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Exploration for Gold in Southeastern Ontario, 1980–1990

By

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ABSTRACT

Interest in gold occurrences of the Grenville Province in southeastern Ontario, relatively dormant since the late 1930's, was revived in the 1980's. New gold discoveries and new information about previously known occurrences, generated by the recent high level of exploration activity, are documented in this report.

The occurrences are classified according to host rock type and the general characteristics of each group are described. Occurrences hosted by intrusive, metavolcanic, and metasedimentary rocks are spatially associated with a major contact between mafic metavolcanics of the Tudor Formation and overlying clastic and chemical metasediments. Several occur at the contact within a hornblende-biotite-garnet schist, an extensive metasedimentary unit conformably overlying the metavolcanics. This unit is correlated with the Ore Chimney Formation, previously thought to unconformably overlie the Tudor Formation. A genetic link between the gold occurrences and metasediments directly overlying the Tudor Formation is postulated.

All of the occurrences consist of mineralized quartz veins, with gold mineralization rarely extending into the altered host rock. Veins were localized within dilatant zones related to shearing or folding of relatively competent rocks and were probably derived from metamorphic fluids during retrograde metamorphism. Two major north-northeast trending shear zones exhibit strong

carbonate and silica alteration with local concentrations of gold mineralization.

Although the majority of occurrences are sub-economic, the recent discovery of two potentially economic deposits -- one a small, high-grade zone and the other a large tonnage, low grade prospect -- indicates that continued exploration for gold in southeastern Ontario is warranted.

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P.W. Kingston, Resident Geologist, Ministry of Northern Development and Mines, Tweed, initiated this study and critically reviewed the final manuscript.

EXPLORATION FOR GOLD IN SOUTHEASTERN ONTARIO, 1980-1990

by: P.S. LeBaron[1]

INTRODUCTION

This report summarizes the results of gold exploration activities in southeastern Ontario in the years 1980-1990. It is intended to be supplementary to Open File Report 5548, "Base Metal, Molybdenum and Precious Metal Deposits of the Madoc-Sharbot Lake Area, Southeastern Ontario" (Malczak et al 1985) and Mineral Deposits Circular 20, "Geology of Base Metal, Precious Metal, Iron, and Molybdenum Deposits in the Pembroke-Renfrew Area" (Carter et al 1980), which contain descriptions of most of the gold occurrences in southeastern Ontario. Only those occurrences which have undergone substantial bedrock exploration programs (diamond drilling and/or trenching) since 1980, recently discovered occurrences not previously documented, and previously known occurrences not included in either of the aforementioned publications are described in this report.

Records of numerous other gold exploration activities in southeastern Ontario, including airborne and ground geophysical surveys, geochemical and geological surveys, and limited prospecting and trenching activities are available in assessment files at the Resident Geologist's Office in Tweed and at the Assessment Files Research Office, Ontario Geological Survey, Toronto.

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The primary sources of information for this report are assessment files, private company reports, existing publications and, in some cases, field examinations by the author.

A substantial amount of new information relating specifically to gold mineralization in southeastern Ontario has been generated by a high level of exploration activity in the 1980's. Much of the previous documentation is based upon work carried out prior to 1940, beginning with the discovery of gold at the Richardson Mine at Eldorado in 1866. Sporadic exploration and development continued into the next century, culminating during the period 1895 to 1908, during which time 12 mines were operating. Little activity was recorded between 1908 and the mid 1930's, at which time Cominco Limited carried out underground development at the Addington and Cordova mines and surface exploration at several other occurrences (Kingston and Papertzian 1982).

The recent renewal of activity in the area is the result of a large increase in the price of gold in the late 1970's, the availability of exploration capital raised by "flow-through financing", and significant new discoveries of gold mineralization in the 1980's.

The price of gold increased from U.S. $35 per ounce in 1970 to over $300 in 1979. After peaking at a high of $850 per ounce in 1980, the price remained within the $350 to $450 range throughout the 1980's (Audet 1990). In 1983, an alteration of the Canadian Income Tax Act allowed an earned depletion deduction of 133 1/3% for exploration and development funds to be transferred to

individual investors. Under this program, known as flow-through financing, mining companies were able to raise unprecedented amounts of investment capital for exploration activities and some of this was directed toward the historical gold mining areas of southeastern Ontario. The discovery of high grade gold mineralization near Bannockburn in 1984 (Mono Prospect, Mono Gold Mines Inc.) and a large tonnage, low grade gold prospect near Malone in 1985 (Dingman Prospect, Noranda Exploration Company Limited) encouraged the continuation of exploration in the area. However, the past year (1990) has seen a substantial drop in the level of gold exploration activity, presumably due in part to the removal of flow-through financing at the end of 1989 and the current economic recession (1991).

In addition to descriptions of gold occurrences, this report presents brief descriptions of the geology of southeastern Ontario, the distribution of gold occurrences, and general characteristics of the occurrences. A more complete report on the geology of the area is presented by Carter (1984). Historical information as well as geological descriptions of most of the gold occurrences in southeastern Ontario are contained in reports by Carter et al (1980), Carter (1984) and Malczak et al (1985).

LOCATION OF THE STUDY AREA

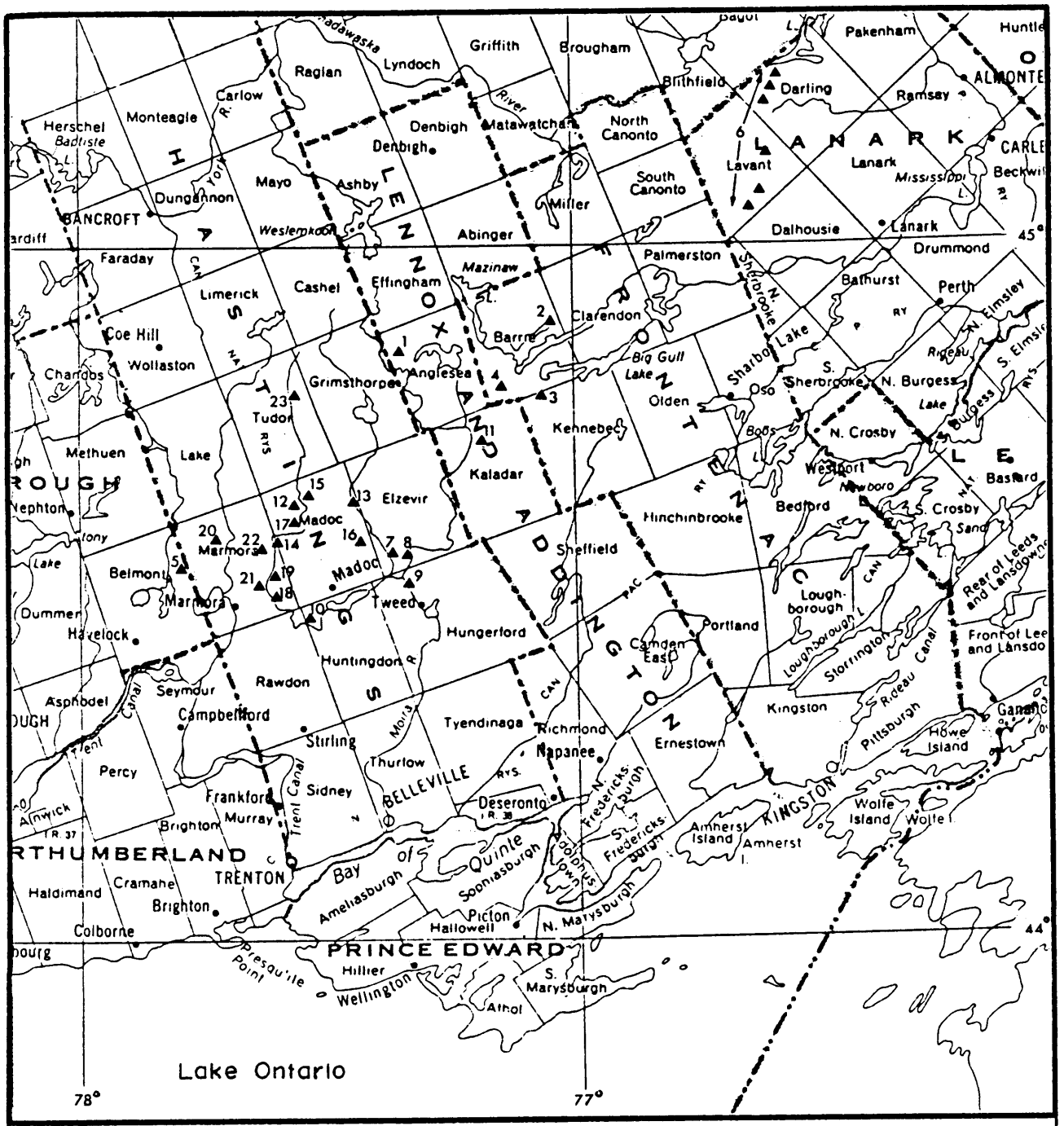
The gold occurrences described in this report are located in two areas: 1) the Havelock-Tweed-Gilmour-Fernleigh area in the northwest quarter of NTS sheet 31C (Kingston) and 2) the Lavant-White Lake area in the southeast quarter of NTS sheet 31F (Pembroke).

Both lie within an area extending from latitudes 44° 25' to 45° 15' and longitudes 76° 30' W to 77° 50' W. Figure 1 shows the approximate locations of the gold occurrences described in this report.

REGIONAL GEOLOGY

The study area is underlain by Precambrian rocks of the Central Metasedimentary Belt of the Grenville Province. More specifically, these rocks belong to the Grenville Supergroup, a suite of metamorphosed volcanic, carbonate, and calcareous and non-calcareous siliceous clastic sedimentary rocks (Figure 2). Deposition of the oldest rocks, metavolcanics of the Tudor Formation, began about 1300 Ma ago followed by clastic and chemical (carbonate) sedimentation and locally repeated volcanic-sedimentary cycles (Bartlett and Moore 1985). A complex suite of plutonic rocks was emplaced between about 1250 and 1100 Ma ago and younger metasediments of the Flinton Group were deposited between about 1100 and 1025 Ma ago (Carter 1984).

The Grenville Orogeny, which culminated about 1100 to 1000 Ma ago, superimposed a northeast structural trend over most of the



▲ Gold occurrence (occurrence names are listed with corresponding numbers in table 1)

Figure 1. Location of the study area, showing gold occurrences described in this report.

Central Metasedimentary Belt and produced regional metamorphic grades ranging from greenschist facies near Madoc to granulite facies north of Kingston (Figure 2).

The Central Metasedimentary Belt is bounded by older rocks of the Ontario Gneiss Segment of the Central Gneiss Belt to the north and west and by overlying Paleozoic sedimentary rocks of the St. Lawrence Platform to the south and east.

GEOLOGY OF THE GOLD OCCURRENCES

General metamorphic, lithologic, and structural associations

Figure 2 indicates a close spatial association of gold occurrences with a large area of low grade metamorphism north of Madoc and a small area of similar grade in Darling and Lavant townships south of Renfrew. Most of the occurrences are hosted by greenschist facies rocks within these zones and several occur within a zone of lower amphibolite facies rocks extending northeastward from the Madoc area metamorphic low.

As indicated on the accompanying map, which shows locations of gold occurrences on a geological base map obtained from Kingston et at (1985), and Figure 8 which shows the Darling-Lavant area occurrences, the gold occurrences also show a spatial association with metavolcanic rocks within and close to the areas of low metamorphic grade. Although gold mineralization is hosted by quartz and quartz-ankerite veins in carbonate and siliciclastic metasediments, metavolcanics, and granitic and gabbroic intrusive rocks, those hosted by metasediments are generally located close

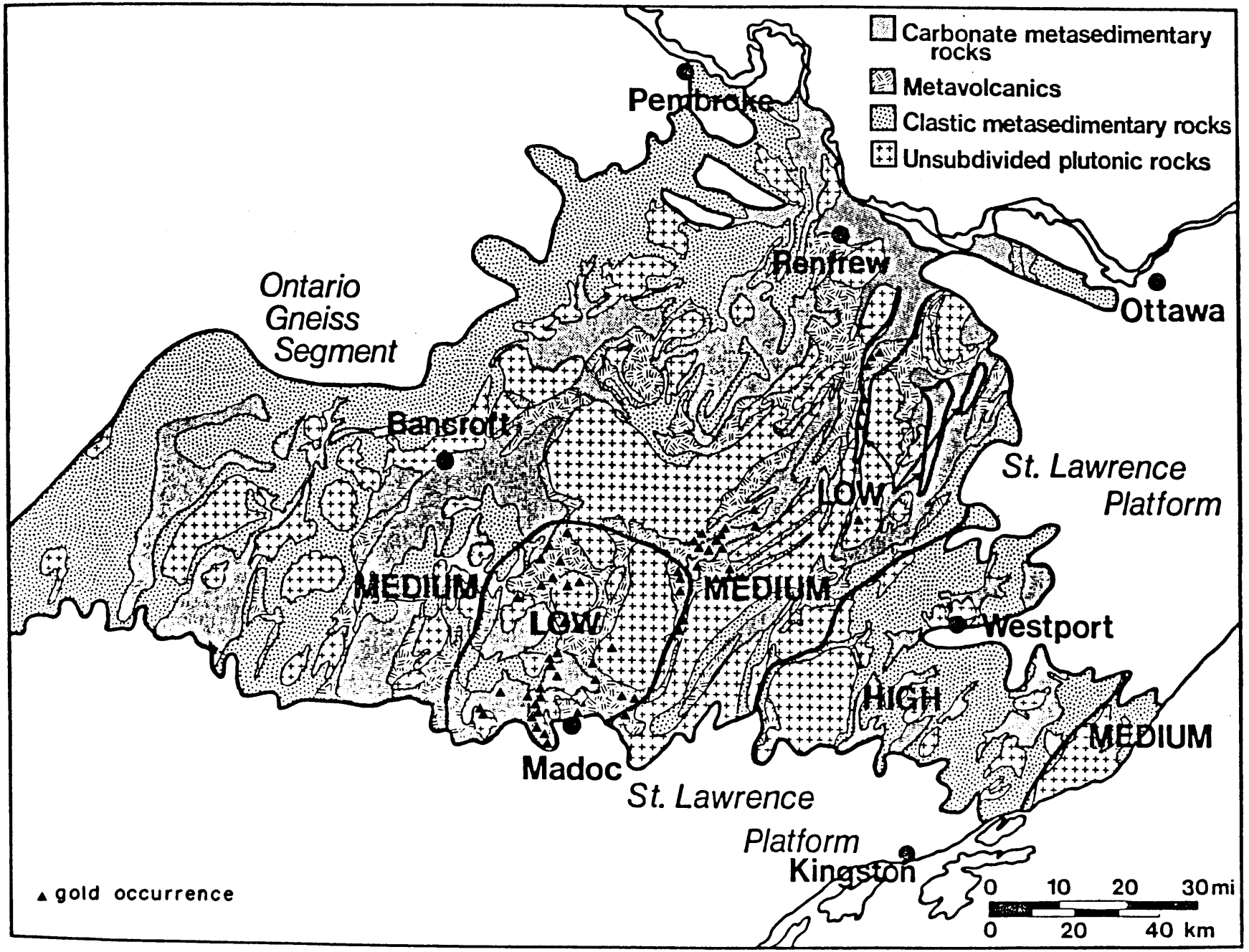


Figure 2. Generalized geology of the Central Metasedimentary Belt in southeastern Ontario, showing locations of gold occurrences and metamorphic isograds (after Carter 1984).

to a metavolcanic contact or near the margin of an intrusive body.

Localization of the mineralized quartz and quartz-carbonate vein zones is structurally controlled. The veins are confined to relatively competent rocks which have undergone brittle deformation within shear zones and less commonly, within fold hinge zones (Mono Prospect, Madoc Township). Veins in carbonate rocks are generally less well developed than those in more competent volcanic, siliciclastic, and intrusive rocks, and tend to be concentrated in dolomitic marbles because of their lower ductility relative to calcitic marbles. The development of "ore shoots" within the vein zones at several of the occurrences (Mono Prospect, Ore Chimney Prospect, Cordova Mines, Addington Mine) is probably the result of intersecting shear zones or flexures within shear zones which may have concentrated the mineralization within pipe-like structures.

Gold mineralization is generally associated with various sulphide assemblages, including assenopyrite and antimony sulphides. Arsenopyrite is more abundant in occurrences hosted by volcanic, siliceous metasedimentary, and intrusive rocks and tetrahedrite is most common in carbonate-hosted occurrences.

The southeastern Ontario gold occurrences have been subdivided into three categories by Malczak et al (1985) as follows:

1) Concordant to discordant quartz and quartz-ankerite vein-hosted gold, silver, and arsenic.
2) Stratabound quartz-ankerite vein hosted gold, copper, lead,

zinc, and antimony in dolomitic marble.

3) Other geological association, gold.

Table 1 lists the occurrence type and host rock type for each of the 23 occurrences described in this report. All except one are classified as type 1. The Clyde Property in Lavant and Darling townships is the exception, classified as type 2. The Dingman Prospect in Marmora and Madoc townships could be classified as type 3 based upon the presence of gold mineralization in altered host rock as well as in quartz veins, but is grouped with the type 1 occurrences because of similarities in host rock type, alteration, and structure with many of the nearby type 1, granite-hosted occurrences along the margin of the Deloro pluton.

The type 1 occurrences are further subdivided according to host rock type as follows:

i) intrusive hosted

ii) metavolcanic hosted

iii) metasedimentary hosted

iv) metavolcanic/metasedimentary contact hosted

The general characteristics of the type 1 and type 2 occurrences described in this report are discussed below.

Type 1 -- Concordant to discordant quartz and quartz-ankerite vein hosted gold, silver, and arsenic.

i) Intrusive hosted occurrences

All except one of the intrusive hosted occurrences lie within felsic intrusive rocks. The Cordova Mine is hosted by gabbro,

Table 1. Classification of gold occurrences in southeastern Ontario

	Occurrence Name	Township	Occurrence Type	Host Rock Type
1.	Killer Creek	Anglesea	1	V
2.	Hardie	Barrie	1	S (sil, carb)
3.	Harlowe Area	Barrie, Kennebec	1	S (sil, carb)
4.	Ore Chimney	Barrie	1	V-S
5.	Cordova	Belmont	1	Gb
6.	Clyde Property	Darling, Lavant	2	S (carb)
7.	Barry	Elzevir	1	V
8.	James Joseph	Elzevir	1	V-S
9.	Hawkins Bay	Hungerford	1	S (carb)
10.	McCann	Huntingdon	1	G
11.	Addington	Kaladar	1	V-S
12.	Bannockburn	Madoc	1	G
13.	Cooper	Madoc	1	V
14.	Dingman	Madoc, Marmora	1	G
15.	Mono	Madoc	1	V-S
16.	Sophia	Madoc	1	V
17.	St. Joe	Madoc	1	S (sil)
18.	Ackerman	Marmora	1	G
19.	Deloro North	Marmora	1	G
20.	Demars	Marmora	1	G
21.	Gatling/Hawkeye	Marmora	1	G
22.	Gawley	Marmora	1	S (sil, carb)
23.	Dillman	Tudor	1	G

Rock Type

Gb	intrusive (gabbro)
G	intrusive (granitic)
V	metavolcanic
S	metasedimentary (sil-siliciclastic, carb-carbonate)
V-S	metavolcanic-metasedimentary contact

but exhibits some similarities with the felsic intrusive hosted occurrences. All consist of mineralized quartz and/or quartz-ankerite veins within shear zones. Shear zones at the McCann, Bannockburn, Ackerman, Deloro North, Demars, and Gatling occurrences are relatively narrow. Gold mineralization is confined to the veins and alteration of the host rock is limited to the zone of most intense veining.

The Cordova, Dingman, and Dillman occurrences are associated with shear zones in the order of 50 to 100 m wide which at Cordova have altered the gabbro to biotite-chlorite schist and have produced mylonitic textures in granitic rocks at the Dingman and Dillman occurrences. Gold mineralization at these occurrences is concentrated at the intersections of later, narrower shear zones with the wide shear zones. At the Cordova mine, economic gold mineralization is confined to pyritic quartz-ankerite veins within the main shear zone, commonly at intersections with cross-cutting shear zones. At the Dingman prospect and to a lesser extent at the Dillman occurrence, low gold values are reported from altered host rock in addition to higher grade vein material, probably due to high permeability of the mylonitized granite.

Sericite is the most common alteration product in the occurrences hosted by granitic rocks, in addition to local hematite, silica, carbonate, and biotite alteration. At the Dingman, Deloro North, and other occurrences along the western margin of the Deloro pluton, the sericite is commonly pale green and is developed to such an extent that the rock has a porphyritic texture,

consisting of pale blue-grey quartz eyes in a green sericite-rich matrix.

ii) Metavolcanic hosted occurrences

Mafic metavolcanic rocks of the Tudor Formation host several gold occurrences which consist of quartz and quartz-ankerite veins within shear zones. The host rocks show various alteration assemblages including silica, iron carbonate, chlorite, amphibole, and biotite. Some may be altered mafic sediments within the metavolcanic sequence, as at the Barry occurrence in which garnetiferous and banded siliceous fragments occur within a strongly carbonatized shear zone flanked by amphibolites. Gold mineralization in the metavolcanic hosted occurrences is associated with various sulphide assemblages with or without arsenopyrite and is confined to the veins, although sulphide mineralization may extend into the host rock.

The Killer Creek and Cooper occurrences are situated close to the contact between metavolcanics and granitic rocks within large areas of silicified and talc-carbonate altered rocks, respectively. The Barry and Sophia occurrences are associated with shear zones within the upper part of the Tudor Formation, close to the contact with overlying clastic metasediments.

In the eastern part of Tudor Township and the northwestern quadrant of Grimsthorpe township, an extensive zone of silicified and/or carbonatized metavolcanics and metasediments of the Tudor Formation is currently being explored for gold mineralization. Homestake Mineral Development Company and Noranda Exploration

Company Limited have carried out airborne geophysical surveys along portions of a regional shear zone termed the Moira River fault by Lumbers (1969). This zone, which trends roughly north-south along the course of the Moira River, is up to 100 m wide and contains sheared, mylonitized and complexly contorted rocks. It is cut by numerous northwesterly and northeasterly trending faults and hosts several minor gold and arsenic occurrences (Lumbers 1969, Kingston et al 1985). Other than assessment files containing airborne geophysical survey reports by both companies and reports of trenching by Homestake, no results of recent work are available. At the time of writing, Homestake was conducting a diamond drilling program in Grimsthorpe Township.

iii) Metasedimentary hosted occurrences

Quartz and quartz-ankerite vein hosted gold mineralization occurs within sulphide-rich siliceous metasediments (St. Joe occurrence) sheared, sericitized siliciclastic metasediments (Gawley occurrence), and carbonate metasediments near contacts with siliceous metasediments (Hawkins Bay, Hardie, and Harlowe area occurrences).

Mineralization in the siliceous metasedimentary hosted occurrences consists of various sulphide assemblages (pyrite ± pyrrhotite ± sphalerite ± chalcopyrite ± arsenopyrite) and traces of native gold. The carbonate hosted occurrences contain tetrahedrite with minor pyrite, chalcopyrite and in one case (Harlowe area), native gold.

The veins have developed in dilatant zones as a result of folding and/or shearing. In the siliceous metasediments these zones exhibit schistose textures and various alteration assemblages including silica, sericite, iron carbonate, and biotite. Veins within carbonate rocks show less evidence of host rock alteration and are generally more irregular and discontinuous than those in siliceous rocks.

iv) Metavolcanic-metasedimentary contact hosted occurrences

The association of gold mineralization at the Ore Chimney and Addington occurrences with the contact between Tudor Formation mafic metavolcanics and unconformably overlying Flinton Group metasediments has been previously discussed by Carter (1984) and Dillon (1985). Both occurrences are hosted by hornblende-biotite-garnet schists known as the Ore Chimney Formation. This unit has been designated as part of the basal formation of the Flinton Group metasediments (Bishop Corners Formation) by Thompson (1972), but is considered as either a pre-Flinton Group mafic metasediment or the product of post-Flinton Group shearing along the Tudor-Flinton contact by Dillon (1985). Harnois and Moore (1989) also consider the Ore Chimney Formation to be derived by weathering of the underlying rocks of the Tudor Formation.

Similar biotite-garnet-rich schists are present at the contact between Tudor Formation mafic metavolcanics and conformably overlying carbonate and siliceous, locally sulphide-rich metasediments of pre-Flinton age in Elzevir and Madoc Townships, suggesting that the Ore Chimney Formation represents an extensive

mafic metasediment deposited at the end of Tudor Formation volcanic activity.

Biotite-garnet schists and metavolcanic amphibolites host gold mineralization at the James Joseph occurrence in Elzevir Township and the Mono prospect in Madoc Township. A similar biotitic unit is present at the St. Joe occurrence in Madoc Township, between Tudor Formation metavolcanics and overlying siliceous, sulphide-bearing metasediments which host minor gold mineralization. Biotite-rich amphibolites are also noted in diamond drill logs from the Sophia Mine in Madoc Township.

These occurrences are similar to those in metavolcanic and siliceous metasedimentary rocks, consisting of quartz and/or quartz ankerite veins containing pyrite ± arsenopyrite and minor amounts of base metal sulphides. Veins are localized within shear zones, which are parallel to the metavolcanic-metasedimentary contact at the Ore Chimney, Addington, and James Joseph occurrences and cross-cut the contact at the Mono prospect.

The high biotite content of the Ore Chimney Formation appears to be at least partly the result of hydrothermal alteration of a mafic metasediment. In diamond drill core from the Ore Chimney mine, cross-cutting fractures show biotite-rich haloes and the main vein is bordered by a biotite-rich zone. Rocks bordering veins at the Addington and James Joseph occurrences also contain abundant biotite and local concentrations of tourmaline.

Type 2 -- Stratabound quartz-ankerite vein hosted gold, copper, lead, zinc, and antimony in dolomitic marble.

The Clyde Property occurrences in Lavant and Darling townships, classified as type 2 occurrences, have been described in previous reports by Carter et al (1980) and Carter (1984). The following general description is summarized from Carter et al (1980).

These occurrences are hosted by dolomitic marbles within a narrow belt of intercalated mafic metavolcanics, calcitic and dolomitic marble, and calcareous mudstone and siltstone. They occur at about the same stratigraphic level in marble over a strike length of about 20 km. Conformable lenses and irregular vein networks of quartz and dolomite up to 2 m wide contain chalcopyrite and tetrahedrite with minor bornite and pyrite. Gold and silver are associated with the sulphides, particularly with tetrahedrite.

Mineralization may be related to syngenetic deposition of sulphides in carbonate sediments as a result of contemporaneous volcanic activity, followed by remobilization and deposition of the metals in vein networks during metamorphism (Carter 1980).

All of the occurrences lie within the eastern part of a major, northerly trending deformation zone known as the Robertson Lake Shear Zone.

Type 3 -- Other geological association, gold

Although not classified as gold occurrences, two sulphide occurrences which contain minor gold mineralization warrant a

brief discussion.

The Eldorado Copper Mine in lot 17, concession V, Madoc Township, produced a small amount of gold and silver as a by-product of copper mining operations. The ore body consisted of a sulphide lens about 36 ft long and 7 to 10 ft wide at the contact between a small granite intrusion and dolomitic marble. A magnetite-talc-carbonate skarn zone occurs at the north end of the ore body in contact with the granite. The upper 75 ft of the sulphide lens was oxidized and mined as hematite ore (known as the Coe Iron Mine) prior to 1906. The sulphide ore, containing chalcopyrite, pyrite, and chalcocite and averaging 4 to 10% Cu, was subsequently mined by open cut to a depth of 300 ft. From 234,000 lbs of copper matte, 109,000 lbs of Cu, 182 oz of Ag, and 23 oz of Au were produced (Malczak et al 1985).

Assuming an average grade of 7% Cu, the above figures indicate that the ore contained an average of 0.25 oz Ag/ton and 0.03 oz Au/ton.

The sulphide body dips northward along the south contact of the granite intrusion, which is of similar composition, size, and attitude to the granite stock which hosts the Dingman gold prospect (Madoc and Marmora Townships, Noranda Exploration Company Limited, this report). Both stocks appear to be satellite bodies of the Deloro granite pluton. Gold mineralization occurs at the eastern end of the Eldorado granite stock at the Richardson Gold Mine, a small, high grade deposit which consisted of native gold associated with a black,

radioactive hydrocarbon in dolomite and calc-silicate rock close to the granite contact (Malczak et al 1985).

The presence of metasedimentary amphibolite and siliceous metasediments in the vicinity of the Eldorado granite as indicated by Hewitt (1968) may indicate proximity to the upper contact of the Tudor Formation.

Another sulphide occurrence containing minor gold mineralization is the Blakely Pyrite Mine in lot 11, concession XI, Madoc Township. Several lenses of massive pyrite up to 15 ft wide and 50 ft long occur within a rusty schist consisting of variable amounts of quartz, sericite, pyrite, and graphite at the contact with garnetiferous hornblende amphibolite. These units occur with a narrow band of felsic metavolcanics and tuffs between underlying mafic metavolcanics of the Tudor Formation and overlying siliceous and carbonate metasediments (Hewitt 1968).

The sulphide lenses also include minor amounts of sphalerite, jamesonite, chalcopyrite, and arsenopyrite. A diamond drill hole by Syngenore Exploration Limited in the 1960's intersected a 15 cm zone containing native silver which assayed 297.1 oz Ag/ton, 0.46 oz Au/ton, 2.15% Cu, and 5.4% Pb. Another hole intersected a 4.6 m section of banded pyrite which assayed 0.04 oz Au/ton (Malczak et al 1985).

The presence of minor gold mineralization within these two sulphide occurrences -- the Eldorado Copper Mine which appears to be a skarn deposit, and the Blakely Pyrite Mine, a volcanogenic

deposit -- suggests that other sulphide rich zones, particularly in the vicinity of the volcanic-sedimentary contact at the top of the Tudor Formation, may contain low-grade gold mineralization.

SUMMARY AND CONCLUSIONS

Gold occurrences in southeastern Ontario are concentrated within zones of greenschist to lower amphibolite facies metamorphism in a broad area north of Madoc and Marmora and in a narrow belt south of Renfrew.

All of the occurrences consist of mineralized quartz and/or quartz-carbonate veins which have formed in dilatant zones related to shearing or folding, probably from metamorphic fluids during retrograde metamorphism (Carter 1984). In some cases, low grade gold mineralization is also present in altered host rocks.

Occurrences in the Lavant-Darling townships area south of Renfrew and in Kennebec and Barrie townships northeast of the Madoc-Marmora metamorphic low are predominantly hosted by carbonate and siliciclastic metasediments close to contacts between the two rock types or close to metavolcanic rocks. Those in the Madoc-Marmora area are predominantly hosted by intrusive, metavolcanic, or siliciclastic metasedimentary rocks. Many occur at a major contact between mafic metavolcanics of the Tudor Formation and overlying clastic and carbonate metasediments, either within or close to a hornblende-biotite-garnet schist which directly overlies or is intercalated with the mafic metavolcanics. This schist, previously thought to unconformably overlie the Tudor Formation at the Addington and Ore Chimney mines where it is

known as the Ore Chimney Formation, appears to be an extensive, conformable metasediment derived from the Tudor mafic metavolcanics and is a key formation in the localization of gold occurrences within the Madoc-Marmora area.

The following sequence of events, based upon a genetic model for the Addington gold deposit postulated by Johnson (1982), is generally applicable to all types of gold occurrences described in this report:

1. Syngenetic enrichment of gold at the volcanic-sediment contact. Gold may have been derived from low-grade concentrations in quartz veins within the mafic volcanics, source of the sediments, and concentrated by placer, chemical, and/or biogenic processes within sediments close to the contact. In addition, or alternatively, low grade syngenetic gold concentrations in pyritic metasediments may have been associated with tuffaceous exhalative activity at the end of Tudor volcanism.
2. Remobilization and concentration of gold from the sediments into shear zones, particularly along the volcanic-sediment contact (Ore Chimney Formation). Gold may also have been concentrated within and ajacent to granitic and gabbroic rocks where the plutonic rocks intruded metasediments containing low grade gold mineralization (Cordova and Deloro plutons). Mechanisms of concentration include assimilation of auriferous metasediments followed by re-deposition in dilatant (shear or fracture) zones near the pluton margins

and skarn mineralization at intrusive-metasedimentary contacts.

3. A second phase of remobilization and concentration of gold by late structural events, producing higher grade "ore shoots" where previously developed, low-grade shear/quartz vein zones in metavolcanic, metasedimentary, and intrusive rocks are folded or intersected by cross-cutting shear zones.

The last phase included several periods of shearing, indicated by major easterly trending shear zones at the Cordova, Gawley, and Dingman occurrences, north-northeast trending structures such as the Moira River and Robertson Lake shear zones, and later northwesterly trending faults which locally offset northerly trending structures and are associated with post-Ordovician fluorite-barite veins in the Madoc area.

Exceptions to the model described above occur locally, such as at the Cooper and Dillman occurrences which are associated with sheared metavolcanics or metasediments and sheared granite, respectively, apparently well below the upper contact of the Tudor Formation. However, the association of gold mineralization with intersecting shear zones (Dillman) and a shear zone close to a granite/metavolcanic contact (Cooper) suggests that multiple phases of gold concentration have also taken place at these occurrences.

The most significant gold deposits discovered to date are situated within the area of low grade metamorphism north of Madoc and Marmora (Figure 2), either at the metavolcanic-

metasedimentary contact at the top of the Tudor Formation (Addington Mine, Mono prospect) or within intrusive rocks which also show a spatial relationship to the upper contact of the Tudor Formation (Cordova mine, Dingman prospect, Deloro area mines and occurrences). Occurrences within carbonate and siliciclastic metasediments stratigraphically above the mafic metavolcanics, such as those in Barrie and Kennebec townships and in Lavant and Darling townships, appear to have less potential with respect to deposit size.

An association of gold occurrences with north-northeast (020^{o}) trending shear zones is apparent in parts of Marmora, Madoc, and Tudor Townships. Specifically, the occurrences along the western margin of the Deloro pluton, the Dingman prospect, St. Joe occurrence, Bannockburn prospect, Mono prospect, and Dillman occurrence lie along a 020^{o} trend which may represent an extension of the Moira River Fault Zone mapped by Lumbers (1969) in Tudor Township. This zone and parallel structures have potential for gold mineralization where they intersect favourable host rocks such as the Deloro pluton, Tudor Formation metavolcanics, and intrusive rocks and metasediments close to the upper contact of the Tudor Formation. The potential for gold mineralization is enhanced by the presence of cross-cutting structures such as the 060^{o} trending shear zone at the Dingman prospect and northeasterly trending fold axes at the Mono prospect.

Other areas which may have potential for gold mineralization based on favourable geology and the presence of minor gold and/or arsenic occurrences are:

1) the Twin Sisters Lake area in the northwest part of Marmora Township, where a granodiorite stock has intruded the contact area between Tudor Formation metavolcanics and overlying metasediments.
2) the Glanmire Lake area in Tudor Township, in which the Tudor meta volcanic-metasedimentary contact area has been intruded by granite and gabbro of the Glanmire complex.
3) a belt of minor gold-arsenic occurrences associated with bands of metasediments within the Tudor Formation extending through southeastern Anglesea Township. This area has undergone sporadic exploration but very little testing for bedrock mineralization due to extensive overburden cover.

Although arsenopyrite is broadly indicative of gold mineralization, there does not appear to be a direct relationship between gold and arsenic content on the occurrence scale. Because the gold is erratically distributed and almost exclusively confined to quartz and quartz-ankerite veins, bulk sampling is required to accurately determine the grade of an occurrence.

The following features characterize areas with the greatest potential for gold mineralization in southeastern Ontario:

1. Location in the vicinity of the contact between mafic metavolcanics of the Tudor Formation and overlying silici-

clastic and carbonate metasediments, or near the margins of plutonic bodies which have intruded the metavolcanic-metasedimentary contact, in areas of geenschist to lower amphibolite facies metamorphism.

2. The presence of relatively competent rocks. These include gabbro, granite, siliceous metasediments, dolomitic marble, and metavolcanics, any of which, if adjacent to less competent rocks, may exhibit brittle deformation under stress. Zones of varying competence may develop within a lithological unit as a result of pervasive carbonatization or silicification along major structures such as the Moira River and Robertson Lake shear zones.

3. The presence of shear zones within or transecting the metavolcanic-metasedimentary contact, and within plutonic rocks which have intruded the contact area. In particular, intersections of shear zones in the vicinity of the metavolcanic-metasedimentary contact may have localized mineralization, as at the Cordova and Dingman occurrences.

DESCRIPTIONS OF OCCURRENCES

The occurrences described in the following pages are ordered alphabetically by township and within each township by occurrence name. The name of the company or individual having performed the most recent exploration work on the occurrence is also listed in the title. Occurrence numbers correspond with those shown on the accompanying geology/occurrence location map.

The descriptions vary in detail according to the amount of previous documentation and new information available. New discoveries and those for which a substantial amount of new information is available are described in greater detail.

1. Killer Creek Occurrence, Anglesea Township

United Reef Petroleums Limited

Location

Lots 27, 28, Con. XIV, Anglesea Township, Lennox and Addington County.

Work Completed

Reconnaissance sampling and prospecting resulted in the discovery of gold mineralization in 1986. A group of 20 claims was staked in 1987. Subsequent work in 1987 and 1988 includes geological, magnetic, and VLF-EM surveys, stripping, and trenching (Johnston 1988).

Geology and Mineralization

Gold mineralization on the United Reef Petroleums property is associated with narrow northerly-striking granitic and syenitic dikes cutting mafic metavolcanic and metasedimentary rocks.

Very narrow quartz veins containing minor pyrite mineralization occur in silicified, rusty-weathering mafic rocks at the margins of the granitic dikes. Assays of up to 0.19 oz Au/ton have been obtained from the quartz veins (Johnson 1988).

Recent geological mapping by Easton and Ford (1990) indicates the presence of a zone of alteration, silicification, and intrusion of felsites within mafic volcaniclastic rocks (Figure 3). The alteration zone trends north-south and is about 5 km long and up to 500 m wide. The United Reef Petroleums gold occurrence, located at the eastern margin of the alteration zone, is de-

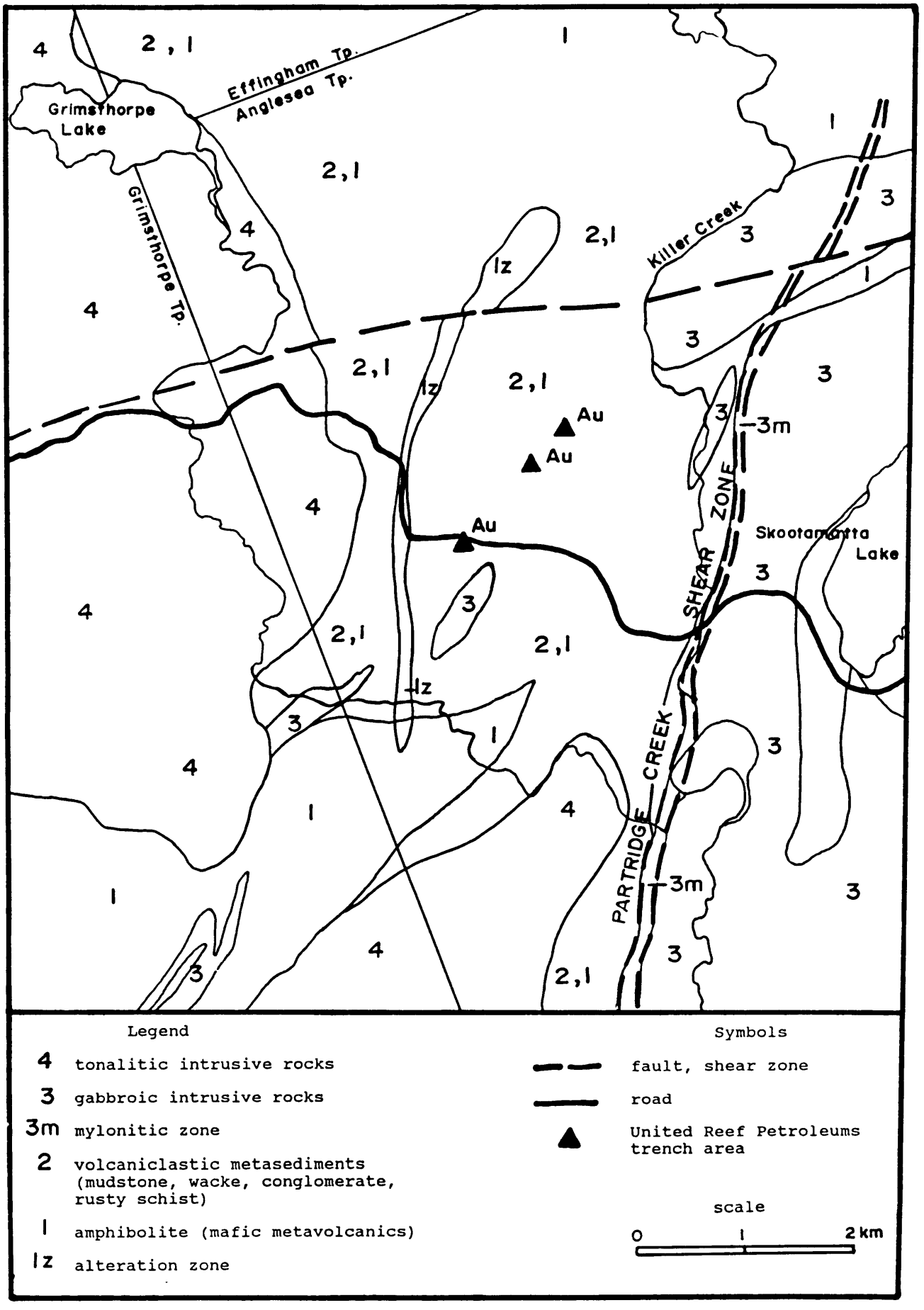


Figure 3. Geology in the area of the Killer Creek occurrence, Anglesea Township (after Easton and Ford 1990)

scribed by Easton and Ford (1990) as a silicified, rusty-weathering mafic metaconglomerate, a sample of which assayed 880 ppb Au. Two other samples from the same trench contained negligible amounts of gold.

Additional sampling by Easton and Ford (1990) within the north-striking alteration zone indicates that the most silicified rocks are strongly depleted in copper, gold, nickel, and zinc. Further exploration is required to determine the significance of this zone and to evaluate its potential for hosting economic gold mineralization.

References

Easton and Ford 1990

Johnson 1988

2. Hardie (Gough) Occurrence, Barrie Township

Grandad Resources Limited

Location

Lot 3, Con. IX, Barrie Township, Frontenac County

Work Completed

From 1980 to 1983, Mr. D.A. Hardie carried out an exploration program which included trenching and diamond drilling totalling 142 m in 9 holes. Grandad Resources, in 1984, carried out magnetometer, VLF-EM, and I.P. surveys and drilled 10 diamond drill holes totalling 914.1 m (Sharpley 1984).

Geology and Mineralization

Two mineralized zones occur within the Hardie property (Figure 4). The north zone consists of high grade gold mineralization associated with quartz-tourmaline-hematite veins within meta-arkose. The veins, containing pyrite and chalcopyrite, have assayed up to 5.7 oz Au/ton over narrow widths (4 inches to 4 ft) over a strike length of 800 ft (Sharpley 1984).

The south zone consists of high grade zinc, lead, and silver mineralization associated with dolomitic marble-hosted quartz calcite-tremolite veins containing tetrahedrite, chalcopyrite, bornite, sphalerite, pyrite, and arsenopyrite. The veins are irregular and discontinuous within a zone up to 50 m wide and 300 m long. Drill hole 1983-3 intersected a 16 ft section which averaged 4.88% Zn, 1.26% Pb, and 1.07 oz Ag/ton (Sharpley 1984). Five of the Grandad Resources drill holes tested for extensions of the zone encountered in hole 83-3 without success. Three

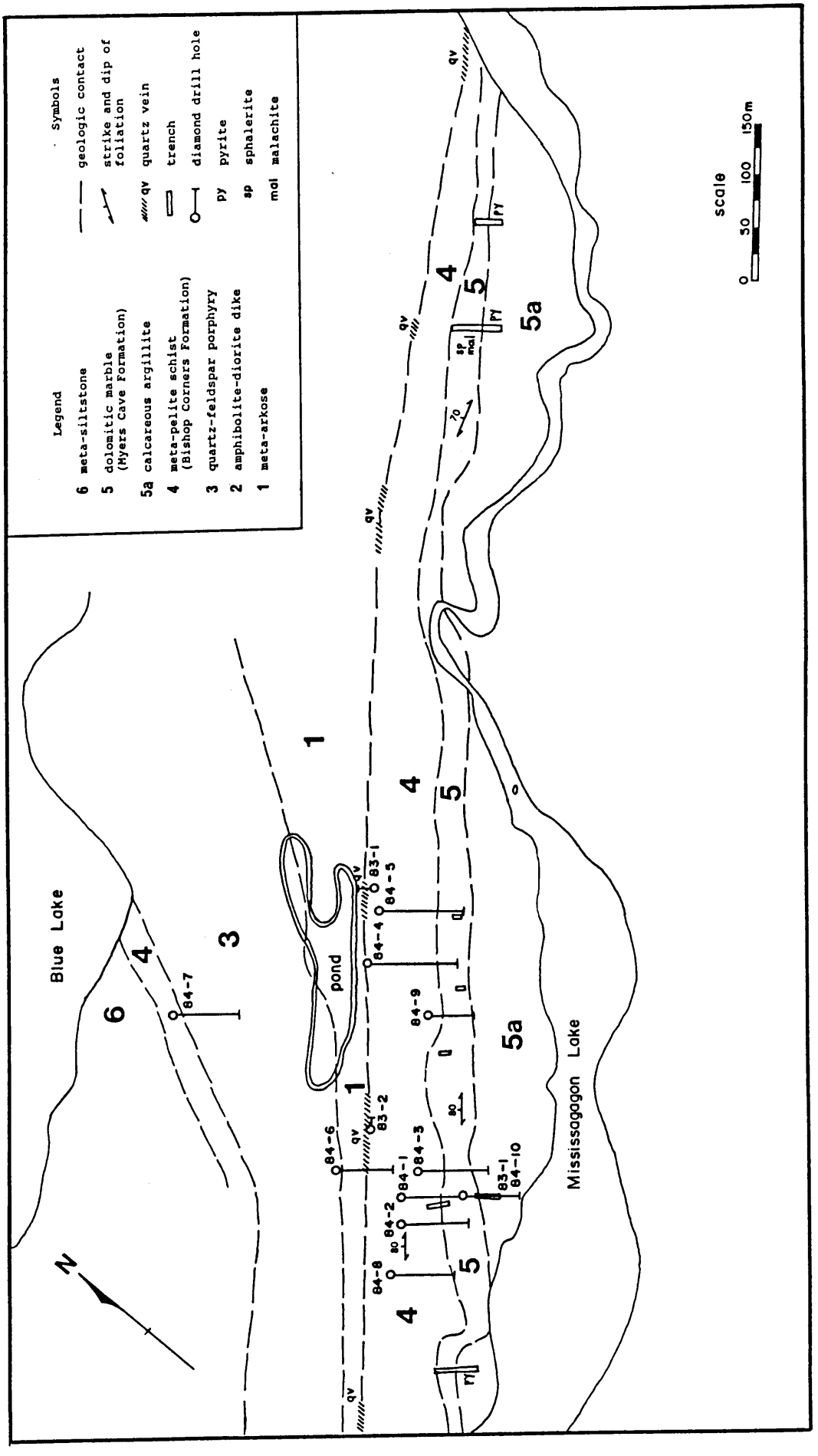


Figure 4. Geology of the Hardie Occurrence, Barrie Township (after Sharpley 1984).

drill holes investigated projected zinc-silver mineralization below surface trenches, also without success.

The downward extension of the north gold zone was tested by one diamond drill hole in 1984. The quartz-tourmaline vein was intersected but no gold values were obtained. One additional drill hole tested an I.P. anomaly which was apparently caused by disseminated pyrite and pyrrhotite within a series of gabbro dikes over a 55 m width in quartz-feldspar porphyry. Gold and silver assays were negligible (Sharpley 1984).

A more detailed geological description of the occurrence is presented by Malczak et al (1985).

References

Malczak et al 1985

Sharpley 1984

3. Harlowe Area, Barrie and Kennebec Townships

Homestake Mineral Development Company

Location

Three claim groups (Harlowe Property, Heacock Option, and Gull Lake Property) cover the following previously known occurrences, described by Malczak et al (1985):

1)	Dome Mine Prospect	Lot 32, Con II, Kennebec Twp.
2)	Pay Rock Occurrence	Lot 16, Con I, Barrie Twp.
3)	Cobalt-Frontenac Occurrence	Lot 13, Con I, Barrie Twp.
4)	Emery Occurrence	Lot 31, Con II-III, Kennebec Twp.

Work Completed

Work done in 1988 included geological and soil geochemical surveys, stripping, trenching, and rock sampling (Lloyd and Bending 1989).

Geology and Mineralization

Figure 5 shows the geology and gold occurrences in the area of the Homestake Harlowe properties. The results of the 1988 program confirmed previous reports of gold mineralization but did not significantly expand the grade/tonnage potential. The following results are reported by Lloyd and Bending (1989).

Gold values in the Dome and Dome Extension occurrences range from less than 5 ppb to 28.5 g/t across 1 m, associated with quartz veins containing pyrite, native gold, and tetrahedrite in a zone 150 m long and up to 10 m wide within dolomitic marble.

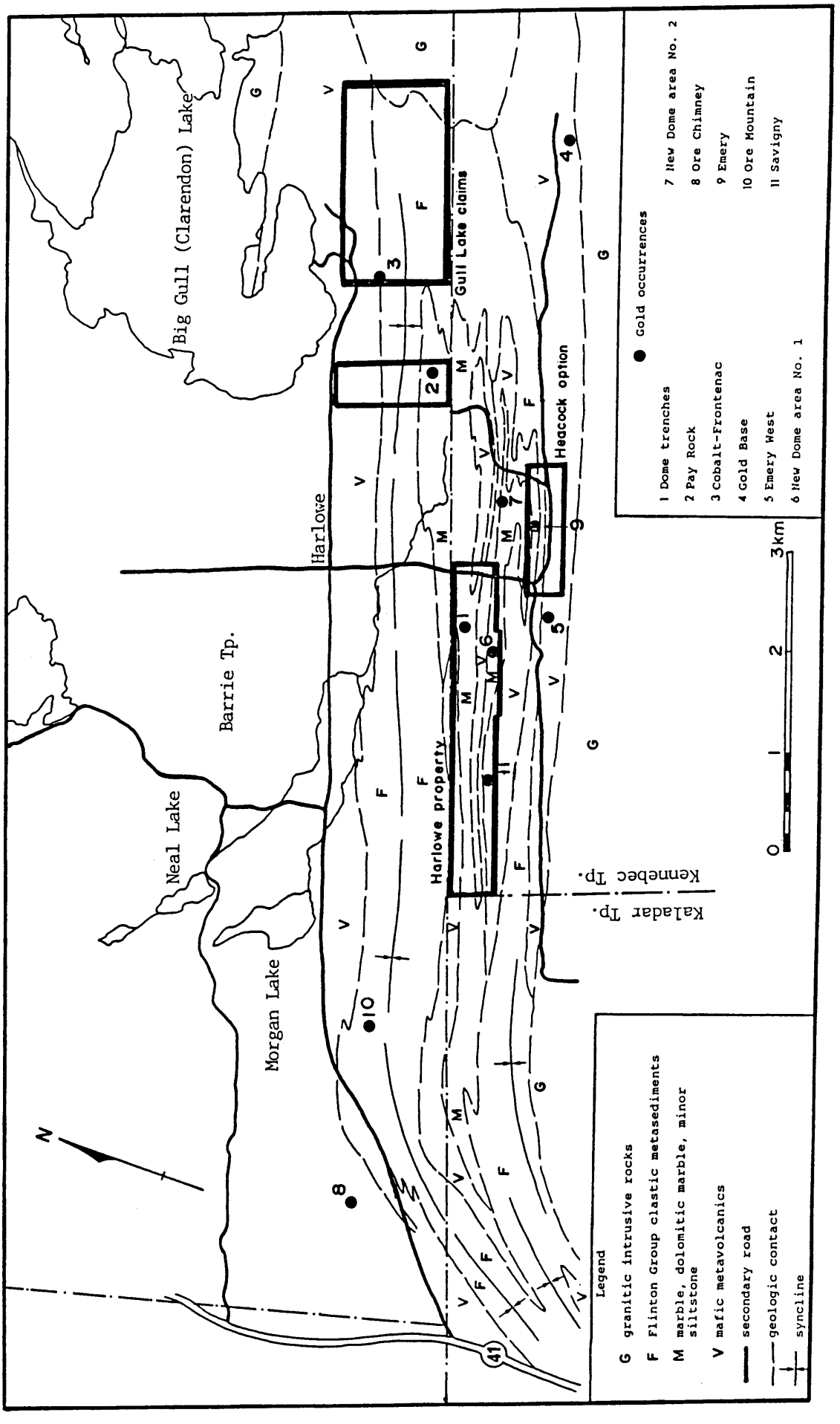


Figure 5. Geology and gold occurrences of the Harlowe area, Barrie and Kennebec Townships (after Lloyd and Bending 1989).

Samples from the Sulphide Zone contained up to 2.7 g Au/t across 1 m. Gold assays of 7 g/t across 40 cm and 4 g/t across 1 m have been obtained from the Biotite Zone.

The best results from trench sampling of quartz vein stockworks in dolomitic marble of the Emery occurrence are 0.93 to 3.9 g Au/t across 1 m.

Lloyd and Bending (1989) present the following conclusions:

"1. The gold occurrences documented within the Harlowe properties are localized within isoclinally folded mafic metavolcanic, carbonate, and clastic metasedimentary rocks. All of the deformation and associated mineralization are interpreted to be closely related to this folding, which is broadly sheath-like in form due to the influence of the Addington shear zone.

2. Significant gold concentrations occur in four distinct settings. Native gold with locally high grade occurs with traces of pyrite and an unidentified bismuth mineral in quartz vein stockworks in dolomitic marble of the Dome Occurrence. Anomalous gold and silver concentrations occur in quartz - pyrite - tetrahedrite - chalcopyrite vein sets in dolomitic marble bands in the Emery and New Dome occurrences. The quartz - biotite - pyrite gneiss of the Sulphide Zone and the core of the Biotite Zone host anomalous gold values and are particularly significant in terms of potential size.

3. The extent and locally high gold concentrations in the Dome and Dome Extension occurrences suggest economic potential

which warrants further investigation. The grades documented to date in the Sulphide Zone and Biotite Zone are generally subeconomic, but the size, poor exposure, and amenability of these prospects to geophysical surveys render them significant targets with potential for rapid evaluation."

References

Lloyd and Bending 1989

Malczak et al 1985

4. Ore Chimney Prospect, Barrie Township

Michele Gold Mines Limited

Location

Lot 35, Con. I, Barrie Township, Frontenac County

Work Completed

In 1987, Sands Mineral Corporation (now Michele Gold Mines Limited), carried out an exploration program in the vicinity of the Ore Chimney shaft and on projected extensions of the mineralized zone. The program consisted of magnetic, electromagnetic, and self potential geophysical surveys; geological mapping, trenching, and channel sampling; and diamond drilling of 14 holes totalling 4,418 feet.

Previous work by the current owner of the propety, Albert Banner, included dewatering of the mine workings to the 150 foot level for inspection and underground sampling in 1983. Mr. Banner is presently investigating the possibility of milling ore from the mine dump.

Descriptions of previous work from 1902 to 1983, as well as descriptions of geology and mineralization, are presented by Malczak et al (1985), Dillon (1985), Moore and Morton (1986), and Harnois and Moore (1989).

Geology and Mineralization

The Ore Chimney prospect consists of a gold-silver-copper-lead-zinc-bearing quartz vein system hosted by sheared hornblende-biotite-garnet schist near the contact between mafic metavolcanics of the Tudor Formation and unconformably overlying

quartzite and quartz-pebble conglomerate of the Bishop Corners Formation, Flinton Group (Dillon 1985).

In the vicinity of the Ore Chimney shaft, the volcanic-sedimentary contact forms an open "S" fold pair with axial planes trending northeastward, parallel to the regional foliation (Figure 6).

The Ore Chimney vein system is from 1 to 4 ft wide, consisting of narrow, discontinuous quartz stringers within a biotite schist.

It strikes northeast and dips about 80^{o} to the southeast. This vein system lies within a wider zone (up to 20 ft) of quartz-carbonate stringers within biotite-hornblende-quartz-garnet schist which hosts minor pyrite and chalcopyrite mineralization but is essentially barren with respect to gold and silver content.

Mineralization within the main vein system generally consists of trace amounts of pyrite, chalcopyrite, galena, and sphalerite. Rusty weathering ankerite is a minor vein constituent and traces of tourmaline have been observed. Biotite and biotite-phlogopite schists form a halo up to 6 ft wide around the main vein system and have also been observed bordering fine, cross-cutting fractures in diamond drill core, suggesting that the biotite-rich schist is an alteration product associated with emplacement of the vein system.

Within the main vein system, significant mineralization is

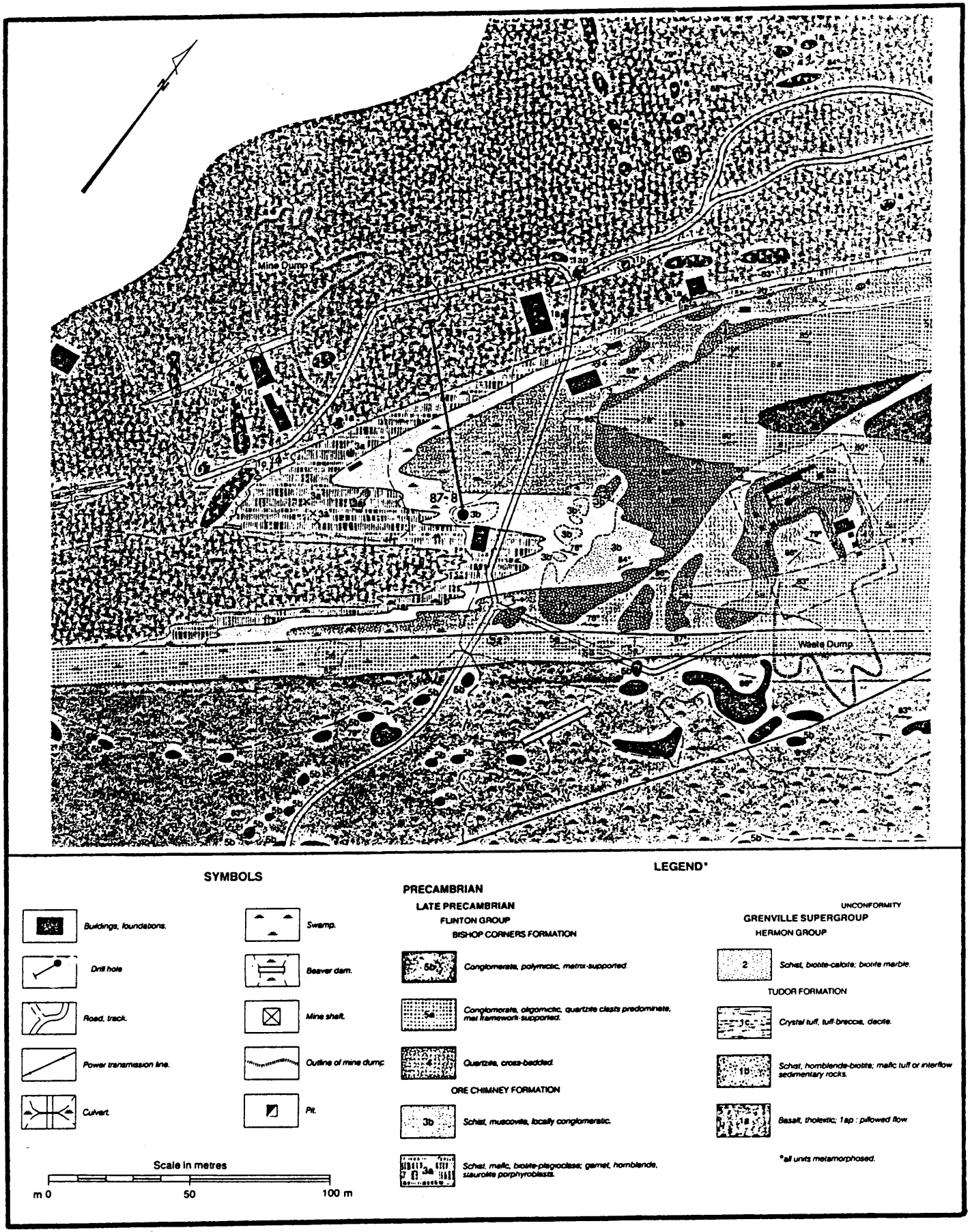


Figure 6. Geology of the Ore Chimney mine area, Barrie Township (from Moore and Morton 1986)

restricted to a pipe-like ore shoot reported to increase in size from 50 ft by 2 ft on the 150 ft level to 100 ft by 4 ft on the 500 ft level (Campbell 1937).

The ore shoot, which rakes to the southwest at about 70°, was intersected below the mine workings at a vertical depth of 600 ft in a 1930 diamond drill hole (Campbell and Chamberlin 1957). It was exposed at surface about 360 ft northeast of the shaft during the 1987 trenching program. The trench exposed a 15 ft width of quartz carbonate veins. One vein, 12 inches wide, contained about 10% combined sphalerite, galena, and tetrahedrite with minor pyrite and chalcopyrite. A 12 inch chip sample taken across the vein by the author assayed 0.03 oz Au/ton and 8.61 oz Ag/ton.

The following table of dimensions and grades of the ore shoot, from Campbell and Chamberlin (1957), indicates that both size and gold content increase, while silver content decreases with depth.

Table 2. Dimensions and grades of the ore shoot, Ore Chimney Mine.

Mine Level (feet)	Length (feet)	Width (feet)	Au (oz/ton)	Ag (oz/ton)	Pb %	Zn %
150	50	1.5	0.108	14.0	--	--
250	55	3.0	0.199	11.6	--	2.26
400	75	4.0	0.230	7.3	1.6	1.90
500	100	3.5	0.390	1.7	--	--
Winze	--	3.75	0.357	4.0	--	--
605 (ddh 1930-3)		3.25	0.158	7.8	3.2	1.90

Reserves within the ore shoot over a 4 ft mining width to the 500 ft level are estimated at 11,000 tons grading 0.20 oz Au/ton and 5.64 oz Ag/ton (Campbell and Chamberlin 1957).

Campbell (1930) estimates that of 17,000 tons of rock hoisted from underground, 6,000 to 8,000 tons may be "milling ore". Recent estimates of grade and tonnage of stockpiled ore based upon sampling of the mine dump range from 14,000 tons grading 0.086 oz Au/ton and 2.41 oz Ag/ton (MacPherson 1983) to 8,200 to 11,400 tons grading 0.04 oz Au/ton and 2.22 oz Ag/ton (Kingston 1980). However, it is not likely that these grade estimates are representative of all material in the dump, particularly as the early stages of mining consisted primarily of shaft sinking and drifting toward the ore shoot, followed by drifting, raising, and stoping within ore grade material in later years (Ore Chimney mine plans 1915-1932, Resident Geologist's Office, Tweed). Therefore, the total reserves of ore in situ and on surface are probably less than 20,000 tons.

In 1987, eight diamond drill holes tested the area of the known ore shoot and six holes were drilled along the projection of the vein system from 450 to 900 ft northeast of the shaft. This program did not contribute any additions to the previously defined ore reserves (Morrison 1988) and indicates that the potential for additional reserves is limited to the down-plunge extension of the known ore shoot.

A previously untested area which warrants consideration as a target for gold-silver mineralization lies to the south of the

shaft where the hornblende-garnet-biotite schist unit which hosts the Ore Chimney vein zone can be projected to conform to the large "S" fold shown in Figure 6. Shear and/or dilation zones within the fold hinges may contain quartz veins, as indicated by diamond drill holes 1930-1 and 1987-8 which intersected a pyritic quartz vein zone over core lengths of 154 and 176 ft., respectively (Resident Geologist's files, MNDM Tweed). The quartz veins occur in muscovite and biotite-rich schists at the base of the Flinton Group in the northwestern axis of the "S" fold. Although this zone is barren with respect to gold and silver values, a similar vein zone within the Ore Chimney horizon could contain more significant mineralization.

References

Campbell 1930

Campbell 1937

Campbell and Chamberlin 1957

Dillon 1985

Harnois and Moore 1989

Kingston 1980

MacPherson 1983

Malczak et al 1985

Moore and Morton 1986

Morrison 1988

5. Cordova Gold Mine, Belmont and Marmora Townships
Lasir Gold Inc.

Location

Lots 20, 21, con. I, Belmont Township, Peterborough County, and lot 20, con. I, Marmora Township, Hastings County.

Work Completed

Between 1980 and 1984, Lasir Gold Inc. carried out an evaluation of the Cordova Mine which included re-calculation of underground reserves based upon old underground assay plans and past diamond drilling, and sampling and cyanide heap leaching tests of surface ore dumps and tailings. In 1983, a mill building with 8 leach tanks was installed and two large plastic-lined ponds and a tailings pond were constructed (Narain and Burkart 1985).

In 1988, under an option agreement with Lasir Gold Inc., Gunnar Gold and Mill City Gold drilled 59 diamond drill holes totalling 30,075 ft (MNDM Drill Core Library files, Tweed).

The Cordova mine has been described in detail by Malczak et al (1985).

Geology and Mineralization

The Cordova mine is located near the northwestern margin of a large gabbroic intrusion (the Cordova gabbro) bordered by carbonate and siliciclastic metasediments to the north and east and by mafic metavolcanics to the west and southwest. Paleozoic limestones unconformably overlie the gabbro to the south (Bartlett and Moore 1985).

Gold mineralization is confined to easterly-striking shear zones varying in width from 30 cm to 50 m in which the gabbro is commonly altered to biotite and chlorite schists. The shear zones host massive, conformable lenses of quartz, conformably banded quartz-ankerite-feldspar veins, and irregular zones of branching veins and lenses. Gold is apparently associated with pyrite which is present in the veins with minor pyrrhotite (Malczak et al 1985).

Although all shear zones in the vicinity of the mine are mineralized, ore bodies have been developed only in the Main vein, or shear zone (Figure 7). Many of these ore bodies occur at intersections of the Main shear zone, trending 065°, with a series of northwesterly (280°) trending shear zones.

Past production from intermittent mining between 1892 and 1940 totals 22,774 oz Au from 120,170 tons of ore (average 0.19 oz Au/ton). Reserves at the close of mining operations by Cominco Ltd. in 1940 were 44,000 tons grading between 0.104 and 0.175 oz Au/ton, with an additional 150,000 tons of probable and possible ore (Malczak et al 1985).

Based upon results of the 1988 diamond drilling program and records of Cominco's underground sampling, total probable and possible geological reserves are estimated at 115,982 tons grading 0.21 oz Au/ton (Norwin Resources 1989). In addition to underground reserves, there are estimated to be 30,000 tons of rock grading 0.05 oz Au/ton in surface dumps and 80,000 tons of

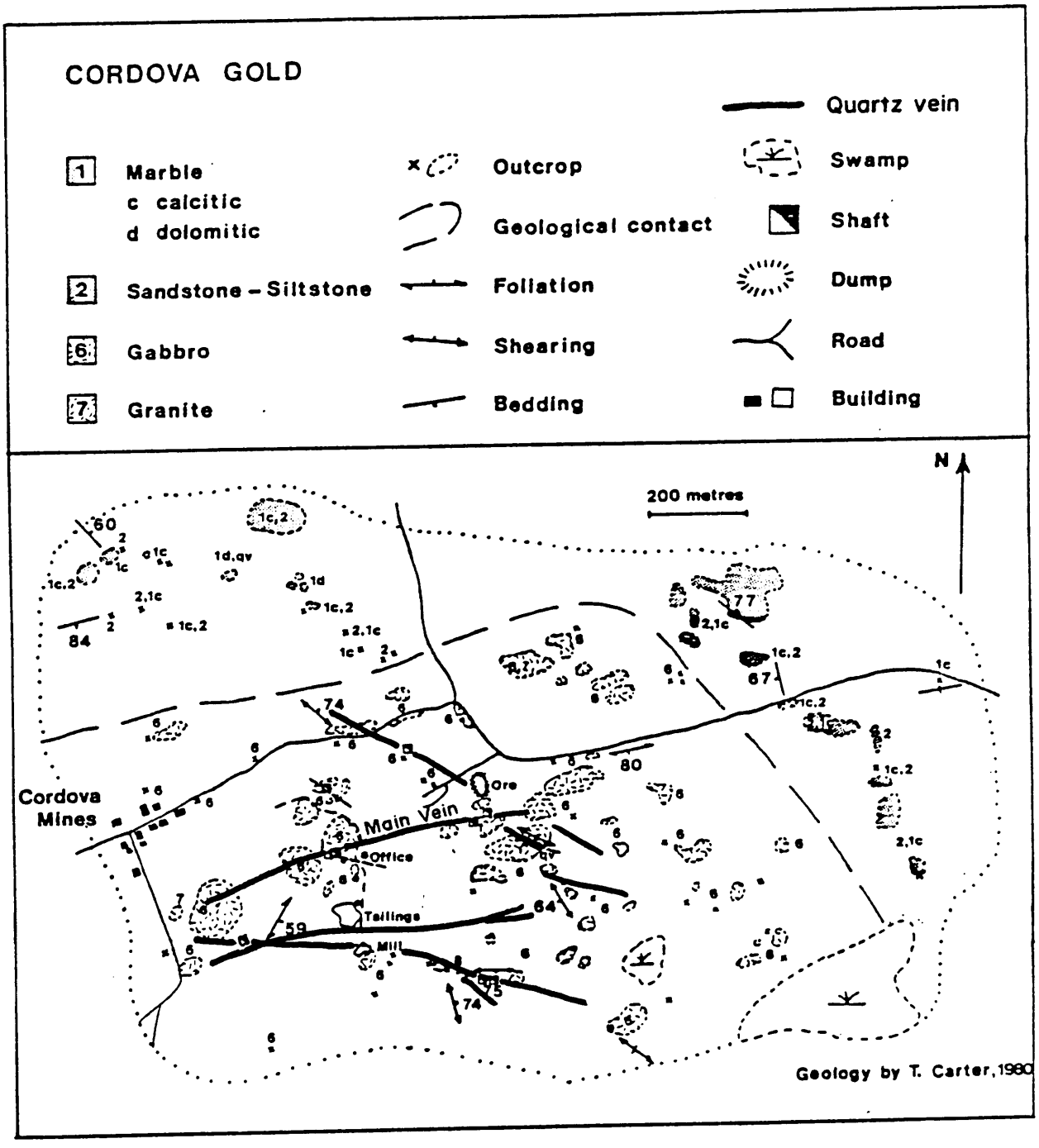


Figure 7. Geology of the Cordova gold mine, Belmont and Marmora townships (from Carter 1980)

tailings averaging 0.04 oz Au/ton (Walter H. Hood, President, Lasir Gold Inc., Cordova Ontario, personal communication 1991).

References

Bartlett and Moore 1985

Malczak et al 1985

Narain and Burkhart 1985

Norwin Resources 1989

Wahl and Rautanen 1981

6. Clyde Property (Robertson Lake Shear Zone) Occurrences, Darling and Lavant Townships

Homestake Mineral Development Company

Location

Lot 16, con. I, Lavant Township, Lanark County; NTS 31 F/2 Clyde Forks; UTM zone 18, 5002300N, 372600E; Lat. 45° 10' N, Long. 76° 37' W (approximate center of the Clyde property).

The Clyde property encompasses an area roughly 25 km long and 4 to 6 km wide, trending north-northeast through the central parts of Lavant and Darling townships, about 45 km northwest of Perth. Access is via Highway 511 and Lanark County roads.

History

Six gold occurrences have been documented within the Clyde project area, associated with rocks within or flanking the Robertson Lake Shear Zone. Carter et al (1980) describe the Bradfords Creek, Darling, and Green Lake occurrences in Darling Township and the Joe's Lake, Lavant, and Robertson occurrences in Lavant Township.

Prospecting in the area began in the mid 1800's. Gold mineralization was recorded by R.W. Ells of the GSC in the early 1900's. Little significant exploration work was done until the 1930's and 40's when Hollinger Gold Mines Limited and Cominco were active in the area. More recent work is described below.

1962: J. Rankin drilled 6 diamond drill holes in the Little Green Lake area, Darling Township (Carter et al 1980).

1967-68: Siscoe Metals Ltd. completed a program of geological mapping and diamond drilling (5 holes totalling 837 m) in the Little Green Lake Area, Darling Township. The best recorded gold assay is 0.04 oz/ton across 5 ft (Hammerstrom 1968).

1978: Selco Mining Corp. Completed geological, VLF-EM, and soil geochemical surveys over the Joe's Lake occurrence. Two diamond drill holes totalling 99.7 m were subsequently drilled. Hole JL-1 intersected a massive pyrite layer 0.46 m thick which assayed 5160 ppb Au and 5.28% Cu (Sinclair 1978).

1983: C.F. Gleeson and V.N. Rampton completed a regional geochemical survey in Lavant and Darling Townships as part of a research project funded by the Ontario soil, and till samples were collected and analysed in order to determine the effectiveness of various sample materials in defining gold exploration targets. Significant gold and arsenic anomalies were obtained along the full strike length of the Robertson Lake Shear Zone and a subsidiary structure, the Geordie Lake Splay (Gleeson et al 1984).

1984: Gleeson-Rampton Explorations conducted airborne EM and magnetic surveys and produced a geological map of the present Clyde property. Detailed geochemical surveys

and trenching were done in the Little Green Lake - Napier Lake, Joe's Lake, and Darling Long Lake areas (Gleeson-Rampton Explorations 1985).

1985: Lac Minerals carried out ground VLF-EM, magnetic, and I.P. Surveys in the Joe's Lake and Little Green Lake - Napier Lake areas. Twelve diamond drill holes were completed in the summer of 1985 and nine additional holes in the fall, seven of which tested the Napier Lake zone. The best results were in hole LGR-13, Napier Lake zone, which averaged 800 ppb Au across 4.9 m, including 2040 ppb/1.0 m (Christie 1989b).

1988-89: Homestake Mineral Development Company optioned the Clyde property and set up a joint venture with Shallow Resources Inc. in order to conduct exploration work. Work completed in 1988 included grid cutting in the Joe's Lake and Geordie Lake areas; trenching in the Geordie Lake, Joe's Lake and Little Green Lake areas; and diamond drilling of 5 holes totalling 660 m in the Little Green Lake area.

In 1989, geological mapping was done in the Geordie Lake, Big Mud lake, and Darling Long Lake areas; soil geochemical sampling was done in the Geordie Lake and Big Mud Lake areas; and trenching and stripping were carried out in the areas of Little Green Lake, Big Mud Lake, Darling Long Lake, Geordie Lake, and Joe's Lake (Christie 1989b).

Size and Grade

Mineralization is erratic within irregular lenses of dolomitic marble containing disseminated sulphides and cross-cutting quartz veins. The known gold occurrences, as described by Carter et al (1980), range in width from 1 to 6 m and are less than 100 m long. Grab samples of mineralized quartz vein material and marble have assayed from 2 to 7.4 g/t Au and up to 1% Cu (Carter et al 1982). The best reported assay from diamond drilling is 5.16 g Au/t and 5.28% Cu across 0.46 m in Selco hole JL-1 (1978), drilled at the Joe's Lake occurrence (Sinclair 1978).

The best results from Homestake's 1989 trenching program were obtained from the Little Green Lake area, where gold values of up tp 26.1 g/t were returned from grab samples taken from a 1 to 2 m wide quartz-flooded fracture zone in dolomitic marble. However, a chip sample across the same zone assayed only 90 ppb Au/2 m (Christie 1989b).

Description

Geology

The first regional geological study of the Darling-Lavant area was done by Peach (1958) for the Ontario Department of Mines. Shear Zone by Easton and de Kemp (1987). Easton (1987) produced aa 1:50,000 scale map showing detailed geology and gold occurrences within the Robertson Lake Shear Zone.

The Robertson Lake Shear Zone, termed the Robertson Lake mylonite zone (RLMZ) by Easton and de Kemp (1987), is interpreted as a major, low-angle thrust fault which separates the Precambrian

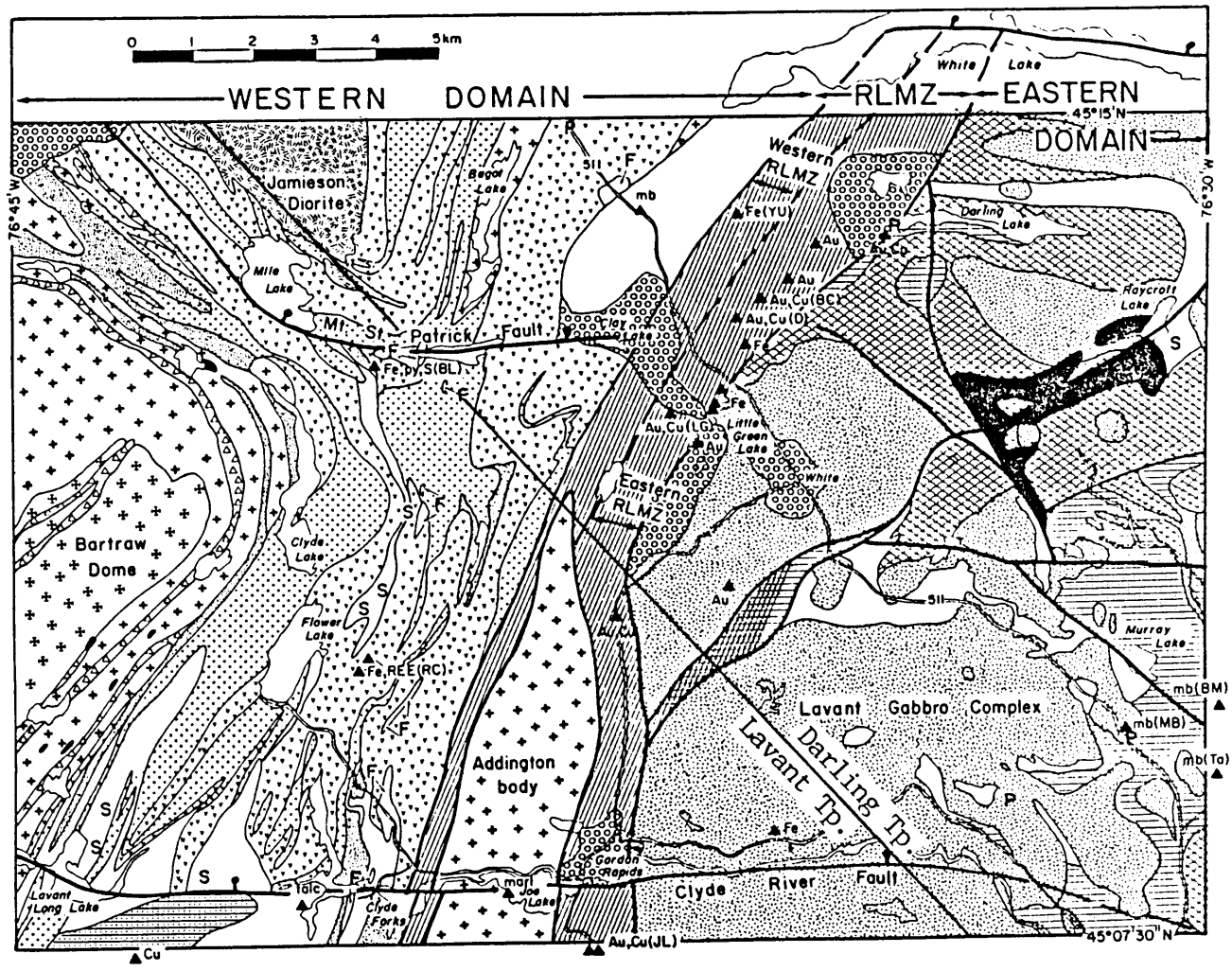
rocks of the Darling-Lavant area into an eastern and a western domain (Figure 8), described by Easton and de Kemp (1987, p. 221) as follows:

"The eastern domain is characterized by a package of mafic flows and pyroclastic rocks, and dolomitic and calcitic marbles, all intruded by gabbro, diorite, and tonalite of the Lavant Gabbro Complex. Folding in the eastern domain is tight. Rocks in the Eastern domain are generally preserved at lower amphibolite facies, but locally middle to upper greenschist facies rocks are present."

"The western domain is characterized by a package of mafic, intermediate, and felsic volcanic rocks, metasediments of predominantly volcanic provenance, and dolomitic and calcitic marbles. These rocks are now preserved at middle to upper amphibolite facies, and are considerably more deformed than rocks east of the RLMZ."

The RLMZ consists of a 1.5 to 2 km wide band of ultramylonites and protomylonites of greenschist facies metamorphism, in part retrograde, which reflect the composition of the adjacent country rocks. The western part of the RLMZ consists mainly of felsic mylonites and the eastern part consists of mylonites derived from mafic metavolcanics, gabbro, and marble.

Gold occurrences in the area are hosted within ferroan dolomitic marble bands within the eastern part of the RLMZ, associated with zones of carbonatization, silicification, and quartz veining. The marbles and adjacent mafic mylonites trend northeasterly and



LEGEND

- Quaternary cover
- P — Paleozoic rocks, regoliths
- mylonite (Robertson Lake Mylonite Zone (RLMZ))

EASTERN DOMAIN

- gabbro, diorite, tonalite
- calcite marble
- dolomite marble
- pyritiferous metasediments
- mafic metavolcanics

WESTERN DOMAIN

- muscovitic metasediments (Flinton Gp.)
- diorite
- granite gneiss
- tonalite gneiss
- anorthosite
- marble breccia
- calcite marble
- dolomite marble
- siliceous clastic metasediments, in part volcanic-derived
- intermediate to felsic metavolcanics
- amphibolite (mafic metavolcanics)

- fault, bar on downthrown side
- S — Stromatolites
- ▲ — mineral occurence, former mine, quarry

ABBREVIATIONS

Au – gold
Cu – copper
Fe – iron
mb – marble
py – pyrite
REE – rare-earth elements
S – sulphur

BC Bradford's Creek
BL Blithfield pyrite mine
BM Blue marble
D Darling
JL Joe Lake
LG Little Green Lake
MB Marble Bluff
RC Radenhurst-Caldwell
TA Tatlock
YU Yuill Iron mine

Figure 8. Geology and gold occurrences in the area of the Robertson Lake mylonite zone, Darling and Lavant townships (from Easton and deKemp 1987)

dip 30 to 65° to the southeast. Marble hosting the gold occurrences in generally very fine grained, massive, light to dark grey ferroan dolomite containing numerous narrow pods and lenses of coarse grained white dolomite with minor quartz and is cut by narrow veinlets of quartz and carbonate (Carter et al 1980).

Mineralization

Mineralization consists of disseminated grains of tetrahedrite and chalcopyrite, locally with minor bornite, sphalerite, and pyrite, within quartz veins and disseminated within lenses of white dolomite. Sulphide content is generally less than 5% but a narrow band (0.46 m) of massive pyrite was intersected in Selco diamond drill hole JL-1 at the Joe's Lake occurrence in 1978 (Sinclair 1978).

The following results of the Homestake 1989 trenching program are summarized from Christie (1989b).

1. Little Green Lake Area

Two trenches exposed auriferous, tetrahedrite-bearing quartz veins in dolomitic marble. Gold values up to 26.1 g/t were obtained from grab samples of vein material.

2. Big Mud Lake Area

A strongly sheared and iron carbonate-altered zone in gabbro and pillowed mafic metavolcanics was exposed across a width of over 40 m. Quartz veins and minor pyrite are present, but all samples assayed less than 50 ppb Au.

3. Darling Long Lake Area

Two types of mineralization were exposed: i) iron carbonate-altered dolomitic marble containing pyrite, chalcopyrite, quartz veins, and green mica, and ii) strongly sheared, iron carbonate-altered gabbro, locally with minor pyrite. The former returned gold values up to 1.03 g/t. No anomalous values were obtained from sheared gabbro.

4. Geordie Lake Area

This area covers an easterly-trending splay of the Robertson Lake Shear Zone. Trenches exposed a strongly sheared, iron carbonate-altered zone in gabbro containing irregular, narrow quartz veins, moderate green mica alteration, and weak hematite alteration. All samples contained less than 15 ppb Au.

5. Joe's Lake Area

Iron carbonate-altered dolomitic marble intruded by gabbro dikes is locally silicified and contains up to 2% fine, disseminated pyrite. The highest gold value obtained was 55 ppb.

Summary

Christie (1989b) has distinguished three types of mineralization on the Clyde property:

1. Iron carbonate-altered dolomite with tetrahedrite-bearing quartz veins and disseminations, containing gold values of up to 26.1 g/t.

2. Iron carbonate-altered dolomite with quartz veins and pyrite/chalcopyrite mineralization, assaying up to 1 g Au/t.

3. Strongly sheared, iron carbonate-altered gabbro and mafic metavolcanics containing quartz veins and minor pyrite but no anomalous gold concentrations.

Gleeson et al (1984) have demonstrated that till geochemistry is a useful exploration tool in outlining areas of gold mineralization within the Robertson Lake Shear Zone and adjacent rocks. Recent exploration efforts have not succeeded in delineating economically significant bedrock gold mineralization. However, anomalous gold concentrations in soil, till, and bedrock on the Clyde property indicate that the eastern part of the Robertson Lake Shear Zone remains the most favourable target area, particularly, as stated by Easton and de Kemp (1990), where it intersects other faults and splays off the main shear zone.

References

Carter et al 1980

Christie 1989b

Easton 1987

Easton and de Kemp 1987

Gleeson et al 1984

Gleeson-Rampton Explorations 1985

Hammerstrom 1968

Pauk 1989

Peach 1958

Sinclair 1978

7. Barry Occurrence, Elzevir Township

Corona Corporation

Location

Lot 5, con. II (SE 1/4) and lot 4, con III (NW 1/4), Elzevir Township, Hastings County.

Work Completed

Geological, soil geochemical, and geophysical (magnetic and VLF-EM) surveys were completed in 1987 by Lacana Mining Corporation on a claim group which covered both the Barry and James Joseph gold occurrences (Bishop 1988).

In 1988 Corona Corporation completed a total of 1,423 ft of diamond drilling in 5 holes on the Barry occurrence (Briggs, 1988). The occurrence has been briefly described by Malczak et al (1985).

Geology and Mineralization

The Barry occurrence is situated near the southern end of a northerly trending belt of mafic metavolcanics of the Tudor Formation which wraps around the western margin of the Elzevir batholith (Hewitt 1968). Within this area, the metavolcanics consist of dark green to black, fine to medium grained amphibolites. Coarser grained varieties, commonly with mafic/felsic segregations, may be altered mafic intrusive rocks. Banded metasedimentary rocks are also present in the metavolcanic sequence, possibly tuffaceous in origin, consisting of various

assemblages of quartz, biotite, chlorite, amphibole, feldspar, and garnet.

Gold mineralization at the Barry occurrence is hosted by a strongly silicified and carbonatized zone 15 to 100 ft wide containing cross-cutting quartz veinlets and clasts of altered amphibolite and metasediments (Figure 9). It is best exposed in a road cut on Hastings County Road 20, 1.1 km north of Hwy. 7, as an 80 ft wide zone of massive, rusty weathering ankerite which contains clasts of siliceous, altered country rock and is cut by quartz veinlets. The zone strikes 110^{o} and dips 85^{o} to the south. Mineralization consists of pods of pyrite and arsenopyrite totalling less than 3% of the rock by volume. Chip samples across this exposure averaged 100 ppb Au with a high of 805 ppb Au (Bishop 1988).

Quartz-ankerite rock is also present on the dumps of overgrown trenches 100 ft east of the road and 250 to 375 ft west of the road. Samples of arsenopyrite-bearing quartz vein material from the dumps returned assays of up to 0.3 oz Au/ton (Bishop 1988).

The 1988 diamond drill program tested the quartz-ankerite zone over a strike length of 800 ft, from 100 ft east of Road 20 to 700 ft west. The results indicate that gold mineralization is low grade and erratic. Only two holes returned assays greater than 0.03 oz Au/ton from the Barry zone. Hole 88-3 assayed 0.12 oz Au ton across 1 ft of the quartz-ankerite zone at its foot wall contact with amphibolite and hole 88-4 returned several assays ranging from 0.03/2.8 ft to 0.096 oz Au/ton across 1.6

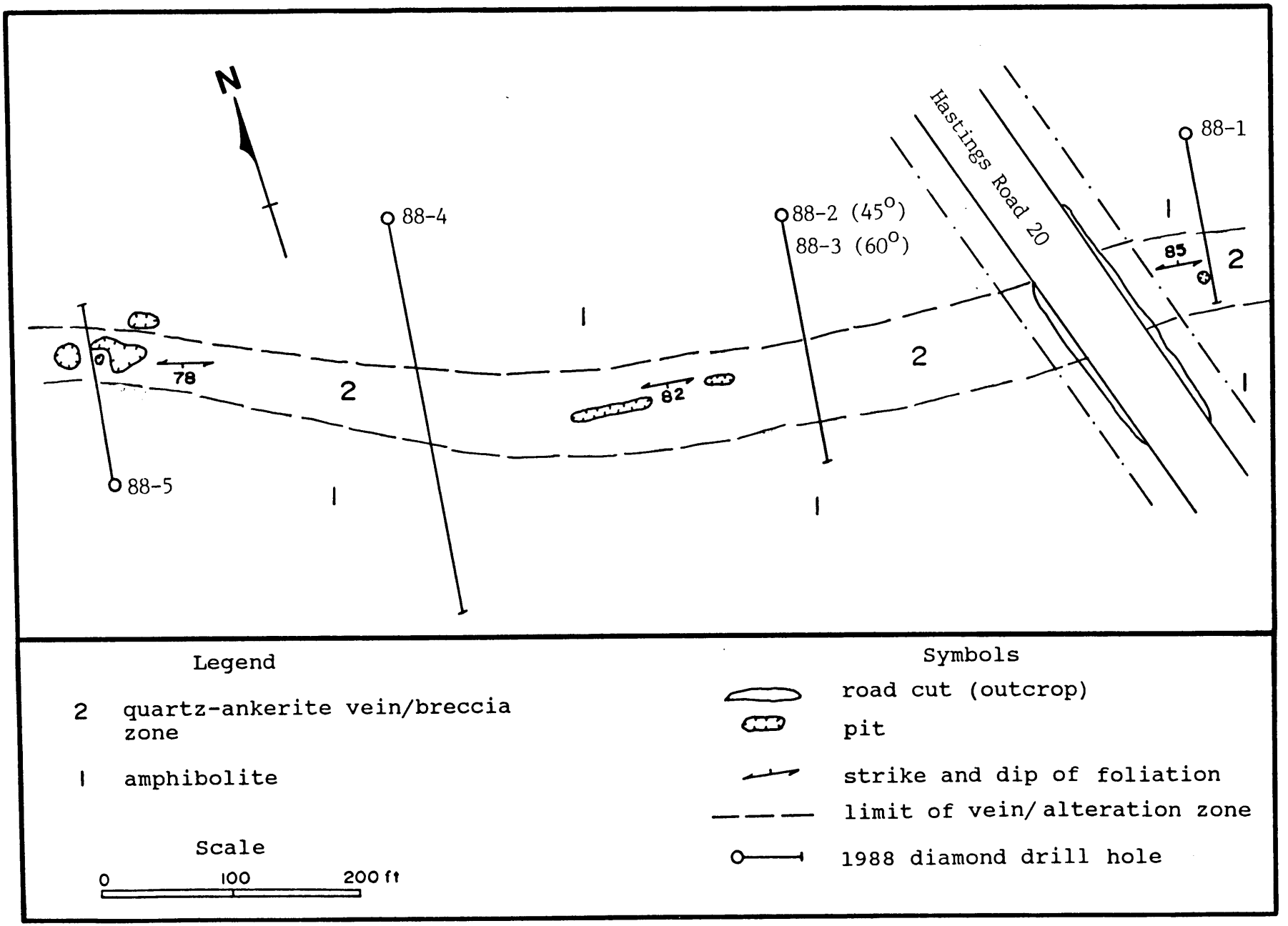


Figure 9. Geology of the Barry occurrence, Elzevir Township (after Briggs 1988)

ft. The gold values are associated with arsenopyrite, chalcopyrite, pyrrhotite, and pyrite mineralization in the 1 to 5% range.

Two holes intersected higher gold values over narrow widths in amphibolite to the north of the Barry zone. Assays of 0.49 oz Au/ton across 3 ft and 0.32 oz Au/ton across 1 ft in holes 88-1 and 88-4, respectively, are associated with minor quartz-carbonate stringer and pyrite-arsenopyrite mineralization (Briggs 1988).

Frequent reference in the drill logs to "garnet bearing amphibolite" and "layered, silicified fragments" within and adjacent to the quartz-ankerite breccia zone (Briggs 1988) suggests that the host rock is a strongly altered and brecciated metasediments.

Di Prisco (1989) has interpreted the Barry zone as part of an east-southeast trending fault which extends eastward to the James Joseph gold occurrence. Bishop (1988) reports that the zone is traceable by geological mapping, soil geochemistry (anomalous As values), and VLF-EM for a distance of at least 1.5 miles, indicating that the Barry occurrence is part of a signficant structural feature showing strong carbonate alteration and anomalous gold and arsenic concentrations.

References

Bishop 1988

Briggs 1988

Hewitt 1968

Malczak et al 1985

8. James Joseph Occurrence, Elzevir Township

Corona Corporation

Location

Lot 3, con. III and IV, Elzevir Township, Hastings County.

Work Completed

In 1987, Lacana Mining Corporation carried out geological, soil geochemical, and geophysical (magnetic and VLF-EM) surveys on a claim group covering both the Barry and James Joseph gold occurrences (Bishop 1988).

In 1988, Corona Corporation drilled three holes totalling 882 ft on the James Joseph occurrence (the "Lucas gold property").

The occurrrence has been previously described by Malczak et al (1985).

Geology and Mineralization

The Joseph occurrence is located at the contact between mafic metavolcanics of the Tudor Formation and overlying clastic metasediments (Figure 10). The metasediments, lying to the south of the metavolcanics in the area of Highway 7 north of Tweed, are described by DiPrisco (1989) as fine grained mafic and intermediate volcaniclastic rocks at the metavolcanic contact, grading southward into metaconglomerates, metalitharenites, metawacke and minor phyllite.

The metavolcanic-metasedimentary contact is conformable, with foliation in both units striking 070° and dipping 75° to the south. DiPrisco (1989) indicates a fault along the contact,

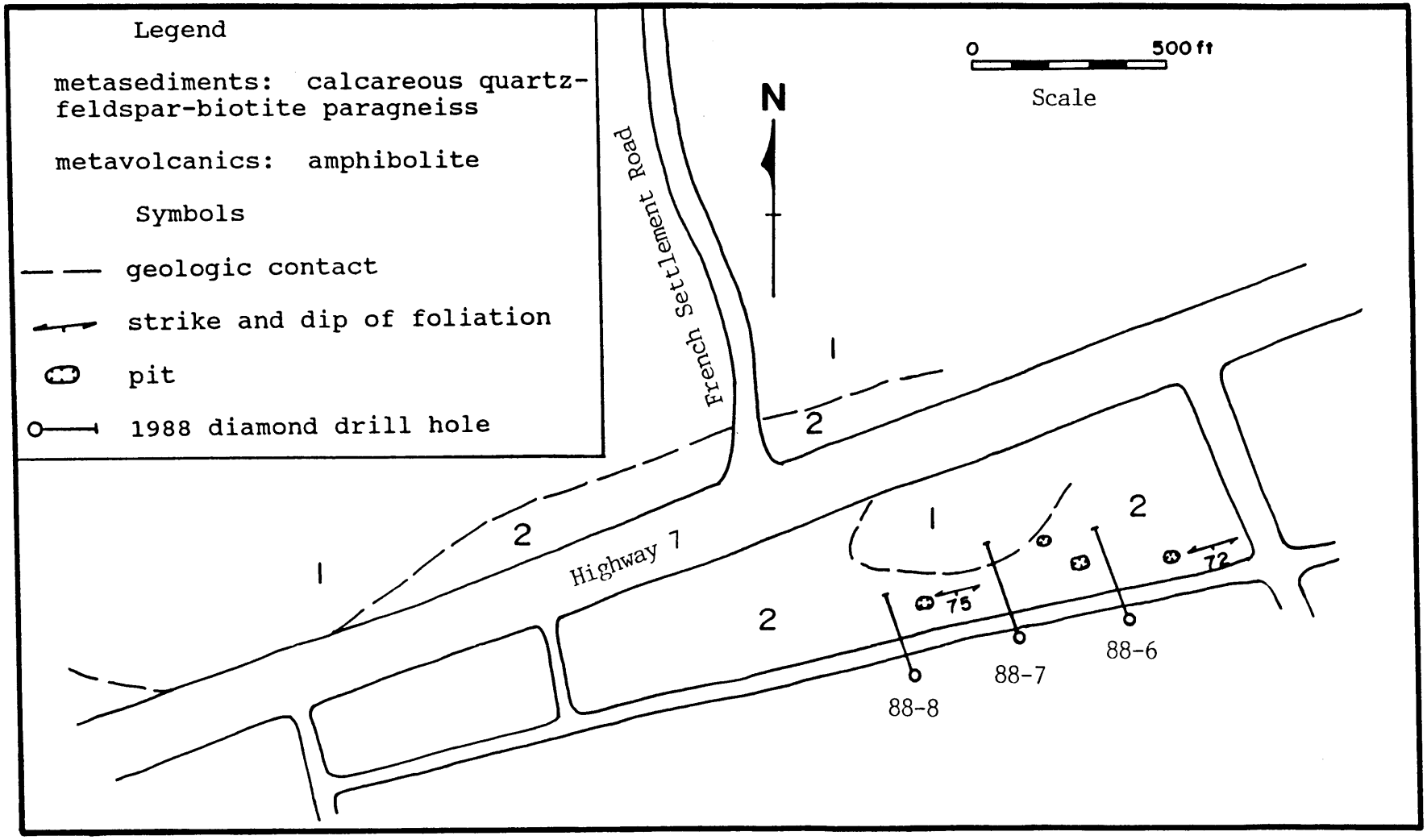


Figure 10. Geology of the James Joseph occurrence, Elzevir Township (after Briggs 1989)

which defines the northern margin of a wide, northeasterly trending series of faults termed the Moira Lake Fault Zone. The contact is gradational, consisting of a zone of intercalated metavolcanic amphibolites and metasedimentary quartz-biotite-rich paragenisses (Briggs 1989).

Minor gold mineralization occurs within an anastomosing quartz vein system reported to be about 400 ft wide, extending for 0.5 miles within the contact zone. Mineralization within the vein zone is described by Briggs (1989, p. 4-5) as follows:

"Tourmaline and arsenopyrite are usually associated with the quartz veins and occur either in the veins or in the wall rock. Tourmaline is usually massive and looks like fragments of brecciated wall rock within the quartz veins. Arsenopyrite is fine to medium grained or massive and can occur in amounts up to 5% by volume over a two-foot length of DDH core. Pyrrhotite or chalcopyrite can occur in trace amounts disseminated in quartz veins or in the host rock. Pyrite can occur in amounts up to 3% disseminated in either amphibolite or in the metasediments. In DDH BJ-88-7, elevated gold concentrations are associated with the presence of pyrite in the quartz-tourmaline veins and bleaching around the veins. Although the presence of gold is related to arsenopyrite there does not appear to be a direct relationship between the concentration of arsenic and the concentration of gold."

The 1988 diamond drill program tested the vein zone over a strike length of 550 ft in the vicinity of 3 large pits. Previous

sampling of quartz veins exposed in the pits returned values of 200 to 3,500 ppb Au and one assay of 0.117 oz Au/ton over 3 ft (Bishop 1988). However, the best assays obtained from diamond drill core sampling range from 0.033 to 0.099 oz Au/ton over widths up to 2 ft. All are associated with minor arsenopyrite mineralization (1-3%) and quartz-tourmaline veins in chloritic amphibolite.

The Joseph zone exhibits several features indicative of a favourable environment for gold mineralization: strong quartz-tourmaline veining, arsenopyrite mineralization, and intercalated metasedimentary and mafic metavolcanic rocks within a faulted contact zone. However, recent exploration work indicates low, erratic concentrations of gold.

References

Bishop 1988

Briggs 1989

DiPrisco 1989

Malczak et al 1985

9. Hawkins Bay Occurrence, Hungerford Township

Robert Ross

Location

S 1/2, lot 9, con. XIV, Hungerford Township, Hastings County.

History

The occurrence was documented by H.G. Vennor in 1870 as "gold in traces in antimonial grey copper ore occurring in nests of quartz, in white and pinkish crystalline limestone" (Uglow 1870). Wilson (1939) indicates a copper occurrence at this location and an article in the Bancroft Times (1989) refers to a 1929 report describing a copper-gold-silver-antimony prospect under development by the Tweed Copper Mining Syndicate. The report states that the company intended to sink a 100 ft shaft on a body of tetrahedrite ore. Ross (1991) reports that a company known as Vankath Mines optioned the south half of lots 8 and 9, concession XIV in 1954. Mr. Ross was informed by a local resident that a pit on the occurrence was excavated about 1910 and possibly deepened in the 1920's.

The occurrence was located by Robert Ross of Belleville in 1990. Mr. Ross carried out prospecting in the surrounding area, sampled the pit dump, and ran soil geochemical and VLF-EM surveys across the mineralized zone as part of an Ontario Prospectors Assistance Program - funded project (Ross 1991).

Geology and Mineralization

The occurrence is located within calcitic marble near the contact between a narrow belt of carbonate sedimentary rocks lying east

of the Moira River at Hawkins Bay and a belt of siliceous, clastic metasediments to the west of the river (Hewitt 1964), as shown in Figure 11.

The pit, reported to have been 30 to 40 ft deep, 15 to 20 ft in diameter at the top and funnel-shaped to the bottom, has been filled in with broken rock from the pit dump by the present land owner (Ross 1991). Some dump material remains on surface to the north and west of the pit.

Mineralization consists predominantly of tetrahedrite and trace amounts of chalcopyrite, pyrite, azurite, and malachite in a quartz vein zone within buff to pale green calcitic marble. Mineralized quartz veins showing a northerly strike are exposed in situ in a small outcrop at the southern margin of the old pit. Examination of dump material indicates that tetrahedrite is most abundant along the vein margins, where it is associated with pale green tremolite alteration of the host marble.

Quartz veins containing up to 5% tetrahedrite are common in the dump. Grab samples of heavily mineralized vein material have returned assays of up to 3% Cu, 0.089 oz Au/ton and 11.1 oz Ag/ton. The following assay results from 5 samples of vein material from the pit dump are reported by Ross (1991):

Sample	Cu %	Au oz/t	Ag oz/t	Sb %
P-90-01	1.43	0.031	3.12	0.58
P-90-02	1.69	0.045	4.29	0.65
P-90-03	2.04	0.069	9.68	0.84
P-90-04	0.79	0.021	2.89	0.32
P-90-05	3.07	0.089	11.1	1.23

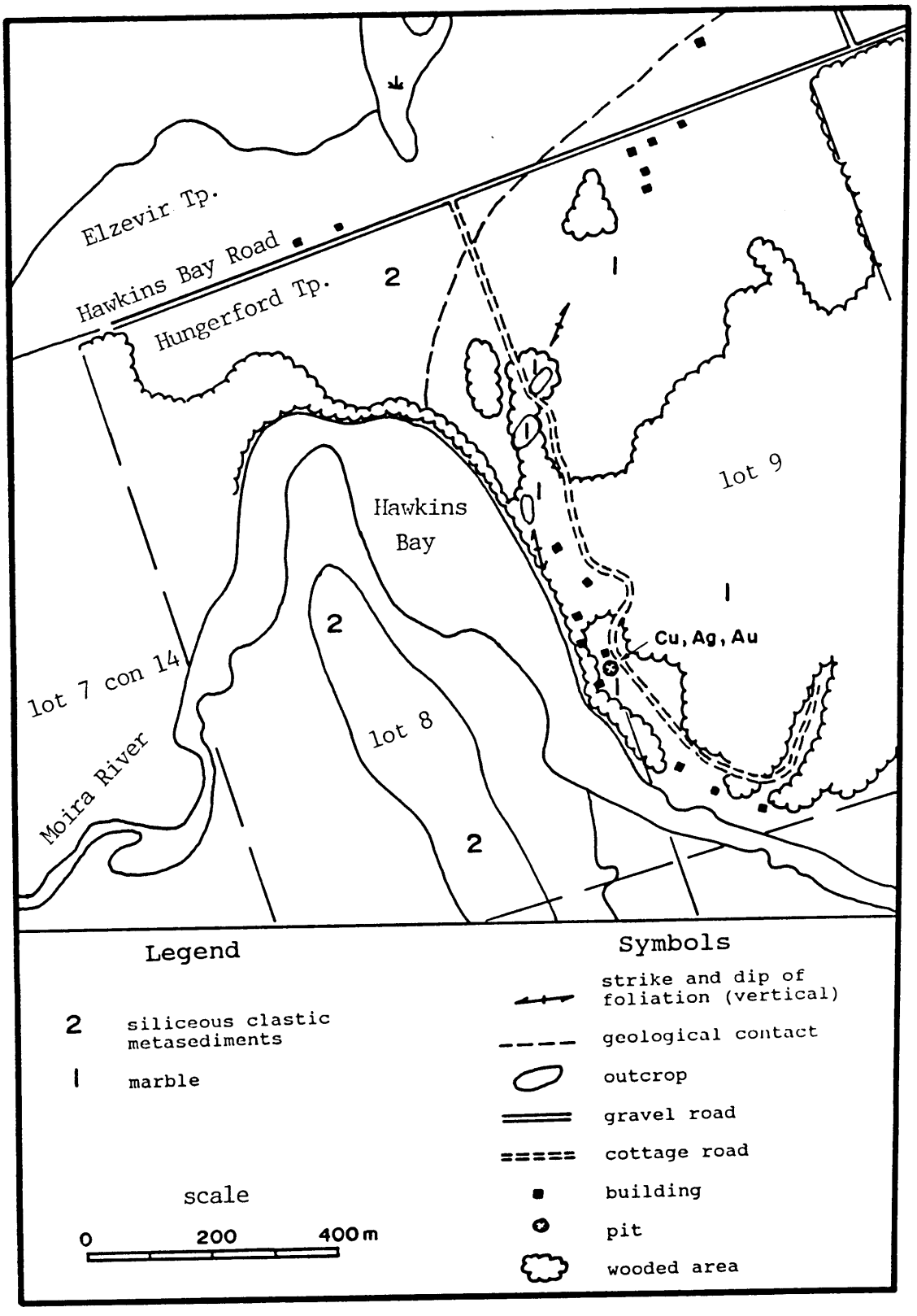


Figure 11. Geology in the area of the Hawkins Bay occurrence, Hungerford Township (after Ross 1991 and Hewitt 1964)

This occurrence resembles the Cu-Sb-Au-Ag, dolomitic marble-hosted occurrences of the Lavant-Darling area described by Carter (1984). Because of extensive overburden cover in the Hawkins Bay area, geochemical prospecting may be the most effective method of locating similar occurrences or extensions of the known mineralized zone.

References

Carter 1984

Hewitt 1964

Ross 1991

The Bancroft Times 1989

Uglow 1870

Wilson 1939

10. McCann Occurrence, Huntingdon Township

Noranda Exploration Company Limited

Location

S 1/2, lot 1, con XIII, Huntingdon Township, Hastings County; patented lot owned by John McCann, Madoc, Ontario.

History

An article in the Montreal Gazette on March 20, 1867, described a specimen of high grade gold in quartz reported to be from the Lundy farm in lot 1, concession XIII, Huntingdon Township (Canadian Mining Journal 1967). Two pits excavated by unknown operators, probably about the time of the newspaper article, were examined by the author in 1990 during reconnaissance geological work for Noranda Exploration Company Limited (LeBaron 1990c). There is no known previous documentation of this occurrence other than the aforementioned reference.

Geology and Mineralization

The occurrence is hosted by a small, easterly-trending syenite stock about 400 m long and 100 m wide which has intruded carbonate metasediments 3 km south of the Deloro granite pluton (Hewitt 1968), as shown in Figure 12. The stock may be a satellite body of the pluton, which has a marginal syenitic phase.

Foliations in both syenite and marble strike east-northeast and dip southward at 60 to 70°. Zones of diopside-garnet skarn are common at syenite-marble contacts, locally also exhibiting strong hematite alteration of magnetite. Quartz veins are common in

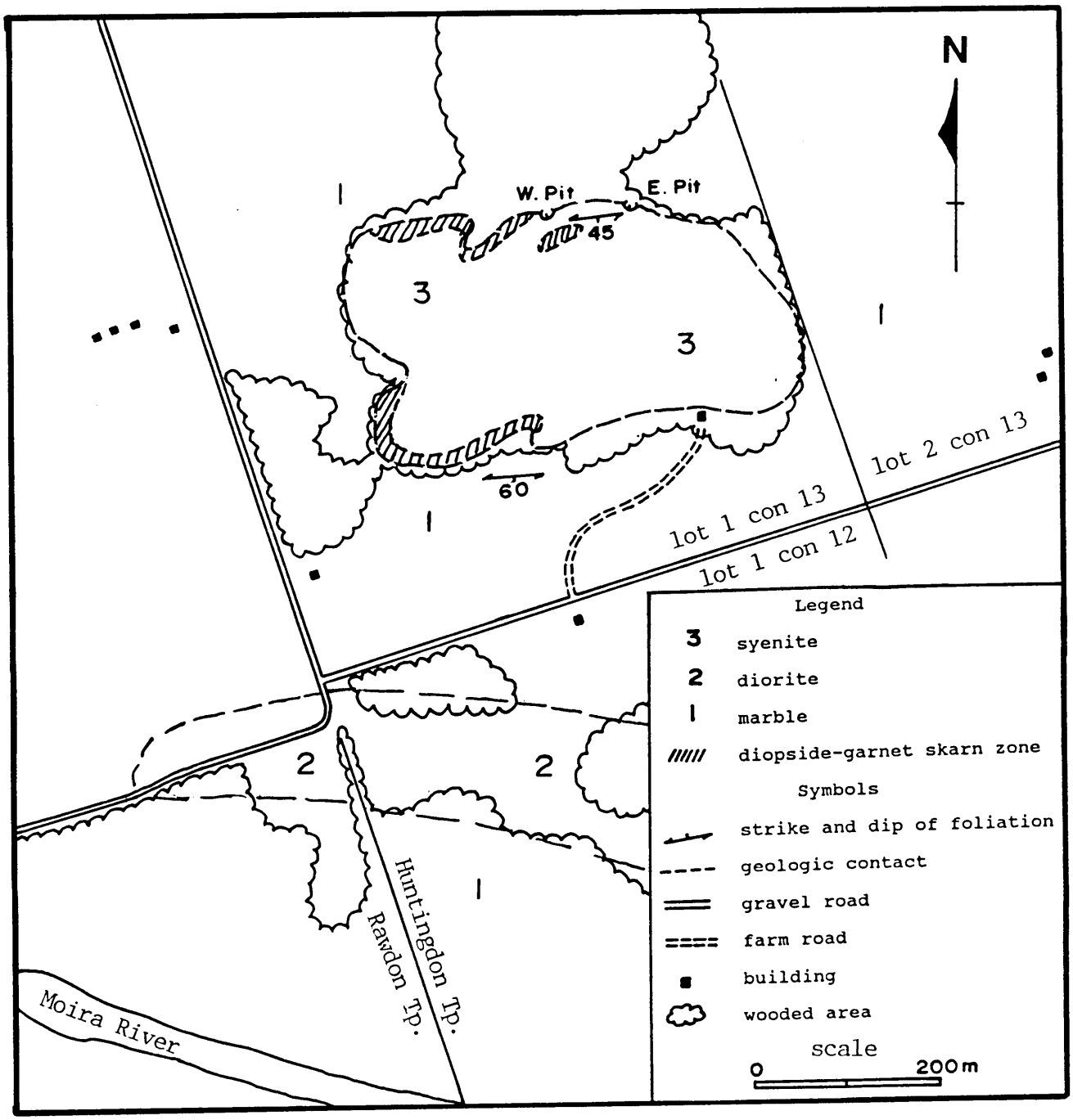


Figure 12. Geology in the area of the McCann occurrence, Huntingdon Township (after LeBaron 1990c and Hewitt 1968)

hematite-sericite altered syenite close to the contact. The veins and wall rock contain up to 1% pyrite and are generally only weakly anomalous in gold content (20 to 30 ppb Au). A sample of diopside-rich skarn containing quartz veins and 1% pyrite also returned an anomalous value of 120 ppb Au.

The McCann occurrence lies on the north side of the syenite outcrop area, close to the syenite-marble contact. Two pits have been sunk 50 m apart on a shear/quartz vein zone striking 075° and dipping 40 to 45° southward. Syenite within the 3 m wide shear zone is silicified and sericitized, containing up to 5% disseminated pyrite and 1 to 3% black, prismatic tourmaline. The quartz veins are vuggy and hematitic, up to 20 cm wide, and contain traces of pyrite. The east pit is 2 m deep and 2 m long; the west pit is 4 m in diameter and 5 m deep with a small (1 m) tunnel extending eastward at the bottom of the pit for about 1 m.

Only one of eight samples taken from the pits returned a significant assay. A sample of quartz-calcite vein material from the east pit contained 4.65 g/t Au. Samples of sandy fault gouge, vein material, and pyritic wall rock from the west pit returned low, but anomalous values of 0.65, 0.19, and 0.05 g/t Au respectively.

Blocks of altered syenite and quartz veins were observed at the base of the syenite outcrop over a strike length of 300 m. The center of the syenite stock is relatively unaltered, suggesting that the quartz veining and alteration at the margins is related to shearing and metasomatism along the syenite-marble contact.

References

Canadian Mining Journal 1967
Hewitt 1968
LeBaron 1990c

11. Addington Gold Mine, Kaladar Township

Michele Gold Mines Limited

Location

Lots 24, 25, con. VI, Kaladar Township, Lennox and Addington County.

Work Completed

Prior to 1980, the property had been idle since the 1936-39 program of underground development and diamond drilling by Addington Mines Limited, a subsidiary of Cominco (Malczak et al 1985).

Between 1980 and 1989, two companies carried out extensive diamond drilling in the vicinity of the mine workings.

E & B Explorations Ltd. completed a total of 24,501 ft of diamond drilling in 32 holes between 1980 and 1983 and Michele Gold Mines Limited, under an option agreement with Cathedral Gold Corporation, drilled 15 holes totalling 3708 ft in 1988.

Other work in the vicinity of the Addington Mine, recorded in assessment files at the Resident Geologist's Office, Tweed, by Cathedral Gold Corporation from 1987 to 1990 includes an airborne magnetometer/VLF-EM survey, geological and geochemical surveys carried out to the north, west, and south of the Addington property, and diamond drilling of one hole to a depth of 216 ft in the SW 1/4 of lot 23, concession VI.

C.R. Young drilled two diamond drill holes in 1983, one to the north and one to the south of the Addington property.

Size and Grade

Production to the end of 1921 is reported to have been valued at $10,000, or about 480 oz of gold (Harding 1944).

Following a considerable amount of underground development work and diamond drilling from 1936 to 1938, Addington Mines Limited in 1939 estimated ore reserves of 256,000 tons grading 0.16 oz Au/ton and an additional 103,000 tons of possible ore grading 0.08 oz Au/ton (Malczak et al 1985).

The most recent available reserve estimate, based upon the results of the E & B Explorations Ltd. diamond drilling, is 318,500 tons grading 0.16 oz Au/ton proven and probable, and a total geological reserve of 785,000 tons grading 0.13 oz Au/ton (Sadowski 1988).

Geology and Mineralization

Detailed descriptions of the geology of the Addington mine have been presented by Wolff (1982), Carter (1984), Malczak et al (1985), and Dillon (1985). The main features are summarized below.

The Addington mine lies at the contact between a northeasterly trending belt of Tudor Formation mafic metavolcanic rocks and a narrow belt of Flinton Group metasediments to the east (Figure 13). Auriferous quartz-tourmaline veins occur within a 2 to 10 m wide shear zone over a 915 m strike length. This zone is hosted by a hornblende-biotite-garnet schist known as the Ore Chimney Formation which has been ascribed to the Flinton Group by

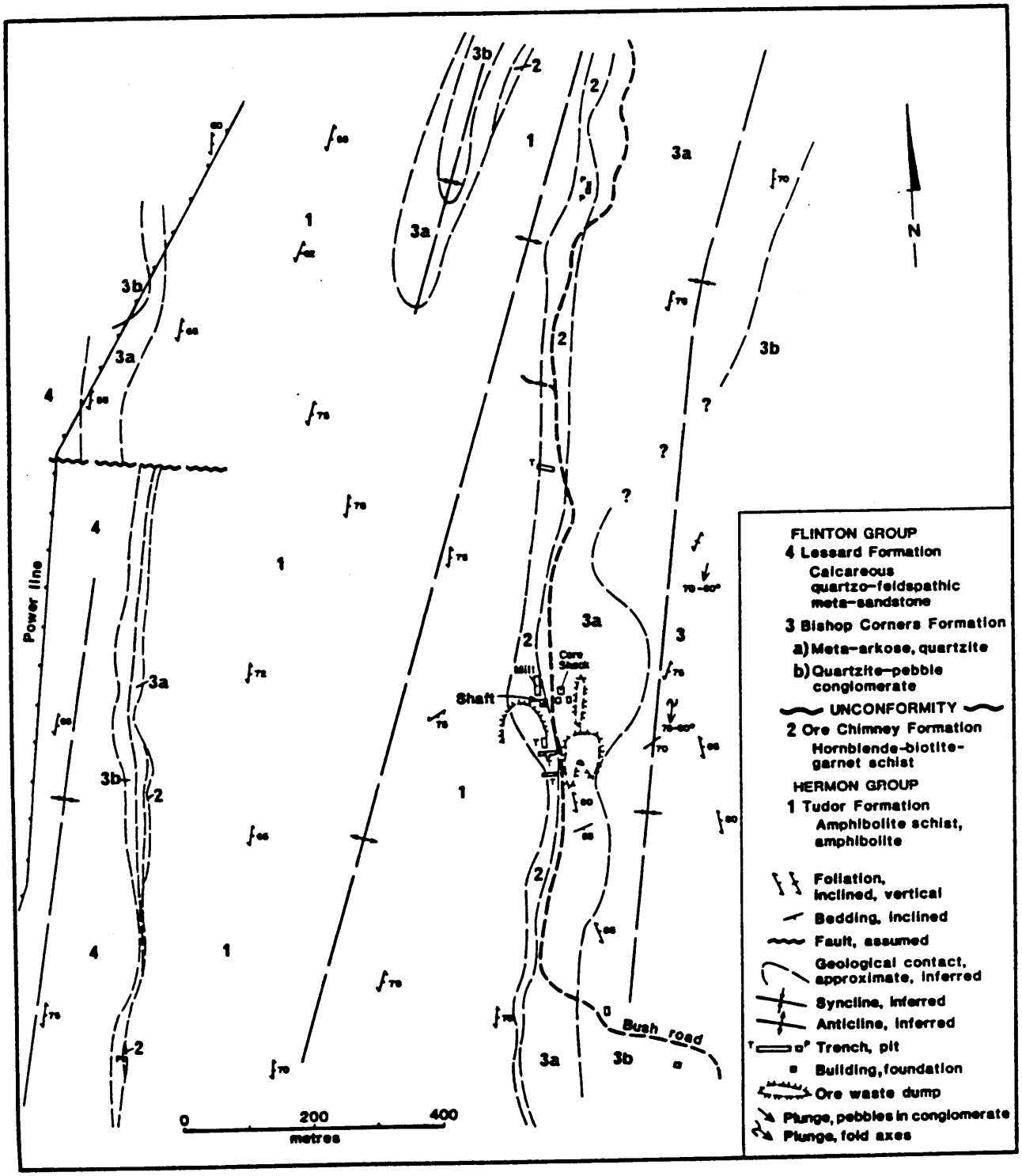


Figure 13. Geology of the Addington mine area, Kaladar Township (from Dillon 1985)

Thompson (1972). Dillon (1985) suggests that the Ore Chimney Formation either represents a mafic metasediment derived from the metavolcanics and deposited prior to Flinton sedimentation, or is the result of extensive shearing along the Tudor-Flinton contact.

Mineralization is concentrated within 4 separate orebodies which plunge steeply southward within the easterly dipping (65^{o}) contact-shear zone. Quartz lenses and stringers, generally concordant to the shear fabric but locally cross-cutting, contain pyrite with lesser amounts of arsenopyrite, pyrrhotite, galena, chalcopyrite, and sphalerite. Accessory vein minerals include ankerite, biotite, tourmaline, scheelite, magnetite, and ilmenite. Native gold has also been reported. Subordinate mineralized quartz-tourmaline veins occur within Flinton Group metasediments east of (stratigraphically above) the Ore Chimney Formation (Dillon 1985).

Two easterly trending, nearly vertical faults intersect the contact-shear zone south of the shaft. The first, about 215 m south of the shaft, intersects the southern limit of the mineralized zone. The second fault, about 60 m further south, does not intersect any of the known ore zones.

Significant gold mineralization at the Addington mine appears to be related to shearing along the Tudor-Flinton contact during post-Flinton regional metamorphism. The association of gold mineralization with the Ore Chinmey Formation at the Addington mine and at the Ore Chimney prospect to the north suggests that

this unit represents a favourable target for gold mineralization in other areas.

References

Carter 1984

Dillon 1985

Harding 1944

Malczak et al 1985

Sadowski 1988

Thompson 1972

Wolff 1982

12. Bannockburn Gold Prospect, Madoc Township

Mono Gold Mines Inc.

Location

Lot 28, Con. V, Madoc Township, Hastings County.

Work Completed

Prior to 1981, the most recent work on the old Bannockburn Gold Mine was a program of trenching and diamond drilling of 5,100 ft in 12 holes in 1965 (House 1984).

In 1981, Mono Gold Mines Inc. carried out geological, magnetic, and VLF-EM surveys, stripping, trenching, and diamond drilling of 1,725 ft in 11 holes in the vicinity of the old shaft and trenches.

Mono extended the geological and geophysical surveys in 1984 to include areas to the south, north, and northeast of the 1981 survey area. Subsequent work on a gold-bearing quartz vein zone discovered during this survey in the northeast area has delineated a significant new gold prospect, described in this report under the title "Mono Prospect, Madoc Township". In 1985, one diamond drill hole 265 ft long was completed by Mono to test the southern projection of the original Bannockburn vein about 400 ft south of the shaft, and a soil geochemical survey was done in the 1984 geological/geophysical survey areas.

Detailed descriptions of the geology and history of the Bannockburn prospect are presented by Malczak et al (1985).

Geology and Mineralization

As shown in Figure 14, the prospect lies within a northerly trending, vertically dipping shear zone at the contact between the Gawley Creek syenite stock and siliceous metasedimentary rocks to the east (Hewitt 1968). Within the 6 ft wide shear zone, the syenite is altered to a biotite-carbonate-potassium feldspar schist containing veinlets of quartz and ankerite and disseminated pyrite mineralization. The veins are 3 to 10 cm wide, and contain up to 10% pyrite with minor chalcopyrite and gold. The mineralized zone has been exposed in trenches and four shafts over a strike length of 700 ft and intersected in diamond drill holes for an additional 300 ft along strike. The main shaft is 75 ft deep with a 10 ft drift on the 32 ft level (Malczak et al 1985).

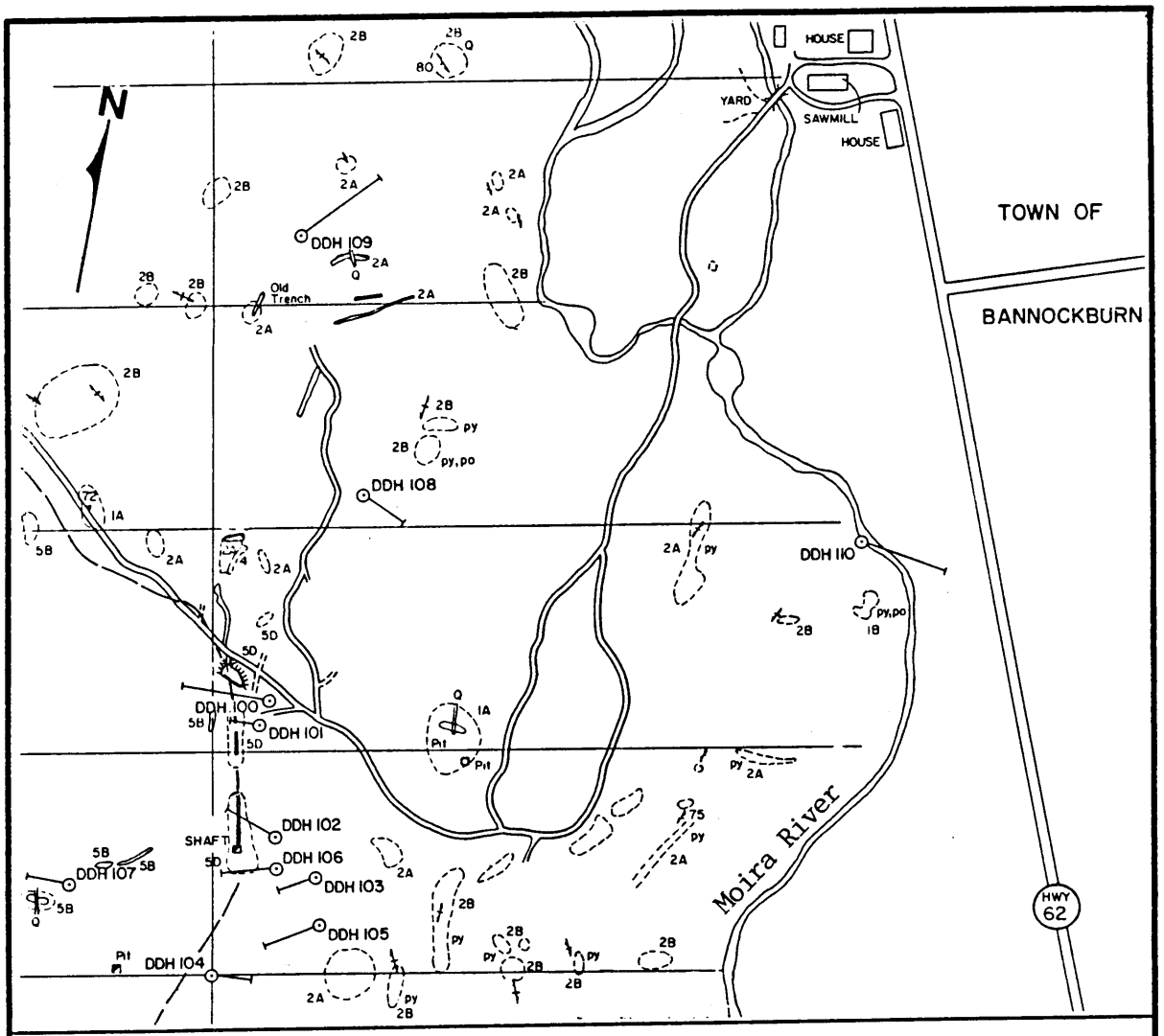
House (1984) reports assays of 0.069 and 0.114 oz Au/ton from surface samples of quartz veins within the main zone, confirming earlier reports of gold mineralization listed by Malczak et al (1985). The 1981 diamond drill program also confirmed the presence of gold within the shear zone (House 1984) but did not significantly increase the tonnage and grade potential.

Sampling of the metasediments, which commonly contain up to 15% sulphides (pyrite, pyrrhotite, and minor chalcopyrite), also indicated low potential for gold mineralization (House 1984).

Additional diamond drilling of 4 holes totalling 2400 ft was recommended by House (1984) in order to test the Bannockburn main zone at depth, but this program was not completed.

References

Hewitt 1968
House 1984
Malczak et al 1985



LEGEND

INTRUSIVES

5 — 5A Syenite, medium to coarse grained, sometimes minor hornblende or biotite.
5B Diorite, hornblende and/or biotite rich
5C Contact hybrid zone, mixed syenite/diorite, syenodiorite
5D Contact zone, mixed syenite/metasediments

4 — Felsitic intrusive - pink fine grained dyke, late stage aplitic syenite dykes, abundant pyrite and chalcopyrite

3 (Q) — Quartz veining

METASEDIMENTS

2 — 2A Quartzite, and quartzo-feldspathic rocks, frequently sheared
2B Quartz, - sericite schist usually light brown to grey-brown, variable schistosity, quartz segregations and boudins, frequently carries pyrite, pyrrhotite, some chalcopyrite

1 — 1A Quartz - biotite - sericite schist, darker grey to green-grey, chlorihzed in part, usually carries pyrite, pyrrhotite
1B Chloritic to amphibolitic schist, usually pyritic

SHAFT — Shaft, pit
Trench
Area of outcrop
Quartz vein, outcrop
30 — Schistosity, foliation, - vertical, dip
Geological contact
HWY 62 — Paved road
Bush road, dirt
py — Pyrite
po — Pyrrhotite

200 100 0 200 400 FEET
SCALE

Figure 14. Geology of the Bannockburn gold prospect, Madoc Township, showing 1981 diamond drill hole locations (from House 1984)

13. Cooper Gold Occurrence, Madoc Township

Gateford Resources Inc.

Location

Lot 24, con XI, Madoc Township, Hastings County; NTS 31C/11 Kaladar; UTM zone 18, 4945950 N, 306250 E; Lat. 44°38'33"N, Long. 77°26'35"W.

The occurrence is located about 15 km north of Madoc. Access is obtained by travelling north on County Road 12 from Highway 7 to the hamlet of Cooper, east on the gravel township road from Cooper for a distance of 1.7 km, and south to the Lennox farm, from which a diamond drill access road leads southeastward across the Moira River to the shaft area.

History

Pre-1980: A shaft, probably dating to the early 1900's, was sunk by unknown operators. C.R. Young of Havelock (co-owner of the property with J.L. Byer of Actinolite), reports that the shaft is 75 ft deep (personal communication 1986). Surface dimensions are about 15 by 20 ft and the shaft is filled with water to within 15 ft of surface.

1982: C.R. Young and J.L. Byer carried out diamond drilling on a talc prospect in the vicinity of the gold occurrence (Kingston and Papertzian 1983).

1985: Twin Buttes Exploration Inc. carried out a diamond drilling program to evaluate the talc prospect. Meillon (1985) reports reserves totalling 3 million tonnes grading

30 to 33% recoverable talc within two zones located north and west of the gold occurrence.

1988: Gateford Resources Inc. completed a total of 13,505 ft of diamond drilling in 33 holes to evaluate the Cooper gold occurrence in the vicinity of the shaft. An additional 10,000 ft of drilling was recommended but was not carried out (Beesley 1990).

Size and Grade

The 1988 Gateford Resources diamond drilling program outlined a small tonnage of gold ore described by Beesley (1990) as follows:

"A gold-mineralized ore lense within the quartz vein was indicated in situ in eight contiguous holes and the shaft collar. The lense is defined with a grade (oz/ton) X width (ft) product cut-off of 1.0. The lense has an average strike length of 135 feet, varying from 75 to 200 feet in length, continues from surface to a depth of 350 vertical feet in a consistent fashion and contains 37,120 undiluted tons with an average grade of 0.225 oz/ton gold across an average width of 7.3 feet."

Description

The Cooper occurrence lies within a belt of mafic metavolcanics of the Tudor Formation which wraps around the western margin of the Elzevir pluton and is overlain to the west by carbonate and siliceous clastic metasediments (Hewitt 1968).

Gold mineralization occurs within an 8 ft wide, sulphide bearing quartz vein in a shear zone consisting of quartz-amphibole-chlorite schist about 30 ft from the contact with granodiorite of

the Elzevir pluton (Figure 15). The vein is conformable to the foliation within the schist and adjacent metavolcanics, striking 025° and dipping about 75° to the west.

Dark green to black amphibolite (metavolcanic) separates the shear zone from the granodiorite to the east. To the west, lenses of ultramafic rock which have been altered to serpentinite, talc-chlorite-carbonate schist and talc-carbonate schist are interfingered with the amphibolites (Meillon 1985). Exploration for talc ore in this area by Twin Buttes Exploration Inc. resulted in the delineation of two talc-rich lenses estimated to contain a total of 3 million tons grading 33% recoverable talc (Meillon 1985). LeBaron and van Haaften (1989) suggest that the talcose rocks may be altered komatiitic volcanics, while DiPrisco (1989) considers them to be derived from highly strained ultramafic plutonic lenses.

The contact between the Elzevir pluton and the metavolcanics is irregular and complex, consisting of a zone of interfingering and parallel bands of metavolcanics, granodiorite, and pink aplite dikes (Meillon 1985).

The quartz vein which hosts the mineralized lens exposed at the shaft has been traced by a series of shallow pits for a distance of 150 ft south of the shaft and 350 ft to the north.

Mineralization

The quartz vein is about 8 ft wide where exposed in the shaft walls. It contains narrow seams of green chlorite schist and

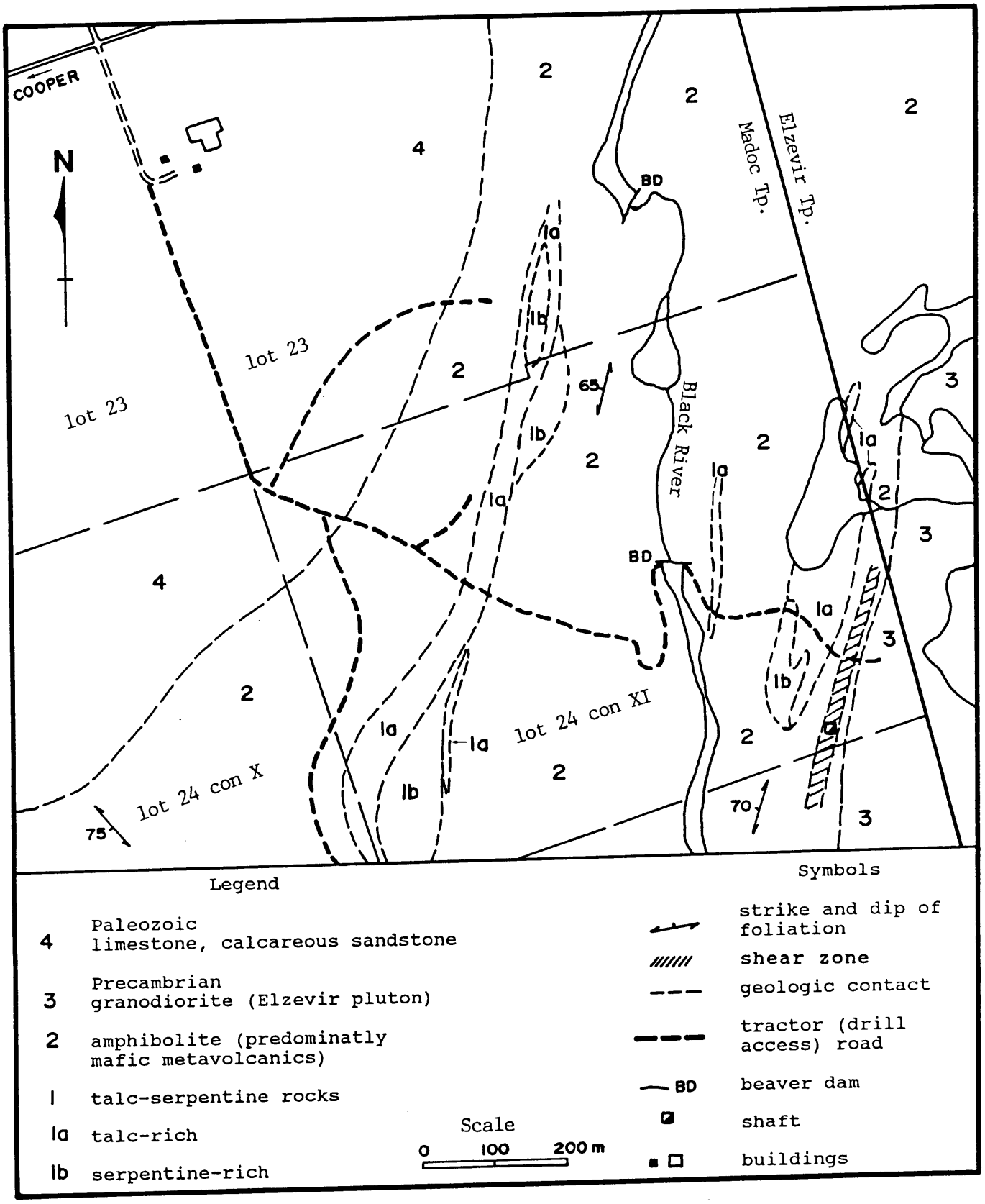


Figure 15. Geology in the area of the Cooper gold occurrence, Madoc Township (after Beesley 1990 and Meillon 1985)

black quartz-amphibole schist which may contain several percent disseminated pyrite. Within the quartz vein material are erratic, coarse clots of galena, sphalerite, chalcopyrite, and pyrite in the percent range, and traces of native gold. Visible gold was noted in 5 of 9 diamond drill intersections within the ore lens (Beesley 1990).

The ore lens averages 135 ft in strike length and plunges steeply northward within the westward dipping quartz vein (Beesley 1990).

Summary

Gold mineralization is associated with a sulphide-bearing quartz vein in sheared mafic metavolcanics close to the contact with the Elzevir granodiorite pluton. An ore lens containing 37,000 tons grading 0.225 Au/ton to a depth of 350 ft has been defined by diamond drilling.

Previous work in the area has largely been directed toward exploration for talc. The presence of a gold occurrence in an area of interfingered mafic volcanics and intensely altered ultramafic rocks close to a large felsic intrusive body suggests that additional exploration for gold mineralization is warranted.

References

Beesley 1990

DiPrisco 1989

Hewitt 1960

Kingston and Papertzian 1983

LeBaron and van Haaften 1989

Meillon 1985

14. Dingman Prospect, Madoc and Marmora Townships

Noranda Exploration Company Limited

Location

Lot 19, con XI, Marmora Township and lot 19, con I, Madoc Township, Hastings County; NTS 31C/12 Bannockburn; UTM zone 18, 4938700N, 293500E; Lat 44° 35' 35"N, Long 77° 35' 50" W.

The prospect is located about 13 km northwest of the town of Madoc and is accessible by following County Road 11 north from Highway 7 for a distance of 11 km. The 10-claim Noranda property which covers the Dingman prospect straddles the county road, which at this point follows the Madoc-Marmora township boundary.

History

There is no record of previous work on the Noranda property, although several shallow pits have been sunk on quartz veins in granite, probably in the late 1800's.

The property was staked in 1985 by Mark Dingman following the discovery of low, but anomalous gold values in granite (Dingman 1986).

In 1986, Noranda Exploration Company Limited acquired the property under an option agreement and carried out geological, geophysical, and soil geochemical surveys and extensive diamond saw channel sampling. Diamond drilling totalling 5027 m in 38 holes and metallurgical testing were done in 1987-88.

Size and Grade

The prospect has been described by Noranda as a "high tonnage,

low grade gold project" (The Northern Miner 1989). No reserve figures or assay results have been released.

Description

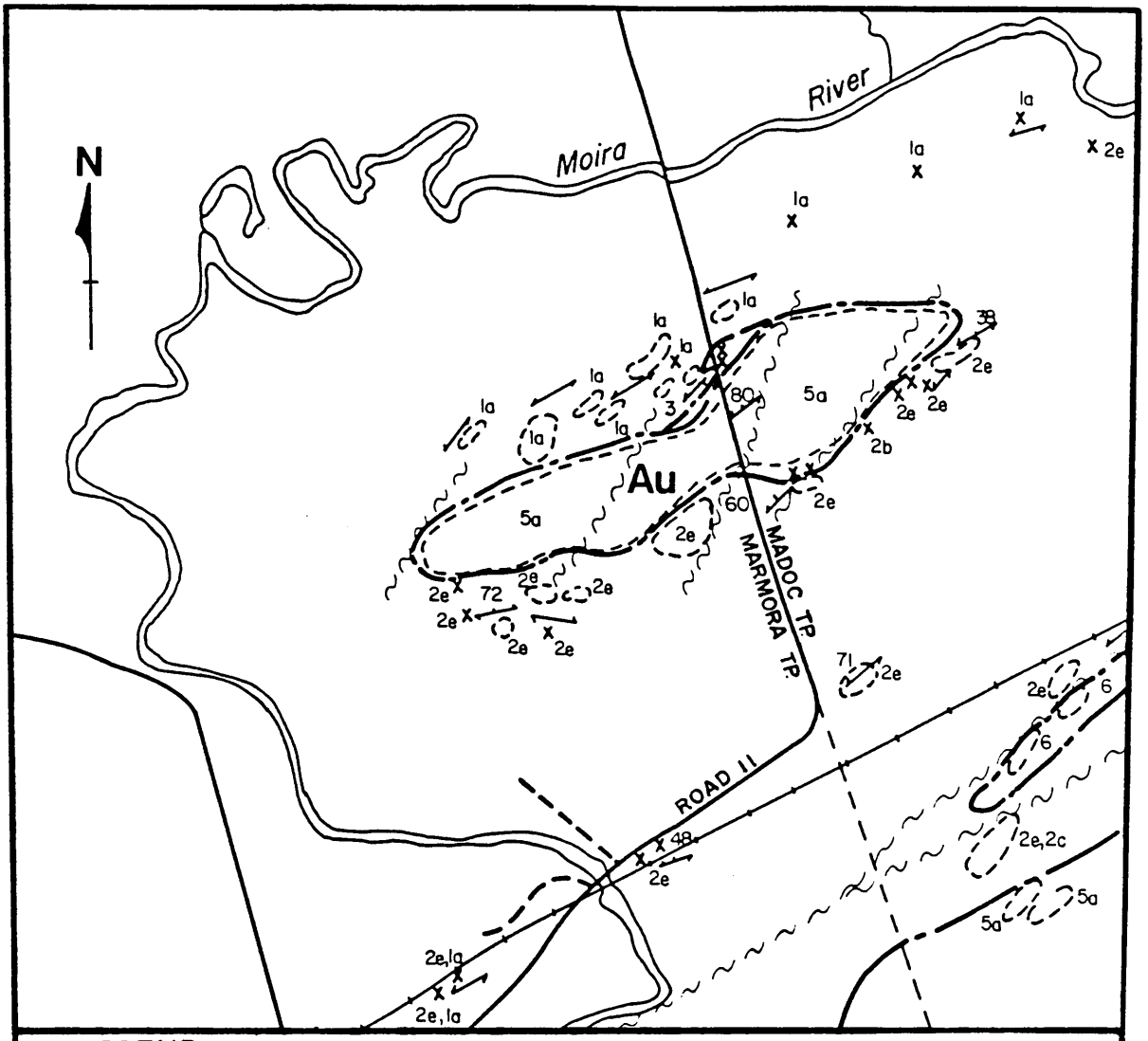
Geology

The Dingman prospect is hosted by an elongate, northeasterly trending granite stock about 800 m long and 80 to 150 m wide which has intruded carbonate metasediments (Figure 16). The stock forms a prominent outcrop ridge above the surrounding pasture and is well-exposed in a roadcut on County Road 11.

The metasediments are predominantly fine grained, grey, foliated calcitic marbles locally intercalated with calcareous schists. A small (5 m) band of wollastonite bearing calcitic marble/calc-silicate rock is exposed in the roadcut at the northern contact between granite and marble (MacKinnon 1990).

Bartlett and Moore (1985) and Hewitt (1968) indicate that the Dingman granite stock lies about 800 m north of the Deloro granitic pluton. Similarities in composition, texture, and alteration suggest that the Dingman granite is a small satellite body of the Deloro pluton, one of a series of similar stocks which rim the pluton, particularly to the north and east as shown by Hewitt (1968).

At the roadcut, the granite exhibits strong shearing throughout its entire width, with foliation striking 060^{o} and dipping northward at 70 to 80^{o}. Mineralogy, colour, and texture of the granite vary with intensity of alteration, described in the



LEGEND

PALEOZOIC

6 Shadow Lake Formation: fine-grained to conglomeratic, thinly-bedded, calcareous feldspathic quartz sandstone.

PRECAMBRIAN

5 FELSIC INTRUSIVE ROCKS

- 5a Granite
- 5d Amphibole-syenite, quartz-syenite

GRENVILLE SUPERGROUP METASEDIMENTS

3 Wollastonite-bearing calcitic marble / calc-silicate rock / skarn

2 Carbonate Metasediments

- 2b Serpentinized calcitic marble
- 2c Siliceous calcitic marble
- 2e Grey calcitic marble

1 Siliceous Metasediments

- 1a Siliciclastic metasediments: calcareous wacke / siltstone

SYMBOLS

- Outcrop
- Geological boundary
- Fault
- Strike dip (inclined, unknown)

Scale

0 500 m

Figure 16. Geology of the Dingman occurrence area, Madoc and Marmora townships (from MacKinnon 1990)

legend accompanying diamond drill log sections (King 1987) as follows.

The granite is described as being medium to coarse grained, with 25 to 60% quartz, 40 to 75% feldspar, and accessory chlorite and pyrite. There is widespread pink to brick red hematite staining and locally strong alteration of feldspars to buff to pale green muscovite/sericite. The foliation is defined by stretched and sericitized feldspar grains and by local mylonitic textures referred to in the diamond drill logs. Subdivisions within the granite, based upon alteration intensity are:

1. weakly altered; well-preserved coarse quartz and feldspar grains, buff colour (little to no hematite stain).
2. weak to moderate alteration: distinct feldspar grains with minor interstitial chlorite-sercite; feldspars pale red (hematite stain).
3. moderate alteration: weak foliation with stretching of feldspar between quartz grains; moderate sericite and hematite alteration of feldspars, pale green colour developing.
4. moderate to strong alteration: banded texture due to extreme stretching and moderate sericite alteration of feldspar; bands are buff to green and locally red (hematitic).
5. strong alteration: feldspars totally altered to pale green muscovite/sericite; strong foliation; rock appears as quartz porphyry with coarse, round blue-grey quartz grains in a

green mica schist; locally with strong hematite staining and trace to 3% disseminated pyrite.

(King 1987)

Narrow, discontinuous quartz veins can be seen in the roadcut and are described in diamond drill logs as pale grey to grey-blue stringers, generally 1 to 3 cm wide, locally containing calcite, purple fluorite and pyritic and/or hematitic vugs.

The granite-marble contact area has been mapped by MacKinnon (1990), who indicates a series of north-northeasterly trending (020^{o}) faults which are evident as shallow topographic depressions within the granite outcrop area and have offset the contact to a small extent (Figure 16). Zones of intense alteration appear to be associated with these structures, which may be the northern extensions of similar, locally auriferous shear zones along the western margin of the Deloro pluton.

Mineralization

Diamond drill logs indicate that sulphide mineralization is common throughout the granite, commonly as pyrite in amounts of 1 to 3%, but locally reaching 15 to 25% combined chalcopyrite and pyrite over core lengths of up to 10 ft. Pyrrhotite and magnetite are also present in minor amounts. One 1.5 ft band of massive sulphide (80-85% pyrite and 5-7% chalcopyrite), visible in the roadcut, was also intersected in diamond drill hole DI 87-2 (King 1987).

Narrow quartz and quartz-carbonate-fluorite stringers commonly contain trace amounts of chalcopyrite, pyrite, pyrrhotite, magnetite, and galena (King 1987).

A few fine grains of native gold were observed by the author in narrow quartz stringers within strongly altered granite during a geological examination of the property for Noranda Exploration Company Limited in 1986. Thin section studies by Noranda have also indicated the presence of microscopic native gold particles within both quartz veins and altered granite.

Summary

The Dingman prospect consists of widespread, low grade gold mineralization in strongly sheared and altered granite. The prospect is similar to gold occurrences along the margin of the Deloro pluton to the south in the association of quartz veining and sericite alteration with north-northeasterly trending shear or fault zones. However, major differences evident at the Dingman property include: 1) the apparent absence of arsenopyrite, 2) the presence of gold mineralization within both quartz veins and host rock, and 3) the much more pervasive nature of the sericite alteration.

The first feature may be the result of metal zoning related to variation in temperature with depth and/or distance from the Deloro pluton. Kuryliw (1988), in a study of zoning within deposits of various Archean gold camps, has recognized a sequence of temperature/pressure related mineral associations. Part of this sequence includes a change from gold-arsenopyrite

mineralization to a gold-pyrite-pyrrhotite association with cooler temperatures directly above the gold-arsenopyrite zone.

Features 2 and 3, above, may be the result of gold-bearing hydrothermal solutions associated with 020° (Moira River fault zone) faults intersecting the Dingman granite which had been intensely micro-fractured and sheared along a 060° trend, allowing more extensive permeation of the mineralizing fluid than occurred within more massive host rocks of the Deloro pluton margin.

References

Bartlett and Moore 1985

Dingman 1986

Hewitt 1968

King 1987

Kuryliw 1988

MacKinnon 1990

The Northern Miner 1989

15. Mono Prospect, Madoc Township

Mono Gold Mines Inc.

Location

East 1/2, lot 29, con VI, Madoc Township, Hastings County; NTS 31C/12 Bannockburn; UTM zone 18, 4947000N, 298000E; Lat. 44° 39' N, Long. 77° 33' W.

The property is located in north-central Madoc Township, about 16 km north of the town of Madoc and 600 m east of Highway 62. About 400 m north of the village of Bannockburn, a gravel access road leads eastward from the highway along an abandoned railway bed for a distance of 400 m, then branches northward for 300 m to the stripped area and decline portal.

History

Pre-1984: A small zinc-lead occurrence known as the Webber property was discovered on lot 29, con VI prior to 1930. Alcock (1930) reports a pit on a northeast striking quartz vein within rusty, pyritic schist. The vein contained pyrite and small amounts of galena and sphalerite.

1984-87: High-grade gold mineralization in quartz veins was discovered in 1984 by Sawyer Consultants Inc. during a surface exploration program for Mono Gold Mines Inc. The program consisted of ground VLF-EM and magnetometer surveys, a geological survey, and extensive sampling of quartz veins. This work was followed by stripping and trenching, soil sampling, diamond drilling, and metallurgical testing of a 750 kg bulk sample of quartz vein material. A total of over 12,500 m of diamond

drilling was completed between February, 1985 and March, 1987 (House and Sawyer 1989).

1988: Micham Exploration Inc. and Mono Gold Mines Inc., under a joint venture agreement, completed an underground exploration program consisting of 268.2 m of ramp to the 22.85 m level, cross-cutting and a total of 97.5 m of drifting on three quartz veins, and a total of 1,737.3 m in 35 underground diamond drill holes.

Mono Gold Mines Inc. drilled an additional 1,513 m in 9 holes from surface (House and Sawyer 1989).

Size and Grade

Gold-bearing quartz veins occur over a strike length of about 450 m and have been tested by diamond drilling to a depth of 140 m. The veins range in width from 1.8 m to several centimeters. "Modified geological reserves" (total of reserves calculated for specific areas of the quartz vein system) are reported as 225,190 tonnes (248,160 tons) grading 9.15 g per tonne (0.267 oz per ton) gold, uncut, over a 1.8 m minimum width with a 1.7 g per tonne (0.05 oz per tonne) cut-off grade (House and Sawyer 1989).

Local high-grade intersections returning assays of 1 to 2 oz Au/ton across widths of 1 to 5 ft are not uncommon.

Description

Unless otherwise noted, the following description is summarized from House and Sawyer (1989).

Geology

A northerly-trending belt of mafic metavolcanics of the Tudor Formation which underlies the eastern part of Madoc Township is overlain to the west by metasedimentary rocks, predominantly impure marbles to the south of the Mono property and pelitic metasediments at the Mono prospect and to the northwest. The pelitic rocks are bounded to the west by the Gawley Creek syenite pluton, the easternmost margin of which hosts the Bannockburn gold prospect (Hewitt 1968).

The Mono gold-bearing zone is situated at the contact between mafic metavolcanics and pelitic metasediments on the southeastern limb of a southwesterly-plunging anticline (Figure 17). Minor lithologies include felsite (probably silicified metavolcanics) and mafic intrusive rocks (dioritic dikes or sills).

Three varieties of metasedimentary rocks have been distinguished by King and House (1987a), as follows.

The rusty schists are banded, fine to medium grained, sericitic and siliceous metasediments commonly containing up to 10% disseminated pyrite and pyrrhotite with traces of chalcopyrite and sphalerite, and locally containing up to 50% sulphides over narrow widths. This unit is often strongly deformed, silicified and carbonatized, particularly near the gold-bearing zones.

Garnet schist forms a discontinuous band up to 21 m wide in the volcanic-sedimentary contact zone. It consists of chlorite,

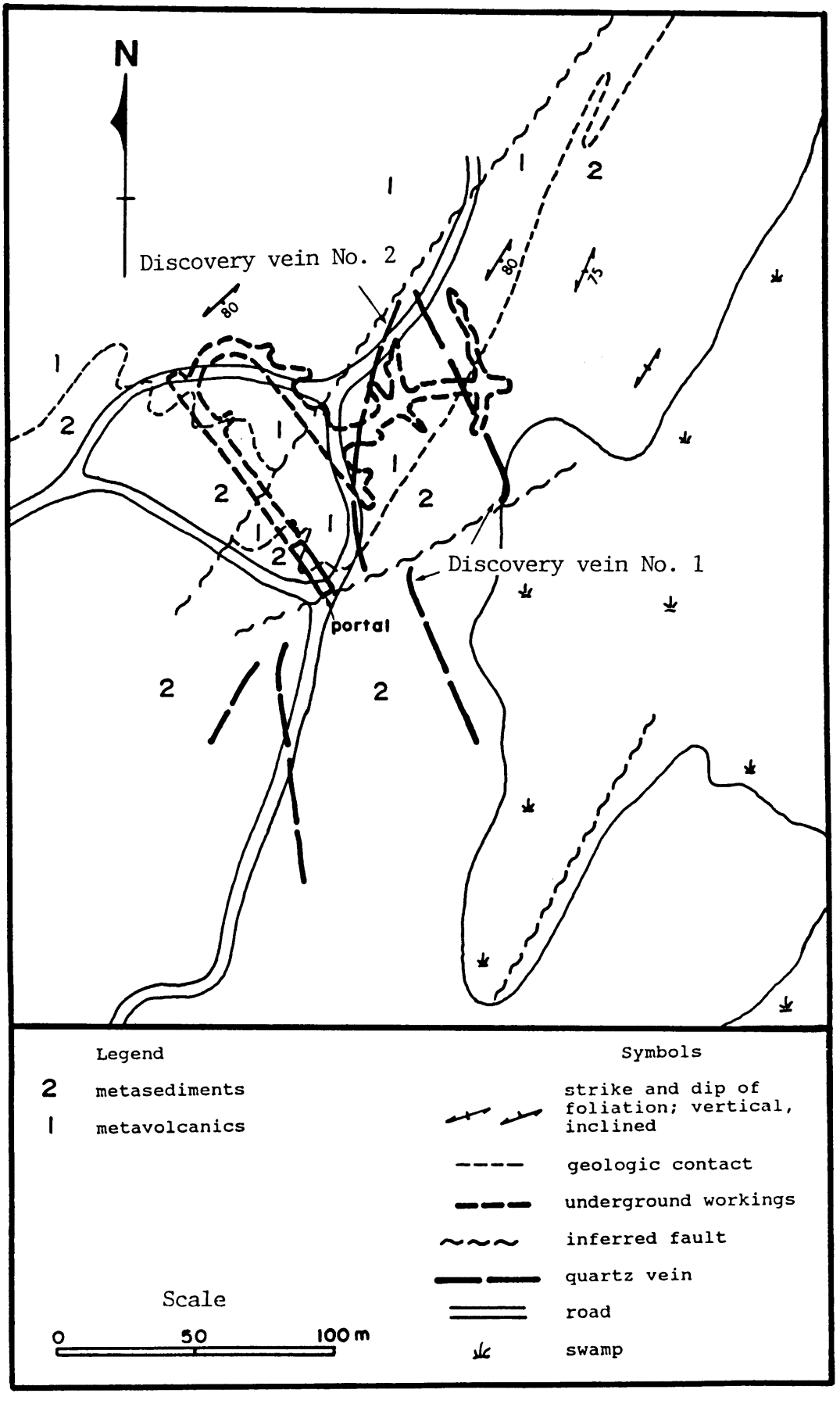


Figure 17. Geology of the Mono prospect area, Madoc Township (after House and Sawyer 1989)

biotite, minor sericite, and up to 40% garnet, with local concentrations of pyrite and pyrrhotite.

Quartz-sericite schists also occur along the volcanic-sedimentary contact as discontinuous lenses.

Metavolcanic rocks are predominant in the area of the gold-bearing zone, occupying the core of the southwesterly-plunging anticline. They are mafic to intermediate, moderate foliated, chloritic rocks which exhibit several alteration types (carbonate, silica, and potassium) and sharp textural changes. There has been no attempt to subdivide this unit because of the difficulty in distinguishing flows from tuffaceous rocks.

Several diamond drill holes have intersected siliceous, massive to foliated rock of unclear origin which has been labelled "felsite". These appear to be crosscutting zones of silicic and potassic alteration related to the quartz vein system, showing both sharp and gradational contacts with the mafic rocks.

The primary structure in the area of the Mono prospect is the southwesterly-plunging anticline (Figure 18). Associated with this is a series of minor northeasterly-trending fold structures, one of which (a synform) closes in the area of the Discovery Vein. These folds have produced a near-vertical axial planar cleavage and shearing. However, structures in the metasediments indicate complex, polyphase folding which is less evident in the metavolcanics due to their lower ductility and lack of marker horizons.

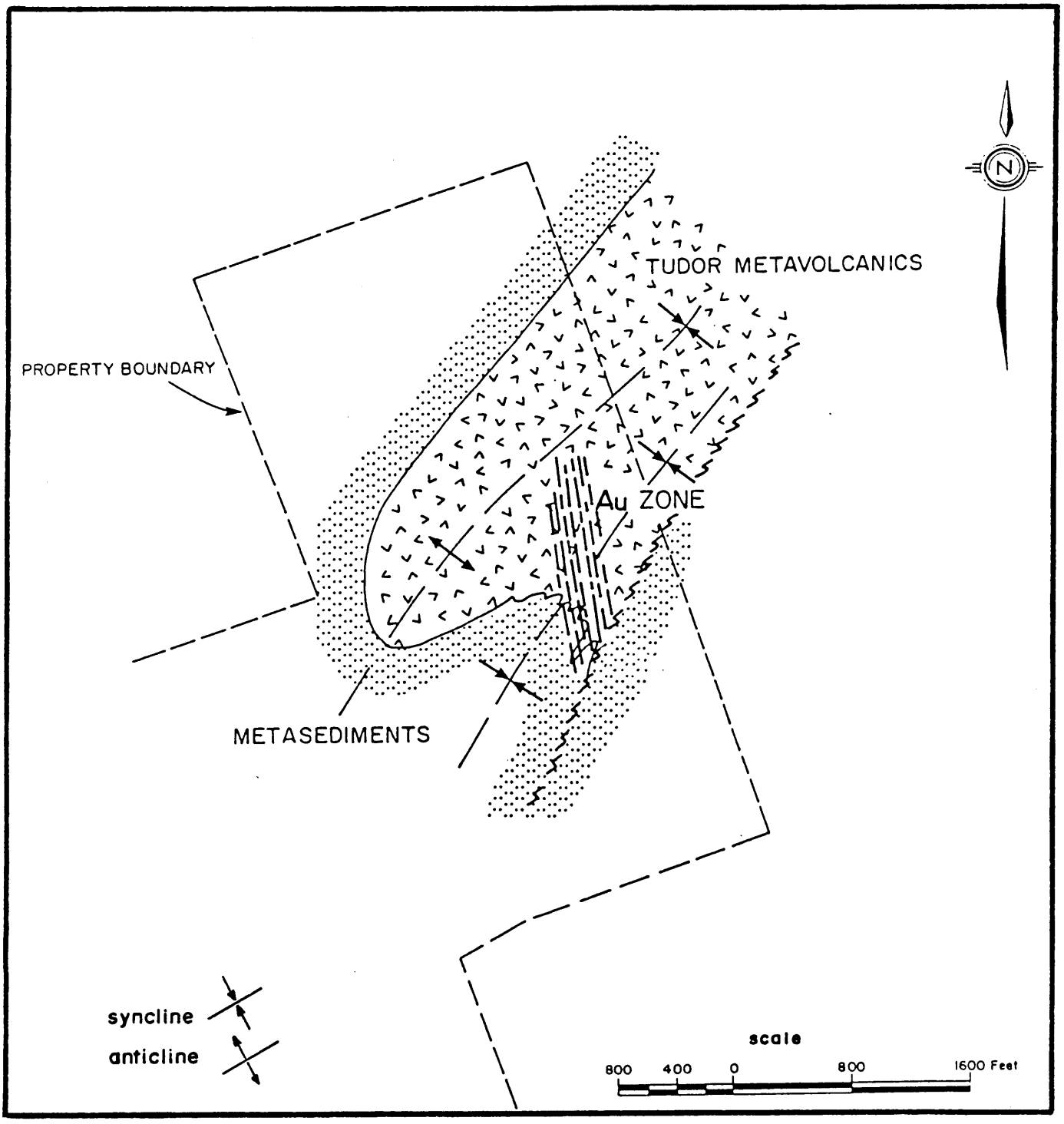


Figure 18. Generalized structural geology of the Mono prospect, Madoc Township (from House and Sawyer 1989)

Brecciation and minor displacements associated with faulting parallel to the axial plane of the anticline are common.

Mineralization

Native gold is associated with minor amounts of pyrite, marcasite, pyrrhotite, arsenopyrite, chalcopyrite, galena, and blue-grey bismuth tellurides in quartz and quartz-carbonate veins. The veins strike north to northwest and dip 40 to 55 degrees east, cutting across the northeasterly-trending metasedimentary and metavolcanic rocks (Figure 18).

A series of four to ten quartz carbonate vein systems in which veins vary in width from a few centimeters to 1.8 m occur over a strike length of about 460 m within a 70 to 100 m wide zone which has been tested by diamond drilling to a vertical depth of about 140 m. Gold mineralization is limited to the quartz veins, concentrated in "ore shoots" which rake to the northeast at about 35^{o} (G.D. House, President, Sawyer Consultants Inc., Vancouver, B.C., personal communication 1991). Coarse visible gold has frequently been observed in drill core and in surface exposures of the vein systems.

The greater part of the gold-bearing zone lies within metavolcanic rocks. Where the quartz carbonate veins extend into metasedimentary host rock, there is no apparent change in the grade or nature of mineralization, other than a minor increase in vein width (G.D. House, personal communication, 1991).

The auriferous veins consist of coarse grained, glassy quartz with a bluish-grey colour and lesser amounts of calcite and rusty weathering ankerite. They are distinct from non-auriferous, white, cherty quartz veins which form irregular, discontinuous pods and lenses conformable to the foliation or axial plane cleavage in the metavolcanics and metasediments.

Metallurgical Test Results

Metallurgical test work was performed on a 750 kg bulk sample of quartz vein material by Witteck Development Inc.

The average grade of the sample was 10.13 g Au/t (0.326 oz Au/ton). A mineralogical analysis of sample concentrate indicated a mineral assemblage dominated by pyrite with lesser to trace amounts of pyrrhotite, arsenopyrite, marcasite, galena, sphalerite, chalcopyrite, and covellite. Several bismuth sulphides and tellurides were also observed. Gold occurs as free, fine to coarse native grains and as fine particles associated with arsenopyrite, galena, and bismuth minerals.

Recoveries of over 98% were obtained by direct cyanidation for 48 hours after 8 hours of pre-aeration. Cyanidation of flotation concentrate was much less effective (57% recovery) due to the abundance of sulphides and tellurides in the concentrate.

Details of the metallurgical test work are presented by House and Sawyer (1989).

Summary

A small gold deposit of 225,000 tonnes grading 9.15 g Au/t has

been defined following the discovery of auriferous quartz veins during geological mapping and sampling in 1984. High grade gold mineralization occurs within a series of cross-cutting quartz veins at the contact between pelitic metasedimentary rocks and mafic metavolcanics on the southern limb of a southwesterly plunging anticline. Polyphase folding has produced complex structures in the vein systems and host rocks, including the development of high grade "ore shoots" within individual veins.

Metallurgical test work indicates that gold recoveries of over 98% are possible by direct cyanidation.

King and House (1987a) suggest that the presence of silicic and potassic alteration combined with the presence of bismuth sulphides and tellurides is indicative of an intrusive source for the mineralization, possibly a granitic or syenitic body at depth within the core of the southwesterly plunging anticline.

References

Alcock 1930

Hewitt 1968

House and Sawyer 1989

King and House 1987a

Malczak et al 1985

16. Sophia (Diamond) Mine, Madoc Township

Faith Mines Ltd.

Location

Lots 13, 14 and 15, con X, Madoc Township, Hastings County.

Work Completed

Faith Mines Ltd. conducted an exploration program on the "Sager Option", a 4,840 acre property which included the Sophia and Blakely mines (former producers of gold and pyrite, respectively) from 1985 to 1987. The program consisted of geological, geophysical, and soil geochemical surveys, trenching, and diamond drilling of 88 holes totalling 16,389 ft. All of the diamond drilling was done in the vicinity of the old Sophia mine (lot 14, con X) and in an area about 2,500 ft to the southeast of the mine (lot 13, con X).

Detailed descriptions of geology, mineralization, and previous work at the Sophia and Blakely mines are presented by Malczak et al (1985).

Geology and Mineralization

The Sophia mine, originally known as the Diamond mine, is located within mafic metavolcanics of the Tudor Formation, close to the contact with overlying marbles and pelitic metasedimentary rocks (Hewitt 1968).

Gold mineralization at the Sophia mine occurs within two quartz-ankerite vein systems which trend north to northwest, parallel to the foliation in the host mafic metavolcanics. The metavolcanics

are dark green, weakly foliated, fine grained, biotite-rich amphibolites. Biotite-rich fragments of wall rock are locally present within the quartz veins. Mineralization within the veins consists of pyrite, arsenopyrite, pyrrhotite, and traces of chalcopyrite and native gold (Malczak et al 1985).

The two vein systems are known as the No. 1 (Mispickel) vein and No. 2 (Free Milling) vein. They are reported to have produced 50 oz of gold from 1,500 tons of ore in 1900 and 60 oz of gold from 300 tons or ore in 1941. These veins and four others were explored by the Faith Mines Ltd. 1986-87 diamond drill program. Locations of veins 1, 2, 5 and 6 in the Sophia mine area are shown on Figure 19 and veins 3 and 4 in the Sophia South area are shown on Figure 20. The following results of the 1986-87 diamond drill program are summarized from Bergman (1987) and McNeil (1988).

No. 1 Vein (Mispickel)

The first phase of drilling consisted of a total of 3,183 ft covering a strike length of 650 ft. The best intersection was 0.50 oz Au/ton across 6.0 ft at a shallow depth within the quartz vein. Several other intersections of the vein returned assays of 0.03 to 0.09 oz Au/ton across widths of 1.5 to 10 ft. An additional 1,270 ft were drilled to test the vein below these intersections and although continuity of the vein was confirmed, no significant gold assays were obtained.

No. 2 Vein (Free Milling)

Diamond drilling totalling 1,525 ft over a strike length of 425

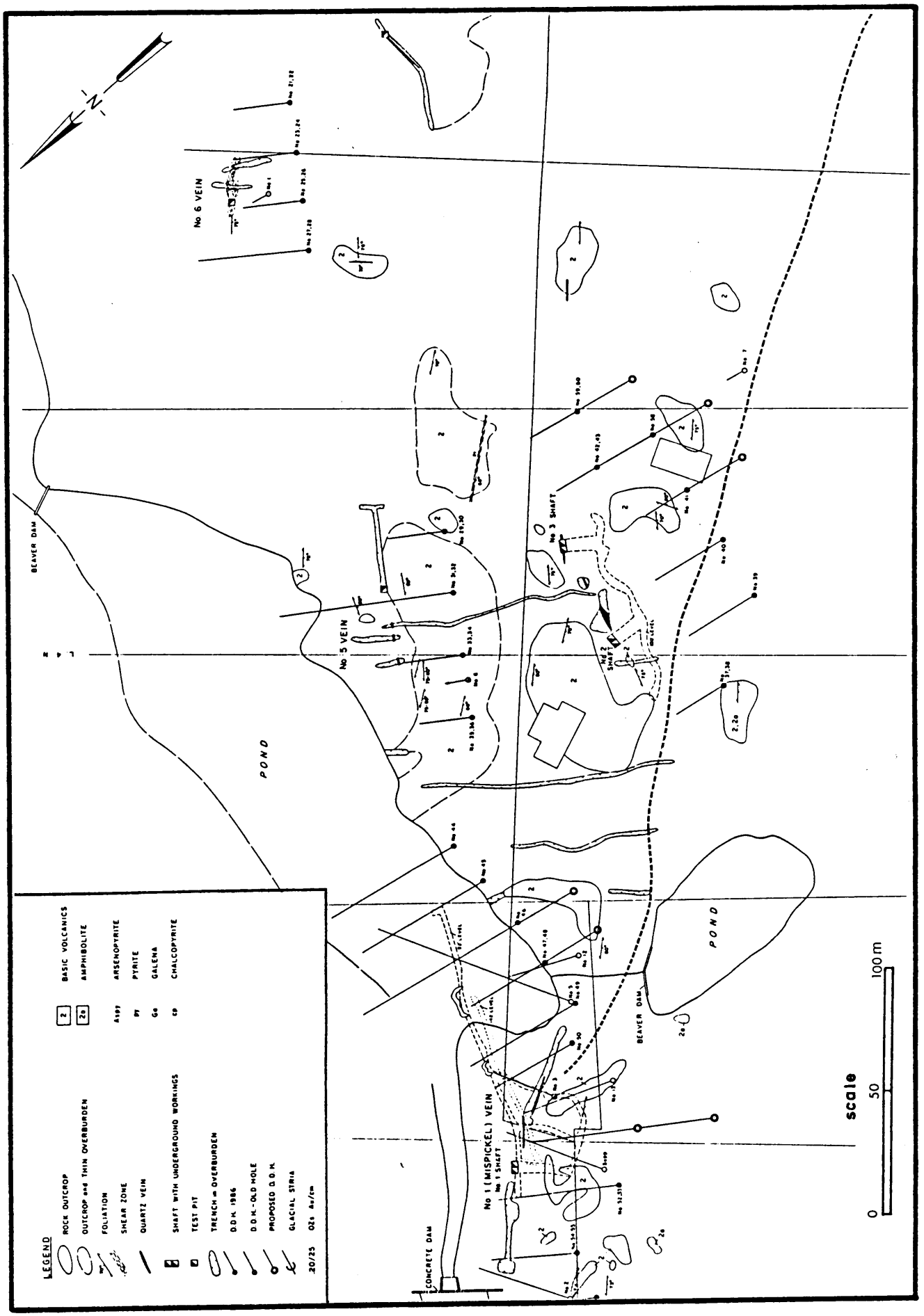


Figure 19. Geology of the Sophia mine area, Madoc Township (from Bergman 1987)

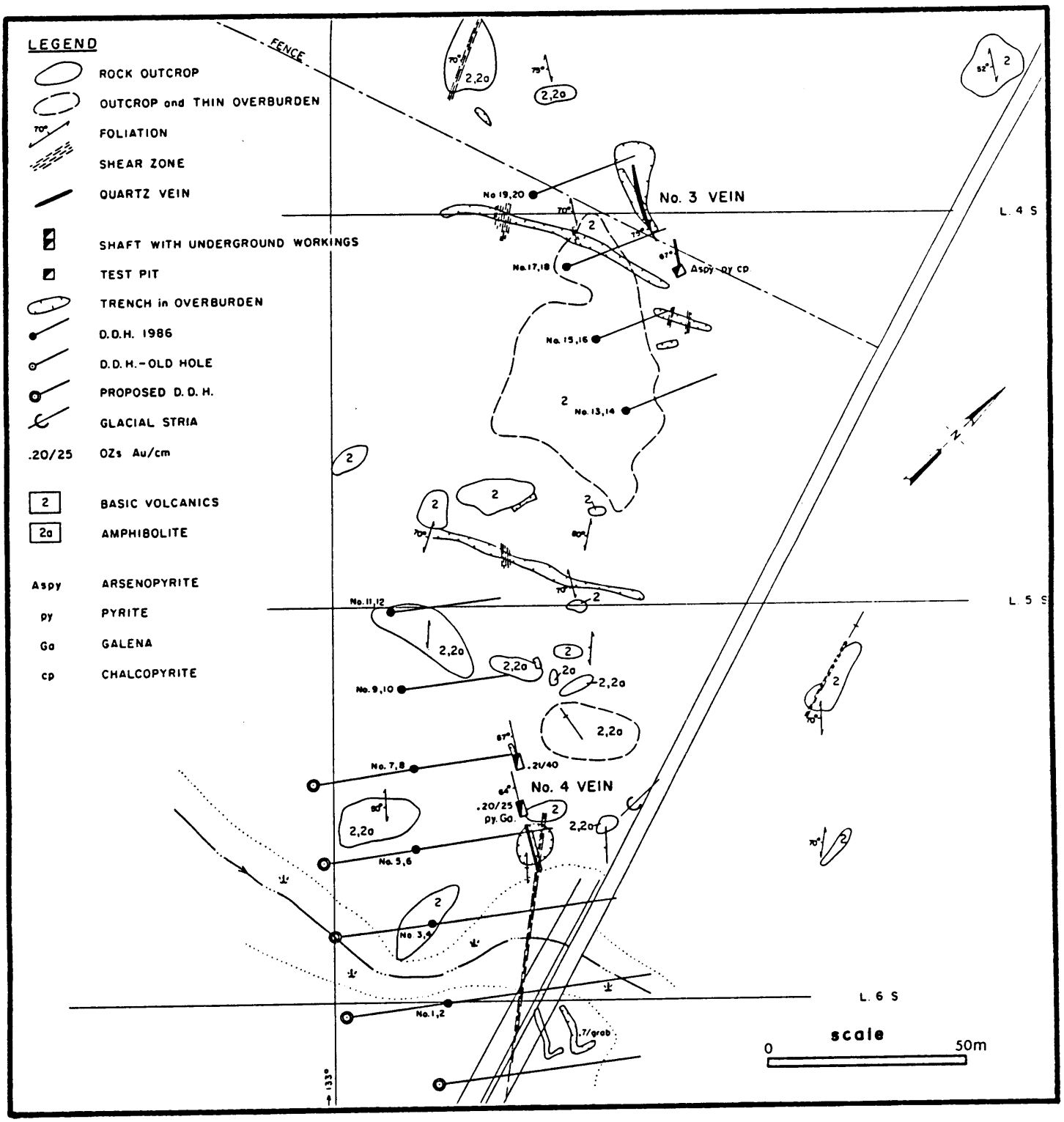


Figure 20. Geology of the Sophia mine south area, Madoc Township (from Bergman 1987)

ft was completed in the first phase of drilling, followed by an additional 791 ft in the second phase. Intersections of 0.13 oz Au/ton across 4 ft, 0.37/2.0 ft and 1.09/4.0 ft were obtained in three drill holes at vertical depths of 48, 120, and 75 ft, respectively, in the first phase of drilling. Subsequent drilling below these intersections returned no significant values.

No. 3 Vein

Eight holes totalling 873 ft were completed, all of which intersected a strong quartz vein. No significant values were obtained.

No. 4 Vein

A total of 5,803 ft of drilling in 30 holes was completed, testing the No. 4 vein over a strike length of 450 ft to a depth of 260 ft. The best intersections are shown in Table 3.

Table 3. Gold-bearing intersections on the No. 4 vein, Faith Mines Ltd. diamond drill program, 1986-87, Sophia Mine

D.D.H. Number	Au (oz/ton)	Width (ft)
1	0.08	2.3
3	0.34	2.0
5	0.08	1.5
6	0.22	1.5
69	0.05	8.0
70	0.13	7.5
72	0.07	2.0
73	0.15	1.5
80	0.35	5.0
	0.22	2.0
81	0.08	1.5
82	0.13	2.0
	0.15	1.0
84	0.06	6.0

No. 5 Vein

Eight holes totalling 1,236 ft tested this vein. A shear zone containing quartz-carbonate veinlets were intersected, returning best assays of 0.01 to 0.05 oz Au/ton across widths of 5 to 18 ft.

No. 6 Vein

Possibly an extension of the No. 5 vein, this vein consists of a rusty shear zone. Eight holes totalling 970 ft tested the structure and returned no significant values.

Although the veins show good continuity, gold values are erratic and no tonnage of economic grade has been outlined. However, small deposits of economic grade may be present within the No. 1, 2, and 4 vein systems. Due to the nature of the mineralization, which includes native gold, bulk sampling is requried in order to more accurately determine the average grade of the veins.

References

Bergman 1987

Hewitt 1968

Malczak et al 1985

McNeil 1988

17. St. Joe Occurrence, Madoc Township

Harwin Exploration and Development Inc.

Location

The original St. Joe occurrence is located in the northeast 1/4 of lot 24, con V, Madoc Township, Hastings County.

The old Bannockburn Pyrite Mine in the west 1/2 of lot 25, con VI and several pits in the northwest 1/4 of lot 25, con IV were also included in the Harwin "St. Joe" property.

Work Completed

In 1987, Harwin Exploration and Development Inc. carried out geological, soil geochemical, magnetic, and VLF-EM surveys on 13 claims centered on the old St. Joe occurrence (King and House 1987b).

The company completed a total of 2,600 ft of diamond drilling in 8 holes, also in 1987. Four holes were drilled in the vicinity of pits in the northwest 1/4 of lot 25, con IV, and four near the old Bannockburn Pyrite Mine in lot 25, con VI (Wares 1987).

The old St. Joe workings, which include a 30 ft shaft reported by Slaght (1898) to be in lot 25, con V, were located and staked by Robert Ross of Belleville in 1980. A small amount of trenching and one 150 ft diamond drill hole were completed in 1981 in the area of the shaft (assessment files, Resident Geologist's Office, Tweed).

Geology and Mineralization

The occurrence is located within siliceous and sericitic schists near the contact with a narrow band of amphibolite-altered mafic metavolcanics which is flanked to the south by carbonate metasediments (Figure 21).

The siliceous and sericitic schists include "rusty schists" which contain abundant disseminated to massive sulphides, predominantly pyrite and pyrrhotite. Intercalated with the rusty and sericitic schists are dark grey, micaceous, strongly graphitic schists. Quartz-rich units, granular to cherty in texture, are restricted largely to the area of the Bannockburn Pyrite Mine. The schists represent altered siliciclastic sediments, possibly tuffaceous in part, which probably are derived from the underlying Tudor Formation metavolcanics (King and House 1987b), Diamond drill logs (Wares 1987) indicate the presence of a garnetiferous chlorite-biotite schist at the contact between siliceous schists and amphibolite.

Foliations in all rock types trend southeasterly in the western part of the Harwin property, easterly at the St. Joe occurrence, and northeasterly near the Bannockburn Pyrite Mine (Figure 21). Dips are generally northward at 70 to 80^{o}. The rocks are tightly folded about northeasterly trending axes plunging moderately to the northeast. More complex folding in the extreme northwestern part of the property is probably associated with intrusion of the Gawley Creek syenite pluton, located immediately west of the Harwin property.

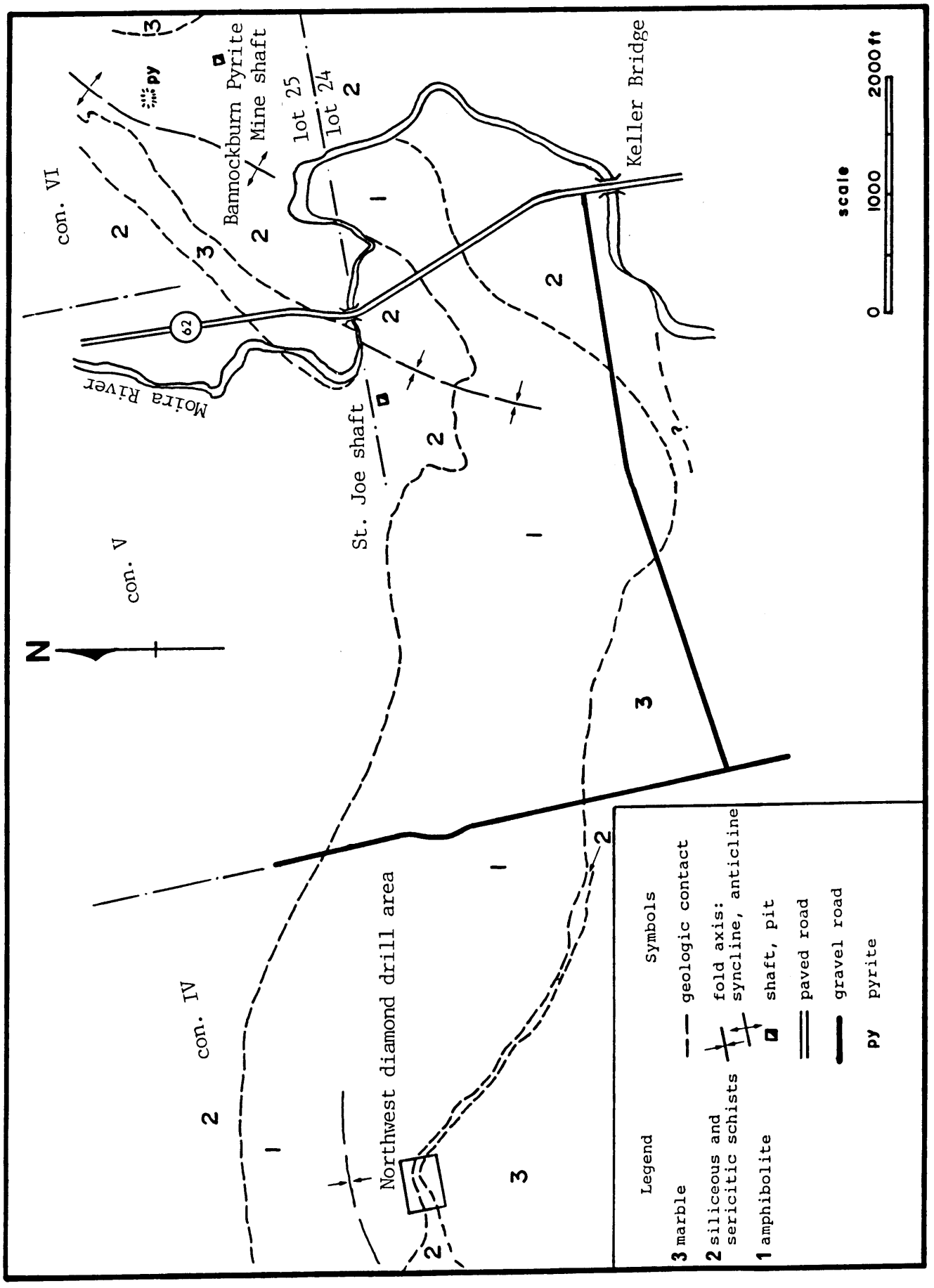


Figure 21. Geology in the area of the St. Joe occurrence, Madoc Township (after King and House 1987b)

Quartz veins are common in amphibolites and sericitic schists in the northwest area (NW 1/4, lot 25, con IV) and in the area of the St. Joe occurrence (NE 1/4, lot 24, con V), both conformable and cross cutting along north-northeast trends.

Logs of diamond drill holes in the northwest area (Wares 1987) indicate the presence of quartz veins within siliceous schists near the metasedimentary-metavolcanic contact. One vein zone 2.5 ft in core length contained quartz, pyrite, traces of sphalerite and one speck of visible gold. No assays are reported in the drill log. The vein occurs at a contact between quartz-pyrrhotite schists (up to 30% pyrrhotite + pyrite) and quartz-hornblende-biotite schist with 20% pyrrhotite. Quartz stringers in the amphibolites are narrow and contain trace amounts of pyrite.

The old St. Joe shaft, located about 800 ft west of Highway 62 and 100 ft south of the north boundary of lot 24, exposes two quartz veins up to 4 ft wide dipping northward at 50^{o}. The veins contain minor sulphides and the wall rocks (siliceous schist) are heavily mineralized with pyrrhotite, pyrite, and traces of chalcopyrite. Samples of quartz vein and wall rock gave assays of 62 and 48 ppb Au, respectively (King and House 1987b). Slaght (1898) reports assays ranging from 0.10 to 3.03 oz Au/ton but does not indicate the sample locations. Two consecutive 3 ft wide chip samples across quartz veins and wall rock in the shaft, taken by the author for Robert Ross in 1981, returned assays of 0.005 and 0.015 oz Au/ton. Mr. Ross also reports a value of 0.26

oz Au/ton from a grab sample of rusty schist taken from a roadcut on Highway 62 at the northern schist-amphibolite contact (R. Ross, Belleville, Ontario, personal communication, 1991).

Semi-massive to massive sulphides in the eastern part of the Harwin property were mined intermittently for sulphur at the Bannockburn Pyrite Mine between 1898 and 1919 (Malczak et al 1985). Diamond drilling by Harwin in 1987 in this area intersected sulphide-rich schists with no significant gold values. Robert Ross sampled the shaft dump in 1983 and reports assays of 0.06 and 0.01 oz Au/ton with 0.27 and 0.47 oz Ag/ton from samples of massive pyrite. (R. Ross, Belleville, Ontario, personal communication 1991).

Although quartz veins and sulphide-bearing metasediments near the metasedimentary-metavolcanic contact are anomalous in gold content, recent work has not confirmed old reports of economic gold mineralization. However, because the old St. Joe workings are located close to the north boundary of the Harwin property, the down-dip extension to the north remains untested.

References

King and House 1987b

Malczak et al 1985

Slaght 1898

Wares 1987

18. Ackerman Prospect, Marmora Township

Belmar Resources Inc.

Location

Lot 6, con VIII and IX, Marmora Township, Hastings County.

Work Completed

In 1985, Belmar Resources Inc. carried out geological, magnetic, VLF-EM, and self potential surveys over a claim group in lots 5 and 6, concessions VIII and IX, Marmora Township. The surveys were done only on the part of the property lying east of the Moira River and covered the old Ackerman gold prospect.

Belmar drilled 6 diamond drill holes totalling 1,237 ft between November, 1985 and January, 1986. Two holes were drilled in the area of the main shaft, 4 holes in the area of a second shaft about 700 ft south of the first, and one hole below the Moira River 700 ft west of the main shaft to test a coincident magnetic, VLF-EM, and S.P. anomaly (Bowdidge 1986).

Belmar extended VLF-EM, magnetic, and soil and humic geochemical surveys west of the Moira River in 1986. Champion Gold Resources Inc. carried out geological and induced polarization surveys in 1988 and drilled 4 holes totalling 1,588 ft in 1989, all located west of the Moira River (Fogal 1989).

The geology and history of the Ackerman occurrence are described by Malczak et al (1985).

Geology and Mineralization

The Ackerman prospect is situated at the western margin of the Deloro Pluton, in the same geological environment as the Gatling Five Acre mine (p. 123). Mineralization, consisting of disseminated grains and massive veinlets of arsenopyrite, is hosted by a quartz-ankerite vein system from 1 to 5 ft wide and at least 1600 ft long. The vein zone trends south-southeast and dips about 45° to the west. Locally, it consists of narrow, barren quartz veins in syenite, but for the greater part, it follows a band of siliceous metasediments up to 50 ft wide within syenite near the pluton margin (Figure 22). Bowdidge (1986) reports that the best gold values occur in quartz-carbonate veins with heavy arsenopyrite mineralization, only where the vein cuts metasediments. Disseminated arsenopyrite in syenite or metasediments bordering the vein zone does not carry significant gold values.

Two inclined shafts have been sunk on the vein system. The main (north) shaft is 207 ft deep (Malczak et al 1985). The second shaft, of unknown depth, is located about 700 ft south of the first. Underground sampling on the 170 ft level at the main shaft indicates two mineralized shoots separated by 24 ft of barren vein material. The north shoot averaged 0.20 oz Au/ton across 4.3 ft for a length of 60 ft and the south shoot contained 0.23 oz Au/ton across 4.0 ft for a length of 88 ft (Malczak et all 1985).

The best assay obtained from the 1985-86 diamond drill program was 0.71 oz Au/ton across 2 ft, from an intersection of the Ackerman vein about 20 ft below the bottom of the main shaft.

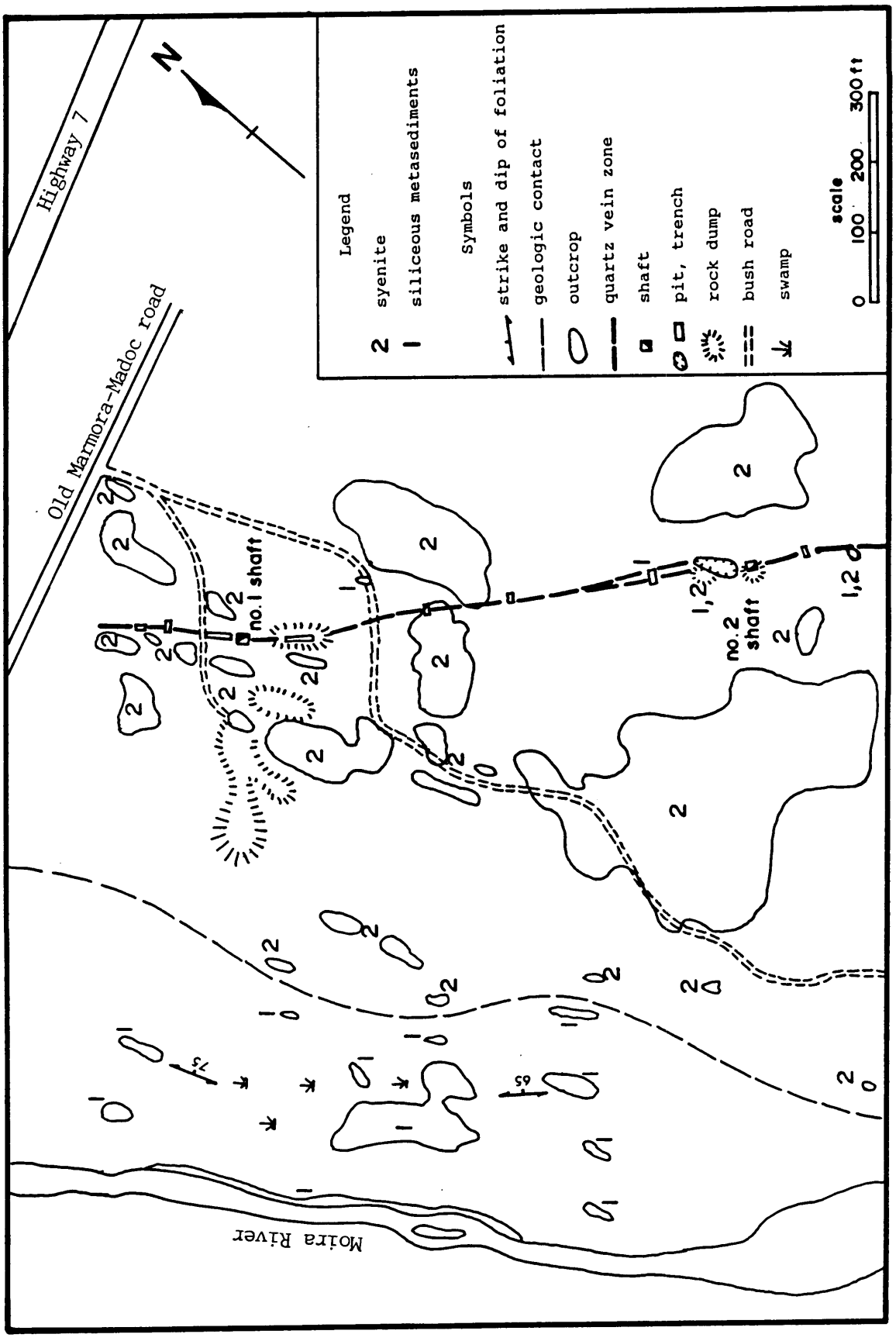


Figure 22. Geology of the Ackerman prospect area, Marmora Township (after Bowdidge 1986)

Ackerman vein about 20 ft below the bottom of the main shaft. The highest gold values obtained from holes drilled in the area of the south shaft range from 0.021 oz Au/ton across 1.6 ft to 0.049/1.0 ft.

Belmar Resources hole 86-3, drilled below the Moira River and Champion Gold Resources holes 89-1 to 89-4, drilled west of the river, intersected pyrrhotite-pyrite-bearing metasediments which gave no significant gold assays. Slightly anomalous values of up to 33 ppb Au were obtained from moderately silicified metasediments containing a network of quartz-calcite stringers (Fogal 1989).

References

Bowdidge 1986

Fogal 1989

Malczak et al 1985

19. Deloro North Occurrence, Marmora Township

Noranda Exploration Company Limited

Location

Northwest 1/4, lot 11, con X, Marmora Township, Hastings County; NTS 31C/12 Bannockburn; UTM zone 18, 4933600N, 292950E; lat 44° 31' 50"N, Long 77° 36' 20" W.

The occurrence lies about 4 km north of Highway 7 and 1.5 km east of Hastings County Road 11 near the village of Deloro. Access is obtained by crossing the dam at the Moira River 1.5 km north of Deloro, traversing east and north to a cut line (lot 10/11, con IX), east to another cut line (con IX/X), and north along the concession line for about 350 m to a large beaver pond. The occurrence consists of two showings at the southwest and northeast corners of the pond.

History

There is no record of previous work on the Noranda property. About 1.5 km south of the Deloro North occurrence, gold is reported to have been found by Andrew Gawley in 1901. Wells (1902) reports assays averaging 0.37 oz Au/ton and 15% As from the prospect in lot 9, concession X, currently known as the Gawley No. 2 occurrence (Malczak et al 1985).

In 1988, Noranda completed a small stripping and sampling program following the discovery of anomalous gold values at the northeastern corner of a beaver pond along the western boundary of lot 11, concession X. This was followed by VLF-EM and magnetic surveys over the entire claim group (lots 11, 12, and

south 1/2 of 13, concession X) in 1989 (Breton 1989b) and by geological and limited humic geochemical surveys in 1990 (LeBaron 1990b).

Size and Grade

The two showings, which appear to be strike extensions of the same mineralized zone, are 100 m apart at opposite corners of a beaver pond. The zone is about 5 m wide at both exposures.

Grab samples from both showings have assayed over 35g/t Au, although mineralization is erratic and most samples have returned values of less then 1 g/t. Insufficient work has been done to estimate average grade, but channel samples from the northeast showing returned best results of less than 1 g/t across 4 to 5 m (LeBaron 1990b).

Description

Geology

The occurrence lies within the Deloro pluton, a large granitic intrusive complex with marginal syenitic, dioritic, and gabbroic phases. The marginal zone, which may also include interfingering layers of metasediments, hosts all of the past producers and signficant occurrences of gold in the Deloro area. The Deloro North occurrence, although similar in some respects to the other Deloro area occurrences, is located within the interior granite phase of the pluton, close to the marginal syenite and diorite (Figure 23).

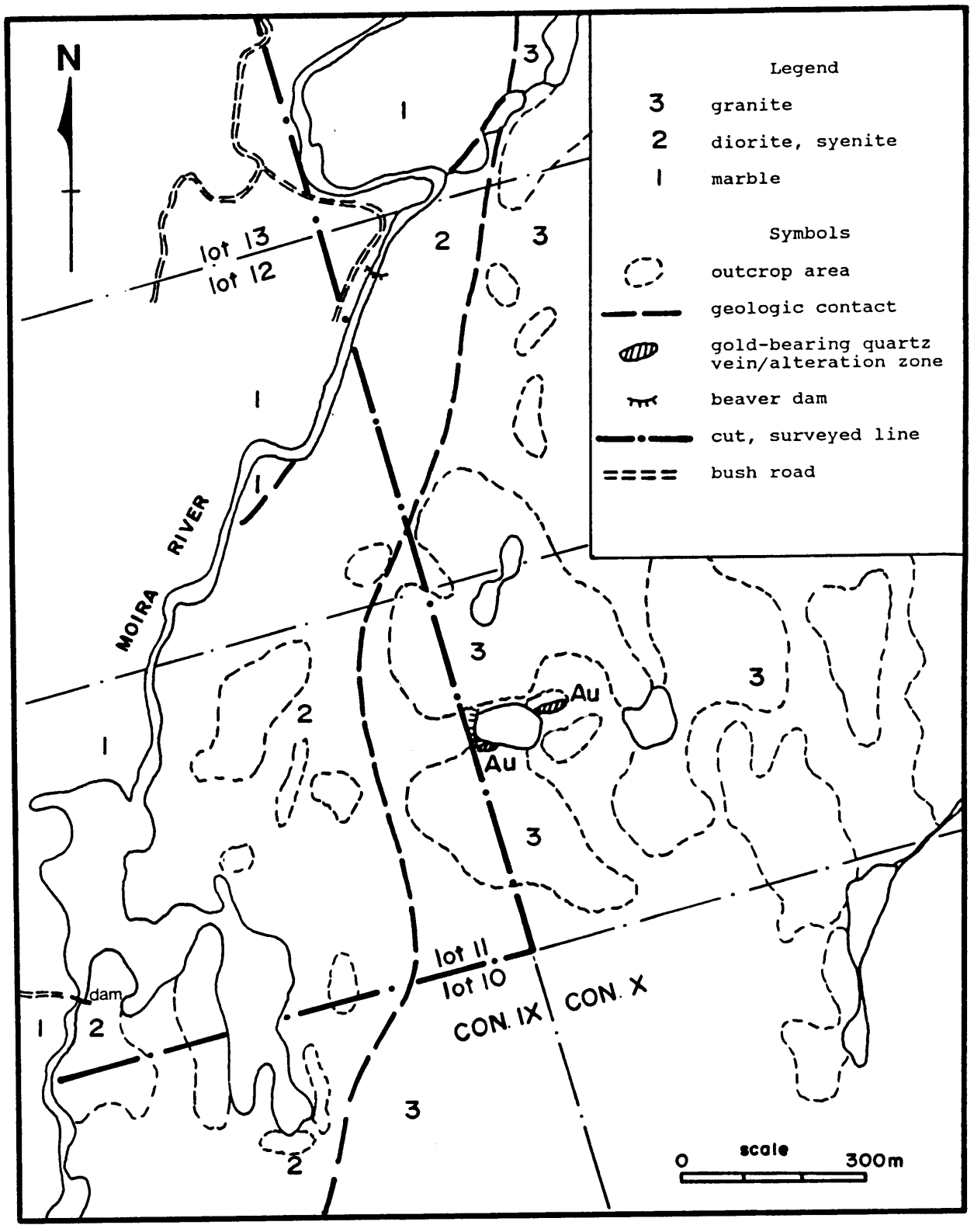


Figure 23. Geology in the area of the Deloro North occurrence, Marmora Township (after Bartlett and Moore 1985 and LeBaron 1990b)

The granite is predominantly massive, medium to coarse grained, and pink, containing 30% pale blue-grey, round quartz grains. Within the vicinity of the occurrence, the granite contains xenoliths of partially assimilated metasediments and silicified diorite up to 50 cm in diameter.

Within the mineralized zone, the granite exhibits alteration ranging from red hematite staining and weak sericitization of feldspar to intense sericitization, producing a porphyritic texture in which pale blue, round quartz grains are set in a fine-grained, green sericite matrix. This alteration is very similar to that within mineralized zones at the Dingman gold occurrence (p. 83).

Two sets of linear topographic depressions occur in this part of the pluton, at 020 to 030^{o} and at 320^{o}, the former being the most prominent. The presence of sheared rocks, granite-diorite breccia, and diorite along the margins of north-northeast trending swamps suggests that this lineation may represent a fault system which is parallel to shear zones hosting gold mineralization along the western margin of the Deloro pluton. The Deloro North gold occurrence and several other similar, but non-auriferous zones of green sericite alteration and quartz veining on the Noranda property appear to be localized along the margins of north to northeast trending topographic depressions (LeBaron 1990b).

Mineralization

Gold mineralization is associated with a zone of irregular, variably-oriented, vuggy, hematitic quartz veins within sericitized granite. The veins are 1 to 5 cm wide and comprise up to 10% of the altered zone. Trace amounts of pyrite and arsenopyrite are present in both quartz veins and wall rock, although local pyrite concentrations may be as high as 15%. The gold content does not appear to be related to pyrite or arsenopyrite content and the presence of native gold was indicated by erratic check assays and by high gold content of the metallic fraction (+100 mesh) of one sample (LeBaron 1990b).

Summary

Gold mineralization at the Deloro North occurrence is hosted by a quartz vein zone within strongly sericitized granite localized along a northeasterly trending topographic depression, possibly representing a fault or shear zone within the Deloro pluton. The significance of this recent discovery is that it confirms the presence of gold mineralization within the interior granitic phase of the Deloro pluton and indicates the potential for similar mineralization within other parallel structures.

References

Breton 1989b

LeBaron 1990b

Malczak et al 1985

Wells 1902

20. Demars Occurrence, Marmora Township

Noranda Exploration Company Limited

Location

Lot 24, con V, Marmora Township, Hastings County.

Work Completed

Noranda Exploration carried out magnetic and VLF-EM surveys in 1989 (Breton 1989a) and geological and soil geochemical surveys in 1990 (LeBaron, 1990a) over two claims in the east half of lot 24, concession V.

The original Demars occurrence, located near the center of the northwest quarter of lot 24, concession 5, about 350 m west of the Noranda claims, was discovered in 1889. Minor development and test pitting were done from 1890 to 1893 (Malczak et al 1985).

Geology and Mineralization

The original Demars occurrence and the mineralized zones on the Noranda "Demars" property are hosted by an elongate felsic intrusive body, about 300 m wide and 1600 m long, trending east-northeast (Figure 24). The intrusive rock is locally granitic, syenitic, and granodioritic and is surrounded by marble with minor interbedded siliceous metasediments (Bartlett and Moore 1985).

Within the Noranda claim group, the intrusive rock is syenitic, with weak to moderate foliation striking 080^{o} and dipping steeply to vertically. Alteration to sericite-carbonate schists is

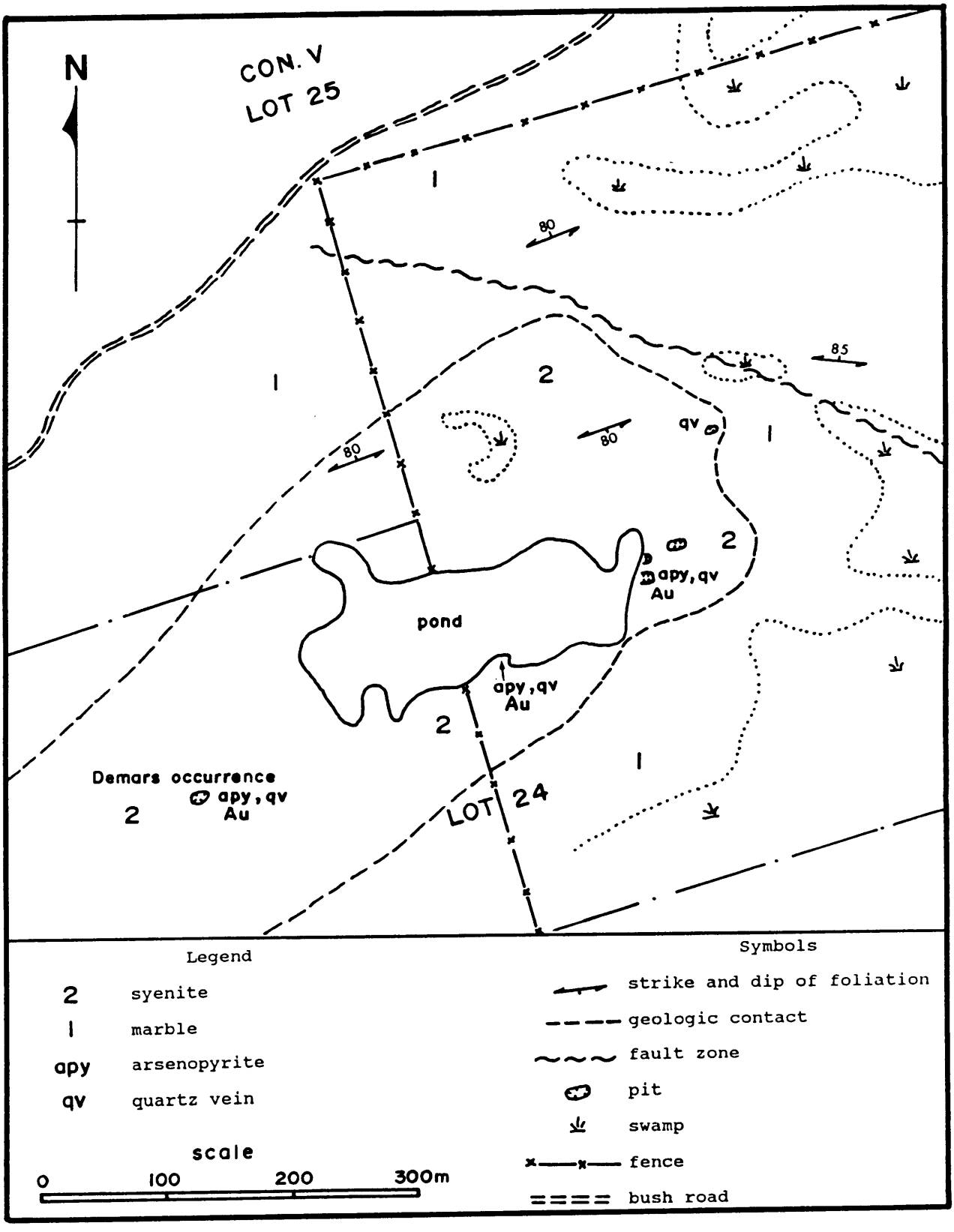


Figure 24. Geology in the area of the Demars occurrence, Marmora Township (after Bartlett and Moore 1985 and LeBaron 1990a)

common, generally toward the center of the intrusion and pervasive iron carbonate alteration of the syenite is common within 50 m of the contact with the surrounding marble (LeBaron 1990a).

Quartz and quartz-ankerite veins are widespread throughout the intrusion, generally from 1 to 15 cm wide and trending subparallel to foliation in the host rock. Mineralization consists of trace amounts of pyrite and arsenopyrite with the exception of a quartz-ankerite vein containing up to 5% arsenopyrite and pyrite at the eastern end of a large pond near the center of lot 24, concession V. This vein material can be seen on the dump of a 5 m diameter pit. However, the vein is not exposed in the pit walls, which consist of strongly sheared, rusty-weathering syenite. Samples of mineralized vein material from the dump assayed 1.06 and 4.37 g/t Au. Gold values were also obtained from arsenopyrite bearing quartz veins in syenite near the middle of the southern shore of the same large pond, where several samples returned assays of 1.56 to 3.06 g/t Au. All other samples of quartz veins within both syenite and marble assayed less than 0.2 g/t Au (LeBaron 1990a).

Despite the widespread occurrence of quartz veins and sericite-carbonate alteration within the felsic intrusive, it appears that gold mineralization is confined to arsenopyrite-bearing quartz veins in the vicinity of the large pond near the center of lot 24, concession V. The presence of a similar gold occurrence 350 m along strike to the west suggests that there may be a zone of

auriferous quartz-arsenopyrite veins which projects below the pond.

References

Bartlett and Moore 1985

Breton 1989a

LeBaron 1990a

Malczak et al 1985

21. Gatling Five Acre Mine/Hawk-Eye Occurrence, Marmora Township Goldbrook Explorations Ltd.

Location

E 1/2, lot 10, con. VIII, Marmora Township, Hastings County.

Work Completed

In 1983, Goldbrook Explorations Ltd. carried out VLF-EM, self-potential, and magnetic surveys on a claim group which included both the old Gatling Five Acre gold mine and the Hawk-Eye gold occurrence.

This work was followed up in 1984 by diamond drilling of 12 holes totalling 2618 ft. Eight of the holes were drilled to test the Hawk-Eye occurrence, three were drilled to intersect the Gatling veins, and one tested a strong VLF-EM conductor 300 m west of the Gatling No. 1 shaft (Bowdidge 1984).

Malczak et al (1985) describe the geology and development history of the Gatling Five Acre mine in detail.

Geology and Mineralization

The Gatling Five Acre and Hawk-Eye are two of a group of similar gold occurrences situated along the western margin of the Deloro Pluton (Figure 25). The pluton margin is a complex zone of interfingering layers of granite, syenite, diorite, gabbro, amphibolite, and siliceous, clastic metasediments, bounded to the east by perthitic granite in the pluton interior and to the west by a succession of calcitic and dolomitic marbles. Gold mineralization is confined to shear or fracture-hosted quartz-

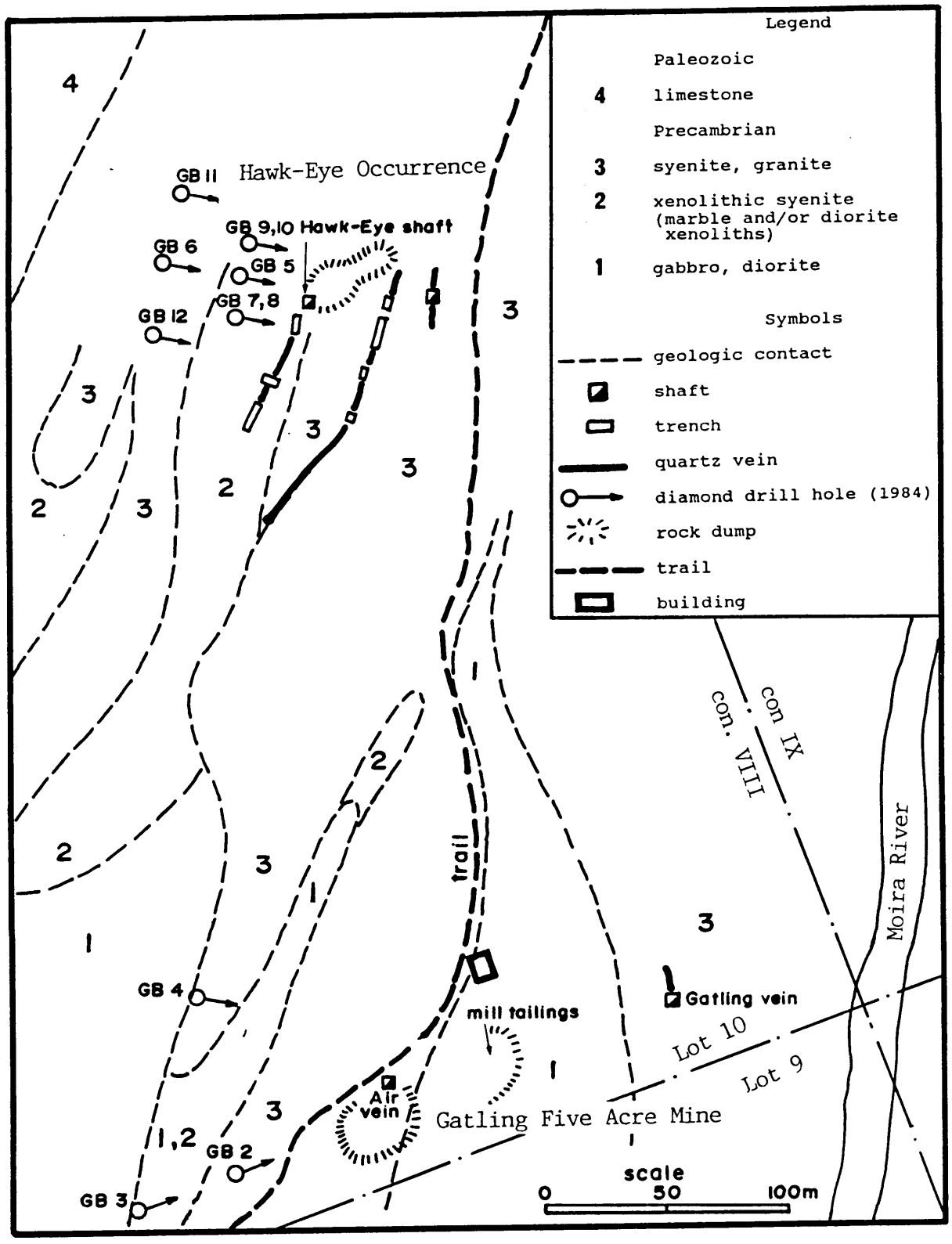


Figure 25. Geology in the area of the Gatling Five Acre mine and the Hawk-Eye occurrence, Marmora Township (after Bowdidge 1984)

arsenopyrite veins within sericitized syenite and diorite, commonly at the contact between the two rock types (Carter 1984).

The Gatling Five Acre occurrence lies along the northern extension of the ore zones of the Deloro Mine. The Deloro and the Gatling Five Acre were the two largest mines in the Deloro area, with production of 10,360 and 2,353 oz gold, respectively, between 1897 and 1903 (Gordon et al 1979).

Most, if not all of the production at the Gatling Five Acre Mine was obtained from the No. 1 ("Air") vein, which consists of two parallel quartz veins striking NE-SW and dipping 60^{o} NW. This vein zone has been developed to a depth of 200 ft over a strike length of up to 300 ft. A 60 ft shaft was sunk on a second vein zone (No. 2 or "Gatling" vein), but the lack of further development suggests that this vein was sub-economic or pinched out at depth.

Two of three holes drilled on the Gatling Five Acre zone in 1988 intersected the No. 1 vein. Hole GB-3 intersected alternating bands of amphibolite and syenite and minor siliceous metasediments. Two zones of silicified, sericitized syenite containing 2 to 5% disseminated arsenopyrite were cut about 30 ft apart, each with a quartz-arsenopyrite vein. The veins assayed 0.20 and 0.24 oz Au/ton across widths of 1.2 and 1.0 ft, respectively. Adjacent altered, arsenopyrite-bearing wall rocks assayed nil to 0.01 oz Au/ton. Hole GB-4 was drilled about 40 m north of GB-3 and returned values of 0.24 oz Au/ton across 3 ft and trace Au from the two veins. The first hole drilled on this

zone, GB-2, broke into underground workings at 78 ft (Bowdidge 1984).

Hole GB-5, drilled 300 m northeast of GB-4, along strike of the vein at the Hawk-Eye shaft intersected a 14.5 ft (core length) quartz vein at a vertical depth of about 30 ft at the contact between amphibolite and syenite. The vein contains minor arsenopyrite and pyrite with the exception of a 2 ft section of almost massive arsenopyrite and is bordered by a strongly silicified and sericitized zone 5 to 10 ft wide. The vein averages 0.31 oz Au/ton across 14.5 ft. However, the gold mineralization is concentrated in the upper (hanging wall) part of the vein, which averages 0.93 oz Au/ton across 4.5 ft, or 0.47/8 ft. The highest assay (1.06 oz Au/ton) was obtained from a 2.5 ft section logged as "barren except some narrow streaks of silver-grey mineral" (diamond drill log GB-5, Bowdidge 1984).

Seven additional holes drilled in the vicinity of the Hawk-Eye shaft intersected narrow quartz-arsenopyrite veins which returned assays ranging from 0.02 to 0.10 oz Au/ton across widths of 1.0 to 4.3 ft (Bowdidge 1984).

The Gatling-Five Acre and Hawk-Eye vein zones show good longitudinal continuity and contain local high grade gold mineralization across narrow widths. An accurate determination of average grade may require bulk sampling, due to the erratic nature of the mineralization.

References

Bowdidge 1984
Carter 1984
Gordon et al 1979
Malczak et al 1985

22. Gawley Occurrence, Marmora Township

Faith Mines Ltd.

Location

SE 1/4, lot 18, con IX, Marmora Township, Hastings County.

Work Completed

In 1983, Goldbrook Explorations Inc. carried out VLF-EM and self potential surveys over the Gawley occurrence as part of an exploration program covering lots 18 and 19, concession IX, Marmora Township.

Faith Mines Limited, in 1988, completed VLF-EM and soil geochemical surveys over a large claim group in lots 17, 18, and 19, concessions VIII and IX, and drilled 9 diamond drill holes totalling 2591 ft, all in the vicinity of the Gawley shaft.

The occurrence has been previously documented by Malczak et al (1985).

Geology and Mineralization

The occurrence consists of a 10 ft wide quartz-carbonate vein striking east-northeast and dipping 70^{o} to the north within interlayered carbonate and clastic metasediments. The host rocks are part of a thick, carbonate-dominated metasedimentary sequence which borders the Deloro granite pluton to the north and west. The Gawley occurrence lies within 1.7 km of the Deloro Pluton and within 1 km of the Malone granite, a satellite body of the Deloro granite (Bartlett and Moore 1985).

A 100 ft shaft was sunk on the quartz-carbonate vein in 1901 by

the Atlas Arsenic Co. Ltd., who reported that the vein contained 14% As and 0.37 oz Au/ton (Wells 1902). Recent drilling by Faith Mines Ltd. tested the vein in the shaft area in 4 holes and an additional 5 holes were drilled about 25 m south of the shaft on a gold-copper-arsenic soil geochemical anomaly (Figure 26).

The diamond drill hole intersections indicate that the vein actually consists of a 10 ft wide zone of quartz-carbonate stringers up to 6 inches wide which contain up to 20% pyrite, chalcopyrite, pyrrhotite, and arsenopyrite. Metasediments bordering the vein zone are sheared, contorted, silicified, sericitized and contain up to 2% disseminated pyrite and arsenopyrite. Two holes drilled directly below the shaft intersected quartz-arsenopyrite veins which assayed 0.032 and 0.135 oz Au/ton across 1 ft at vertical depths of 75 and 125 ft, respectively. Holes drilled 20 m east and west of the shaft along the strike of the vein zone also intersected quartz-carbonate veins and minor arsenopyrite mineralization but all samples assayed 0.001 oz Au/ton (Brown 1988).

South of the shaft, five holes drilled to test a soil geochemical anomaly intersected carbonate and siliceous metasediments, amphibolitic and argillitic metasediments, logged as volcanics by Brown (1988), and syenite dikes ranging in width from 3 to 25 ft. Sheared, sericitic, sulphide-bearing zones are common in the metasediments, but no anomalous gold values were obtained.

The syenite dikes are very fine grained, with a greenish to reddish grey colour derived from pervasive alteration of feldspar

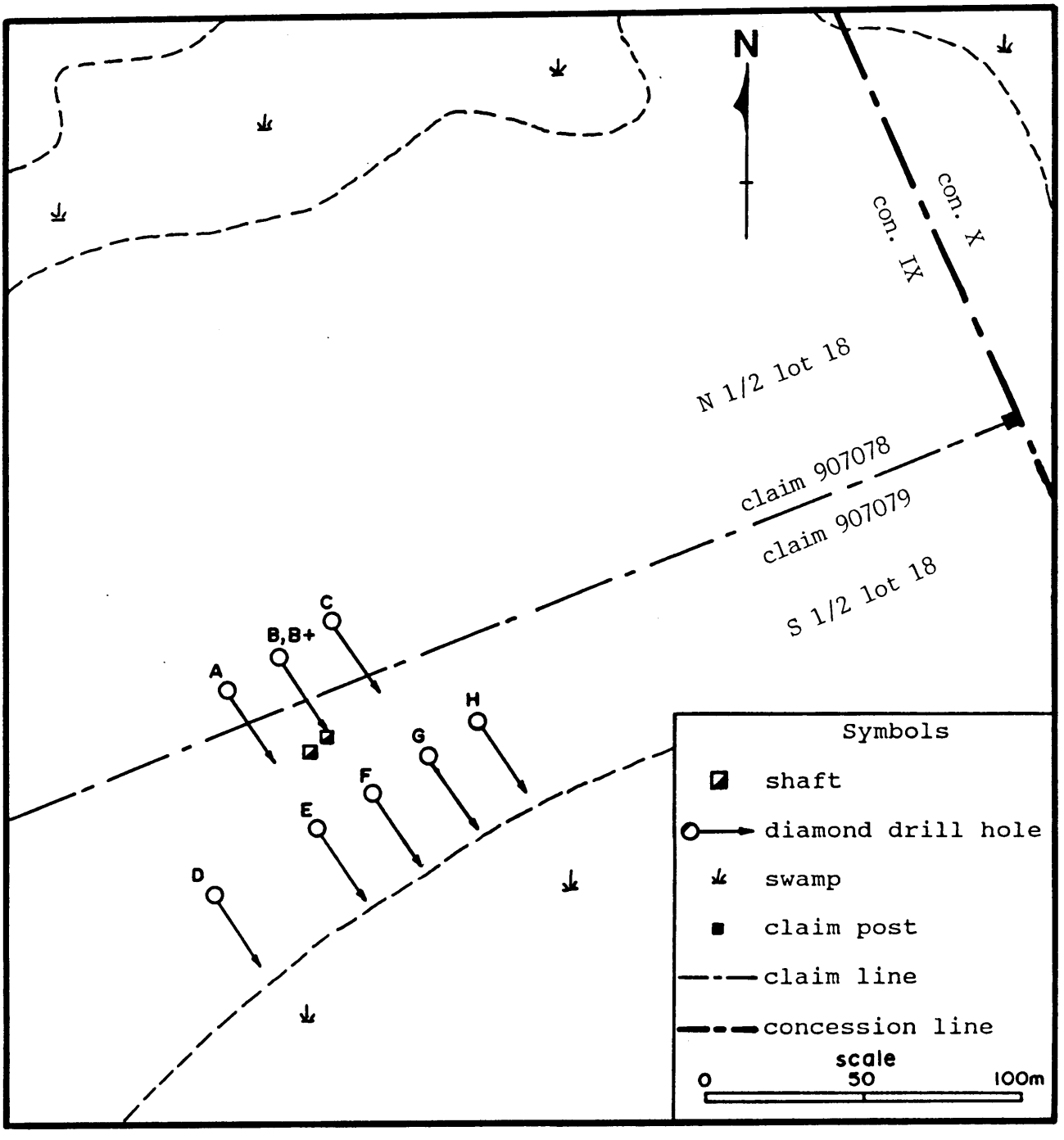


Figure 26. Faith Mines Limited diamond drill hole locations, Gawley occurrence, Marmora Township (after Brown 1988)

to pale green sericite and from local hematite staining. They exhibit sharp, conformable to low-angle (10^{o}) cross-cutting contacts with the metasediments. Mineralization consists of minor quartz-pyrite veining and up to 3% disseminated pyrite, however, no anomalous gold values were obtained. Despite the lack of gold mineralization, the syenite dikes are of interest because of their similarity to altered dikes within marble flanking the granite body which hosts the Dingman gold prospect, located 2 km along strike to the east. Gold mineralization at the Dingman prospect is associated with zones of green sericite alteration in granite, and syenite dikes close to the granite show moderate sericite and hematite alteration. Although the original Gawley occurrence appears to have low economic potential, there has been little exploration work done in the surrounding area, primarily due to low bedrock exposure. About 1.4 km southwest of the Gawley shaft, in the south 1/2 of lot 17, concession VIII, a pit has been sunk on a 2 to 3 m wide granitic dike containing quartz veins with arsenopyrite mineralization. The pit is located about 70 m south of an abandoned railway line on the northern margin of a swamp. An assay of 0.17 oz Au/ton across 7 ft is reported from this pit (John French, prospector, Stirling, Ont., personal communication 1990).

The presence of gold mineralization, strongly sheared, sericitized metasediments, and green sericite alteration in felsic intrusive rocks suggests that further exploration work is warranted in the area of the Gawley occurrence.

References

Bartlett and Moore 1985
Brown 1988
Malczak et al 1985
Wells 1902

23. Dillman Occurrence, Tudor Township

Homestake Mineral Development Company

Location

Lot 6, con VI; lot 5, con XIII (N 1/2); and lot 5, con XIV (S 1/2), Tudor Township, Hastings County; NTS 31 C/13 Coe Hill; UTM zone 18, 4963100 N, 297200 E; Lat 44° 47' 40", Long. 77° 33' 30" W.

The occurrence lies in the northeastern part of Tudor Township, about 25 km north of Madoc. Access is via Highway 62 to the Weslemkoon Lake Road, east to the Pine Ridge road (3 km east of the village of Gilmour), and south 5.5 km to a hydro line access road which leads eastward to the northern exposure of the occurrence. A four wheel drive vehicle is required on the hydro line access road.

History

Pre-1961: Numerous overgrown pits and trenches indicate prospecting activity, but no records of this work exist.

1961: S.B. Lumbers sampled an open cut on the north side of a beaver pond in the northwest corner of lot 5, concession XIII during a geological survey of Tudor Township for the Ontario Department of Mines. He reported an assay of 0.01 oz Au/ton from a 2 ft. wide quartz vein in potassic rhyolite containing a few stringers of arsenopyrite. A sample of arsenopyrite from the rhyolite assayed 0.03 oz Au/ton.

Samples of mylonitized, porphyritic, potassic rhyolite containing up to 10% disseminated arsenopyrite were taken from the same unit exposed in shallow trenches 115 m south of the power line, in the the west-central part of lot 4, concession XIV. Assays indicated traces of gold, copper, and silver (Lumbers 1969).

1970-71: Roger England carried out limited trenching and prospecting on the south half of lot 5, concession XIV, obtaining gold values of up to 0.06 oz Au/ton (England, 1971).

1985-88: R.J. Dillman staked the current four-claim group and completed linecutting, rock sampling , VLF-EM and magnetic surveys, and a soil geochemical survey. Grab samples of quartz-arsenopyrite vein material in felsic mylonite assayed up to 0.19 oz Au/ton (Christie 1989a).

1989-90: Homestake Mineral Development Company acquired the Dillman claims by an option agreement and carried out linecutting, geological, soil geochemical and induced polarization surveys, trenching, channel sampling, and diamond drilling (Christie 1989a, 1990).

Size and Grade

Gold values of up to 12g/t, but more commonly in the range of 2 to 4 g/t, have been obtained from narrow mineralized zones within a granitic gneiss unit 70 to 125 m wide over a strike length of 1400 m (Christie 1989a). Dimension and average grades of individual mineralized zones are not reported. Diamond drill hole DT-90-1 intersected a series of 5 mineralized zones from 0.6 to 3.1 m wide (silicified granite gneiss containing arsenopyrite

± pyrite ± quartz veins) within a 22.5 m section of granitic gneiss. Assay results are not included in the diamond drill log (Christie 1990).

Description

Geology

The Dillman occurrence lies within an area dominated by mafic metavolcanic rocks of the Tudor Formation which trend north-northeast along the western margin of the Lingham Lake plutonic complex (predominantly gabbro-diorite) and the Grimsthorpe trondhjemite.

The mafic metavolcanics are intruded by conformable, elongate bodies (probably sills) of gabbro, diorite, and granitic gneiss.

Dark green, weakly foliated, massive and gabbroic flows are the most abundant rock types within the metavolcanic sequence in this area. Within the thermal aureole of the Lingham Lake complex, these rocks have been altered to massive, fine to medium grained, black amphibolites. Laminated mafic units and chlorite ± biotite ± sericite schists, locally with strong iron carbonate alteration and intercalated magnetite-rich units, may be volcaniclastic metasediments.

A single granitic unit, host to the Dillman gold occurrence, occurs as a sill-like body trending north-northeast, varying in width from 70 to 125 m (Figure 27). It consists of a marginal felsite phase and a medium to coarse-grained, gneissic core. The rock appears to be mylonitic, with a buff to pale reddish-brown

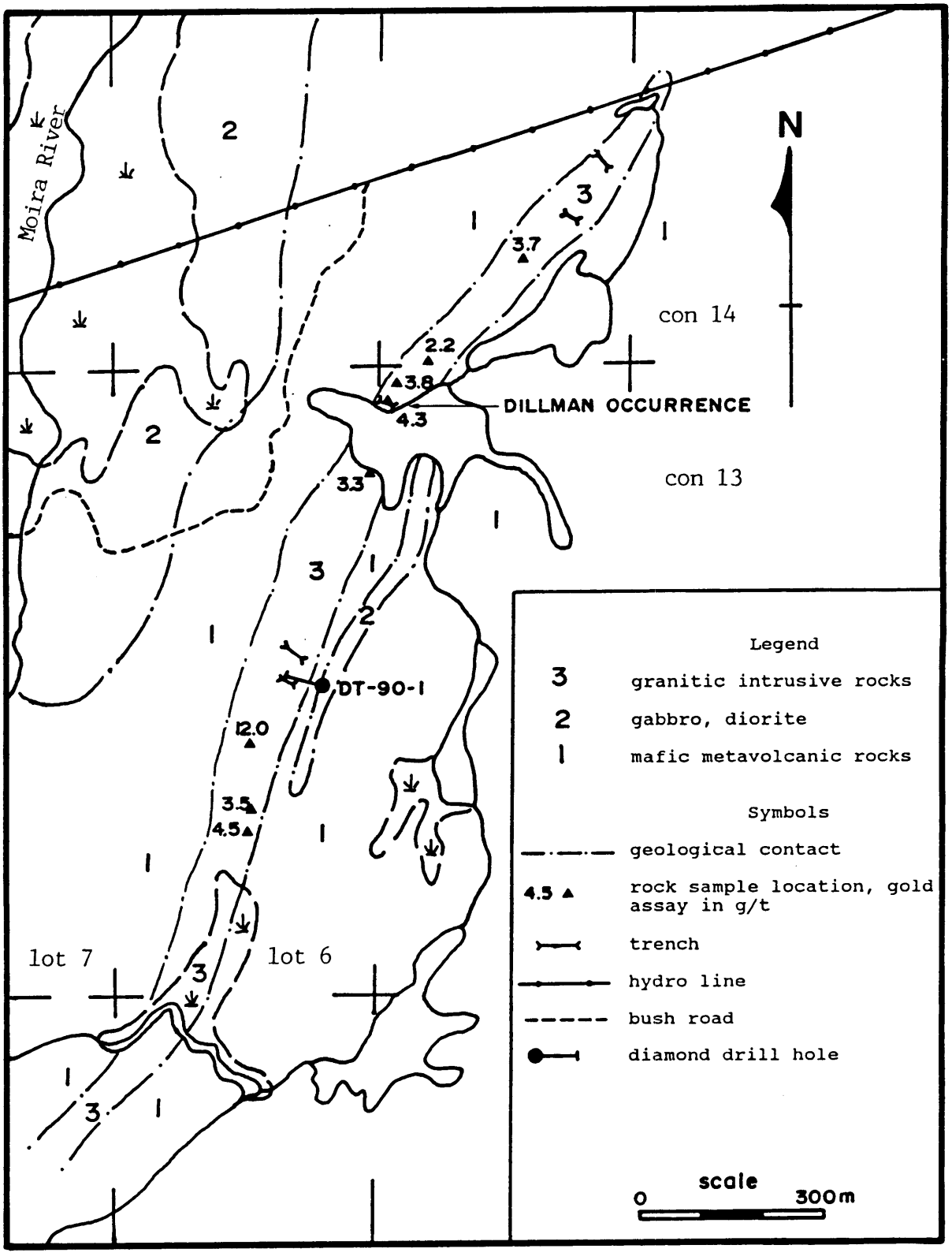


Figure 27. Geology of the Dillman occurrence area, Tudor Township (after Christie 1989 a)

felsic component consisting of fine to medium, angular grains of quartz and feldspar in a white rock-flour matrix. Fine, anastamosing seams of black biotite and amphibole spaced at 1 to 5 mm comprise 5 to 50% of the rock by volume. This unit was described as "mylonitized, porphyritic, potassic rhyolite" by Lumbers (1969).

Christie (1989a) describes three foliations within the rocks hosting the Dillman occurrence: 1) a steeply dipping regional foliation at 0-012°, 2) a steeply dipping foliation at 012-030°, probably related to the Moira River fault zone, and 3) a late, steeply dipping foliation at 030-045°.

The Moira River Fault is one of several major faults in the area, described by Lumbers (1969) as being from a few meters to 100 m wide, containing sheared, mylonitized, and complexly contorted rocks. Lumbers (1969) shows the Moira River Fault cut by a northwest-trending fault in the vicinity of the Dillman occurrence. However, a series of northeasterly trending (030° - 045°) faults are indicated by topographic lineaments and by corresponding breaks in the magnetic pattern shown on a total field magnetic contour map of the area (McConnell, 1990). One of the most prominent of the northeasterly-trending "breaks" occurs in the vicinity of the Dillman occurrence, where a series of quartz veins from 0.5 to 3 cm wide cuts the granitic rock at an angle of 25° to the mylonitic-gneissic foliation. This vein direction corresponds with the "break" direction derived from coincident topographic and magnetic features.

Mineralization

Christie (1989a) describes mineralization at the Dillman occurrence as follows:

"Three styles of gold mineralization have been noted on the property:

1. Quartz-arsenopyrite veins in sheared granitic gneiss.
2. Clotty disseminated arsenopyrite in sheared granitic gneiss.
3. Fine grained disseminated arsenopyrite in granitic gneiss.

The first type of mineralization occurs in narrow discontinuous shears in granitic gneiss. These shears are 10-100 cm wide, and 1-2 m in strike length. They trend anywhere from 12-30 degrees. The quartz-arsenopyrite veins are 1-3 cm wide and are generally <1 m in length. The veins contain from 10-80% arsenopyrite. Locally the sheared wallrocks appear potassium altered. Grab samples of this style of mineralization grade up to 3-12 g/t gold.

The second type of mineralization occurs in shears similar to those hosting type 1 mineralization. The sheared gneiss contains 0.5-3%, 1-2 cm clots of arsenopyrite. Again the sheared wall-rocks appear weakly potassic altered. Grab samples of this style of mineralization grade up to 2-3 g/t gold.

The third type of mineralization consists of 0.25-1% fine grained disseminated arsenopyrite in weakly foliated granitic gneiss. This type of mineralization contains up to 200-300 ppb gold."

Quartz veins also occur within schistose, iron carbonate altered mafic rocks. However, gold mineralization is apparently confined to the granitic gneiss unit.

Summary

Erratic gold mineralization occurs within a mylonitic granite gneiss in association with cross-cutting quartz veins containing arsenopyrite and pyrite. The host rock also contains clots and disseminations of arsenopyrite, but economically significant gold values are apparently restricted to the quartz veins and are not directly related to arsenopyrite content.

Granitic gneiss containing disseminated arsenopyrite with no quartz veins is generally only moderately anomalous (200-300 ppb Au) and where higher gold values have been obtained (2-3 g/t), it is likely that very fine, quartz-filled fractures are present.

The auriferous quartz vein system appears to be related to a series of northeasterly-trending shear zones which intersect both the Moira River Fault and the northerly-trending granitic gneiss. Localization of gold mineralization within the granitic rock is the result of the contrast in competence between the brittle granite and more ductile mafic metavolcanics and metasediments flanking the granite. Similar gold exploration targets may occur where other relatively competent units such as siliceous metasediments or pervasively iron-magnesium carbonate altered rocks are intersected by the northeasterly-trending shear zones in the vicinity of the Moira River Fault.

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Christie 1989a
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England 1971
Lumbers 1969
McConnell 1990

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Appendix

List of gold occurrences in southeastern Ontario from which diamond drill core is stored at the Ministry of Northern Development and Mines Drill Core Library, Tweed.

Occurrence Name	Township	Company	Year
Ultimate Energy	Anglesea	Ultimate Energy and Resources Ltd.	1978
Gough (Hardie)	Barrie	Grandad Resources Ltd.	1984
Ore Chimney Mine	Barrie	Michele Gold Mines Ltd.	1987
Cordova Mine	Belmont	Cordova Mines Ltd. Lasir Gold Inc.	1989
Green Lake, Napier Lake (Clyde Property)	Darling	Homestake Mineral Development Company; Lac Minerals	1988 1985
Barry	Elzevir	Corona Corporation	1988
James Joseph	Elzevir	Corona Corporation	1988
Addington Mine	Kaladar	E & B Explorations Ltd. Cathedral Gold Corporation	1980-83 1988
Joe's Lake (Clyde Property)	Lavant	Lac Minerals	1985
St. Joe	Madoc	Harwin Exploration and Development Inc.	1987
Bannockburn	Madoc	Mono Gold Mines Inc.	1981
Mono	Madoc	Mono Gold Mines Inc.	1985-88
Sophia (Diamond)	Madoc	E. Sager; Faith Mines Ltd. (Arbor Resources)	1980-82 1986-87
Ackerman	Marmora	Belmar Resources; Champion Gold Resources Inc.	1986-87 1989
Dingman	Marmora	Noranda Exploration Company Limited	1987-88
Hawk-Eye	Marmora	Goldbrook Explorations Ltd.	1984

Occurrence Name	Township	Company	Year
Gatling Five Acre	Marmora	Goldbrook Explorations Ltd.	1984
Gawley	Marmora	Faith Mines Ltd.	1988

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^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
			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	1.103 311	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

1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight perton (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 cooperation with the Coal Association of Canada.