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# Geology of the Kabinakagami Lake Greenstone Belt

By

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Geology of the Kabinakasami Lake Greenstone Belt

by

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Wawa

Critical Reader: G.Bennett; manuscript approved for publication by B.Dressler, Section Chief, Precambrian Geoscience Section, Ontario Geological Survey; 4.Oct.1993. This report is published with the permission of John Wood, Director, Ontario Geological Survey, Sudbury.

## Foreword

The results presented in this geological report are based on the compilation of the author's field investigation, previous mapping by the Ontario Geological Survey and information in the assessment files of the Wawa resident geologist office.

The area is underlain by Archean supracrustal rocks and granodioritic to tonalitic intrusive rocks. The author describes several gold occurrences mainly associated with deformation zones and base metal occurrences. She recommends exploration for these types of mineralization.

John Wood
Director, Ontario Geological Survey

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## ABSTRACT

This report details the geology, structure and mineral occurrences of the Kabinakagami Lake greenstone belt approximately 100 km north-northeast of the town of Wawa. The area includes the contiguous townships of Derry, Ermine, Hawkins, Lipton and Lizar.

The greenstone belt has been subdivided into two distinct belts. The northern belt (Hawkins Township) is dominated by mafic metavolcanic rocks that have been crosscut by quartz-feldspar porphyry sills and dikes. Small scale isoclinal folding and intense shearing and flattening are prominent structural features in this belt. Carbonate alteration is pervasive.

The southern belt (Kabinakagami Lake) is dominated by mafic metavolcanic and metasedimentary rocks. This northeast-trending greenstone belt is moderately deformed and exhibits no obvious folding. No carbonate alteration was observed.

Both greenstone belts are intruded by granodiorite to tonalite sills and plugs. Southeast-trending diabase dikes crosscut all rock types.

Gold was produced from both the Shenango Gold Mine (Hawkins Township) and the Hiawatha Gold Mine (Lizar Township), but they were low grade and very low tonnage mines.

All of the known mineral occurrences in the map area are either within a moderately sheared zone, lying along the steeply-dipping, northeast-trending Bear Creek Fault in Lizar Township, or along a strongly sheared, steeply dipping, east-striking contact between mafic metavolcanic rocks and a tonalitic intrusion in central Hawkins Township. Quartz veins are a prominent feature in all of the known gold occurrences.

In Lizar Township, the shear zone is occupied by a granodiorite to trondhjemite sill. Gold-bearing quartz veins are associated either with the margins of the sill or with quartz porphyry sills in mafic metavolcanic rocks within the shear zone. A similar shear zone with associated granodiorite sills has been reported to lie within the southwest extension of the Bear Creek Fault Zone in Nameigos Township.

In Hawkins Township, the gold showings occur in quartz veins at the strongly sheared contact between mafic metavolcanic rocks and a tonalite intrusion. The 1 km wide shear zone (Puskuta Lake Shear Zone) is a steeply dipping, dextral, transcurrent structure that bounds the south side of the Kabinakagami Lake greenstone belt and extends approximately 60 km to the southeast. Any mineralization observed along the southeastern extention of the shear zone is usually associated with quartz segregations in fractured and mylonitic metavolcanic rocks.

The southeastern and southwestern extensions of the greenstone belt are promising targets for gold exploration.

# GEOLOGY OF THE KABINAKAGAMI LAKE GREENSTONE BELT

by A. C. Wilson

## INTRODUCTION

### Location and Access

The Kabinakagami Lake greenstone belt is in the northeastern corner of the Wawa Resident Geologist's District within the Sault Ste. Marie Mining Division (Figure 1). The map area is bounded approximately by latitudes 48°18'00" and 49°03'30"N and longitudes 84°01'00" and 84°38'00"W. It includes the five contiguous townships of Lipton, Derry, Hawkins, Lizar and Ermine.

Access to Kabinakagami Lake is by float-equipped aircraft from Wawa, approximately 100 km to the south-southwest. Hawkins Township is accessible by all weather road from Hearst or via logging road from Highway 613, west of the map area.

The 1:50 000 scale Gourlay Lake (42C/15), Kabinakagami Lake (42C/16) and Oba (42F/1) topographic maps cover the area. The Ontario Department of Mines - Geological Survey of Canada aeromagnetic maps 2195G, 2196G, 2209G and 2223G (ODM-GSC 1963a, b, c, e) also cover the area at a scale of 1:63 360. Portions of the eastern section of the map area are covered, at a scale of 1:20 000, by the Ontario Geological Survey geophysical/geochemical series maps 80 831, 80 832, 80 836 and 80 837 (OGS 1986 a, b, f, g).

### Previous Geological Work

The earliest reported work in the area was by Tanton (1917), who did reconnaissance mapping in Hawkins Township and the

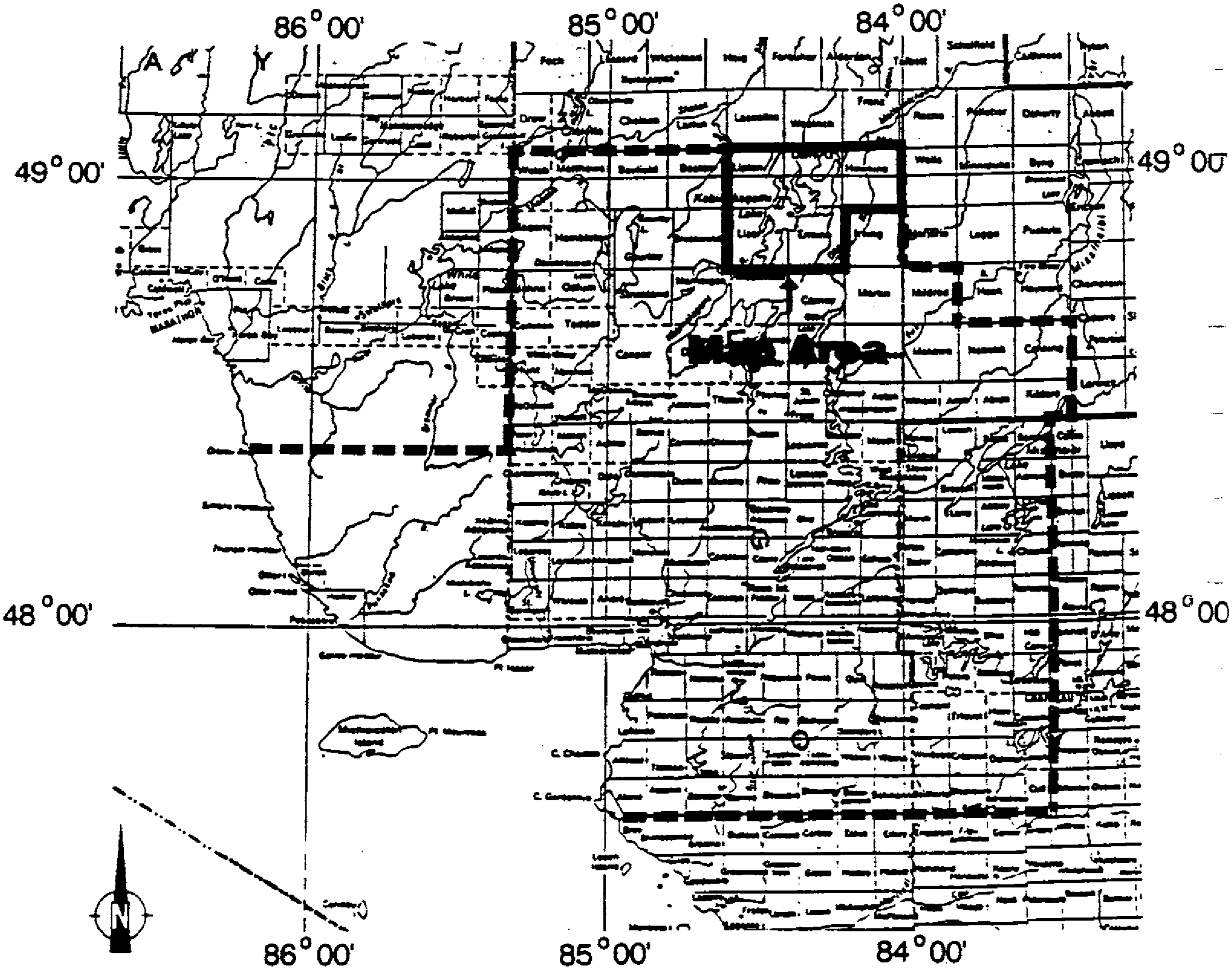


Figure 1. Location map showing the map area. Scale approximately 1:1 280 000. Dashed line indicates the boundary of the Wawa Resident Geologist's District.

northeastern section of Kabinakagami Lake. Gledhill (1927) visited the eastern section of the map area (Hawkins and Walls townships) and examined the gold occurrences. In 1929, Maynard produced a report and map on the map area as part of a twelve township study of the Oba area. Giblin (1968) also published a short report on the mineral occurrences of the area.

The most recent and detailed mapping of the area was done by Siragusa (1977) who mapped the area at a scale of 1: 15 840. This mapping covered only the Kabinakagami Lake portion of the present project area. Siragusa (1978) also mapped the southwestern section of the greenstone belt in Nameigos and Mosambik townships.

Hawkins Township had not been mapped at a more detailed scale. Previously, detailed information concerning Hawkins Township was available only in the assessment files (Wawa Resident Geologist's office).

## Present Geological Work

Field work in Lipton, Derry, Lizar and Ermine townships was carried out in 1988, and in Hawkins Township in 1989. Follow up mapping for all five townships was completed in 1990. Geological mapping was conducted using aerial photographs provided by the Air Photo Library of the Ministry of Natural Resources, at a scale of 1: 15 840.

On Kabinakagami Lake, mapping was confined to the lakeshore, except in the vicinity of the Hiawatha Gold Mine where there is good outcrop exposure. In Hawkins Township, all terrain vehicles were used to access a complex system of logging roads. Due to time constraints, the southeastern and northwestern corners of the township, where access is more difficult, were not examined.

The results presented on the accompanying map (rear pocket) are a compilation of: current mapping, the authors observations, Siragusa (1973a, b), and information available from the assessment files (Wawa Resident Geologist's office). The lithologic subdivisions used in the legend are based on the author's observations.

In the map area, the outcrop distribution is sparse and, with the exception of the Kabinakagami lakeshore, limited to a few steep-sided ridges in western Lizar Township. The lakeshore provided access to the best exposures, particularly of the metavolcanic rocks. In Hawkins Township, the topography is low and flat, and any outcrops mapped in the area are those that had been uncovered during logging operations. By 1990, many of the outcrops mapped in 1989 had been covered over during subsequent logging operations.

## Acknowledgements

Assistance during the program was capably provided by Isabelle Martin (1988), Christine Brown (1989) and Erinn Wilson (1990). John Walmsley of the Sault Ste. Marie Drill Core Library capably redrafted the final version of the map legend. The help provided by Cheryl and Erling Johnson at Kaby Lodge, Al Nelson of Air Dale and the Ministry of Natural Resources, Hearst District, is also gratefully acknowledged. Editorial assistance was provided by E. D. Frey.

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## GENERAL GEOLOGY

The Kabinakagami Lake greenstone belt is part of the Wawa Subprovince and is an isolated belt of mostly mafic metavolcanic rocks that extends from Nameigos and Mosambik townships in the southwest, to Champlain Township in the east, a distance of approximately 100 km. The greenstone belt ranges from 1 to 6 km in width, with the Kabinakagami Lake section being the widest part of the belt.

In the Kabinakagami Lake area, the greenstone belt trends northeast. This trend changes to east in the central portion of the belt (Hawkins and Walls townships) and to the southeast in the eastern portion of the belt (Figure 2 in rear pocket). The eastern section of the greenstone belt has been interrupted by a major north to northwest trending fault that has resulted in a 1 km displacement of the belt (Thurston et al. 1977).

Interpretation of aeromagnetic maps (ODM-GSC 1963a-f) suggests that the greenstone belt diverges into a northern and southern belt in Hawkins Township. A strong magnetic signature trends from north central Derry Township eastward into central Hawkins Township. The main aeromagnetic trend of the Kabinakagami Lake belt can be traced from Nameigos Township, northeast into the southwest corner of Hawkins Township where it apparently terminates against a northeast trending diabase dike.

Mafic metavolcanic rocks form the dominant rock type within the map area. Primary structures, such as pillows, are rarely preserved. In the southwest part of the map area, the mafic metavolcanic rocks are often interlayered with narrow (less than 1 m thick) layers of intermediate to felsic metavolcanic rocks. These interlayers were not observed in the eastern section of the map area.

Intermediate to felsic fragmental metavolcanic rocks outcrop in western Hawkins Township. These may be related to the felsic metavolcanic rocks observed by Thurston et al. (1977) in Minnipuka Township, east of the map area. Some felsic tuffs also outcrop in the southwestern section of Kabinakagami Lake (see map in rear pocket).

Metasedimentary rocks comprising interbedded siltstones and sandstones/greywackes have been observed only on the southeastern shore of Kabinakagami Lake. Relict graded bedding has been preserved in some outcrops. However, only limited stratigraphic information could be determined from it. Some of the metasedimentary rocks mapped by Siragusa (1973a, b) have been reinterpreted by the author as intermediate to felsic metavolcanic rocks.

The surrounding granitic rocks are typically biotite or biotite-hornblende granodiorite to trondhjemite. Minor variations in composition occur within the map area. A strongly sheared to gneissic tonalite forms a prominent unit in central Hawkins Township.

A geophysically interpreted metagabbro or metapyroxenite intrudes the granitic rocks in northwestern Lizar Township.

All units are crosscut by diabase dikes. These dikes trend north to northwest in the main portion of the greenstone belt, but have a dominantly northwestern trend in the eastern part of the greenstone belt.

The entire area was glaciated during the Quaternary. A thin cover of ground moraine blankets most of the map area. Fine lacustrine sands and clays cover the eastern sections (Boissonneau 1965). A prominent south-trending esker is located in southeastern Derry Township and northeastern Ermine Township.

Table 1 lists the lithological units mapped within the Kabinakagami Lake greenstone belt.

## Mafic to Intermediate Metavolcanic Rocks

Mafic to intermediate metavolcanic rocks are the dominant rock types of the greenstone belt. They include: fine- to medium-grained flows, pillowed flows, flow-top breccia, monolithic and polymictic breccias and chlorite schists. Partially assimilated xenoliths of mafic metavolcanic rocks also occur within the surrounding granitic rocks.

### Massive Flows

The mafic to intermediate metavolcanic rocks are generally fine- to medium-grained, equigranular, dark green to black in colour and moderately to strongly foliated. Due to the absence of major primary structures, these rocks have been interpreted as massive flows. Various reports in the assessment files (Wawa Resident Geologist's office) describe the occurrence of mafic

Table 1: Lithologic Units for the Kabinakagami Lake greenstone belt

PHANEROZOIC
- CENOZOIC
  - QUATERNARY
    - RECENT
      - Swamp and stream deposits
    - PLEISTOCENE
      - Clay, till, sand, gravel and boulder

*UNCONFORMITY*

PRECAMBRIAN
- MIDDLE TO LATE PRECAMBRIAN
  - (PROTEROZOIC)
    - MAFIC INTRUSIVE ROCKS
      - Diabase dikes, porphyritic diabase dikes and lamprophyre dikes

*INTRUSIVE CONTACT*

- EARLY PRECAMBRIAN
  - (ARCHEAN)
    - FELSIC TO INTERMEDIATE INTRUSIVE ROCKS
      - Biotite granodiorite to trondhjemite, monzonite and tonalite

*INTRUSIVE CONTACT*

    - MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS
      - Metagabbro

*INTRUSIVE CONTACT*

    - CLASTIC METASEDIMENTARY ROCKS
      - Metagreywackes, metasiltstones and garnetiferous metagreywackes
    - METAVOLCANIC ROCKS
      - INTERMEDIATE TO FELSIC METAVOLCANIC ROCKS
        - Massive to foliated flows, tuff, polymictic breccia and synvolcanic quartz-feldspar porphyry dikes
      - MAFIC TO INTERMEDIATE METAVOLCANIC ROCKS
        - Massive flows, pillowed flows, flow top breccia, pyroclastic breccia and chlorite schist

tuffs, but the degree of deformation in the greenstone belt is generally so intense that primary tuffaceous textures will have been obscured and these rocks may, in fact, be sheared mafic flows.

Amphibolite grade metamorphism has destroyed most of the original mineralogy of these rocks. Hornblende forms between 60 and 85 percent of the mafic metavolcanic rocks examined. Plagioclase, variably altered to sausserite, carbonate or zoisite, forms the remaining 15 to 40 percent of the mineralogy. Quartz, sphene and opaque minerals are present in trace or minor amounts in all of the mafic metavolcanic rocks. Chlorite is an important component of the mafic metavolcanic rocks in the vicinity of the Hiawatha Gold Mine, where retrograde greenschist metamorphism is apparently associated with shearing and movement along the Bear Creek Fault.

Texturally, the mafic metavolcanic rocks exhibit a foliation enhanced by the strong alignment of hornblende and plagioclase. The coarser, more granular textures observed in some thin sections suggest that these samples may have come from the centres of thicker, more massive, flows.

### Pillowed Flows

Pillowed flows were observed at the Hiawatha Gold Mine site, on a ridge northwest of the shaft and along the northern shore of Kabinakagami Lake. The pillows at the Hiawatha Gold Mine are relatively undeformed, but they provide no stratigraphic information. These pillows range in length from 20 cm to 50 cm and have length to width ratios of approximately 1.5:1. No estimation of strike extent or width of these flows was made because of the relatively poor exposures.

Recognizable, but strongly flattened, pillows are present in Hawkins Township. The pillowed flows range between 30 cm and 150 cm in width, and have a short strike extent. These flows are best preserved in the west central portion of the township. The pillows are usually less than 20 cm in length, with length to width ratios of approximately 15:1. Garnets, ranging in size from less than 1 mm to 5 mm, are concentrated within the relict pillow selvages. The pillow selvages are amphibole- and biotite-rich and range in width from 5 mm to 20 mm. Pillow centres are very fine grained and weather light green to grey in colour.

### Mafic Metavolcanic Rocks with Quartz-Epidote Lenses

Mafic metavolcanic rocks containing bands of aligned quartz and epidote lenses have been observed throughout the greenstone belt. These flows are fine- to medium-grained and equigranular. The lenses are usually extremely siliceous and light green to white in colour. They range from 1 cm to 15 cm in length, with the majority between 3 cm and 5 cm in length. Glassy quartz is often present as veinlets surrounding the lenses, or as cores within the lenses. These lenses may represent boudinaged felsic metavolcanic interlayers, since these lenses often occur in areas of the strongest deformation.

These rocks may be zones of very strongly deformed pillowed metavolcanic rocks.

## Interlayered Mafic and Felsic Metavolcanic Rocks

Layered mafic and felsic metavolcanic rocks were observed only on the southwestern shore of Kabinakagami Lake. Both rock types are massive, fine-grained and equigranular, although the felsic layers sometimes contain quartz phenocrysts. The two rock types are interlayered in approximately a 50:50 ratio. Layers are usually less than 1 m wide, although layers up to 3 m have been observed. Contacts between the rock types are sharp and the rocks are moderately foliated. This unit forms a distinctive unit of alternating bands of light and dark green.

## Flow Top Breccia

Flow top breccia and other monolithic breccias occur at isolated locations on Kabinakagami Lake. The best example of flow top breccia outcrops at the Ministry of Natural Resources cabin on the southwest side of the lake, opposite the Hiawatha Gold Mine. The rocks are dark green on their weathered surfaces and are distinguished by the blocky nature of the fragments. The fragments are angular in shape and range in size from 3 cm to 25 cm. Occasional pillow fragments can be recognized in some outcrops. No relationships among these various outcrops have been established.

## Polymictic Mafic Metavolcanic Breccia

A polymictic fragmental unit is mappable for a strike length of over 4 km in the southwestern section of Kabinakagami Lake and has a mappable width of less than 500 m. The unit is distinctive within the stratigraphy and consists of 70 to 85 percent, subangular intermediate to felsic metavolcanic fragments in a fine-to medium-grained, medium to dark green, intermediate matrix. Some amphibolite and quartz porphyry fragments also were observed. The fragments range from 1 cm to 15 cm in length, with an average size range of 5 cm to 10 cm. The rock shows the development of a strong flattening fabric.

Siragusa (1978) has observed a similar unit on the west shore of North Wejinabikun Lake in Mosambik Township, to the southwest of the map area.

### Chlorite Schist

Chloritic schists were mapped in a few localities in the map area. They are chlorite-rich composition, strongly foliated and extremely friable. These units are usually of short strike extent and are observed close to major shear zones or faults.

## Intermediate to Felsic Metavolcanic Rocks

Felsic metavolcanic rocks are distributed sparsely throughout the greenstone belt. They occur as: fine-grained tuffaceous interlayers within the mafic metavolanic sequence; a narrow sequence of tuffaceous metavolcanic rocks; and as a felsic fragmental unit. Quartz and quartz-feldspar porphyry dikes and sills are also found in the Kabinakagami Lake and western Hawkins Township portions of the map area.

### Felsic Flows

The felsic flows that outcrop in southwestern Kabinakagami Lake are very fine-grained to aphanitic, siliceous and weather light green to white and exhibit a strong foliation. Quartz phenocrysts commonly are developed in these layers, and biotite is present as the major mafic component, particularly at the contacts with the mafic rocks. These contacts are often rusty. Barren, coarse-grained quartz veins are a prominent feature in the felsic layers. In some instances, these felsic metavolcanic flows are boudinaged into lenses up to 50 cm in length. This is especially prevalent in those areas where the felsic metavolcanic rocks form units that are less than 1 m wide.

The felsic metavolcanic rocks contain approximately 70 percent variably altered feldspar. The remainder of the mineralogy is composed of quartz (30 percent), biotite (7 to 8 percent) and trace amounts of hornblende, epidote, sphene and muscovite. All thin sections examined showed the development of 2 mm to 4 mm long quartz augens within a strongly foliated groundmass of quartz and feldspar. The groundmass frequently shows evidence of crushing and the development of pressure shadows around the augens.

The felsic metavolcanic flows observed in Hawkins Township are usually much narrower than those seen on Kabinakagami Lake. These layers are typically white to light grey in colour, strongly foliated and have widths ranging from 10 cm to 30 cm. Many of these layers show the development of strong iron-carbonate alteration, particularly along the contacts with mafic metavolcanic rocks. Opalescent quartz eyes occur only locally within felsic metavolcanic rocks in Hawkins Township.

### Felsic Tuffs

A narrow unit of felsic crystal tuffs outcrops on southern Kabinakagami Lake. The best exposure of these rocks occurs on the east side of Windy Point (central Kabinakagami Lake). The rocks are light grey on the weathered surface, massive, fine-grained and contain 1 mm and 3 mm quartz eyes. The unit is interpreted to be a massive crystal tuff and may be a thicker felsic layer in the layered mafic and felsic sequence previously described.

### Felsic Pyroclastic Rocks

An isolated series of intercalated massive, intermediate to felsic flows and felsic pyroclastic flows outcrops in southwestern Hawkins Township. The more massive portions of the unit are similar in appearance to those described on Windy Point. The pyroclastic unit is light grey on the fresh and weathered surfaces and consists of between 25 and 35 percent intermediate to felsic and mafic fragments within an intermediate to felsic matrix. The fragments range in composition from amphibolite to dacite(?) and in size from 2 cm to 7 cm. All fragments show a strong flattening fabric and the mafic fragments, in particular, show strong attenuation. Epidote alteration is pervasive throughout this unit.

### Quartz Porphyry Dikes

Quartz porphyry, and to a lesser extent, quartz-feldspar porphyry, sills and dikes are a prominent feature in western Hawkins Township. The dikes and sills are light grey to white on their weathered surfaces and contain up to 15 percent, 5 mm to 15 mm opalescent quartz eyes. The feldspar phenocrysts are euhedral to subhedral and are white to yellow-white in colour and seldom form more than 5 percent of the mineralogy. The groundmass of the porphyry is very siliceous, fine-grained and equigranular.

Dikes are granular and massive in texture, but the porphyry sills exhibit a very strong foliation in the groundmass.

## Metasedimentary Rocks

Interbedded metagreywackes and siltstones outcrop on the southeastern shore of Kabinakagami Lake. The rocks are interbedded metagreywackes and siltstones. Isolated outcrops of biotite-garnet schist, interpreted to be metagreywacke were mapped within the mafic metavolcanic sequence in western Hawkins Township.

Interbedded metagreywacke and metasiltstone are the dominant metasediments observed in the map area. These rocks are strongly foliated and primary sedimentary structures have not been well preserved. Faintly preserved, relict bedding, subparallel or parallel to the foliation direction has been observed in some outcrops. The sediments consist of layers of coarse, equigranular, light blue-grey weathering metagreywacke, interbedded with finer-grained, biotite-rich, blue-grey weathering metasiltstones. The beds range in thickness from 3 cm to 15 cm. The coarser layers have a greater quartz content and may contain small (2 mm) quartz eyes. These rocks are usually injected with multiple pegmatite veins.

The metasediments along the southern contact with the surrounding granites are gneissic. A 500 m to 750 m wide intrusion breccia of metasedimentary rocks and felsic intrusive material is found along the contact.

Within the mafic metavolcanic rocks in Hawkins Township, isolated outcrops of metagreywacke were observed. This unit weathers a light brown colour and is light grey on the fresh surface. The rock is equigranular and contains 5 to 10 percent, 2 mm to 3 mm garnets. A strongly developed compositional layering consisting of alternating quartz-rich and garnet-biotite layers can be observed in the outcrops. Contacts between these rocks and the surrounding mafic metavolcanic rocks are sharp.

In the southwestern part of Hawkins Township, exploration activity has uncovered narrow zones (less than 10 cm wide) of rusty, weathered folded sulphide iron formation within the mafic unit. Ground geophysics may help to trace this unit. No other chemical metasedimentary rocks were observed in the greenstone belt.

## Mafic to Ultramafic Intrusive Rocks

A roughly circular body with a high magnetic signature occurs, but is not exposed in northern Lizar Township (ODM-GSC 1963c). Rupert (1972) and Siragusa (1977) have interpreted this unit to be either a metagabbro or metapyroxenite. It is coarse-grained, equigranular, dark green on the weathered surface and composed of hornblende, titaniferous magnetite and altered plagioclase (Siragusa 1977). A discussion of the economic potential of the intrusion is presented in the Economic Geology section of this report.

Along the lakeshore, in the vicinity of this intrusion, the author noted a single exposure of a light green, coarse-grained, magnetite-rich diabase.

Siragusa (1977) also reported an occurrence of metapyroxenite in northern Ermine Township. The rock is medium- to coarse-grained, massive, dark green and contains up to 20 percent fine-grained magnetite. An isolated magnetic high is located in the vicinity of this occurrence (ODM-GSC 1963c).

An occurrence of metapyroxenite previously described by Siragusa (1977) in the vicinity of the Bear Creek Fault, was interpreted by the author to be sheared mafic metavolcanic rocks.

## Felsic Intrusive Rocks

The granitic rocks that outcrop in the map area are dominantly biotite or biotite-hornblende trondhjemite to granodiorite. Minor variations are mappable, but no distinctive separate intrusions can be defined in the Kabinakagami Lake area. A more leucocratic intrusion, mapped as hornblende granodiorite to monzonite, outcrops on a chain of islands in Kabinakagami Lake in northwestern Ermine Township. These rocks may represent a sill or dike injected into the main intrusive body. Migmatite is well developed along the northern contact of the greenstone belt in Derry and Lipton townships.

A sill of strongly foliated biotite granodiorite hosts the mineralization at the Hiawatha Gold Mine. The injection of this sill has resulted in the development of an intrusion breccia that can be observed to the south and northeast of the mine.

The intrusion in central Hawkins Township is a distinctive sheared tonalite. Other granitic rocks in Hawkins Township are poorly exposed, but where observed, they also show a strong gneissic texture.

## Biotite Granodiorite to Trondhjemite

Biotite or biotite-hornblende granodiorite to trondhjemite is the dominant intrusive rock occurring in the Kabinakagami Lake area. The rock is light grey weathering, medium-grained, equigranular and homogeneous. Quartz eyes, garnets and feldspar phenocrysts were observed locally. Foliation is moderately to strongly developed throughout the area.

These rocks are composed of 5 to 10 percent quartz, 25 to 50 percent plagioclase and 15 to 40 percent microcline and orthoclase feldspar. Biotite and hornblende form the remaining 5 to 15 percent of the rock. Biotite and hornblende coexist in most of the thin sections examined. Sphene occurs as an accessory mineral (up to 5 percent) in all thin sections. Trace amounts of tourmaline, zircon, apatite, rutile, muscovite, epidote, chlorite and oxide phase minerals also were observed.

At the Hiawatha Gold Mine, the gold mineralization is hosted by strongly sheared granodiorite. The rock is light brown on the weathered surface and light grey on the fresh surface. Exposures of the granodiorite at the mine site are very poor. The best samples of the granodiorite were obtained from the muck pile at the mine. In hand sample, textures such as quartz augens and quartz ribbons are well defined and are inferred to be the result of shearing along the Bear Creek Fault zone.

As seen in thin section, the granodiorite sill is very fine-grained and shows the development of abundant strained and crushed quartz grains. Quartz recrystallization and the development of pressure shadows around quartz augens are also apparent. Chlorite, muscovite and epidote also are present.

To the southeast of the mine site, and on the islands to the northeast, the granodiorite sill contains 40 to 50 percent angular blocks of amphibolite. These fragments range in size from less than 1 cm to 25 cm, with the majority of the fragments in the 10 cm to 15 cm range. The fragments are massive to moderately foliated, but are not aligned parallel to the overall foliation of the sill. The matrix of the intrusion breccia is sheared granodiorite to trondhjemite.

## Monzonite

A younger monzonite intrusion was mapped in a chain of islands in Kabinakagami Lake in northwestern Ermine Township. These rocks are massive, medium-grained, equigranular and light pink on their weathered surfaces. Their mineralogy consists of 5 percent (or less) quartz, 30 to 40 percent orthoclase, 5 to 10 percent microcline, 30 percent plagioclase and 10 to 15 percent hornblende and biotite. Sphene, chlorite, epidote, tourmaline and oxides occur as accessory minerals. This may be a northwest-trending dike within the main granodioritic to trondhjemitic body. Siragusa (1977) has observed quartz monzonite as dikes, sills and irregular intrusions within the surrounding granodiorite to trondhjemite in Breckenridge and Gourlay townships, to the west of the map area.

## Tonalite

A sheared tonalite has been mapped in central Hawkins Township. North and south of the shear zone where the rock is relatively undeformed, it is white to light grey on the fresh and weathered surfaces, medium- to coarse-grained and equigranular. Biotite is the major mafic mineral observed. In most occurrences, however, the rock exhibits a strong foliation. The tonalite consists of quartz (5 to 10 percent), plagioclase (40 to 50 percent) and microcline (20 to 30 percent). Hornblende, biotite, sphene, chlorite, epidote and oxides are present as accessory minerals.

The north contact between the tonalite and mafic metavolcanic rocks is sheared and the tonalite had previously been mapped as a felsic metavolcanic. The sheared tonalite is light grey to white on fresh and weathered surfaces and shows a cataclastic texture. Clots of sulphides (pyrite and chalcopyrite) and quartz are prominent within this 500 m to 1000 m wide zone. Thin sections of the sheared contact show finely crushed quartz and feldspar grains with interstitial, aligned biotite, chlorite, epidote and muscovite. The contact between the sheared tonalite and the sheared mafic metavolcanic rocks is the zone that hosts the gold mineralization in Hawkins Township.

## External Granitoids

Granitic rocks observed outside of the greenstone belt in Hawkins Township are strongly gneissic. The outcrops are generally low and flat and are crosscut by numerous pegmatite and quartz lenses and pods. With the exception of the injected pegmatite phases, these external gneisses closely resemble the tonalite in the central part of the township. The external biotite granodiorite to trondhjemite in Derry, Lipton and Lizar townships is usually weakly foliated to massive. Migmatite is particularly well developed in Derry and Lipton townships.

All external granitic rocks in the map area are crosscut by aplitic and biotite pegmatite veins, sills and dikes.

### Late (Proterozoic) Mafic Intrusive Rocks

Numerous northwest- and some northeast-trending diabase dikes crosscut all rock types. A prominent northeast-trending dike is found in Walls and Irving townships and truncates the main geophysical trend of the Kabinakagami Lake greenstone belt (ODM-GSC 1963d, e).

The diabase dikes are vertical to steeply dipping and range in width from less than 1 m to 30 m (Siragusa 1977). The dikes are dark green to black weathering, coarse-grained, equigranular and homogeneous. Narrow chill margins (5 cm to 10 cm wide) of much finer grained material are developed in a few of the wider dikes. Glomeroporphyritic clots of coarse plagioclase crystals also were observed in a few of the wider dikes. Maynard (1929) observed that olivine occasionally was present in some of the thin sections of diabase he examined. No macroscopic olivine was observed by the author. Some magnetite-phyric dikes also are present in the map area. No crosscutting relationships between any of the various diabase dikes were observed.

Narrow lamprophyre dikes also occur in the map area. The dikes are usually less than 25 cm wide and consist of a fine-grained, biotite-rich matrix with 1 cm biotite phenocrysts.

### Quaternary Deposits

The area is overlain primarily by sandy and silty tills mixed with clay. The tills contain some pebbles of Paleozoic limestone and dolostone mixed with the predominantly granitic clasts (Siragusa 1977). Glaciofluvial deposits associated with a prominent north trending esker are present in the southeastern portion of the Kabinakagami Lake area. Siragusa (1977) estimates a till thickness of between 2.4 m and 3.6 m in the southeastern part of the map area.

Clay rich tills cover the northern portions of the map area. These have been interpreted to be part of a northwest-trending segment of the Ontario clay belt (Boissoneau 1966).

Several south- to southwest-trending eskers are featured in the area (Gartner and McQuay 1980a, b). A prominent south-trending esker is located at Pine Portage Bay on Kabinakagami Lake in southern Derry Township.

## METAMORPHISM AND ALTERATION

Supracrustal rocks in the Kabinakagami Lake greenstone belt have been affected by regional metamorphism, silicification and minor retrograde metamorphism associated with shearing.

The supracrustral rocks have been subjected to low to medium amphibolite grade metamorphism. The dominant mineralogy observed in the basaltic supracrustal rocks is albite + epidote + biotite + hornblende -/+ garnet. Garnet is prominent in the mafic metavolcanic rocks in central Hawkins Township. Amphibolite grade metamorphism also has been observed in portions of the Kabinakagami Lake greenstone belt that occur to the east of the map area (Thurston et al. 1977).

Retrograde greenschist metamorphism was observed along the Bear Creek Fault in southwestern Lizar Township. Mafic metavolcanic rocks in this area are characterized by the mineralogy albite + chlorite + epidote + calcite. Isolated outcrops of chlorite-rich schists also have been observed in central Hawkins Township. These rocks are inferred to reflect local, shear zones of short strike extent that splay off of the main shear (Puskuka Lake Shear Zone).

Silica alteration is best observed in the biotite granodiorite sill that occupies the Bear Creek fault zone at the Hiawatha Gold Mine. As seen in thin section, the granodiorite shows evidence of quartz replacement and recrystallization. The margins of the sill also show evidence of quartz flooding and veining. Silicification also is associated with the northern contact between the mafic metavolcanic rocks and the tonalite in central Hawkins Township.

Carbonate alteration has been noted within the shear zone in the vicinity of the gold occurrences in central Hawkins Township. Similar alteration also has been observed in southwestern Hawkins Township, where the mafic metavolcanic rocks show a prominent iron carbonate alteration, particularly within the pillowed flows.

Epidote alteration is observed within the felsic metavolcanic rocks that outcrop in western Hawkins Township and the epidote-rich lenses that occur in the mafic metavolcanic rocks.

Quartz veins are commonly developed throughout the supracrustal sequence.

## GEOCHEMISTRY

Whole rock chemical analyses have been completed on 30 samples collected from representative rock types within the Kabinakagami Lake greenstone belt. Sample locations are shown on Figure 2 (rear pocket) and the analytical results are tabulated in Appendix I. All analytical work was completed by the Geoscience Laboratories, Ontario Geological Survey, Toronto.

Additional geochemical results from Siragusa (1977) are tabulated in Appendix II.

## STRUCTURAL GEOLOGY

### Small Scale Features

All of the supracrustal rocks show a moderate foliation. The deformation intensity in the vicinity of the Puskuta Lake shear zone is intense. Foliation intensity in the granitoid rocks surrounding the greenstone belt ranges from weak, in the Kabinakagami Lake area, to strong, in Hawkins Township.

The foliation in the Kabinakagami Lake area trends 055° to 075° and is steeply to vertically dipping. The foliation changes to west-trending (085° - 090°) in Hawkins Township and in northern Derry Township. Foliation in a narrow tongue of mafic metavolcanic rocks in northeastern Hawkins Township is northwest-trending. A similar northwest trend occurs along the Kabinakagami River in northern Derry Township, but this orientation is related to a northwest trending fault in the area. In most outcrops, the foliation is vertical to steeply dipping.

In the granitic rocks, the foliation is usually steeply dipping and is parallel or subparallel to that observed in the supracrustal rocks.

Mineral lineations are well developed in the vicinity of the Hiawatha Gold Mine and plunge 040° to the northeast. Lineations plunge eastward (025° to 040°) in northern Ermine and southern Derry townships.

Very few primary structures have been preserved in the greenstone belt. The intense deformation has flattened most of the pillows so that any surviving stratigraphic indicators are suspect. Siragusa (1977) suggests that pillows in southwestern Lizar Township indicate a southeast topping direction. The author has found no definitive stratigraphic indicators anywhere in the map area.

Jointing is well developed in most of the granitic outcrops examined. The joints are typically steeply dipping and a major trend is developed between 340° and 020°. A secondary joint set strikes between 075° and 115°. Joints with similar orientations have been recorded in many of the diabase dikes that crosscut the map area.

## Folds

Siragusa (1977) has suggested the presence of a major syncline with a northeast-trending axis in the vicinity of the Bear Creek Fault (Figure 3 in rear pocket).

Broad, open and tight, isoclinal folds are present in western

Hawkins Township. Folding is suggested by the repetitious sequences of quartz-feldspar porphyry and pillowed volcanics that are observed in trenched areas. Fold noses plunge steeply (060° to 075°) to the east. Abundant parasitic folds also were observed in the metavolcanic rock units in central Hawkins Township. No small scale folds were observed in the Kabinakagami Lake portion of the map area.

## Faults

All faults within the map area are of short strike length and exhibit horizontal displacements of less than 1 km. The position of these faults has been interpreted from aerial photographs and from the presence of strain in the surrounding rocks.

The Bear Creek Fault is a northeast-trending structure that lies in southwestern Lizar Township. The presence of the fault is suggested by the linear nature of Bear Creek, its relatively steep outcrop embankment and by the deformation and silicification of the rocks on either side of the creek. A zone of high strain (approximately 50 - 100 m wide) is observed along the northeast-trending Bear Creek Fault. All of the known gold occurrences in Lizar Township are hosted within this fault zone and its accompanying high strain zone. Narrow shear zones (< 2m wide), parallel to the fault, occur to the northwest of the mine site. These shears host minor gossans.

Northwest-trending lineaments are interpreted to parallel the northwest-trending bays of Kabinakagami Lake in northern Derry Township. A third northwest-trending fault is interpreted to occur within the metasedimentary rocks in western Ermine Township. Horizontal displacement (up to 500 m) of the mafic metavolcanic rocks has occurred along the faults in Derry Township. No evidence of shearing was observed along any of these faults.

**Shear Zones**

A major east-trending, steeply dipping shear zone has been mapped by the author in central Hawkins Township (Figure 4 in rear pocket). Strongly to intensely foliated metavolcanic rocks and tonalites occur within the shear zone (Wilson 1990).

The shear zone has been traced for a distance of 60 km to the east and southeast of the map area (Leclair 1990) (see Figure 3 in rear pocket). Systematic mapping of the area by Leclair (1990) and Leclair and Poirier (1989), has outlined an arcuate, concave to the southwest, regional scale deformation zone that forms the southeast boundary of the Kabinakagami Lake greenstone belt. The deformation zone has been named the Puskuta Lake shear zone by Leclair (1990).

The Puskuta Lake shear zone has been recognized by the abrupt northward transition from coarsely crystalline granitoid rocks in the south, to extremely well foliated, tectonically layered, mafic and felsic metavolcanic rocks in the north (Wilson 1990, Leclair 1990). Leclair (1990) has observed that the fabrics developed within this shear zone dip steeply to the northeast and that they have a subhorizontal stretching lineation.

The Puskuta Lake shear zone is an approximately 2 km wide zone of intense, ductile deformation that is coincident with the southern volcano-plutonic contact of the Kabinakagami Lake greenstone belt. The eastern section of the shear zone in Walls, Minnipuka and Puskuta townships may be of economic interest (see Recommendations to Prospectors section).

The Puskuta Lake shear zone has affected a sequence of pillowed and massive mafic metavolcanic rocks, which are intruded by quartz porphyry and quartz-feldspar porphyry sills, and a tonalitic intrusion in Hawkins Township. The mafic metavolcanic rocks within the shear zone are strongly deformed. Pillows are stretched and are recognizable only by layers of garnet- and biotite-rich pillow selvages and fine-grained pillow cores. The porphyry sills also are strongly deformed and have flattened quartz eyes.

The southern section of the shear zone lies within the tonalitic intrusion that separates the two major branches of mafic metavolcanic rocks in Hawkins township.

Several northwest-trending, localized shear zones have been observed in central Hawkins Township. These narrow zones (less than 10 m wide) strike between 130° and 155° and have a very short strike length, usually less than 250 m. They are identifiable as strongly foliated chlorite-rich zones that crosscut the main trend of the Puskuta Lake shear zone.

## CORRELATION BETWEEN GEOLOGY AND AEROMAGNETIC DATA

The Puskuta Lake shear zone and its coincident mafic metavolcanic rocks can be recognized by a strong west northwest-trending aeromagnetic anomaly (Geological Survey of Canada 1984b, ODM-GSC 1963f). This aeromagnetic trend extends from Champlain Township in the southeast, to Derry Township in the northwest. The aeromagnetic high dies out in the vicinity of the Derry Township copper-lead occurrence. The Kabinakagami River Fault, which apparently hosts this mineral occurrence, may truncate the aeromagnetic high.

The main northeast trend of the Kabinakagami Lake greenstone belt appears as an aeromagnetic high, to the south of the Puskuta Lake shear zone aeromagnetic high (Geological Survey of Canada 1984a, ODM-GSC 1963a-e).

It is possible that the two aeromagnetic trends may be indicative of two separate greenstone belts; a northern belt which is east-trending across northern Hawkins Township and a southern belt which is northeast-trending across Kabinakagami Lake. Sufficient subtle differences exist between the geology of the two belts to substantiate this possibility (Table 2).

The main differences are related to the volume of specific rock types present. Quartz and quartz-feldspar porphyry are prominent rock types in the northern belt, but are not prominent in the southern, Kabinakagami Lake section. Metasedimentary rocks are present in the southern belt, but are not present in the northern belt. Carbonate alteration is prominent in the northern belt, but absent in the southern belt. In addition, garnet is prominent in the northern belt and occurs in only a few isolated outcrops on Kabinakagami Lake. Folding is commonly observed in the Hawkins Township belt, and is not readily observed in the Kabinakagami Lake

Table 2

Comparison Between the Hawkins Township Greenstone Belt and the Kabinakagami Lake Greenstone Belt

| | Northern Belt (Hawkins Township) | Southern Belt (Kabinakagami Lake) |
|---|---|---|
| Lithology | quartz and quartz-feldspar porphyry dikes/sills are prominent | rare quartz and quartz-feldspar porphyry dikes/sills |
| | metasedimentary rocks uncommon | metasedimentary rocks prominent in southwestern section of belt |
| Alteration | carbonate alteration prominent | no carbonate alteration |
| Mineralogy | garnet prominent in mafic metavolcanic rocks | no garnet in mafic metavolcanic rocks |
| Structure | small scale isoclinal folding | no obvious folding |
| | strong shearing and flattening | moderate shearing and deformation |
| Mineralization | gold in quartz veins in strongly sheared mafic metavolcanic rocks or tonalite | gold in quartz veins associated with moderately sheared granodioritic sills or quartz porphyry sills crosscutting mafic metavolcanic rocks |

belt. Significant differences have also been observed between the mineralization occurring in the Kabinakagami Lake belt (southern) and the Hawkins belt (northern (see Economic Geology section for further discussion).

## ECONOMIC GEOLOGY

All of the known mineral occurrences within the Kabinakagami Lake greenstone belt are located within southwestern Lizar Township and eastern Hawkins Township (Figure 2 in rear pocket). Exploration activity in the area has been sporadic since gold was discovered by G. Taylor (prospector) in 1923 in Hawkins Township (assessment files, Wawa Resident Geologist's office).

Two mines within the belt have recorded gold production. The Shenango Gold Mine (1935-1941) in Hawkins Township, and Hiawatha Gold Mine (1936-1939) in Lizar Township. Both gold mines were low grade and very low tonnage operations.

Most of the mineral occurrences are gold or gold and silver. One lead-zinc occurrence (Charpentier lead-zinc occurrence) and one iron-titanium occurrence (Kabinakagami Lake occurrence) are located in the map area.

Quartz veins are prominent within all of the known gold and sulphide occurrences. Moderate to strong shearing is associated with anomalous gold values in all of the occurrences.

Although similarities exist among all of the mineral occurrences, differences are apparent between the occurrences in Lizar and Hawkins townships. All of the gold showings in Lizar

Township are within the strained rocks adjacent to the steeply dipping, northeast-trending Bear Creek Fault. In some instances, the gold-bearing quartz veins occur at the sheared margins of a granodiorite to trondhjemite sill (Hiawatha Gold Mine, Kalibak North showing, Kalibak South showing). In other cases, the quartz veins are associated with quartz porphyry sills within mafic metavolcanic rocks, (Vasey-Stenabough occurrence, Charpentier gold-silver occurrence). Chlorite and silica are common alteration minerals at these gold occurrences.

The gold showings in Hawkins Township occur within quartz veins in the Puskuta Lake shear zone. Carbonate is the most common alteration mineral associated with the Langdon Lake showing, Shenango Gold Mine and the Taylor showing.

The Charpentier lead-zinc occurrence is adjacent to the northeast-trending Bear Creek fault zone in southwestern Lizar Township. Sulphide minerals occur within quartz veins and lenses in sheared mafic metavolcanic rocks.

Molybdenite also has been reported in both Hawkins and Derry townships by Maynard (1929). The molybdenite was reported to occur as coarse-grained flakes within quartz veins and granitic dikes which intrude mafic and felsic metavolcanics. More commonly, molybdenite occurs within coarse-grained pegmatite dikes. No molybdenite was observed by Siragusa (1977) or by Wilson (1990).

## PROPERTY DESCRIPTIONS

Data for the occurrences detailed in this section of the report are compiled from Gledhill (1927), Maynard (1929), Giblin

(1968), and Siragusa (1977). More recent information from assessment files (Wawa Resident Geologist's office) and the present mapping have been included (Wilson 1989, 1990). The number following each mineral occurrence title refers to its map location on Figure 2 and/or the accompanying geological map (rear pocket). Table 3 lists the pertinent assessment files stored at the Wawa Resident Geologist's office for each of the mineral occurrences.

### Charpentier Gold - Silver Occurrence (1)

The Charpentier gold-silver occurrence is located in the southwest corner of Lizar Township approximately 1.6 km north of the south township boundary and 4.4 km east of the west township boundary (Giblin 1968).

The occurrence reportedly consists of a 30 cm wide, sugary textured, steeply dipping quartz vein. The vein is exposed for over 30 m along strike and strikes between 055° and 060°. The wall rocks consist of strongly foliated hornblende-chlorite schist. Quartz porphyry sills and dikes reportedly crosscut the schist (assessment files, Wawa Resident Geologist's office). A geological sketch of the property is presented in Figure 5.

The schist is strongly mineralized on either side of the quartz vein. Pyrite is the dominant sulphide although galena and pyrrhotite are of local importance. Visible gold reportedly occurs in the quartz vein and is sometimes associated with galena.

Reported assay values are erratic and were obtained from both grab and systematic chip sampling across the vein. Available results range from 0.06 ounce Au per ton to 1.10 ounces Au per ton.

Table 3: List of Exploration Activities Past and Present for the Kabinakagami Lake Greenstone Belt

| Mineral Occurrence | Assessment File Number | Year | Company Name | Type of Work |
|---|---|---|---|---|
| Charpentier Gold-Silver Occurrence (1) | Lizar 0014 | 47 | Sylvanite Gold Mines | property description |
| | WT Hawkins.1 | 87 | River Oaks Gold Resources Ltd. | airborne geophysics |
| | WT Lizar.3 | 88 | Noranda Exploration Company Ltd. | soil geochemistry |
| Hiawatha Gold Mine (3) | Lizar 0011 | 78 | Nickle Rim Mines Ltd. | 4 ddh (2702 ft.) |
| | Lizar 0012 | 79 | Nickle Rim Mines Ltd. | ground geophysics; geological mapping |
| | Lizar 0013 | 81 | Sveinson Way Mineral Services Ltd. | soil geochemistry 18 ddh (4265 ft.) |
| | Lizar 0015 | 37 | Hiawatha Gold Mines | property description |
| | Lizar 0020 | 67 | Primrock Mining and Exploration Hiawatha Gold Mines | geological mapping; underground assays |

Table 3 cont'd

| | | | | |
|---|---|---|---|---|
| Hiawatha Gold Mine (3) | Lizar 0021 | 70 | Primrock Mining and Exploration | 2 ddh (250 ft.) |
| | Lizar 0022 | 67 | Primrock Mining and Exploration Hiawatha Gold Mines | geological report; assays |
| | Lizar 0025 | 74 | Keltic Mining Corporation | ground geophysics |
| | Lizar 0026 | 74 | Keltic Mining Corporation | assays; property description |
| | Lizar 0030 | 83 | Tundra Gold Mines | airborne geophysics |
| | Lizar 0031 | 83 | Tanglewood Petroleum Corporation | airborne geophysics |
| | WT Lizar. 2 | 84 | Tanglewood Consolidated Resources Inc. | geological mapping; trenching |
| | WT Lizar. 3 | 88 | Noranda Exploration Company Ltd. | soil geochemistry |
| | WT Lizar. 6 | 89 | Noranda Exploration Company Ltd. | soil and rock geochemistry |
| | WT Lizar. 11 | 89 | Noranda Exploration Company Ltd. | geological mapping; soil and rock geochemistry |

Table 3 cont'd

| | | | | |
|---|---|---|---|---|
| Vasey - Stenabough Occurrence (10) | Lizar 0016 | 37 | Sylvanite Gold Mines | property description |
| | Lizar 0019 | 37 | Erie Canadian Mines | property description |
| | WT Hawkins. 1 | 87 | River Oaks Gold Resources Ltd. | airborne geophysics |
| | Breckenridge 0010 | 74 | Rio Tinto Canadian Exploration Ltd. | ground geophysics |
| | Breckenridge 0012 | 83 | Tundra Gold Mines Ltd. | airborne geophysics |
| Langdon Lake Showing (7) | Hawkins 0014 | 80 | A. MacDonnell | mechanical work |
| | Hawkins 0022 | 83 | Falconbridge Ltd. | ground geophysics |
| | Hawkins 0023 | 84 | Falconbridge Ltd. | ground geophysics |
| | Hawkins 0025 | 84 | Falconbridge Ltd. | ground geophysics |
| Shenango Gold Mine (8) | Hawkins 0011 | 81 | Sulpetro Minerals Ltd. | geological mapping |
| | Hawkins 0012 | 80 | St. Joseph's Exploration Ltd. | ground geophysics |
| | Hawkins 0013 | 79 | St. Joseph's Exploration Ltd. | ground geophysics |
| | Hawkins 0019 | 72 | Shenango Gold Mining Co. Ltd. | property description |

Table 3 cont'd

| | | | | |
|---|---|---|---|---|
| Hiawatha Gold Mine (3) | WT Lizar. 15 | 69 | Primrock Mining and Exploration | underground geological mapping |
| | WT Hawkins. 1 | 87 | River Oaks Gold Resources Ltd. | airborne geophysics |
| Kalibak Gold Mines-North Showing (5) | Lizar 0018 | 46 | Kalibak Gold Mines | property description |
| | WT Lizar. 3 | 88 | Noranda Exploration Company Ltd. | soil geochemistry |
| | WT Lizar. 6 | 89 | Noranda Exploration Company Ltd. | soil and rock geochemistry |
| | WT Hawkins. 1 | 87 | River Oaks Gold Resources Ltd. | airborne geophysics |
| Kalibak Gold Mines-South Showing (6) | Lizar 0018 | 46 | Kalibak Gold Mines | property description |
| | WT Lizar. 3 | 88 | Noranda Exploration Company Ltd. | soil geochemistry |
| | WT Lizar. 6 | 89 | Noranda Exploration Company Ltd. | soil and rock geochemistry |
| | WT Hawkins. 1 | 87 | River Oaks Gold Resources Ltd. | airborne geophysics |

Table 3 cont'd

| | | | | |
|---|---|---|---|---|
| Shenango Gold Mine (8) | Hawkins 0022 | 83 | Falconbridge Ltd. | ground geophysics |
| | Hawkins 0023 | 84 | Falconbridge Ltd. | ground geophysics |
| | Hawkins 0024 | 84 | Falconbridge Ltd. | 1 ddh (230 ft.) |
| | Hawkins 0025 | 84 | Falconbridge Ltd. | ground geophysics |
| | Hawkins 0026 | 86 | Falconbridge Ltd. | 12 ddh, (1517 m) |
| | Hawkins 0027 | 85 | Falconbridge Ltd. | 13 ddh, (1833 m) |
| | Hawkins 0028 | 86 | Falconbridge Ltd. | 2 ddh, (351 m) |
| | Hawkins 0029 | 86 | Falconbridge Ltd. | 5 ddh, (1372 m) |
| | Hawkins 0030 | 85 | Falconbridge Ltd. | 23 ddh, (2500 m) |
| | Hawkins 0031 | 84 | Falconbridge Ltd. | 4 ddh, (931.5m) |
| Taylor Showing (9) | Hawkins 0011 | 81 | Sulpetro Minerals Ltd. | geological mapping |
| | Hawkins 0012 | 80 | St. Joseph's Exploration Ltd. | ground geophysics |
| | Hawkins 0013 | 79 | St. Joseph's Exploration Ltd. | ground geophysics |

Table 3 cont'd

| | | | | |
|---|---|---|---|---|
| Taylor Showing (9) | Hawkins 0015 | 74 | Magi Gold Mines | 3 ddh, (909 ft.) |
| | Hawkins 0017 | 73 | Magi Gold Mines | ground geophysics |
| | Hawkins 0021 | 84 | Falconbridge Ltd. | 1 ddh, (128.2 ft.) |
| | Hawkins 0022 | 83 | Falconbridge Ltd. | ground geophysics |
| | Hawkins 0023 | 84 | Falconbridge Ltd. | ground geophysics |
| | Hawkins 0025 | 84 | Falconbridge Ltd. | ground geophysics |
| | Hawkins 0026 | 86 | Falconbridge Ltd. | 12 ddh, (1517 m) |
| | Hawkins 0027 | 85 | Falconbridge Ltd. | 13 ddh, (1833 m) |
| | Hawkins 0028 | 86 | Falconbridge Ltd. | 2 ddh, (351 m) |
| | Hawkins 0029 | 86 | Falconbridge Ltd. | 5 ddh, (1372 m) |
| | Hawkins 0030 | 85 | Falconbridge Ltd. | 23 ddh, (2500 m) |
| | Hawkins 0031 | 84 | Falconbridge Ltd. | 4 ddh, (931 m) |
| Charpentier Lead-Zinc Occurrence (2) | Breckenridge 0013 | 83 | Tay River Petroleums Ltd. | airborne geophysics |

Table 3 cont'd

| | | | | |
|---|---|---|---|---|
| Charpentier Lead-Zinc Occurrence (2) | Lizar 0016 | 37 | Sylvanite Gold Mines | property description |
| | Lizar 0028 | 37 | J. E. Stenabough | property description |
| | WT Hawkins. 1 | 87 | River Oaks Gold Resources Ltd. | airborne geophysics |
| Kabinakagami Lake Occurrence (4) | Lizar 0027 | 57, 71 | Sand River Gold Mining | 6 ddh, (2998 ft.) |
| | Lizar 0029 | 54 | Neoscope Explorations Ltd. | airborne geophysics |
| | WT Lizar 7 | 89 | Pamax Resources Ltd. | ground geophysics |
| | WT Lizar. 14 | 77 | Hanna Mining Co. | property description |
| | WT Hawkins. 1 | 87 | River Oaks Gold Resources Ltd. | airborne geophysics |

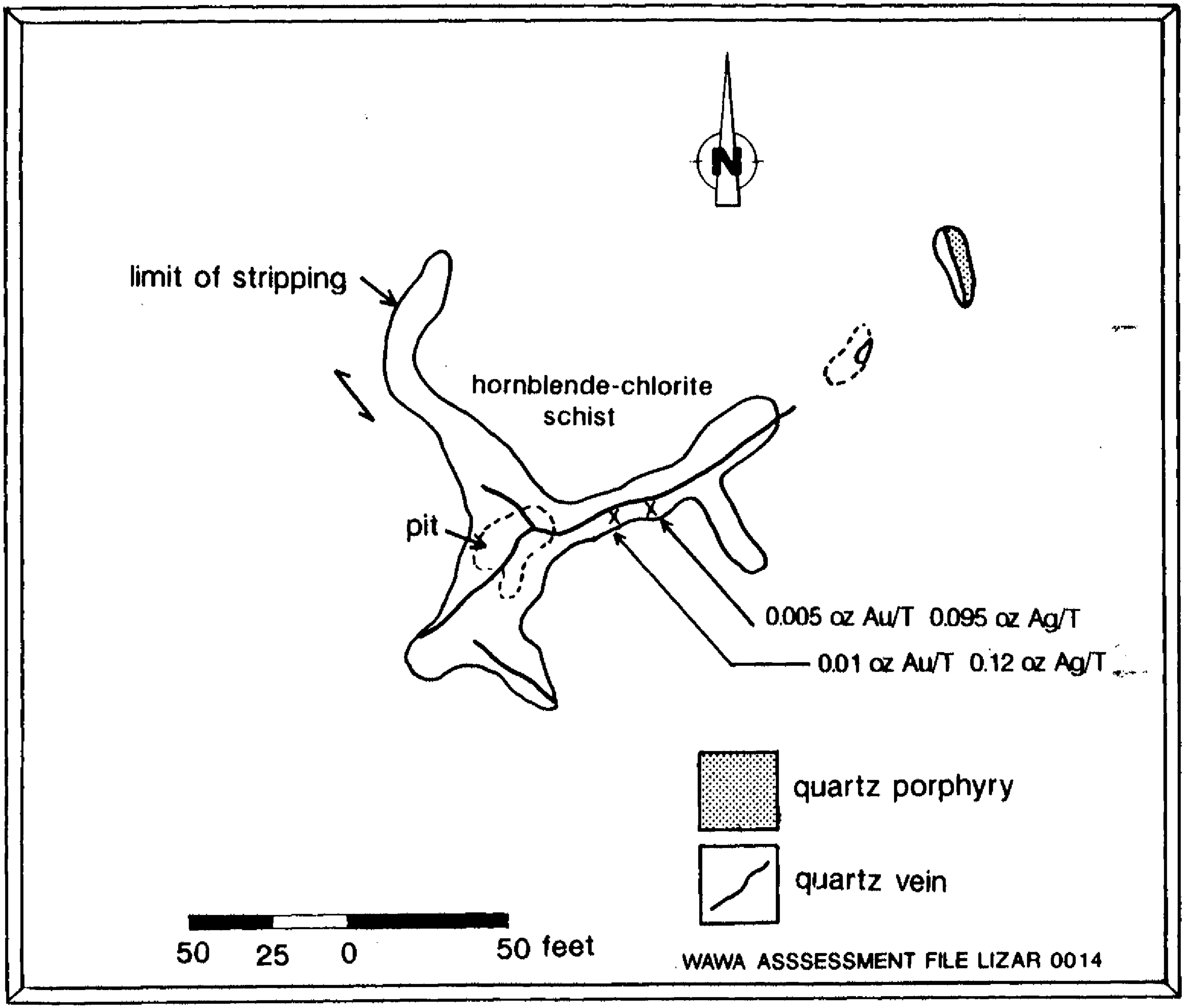


Figure 5: Charpentier Gold - Silver Occurrence, Lizar Township - Erie Canadian Mines 1946 trench sample plan showing assay results.

Silver values range between 0.095 ounce Ag per ton and 0.14 ounce Ag per ton (assessment files, Wawa Resident Geologist's office).

Exploration work on the property consisted of minor trenching and stripping during 1946 or 1947. No additional work has been reported. Due to imprecise location details, the occurrence could not be located by Siragusa (1977) or Wilson (1989, 1990).

Recent assessment work conducted to the southwest of the occurrence has indicated the presence of shear zones parallel to the shearing and veining described at the occurrence. Several sugary quartz veins also have been exposed to the southwest, many of which have returned elevated arsenic and anomalous gold values.

**Hiawatha Gold Mine (3)**

The Hiawatha Gold Mine (Figure 6 in rear pocket) is located in Lizar Township, on the west side of Kabinakagami Lake.

Gold was discovered on the property in 1926. Hiawatha Gold Mines Ltd. carried out exploration and development work on the property between 1936 and 1939. The work consisted of surface prospecting, trenching and 13 034 feet of surface drilling. A vertical three-compartment shaft was sunk to 299 feet and two levels were established at 150 feet and 275 feet (assessment files, Wawa Resident Geologist's office). In 1939, 179 ounces of gold were produced from a 1931 ton bulk sample.

All production ceased at the outbreak of World War II and was never continued.

The property was restaked in 1965 and optioned to Primrock Mining and Exploration Ltd. Primrock subsequently dewatered and sampled the mine workings. Two diamond drill holes (250 feet total) were drilled to test a gold occurrence located to the south of the mine. Although the assay results from this exploration activity were encouraging, the recommended exploration program was not carried out (assessment files, Wawa Resident Geologist's office).

Keltic Mining Corporation Limited acquired the property in 1974 and performed surface geophysical surveys over the water covered portions of the property. The company subsequently dewatered the underground workings and completed systematic underground mapping and sampling. This systematic approach to sampling resulted in the delineation of two or three shoots of sub-ore grade material which improved in grade and extent from the upper to lower levels of the mine. No additional exploration was undertaken (assessment files, Wawa Resident Geologist's office).

A program of line cutting, geophysics and diamond drilling was undertaken in 1978 by Nickel Rim Mines. Four diamond drill holes (2702 feet total) were drilled to test the South Zone and intersected several sections of gold-bearing quartz sericite schist (assessment files, Wawa Resident Geologist's office).

The property was optioned to Swenson-Way Mineral Services Ltd. in 1980. Their exploration program consisted of soil sampling, prospecting and diamond drilling. Eighteen drill holes totalling 4265 feet were drilled. The North Zone, Bear Creek Zone and the South Zone were all tested by the drill program (assessment files, Wawa Resident Geologist's office).

Tanglewood Consolidated Resources Inc. optioned the property in 1983. An exploration program consisting of airborne geophysics, geological mapping, sampling and diamond drilling was carried out. Twelve diamond drill holes, totalling 4497 feet, were drilled to test the North and South Zones (assessment files, Wawa Resident Geologist's office).

From 1985-1987, the property was leased or optioned to several small companies. In 1987, Noranda Exploration Company Ltd. staked and/or optioned many of the claims surrounding the patented claims. Noranda performed both soil and rock geochemical sampling and completed geological mapping (assessment files, Wawa Resident Geologist's office).

The general geology of the property consists of a steeply dipping, northeast-trending sequence of mafic and felsic metavolcanic rocks. These rocks are intruded by a 120 m wide granodiorite to trondhjemite sill that has a strike length of 4 km. A coarse intrusion breccia unit also outcrops on the property and lies adjacent to the sill. All rock units are locally fractured in association with north-trending fault zones (assessment files, Wawa Resident Geologist's office). In addition, all rock units are locally intruded by younger, northeast- or northwest-trending diabase and lamprophyre dikes. The general geology of the Hiawatha Mine site is presented in Figure 6 (rear pocket).

The mafic metavolcanic rocks are moderately to strongly foliated. The foliation strikes northeast and dips very steeply to the northwest. The Bear Creek Fault is northwest of the property and is parallel to the overall structural trend of the property. North-trending en-echelon faults, that post-date the Bear Creek Fault cut across the stratigraphy east and west of the mine shaft. These faults are characterized by displacements of lithological units up to 90 m, to the south.

Gold mineralization occurs in two main zones on the property. The South Zone cuts across the granodioritic sill at approximately 65° and consists of a series of mineralized quartz veins in a silicified shear (approximately 40 m wide) within the granodioritic sill. All of the underground development and production work was carried out on the South Zone.

The North or West Zone consists of a 5 cm to 25 cm wide sheared quartz vein which lies along the north contact of a quartz porphyry unit. This vein is traceable over a strike length of 450 m.

In both mineralized zones, gold occurs in, or adjacent to, sheared and altered quartz veins in strongly sheared and sericitized granodiorite to trondhjemite which contains small quartz eyes. Disseminated pyrite, galena and ruby silver has been identified in diamond drill core from the South Zone, as well as trace amounts of chalcopyrite, pyrrhotite, malachite, sphalerite, magnetite and molybdenite (assessment files, Wawa Resident Geologist's office).

Assay results are erratic throughout all mineralized zones on the property. Surface sampling of both the North and South Zones have returned assay values, ranging from trace to 1.35 ounces Au per ton and 0.224 ounce Ag per ton in the South Zone and up to 4.9 ounces Au per ton in the North Zone. Assays of diamond drill core from the South Zone have yielded up to 3.03 ounces Au per ton. Isolated, high assay values were also obtained for the North Zone, but drill results indicate that the mineralization is more erratically distributed than within the South Zone (assessment files, Wawa Resident Geologist's office).

**Kalibak Gold Mines - North Showing (5)**

The Kalibak North showing, or the Johnston-Stenabough property, is located in the southwest corner of Lizar Township, approximately 3 km southwest of the Hiawatha Gold Mine.

The showing consists of a mineralized quartz vein that occurs along the contact between mafic metavolcanic rocks and a porphyry. Descriptions of the porphyry suggest that the unit may be a felsic interbed in the mafic metavolcanic rocks. The vein is steeply dipping and trends northeast at 75° (assessment files, Wawa Resident Geologist's office).

The quartz vein ranges from 2 m to 2.5 m in width and is traceable for over 45 m. Mineralization consists of pyrite, pyrrhotite, chalcopyrite, sphalerite and galena. The sulphides reportedly occur as massive patches and seams and as disseminated grains (assessment files, Wawa Resident Geologist's office).

All of the major exploration work has been carried out prior to 1940. The earliest reported work was by W. R. Johnston and W. H. Stenabough in 1936 (assessment files, Wawa Resident Geologist's office). The occurrence was trenched and four pits were excavated along the mafic-felsic metavolcanic contact. A diamond drilling program consisting of four drill holes reportedly was carried out, but no additional information concerning the program is available in the assessment files. Erie Canadian Mines Ltd. had an interest in the property in the late 1930's, but no work has been reported. Kalibak Gold Mines reportedly had interests in the property between 1940 and 1960 but no work beyond a property assessment is in the assessment files. Keltic Mining Corporation optioned the property during the period 1974-77 and performed a ground geophysical survey. In 1988-89, Noranda Exploration completed soil and rock geochemical surveys in the vicinity of the occurrence (assessment files, Wawa Resident Geologist's office).

The pits and trenches were not located by either Siragusa (1977) or the author (1989, 1990).

**Kalibak Gold Mines - South Showing (6)**

The Kalibak South showing, or the Hiawatha Vein, is located approximately 4.3 km north and 5 km east of the southwest corner of Lizar Township (Giblin 1968).

The occurrence consists of a quartz vein within a strongly sheared sequence of mafic metavolcanic rocks and associated quartz-feldspar porphyry. The shear zone trends 060° and dips 85°E. The vertically dipping vein strikes 060°, and is enclosed by a biotite-rich envelope that ranges from 10 cm to 20 cm in width. A strike length of 800 m has been estimated for the vein (assessment files, Wawa Resident Geologist's office). A granitic intrusion cuts the vein off, to the east of the showing (see Figure 7). North-

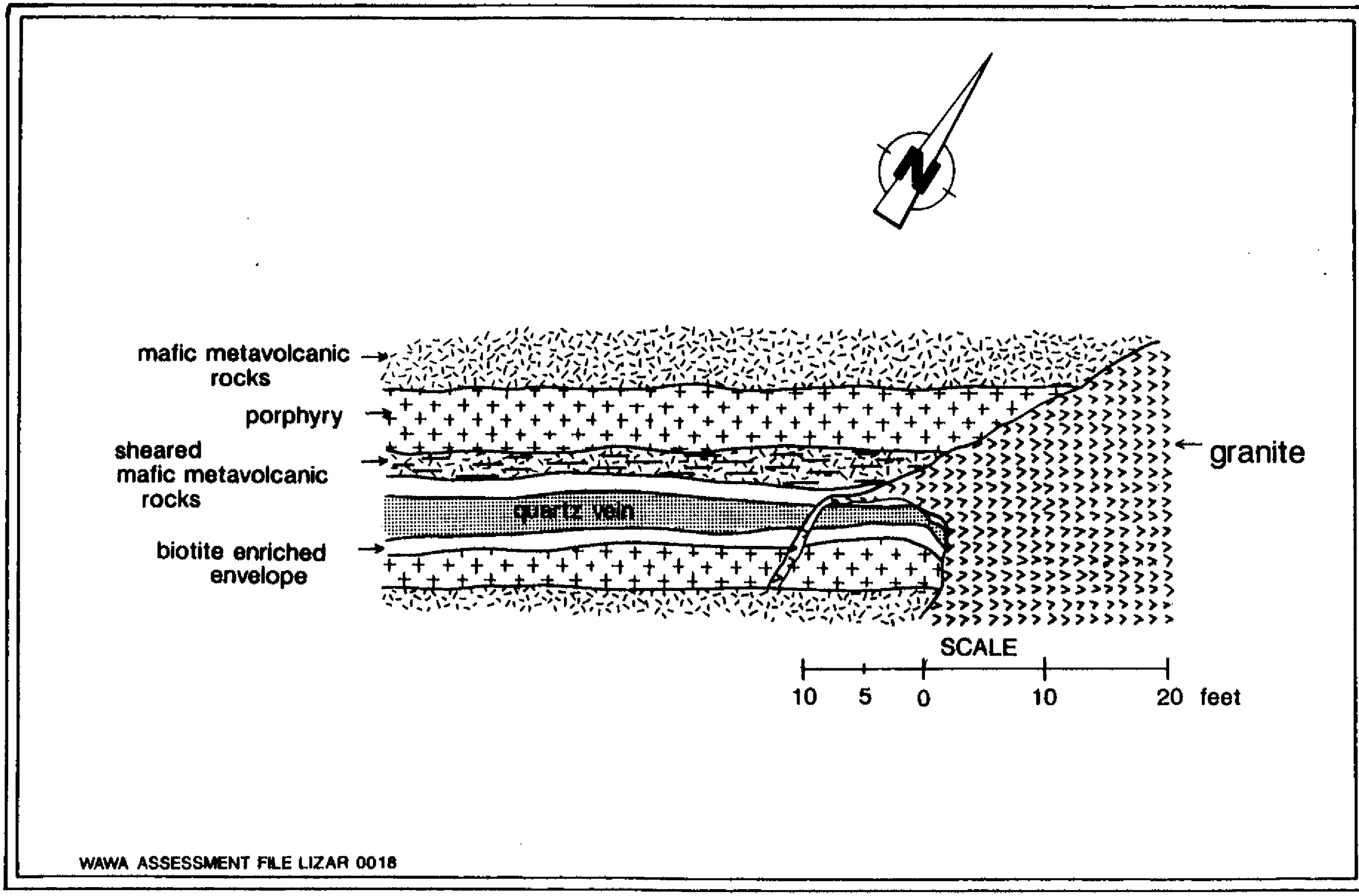


**Figure 7: Geology of the Kalibak Gold Mines - South Showing, Lizar Township.**

trending lamprophyre dikes also cut off subsidiary veins located to the north of the main showing.

Two generations of quartz mineralization have been reported in the vein. Primary, sugary-textured quartz, heavily mineralized with granular pyrite and some sphalerite, occupies the main vein at the showing. Secondary, massive, unmineralized quartz occupies secondary stringers and veinlets as offshoots from the main vein. Pyrite is present along seams or as disseminated grains along the plane of shearing. Sphalerite is massive or infills seams along the shear planes (assessment files, Wawa Resident Geologist's office).

Assay results for the occurrence are reported to be as much as 1.5 ounces Au per ton from a grab sample in a trench. Surface channel samples returned much lower values (assessment files, Wawa Resident Geologist's office).

All exploration work on the property occurred prior to 1950. It consisted of stripping and trenching of the shear zone for a distance of approximately 50 m. Some X-ray drilling reportedly was done on the property during 1946 by Kalibak Gold Mines, but no records of this work have been found. This occurrence was part of a group of claims optioned by Keltic Mining Corporation during the period 1974-77. A ground geophysical survey was performed, but no additional exploration work resulted. A soil and rock geochemical survey by Noranda Exploration in 1988-89 covered the vicinity of the occurrence (assessment files, Wawa Resident Geologist's office).

Siragusa (1977) could not locate either the claim or the trenches. Due to imprecise location information, no attempt was made by the author to visit the showing.

**Vasey - Stenabough Occurrence** (10)

The Vasey-Stenabough occurrence is located approximately 3.2 km north and 2.4 km east of the southwest corner of Lizar Township (Giblin 1968).

The earliest reported work on the property is a trenching and stripping program carried out by J. E. Stenabough in or around 1936. No assay results are reported from the discovery, but an assessment of the property performed by Erie Canadian Mines in 1937 produced encouraging assay results from quartz veins in the shear zone (assessment files, Wawa Resident Geologist's office).

Two airborne geophysical programs were conducted over the property during 1983 for Tay River Petroleums Ltd. and Tundra Gold Mines Ltd. A third airborne survey was flown for River Oaks Gold Resources Ltd. in 1987. These surveys revealed the presence of weak VLF anomalies in the vicinity of the occurrence. No additional work has been reported (assessment files, Wawa Resident Geologist's office).

Siragusa (1977) located an old trench during the 1973 field season. Assay values obtained at that time from pyrite-bearing quartz samples were 0.02 ounce Au per ton and 0.04 ounce Au per ton.

The showing lies within a geological setting similar to that hosting the Hiawatha Gold Mine. Gold-bearing quartz veins and lenses occupy a northeast (55°) trending shear that is within a steeply dipping, 2 m to 10 m wide quartz porphyry sill or dike that has intruded along the contact between mafic and felsic metavolcanic rocks. The vein system is interrupted by a northwest-trending diabase dike (assessment files, Wawa Resident Geologist's office). Figure 8 (rear pocket) provides a geological sketch of the property.

The quartz veins strike 65° and dip 80° to the south and vary between 2 cm and 35 cm in width and have strike extents of 15 m to 45 m. The width of the shear zone at the occurrence is unknown, but it reportedly extends over 100 m and may represent the southwestern extension of the Bear Creek Fault zone (assessment files, Wawa Resident Geologist's office).

Mineralization within the quartz veins consists of pyrite, chalcopyrite, galena and sphalerite. The host rocks contain pyrite disseminations and massive stringers (Siragusa 1977).

Assay values from a 1937 grab and chip sampling program range between 0.05 ounce Au per ton over 20 cm and 0.4 ounce Au per ton in a grab sample. Assay results from grab samples of mineralized mafic metavolcanic rocks collected by Siragusa (1977) were 0.02 ounce Au per ton and 0.04 ounce Au per ton.

The rocks in the area of the showing are strongly chloritized and silicified (Siragusa 1977).

### Langdon Lake Showing (7)

The Langdon Lake showing is located in north-central Hawkins Township, on the west side of the Algoma Central Railway tracks, approximately 150 m north of Langdon Lake.

Four pits or shafts of unknown vintage were discovered on the property by the author in 1989. All of the open holes had been fenced in and are now inaccessible. A sketch of the location of pits and trenches on the property, and the property geology is shown in Figure 9.

The occurrence is within a moderately to strongly sheared sequence of mafic and felsic metavolcanic rocks and deformed felsic intrusive rocks. Mineralization appears to be concentrated at the contact between the mafic metavolcanic rocks that outcrop in the northern part of the area and light grey, sheared tonalite that outcrops to the south.

At the occurrence, the shear zone is approximately 750 m wide, although the mineralization does not occur over the entire width. The mineralization appears to be concentrated at the contact and most elevated gold values occur in the felsic rocks. The shear zone and the contact is west-trending and dips very steeply to the north (266/86N). The auriferous zone has an estimated strike extent of 100 m. Mineralization consists of disseminated pyrite and chalcopyrite.

Reported assay values for this occurrence range from 190 ppb Au in quartz veins to 390 ppb Au from felsic sections of drill core (assessment files, Wawa Resident Geologist's office).

A pervasive carbonate alteration is evident both in outcrop and in drill core and it appears to increase from the north towards the mineralized zone and then decreases toward the south

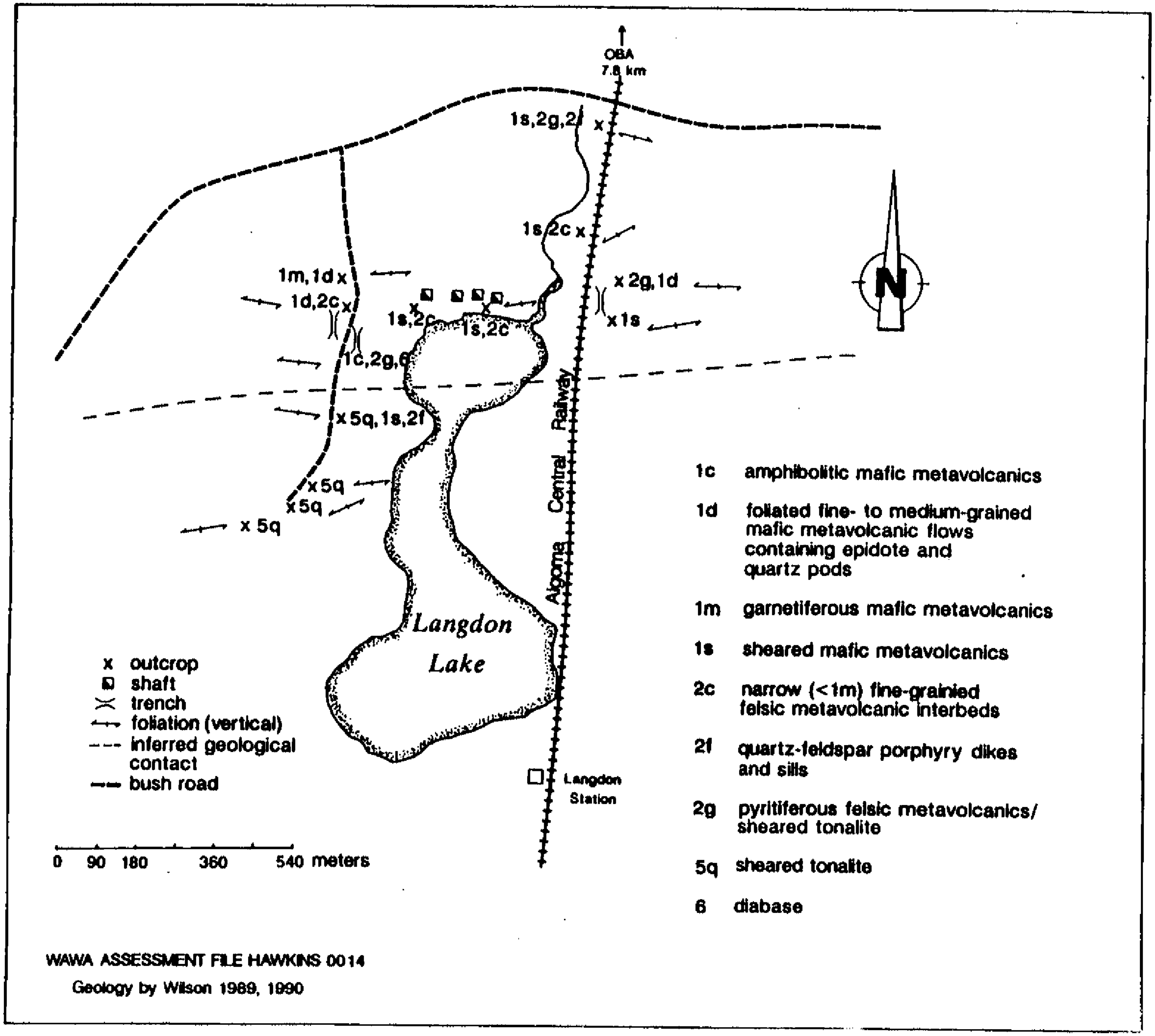


Figure 9: Geology of the Langdon Lake Showing, Hawkins Township showing the locations of shafts and trenches.

(assessment files, Wawa Resident Geologist's office). Hematite alteration is also pervasive in drill core where the felsic unit has undergone extensive fracturing, but is not evident in outcrop.

The record of exploration and development work on the property is not well documented. Gold was discovered in the area by G. Taylor in 1923 (Maynard 1929). No work was reported to have been done until 1925-1939 when Shenango Mining Co. Ltd. did prospecting and trenching and sank some test pits. It is believed that the old pits or shafts found at Langdon Lake date from this period of exploration. No additional assessment work was filed at that time.

The Langdon Lake property was acquired by Falconbridge Limited in 1983. During 1983 and 1984 Falconbridge completed a soil and rock geochemical survey, an IP survey and an extensive trenching program that included the Langdon Lake showing. One diamond drill hole (233.0 feet) also was drilled on the property by Falconbridge Ltd. Assay results from this drill hole were encouraging. No additional exploration work has been completed on this property (assessment files, Wawa Resident Geologist's office).

**Shenango Gold Mine (8)**

The Shenango Gold Mine is located in central Hawkins Township approximately 1.2 km northeast of Langdon Station on the Algoma Central Railway. Two shafts are present on the property, the Shenango No. 1 and the Shenango No. 2, approximately 500 m west of the Shenango No. 1 shaft. A submerged adit is located on the shoreline north of the Shenango No. 1 shaft. The geology and the shaft locations at the Shenango Gold Mine are presented in

Figure 10 (rear pocket).

Exploration and development work on the property began in 1935 when the Shenango Mining Company Ltd. staked the property, performed surface channel sampling, 1800 feet of trenching and sank a 25 foot exploration shaft. A 50 ton per day mill was completed in 1936 and a small scale open cut mining operation began. A total of 1572 tons of rock was processed. In 1937, a 90 foot adit and 40 feet of crosscutting from the bottom of the open cut were excavated. Shaft No. 1 was deepened to 52 feet, and 2500 feet of diamond drilling were completed. The mill processed an additional 828 tons of material. Between 1936 and 1937 the No. 1 shaft produced 30.3 ounces of gold and 32 ounces of silver (assessment files, Wawa Resident Geologist's office).

Over the 1937 to 1941 period, the Shenango Gold Mining Company Ltd. performed an additional 1400 feet of surface drilling and 1310 feet of trenching. Shaft No. 2 was sunk to 125 feet and was deepened to 135 feet in 1941. There are no records of any gold production from this shaft (assessment files, Wawa Resident Geologist's office).

In 1945, a clean-up operation of the mill yielded an additional 35.87 ounces of gold and 5 ounces of silver. Drill indicated reserves of 41 600 tons at 0.14 ounce Au per ton are estimated to exist at the Shenango No. 1 shaft (assessment files, Wawa Resident Geologist's office).

St. Joseph Exploration completed a ground geophysics survey and an IP survey over the property in 1979-80. Sulpetro Minerals

Ltd. performed the only recorded geological mapping of the occurrence in 1981 (assessment files, Wawa Resident Geologist's office).

The property was acquired by Falconbridge Ltd. in 1983. An extensive exploration program consisting of soil and rock geochemistry, IP surveying and a trenching program was completed during 1983-1984. Falconbridge Ltd. also completed a drilling program consisting of 13 diamond drill holes (1816 feet total) on the occurrence in 1986. No additional work has been performed on the property to date (assessment files, Wawa Resident Geologist's office).

The property was visited by the author in 1989 and 1990. Both of the shaft sites are fenced in and outcrop immediately surrounding the shafts is inaccessible. During 1989-90, the Falconbridge trenches were still accessible, but all of the trenching or stripping that had occurred before 1983 was completely obscured. Muck piles were available for sampling at both the No. 1 and the No. 2 shaft sites.

The occurrence lies within a moderately to strongly sheared sequence of mafic and felsic metavolcanic rocks and felsic intrusive rocks. Mafic metavolcanic rocks outcrop in the northern portion of the claim group and consist of fine-grained flows and tuffs. The felsic rocks are medium- to fine-grained and may represent sheared and sericitized flows or strongly foliated tonalite. The felsic rocks have a locally gneissic texture and are intruded with aplite, feldspar porphyry, amphibolite and pegmatite.

In the vicinity of the occurrence, all rock types are crosscut by north-trending diabase dikes. Carbonate and silica alteration has obscured much of the original texture of the rocks.

At the Shenango Gold Mine, the overall trend of the foliation is easterly, with a steep dip (86°) to the north. North-trending faults and localized shear zones cut across the main shear zone (Puskuta Lake shear zone) in the vicinity of the occurrence and may have resulted in secondary gold enrichment. Minor displacement has occurred along these faults.

Gold mineralization is, in general, concentrated within the felsic metavolcanic rocks. Pyrite is the dominant sulphide present in these units and usually occurs as disseminated grains, fracture infilling or coarse blebs associated with secondary quartz veins and clots. Visible gold also has been reported in one of the trenches. The auriferous zones have a strike length between 150 m and 250 m (assessment files, Wawa Resident Geologist's office).

Reported assay values for the occurrence are variable. At the No. 1 shaft, assays of quartz veins range up to 1.89 g/t Au, and up to 6.28 g/t Au in 1.18 m of drill core. Assay values at the No. 2 shaft are equally variable. Grab samples from the muck piles have yielded assays ranging from 3.26 g/t Au to 52.11 g/t Au. Trench samples from across the entire length and width of the shear zone at the Shenango Gold Mine have consistently yielded encouraging results (assessment files, Wawa Resident Geologist's office).

### Taylor Showing (9)

The Taylor showing, or the Hawkins showing as it is also referred to, is in west-central Hawkins Township, approximately 2.8 km east of the Shenango No. 1 shaft.

G. Taylor (prospector) made the first gold discovery in the area in 1923. Over the period of 1925-29, he carried out a program of stripping, trenching, sampling and gold panning. No assay results have been reported from this work (assessment files, Wawa Resident Geologist's office).

The property was acquired by the Hawkins Mining Syndicate in 1929. An exploration program consisting of stripping, trenching and two bulk samples (2000 lb per sample) was completed between 1929 and 1935. Assay results reportedly ran 30.5 g/t Au over 0.3 m in a quartz vein and 5.1 g/t Au from a test pit. No results from the bulk samples were recorded (assessment files, Wawa Resident Geologist's office).

Hollinger Gold Mines reportedly conducted a prospecting and diamond drilling program on the property in 1935. Assay values of 32.31 g/t Au across 6.1 m in a quartz vein have been reported. No drill logs or core have been recovered from this program (assessment files, Wawa Resident Geologist's office).

Between 1935 and 1945, Mitnor Gold Mines conducted a prospecting and channel sampling program on the property. A diamond drilling program was completed by Inco sometime during the 1960's. Neither of these programs are fully documented in the assessment files (assessment files, Wawa Resident Geologist's office).

Magi Gold Mines ran an extensive exploration program on the

Taylor property between 1972 and 1974. An IP survey and a ground magnetometer survey were conducted over the property during 1972-73. In 1974, a diamond drilling program consisting of 3 holes (907 feet total) was performed (assessment files, Wawa Resident Geologist's office).

St. Joseph Exploration conducted ground geophysical surveys (magnetometer, VLF, HLEM) over the property in 1979-80. Five VLF anomalies were outlined. The results of the HLEM survey yielded only very weak anomalies. In 1980, Sulpetro Minerals (formerly St. Joseph Exploration) completed a reconnaissance and detailed geological survey on the property. Reported assay values on the property were encouraging, with values up to 20.91 g/t Au reported from a quartz vein (assessment files, Wawa Resident Geologist's office).

In 1983, Falconbridge acquired the property and conducted a soil and rock geochemical survey over the property. Anomalous assay values proved encouraging enough to initiate an extensive trenching program in 1984. Results of the trenching program indicated that there is an overall increase in gold values eastward along the trend of the mineralization. Falconbridge reportedly conducted IP and magnetometer surveys over the Taylor showing in the spring of 1984. No details of this work have been filed for assessment credit (assessment files, Wawa Resident Geologist's office).

An extensive drilling program was carried out by Falconbridge between 1984 and 1986. An estimated 16 holes totalling 2334 feet were drilled on the prospect. Assay results from this program are not available (assessment files, Wawa Resident Geologist's office).

The showing reportedly is hosted by the same sheared mafic/felsic metavolcanic and tonalitic sequence that hosts all of the gold occurrences in the township. Auriferous quartz veins lie close to the northern contact of a west-trending felsic unit. The quartz veins range in width from 20 cm to 60 cm and have been traced along strike for 70 m. The rusty medium-grained felsic unit is strongly foliated and sericitic. A sketch of the showing is presented in Figure 11 (rear pocket).

The showing lies within the west-trending Puskuta Lake shear zone. Geophysically interpreted northeast-trending shear zones cross the main shear zone in the vicinity of the showing and may have served as a secondary mineral enrichment factor. Auriferous quartz veins reportedly cut both rock types and trend 260/80N.

Carbonate and sericite are the major alteration minerals present in all rock types at the showing. The carbonate content of the units increases towards the mineralized zone.

Mineralization occurs within a series of 3 to 7 quartz veins which occur within the felsic and mafic metavolcanic units. Pyrite, pyrrhotite, chalcopyrite, sphalerite and galena occur within the veins. Visible gold has been reported to occur in the No. 2 vein and gold has been panned from the No. 3 vein (Maynard 1929).

The most encouraging assay results obtained from the entire township have been from the Taylor occurrence. Assay results from quartz veins range from 5.83 g/t Au to 20.9 g/t Au (assessment files, Wawa Resident Geologist's office).

### Charpentier Lead - Zinc Occurrence (2)

The Charpentier lead-zinc occurrence is about 400 m northeast of the Charpentier gold-silver occurrence. approximately 2.25 km north of the south boundary and 3.4 km east of the west boundary of Lizar Township (Giblin 1968).

The mineralization is within a series of parallel, heavily mineralized quartz lenses and veins which occur in a strongly sheared hornblende-chlorite schist. The mineralized zone trends 100° and follows the contact between the hornblende-chlorite schist and a more felsic unit, and is exposed for approximately 45 m.

Mineralization consists of pyrite, sphalerite and galena. No assay values are reported.

Assessment work on this property consisted of stripping and trenching performed between 1946 and 1947. No additional assessment work has been reported. The occurrence could not be located by either Siragusa (1977) or Wilson (1989, 1990).

### Kabinakagami Lake Occurrence (J. Perkin Occurrence) (4)

The Kabinakagami Lake occurrence is located in the west central portion of Kabinakagami Lake, in Lizar Township.

The occurrence consists of a small, elongated, magnetic anomaly which has been mapped variously as an amphibolitic gabbro (Rupert 1972) and metapyroxenite (Siragusa 1977). This 900 m long by 450 m wide body has intruded the mafic metvolcanic rocks and granodiorite that outcrop on the peninsula.

Massive magnetite forms up to 40 percent of the rock. Minor pyrite, pyrrhotite and graphite were observed in core stored on the property (Rupert 1972). A grab sample collected by Siragusa (1977) yielded metal contents of Fe 48.9%, Ti 6.36%, Cr 0.07%, V 0.70%, and Ni 0.01%. Shklanka (1968) estimates available tonnage at 10 million tons of ore grading at 66.5% iron.

Exploration work on the property has included an airborne survey by Neoscope Explorations Ltd. in 1954. The most recent exploration activity on the property consisted of a drilling program of 6 diamond drill holes (2998 feet total) drilled by Sand River Gold Mines in 1957. No subsequent assessment work has been reported for the property (assessment files, Wawa Resident Geologist's office).

The property was not visited during the 1988 or 1990 field seasons.

### Other Mineralization

Reports of other types of mineralization have been made by Gledhill (1927), Maynard (1929), Giblin (1968) and Siragusa (1977). In most cases little or no investigation of the mineralization has been undertaken. The locations of these mineral occurrences appear in Figure 2 (rear pocket).

Maynard (1929) has reported occurrences of copper and lead mineralization in three localities on Kabinakagami Lake (map reference numbers 11, 12, 13). The Boot Bay occurrence (11) reportedly consists of a narrow zone of quartz, pyrite, pyrrhotite, chalcopyrite and galena in a felsic schist. No assay results have been reported for this occurrence.

A 10 cm wide quartz vein containing galena and chalcopyrite has been reported in mafic metavolcanic rocks on the north side of Agamik Island in Ermine Township (Kabinakagami Lake galena occurrence, map reference number 12) (Maynard 1929). Siragusa (1977) reported that no mineralization of this type was noted by him in that area, but disseminated pyrite mineralization was located within the mafic metavolcanic rocks on the western side of the island. An assay from this site returned trace gold and 0.04% Cu (Siragusa 1977). Recent sampling, completed by Derry Gold Resources Inc. in 1988, yielded assays of 1080 ppm Cu and 7900 ppm Zn.

The third copper-lead occurrence is the Derry Township occurrence (map reference number 13) which lies in the northeast section of the township, approximately 1.2 km northwest of the portage on the Kabinakagami River (Maynard 1929). The occurrence reportedly consists of a 30 cm wide quartz vein containing chalcopyrite and galena in a strongly schistose sequence of mafic metavolcanic rocks. No assay results or reports of exploration activity are available. The property was visited by Siragusa (1977) and Wilson (1990). No evidence of exploration activity or mineralization was found.

Molybdenite has been reported at two locations in the map area (map reference number 14 and 15). Maynard (1929) describes the occurrence in Derry Township as being on southeastern Big Point, in the central part of Kabinakagami Lake (map reference number 14).

The occurrence reportedly consists of a molybdenite-bearing pegmatite vein crosscutting the mafic metavolcanic rocks. The property has been visited by Siragusa (1977), and Wilson (1989), but no evidence of molybdenite mineralization or exploration activity was found. No molybdenite was noted at the occurrence by Derry Gold Resources Inc., but elevated gold values from a granitic dike in the area were obtained.

Maynard (1929) also reported the presence of molybdenite in two locations in Hawkins Township (map reference number 15). Molybdenite occurs on both the east and west banks of the Oba River near Langdon station on the Algoma Central Railway. The molybdenite occurs as flakes in sulphide-bearing quartz veins, granitic dikes and felsic lenses within mafic metavolcanic rocks. Recent assessment work has indicated that these showings consist of less than 1% molybdenite in the veins, but that samples collected near the showings have yielded elevated molybdenum and gold values (assessment files, Wawa Resident Geologist's office).

The Culbert-Peterson-Dubroy occurrence (map reference number 16), in Walls Township, lies to the east of, and on strike with, the gold showings in Hawkins Township. This gold occurrence consists of a series of 7 auriferous quartz veins which trend 352° and dip 85°E. The veins range in width from 2 cm to 30 cm and the total width of the mineralized section is 125 m (Maynard 1929). Visible gold has been reported in these veins. Exploration work on the property has been sporadic up to the present, and assay results have been disappointing (assessment files, Wawa and Timmins

Resident Geologists' offices).

The geology of the Culbert-Peterson-Dubroy occurrence resembles that of the gold occurrences in Hawkins Township. Quartz veins and gossans are hosted within sheared mafic/felsic metavolcanic rocks and felsic intrusive rocks (Puskuta Lake shear zone). Here, the shear zone trends northwest, although there appears to be considerable evidence to support a complicated structural history of folding and faulting (assessment files, Wawa Resident Geologist's office). This structural trend suggests that the auriferous horizon may have been either faulted or folded to produce the northwest-trending Puskuta Lake shear zone (Leclair 1990).

## RECOMMENDATIONS TO PROSPECTORS

Encouraging anomalous gold assay results for the mineral occurrences in both the Kabinakagami Lake area and Hawkins Township suggest that the southwestern extension of the Bear Creek Fault and the eastern extension of the Puskuta Lake shear zone are potential targets for gold exploration.

Siragusa (1977) suggested that the rocks exposed in Nameigos Township are an extension of the Kabinakagami Lake greenstone belt and that the mafic metavolcanic rocks may host significant gold concentrations similar to those at the Hiawatha Gold Mine.

Assessment file research indicates that exploration activity in the southwestern extension of the greenstone belt has consisted mainly of airborne geophysical surveys. These surveys have revealed a number of anomalies which have not been examined further. A soil and rock geochemistry survey conducted by Norwin Resources Ltd. over one of the mineral occurrences in Nameigos Township, suggests that the geology is similar to that of the gold occurrences in the Kabinakagami Lake area and that further prospecting along the feldspar porphyry intrusion is warranted because a soil survey in the area yielded anomalous gold values (assessment files, Wawa Resident Geologist's office).

Although outcrop exposure to the southwest is sparse, field investigation by the author suggests that the high strain zone which is interpreted to trend along Bear Creek, extends southwest into Nameigos Township. Recent assessment work has revealed the presence of sheared and mineralized mafic and felsic metavolcanic rocks in Nameigos Township (assessment files, Wawa Resident Geologist's office). A program of detailed geological mapping, ground geophysics and sampling along the trend of the Bear Creek fault zone may result in the discovery of areas of gold concentration.

Geophysical evidence suggests the presence of a late Archean shear zone which extends from Hawkins Township southeast into the Kapuskasing uplift, a distance of approximately 60 km (Leclair 1990). A moderately strong magnetic signature can be seen in the vicinity of the shear zone on the most recent aeromagnetic maps released for the area (OGS 1986c - e).

The Puskuta Lake shear zone is a steeply dipping, dextral, transcurrent shear structure which bounds the south side of a portion of the Kabinakagami Lake greenstone belt (Leclair 1990). In addition to hosting some of the gold occurrences discussed in the previous section (Langdon Lake showing, Shenango Gold Mine, Taylor showing and Culbert-Peterson-Dubroy occurrence), Leclair (1990) notes the presence of several mineralized localities along the length of the shear. The mineralization along the southeastern portion of the shear zone is usually associated with quartz veins and lenses in fractured and mylonitic metavolcanic rocks (Leclair 1990). Although no known mineral occurrences other than those discussed, have been discovered along the southeastern extent of the shear, no extensive exploration work has been undertaken in the area. The brittle and ductile nature of this shear zone and its close relationship to a metavolcanic sequence indicate it this is a structurally favourable area for gold exploration.

The westward extension of the Puskuta Lake shear zone is uncertain since outcrop exposure in the northern part of Derry Township is poor. Interpretation of available aeromagnetic information suggests that the magnetic high related to the shear zone sweeps to the northwest of Kabinakagami Lake. Strongly foliated mafic metavolcanic rocks have been mapped by the author along the Kabinakagami River. The Derry Township copper-zinc occurrence (Maynard 1929) is within this aeromagnetic high. Investigation of the northwestern extension of the Puskuta Lake shear zone would reqire stripping and a detailed mapping program. No exploration or development work has been reported along this trend. Although the reported gold assays increase toward the east, the continuation of the aeromagnetic high and the presence of known lead-zinc mineralization along the trend suggest that there is some potential for mineralization to the northwest.

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# APPENDICES

**APPENDIX IA: WHOLE ROCK GEOCHEMISTRY – KABINAKAGAMI LAKE GREENSTONE BELT**
**(analyses by Ontario Geological Survey, Geoscience Laboratories – Ministry of Northern Development and Mines)**

| Sample Number | $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MgO | CaO | $Na_2O$ | $K_2O$ | $TiO_2$ | $P_2O_5$ | MnO | $CO_2$ | S | $H_2O^+$ | $H_2O^-$ | L.O.I | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 88-051 | 67.84 | 16.77 | 1.44 | 1.28 | 1.12 | 3.44 | 4.41 | 1.23 | 0.27 | 0.10 | 0.04 | 0.04 | 0.00 | 0.00 | 0.00 | 1.2 | 97.98 |
| 88-088A | 71.92 | 15.69 | 1.04 | 0.41 | 0.62 | 1.56 | 1.77 | 4.55 | 0.22 | 0.06 | 0.01 | 0.01 | 0.41 | 0.00 | 0.00 | 1.7 | 98.27 |
| 88-088C | 68.14 | 16.75 | 0.65 | 1.69 | 0.76 | 3.30 | 4.03 | 1.72 | 0.26 | 0.07 | 0.04 | 0.65 | 0.11 | 0.00 | 0.00 | 1.4 | 98.17 |
| 88-088E | 69.96 | 15.45 | 1.26 | 0.64 | 0.62 | 1.81 | 1.95 | 4.55 | 0.22 | 0.06 | 0.03 | 0.29 | 0.68 | 0.00 | 0.00 | 1.9 | 97.52 |
| 88-108 | 69.10 | 16.11 | 1.26 | 1.33 | 0.82 | 3.65 | 4.38 | 1.34 | 0.26 | 0.10 | 0.04 | 0.07 | 0.02 | 0.00 | 0.00 | 0.5 | 98.48 |
| 88-131 | 67.96 | 15.91 | 1.26 | 1.86 | 1.17 | 3.67 | 4.76 | 1.30 | 0.34 | 0.15 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.8 | 98.41 |
| 88-147 | 67.96 | 16.49 | 0.75 | 1.64 | 1.03 | 2.39 | 5.12 | 1.16 | 0.25 | 0.07 | 0.04 | 0.11 | 0.00 | 0.00 | 0.00 | 1.4 | 97.85 |
| 88-152 | 62.00 | 15.84 | 2.02 | 3.32 | 3.13 | 6.54 | 2.97 | 1.30 | 0.59 | 0.19 | 0.08 | 0.16 | 0.00 | 0.00 | 0.00 | 0.9 | 98.14 |
| 88-215 | 62.03 | 16.29 | 1.71 | 2.78 | 2.38 | 4.02 | 4.19 | 3.98 | 0.42 | 0.20 | 0.09 | 0.04 | 0.00 | 0.00 | 0.00 | 0.7 | 98.13 |
| 88-219 | 50.33 | 14.13 | 4.47 | 11.24 | 5.16 | 7.99 | 2.39 | 0.58 | 1.45 | 0.12 | 0.24 | 0.11 | 0.10 | 0.00 | 0.00 | 0.6 | 98.31 |
| 88-221 | 66.55 | 16.31 | 1.14 | 1.86 | 1.27 | 2.77 | 4.10 | 3.51 | 0.29 | 0.15 | 0.05 | 0.02 | 0.00 | 0.00 | 0.0 | 0.7 | 98.02 |
| 88-236 | 68.33 | 15.81 | 1.07 | 1.52 | 1.05 | 3.12 | 4.05 | 2.22 | 0.25 | 0.07 | 0.05 | 0.19 | 0.01 | 0.00 | 0.00 | 0.8 | 97.74 |
| 88-242 | 62.49 | 14.93 | 1.85 | 3.97 | 1.09 | 5.54 | 4.04 | 1.66 | 0.94 | 0.23 | 0.18 | 1.45 | 0.01 | 0.00 | 0.00 | 2.0 | 98.38 |
| 89-195 | 68.09 | 15.77 | 1.74 | 0.87 | 0.57 | 1.70 | 4.40 | 4.50 | 0.28 | 0.14 | 0.06 | 0.07 | 0.00 | 0.00 | 0.00 | 0.5 | 98.19 |
| 89-199 | 44.04 | 7.99 | 3.22 | 7.29 | 21.47 | 8.37 | 0.45 | 0.05 | 0.47 | 0.02 | 0.16 | 0.11 | 0.02 | 0.00 | 0.00 | 4.8 | 93.66 |
| 89-202 | 49.86 | 12.26 | 3.13 | 9.22 | 9.00 | 10.39 | 2.28 | 0.44 | 0.79 | 0.00 | 0.24 | 0.06 | 0.02 | 0.00 | 0.00 | 1.0 | 97.70 |
| 89-214 | 71.76 | 15.23 | 0.55 | 1.87 | 0.53 | 3.07 | 4.20 | 1.02 | 0.27 | 0.10 | 0.06 | 0.15 | 0.01 | 0.00 | 0.00 | 0.5 | 98.87 |
| 89-235 | 71.86 | 16.09 | 0.90 | 0.64 | 0.35 | 1.12 | 6.15 | 0.93 | 0.15 | 0.04 | 0.02 | 0.03 | 0.02 | 0.00 | 0.00 | 1.0 | 98.30 |
| 89-240A | 69.21 | 15.82 | 0.79 | 1.80 | 1.01 | 3.34 | 4.34 | 1.38 | 0.27 | 0.08 | 0.04 | 0.37 | 0.06 | 0.00 | 0.00 | 1.2 | 98.51 |
| 89-240B | 50.28 | 13.96 | 3.90 | 10.54 | 4.71 | 9.32 | 2.17 | 0.55 | 1.31 | 0.13 | 0.25 | 0.03 | 0.12 | 0.00 | 0.00 | 0.9 | 97.27 |
| 89-241 | 51.36 | 14.28 | 2.42 | 7.63 | 7.50 | 12.01 | 1.08 | 0.08 | 0.64 | 0.05 | 0.15 | 0.05 | 0.01 | 0.00 | 0.00 | 0.8 | 97.26 |
| 89-247 | 49.03 | 14.63 | 2.71 | 10.63 | 7.00 | 9.01 | 3.05 | 0.29 | 1.01 | 0.09 | 0.24 | 0.06 | 0.03 | 0.00 | 0.00 | 0.9 | 97.78 |

Appendix I cont'd

| Sample Number | $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MgO | CaO | $Na_2O$ | $K_2O$ | $TiO_2$ | $P_2O_5$ | MnO | $CO_2$ | S | $H_2O^+$ | $H_2O^-$ | L.O.I. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 89-248 | 70.90 | 15.85 | 0.35 | 0.99 | 0.40 | 2.27 | 5.20 | 1.13 | 0.19 | 0.07 | 0.01 | 0.60 | 0.00 | 0.00 | 0.00 | 1.3 | 98.32 |
| 89-259 | 69.53 | 15.72 | 1.14 | 1.93 | 0.80 | 2.55 | 4.77 | 1.12 | 0.38 | 0.11 | 0.05 | 0.26 | 0.00 | 0.00 | 0.00 | 0.7 | 98.34 |
| 89-277 | 49.77 | 14.86 | 2.05 | 8.17 | 7.90 | 11.93 | 1.74 | 0.06 | 0.62 | 0.05 | 0.18 | 0.03 | 0.04 | 0.00 | 0.00 | 0.7 | 97.40 |
| 89-281 | 69.76 | 15.53 | 1.25 | 1.80 | 0.79 | 3.31 | 4.36 | 1.08 | 0.30 | 0.10 | 0.05 | 0.04 | 0.00 | 0.00 | 0.00 | 0.7 | 98.37 |
| 89-283A | 69.85 | 15.36 | 1.01 | 2.04 | 0.75 | 3.77 | 4.36 | 1.11 | 0.30 | 0.08 | 0.05 | 0.12 | 0.01 | 0.00 | 0.00 | 0.5 | 98.81 |
| 89-283C | 51.41 | 13.80 | 3.33 | 9.47 | 5.72 | 8.43 | 3.90 | 0.21 | 1.10 | 0.08 | 0.20 | 0.05 | 0.00 | 0.00 | 0.00 | 0.1 | 97.84 |
| 89-296 | 69.64 | 14.42 | 0.74 | 1.16 | 0.52 | 3.04 | 4.30 | 0.45 | 0.22 | 0.06 | 0.03 | 0.70 | 0.13 | 0.00 | 0.00 | 2.0 | 97.58 |
| 89-305A | 69.16 | 15.06 | 1.17 | 1.04 | 0.82 | 3.54 | 3.20 | 2.98 | 0.23 | 0.05 | 0.05 | 0.53 | 0.39 | 0.00 | 0.00 | 1.4 | 98.28 |

## APPENDIX IB

## WHOLE ROCK GEOCHEMISTRY
## SAMPLE DESCRIPTIONS

| SAMPLE NUMBER | DESCRIPTION |
|---|---|
| 88-061 | strongly foliated biotite granodiorite; light grey, medium-grained; Kabinakagami Lake, Schist Bay, Lipton Twp. |
| 88-088A | strongly foliated, siliceous granodiorite sill; Hiawatha Mine site, Kabinakagami Lake, Lizar Twp. |
| 88-088C | fresh, strongly foliated, biotite granodiorite sill from rock dump; Hiawatha Mine site, Kabinakagami Lake, Lizar Twp. |
| 88-088E | fine-grained, light grey felsic to intermediate metavolcanic rock; Hiawatha Mine site, Kabinakagami Lake, Lizar Twp. |
| 88-108 | moderately foliated, light grey, medium-grained, biotite granodiorite; Kabinakagami Lake, Derry Twp. |
| 88-131 | very strongly foliated, medium-grained, light grey, biotite granodiorite; Pine Portage Bay, Kabinakagami Lake, Derry Twp. |
| 88-147 | fine-grained, light grey, felsic to intermediate metavolcanic rock; Kabinakagami Lake, Lizar Twp. |
| 88-162 | fine- to medium-grained, intermediate matrix of fragmental unit; Kaby Lodge, Kabinakagami Lake, Lizar Twp. |
| 88-215 | white to light pink, medium-grained, massive quartz monzonite (?); islands south of Agamik Island, Kabinakagami Lake, Ermine Twp. |
| 88-219 | strongly foliated, fine- to medium-grained mafic metavolcanic rock; islands west of Windy Point, Kabinakagami Lake, Lizar Twp. |
| 88-221 | weakly foliated, light pink, medium-grained monzonite; Kabinakagami Lake, Ermine Twp. |

| | |
|---|---|
| 88-236 | massive, fine- to medium-grained intermediate to felsic metavolcanic rock; Kabinakagami Lake, Lizar Twp |
| 88-242 | massive, fine- to medium-grained, light grey weathering, metasedimentary rock; Kabinakagami Lake, Lizar Twp. |
| 89-195 | weakly foliated, fine-grained aplite dike in mafic metavolcanic rocks; southwestern Hawkins Twp. |
| 89-199 | fine-grained, moderately foliated, mafic metavolcanic rock; southwestern Hawkins Twp. |
| 89-202 | medium- to coarse-grained, strongly foliated mafic metavolcanic rock; southwestern Hawkins Twp. |
| 89-214 | fine- to medium-grained quartz, feldspar porphyry dike; southwestern Hawkins Twp. |
| 89-235 | medium-grained, equigranular, biotite tonalite; south-central Hawkins Twp. |
| 89-240A | strongly foliated biotite tonalite in contact with mafic metavolcanic rocks; central Hawkins Twp. |
| 89-240B | strongly foliated, carbonatized, medium-grained, mafic metavolcanic rock; central Hawkins Twp. |
| 89-241 | strongly foliated, very fine-grained, mafic metavolcanic rock; central Hawkins Twp. |
| 89-247 | coarse-grained, carbonatized, hornblende-rich mafic metavolcanic; west-central Hawkins Twp. |
| 89-248 | strongly foliated, pyritiferous, fine-grained quartz porphyry sill/dike; west central Hawkins Twp. |
| 89-259 | strongly foliated, fine-grained, light grey quartz-feldspar porphyry sill/dike; west central Hawkins Twp. |
| 89-277 | strongly foliated, fine-grained mafic metavolcanic rock; southwestern Hawkins Twp. |
| 89-281 | strongly foliated, fine grained intermediate |

metavolcanic; southwestern Hawkins Twp.

| | |
|---|---|
| 89-283A | strongly foliated, medium-grained light grey quartz porphyry; southwestern Hawkins Twp. |
| 89-283C | coarse-grained, moderately foliated mafic metavolcanic rocks; southwestern Hawkins Twp. |
| 89-296 | strongly foliated, medium-grained, pyritiferous intermediate metavolcanics; central Hawkins Twp. |
| 89-305A | strongly foliated, fine- to medium-grained intermediate to felsic metavolcanic rocks from muck pile; Shenango Gold Mine, central Hawkins Twp. |

| APPENDIX II: WHOLE ROCK CHEMICAL ANALYSES OF TYPICAL METAVOLCANICS (Siragusa 1977) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Number | $SiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MgO | CaO | $Na_2O$ | $K_2O$ | $TiO_2$ | $P_2O_5$ | S | MnO | $CO_2$ | $H_2O^+$ | $H_2O^-$ | Total |
| 1 | 48.60 | 12.30 | 2.02 | 9.75 | 8.89 | 12.60 | 1.62 | 0.10 | 0.93 | 0.06 | 0.01 | 0.23 | 0.25 | 1.81 | 0.91 | 100.08 |
| 2 | 50.20 | 14.60 | 2.38 | 13.60 | 2.67 | 8.25 | 2.72 | 0.46 | 1.71 | 0.14 | 0.05 | 0.37 | 0.10 | 1.54 | 0.23 | 99.02 |
| 3 | 49.40 | 14.50 | 1.60 | 9.35 | 9.81 | 9.30 | 2.40 | 0.29 | 0.73 | 0.06 | 0.01 | 0.20 | 0.10 | 1.47 | 0.22 | 99.44 |
| 4 | 53.20 | 15.00 | 1.42 | 9.75 | 5.50 | 9.88 | 1.98 | 0.31 | 1.10 | 0.13 | 0.01 | 0.32 | 0.15 | 0.87 | 0.16 | 99.78 |
| 5 | 53.20 | 13.70 | 1.50 | 9.00 | 9.20 | 11.00 | 1.87 | 0.07 | 0.77 | 0.07 | 0.01 | 0.20 | 1.10 | 1.10 | 0.14 | 99.93 |
| 6 | 47.80 | 10.70 | 1.85 | 8.65 | 16.20 | 11.10 | 1.16 | 0.07 | 0.52 | 0.04 | 0.01 | 2.25 | 0.10 | 1.88 | 0.13 | 102.66 |
| 7 | 48.20 | 14.80 | 1.75 | 9.50 | 7.65 | 12.00 | 1.64 | 0.13 | 0.98 | 0.10 | 0.06 | 0.21 | 0.10 | 1.11 | 0.10 | 99.13 |
| 8 | 74.00 | 14.60 | 0.44 | 1.11 | 0.10 | 2.27 | 6.04 | 0.48 | 0.16 | 0.05 | 0.02 | 0.03 | 0.10 | 0.53 | 0.09 | 100.02 |
| 9 | 73.20 | 16.30 | 1.17 | 0.29 | 0.45 | 0.39 | 1.75 | 3.88 | 0.27 | 0.06 | 0.41 | 0.02 | 0.05 | 1.66 | 0.11 | 100.01 |
| 10 | 70.60 | 15.20 | 0.73 | 1.40 | 0.91 | 2.90 | 3.88 | 2.58 | 0.24 | 0.07 | 0.31 | 0.05 | 0.85 | 0.91 | 0.10 | 100.737 |

Samples 1 to 7 are mafic metavolcanic rocks from Dorry Township, and samples 8 to 10 are felsic metavolcanic interbeds from Lizar Township (specific locations are unknown).

## CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

| Conversion from SI to Imperial | | | Conversion from Imperial to SI | | |
|---|---|---|---|---|---|
| *SI Unit* | *Multiplied by* | *Gives* | *Imperial Unit* | *Multiplied by* | *Gives* |
| | | | **LENGTH** | | |
| 1 mm | 0.039 37 | inches | 1 inch | **25.4** | mm |
| 1 cm | 0.393 70 | inches | 1 inch | **2.54** | cm |
| 1 m | 3.280 84 | feet | 1 foot | **0.304 8** | m |
| 1 m | 0.049 709 7 | chains | 1 chain | 20.116 8 | m |
| 1 km | 0.621 371 | miles (statute) | 1 mile (statute) | **1.609 344** | km |
| | | | **AREA** | | |
| 1 cm@ | 0.155 0 | square inches | 1 square inch | **6.451 6** | cm@ |
| 1 m@ | 10.763 9 | square feet | 1 square foot | **0.092 903 04** | m@ |
| 1 km@ | 0.386 10 | square miles | 1 square mile | 2.589 988 | km@ |
| 1 ha | 2.471 054 | acres | 1 acre | 0.404 685 6 | ha |
| | | | **VOLUME** | | |
| 1 cm# | 0.061 02 | cubic inches | 1 cubic inch | **16.387 064** | cm# |
| 1 m# | 35.314 7 | cubic feet | 1 cubic foot | 0.028 316 85 | m# |
| 1 m# | 1.308 0 | cubic yards | 1 cubic yard | 0.764 555 | m# |
| | | | **CAPACITY** | | |
| 1 L | 1.759 755 | pints | 1 pint | 0.568 261 | L |
| 1 L | 0.879 877 | quarts | 1 quart | 1.136 522 | L |
| 1 L | 0.219 969 | gallons | 1 gallon | **4.546 090** | L |
| | | | **MASS** | | |
| 1 g | 0.035 273 96 | ounces (avdp) | 1 ounce (avdp) | 28.349 523 | g |
| 1 g | 0.032 150 75 | ounces (troy) | 1 ounce (troy) | **31.103 476 8** | g |
| 1 kg | 2.204 62 | pounds (avdp) | 1 pound (avdp) | **0.453 592 37** | kg |
| 1 kg | 0.001 102 3 | tons (short) | 1 ton (short) | **907.184 74** | kg |
| 1 t | 1.102 311 | tons (short) | 1 ton (short) | **0.907 184 74** | t |
| 1 kg | 0.000 984 21 | tons (long) | 1 ton (long) | **1016.046 908 8** | kg |
| 1 t | 0.984 206 5 | tons (long) | 1 ton (long) | **1.016 046 908 8** | t |
| | | | **CONCENTRATION** | | |
| 1 g/t | 0.029 166 6 | ounce (troy)/ ton (short) | 1 ounce (troy)/ ton (short) | 34.285 714 2 | g/t |
| 1 g/t | 0.583 333 33 | pennyweights/ ton (short) | 1 pennyweight/ ton (short) | 1.714 285 7 | g/t |

### OTHER USEFUL CONVERSION FACTORS

| | *Multiplied by* | |
|---|---|---|
| 1 ounce (troy) per ton (short) | 20.0 | pennyweights per ton (short) |
| 1 pennyweight per ton (short) | 0.05 | ounces (troy) per ton (short) |

*Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.*

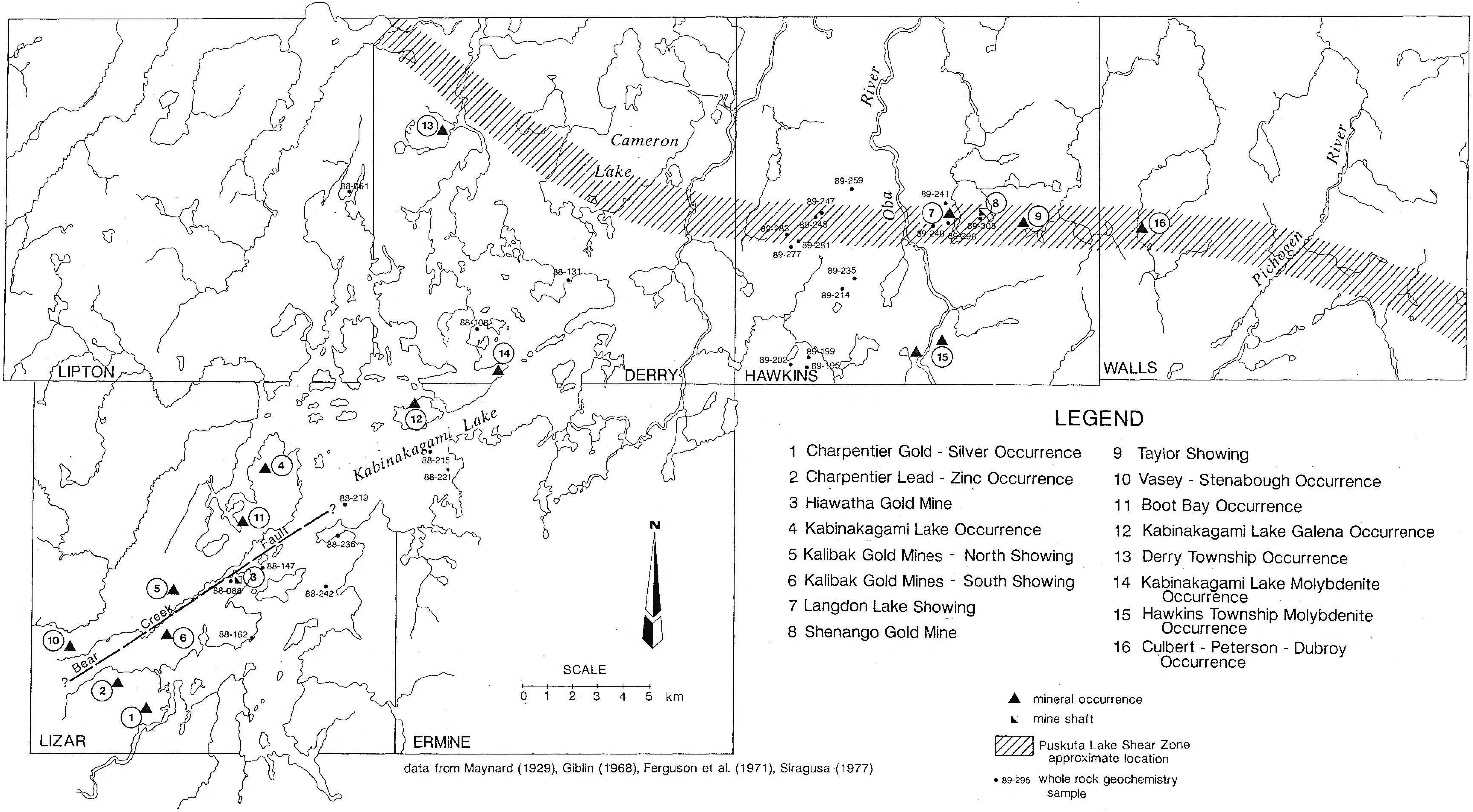



Figure 2: Mineral occurrences and whole rock geochemical sample sites, Kabinakagami Lake area

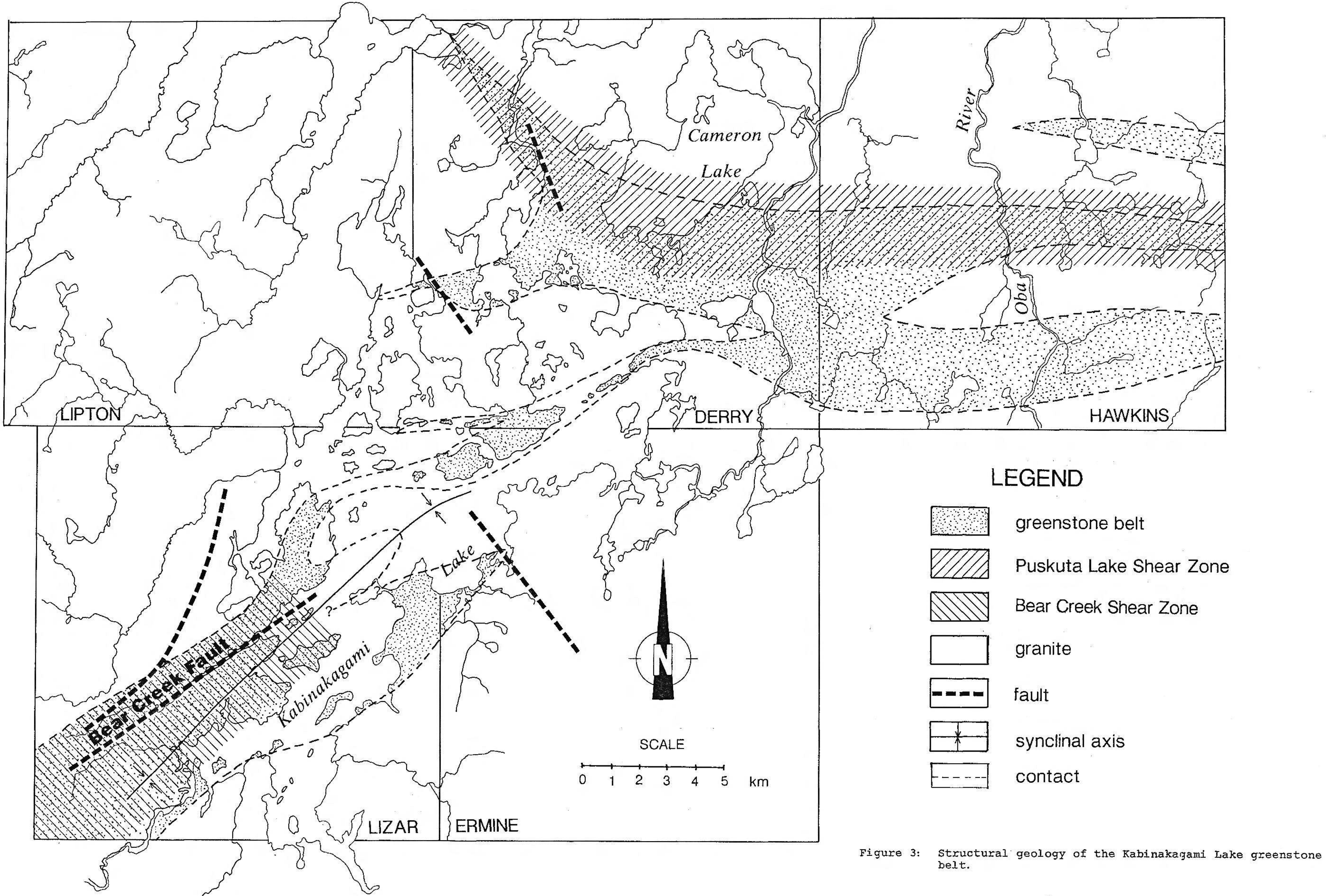



Figure 3: Structural geology of the Kabinakagami Lake greenstone belt.

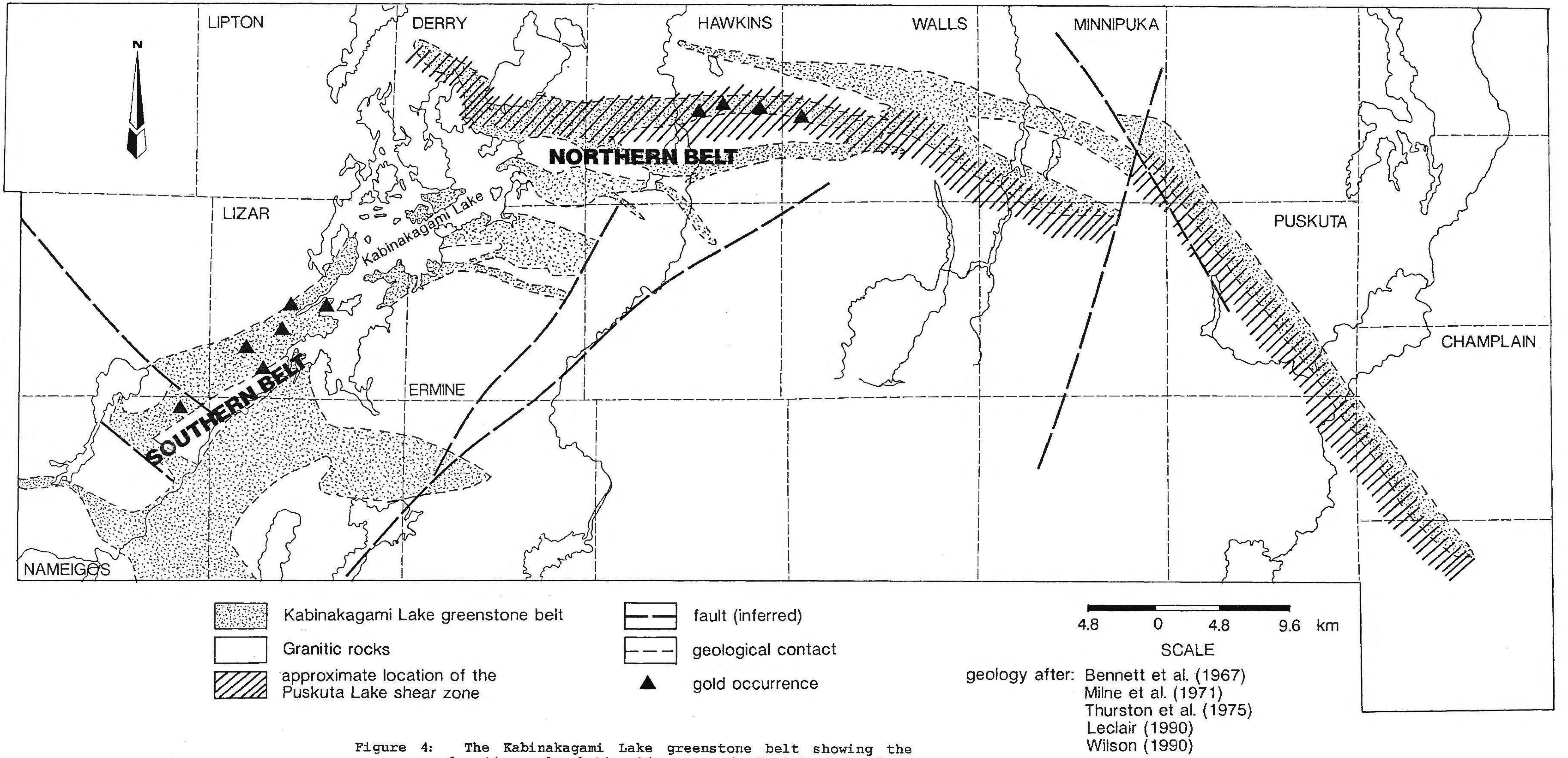



Figure 4: The Kabinakagami Lake greenstone belt showing the location and relationship among the Puskuta Lake shear zone, the known mineral occurrences and the location of the northern and southern belt subdivisions.


Figure 6: Geology of the Hiawatha Gold Mine, Lizar Township.

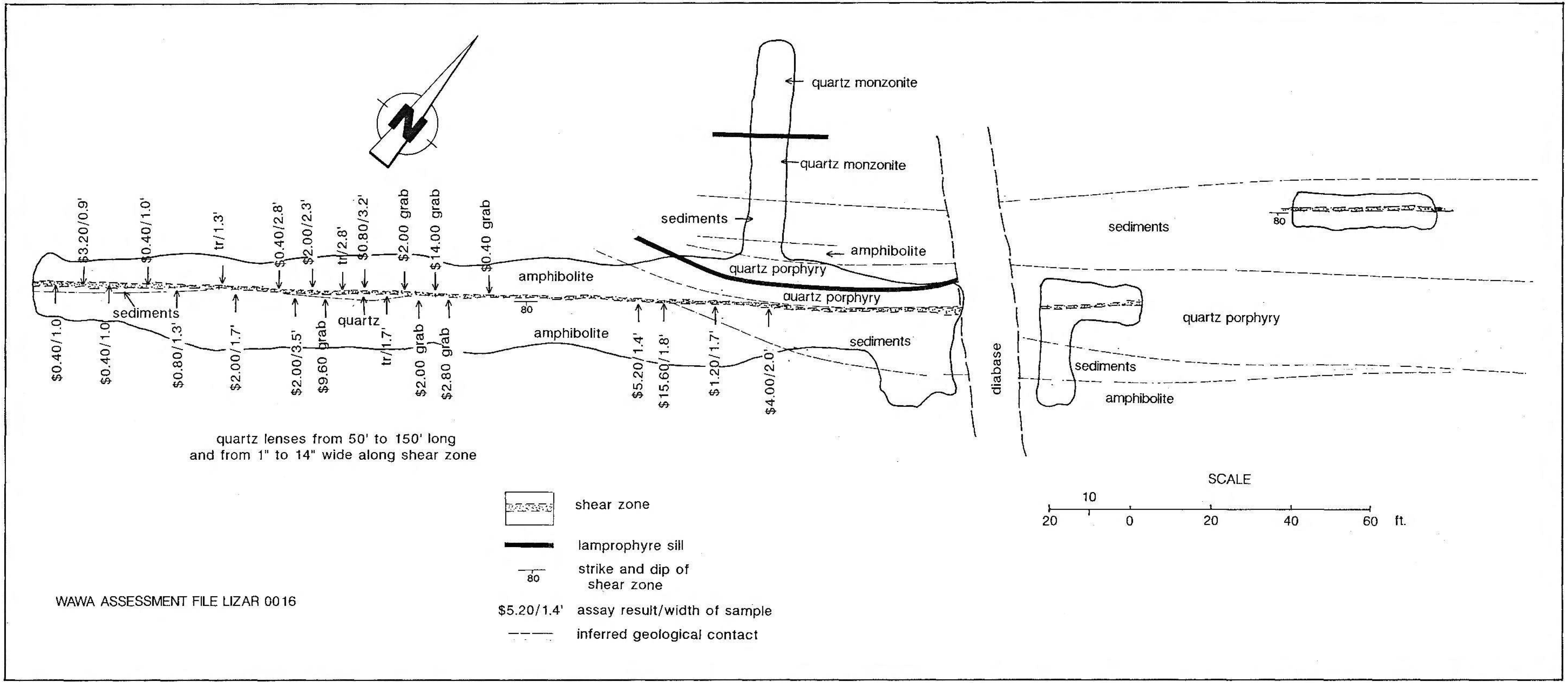



Figure 8: Vasey-Stenabough Occurrence, Lizar Township - 1937 trench plan showing locations of assay samples and relationship between the quartz veins and the geology.

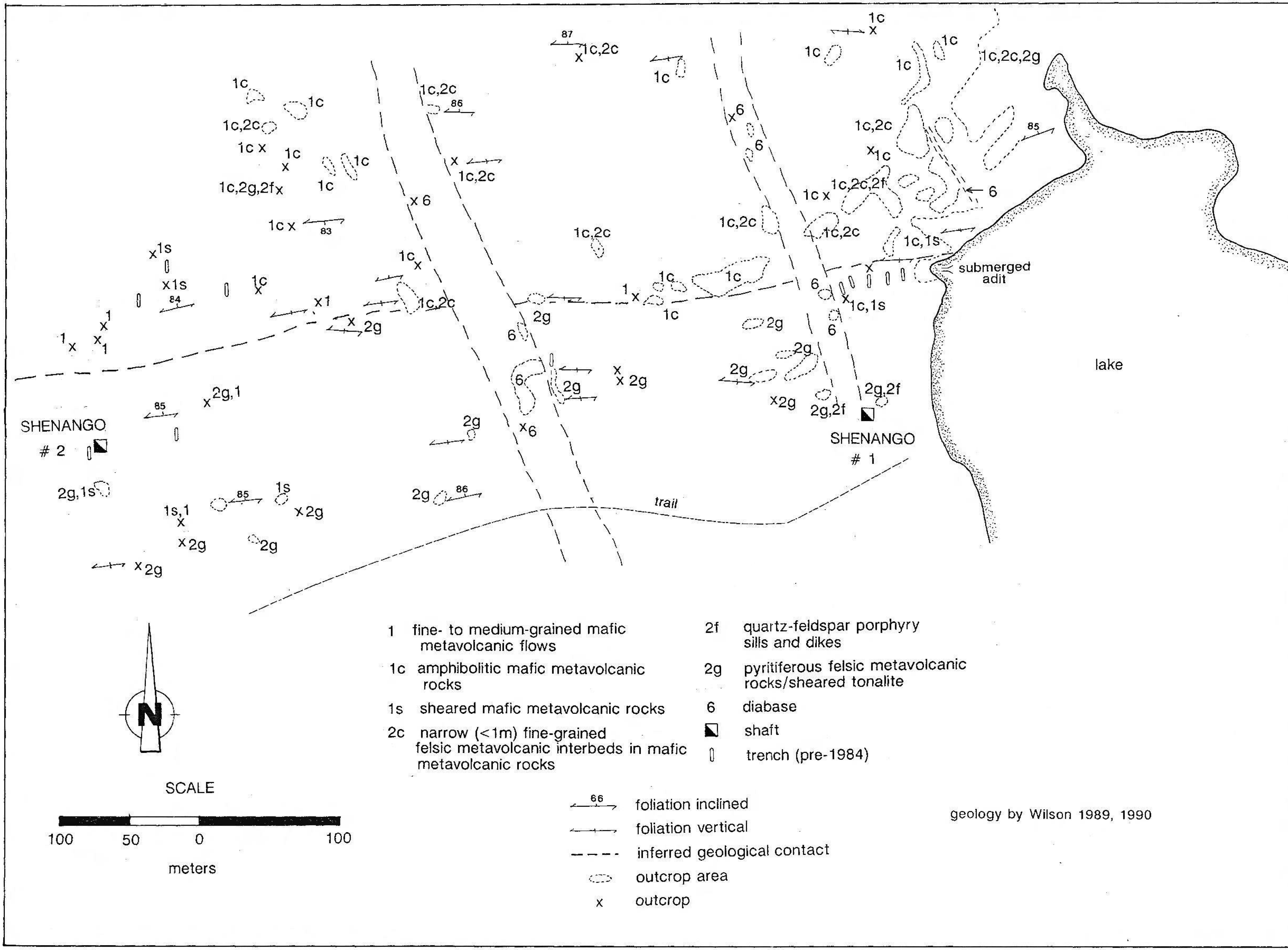
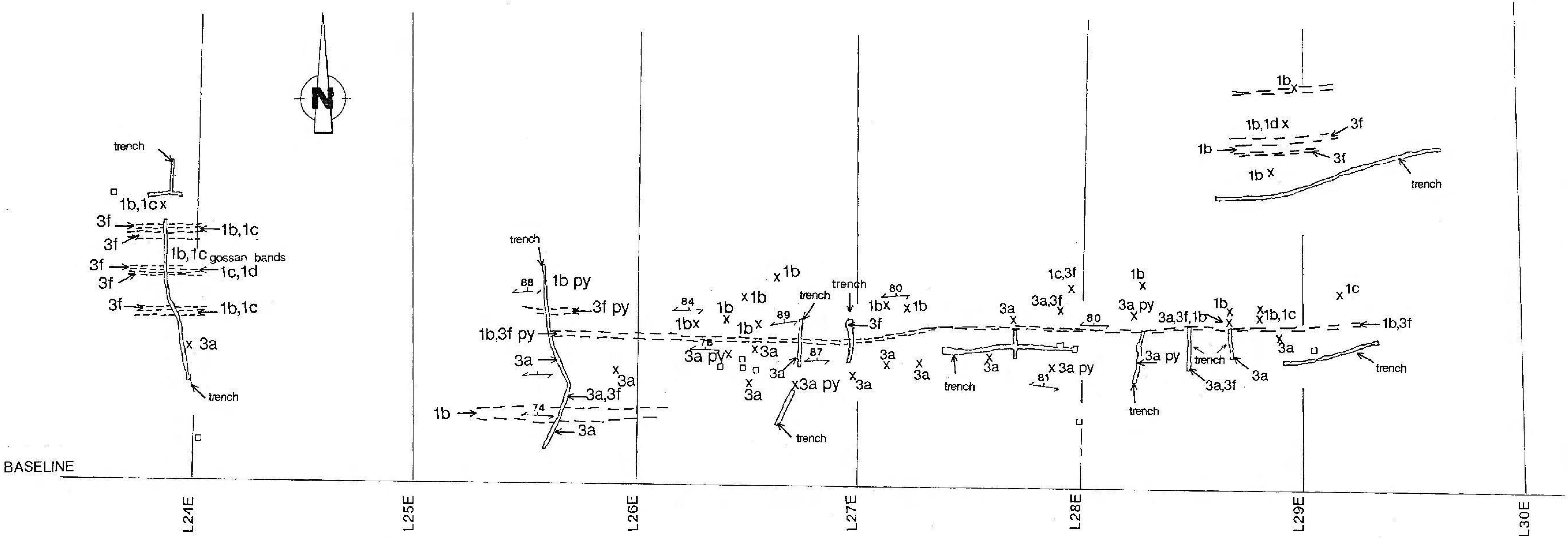



Figure 10: Geology of the Shenango Gold Mine, Hawkins Township.




50 25 0 50 meters

SCALE

geology by St. Joseph Explorations Limited (1981)

WAWA ASSESSMENT FILE HAWKINS 0011

- 3a rhyolite tuff
- 3f sheared felsic rocks (includes aplite and feldspar porphyry)
- 1b amphibole-biotite mafic metavolcanic rocks
- 1c layered/banded amphibolite
- 1d massive fine-grained amphibolite
- py pyrite
- ▫ pit
- 38 foliation inclined
- --- contact (inferred)
- x outcrop


Precambrian Geology
KABINAKAGAMI LAKE GREENSTONE BELT
DERRY, ERMINE, HAWKINS, LIPTON AND LIZAR TOWNSHIPS
District of Algoma
SCALE
1:31 680
LEGEND
6 MAFIC INTRUSIVE ROCKS
6 diabase dike
6a porphyritic (plagioclase) diabase dike
6b lamprophyre dike with magnetite phenocrysts
Intrusive Contact
5 FELSIC INTRUSIVE ROCKS
5 undifferentiated
5a biotite trondhjemite to granodiorite
5b potassium feldspar porphyritic biotite trondhjemite to granodiorite
5c gneissic trondhjemite to granodiorite
5d hornblende–biotite trodhjemite to granodiorite
5e garnetiferous hornblende–biotite trondhjemite to granodiorite
5f biotite–hornblende granodiorite to diorite
5g undifferentiated felsic intursive rock with magnetite phenocrysts
5h aplitic veins and dikes
5j biotite pegmatite veins and dikes
5k granitic rocks containing hornblende–rich xenoliths
5m migmatite
5p hornblende granodiorite to quartz monzonite
5q sheared tonalite
5r undifferentiated gneissic intrusive
Intrusive Contact
4 MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS
G4 metagabbro (geophysically interpreted)
Intrusive Contact
3 CLASTIC METASEDIMENTARY ROCKS
3 undifferentiated
3a foliated wacke, siltstone
3b garnetiferous wacke, siltstone
3c wacke/granite intrusion breccia
2 INTERMEDIATE TO FELSIC METAVOLCANIC ROCKS
2 undifferentiated
2a foliated felsic flows
2b quartz porphyritic felsic flows
2c felsic sills
2d tuff
2e monolithic breccia
2f quartz–feldspar porphyry dikes and sills
2g sheared pyritiferous flows
2h heterolithic breccia
1 MAFIC TO INTERMEDIATE METAVOLCANIC ROCKS
1 foliated fine– to medium–grained flows
1b pillowed flows
1c amphibolitic mafic metavolcanics
1d foliated fine– to medium–grained flows containing epidote and quartz lenses
1e finely layered mafic and felsic flows
1f mafic sills
1g flow top breccia
1h monolithic breccia (mafic fragments in mafic groundmass)
1j monolithic breccia (felsic fragments in mafic groundmass)
1k heterolithic mafic breccia
1m garnetiferous mafic metavolcanics
1q chlorite schist
1r intrusion breccia
1s sheared mafic metavolcanics
small bedrock outcrop
area of bedrock outcrop
geological contact; position interpreted
fault; position interpreted
foliation (inclined, vertical)
jointing (inclined, vertical)
bedding (inclined, vertical)
lineation with plunge
mineral occurrence
trench
shaft
Au gold
cp chalcopyrite
gn galena
mo molybdenite
PROPERTIES, MINERAL OCCURRENCES
1 Charpentier Gold – Silver Occurrence
2 Charpentier Lead – Zinc Occurrence
3 Hiawatha Gold Mine
4 Kabinakagami Lake Occurrence (J. Perkin Occurrence)
5 Kalibak Gold Mine – North Showing
6 Kalibak Gold Mine – South Showing
7 Langdon Showing
8 Shenango Gold Mine
9 Taylor Showing
10 Vasey – Stenabough Occurrence
SOURCES OF INFORMATION
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ODM–GSC 1963a. Gourlay Lake; Map 2195G, scale 1:63 360
ODM–GSC 1963b. Hornepayne; Map 2196G, scale 1:63 360
ODM–GSC 1963c. Kabinakagami Lake; Map 2209G, scale 1:63 360
ODM–GSC 1963d. Goat River; Map 2223G, scale 1:63 360
OGS 1973a. Kabinakagami Lake Area; Preliminary Map P.812, scale 1:31 680
OGS 1973b. Kabinakagami Lake Area; Preliminary Map P.813, scale 1:31 680
Files of the Resident Geologist's Office, Wawa
NTS Reference 42 C/15, 42 C/16, 42 F/1
LIPTON
DERRY
HAWKINS
Cameron Lake
Kabinakagami Lake
Oba River
Derry Lake
Hawkins Lake
Dubroy Lake
C.N.R.