facies iron formations have a rusty weathering surface. They are composed of 15 to 20 per cent disseminated pyrite and pyrrhotite in a massive rock that is very siliceous, fine grained and contains minor biotite and plagioclase feldspar. Banded chert has been observed in two outcrops.

Continuity of the unit in the project area is interpreted from geophysical data (Questor INPUT Survey 1968; H.B.E.D., E.M. Survey, 1961) and diamond drill hole data (H.B.E.D., 1961) contained in the Manitoba Mineral Resources Division cancelled assessment files.

A polymictic volcanic and plutonic derived conglomerate interbedded with arkosic sandstone that outcrops south and west of Muskayk Lake is the uppermost stratigraphic unit in the Northern Fault Block that is exposed in the project area. The rocks are deformed and have been folded around the east end of a granitic pluton that occupies the area north of Muskayk Lake. North and west of the pluton there are no outcrops thus the outcrop pattern and distribution of the unit in these areas is unknown.

Volcanic clasts in this conglomerate are intermediate, felsic and mafic in composition; intermediate compositions are most abundant. The majority of plutonic clasts are tonalite; a few quartz monzonite clasts have been observed. Quartz clasts are also present. All of the clasts have been flattened in the plane of the foliation which is parallel to bedding. Plutonic, felsic and mafic volcanic and quartz clasts, on outcrop surface, have a length to width ratio of about 5:1, felsic volcanic clasts are up to 15 cm in length, whereas plutonic clasts range up to 9 cm; mafic volcanic clasts up to 7 cm and quartz clasts up to 2 cm. The matrix of the conglomerate beds is hornblende-bearing arkose. The hornblende forms prismatic crystals up to 3 mm long. Conglomerate beds are from 2 to 20 m thick. The arkosic sandstone is identical to the matrix of the conglomerate. The beds are massive and from 0.5 to 8 m thick. Primary sedimentary features have not been observed thus facing direction is unknown.

In summary, with the exception of two relatively thin mafic flow units and small gabbroic and intermediate intrusive bodies, the Northern Fault Block is made up of epiclastic rocks. The rocks in the lowermost unit in the fault block were probably transported by

turbidity currents. The distribution of the rocks, particularly the conglomerates and current indicators (flame structures and rip-ups) indicate that transport was from west to east. This is also evidenced by the distribution of flow features in the two mafic flow units.

Eastern Block

In this block the area that contains outcrop is approximately 8 km^2. Outcrop in the area is sparse and is lichen and moss covered. The area is inaccessible except by helicopter. As a result, the rocks in this area have not been studied in as much detail as the rocks in other parts of the project area. Top indicators have not been observed thus the facing direction in the block is unknown.

The rocks in this fault block are massive mafic plagioclase- and hornblende-phyric rocks, felsic volcanic flow rocks and volcanic derived sedimentary rocks.

The massive mafic plagioclase- and hornblende-phyric rocks are fine- to medium grained. The phenocrysts of plagioclase are euhedral to subhedral, 1 to 2 mm in diameter and the hornblende phenocrysts are euhedral to subhedral and 2 to 3 mm. Locally, the rocks are amygdaloidal. The amygdales are quartz-filled, rounded to elliptical and from 3 mm to 2.5 cm in diameter. Local poorly developed pillow-like structures are observed and in one outcrop a massive mafic rock, overlain by a 2 m zone of fine grained mafic rock (that appears to be flow laminated), is in turn overlain by a 3 m zone that appears rubbly or brecciated. Flow contacts were not observed. The outcrops are such poor quality that positive identification of flow features could not be made nor could a pattern be distinguished in the distribution of amygdales. Consequently, an extrusive or intrusive origin for these mafic plagioclase and hornblende-phyric rocks has not been determined.

The felsic volcanic rocks are white, massive, flow banded and fragmental rhyolite or dacite. The massive rocks are very fine grained, contain 1 mm euhedral plagioclase phenocrysts and have conchoidal fracture. Flow banding is distinguished by colour variation from white to pale pink to dark grey, and aphanitic texture. Individual bands are less than 1 mm to 1.5 cm thick and flow folding is present locally. In the fragmental rocks, fragments and matrix are the same composition but the matrix does not have plagioclase phenocrysts. Fragments are generally angular but up to 5 per cent are rounded. The average size of the fragments is 7 to 10 cm, minimum size is 3 mm and the maximum is 60 cm. They are flattened and have a 4:1 length to width ratio on outcrop surface. The fragmental rocks may be autoclastic and occur as 4 to 5 m thick beds interbedded with massive and flow banded rock. The felsic volcanic units are 150 to 160 m thick and probably represent single flows. The observed distribution of the rocks across the strike of a unit from south to north is as follows: (1) 75 to 100 m of the massive rock; (2) 25 to 40 m consisting of 4 to 5 m thick beds of fragmental rock interbedded with 10 to 15 m thick beds of massive rocks; (3) 20 to 30 m consisting of 4 to 5 m thick beds of fragmental rock interbedded with 1.0 to 1.5 m thick beds of flow banded rocks. This organization in the felsic volcanic units is not observed on a single outcrop and has been compiled from observations made on several outcrops. If correct and the units represent a single flow then the stratigraphic younging direction in the Eastern Fault Block is to the north.

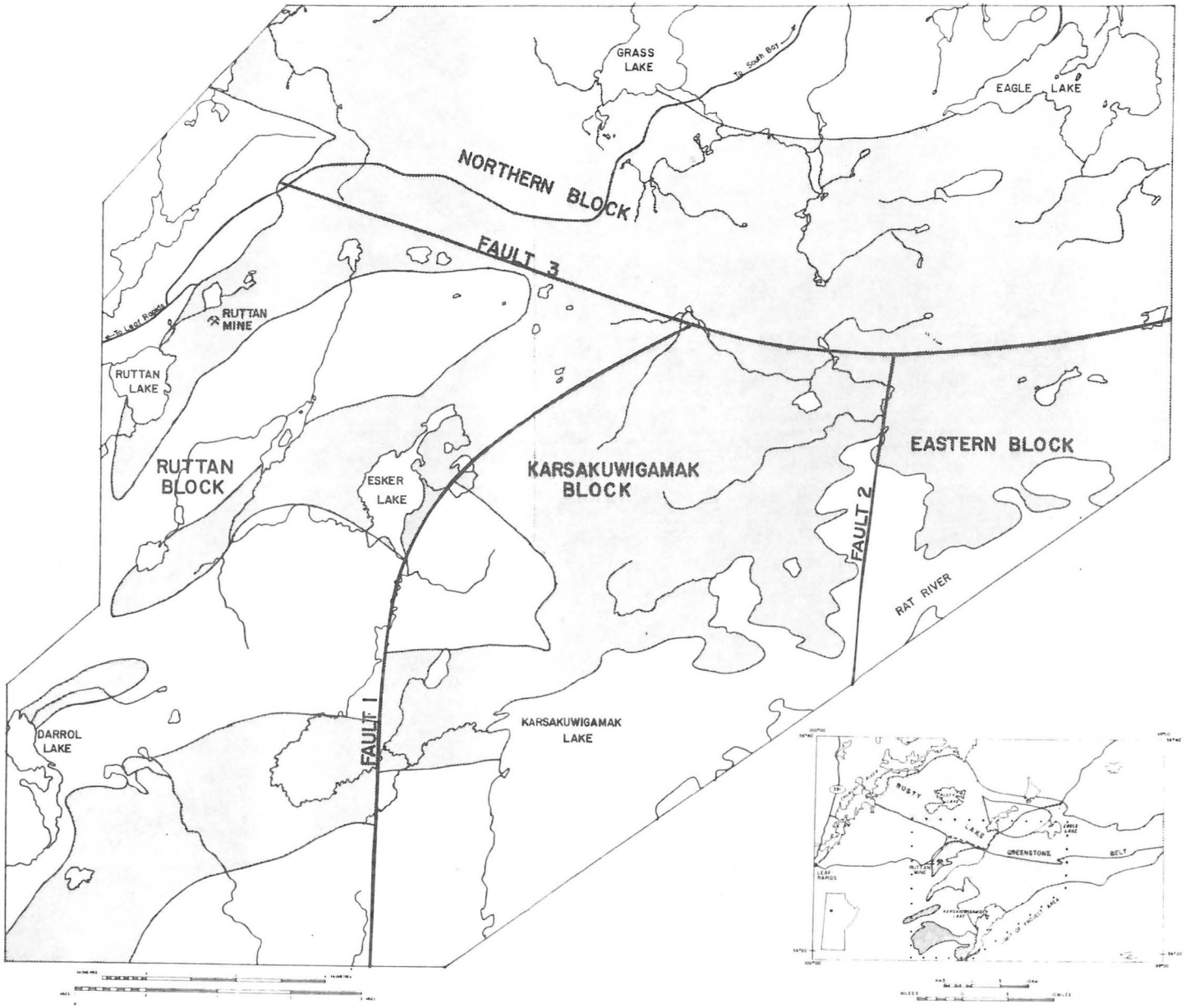


Figure 1: Generalized map of the project area showing the location of the major faults and the fault blocks, and the distribution of volcanic rocks (patterned area) and plutonic rocks. The geographic location of the Rusty Lake Greenstone Belt and the limits of the project are shown in the inset. (From Baldwin, 1980).

The volcanic derived sedimentary rocks are conglomerates and interbedded conglomerates and siltstones. There are three units of volcanic derived sedimentary rocks in the Eastern Fault Block. The most southern unit consists of intermediate siltstones that are interbedded with conglomerate. The siltstones are fine grained, green to brown, thinly layered (1 to 4 cm). They form members in the unit that are generally about 2 m thick. The conglomerates are composed of intermediate to felsic clasts supported in a fine grained intermediate matrix. The clasts which are all elongated in the plane of layering, are less than 1 cm and are unsorted. They form beds that are 1 to 2 m thick. Younging criteria have not been observed. The unit is approximately 200 m thick.

The sedimentary unit that occurs in the centre of the fault block is a volcanic derived conglomerate. It is composed of mafic, intermediate and felsic clasts, in order of abundance, set in a light green, fine grained mafic matrix. The clasts are matrix-supported, unsorted, rounded to angular and from less than 1 cm up to 60 cm. The larger fragments are mafic in composition and one such fragment contains a fragment of plagioclase-phyric mafic rock. The unit is approximately 25 m thick.

The volcanic derived sedimentary unit that occurs in the northern part of the fault block is poorly exposed and is best described as a lapilli-stone. Fragments are angular to subrounded, 3 to 7 mm, intermediate and mafic in composition, set in a very fine grained intermediate matrix. Fragments make up to 65 to 70 per cent of the rock. The unit is uniform throughout and is approximately 50 to 60 m thick.

Karsakuwigamak Block

The rocks in the Karsakuwigamak Block are felsic volcanic flows and their derived volcaniclastic rocks, dioritic to gabbroic intrusive rocks and subordinate epiclastic volcanic derived conglomerates and siltstones and mafic volcanic flows.

Felsic volcanic flows are white, pale pink or very light grey. They are massive and flow banded and autoclastic breccia is common. Textures are aphanitic, aphanitic with quartz phenocrysts, aphanitic with feldspar phenocrysts or aphanitic with quartz and feldspar phenocrysts. In the north of the fault block, felsic flow rocks are vesicular. Texture appears to be uniform throughout any one flow. The flows are in the order of 60 to 100 m thick and at least 3 to 4 km in length. Many of these flows are overlain by felsic tuffs and flanked by derived volcaniclastic rocks. The relationship between the flows and the volcaniclastic rocks has yet to be determined.

Continuity of stratigraphy in the fault block is interrupted by dioritic and gabbroic intrusive rocks. The dioritic rocks are generally equigranular and homogeneous consisting of euhedral to subhedral 2 mm plagioclase and hornblende with minor quartz and biotite. These rocks appear to form sills. The gabbroic rocks occur as sills and as discordant bodies several km^2 in area. They are coarse grained to fine grained, generally black to very dark green and hypidiomorphic-granular. Hornblende is the mafic mineral and occurs as euhedral to subhedral stubby crystals. At a few localities, the hornblende appears to be a pseudomorph of

pyroxene.

The volcanic derived conglomerates in the fault block are composed of intermediate and felsic clasts supported in a fine grained matrix that is intermediate in composition. Clasts are rounded to elliptical, 0.5 to 8 cm in diameter and are matrix-supported. Bedding is defined by clast sorting and variations in the proportion of matrix to clasts. The beds are 1 to 7 m thick. Conglomerate units are several tens of metres thick. Siltstones are generally associated with and overlie the conglomerates. They form units that are less than 10 m thick. Beds vary in thickness from 2 to 20 cm. Many beds have a gritty base that is composed of 1 mm plagioclase and/or plagioclase and hornblende that grades into siltstone. The siltstones are intermediate in composition.

One unit of mafic volcanic flow rock has been identified in this fault block. It is located to the west and east of, and passes through, the lake immediately northeast of Karsakuwigamak Lake. In the east the flows are thin (1.5 to 3 m). Massive equigranular basalt represents 75 to 80 per cent of an individual flow. The remainder of the flow is a breccia in which the breccia fragments have the same equigranular texture observed in the massive parts of the flow. The breccia fragments are rounded to elliptical, 4 to 12 cm in diameter and set in a fine grained tuffaceous matrix. The breccia is overlain by 5 to 20 cm of laminated tuffaceous material, that resembles the breccia matrix. In the west the flows comprise massive lava, pillow lava, pillow breccia and tuff. One 7 m thick flow comprises 2 m of massive plagioclase-phyric lava, 3 m of vesicular plagioclase-phyric pillow lava, 2 m of plagioclase-phyric vesicular pillow breccia and 5 cm of mafic tuff. The unit has a maximum thickness of approximately 70 m.

Ruttan Block

Rocks in the Ruttan Block in the Ruttan Mine area and east to Fault 1 are volcanic derived epiclastic greywacke, siltstone, conglomerate and mafic volcanic flows and derived breccia. Bedding characteristics and primary structures in the epiclastic rocks are the same as have been described for epiclastic rocks in the Northern Block. Current indicators indicate transport from east to west. The mafic flow rocks are aphyric and plagioclase-phyric. The unit of mafic volcanic flow rocks that occurs stratigraphically below the Ruttan Mine is aphyric and is everywhere intruded by gabbroic to dioritic intrusive rocks and complete flows have not been observed. Nevertheless, outcrops of pillow lava, pillow breccia and massive aphyric rock are numerous. From east to west the amount of breccia relative to pillow and massive lava increases. The unit of mafic volcanic flow rocks that is stratigraphically higher in the section than the Ruttan Mine is plagioclase-phyric and in the east complete flows are well exposed. The flows vary in thickness from 5 to 10 m, have a 0.5 to 3 cm chilled zone at their base, a massive zone that is overlain by flow breccia, or pillow breccia, followed by a zone of hyaloclastite. From east to west there appears to be an increase in the amount of breccia in the flows.

The unit in the immediate footwall of the Ruttan Mine is a grey, massive, non-bedded volcaniclastic rock that contains fine grained felsic volcanic fragments that are up to 7 cm

set in a homogeneous 1 to 2 mm quartz, plagioclase and biotite matrix that is greywacke in composition.

In the remainder of the Ruttan Block outcrops of volcanic rocks are sparse, lichen covered or have a thick moss and soil cover. Furthermore, intrusive rocks are abundant and stratigraphic relationships are interrupted or obscured. Therefore, the mapping in this part of the fault block is very interpretive.

West and north of Esker Lake complete flows and flow contacts, in rocks mapped as mafic volcanic, have not been observed. In many of the outcrops a mafic breccia in a mafic matrix is observed and the breccia fragments are the same composition and have the same porphyritic texture as do the massive mafic rocks in the immediate vicinity. Most of the rocks in these areas are massive. In a few outcrops gradational changes in grain size across the outcrop have been observed. This may represent differentiation within a flow or within an intrusive rock.

Felsic volcanic rocks south of Ruttan Lake are the best exposed rocks in this part of the fault block. They are light grey, pink or pale pink on weathered surface and pinkish-grey on fresh surface, aphanitic and contain 1 mm feldspar phenocrysts. The rocks are massive, flow banded and fragmental. The amount of fragmental rock increases toward the unnamed lake between Ruttan Lake and Esker Lake. Flow banding is 1 mm to 2 cm and is distinguished by colour variation on weathered surfaces. Flow folding in the flow banded rocks has been observed.

The sedimentary rocks that occur on the southeast shore and extending southwest of this same unnamed lake comprise interbedded conglomerate and sandstone overlain to the east by siltstone. The conglomerate beds are 1 to 4 m thick, contain felsic, intermediate and mafic volcanic clasts that are from 4 mm to 20 cm in long dimension on outcrop surface and have a 3:1 length to width ratio. The clasts are supported in an intermediate fine grained matrix. The interbedded sandstones are greywacke to arkose in composition; beds are 30 cm to about 70 cm thick and massive. The siltstone is greywacke to arkose in composition. Beds are 2 to 10 cm thick and a few have a gritty base.

The volcanic and volcanic derived rocks east and south of Darrol Lake are deformed and metamorphosed to a greater degree than the rocks elsewhere in the project area. A strong schistosity defined by hornblende in mafic rocks and biotite in sedimentary rocks is present everywhere in this part of the area. Staurolite, garnet and andalusite are common in greywacke sediments.

Nevertheless, local primary flow features are preserved. At one locality south of the hook-shaped lake east of Darrol Lake two complete flows are exposed. The flows are aphyric and 2.5 to 3 m thick. They both have a chilled zone less than 1 cm thick at their basal contact, and a 60 cm to 1 m thick flow breccia at the flow top. The matrix of the flow breccia in the 3 m thick flow is altered to epidote and the matrix and breccia fragments in the 2.5 m thick flow are altered to epidote. Immediately north of the small lake south of Darrol Lake repeated textural and grain size variations may indicate that the mafic rocks are flows. Here, three members, each approximately 5 m thick, have the following features. Hornblende aggregates 4 cm

across are uniformly distributed in a matrix of 1 to 2 mm hornblende and plagioclase, and occupy about 65% of each member. The aggregates get progressively smaller in the remaining 25% of the member and grade into a fine grained 10 to 15 cm thick hornblende-chlorite schist. Contacts between the members are sharp and at one a 1.5 cm thick very fine grained chloritic rock occurs between hornblende-chlorite schist and the rock that contains the 4 cm hornblende aggregates.

Sedimentary rocks in this part of the area are greywacke, biotite-amphibole-quartz schist, and non-bedded tuffaceous rocks of intermediate composition. Primary features have not been observed.

Banded oxide facies iron formation and chert are associated with altered greywacke sediments. The greywacke sediments are silicified and contain sillimanite, anthophyllite and garnet. Locally chlorite is present. Andalusite and staurolite, although present, are components of the regional metamorphic mineral assemblage. The iron formation consists of bands of magnetite 0.5 to 20 cm thick interlayered with chert and siliceous greywacke. Chert bands are less than 3 cm thick. The banded iron formation was only observed in association with altered sedimentary rocks.

Distribution of Mineral Localities

General Statement

Within the area there are 37 mineral localities which include: a) the Ruttan copper-zinc-bearing massive sulphide deposit; b) 11 massive sulphide strata of which 4 may be massive sulphide lenses; c) 4 semi-massive sulphide strata of which one of these may be a semi-massive sulphide lense; d) 5 are disseminated sulphide strata; e) 4 discordant disseminated sulphide deposits; f) 5 oxide facies iron formation; g) one silicate-oxide facies iron formation; h) 2 vein sulphide; i) one shear or fault zone; j) one graphite zone; k) one Au-quartz vein; and one of undetermined origin.

Northern Block

Of the fifteen mineral localities that occur in the Northern Block, there are 6 massive sulphide strata, 3 semi-massive sulphide strata, 4 disseminated sulphide strata, one graphite zone and one unclassified occurrence.

Ruttan Block

Eight mineral localities occur in the Ruttan Block. These comprise the Ruttan copper-zinc deposit, one occurrence which is either a massive sulphide stratum or a massive sulphide lense, 2 oxide facies iron formations, 2 discordant disseminated occurrences, one shear or fault zone and one sulphide vein.

Karsakuwigamak Block

Fourteen mineral localities occur in the Karsakuwigamak Block. They include 4 massive sulphide strata, 3 of which may be massive sulphide lenses, one semi-massive sulphide stratum

or semi-massive sulphide lense, one disseminated sulphide stratum, 3 oxide facies iron formations, one silicate-oxide facies iron formation, two discordant disseminated occurrences, one sulphide vein and one Au-quartz vein.

Eastern Block

Two sulphide showings are present in this fault block (Steeves and Lamb, 1972). (Neither were examined during the present study and descriptions are not provided by previous workers). Two magnetic anomalies and one weak HLEM conductor were detected in a geophysical survey; these geophysical anomalies do not appear to have been tested by diamond drilling or trenching.

Distribution of Mineralization

The rocks in the Northern Block are volcanic derived conglomerates, sandstones and siltstones, polymictic volcanic and plutonic derived conglomerates and greywackes, and two thin units of mafic volcanic flow rocks. Sills of mafic to intermediate composition intrude the sedimentary rocks. The sulphide mineralization is associated with greywacke stratigraphically above polymictic conglomerate and well above the mafic volcanic rocks.

In the Karsakuwigamak Block the rocks include felsic volcanic flows and their derived volcaniclastic rocks, felsic pyroclastic flow rocks, dioritic to gabbroic intrusive rocks, mafic volcanic flow rocks and epiclastic volcanic derived conglomerates, sandstones and siltstones. Stratiform sulphide mineralization is associated with the epiclastic rocks. Non-stratiform sulphide mineralization is associated with the felsic volcanic rocks.

In the Ruttan Block the rocks include mafic to felsic volcanic flow rocks, derived breccias and volcaniclastic rocks and volcanic derived conglomerate (debris flow), greywacke and siltstone. The volcanic and sedimentary successions are intruded by granitic rocks. Stratiform sulphide mineralization is hosted in the sedimentary units of rock successions that contain mafic volcanic rocks. There are no known stratiform sulphides associated with the felsic flow rocks. Discordant disseminated mineralization is associated with granitic intrusive rocks.

In summary, the stratiform sulphide mineralization in the area occurs in volcanic derived sedimentary rocks in rock successions containing mafic lavas. These successions were deposited in a submarine environment. The host sediments are generally well bedded and many have characteristic turbidite bedding. The mafic lavas in the Ruttan Mine area and in the Northern Block are pillowed.

Discordant disseminated mineralization is hosted in a variety of rock types but occurs mainly at the periphery of granitic and ultramafic intrusive bodies.

Geological Setting of the Mineralization

Stratiform sulphide mineralization in the area is associated with volcano-sedimentary rocks. In most cases they are hosted by or directly associated with a layer of sediment that is

chemically distinct (i.e. cherts, oxide facies iron formation and other chemical sediments) from the sedimentary succession in which it occurs. These chemically distinct layers and the associated sulphides are probably volcanogenic in origin.

The sulphides at the Ruttan copper-zinc deposit are directly associated with a zone of alteration and associated with a chemically distinct layer within a thick, well bedded, sedimentary succession with turbidite structures. This is a volcanogenic massive sulphide deposit (Sangster, 1972a) that is proximal to its exhalative centre but distal to an eruptive centre. The thick (minimum of 2500 m) heterolithic clastic (debris flow) and greywacke deposits that stratigraphically overlie the copper-zinc deposit suggest deposition of the sulphides at the end of or very late in a volcanic cycle.

The sulphide mineralization east of Darroll Lake is associated with an oxide facies iron formation and a tremolite schist. The iron formation occurs in a unit of bedded greywacke sediments that are underlain and overlain by hornblende-phyric differentiated basalt flows. The presence of tremolite, anthophyllite, staurolite and chlorite in the greywacke may be products of alteration. If this is the case, the alteration at the mineralized locality is in the form of a blanket. A corresponding alteration has not been observed in the basalts. It appears that this mineralization is exhalative, but its relationship to an exhalative centre or an eruptive centre is unknown.

West of Karsakuwigamak Lake, sulphide mineralization occurs in a sedimentary succession that is characterized by interbedded volcanic derived conglomerate, bedded and laminated siltstones. The sulphides are hosted in siltstone and mica-quartz-garnet schist. There are no known lavas in the succession nor are there any known occurrences of alteration. The mineralization is probably exhalative but distal from an exhalative site.

East of Karsakuwigamak Lake the rocks have been metamorphosed to amphibolite facies and have gneissic structure and texture. Nevertheless, the layered nature of the rocks and the regular changes in mineralogy suggests that the rocks are paragneisses.

Sulphide mineralization in the Northern Block occurs in siliceous rocks and in graphite-rich siltstones within an epiclastic sedimentary succession consisting of interbedded volcanic derived pebble conglomerate, greywacke and siltstone. The mineralized zones can be traced geophysically for more than 10 km. In the western part of the Northern Block the sulphide mineralization is in sulphide facies iron formation. Iron sulphide is contained in very siliceous rocks (chert?) that are interbedded with fine grained greywacke that locally contains minor sulphide. South and southwest of Muskayk Lake the mineralization is hosted in siliceous rocks, graphite-rich siltstone or near solid to solid graphite in siltstone. Mineralization in the Northern Block is probably of the volcanogenic type but was deposited contemporaneously with sediments, distal from both an exhalative centre and a volcanic centre.

Discordant disseminated mineralization occurs in a variety of rock types. Where this type of mineralization has been encountered it is associated with granitic and ultramafic intrusive rocks. The mineralization occurs in both the intrusive and the intruded rocks. Existing data are inadequate to determine precisely the nature of the mineralization or the source of

the metals. Contact breccia zones are common. Veins and veinlets of the intrusive rocks penetrate the country rocks and the foliation in the intrusive rocks is interpreted to be pretectonic and possibly syn-volcanic. Data are not available to determine whether or not the disseminated mineralization in the sedimentary and volcanic rocks is stratabound.

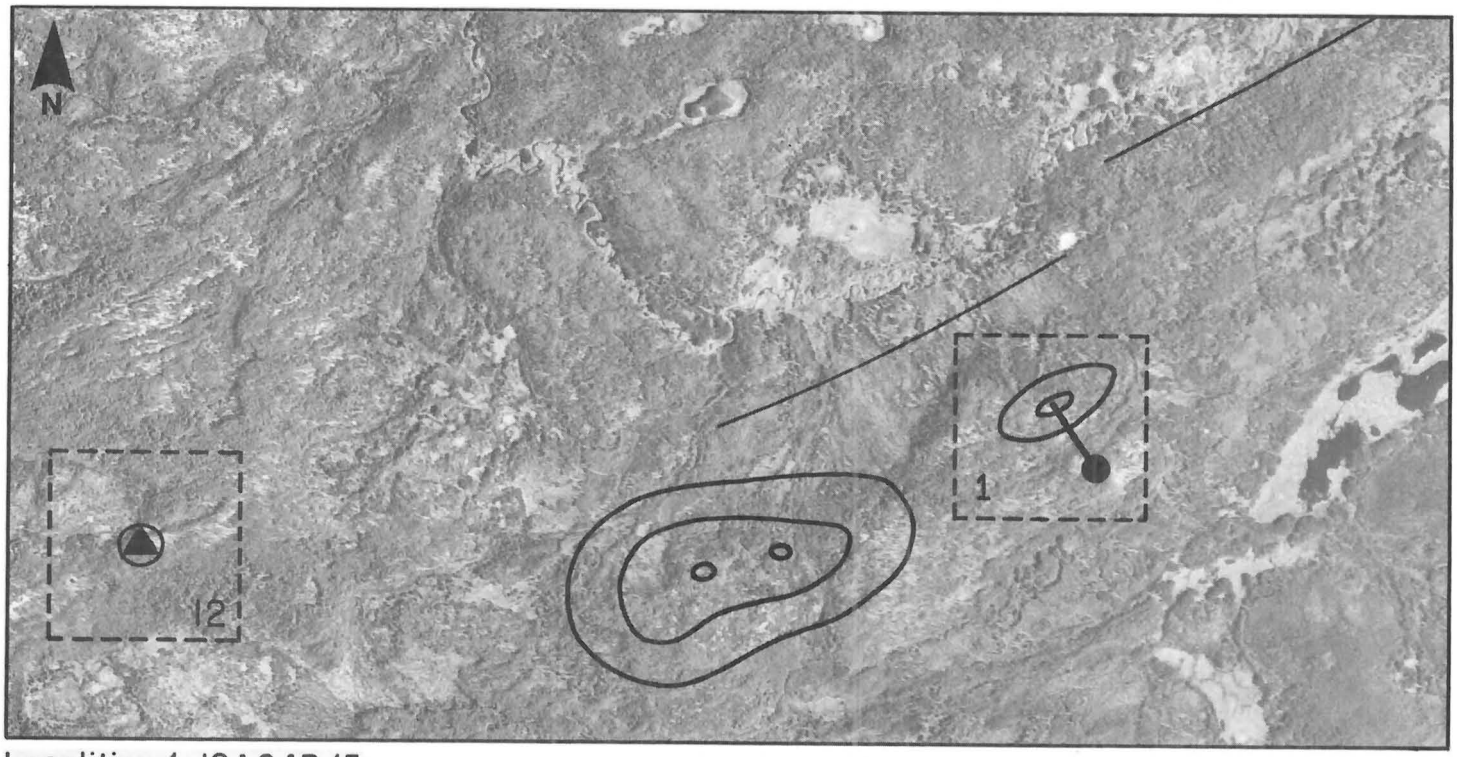
There are only a small number of localities where the mineralization occurs in veins, shears, or fault zones and consequently there is insufficient information to relate these types of mineralization to the geological history of the area.

Conclusions

Stratiform sulphide mineralization in the Ruttan Lake, Karsakuwigamak Lake, Muskayk Lake area is probably of volcanogenic origin. Sulphide strata and lenses occur in submarine volcano-sedimentary sequences. With the exception of the Ruttan copper-zinc deposit and the mineralization east of Darrol Lake, stratiform sulphide mineralization appears to have been deposited contemporaneously with epiclastic sediments.

At the Ruttan deposit and at Darrol Lake the epiclastic sediments overlie the mineralization.

The Ruttan copper-zinc deposit is a proximal volcanogenic massive sulphide deposit. The other stratiform sulphide mineralization in the area appears to have been deposited distal from exhalative centres. The association of sulphide mineralization with epiclastic sedimentary rocks suggests that the deposition of the sulphides took place at the end of or very near the end of major volcanic events and distal from an eruptive volcanic centre.



Localities 1,12:64B/5

Mineral Localities 64B/5

Locality 1. Property: CBM 983 MRD-CAF: 91498

Company: Ruttan Lake Exploration Ltd. Date: April, 1971

Company Drill Hole No. RL#6 Hole length: 77 m

Date Source: DDH Logs

Target: HLEM conductor; corresponding magnetic anomaly

Description

The occurrence consists of two banded oxide facies iron formations 0.3 m and 6 m thick respectively. Sulphides (py, po, sp) vary in amount from 1 to 10% and occur as discrete grains with magnetite in the oxide layers. Rare bands of semi-massive sulphide, less than 5 cm thick, are present in the banded iron formation.

The banded iron formation occurs in a 25 m thick unit of metagreywacke. The mineralogy of the metagreywacke is plagioclase, quartz, biotite, euhedral pinhead garnet and chlorite. The rocks to the north of the greywacke are white to dark grey felsic gneiss. To the south, the rocks are a layered sequence of dark green amphibolite, sheared amphibolite with quartz-carbonate stringers, biotite-quartz gneiss and quartz-biotite-garnet gneiss.

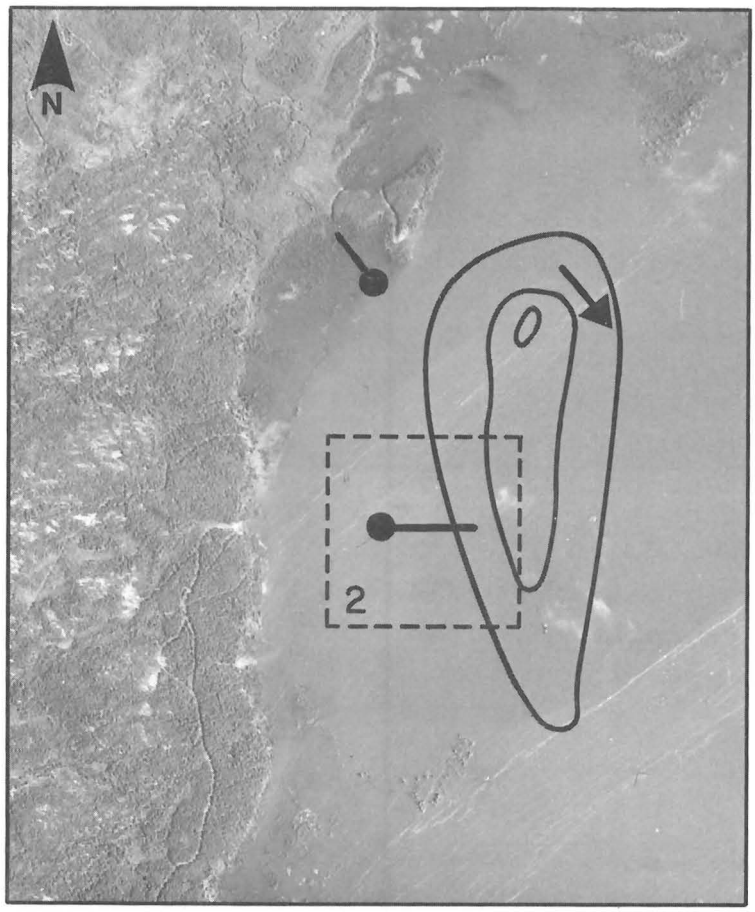
Stratigraphy in the area of the occurrence is unknown. The rocks have probably been metamorphosed by the large granitic bodies that were emplaced nearby.

The similarity of the rock succession and the presence of banded iron formation suggest correlation with locality 13, 6 km to the west.

Assay Data:

Width	Ni%	Cu%	Zn%	Ag oz/ton	Au oz/ton
2 m	Tr	Tr	Tr	0.02	Tr
1 m	Nil	0.02	0.01	Nil	Tr
2 m	Nil	0.03	0.02	Nil	Tr
1 m	Tr	0.02	Tr	Nil	Tr

Classification: Oxide facies iron formation; semi-massive sulphide stratum.



Locality 2 : 64B/5

64B/5

Locality 2. Property: CB 1261 MRD-CAF: 91498

Company: Ruttan Lake Exploration Ltd. Date: March, 1971

Company Drill Hole No. RL#5 Hole Length: 99 m

Data Source: DDH Logs

Target: Magnetic anomaly

Description

The occurrence is characterized by sulphide veins hosted by ultramafic rocks (pyroxenite). Veins are 1.25 cm wide and are filled with talc-carbonate and sulphide. Sulphide makes up 1 to 2 per cent of the vein filling material. The veins appear to occur in swarms separated by massive pyroxenite. Three vein swarms were intersected in the drill hole and have widths of 1.6 m, 1 m and 1.6 m.

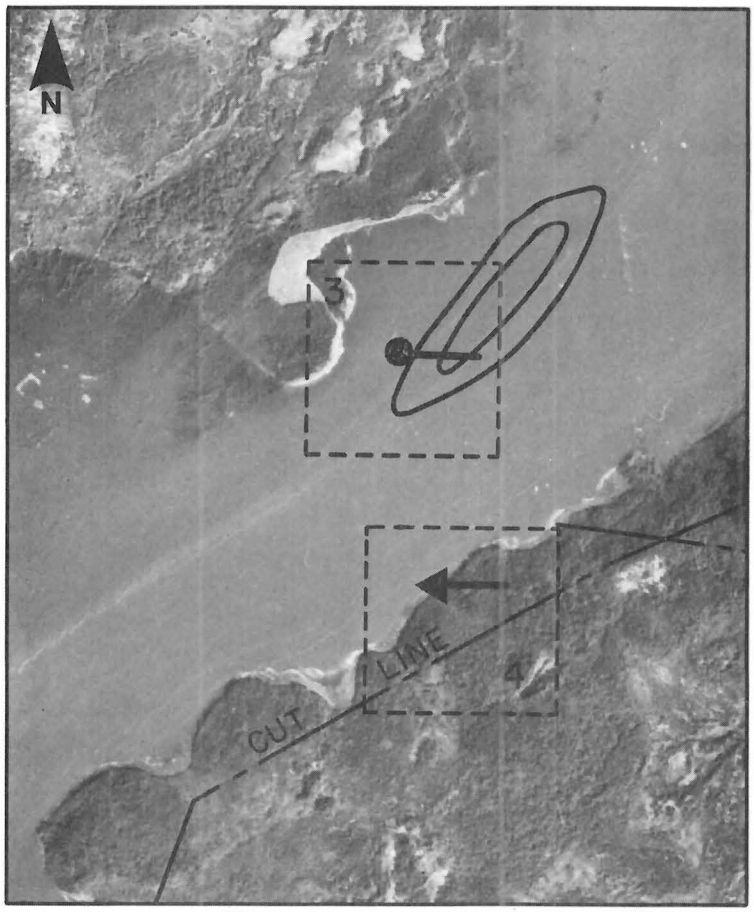
The host rock to the mineralization is pyroxenite. The unit is dark greyish green,

talcose through the length of the drill hole, weakly magnetic and contains patches of biotite.

Assay Data:

Ni%	- Tr to 0.06
Cu%	- Tr
Zn%	- Tr
Ag oz/ton	- Tr
Au oz/ton	- Tr

Classification: Vein sulphide



Localities 3,4 : 64B/5

64B/5

Locality 3. Property: CBM 1250 MRD-CAF: 91498

Company: Ruttan Lake Exploration Ltd. Date: March, 1971

Company Drill Hole No. RL#4 Hole Length: 125 m

Data Source: DDH Logs

Target: Magnetic anomaly

Description

The occurrence comprises four banded oxide facies iron formation 0.3 m, 0.3 m, 1.3 m and 2.3 m thick, respectively, and a 2 cm semi-massive pyrite band. Trace sulphide (po, py) occurs in one of the iron formations.

The iron formation is hosted by a 20 m thick unit of quartz-hornblende gneiss. The magnetite content of the iron formation ranges from 20 to 40 per cent. The 1.3 m thick iron formation is essentially a garnet band containing a few magnetite layers with rare grains of sulphide. Garnet occurs at the contacts of the iron formations and the quartz-hornblende gneiss.

The 2 cm semi-massive pyrite band occurs in a 13 m thick hornblende-biotite gneiss. This gneiss occurs up the hole from the iron formation and is separated from the quartz-hornblende gneiss by 6 m of fine grained andesite (probably an intrusive).

The rocks encountered in the drill hole are described as metaquartzite, hornblende-biotite gneiss, quartz-hornblende gneiss, chlorite-biotite-sericite schist with narrow layers of hornblende gneiss and medium- to fine-grained massive andesites. These rocks occur within 0.5 km of the contact between the greenstone belt and the granitic terrane to the south. These gneisses and schists are probably a metamorphosed sedimentary succession intruded by sills of mafic to intermediate composition.

Classification: Oxide facies iron formation.

64B/5

Locality 4. Property: Kar #3 MRD-CAF: 90948

Company: Western Nuclear Mines Ltd. Date: July, 1968

Company Drill Hole No. Kar 1 Hole Length: 33.5 m

Kar 2 33.5 m

Kar 3 12.5 m

Data Source: DDH Logs; MRD mineral inventory; Quinn (1956).

Description

Quinn (1956) described this property (Parres-Baker prospect) as "a quartz vein exposed on the shore can be traced along its southeasterly strike for 110 ft. The vein is steeply dipping, 1 to 3½ feet wide and carries erratic gold values".

Hudson Bay Exploration and Development trenched and sampled the showing in 1947. Of the twelve channel samples assayed three gave gold values.

Sample	Width (cm)	oz/ton Au	oz/ton Ag
1	50	2.18	0.26
2	30	1.06	Tr
3	85	0.26	Tr

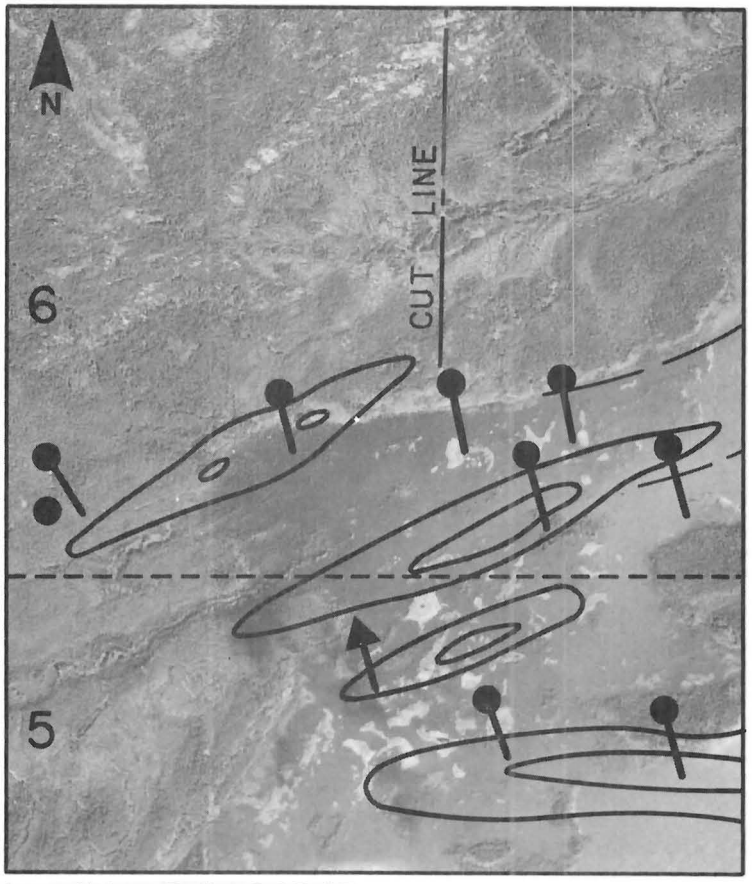
The rocks which the quartz vein cuts through are metagreywacke, meta-argillite and quartz sericite schist.

Western Nuclear Mines Limited sampled and assayed the siliceous rocks in drill core in 5' - 0 sections, the quartz seams separately and the sludge in 7 to 12 foot sections. The only assays that gave any results were from DDH Kar #1.

	oz/ton Au	oz/ton Ag	Cu%
Siliceous rock	Nil	0.02	0.016 - 0.043
Quartz seams	Nil	Nil	0.019 - 0.022
Sludge	Tr	0.05 - 0.06	0.021 - 0.084

Minor disseminated sulphide (py, cp) occur with the quartz vein and rare massive pyrite fills fracture planes less than 15 cm wide.

Classification: Au-quartz vein.



Localities 5,6 : 64B/5

64B/5

Locality 5.

Property: CB 962
CB 917

MRD-CAF: 91939, 90945

Company: INCO

Date: August, 1970;
June, 1971

Company Drill Hole No. 38801 — Hole Length: 285 m
38802 — 16 m
38803 — 158 m
35346 — 44 m

Data Source: DDH Logs

Target: Magnetic anomalies.

Description

This locality contains two occurrences, both have magnetic anomalies.

The southern occurrence consists of quartz-amphibole-magnetite iron formation with associated quartzite (probably recrystallized chert). It is 3.6 m thick in the west and 13 m thick in the east. Sulphide (po, py) occurs as stringers, streaks and specks in the iron formation. The volume of sulphide in the iron formation is 1 to 2 per cent but over short drill hole intersections (< 0.5 m) sulphide makes up 15 to 40 per cent of the iron formation.

The rocks encountered by the drill holes are gneisses and schists containing various amounts of amphibole, plagioclase, biotite and quartz, suggesting a metamorphosed sedimentary succession.

Sulphides (po, py) in amounts of 1 to 2 per cent as discrete grains, and streaks are present in all the schists and gneisses.

The northern occurrence is in the same rock types with the addition of sericite-biotite-quartz schist, sericite-quartz-schist and amphibole-chlorite schist. The iron formation in this occurrence is a garnet-quartz-magnetite iron formation. Disseminated sulphide (po, py) grains are present in all rock types in amounts of 1 to 2 per cent. In the iron formation, up to 12 per cent of the volume of the rock can be sulphide.

Classification: Silicate-oxide facies iron formation.

64B/5

Locality 6.

Company: Ryanor Mining Property: CB 1001 MRD-CAF: 91938

Company Drill Hole No.	1	Date: 1969-70
	2	Hole Length: 106 m
	3	106 m
	4	99.5 m
	5	90 m
	6	72.3 m
	7	206 m
		170 m

Data Source: DDH Logs, Baldwin, Field Work 1978.

Target: HLEM conductors. Magnetic anomalies oblique to the HLEM conductors.

Description:

The southern conductor consists of graphite to meta-argillite (siltstone, unit 6, Map OF81-4-1). Sulphide (po, py) occurs in stringers 2 to 3 mm wide in the graphite-rich zone in the meta-argillite.

The northern conductor is a 10 m thick zone containing six, 2.5 cm thick bands of massive sulphide (po, py, cp, sp) in mica-quartz-garnet schist.

The rocks at the mineral locality are not exposed but the geology, inferred from correlation of drill hole data and outcrops occurring to the northwest, comprises an interlayered sequence of siltstone and volcaniclastic rocks (units 6 and 4, Map OF81-4-1). The facing direction of the sequence is unknown.

Pink to red, euhedral, garnets (< 1 mm) are present in the siltstone and in the fine grained laminated fraction of the volcaniclastic rocks. Lithologic contacts strike about 290° and layering in the rocks dips steeply to the southwest. Unit thickness ranges from 30 to 100 m.

The rocks encountered by the drill holes are described in the drill logs as meta-argillite with varying amounts of garnet, quartz-mica schist and mica-quartz-garnet schist. These rocks probably equate with the bedded and laminated siltstones of unit 6, Map OF81-4-1.

The sulphide mineralization appears to be conformable with lithologic contacts, bedding and lamination.

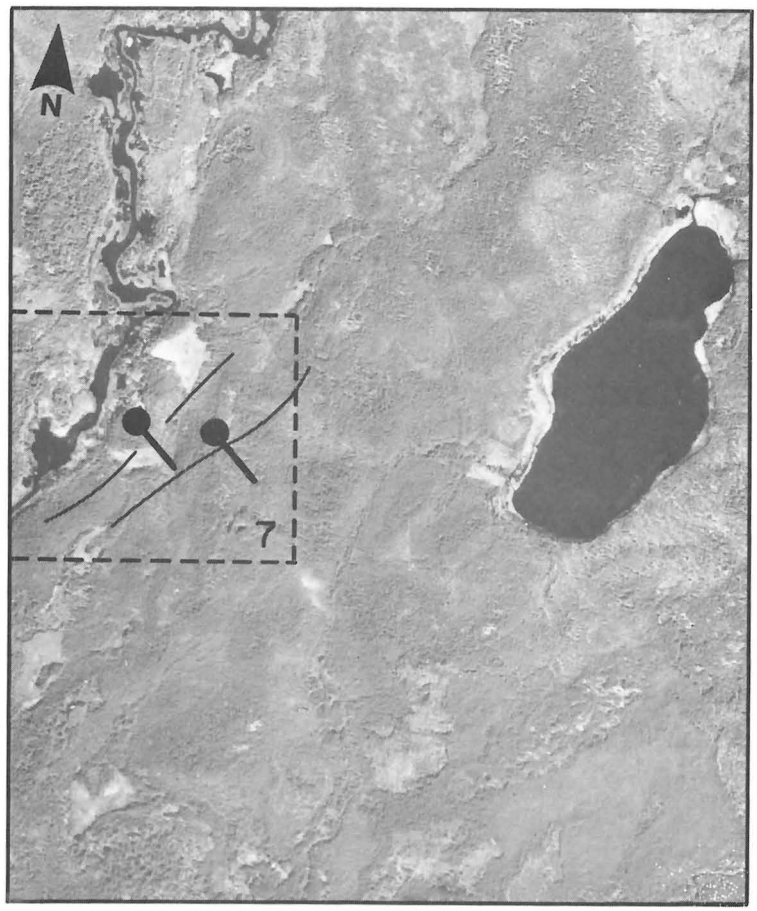
The magnetic anomaly trends are oblique to the geological trends and to the HLEM conductor trends. The cause of these magnetic anomalies has not been observed in the field nor is there data in the drill logs to explain this pattern. A possible interpretation of these magnetic anomalies is that they are related to a series of dykes.

Assay Data:

Samples for assay were taken over 0.6, 1.0 and 1.6 m intervals across the mineralized section. The results are summarized below:

	Cu%	Zn%	Ni%	oz/ton Ag	oz/ton Au
Typical values	0.01 - 0.14	0.03 - 0.25	Nil-Tr	0.01 - 0.02	Nil-Tr
Anomalous values	2.26	1.40		0.06	0.005

Classification: Massive sulphide stratum.



Locality 7 : 64B/5

64B/5

Locality 7.

Property: CB 727

MRD-CAF: 90942

Company: HBED

Date: July, 1970

Company Drill Hole No. Jit-20
Jit-21

Hole Length: 113 m

Data Source: DDH Logs

Target: HLEM conductors

Description

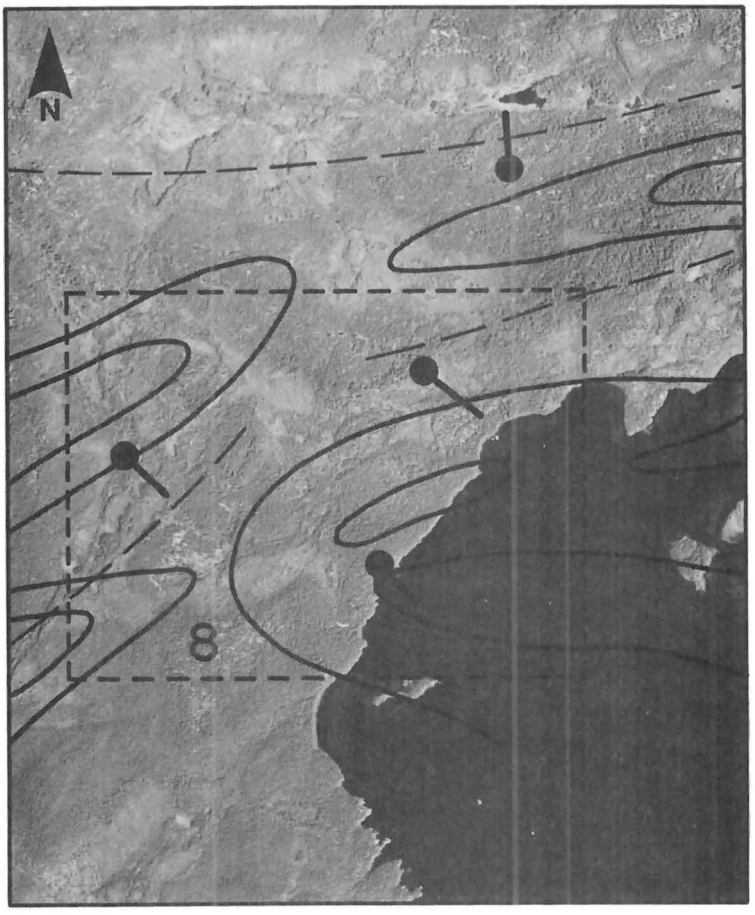
The occurrence consists of 1 to 10 per cent disseminated sulphide (po, py, trace cp) and one 30 cm section of 50 per cent sulphide. The mineralization is contained in three zones in the strong conductor. Negligible sulphide is reported in the weaker conductor.

The three zones of sulphide mineralization in the strong conductor are 2.6 m, 1.0 m and 1.3 m thick. The 2.6 m thick zone is contained in fine- to medium-grained quartz-hornblende-feldspar gneiss. In this zone, 2.3 m of disseminated sulphides (1 to 4 per cent) occur on the north side of and in contact with 30 cm of 50 per cent sulphide. The 1.0 m thick zone is contained in fine grained hornblende-biotite gneiss and consists of 1 to 10 per cent disseminated sulphide (po, py) in which there is a 30 cm section containing 1 per cent chalcopyrite. This zone occurs south of the 2.3 m thick zone and is separated from it by 33 m of

barren rock. The 1.3 m thick zone occurs in quartz-hornblende-biotite gneiss and consists of 2 per cent disseminated sulphide (po, py). This zone is south of and separated from the 1.0 m zone by 15 m of barren rock. All three sulphide zones occur within lithologic units, not at lithologic boundaries.

This occurrence is located very close to the contact between its host rocks and a large granitic intrusive body. Granite and quartz-feldspar gneiss are reported in the drill logs.

Classification: Massive sulphide stratum or lense.



Locality 8 : 64B/5

64B/5

Locality 8.

Property: Top 22,
Top 10,
Top 13

MRD-CAF: 90944

Company: Obaska Lake Mines Ltd.

Date: July, 1970

Company Drill Hole No. 1
2
3

Hole Length: 111.2 m
127.3 m
190 m

Data Source: DDH Logs

Target: HLEM conductors; no direct magnetic association.

Description

This locality contains two mineral occurrences. The type and nature of the mineral-

ization is similar at both occurrences.

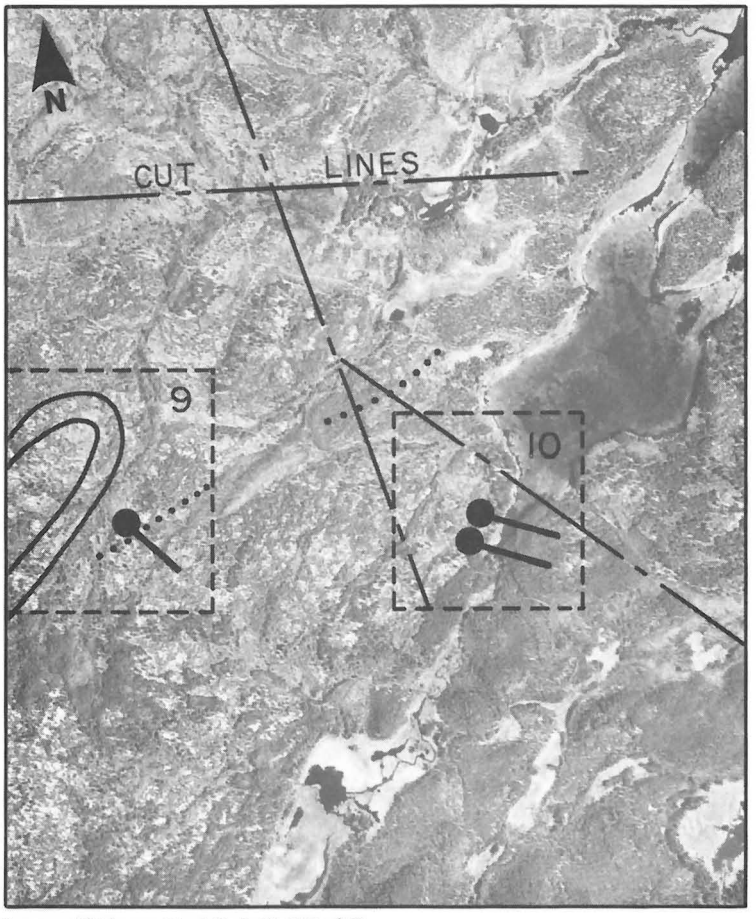
Chalcopyrite, bornite, azurite, malachite and native copper occur as specks or in quartz stringers in shear zones and fault zones.

The occurrences are situated in an east to west topographic depression that lies between outcrop ridges of hornblende-phyric, massive medium- to fine-grained mafic rocks (units 14, 13B, Map OF81-4-1). In the drill logs the rocks are described as metavolcanic rocks with epidote-rich sections, calcite lined vugs, calcite veinlets, biotite-rich zones and chlorite-rich zones. The biotite-rich and chlorite-rich zones are interpreted to be shear zones or fault zones along which there are local heavy concentrations of magnetite and sparse-copper mineralization.

Assay Data:

0.02 to 0.08 per cent Cu over widths of 0.67 to 2 m.

Classification: Shear and/or fault zones.



Localities 9,10: 64B/5

64B/5

Locality 9. Property: CB 842 MRD-CAF: 91547

Company: Janus Exploration Date: July, 1970

Company Drill Hole No. J-1 Hole Length: 110 m

Data Source: DDH logs; Baldwin, Field Work, 1979, 1980.

Target: VLEM conductor, corresponding magnetic anomaly.

Description

The mineralization comprises disseminated sulphide (py, cp) occurring as specks and sparce blebs in 1 to 2 m thick zones in quartz-diorite, amphibolite and dioritic schist.

On surface the quartz-diorite (unit 34, Map OF81-4-1) is homogeneous, equigranular, foliated and contains numerous xenoliths of amphibolite and schists of dioritic composition. The xenoliths are probably metamorphosed equivalents of hornblende-phyric mafic volcanic rocks and intermediate volcanic rocks. The intrusive rock is interpreted to have a syn-volcanic origin. Mineralization was not observed in outcrop.

Assay Data:

Cu%	Zn%
Tr to 0.12%	Tr

Gold values are not reported and it must be assumed that gold assays were not performed.

Classification: Discordant, disseminated.

64B/5

Locality 10. Property: CB 842 MRD-CAF: 91547

Company: Janus Exploration Date: July, 1970

Company Drill Hole No. J-2 Hole Length: 166 m
J-3 78.1 m

Data Source: DDH Logs; Baldwin, Field Work 1979, 1980.

Description

The mineralization is disseminated sulphide (py, cp) and rarely as stringers in quartz-diorite and hybrid rocks.

The rocks, as described in the drill logs, are quartz-diorite, hybrid rocks and andesite.

In outcrops in the vicinity of the occurrence the rocks are quartz-diorite with numerous xenoliths of mafic to intermediate volcanic and plutonic rocks (unit 34, Map OF81-4-1) felsic volcanic rocks (unit 15, Map OF81-4-1) and conglomerate with interbedded sandstone and siltstone (unit 20, Map OF81-4-1).

The contact of the quartz-diorite with the felsic volcanic and sedimentary rocks is extensively brecciated. Veinlets of quartz-diorite penetrate and alter the volcanic and sedimentary rock. The result is a stockwork pattern of veinlets enclosing xenoliths of country rock which are very commonly altered adjacent to the veinlets. The alteration products are epidote, amphibole and/or biotite. These rocks are probably what was described in the drill logs as hybrid rocks.

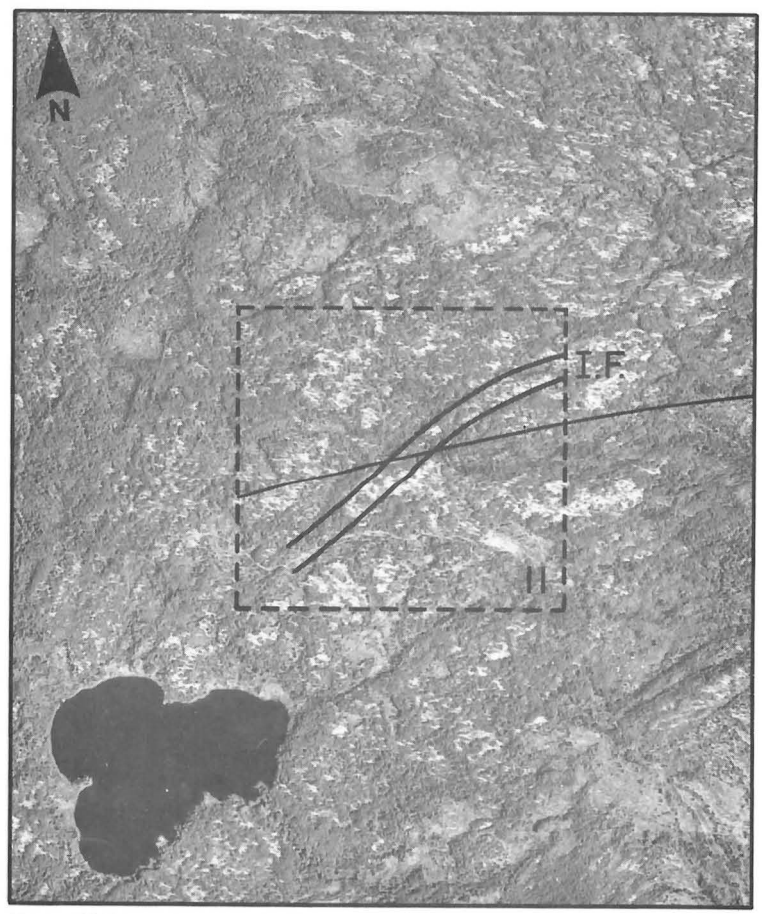
Assay Data:

Assayed sections range in width from 1.6 to 4.5 m.

Cu%	Zn%
0.01 - 0.07	0.01

Values for gold are not reported and it must be assumed that gold assays were not performed.

Classification: Discordant, disseminated.



Locality II: 64B/5

64B/5

Locality 11.

Data Source: Baldwin, Field Work 1980

Description

The occurrence consists of two banded iron formations that have minimum thicknesses of 3 m. A maximum thickness was not observed. The iron formations consist of 0.1 to 1.5 cm bands of magnetite interlayered with 0.1 to 20 cm thick bands of quartzite (recrystallized chert) and tremolite schist. Very minor amounts of sulphide (py, po, sp) occur as discrete grains in the magnetite bands and in altered metasediments.

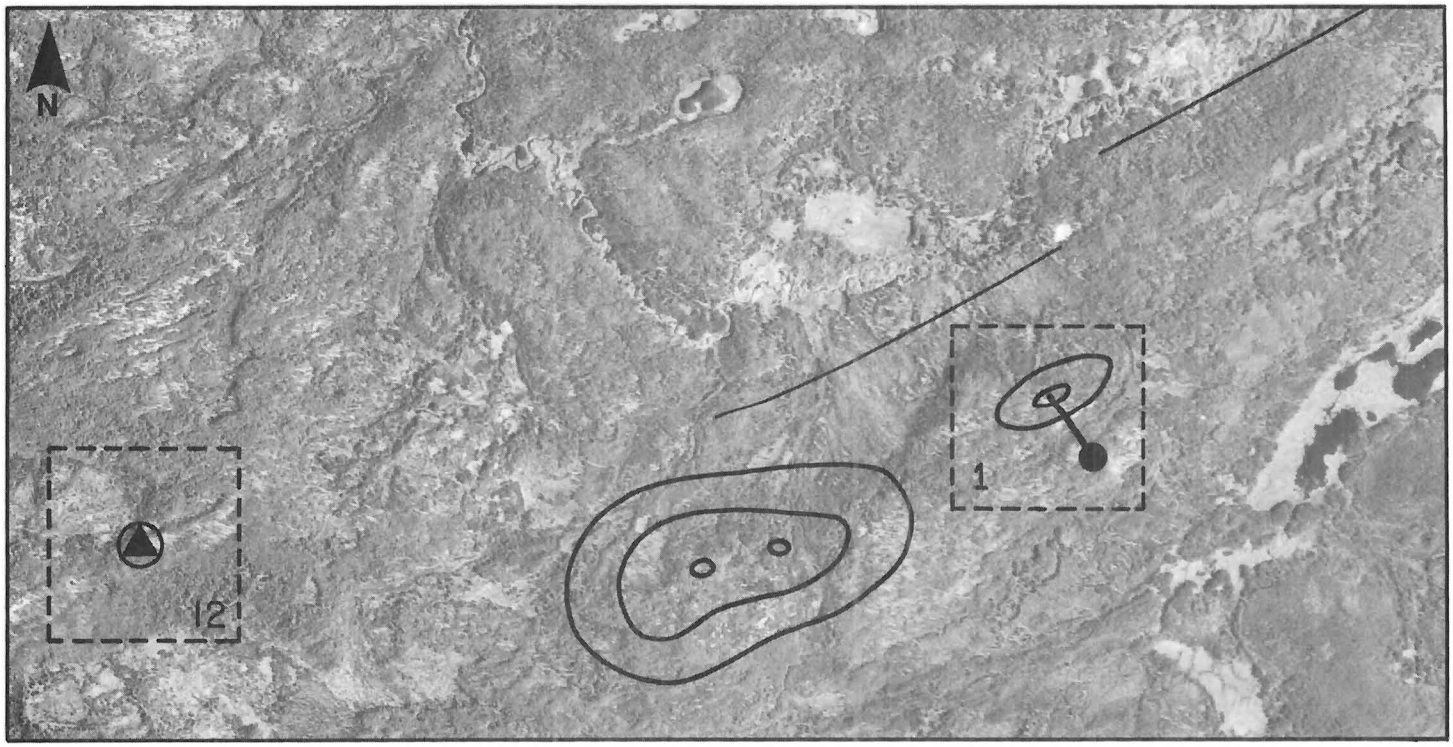
The iron formation is contained in metagreywacke. The metagreywacke is altered; quartz-plagioclase, biotite and garnet with variable amounts of sillimanite plus staurolite, or tremolite plus anthophyllite,or staurolite plus muscovite,or anthophyllite or chlorite make up the mineral assemblages.

One 0.5 m thick layer occurring between the two iron formations is made up of equal amounts of equigranular granoblastic quartz and plagioclase and contains porphyroblasts of staurolite, muscovite, sillimanite and sillimanite-fibrolite.

The metagreywacke unit is underlain and overlain by differentiated mafic lava flows (unit 13, Map OF81-4-1).

Alteration in the basalts was not observed.

Classification: Oxide facies iron formation.



Localities 1,12 : 64B/5

64B/5

Locality 12.

Data Source: Pearce, 1964; MRD Mineral Inventory.

Description

Massive po associated with sugary vein quartz occurs in a narrow easterly-trending zone in Wasekwan lavas. The zone is 0.7 to 1.65 m wide and has an exposed length of greater than 35 m, beyond which it passes beneath muskeg (Pearce, 1964).

Disseminated mineralization in the country rock on either side of the quartz vein causes a rusty weathered surface more than 16 m wide. Chalcopyrite is rarely present and marcasite is present in the zone probably as a secondary mineral.

Assay Data: Grab samples

Zn%	Cp%	Pb%
2.5	Nil	Nil

The writer could not locate this mineral locality during his field work. However, data collected within 100 m of the locality would suggest that the mineralization is not contained in lavas but rather is contained in felsic to intermediate, interlayered, laminated fine-grained rocks in which there are a few beds that are heterolithic clastic deposits. Approximately 500 m to the east of the locality there are outcrops of a fine grained ultramafic rock that is probably a pyroxenite.

Classification: Vein sulphide.

Locality 13: 64B/5

64B/5

Locality 13. Property: Ruttan Mine

Company: Sherritt Gordon Mines Ltd.

Data Source: Speakman et al. (in press)
Baldwin (1978)
Baldwin - field work 1979, 1980

Description

The Ruttan Mine is a copper-zinc proximal volcanogenic massive sulphide deposit. Fifty-one million tons with a grade of 1.47% Cu and 1.6% Zn to a depth of 600 m were outlined during the initial exploration drilling program that was begun in 1969. Production at 10,000 tons per day commenced from an open pit in 1973.

The Ruttan Mine occurs in the south to southeast facing monoclinal Ruttan Block in the Rusty Lake greenstone belt (Baldwin 1979, 1980). The rocks in the mine area (Fig. 2) are mafic volcanic rocks and associated tuffs, intermediate to felsic volcaniclastic rocks, chemical and fine grained detrital rocks, greywackes and conglomerates. Massive sulphide lenses are associated with the intermediate to felsic volcaniclastic rocks. Speakman et al. (in press) have introduced the terminology "footwall volcaniclastics" and "hanging wall sediments" for the intermediate to felsic volcaniclastic rocks and the chemical and fine grained detrital rocks, greywackes and conglomerates, respectively. This terminology will be used in this description to conform to that of the mine geologists.

Lithologies

The stratigraphic succession is illustrated in Figure 3. The mafic volcanic rocks are the lowermost exposed rocks in the Ruttan Block. They are dominantly basalt flows with subordinate breccia and interflow tuffaceous rocks. The flows are both massive and pillowed and aphyric and phyric. The phyric basalts contain 1 to 2 m phenocrysts of plagioclase and hornblende. They occur in the upper one-half of the unit and become progressively more abundant than the aphyric basalt toward the stratigraphic top of the unit. Phyric and aphyric basalt may or may not be vesicular. Flow thickness has not been determined due to poor quality or lack of exposure and in areas where exposure is abundant basalt occurs as large xenoliths in gabbro or diorite. Interflow tuff is extremely fine grained, black to dark green bedded or laminated and rarely contains a few ash size fragments of basalt. Interflow tuff units rarely exceed 1.5 m thickness and are less than 2.5 m thick. Bedding usually is less than 8 cm thick, and is generally observed as a colour change or grain size difference. Graded bedding is rarely present. Basalt is the uppermost member of the mafic volcanic unit, northeast of the mine, whereas mafic sediments are the dominant constituent of the basic volcanic unit southwest of the mine. These sediments are similar to the interflow tuff except that the beds are up to five times thicker than beds in the tuff.

Intermediate to felsic volcaniclastic rock overlie the mafic volcanic rocks. The unit is thickest at and to the northeast of the mine; it thins to the southwest. At the mine these rocks are massive equigranular and fine- to medium-grained. Primary structures are obliterated but fragments of intermediate to felsic composition are recognized. The rocks are uniform in appearance and in composition (Speakman et al., in press). Away from the orebody the unit consists of felsic and intermediate fragmental rocks and sediments. In any one fragmental member there is generally one clast type (texturally and compositionally) in a clastic matrix that is probably greywacke in composition. The fragments are elliptical in shape, generally equally distributed, are matrix-supported and rare size grading of the fragments is observed. A few heterolithic members are present and in these there are more clasts than in the monolithic member and at some localities the fragments are clast-supported. Thin (1 to 2 m) members consisting of thinly bedded sediments with intermediate to felsic compositions are interbedded with the volcaniclastic rocks. In the upper part of, but within the volcaniclastic unit, there is a 25 m thick sequence of thinly bedded to thinly laminated sedimentary rock (Speakman et al., in press).

Massive sulphide lenses occur stratigraphically above the 25 m thick sedimentary member and are separated from it by approximately 125 m of intermediate to felsic volcaniclastic rocks.

The hanging wall sediments directly overlie the footwall volcaniclastics and to the northeast of the massive sulphide deposit the hanging wall sediments overlie the mafic volcanic rocks. The hanging wall sediments have been traced along strike from the deposit for about 10 km to the northeast and east end for about 2 km to the southwest. The lowermost unit consists of interbedded chemical sediments and fine grained detrital sediments. On a regional

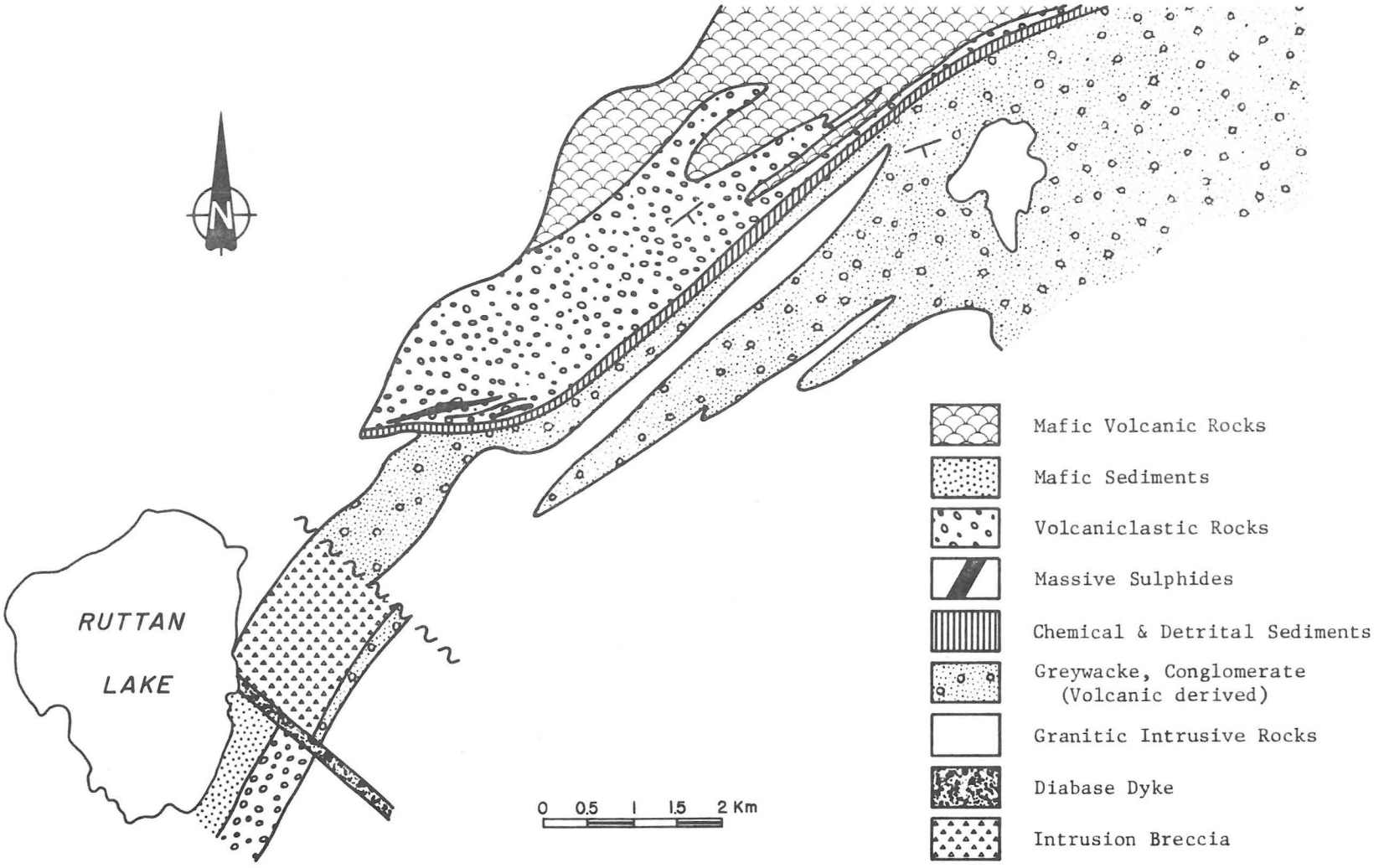


Figure 2: Generalized geological map of the Ruttan Mine Area.

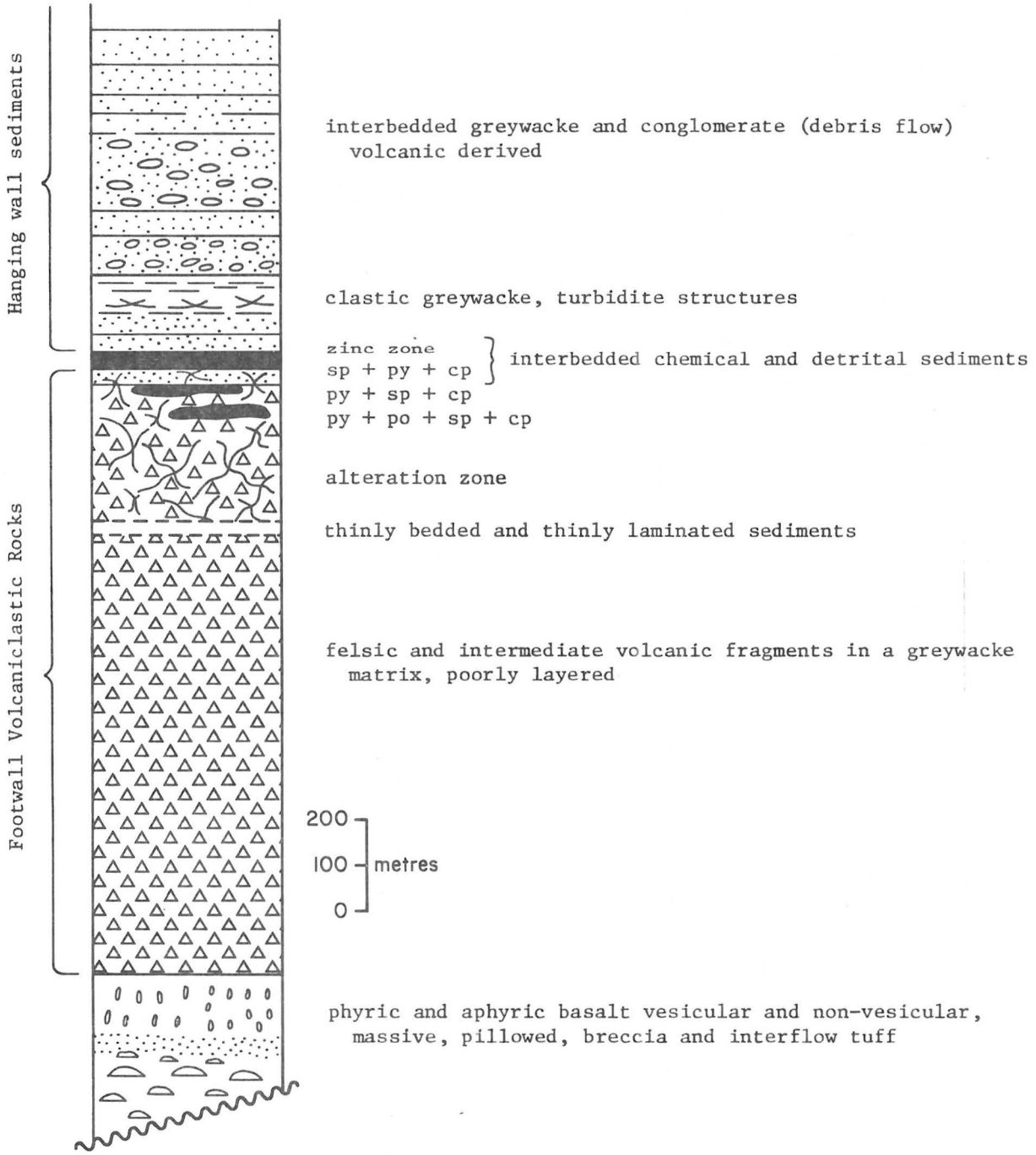


Figure 3: Stratigraphic section of the Ruttan Mine Area.

scale this unit thins away from the mine where it is approximately 100 m thick. Chemical sediments are chert, and iron-rich siliceous beds. Volumetrically, magnetite porphyroblasts 4 mm across commonly make up 25 to 40 per cent of the iron-rich siliceous beds. Detrital sediments are well bedded, generally 35 to 50 cm thick, massive and equigranular with a 0.5 to 1.5 cm thick siltstone top. Graded bedding is present in a few of the detrital sediment beds. The boundary between the siltstone top and the rest of the bed is gradational. Metamorphic minerals in these sediments reflect a change in composition from bottom to top of the beds, especially adjacent to or very close to the sulphide lenses. Here, garnet and cordierite occur at the base and part way up the bed. Toward the top of the bed, staurolite is abundant. These metamorphic minerals are only present in the immediate vicinity of the sulphide deposit.

Clastic sediments with greywacke composition and turbidite bedding overlie the chemical and detrital sediments. Beds are up to 0.75 m thick. Graded bedding, horizontal and convolute laminations are abundant and rip-up and load structures are common. Grain size ranges from grit to silt. The maximum thickness of the unit is approximately 100 m.

Interbedded greywacke sandstone and polymictic conglomerate represent the stratigraphically highest unit of the Ruttan Block exposed in the vicinity of the sulphide deposit. The greywacke sandstone units are 10 to 20 m thick and consist of 30 to 40 cm thick graded beds that commonly contain intraclasts. Bedding is typically rhythmic. Conglomerate beds are 1 m to tens of metres thick. They are typically non-sorted and matrix-supported. Clasts are very angular to rounded, the most angular occurring at the base of the unit. Clasts are generally intermediate to felsic in composition but mafic clasts are present. They are volcanic in origin. In one outcrop highly vesicular fragments (scoria or pumice) have been observed. The clasts range in size from 4 to 5 cm to 40 cm. Rare 75 to 80 cm clasts are present. Clasts generally make up less than 50 per cent of the rock but locally clast-supported beds with clasts making up to 75 per cent of the rock occur. These conglomerates are interpreted as representing debris flows.

Sulphide Orebody

The data contained here are from Speakman et al. (in press). The sulphide ore consists of numerous lenses that at surface strike east-west and with depth rotate to northeast-southwest. The lenses dip between 60° and 90° to the south and plunge 60° to the southeast.

The sulphides occur in three zones, the North Zone, the Pyrrhotite Zone and the South Zone.

The North Zone is sphalerite-rich and accounts for the majority of the zinc found to date. The mineralogy is pyrite, sphalerite, pyrrhotite, chalcopyrite and magnetite. The grain size of the sulphide is coarse with pyrite and sphalerite crystals up to 1 cm diameter. The sulphides in this zone are crudely banded and locally sphalerite has been mobilized resulting in sphalerite with pegmatitic texture cross-cutting finer grained sphalerite-pyrite ore.

The South Zone can be divided into two areas, one containing pyrite and chalcopyrite and the other banded pyrite and sphalerite. The pyrite-chalcopyrite ore is characterized by equigranular medium grained pyrite with chalcopyrite occurring along pyrite grain boundaries and

at triple junctions. The ore is generally massive but where chlorite and biotite are abundant the ore has a gneissic texture. The banded pyrite-sphalerite ore is located in the hanging wall sediments. It occurs as 1 cm to 1 m thick alternating bands of sphalerite and pyrite and silicate-rich rock.

Galena is present in the sphalerite-rich bands and increases in abundance eastward.

Alteration

The data presented here are from Speakman et al. (in press). The alteration zone at the deposit is characterized by magnesium and silica enrichment and alumina, sodium, potassium and calcium depletion (Speakman et al., in press).

The alteration occurs in the footwall volcaniclastics and with the exception of magnesium terminates at the contact between the footwall volcaniclastics and the hanging wall sediments. Magnesium enrichment is recognized in the interbedded chemical and detrital sediments in the hanging wall. Alteration has not been recognized stratigraphically below the 25 m thick finely banded sediments that occur in the upper portion of the footwall volcaniclastics.

The alteration zone is dome-shaped in plan view. The maximum thickness is 400 m which decreases to 100 m east and west from the deposit. It is at least 1 km in length.

There is a marked increase in the grain size of the rocks in the alteration zone and the mineralogy consists of magnesium-rich chlorite, cordierite, sericite, biotite, andalusite, staurolite and garnet. The assemblages reflect variations in the chemistry in the alteration zone. Chlorite, identified as sheridanite, is present in the area of magnesium enrichment. Biotite and/or sericite occur in the area of potassium depletion. Garnet is replaced by cordierite in all areas of the alteration zone except where the magnesium/iron ratio is low. Staurolite occurs in areas of alkali depletion which are accompanied with a low magnesium/iron ratio. Andalusite occurs in areas of sodium depletion and alumina enrichment.

Sulphate, carbonate and barium all increase in amount toward the hanging wall of the deposit.

Summary

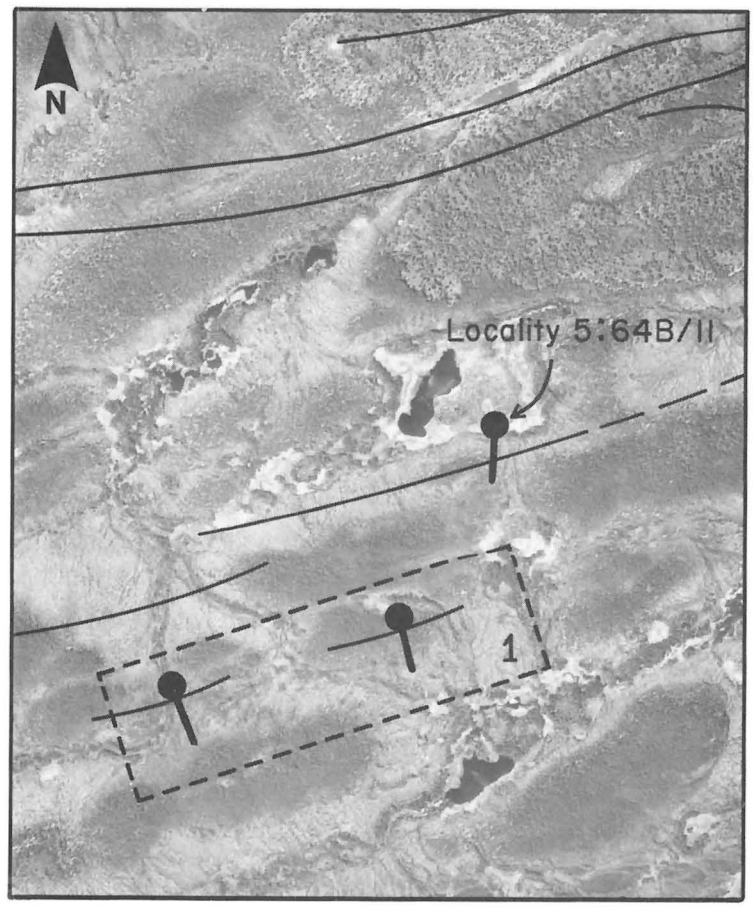
The Ruttan Mine copper-zinc deposit is lenticular and stratiform and contains a number of lenses. The deposit was formed during and following the emplacement of the footwall volcaniclastic rocks. Seventy to eighty per cent of the known zinc occurs in the North Zone, an apparent reversal of metal zoning with respect to stratigraphy. This may indicate that there were two periods of mineralizing activity or that the North and South Zones were at one time at the same stratigraphic level and were emplaced in their present position by faulting (Speakman et al., in press).

The greatest extent of alteration is in the footwall volcaniclastic rocks. The alteration is directly associated with the sulphide deposit indicating proximity to an exhalative centre.

This exhalative activity took place in a localized sedimentary basin distal to an

eruptive centre.

Classification: Massive sulphide lenses.



Locality 1:64B/6

Mineral Localities 64B/6

Locality 1. Property: Tam 20, Tam 30 MRD-CAF: 90957

Company: HBED Date: March, 1963

Company Drill Hole No. Tam 12 Hole Length: 65 m

Tam 11 198 m

Data Source: DDH Logs, Baldwin, Field Work 1979.

Target: HLEM conductor

Description

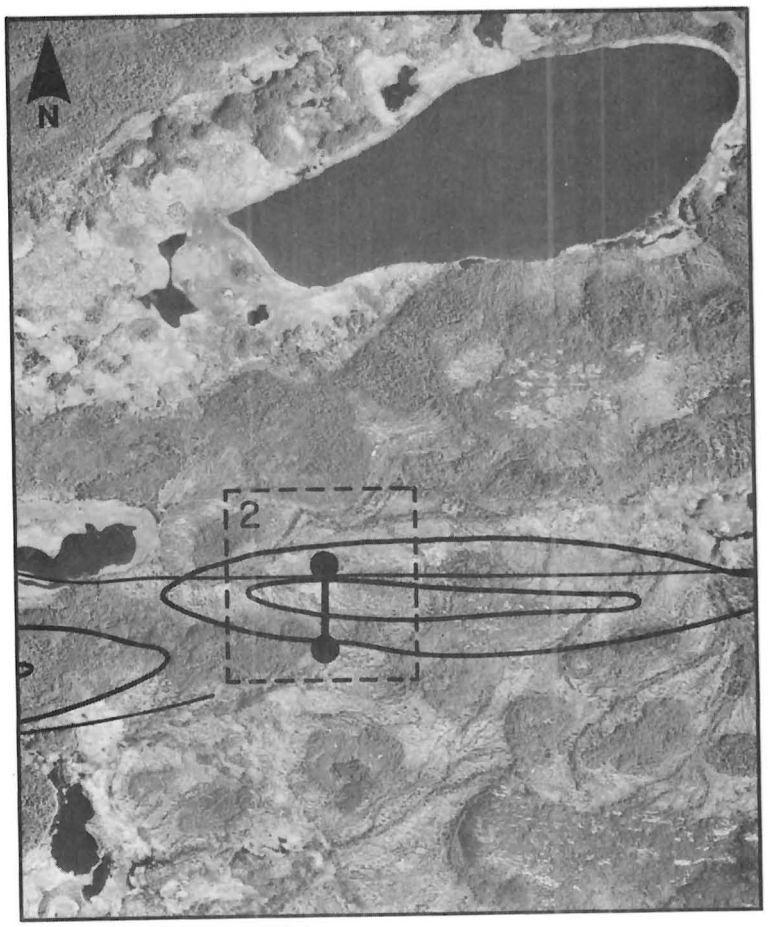
Slight sulphide (py) with graphite occurs in a zone that is 22 cm interbedded tuff, breccia and conglomerate.

West of this mineral locality the rocks in outcrop are conglomerates with interbedded fine grained greywacke and arkosic sandstones and siltstones (units 27, 28, 29, Map OF81-4-1). Local siltstones contain variable amounts of graphite and very minor disseminated sulphide. Several of the conglomerates have an abundance of mafic clasts and many of the siltstones are mafic or intermediate in composition. A sheared mafic to intermediate, graphitic siltstone with minor disseminated pyrite, was identified in drill core as a sheared basalt with graphite and

disseminated sulphide, and the conglomerate with mafic clasts identified as breccias.

Estimates on the volume of sulphide and assay data are not reported.

Classification: Disseminated sulphide stratum.



Locality 2:64B/6

64B/6

Locality 2. Property: Tam 80 MRD-CAF: 90957

Company: HBED Date: March, 1963

Company Drill Hole No. Tam 8 Hole Length: 64.65 m
Tam 10 120 m

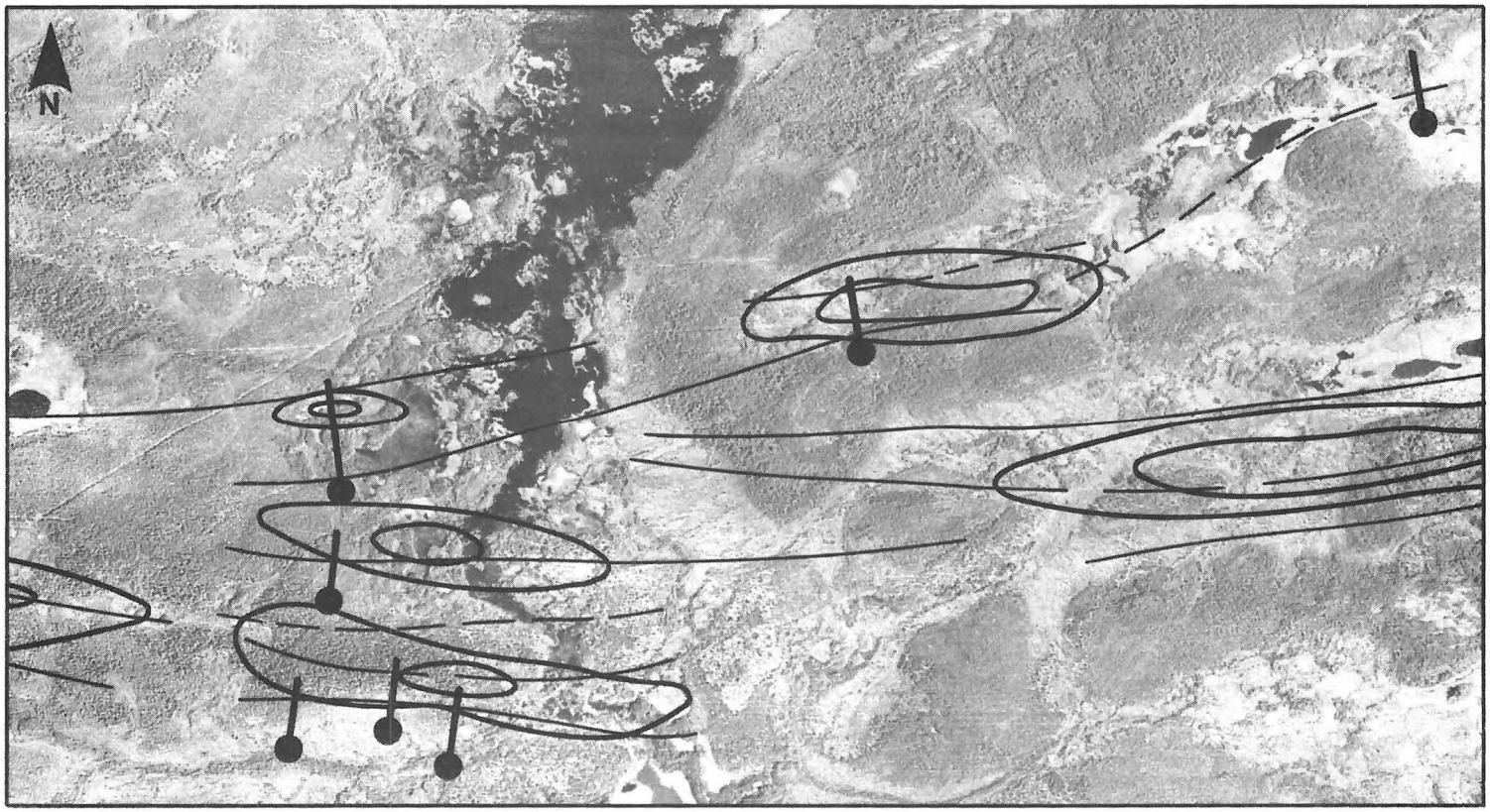
Data Source: DDH Logs; Baldwin, Field Work 1979.

Target: HLEM conductor with corresponding magnetic anomaly.

Description

Two separate mineralized zones are present in this occurrence. From south to north they are 6.2 m and 13 m thick, respectively, and are reported to occur in sheared basalts. The 6.2 m thick zones consist of slight pyrite in sections up to 2 m thick, separated by 1 m thick sections of sulphide-free rock. Graphite in this zone increases in amount from south to north across the drilled intersection. The 6.2 m thick zone consists of slight pyrrhotite in section 3.3 m thick separated by sulphide-free zones. Graphite is not reported from this mineralized drill intersection.

The rocks as described in the drill logs are sheared basalts with interbedded tuffs



Locality 3 : 64B/6

and breccias (see description of Locality 1, 64B/6 for an interpretation of the sheared basalts and breccias).

Estimates for volume per cent of the sulphides in the rock and assay data are not reported.

Classification: Disseminated sulphide stratum.

64B/6

Locality 3. Property: CB 967, CB 1060, CB 1063 MRD-CAF: 90967

Company: INCO Date: March, April, 1970

Company Drill Hole No. 35314 Hole Length: 186 m

35316 156.2 m

35315 140 m

Data Source: DDH Logs

Target: VLEM conductors; parts of the conductors have associated magnetic anomalies

Description

This mineral locality consists of three occurrences, one of which (Hole No. 35313) occurs at the south end of 64B/11, but is included in this locality because the associated geophysical conductor is continuous with the geophysical conductors on 64B/6.

The southernmost occurrence (Hole No. 35316) consists of less than 20 per cent disseminated and streaks of sulphide (po, py) in micaceous quartzite graphite schist, quartz graphite schist, muscovite-quartz schist and biotite-quartz schist. The micaceous quartzite has a minimum thickness of 30 m. Graphite schist, quartz-graphitic schist, muscovite-quartz-schist and biotite-quartz schist make up an interbedded succession in which the thickness of the rock types ranges from 0.3 to 6.5 m.

Mineralized sections range in thickness from 15 to 76 m. Generally the sulphide content appears to remain constant across lithologic contacts. Sulphide content varies from 3 to 20 per cent.

The central occurrence consists of disseminated sulphide (po, py) in impure quartzite and metasediments and massive sulphide (po, py) in a quartz vein. The impure quartzite has a minimum thickness of 100 m, is banded, locally sheared and locally graphitic. It is mineralized throughout and contains less than 15 per cent sulphide. The metasedimentary rocks are banded (bedded) and contain argillite beds. The unit is approximately 25 m thick and contains up to 8 per cent sulphide as disseminations or streaks. Chalcopyrite is reported as being present in a very minor amount.

The quartz vein is in the impure quartzite. It contains 60 per cent sulphide (po, py) across 6 cm.

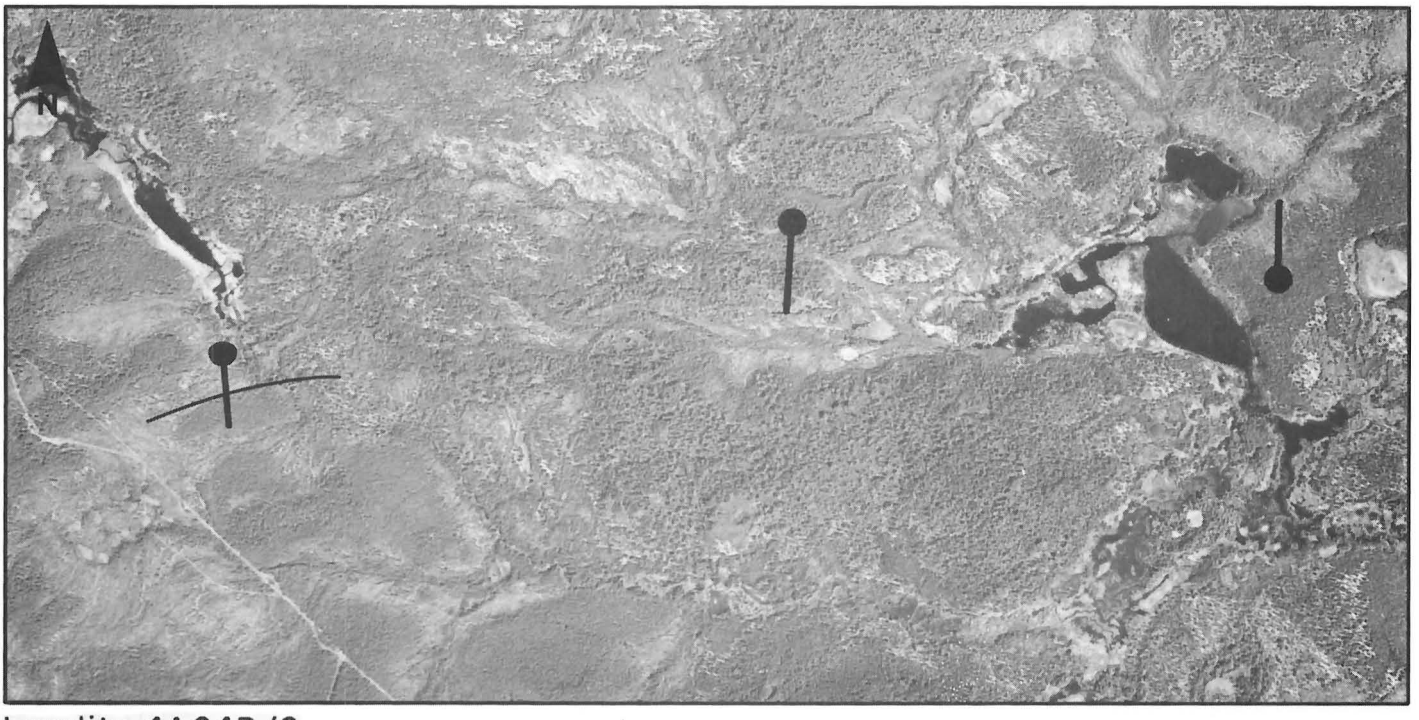
The northernmost occurrence consists of 1 to 2 per cent sulphide in quartzite. The sulphide is disseminated or occurs as sulphide streaks in biotite-graphite schist.

The quartzite has a minimum thickness of 76 m, is generally massive and fine grained. It contains a few schist bands. The biotite-graphite schist is not banded but the mineralization in it occurs in numerous 15 cm thick zones.

Assay data for these occurrences is not reported.

The writer interprets these mineralized zones as being stratigraphically equivalent to the sulphide facies iron formations (unit 30, Map OF81-4-1), on 64B/12.

Classification: Semi-massive sulphide stratum.



Locality 4: 64B/6

64B/6

Locality 4.

Property: CB 257, CB 1074, CB 1073

MRD-CAF: 90953, 9-955

Company: Mineral Mountain Mines Ltd.

Date: October, 1970; February, 1973

Company Drill Hole No. 124-5, 128-1, 128-2

Hole Length: 121.5 m, 120.6 m, 127.2 m

Data Source: DDH Logs; Baldwin, Field Work 1979, 1980; MRD Mineral Inventory

Target: HLEM conductors

Description

Three occurrences make up this locality. Similarities of rock descriptions and stratigraphic succession in outcrop at one occurrence and to the west of the locality suggests that the mineralization is stratiform. Therefore the three occurrences at this locality are here treated as one.

The sulphide mineralization (po, py) is disseminated and is contained in quartzite and

argillaceous greywacke.

The quartzite is impure, dense and hard with a true thickness of approximately 18 m, and contains 3 per cent pyrrhotite and a few specks of pyrite. The argillaceous greywacke is black, hard, 3 to 3.5 m true thickness, generally graphitic and contains up to 10 per cent pyrrhotite and 3 per cent pyrite.

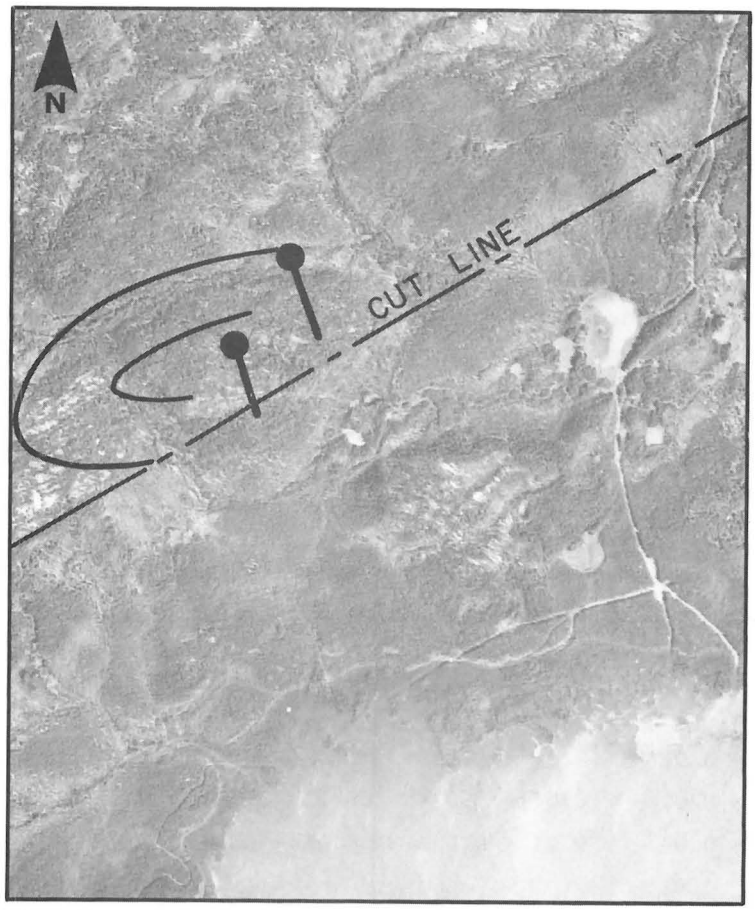
The rocks as described in the drill logs are an interbedded sequence of conglomerate, greywacke, quartzite, siliceous greywacke and hard black argillaceous greywacke. In outcrops at one occurrence and in outcrops to the west of the occurrence the rocks are volcanic derived sandstone, massive chert, conglomerate (debris flow) and black siltstones (units 3c and 6, Map OF81-4-1). The succession youngs toward the north and overlies a thick sequence of volcanic derived epiclastic rocks (unit 5, Map OF-81-4-1) with subordinate felsic flow rocks (unit 3, Map OF-81-4-1).

The quartzite and argillaceous greywacke identified in drill logs are interpreted to be the same members of the sedimentary succession identified in outcrop.

Assay Data:

Hole No.	Cu%	Zn%	Ni%	Az oz/ton	Au oz/ton
124-5	Tr - 0.01	Tr - 0.01	-	Nil	
128-2	0.02 - 0.04	0.01 - 0.02	0.01 - 0.02	0.12	
128-1	0.02 - 0.03	0.01 - 0.02	0.01 - 0.02	0.04 - 0.28	0.01 - 0.02

Classification: Disseminated sulphide stratum.



Locality 5 : 64B/6

64B/6

Locality 5. Property: CB 1076 MRD-CAF: 90953

Company: Canex Aerial Exploration Ltd. Date: September, 1970

Company Drill Hole No. 124-2 Hole Length: 125.3 m

Data Source: DDH Logs

Target: VLEM conductor

Description

The occurrence consists of intermittent finely disseminated sulphides (po, py, cp) that rarely make up one per cent of the rock. The sulphides occur in mafic, intermediate and felsic volcanic rocks.

The conductor is probably a 30 cm water seam.

Classification: Discordant, disseminated.

64B/6

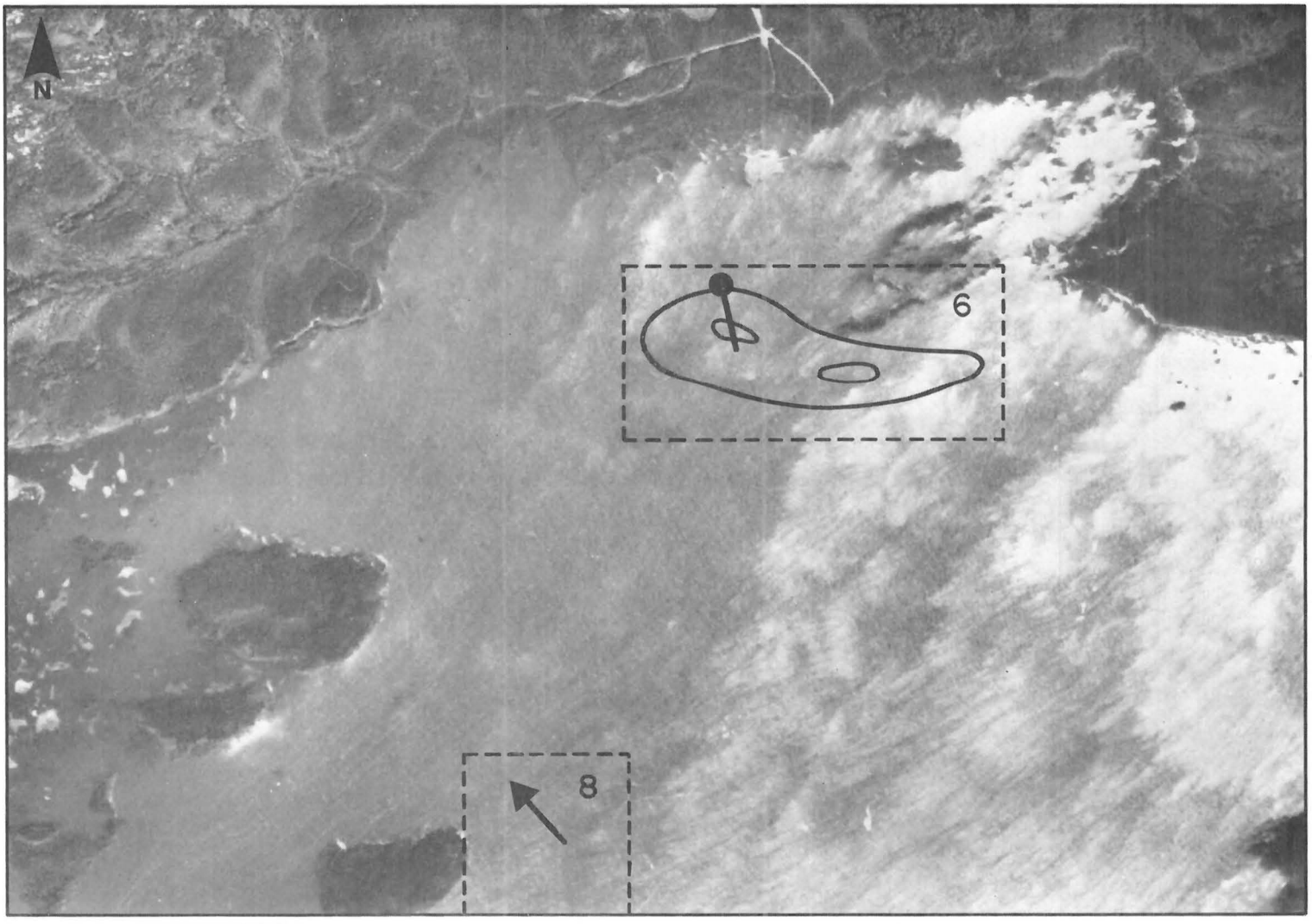
Locality 6. Property: CBM 773 MRD-CAF: 90956

Company: Ruttan Lake Exploration Ltd. Date: March, 1971

Company Drill Hole No. RU-3 Hole Length: 111.2 m

Data Source: DDH Logs; MRD Mineral Inventory.

Target: HLEM conductor, Magnetic Anomaly.



Localities 6,8 : 64B/6

Description:

Several 1.5 m thick sections of finely disseminated or very thinly banded sulphide (po, py), one 1.5 m thick band of semi-massive sulphide (po, py, cp) and one 1.2 cm thick band of massive po in massive to sheared andesite.

The drill logs also record an intersection of unspecified width of 10 to 15 per cent banded magnetite with 6 to 8 per cent pyrrhotite and one per cent pyrite and an intersection 30 cm wide of 20 per cent banded magnetite in sheared andesites.

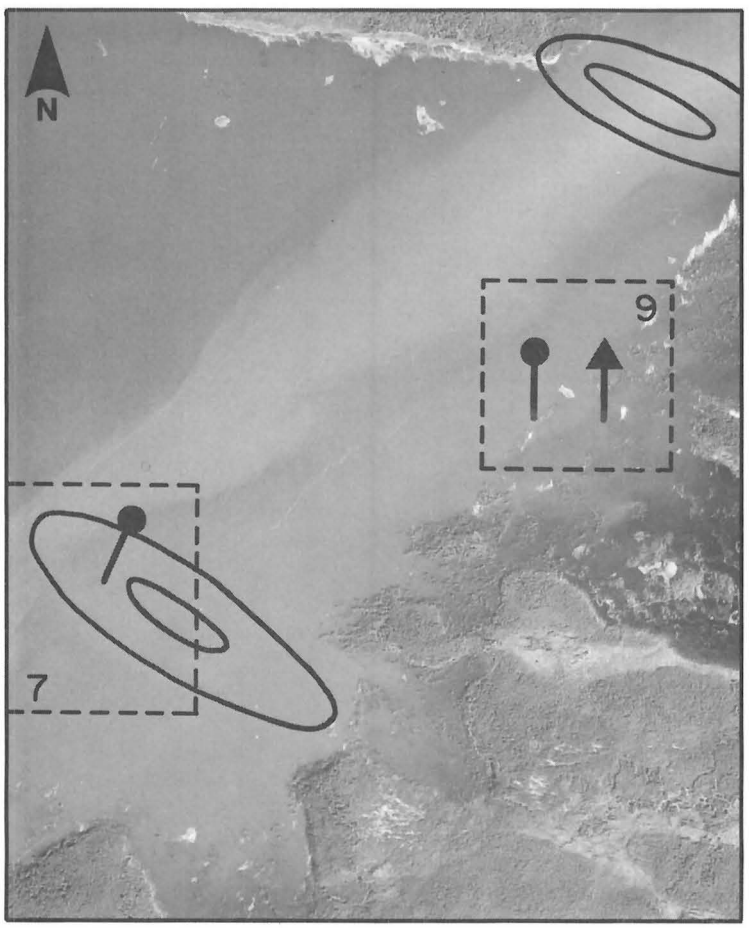
The magnetic anomaly at the occurrence does not correspond with the trend of the VLEM conductor.

The VLEM conductor can be explained by the sulphide mineralization in the andesite. The magnetic anomaly could result from a magnetite-bearing ultramafic body rather than the logged andesites.

Assay Data:

Assays for Ni, Au, Ag are reported as Nil, Copper varies from 0.06 to 0.1 per cent.

Classification: Massive sulphide stratum or lense, oxide facies iron formation.



Localities 7,9 : 64B/6

64B/6

Locality 7. Property: CB 710 MRD-CAF: 91529

Company: INCO Date: March, 1972

Company Drill Hole No. 38810 Hole Length: 170 m

Data Source: DDH Logs

Target: Magnetic anomaly.

Description:

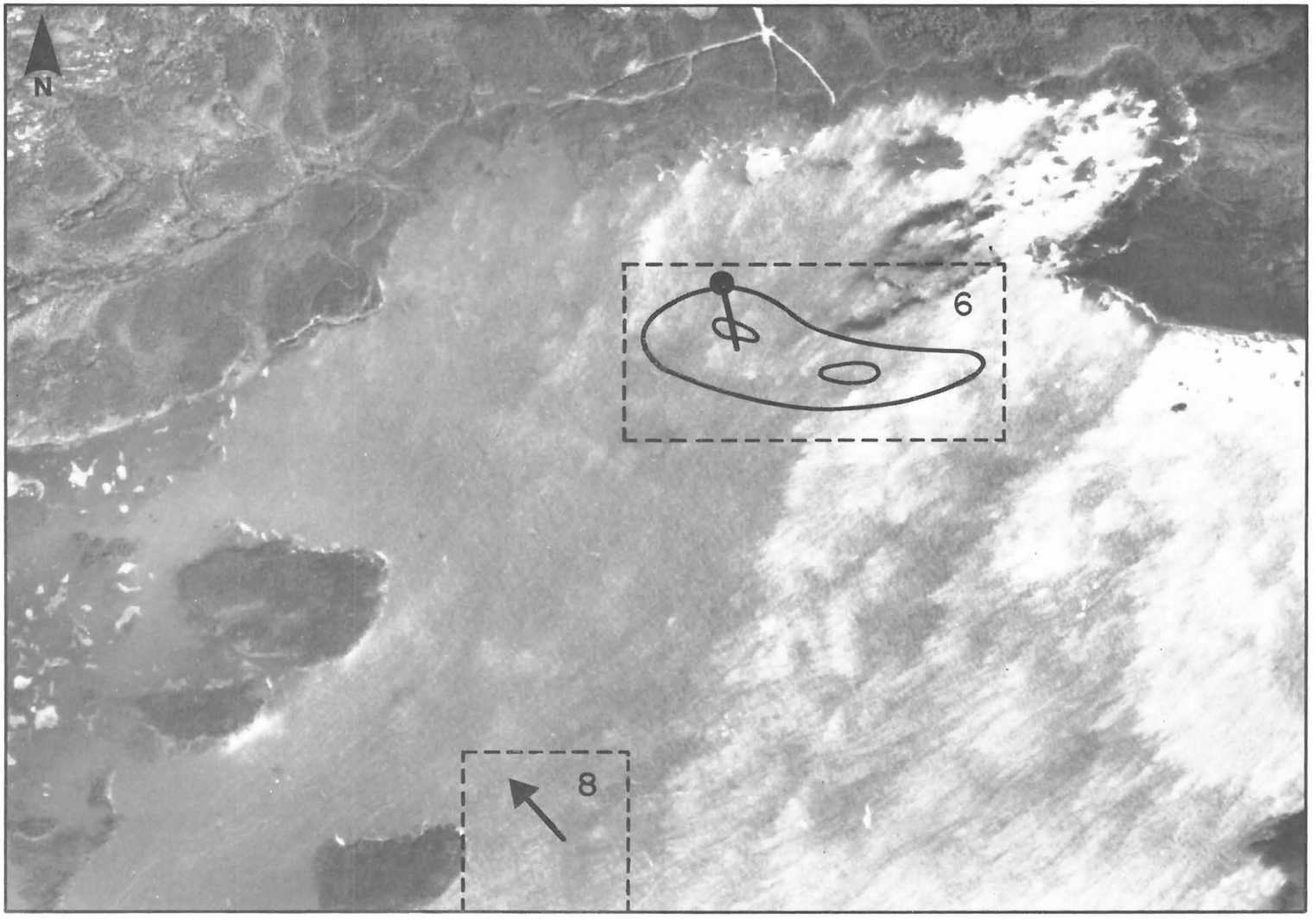
The occurrence is disseminated sulphide (py, po) and minor magnetite in zones that are generally 1.5 m thick and rarely 4.5 m thick in an interlayered sequence of various schists and gneisses. The sulphide makes up less than 6 per cent of the rock and is contained in amphibole-biotite schist or quartz-biotite schist.

The occurrence is very close to the contact of the greenstone belt and the vast granite terrane to the south and east.

Assay Data:

Not reported.

Classification: Discordant disseminated.



Localities 6,8 : 64B/6

64B/6

Locality 8. Property: CB 710 MRD-CAF: 91939

Company: INCO Date: February, 1972

Company Drill Hole No. 38809 Hole Length: 175 m

Data Source: DDH Logs

Target: Unknown

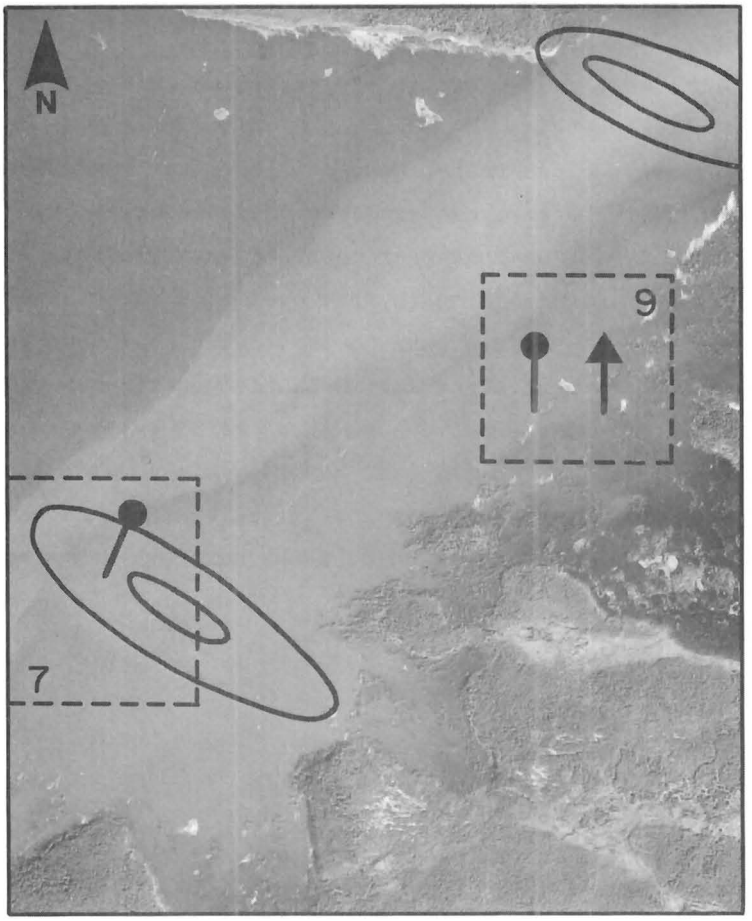
Description

Banded iron formation containing very minor sulphide (po, py) occurs in three zones, 6, 4, and 3.2 m thick in a layered sequence of biotite-amphibole-garnet schists.

Assay Data:

Not reported.

Classification: Oxide facies iron formation.



Localities 7,9 : 64B/6

64B/6

Locality 9. Property: CB 734 MRD-CAF: 90942

Company: HBED Date: July, August, 1970

Company Drill Nole No. Jit 22 Hole Length: 50 m

Jit 23 66 m

Jit 24 118.7 m

Data Source: DDH Logs

Target: HLEM conductor

Description

Massive sulphide (po, py, cp) occurs in two zones in biotite-hornblende-quartz gneiss and biotite-quartz-hornblende-quartz gneiss in Jit 22. The biotite-hornblende-quartz gneiss is about 15.5 m thick and hosts a 1.98 m thick zone that consists of layered sulphide. The layering in the sulphide is defined by the amount of sulphide and by the sulphide mineralogy. Sulphide content varies from 80 per cent to 95 per cent and the mineralogy of the layers is as follows:

Width	Po%	Py%	Cp%
30 cm	40	40	Tr
1.5 m	45	45	1-2
18 cm	90	5	-

A semi-massive (40 per cent) sulphide zone 30 cm thick is separated from this massive sulphide zone by a 1.3 m thick non-mineralized zone.

The massive sulphide zone in the biotite-quartz-hornblende gneiss is about 15 cm thick and consists of 60 per cent pyrrhotite.

In Jit 23, which is very close to but west of Jit 22, a zone of semi-massive to massive sulphide 3.2 m thick in quartz-hornblende-sericite gneiss carries 5 to 10 per cent sphalerite and 1 to 10 per cent chalcopyrite in four sections that are less than 35 cm thick.

In Jit 24 which is west of Jit 23 there is a one metre thick zone of massive sulphide that contains 60 per cent pyrite, 10 per cent pyrrhotite, trace chalcopyrite, trace to one per cent sphalerite, and one to two per cent magnetite in biotite-quartz-hornblende gneiss.

Although the massive sulphide zones in the three drill holes are contained in different lithologies, the lithologies differ in mineral mode not mineralogy, with the exception of the identification of sericite in Jit 23. Jit 22 was not logged by the same geologist who logged Jit 23 and 24. The differences from one drill hole to the next appear to be slight.

Assay Data:

Not reported.

Classification: Massive sulphide stratum or lense.

64B/6

Locality 10. Property: CB 1363 MRD-CAF: 90942

Company: HBED Date: August, 1970

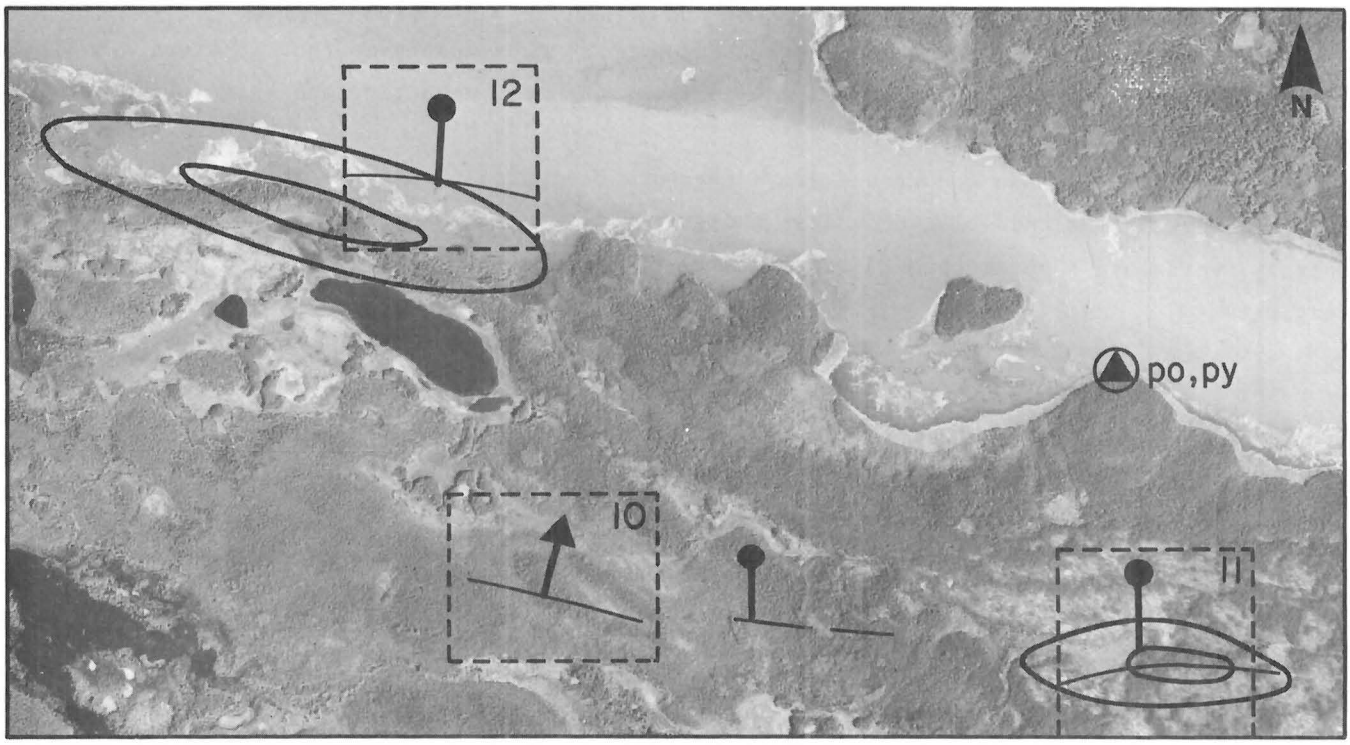
Company Drill Hole No. Jit 25A Hole Length: 81.5 m

Data Source: DDH Logs

Target: HLEM conductor

Description:

The occurrence consists of four sulphide (po, py) zones in quartz-biotite-hornblende gneiss that contains minor amounts of garnet and chlorite. Three of the zones contain less than 10 per cent total sulphide and contain about 3 per cent magnetite. The fourth zone, which is probably responsible for the conductor is 2.1 m thick and contains 50 to 20 per cent pyrite and



Localities 10,11,12 : 64B/6

5 to 35 per cent pyrrhotite.

The rocks in the drill logs are described as hornblende-biotite gneiss, quartz-hornblende gneiss, quartz-hornblende gneiss and granite gneiss. The units are about 5 to 15 m thick and probably represent a metasedimentary succession intruded by granitic sills or dykes.

Assay Data:

Not reported.

Classification: Semi-massive sulphide stratum or lense.

64B/6

Locality 11. Property: CBM 978 MRD-CAF: 90956

Company: Ruttan Lake Exploration Ltd. Date: March, 1971

Company Drill Hole No. RL-1 Hole Length: 152.5

Data Source: DDH Logs

Target: HLEM conductor; associated magnetic anomaly.

Description:

Disseminated sulphide (po, py) occurs in a 60 cm thick zone in quartz-hornblende gneiss and massive sulphide (po, cp) 1.2 m thick occurs in a hornblende-epidote gneiss. These two sulphide zones are separated by about 10 m of chlorite-epidote schist that contains magnetite bands up to 2 or 3 cm thick. Minor sulphide occurs with the magnetite and one band is reported to contain arsenopyrite (1%).

The massive sulphide zone contains 80 to 90 per cent pyrrhotite and trace chalcopyrite.

Immediately north of the disseminated sulphide zone a section that is about 2 m thick is reported to be very strongly altered and contains garnets, magnetite and trace pyrrhotite in chlorite-epidote schist.

The rocks at the occurrence are a sequence of quartz-hornblende gneiss, hornblende-biotite gneiss, hornblende-biotite schist and granitic to mafic intrusive rocks. The sequence probably represents a metamorphosed sedimentary succession.

Assay Data:

Cu%	Ni%	Ag oz/ton	Au oz/ton
0.005 - 0.05	Nil	0.1 - 0.25	Nil-Tr

Classification: Massive sulphide stratum or lense.
Oxide facies iron formation.

64B/6

Locality 12. Property: CB 981 MRD-CAF: 90956
Company: Ruttan Lake Exploration Ltd. Date: March, 1971
Company Drill Hole No. RL-2 Hole Length: 155 m
Data Source: DDH logs
Target: HLEM conductor; associated magnetic anomaly
Description:

Banded iron formation occurs in a 1.5 m thick zone that is made up of numerous 0.5 to 1.5 m thick bands of magnetite in a strongly chloritized rock. Pyrrhotite (1-2%) is present in the magnetite bands.

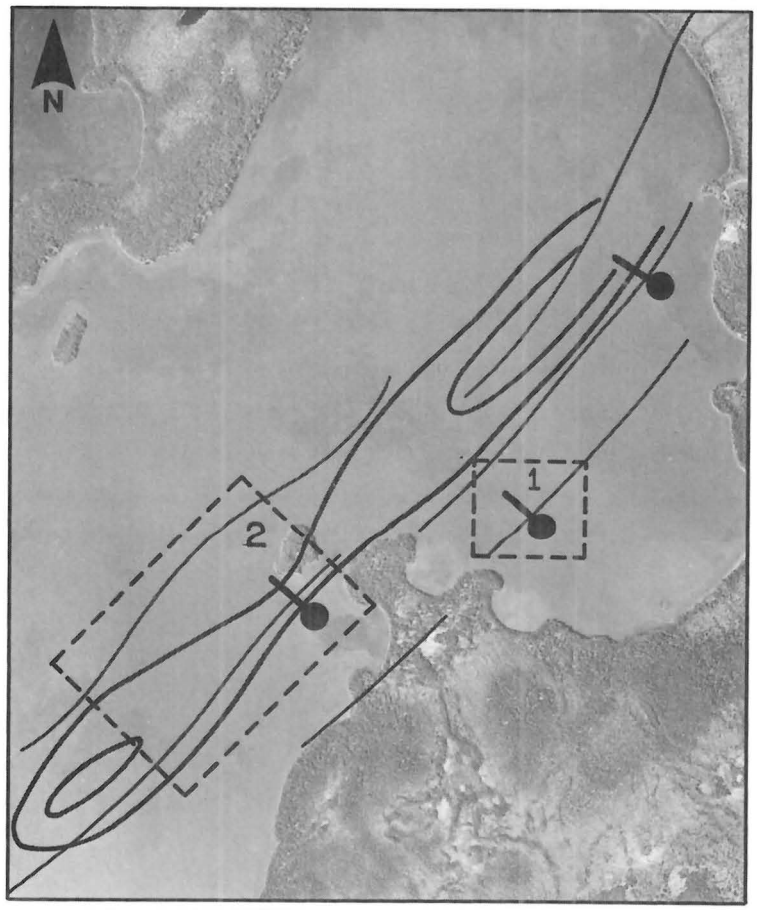
The rocks at the occurrence are quartz-hornblende gneiss and hornblende gneiss.
Classification: Oxide facies iron formation.

Mineral Localities 64B/11

Locality 1. Property: Cat 386 MRD-CAF: 90964
Company: HBED Date: March, 1971
Company Drill Hole No. Cat 37 Hole Length: 166.6 m
Data Source: DDH Logs
Target: HLEM conductor
Description:

This occurrence consists of three graphitic zones which contain disseminated and massive sulphide. The host rock is quartz-mica schist.

From the top to the bottom of the drill hole (southeast to northwest) the mineralized zones are 65.3, 15, and 8.1 m thick. The 65.3 m thick zone contains slight pyrrhotite and a few specks of sphalerite throughout and one 1.5 m thick massive sulphide (po, py) section in which the pyrite content increases down the hole. This zone and the 15 m thick zone are separated by 3 m of unmineralized quartz-mica schist. The 15 m thick zone contains minor pyrrhotite throughout plus a 1 m thick massive pyrite on the down hole side of the halfway point of the zone.



Localities 1,2 : 64B/11

Very few specks of sphalerite are reported in the zone. These zones and the 8.1 m thick zone are separated by a 1.25 m granitic intrusive (dyke). The 8.1 m thick zone (probably a continuation of the 15 m zone) consists of well mineralized pyrrhotite throughout, a 1.9 m thick massive pyrrhotite layer next to the granitic intrusive and a 2.5 cm layer of massive pyrite very close to the down hole termination of this mineralized zone.

The amount of graphite in the graphitic zones is not recorded.

The entire section of rock intersected by the drill hole consists of quartz-mica schist, minor amounts of quartz-plagioclase-mica schist and quartz-mica gneiss, and a fine grained albite granite dyke. The quartz-plagioclase-mica gneiss and the dyke contain stringers and specks of sulphides. These sulphides are probably mobilizate from the mineralized zones.

Within each mineralized zone it appears that the amount of pyrite increases down the hole.

Assay Data:

Not reported.

Classification: Massive sulphide stratum.

64B/11

Locality 2. Property: Cat 416 MRD-CAF: 90964

Company: HBED Date: March, 1961

Company Drill Hole No. Cat 38 Hole Length: 111.25 m

Data Source: DDH Logs

Target: HLEM conductor

Description:

The occurrence consists of a 56.25 m thick graphitic zone that contains disseminated sulphide throughout and three sections of massive sulphide. The massive sulphide sections are 1, 12 and 20 cm thick. The sulphide mineralogy in the massive zones is pyrite, pyrite and pyrrhotite with a few specks of chalcopyrite and sphalerite, and pyrite and graphite. The sections of disseminated sulphide contain a few specks of sphalerite.

The mineralized zone is contained in quartz-sericite schist that is intruded by felsic and intermediate dykes or sills. The thickness of these intrusive units is less than 2 m.

Assay Data:

Not reported.

Classification: Massive sulphide stratum.

64B/11

Locality 3: Property: Tam 6 MRD-CAF: 90957

Company: HBED Date: March, 1963

Company Drill Hole No. Tam 6 Hole Length: 187.5 m

Data Source: DDH Logs

Target: HLEM conductor

Description:

This occurrence and the one at locality 2 are on the same conductor which has length of approximately 3 km.

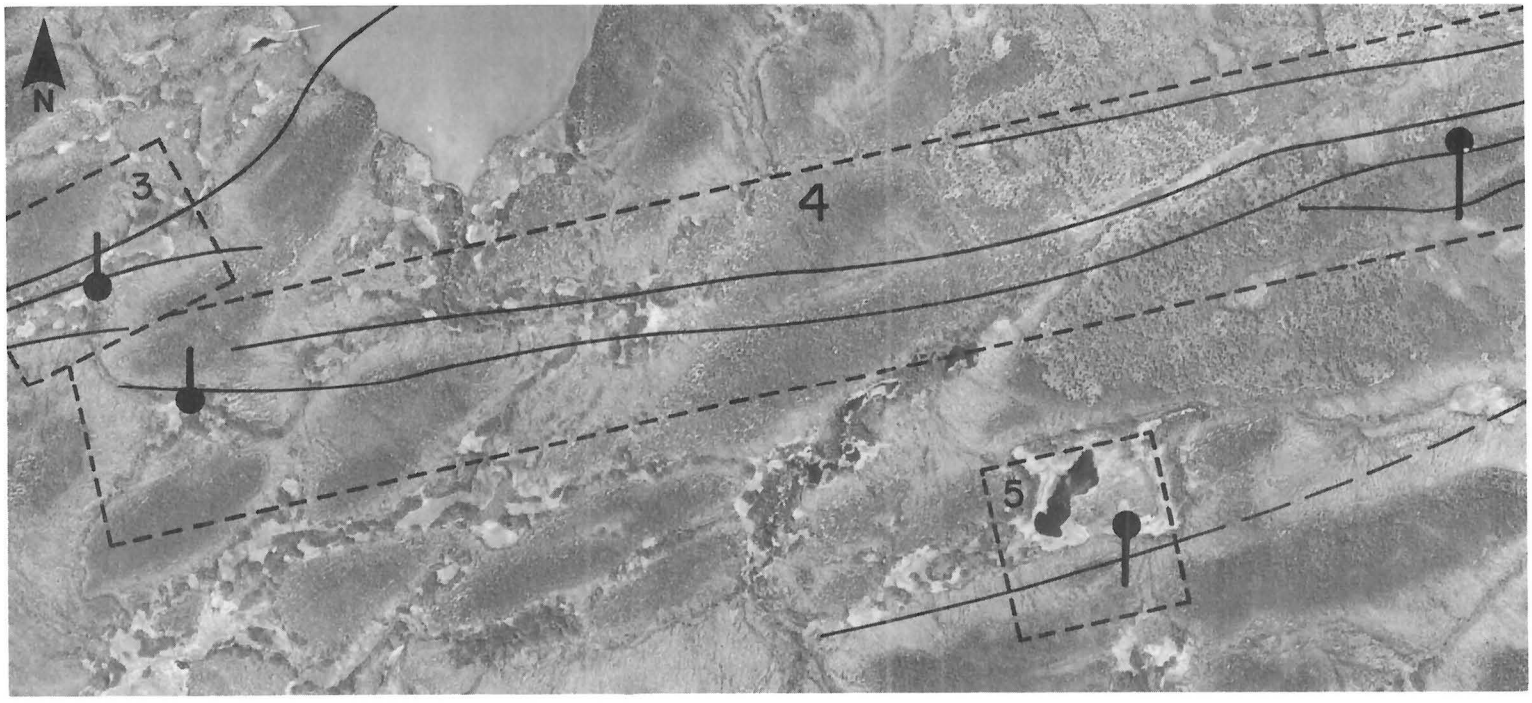
The mineralized zone is 163.75 m thick. It consists of sulphide layers 30 to 60 cm thick that alternate with unmineralized sections. The mineralized sections are massive or disseminated sulphide (po, py). Barren sections are 60 to 90 cm thick and very rarely up to 5 cm thick. Graphite is abundant but is only recorded in association with pyrite. The mineralogy is pyrrhotite, pyrrhotite + pyrite, pyrrhotite + pyrite + graphite, pyrite + graphite or pyrite. Although estimates of mineral per cent in the zone are not given in the drill logs it appears that pyrrhotite is much more abundant than pyrite or graphite.

The rocks are described as altered sediments, basalt lava flows, with interbedded breccias and tuffs. The rock types in the unmineralized sections are not identified in the drill logs and therefore it must be assumed that all of the rock types are impregnated with sulphide.

Although the rocks at this locality are not exposed, extrapolation from scattered outcrops 1 to several km to the west would suggest to the writer that the basalt flows are mafic sills, the tuffs are argillite and fine grained greywacke, and the breccias are conglomeratic beds (unit 29, Map OF-81-4-1).

Assay Data:

Not reported.



Localities 3,4,5 : 64B/11

Classification: Massive sulphide stratum.

64B/11

Locality 4. Property: Tam 7, Tam 37 MRD-CAF: 90957

Company: HBED Date: March, 1963

Company Drill Hole No. Tam 7, Tam 37 Hole Length: 112.5 m 245.3 m

Data Source: DDH Logs

Target: HLEM conductor

Description:

The two drill holes at this locality are 3.4 km apart but intersect the same conductor.

The mineralization encountered in both drill holes is the same. It consists of sulphide (po, py) layers 30 cm to 3 m thick that alternate with barren sections that are 30 cm to 6 m thick. The mineralized zone is approximately 80 m thick. The majority of the sulphide layers contain disseminated pyrrhotite and/or pyrite. Massive sulphide layers are up to 1.5 m thick and consist of pyrrhotite and pyrite and a few contain graphite. A few layers consist of massive graphite with minor amounts of pyrrhotite and pyrite.

In drill logs the rocks are described as altered sediments and basalt flows interbedded with breccias and tuffs. The writer interprets these rocks as greywackes, siltstones, conglomerates (unit 29, Map OF81-4-1) and mafic intrusive rocks.

Unfortunately, the rock types in barren sections are not identified in the drill logs and it is impossible to tell if there is any one rock type that is preferably mineralized.

Assay Date:

Not reported.

Classification: Massive sulphide stratum.

64B/11

Locality 5. Property: Tam 34 MRD-CAF: 90957

Company: HBED Date: March, 1963

Company Drill Hole No. Tam 9 Hole Length: 73.43 m

Data Source: DDH Logs

Target: HLEM conductor

Description:

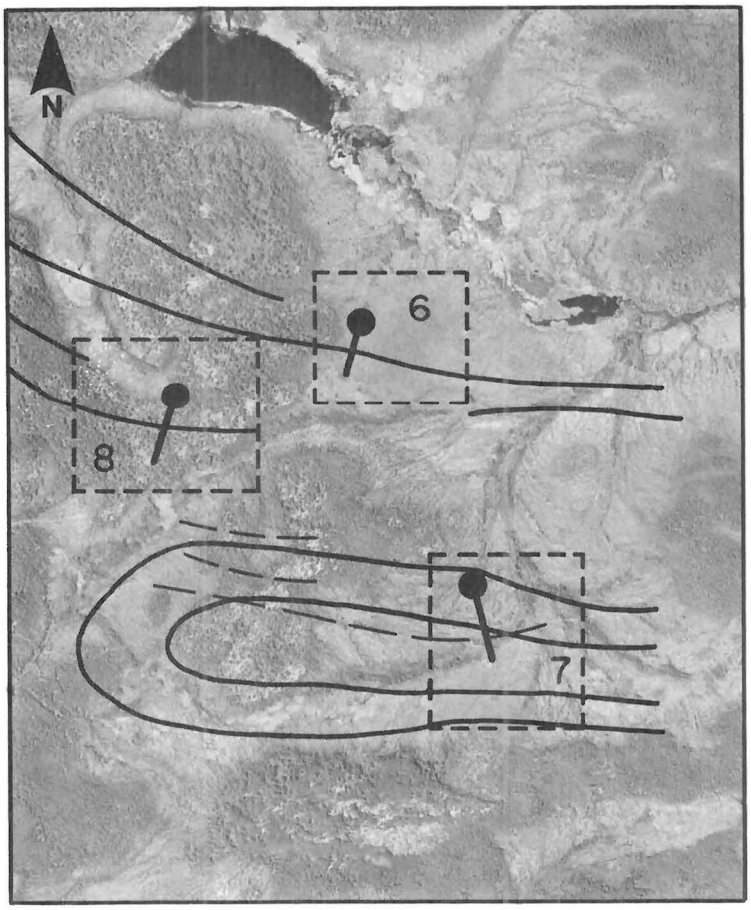
The mineralized zone is 40 m thick and consists of numerous sections, less than 2 m thick, of minor sulphide (po, py) in near solid graphite. These sections are separated by 1 to 1.5 m thick sections that are unmineralized. Visible chalcopyrite occurs in two of the near solid graphite sections.

The rocks as described in drill logs are sheared basalts with quartz stringers and short sections of altered sediments. The writer interprets the sheared basalts as fine grained laminated siltstones (unit 29, Map OF81-4-1).

Assay Data:

Not reported.

Classification: Graphite zone.



Localities 6,7,8 : 64B/11

64B/11

Locality 6. Property: Cat 598 MRD-CAF: 90950

Company: HBED Date: April, 1961

Company Drill Hole No. Cat 49 Hole Length: 194.4 m

Data Source: DDH Logs

Target: HLEM Conductor

Description:

The occurrence consists of graphitic sections that contain very slight pyrrhotite. The mineralization occurs in tuffaceous sediments interbedded with fragmental rocks. Rare specks of sphalerite occur in a quartz mica schist that contains a minor amount of disseminated pyrrhotite.

The fragmental rocks interbedded with the tuffaceous sediments are probable pebble conglomerate beds (unit 29, Map OF81-4-1).

Classification: Disseminated sulphide stratum.

64B/11

Locality 7. Property: Cat 598 MRD-CAF:

Company: HBED Date: April, 1961

Company Drill Hole No. Cat 48 Hole Length: 171.5 m

Target: HLEM conductor

Description:

The mineralized zone is 2.4 m thick and consists of interlayered massive sulphide and chert. The massive sulphide layers are pyrrhotite with specks of sphalerite and are 10 to 45 cm thick. One sulphide layer is 1 m thick and contains quartz inclusions. The chert layers contain specks of pyrrhotite and are 20 to 60 cm thick.

The rocks as described in drill logs are felsic volcanic rocks and felsic fragmental rocks that are intruded by diorite and gabbro. The felsic volcanic units are 2 to 25 m thick and the felsic fragmental units are approximately 25 m thick.

The mineralization is in the felsic volcanic rocks.

Assay Data:

Not reported.

Classification: Massive sulphide stratum.

64B/11

Locality 8. Property: Cat 579 MRD-CAF: 90950

Company: HBED Date: April, 1961

Company Drill Hole No. Cat 47 Hole Length: 187.5 m

Data Source: DDH Logs

Target: HLEM conductor

Description:

Pyrrhotite and pyrite occur with graphite in tuffaceous rocks. The tuffaceous rocks are banded and are interbedded with quartz-mica schist, biotite-plagioclase schist and fragmental rocks.

Quartz-mica schist units are 2.5 to 18 m thick. The thicker units contain bands of graphitic tuff and fragmental rocks.

Banded tuff units are 1.5 to 18 m thick and are mineralized with pyrrhotite and graphite. The conductor is probably a 45 cm thick layer in banded tuff that is well mineralized with pyrrhotite and graphite. Pyrrhotite stringers in quartz-mica schist occur only on the south side of the conductor.

Classification: Massive sulphide stratum.

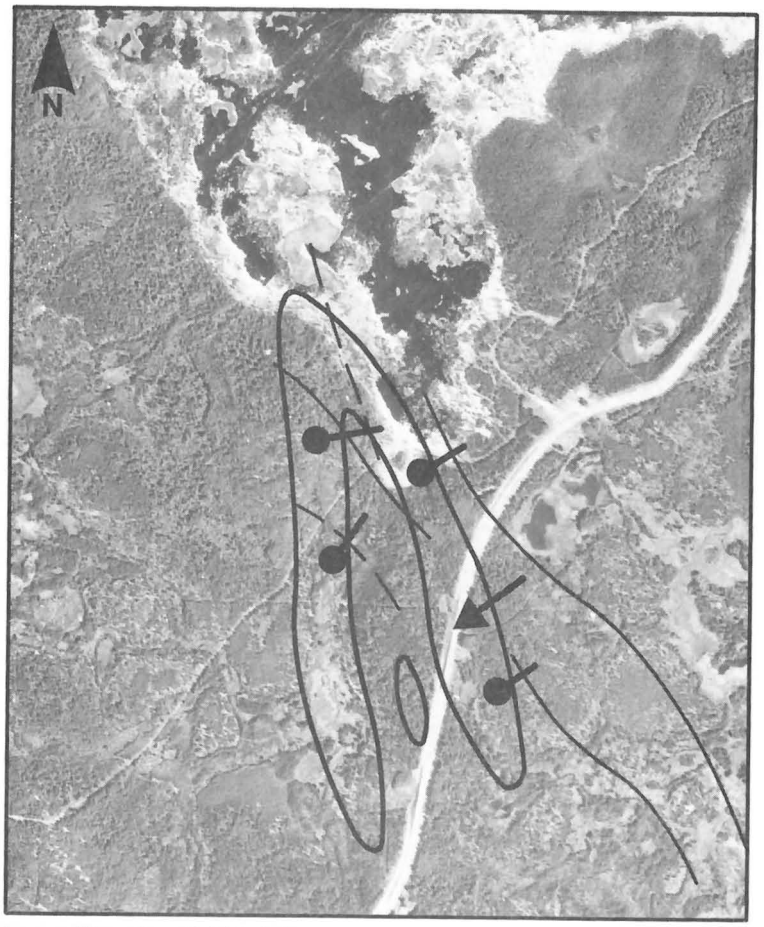
64B/11

Locality 9. Property: Roc 8, 9, 12, 15 MRD-CAF: 90968

Company: HBED Date: August, 1960

Company Drill Hole No.		Hole Length:
	Roc 1	91.0 m
	Roc 2	102.8 m
	Roc 3	76.0 m
	Roc 5	57.2 m
	Roc 6	64.6 m

Data Source: DDH Logs



Locality 9 : 64B/11

Target: HLEM conductor

Description:

At this locality three conductors have been drilled. The nature of the mineralization and the host rocks are the same for the five drill holes, therefore they will be described collectively.

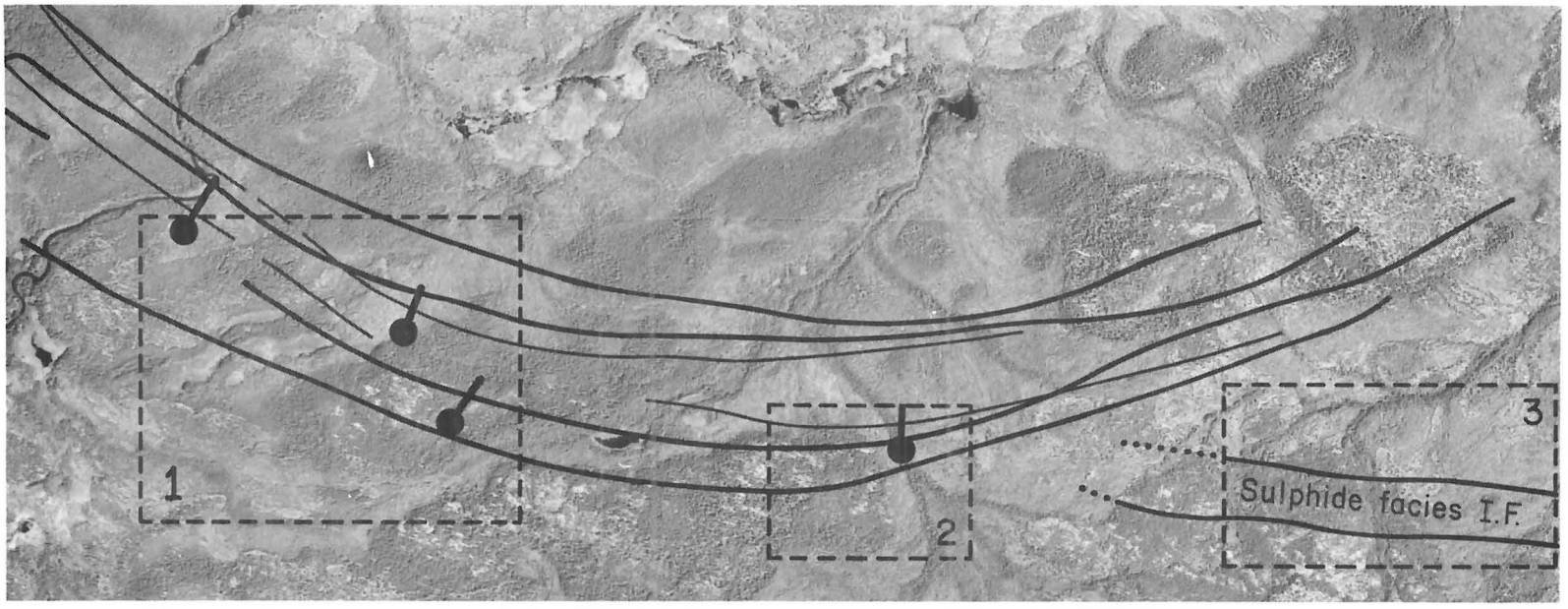
The mineralization consists of graphitic zones that contain very little sulphide (po) up to well mineralized sections. Rare chalcopyrite specks are present. The mineralized zones range in thickness from 60 cm up to 19 m. Within a mineralized zone there can be numerous sections 30 cm to 1 m thick in which the amount of sulphide varies from section to section.

The rock types as described in the drill logs are quartz-plagioclase-biotite gneiss, quartz-plagioclase-mica gneiss, quartz-biotite gneiss and schist and rare banded metasediments and altered meta-volcanic rocks. These rocks are interpreted by the writer to be high grade metamorphic equivalents to the sedimentary rocks of unit 28 (Map OF81-4-1).

Assay Data:

Not reported.

Classification: Semi-massive sulphide stratum.



Localities 1,2,3 : 64B/12

Mineral Localities 64B/12

Locality 1. Property: Gab 12 MRD-CAF: 90974

Company: HBED Date: July, 1959

Company Drill Hole No. Gab 5 Hole Length: 83.1 m

Gab 7 120.9 m

Data Source: DDH Logs, Baldwin Field Work, 1979, 1980.

Target: HLEM conductor

Description:

Disseminated sulphide (po, py) and specks of cp occur in gneisses that have the mineralogy quartz, plagioclase, biotite (with ± or without) hornblende. The gneiss units are interlayered and range in thickness from 1.5 to 15 m thick. The mineralized gneisses are separated by gneisses that do not contain quartz or sulphide.

Field work to the south and to the east of this locality suggests that the gneisses are metasedimentary rocks of unit 28 (Map OF81-4-1), and that the sulphide was deposited contemporaneously with the sediment.

The intensity of the HLEM conductor at this locality is not adequately explained by the amount of sulphide indicated in the drill logs.

Assay Data:

Not reported.

Classification: Disseminated sulphide stratum.

64B/12

Locality 2. Property: Cat 85F MRD-CAF: 90964

Company: HBED Date: September, 1969

Company Drill Hole No. Cat 4 Hole Length: 151.4 m

Data Source: DDH Logs, Baldwin, Field work, 1980

Target: HLEM conductor

Description:

The mineralization at this locality consists of numerous short (less than 1.5 m) sections of sulphide (po) that range from disseminated to massive within any one section. One section is 6 m thick. Rare specks of chalcopyrite are reported. The massive parts of the mineralized sections are graphitic.

The rocks in which the sulphide occurs are described in the drill logs as mica schist that in places is gneissic, granitic, amphibolitic, quartzose and pegmatitic. These rocks are the volcanic and plutonic derived polymictic conglomerate (unit 28, Map OF81-4-1) described by Baldwin (1980).

Sulphides were not observed in outcrops. From the drill logs it appears that the sulphide is formational but the HLEM conductor is oblique to bedding. The sulphide may have been deposited with and as a component of the sediment and redistributed and concentrated during later tectonism.

Assay Data:

Not reported.

Classification: Not determined.

64B/12

Locality 3:

Data Source: Baldwin, 1980

Description:

At this locality there are two occurrences of sulphide facies iron formation (unit 30, Map OF81-4-1). These units are 15 to 20 m thick and are interbedded with greywacke.

The sulphide-bearing rock is very siliceous, massive to foliated and contains variable amounts of biotite and plagioclase and 15 to 20 per cent disseminated pyrrhotite, pyrite and very rare chalcopyrite. This rock is fine grained, rusty or grey to brownish grey on weathered surface; the fresh surface is dark grey. Sulphide grains are less than 0.025 mm across. Beds of sulphide-bearing rock are 1 to 2 m thick. Locally, 2 cm to 4 m thick beds of chert interbedded with the sulphide-bearing rock have been observed.

The interbedded greywacke is sandstone and siltstone. The beds are 1 cm to 0.5 m thick. The rocks have a pronounced foliation and primary structures are destroyed. Contacts with the sulphide-bearing rock are sharp.

The sulphide facies iron formations are conformable and have been traced intermittantly along their strike for 1.5 km.

Classification: Semi-massive sulphide stratum.

References

Baldwin, D.A.
1980: GS-3 Ruttan Lake, Karsakuwigamak Lake, Eagle Lake Project; in Man. Min. Res. Div., Report of Field Activities, 1980.

1979: GS-5 Ruttan Lake, Karsakuwigamak Lake, Eagle Lake Project; in Man. Min. Res. Div., Report of Field Activities, 1979.

1978: Volcanic environments of massive sulphide mineralization in the lower Wasekwan Group in the Rusty Lake greenstone belt; in Man. Min. Res. Div., Report of Field Activities, 1978.

Burwash, R.A.
1962: Geology of the Rusty Lake Area (East Half) Manitoba; Man. Mines Br. Publ. 60-3.

Gale, G.H., Baldwin, D.A. and Koo, J.
1980: A geological evaluation of Precambrian massive sulphide deposit potential in Manitoba; Man. Min. Res. Div. Publ. ER79-1.

Hinds, R.W.
1972: Geology of the Opachuanau Lake-Fraser Lake-Lemay Island Area, Manitoba; Man. Mines Br. Publ. 71-2G.

Pearce, G.
1964: Geology of the Pemichigamau Lake Area (East Half), Manitoba; Man. Mines Br. Publ. 61-3.

Quinn, H.A.
1956: Mineral occurrences between Chipewyan and Herb Lakes, Manitoba; Precambrian, V.29, Part II, p. 6-14.

Speakman, D.S., Chornoby, P.J., Holmes, G.F. and Haystead, B.C.W.
in press: Geology of the Ruttan Deposit; Robinson Symposium, Geological Association of Canada, Special Volume.