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***HMC -1996 Bidjovagge Report  
Exploration Summary***

***Appendix # 1-Field data /Maps***

**Appendix 1a : 1987 *Economic Geology Review*  
- *Bidjovagge Geology***

## Bidjovagge Copper-Gold Deposit in Finnmark, Northern Norway

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### Abstract

The Bidjovagge copper-gold deposit is located 40 km northwest of Kautokeino in Finnmark, northern Norway. The deposit occurs in the lower Proterozoic Kautokeino greenstone belt and consists of four ore deposits in albitic felsite and graphitic albitic felsite over a strike length of 2.5 km. The orebodies occur on the eastern limb of a north-south-striking anticline. The albitic felsite may represent strongly altered tuffite and diabase or partly metamorphosed chemical sediment. The alteration of the metadiabase in the footwall sequence is complex. Carbonatization is very extensive, but there are also zones with biotite, scapolite, and hematite alteration.

The main ore is strata bound and occurs as veins, breccias, and low-grade disseminated mineralization of a more stratiform character. High gold values are usually related to late quartz-carbonate veins containing tellurides and are often associated with weak uranium mineralization. The ore minerals of economic significance are chalcopyrite and native gold. Other common metallic minerals are pyrite and pyrrhotite. Marcasite, magnetite, ilmenite, hematite, tellurides, rutile, sphalerite, galena, davidite, and pentlandite occur in accessory amounts. Preliminary isotopic analyses show that the lead isotope composition is markedly radiogenic ( $^{206}\text{Pb}/^{204}\text{Pb} = 22.2-23.8$ ).

The association of ore deposits with albitic felsites is also known to the north, in the Kvænangen tectonic window, where similar copper deposits but with low gold values occur in the Bergmark area and to the east near Masi in Big'geluobbal where U-V-Ti-rare earth element mineralization has recently been found. Bidjovagge is similar in its depositional environment to the Viscaria deposit in Sweden and the Pahtavuoma deposit in Finland.

### Introduction

SEVERAL ore deposits and prospects occur in lower Proterozoic greenstone belts in the northern parts of Norway, Sweden, and Finland. Best known are the Viscaria Cu deposit at Kiruna, northern Sweden (Godin) and the Pahtavuoma Cu, Zn, and U deposit in the Kittila area of northern Finland (Inkinen, 1979). Recently a small deposit with Sc and light rare earth elements has been found near Masi in northern Norway (Bjørlykke et al., 1985). All of these deposits are associated with strong sodium metasomatism, but the style of mineralization and the metal composition differ from deposit to deposit.

The Bidjovagge copper-gold deposit is situated 40 km northwest of Kautokeino in the Caskias

mountains of Finnmark, northern Norway. Claims were first staked in 1952 by the Boliden Mining Company (Hollander, 1979). Exploration was later taken over by a committee under the Norwegian government. By 1966 they had found four separate deposits over a strike length of 2.5 km with total ore reserves of approximately 3 million metric tons averaging 1.8 percent Cu and 0.5 ppm Au.

The Bleikvassli Mining Company leased the property in 1967 and production started in 1970 with a yearly production of 100,000 tons. The mine closed in 1975 due to low copper prices and technical problems. New and more detailed data on gold distribution made it possible for Outokumpu Oy to reopen the mine in 1985 with reserves of 1 million tons of ore averaging 2 g/metric ton Au and 1.2 percent Cu. Previous work includes regional mapping by Holmsen et al. (1959), Mathiesen (1970a, b), and Sandstad (1983). A more comprehensive description of the orebody was published by Hollander (1979), and Hagen (1982) has investigated

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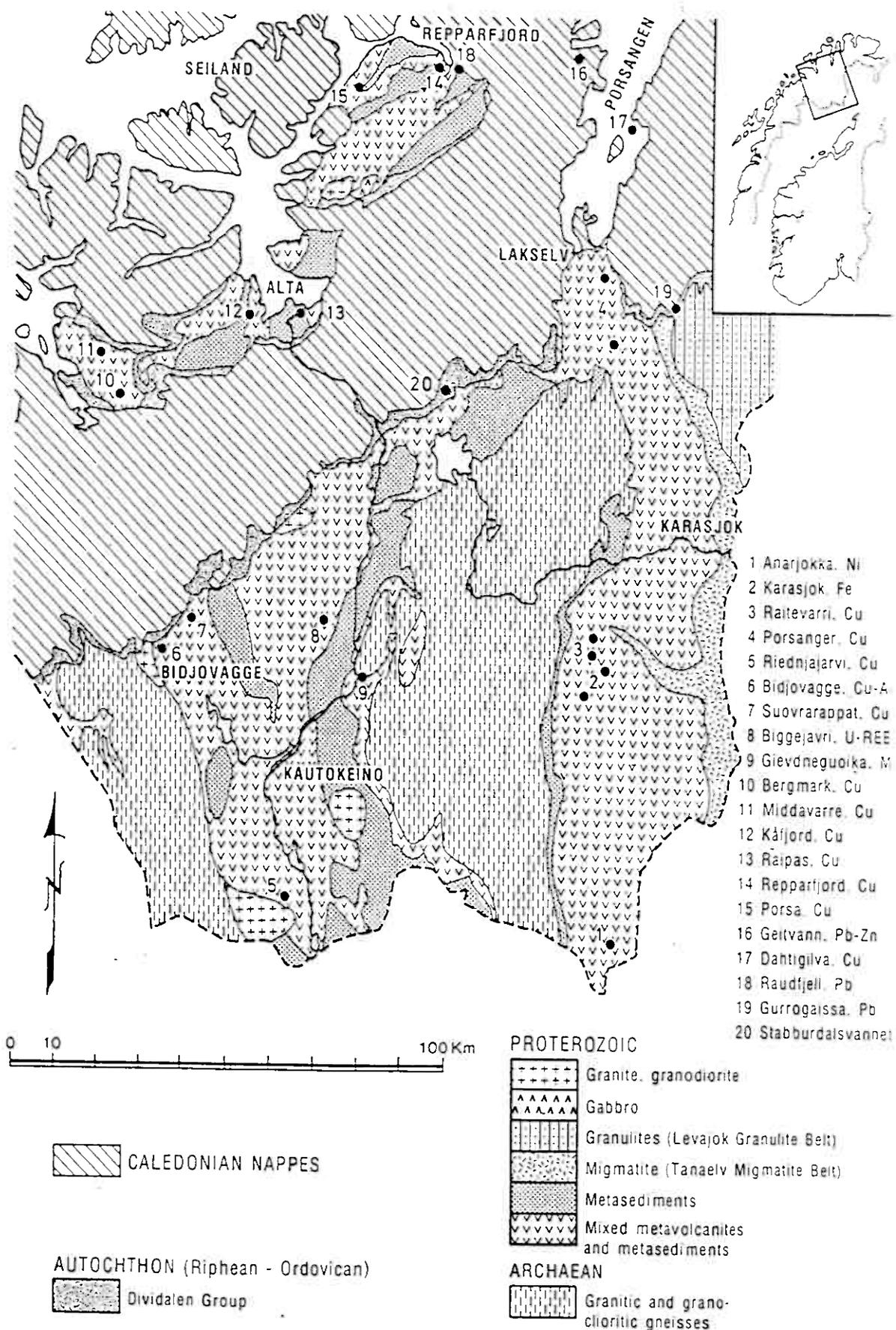


FIG. 1. Geologic map of the Finnmark area. Reproduced from Bjørlykke et al. (1985).

the mineralogical composition of the orebody, particularly the gold-rich paragenesis.

#### *Geologic setting*

The Precambrian of Finnmark (Fig. 1) consists of Archean gneisses and amphibolites separated by three north-south-trending Proterozoic greenstone belts: Kautokeino, Karasjok, and Pasvik-Polmak. The Archean gneisses consist mainly of felsic orthogneisses and paragneisses, and they constitute domal structures which are pierced by Proterozoic plutonic rocks. Together with the gneisses occur amphibolites (Galdenvarri Formation; Solli, 1983), which can be classified chemically as tholeiitic basalts. Characteristic are low  $TiO_2$  (mean 0.5%) and high Mg contents (mean 12.3%).

The precise relationship between the greenstone belts is a subject of controversy, but they are all three probably of similar early Proterozoic age (Krill et al., 1985). Based on structural and metamorphic studies and age determinations, Krill (1985) has adopted a plate tectonic model and described a complete "Wilson orogenic cycle" for the Karasjok greenstone belt. The supracrustal rocks of the Kautokeino greenstone belt can be followed on magnetic maps to the north under the Caledonian cover into the Alta-Kvenangen, Altenes, and Repparfjord-Komagfjord tectonic windows. The rocks consist of fluvial and shallow marine sediments and volcanites and are intruded by gabbroic sills. Both a continental rift setting (Torske, 1978) and an ensialic back-arc basin (Pharaoh and Pearce, 1984) have been suggested as depositional environments for the greenstones in the Kautokeino greenstone belt. The best preserved example of rift sediments is exposed in the Komagfjord-Repparfjord window where the 3-km-thick Saltvann Group is deposited in a horst and graben tectonic environment.

The early Proterozoic rocks in the Bidjovagge area (western part of the Kautokeino greenstone belt) are divided into the Cas'kejas Formation, the Bik'kakakka Formation, and the Carravarri Formation (Siedlecka et al., 1985). There are no depositional contacts between the Cas'kejas Formation and the Archean basement in the area due to the middle Proterozoic granite intrusion to the west.

The Cas'kejas Formation consists of dolomites, schists, metatuffites, and metavolcanics, which mainly in the lower part, are intruded by synvolcanic diabase sills. Albitic felsite occurs often in contact with the sills and is the host rock for the copper-gold mineralizations. The sequence is metamorphosed in greenschists facies to the east and in amphibolite facies in the west, near the granitic intrusion. The total thickness is approximately 4 km.

The Bik'kakakka Formation consists of a lower member of fine- to medium-grained sandstone with

thin beds of limestone. The upper member consists of brown to green shales and argillites with intercalations of siltstones (Siedlecka et al., 1985). It is metamorphosed in very low to low grade facies and the thickness is approximately 1 km.

The Carravarri Formation is the youngest in the greenstone belt and consists of gray to reddish feldspathic sandstones. The formation has been interpreted as alluvial, consisting mainly of braided stream deposits (Torske and Bergh, 1984).

#### *Geology of the Bidjovagge Area*

A generalized geologic map of the Bidjovagge area is shown in Figure 2. The map is mainly based on work by Sandstad (1983), with minor contributions from unpublished company reports by K. I. Olsen, I. G. Hultin, and R. Hagen. The map (Fig. 2) covers the northwestern part of the Cas'kejas Greenstone Formation already mentioned. Toward the north the Precambrian rocks are overlain by the late Precambrian Dividal Group. The Dividal Group consists of autochthonous shale and sandstone with a basal conglomerate.

The main structure of the Bidjovagge area, first recognized by Gjelsvik (1958), is a north-south-striking anticline, which can be followed over an axial length of 8.5 km. The lower parts of the Cas'kejas Formation with the ore-bearing units of albitic and graphitic felsite are exposed in this anticline. The same stratigraphic level occurs presumably in the small western anticline (Fig. 2) and in three anticlines more than 7 km to the east and northeast (outside the map area). From the main anticline and westward, the rocks are folded isoclinally and dip steeply. East of the main anticline the folds gradually become more open. A large complex synclinal structure with argillites is found in the northeastern part of the map area. Metamorphism and deformation increase gradually from lower grade in the east to middle grade in the west (Sandstad, 1983). Based on a study of regional aeromagnetic and gravimetric maps, Olesen et al. (1985) have proposed that the general deformation of the Kautokeino greenstone belt is a result of gravity tectonics.

#### *Stratigraphy and petrography*

The general stratigraphy of the Cas'kejas Formation is shown in Figure 3. The lowermost beds outcropping in the Bidjovagge area consist mainly of carbonates. Then follow argillites, often carbonaceous and usually altered to albitic felsites in the mining area. The uppermost beds in the Bidjovagge area consist of tuffites and amphibolites. This primary sequence has been intruded by diabase sills.

*Carbonates:* The lowermost units are carbonate rocks with tuffites in the core of the Bidjovagge

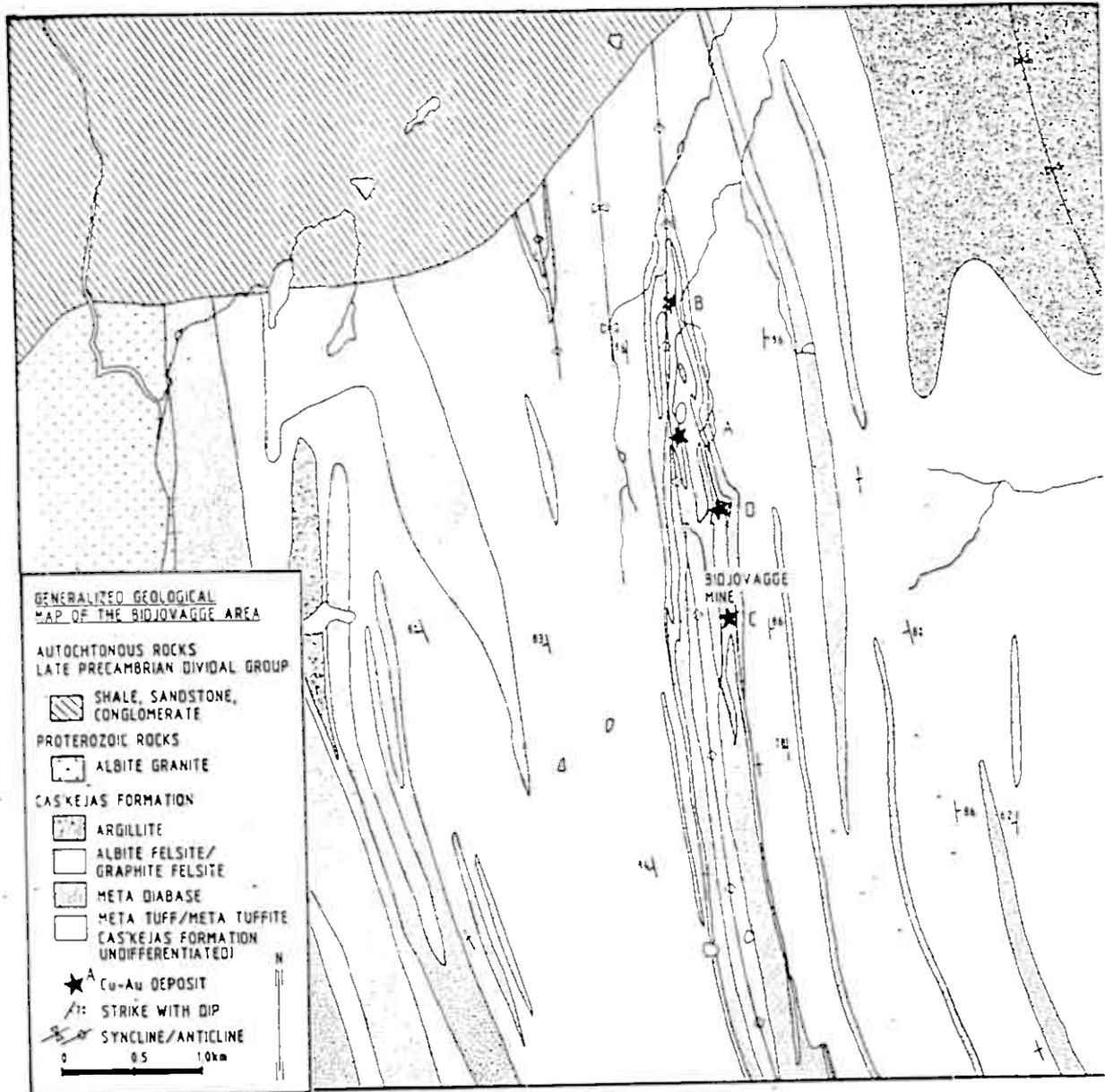


FIG. 2. The geology of the Bidjovagge area with the Bidjovagge antiline and the ore deposits on the eastern limb.

antiline. The carbonate rocks are partly fine-grained dolomites, though massive amphibole-bearing coarser grained dolomite is more common. The coarse-grained amphibole-bearing dolomite is interpreted as dolomite intermixed with tuff material. Rocks underlying these units are not exposed and the nature of the contact with the basement of the greenstones is not known. The white to gray, fine-grained (grain size 0.01–0.1 mm) dolomite has a fine lamination similar to the algal mat lamination seen in less deformed carbonates in the Kvenangen

area (Fig. 1). It is often albitized and in some sections most of the dolomite is replaced by albitized dolomite. Albitization of carbonates has been reported by V (1985) from the Kvenangen area. Elvebakk et al. (1985) describe tidal sediments from the Karasjø area with sedimentary macrostructures preserved but all microtextures show a complete recrystallization with albite and no evidence of primary grain boundaries. *Albitized argillites:* Above the carbonate belt follows a 20- to 50-m thick sequence of albitized argillites interbedded with thin limestones and t

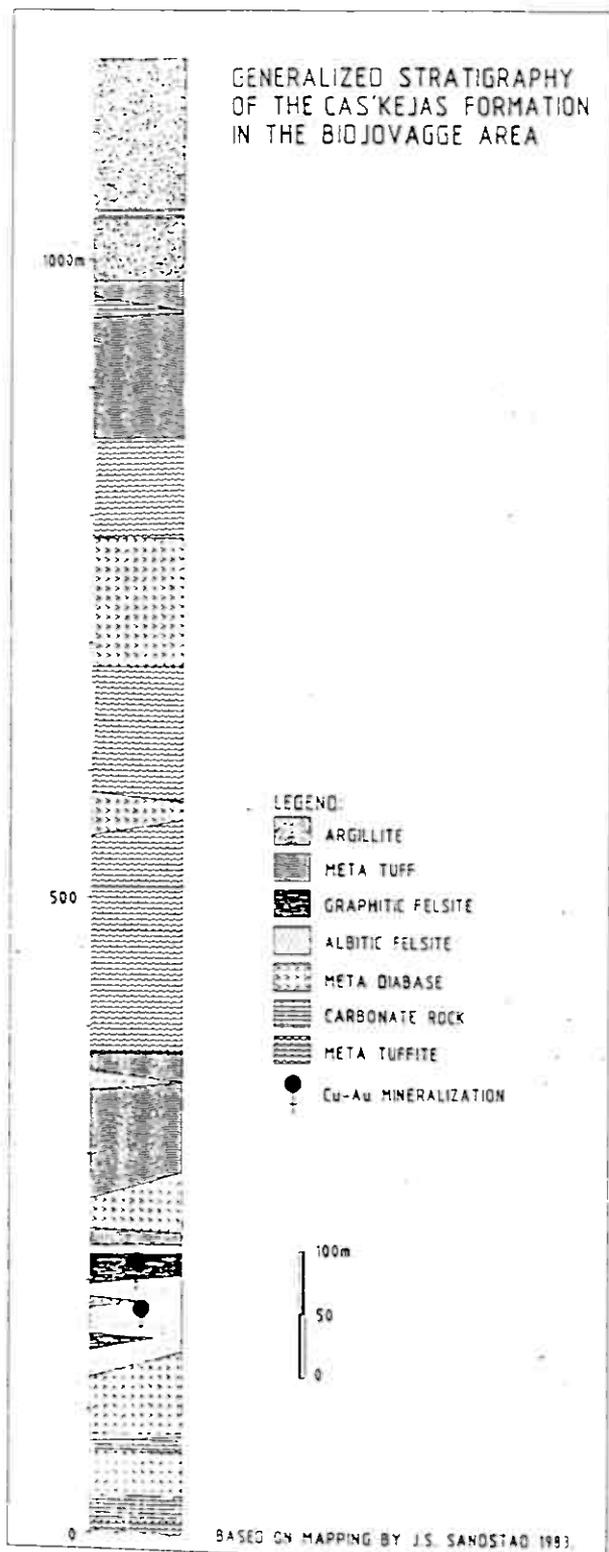


FIG. 3. Stratigraphy of the Cas'kejas Formation in the Bidjovagge area.

fités. When it is completely albitized the rock is called albitic felsite or graphitic felsite. The graphitic felsite is altered carbonaceous argillite and it can contain up to 40 percent C as very fine grained graphite. There are both sharp contacts and continuous transitions from albitic felsite to graphitic felsite. Near the orebodies the contacts between the two types of felsite are often discordant with the primary bedding.

*Tuffites and amphibolites:* The Bidjovagge level is succeeded by a mixed sequence of diabase sills, metatuffites, and amphibolites. Units of carbonate rocks also occur in this part of the sequence. The tuffites are the most dominant rock type. The most common variety is mapped as "banded amphibolites" and consists of light and dark bands alternating on a centimeter to decimeter scale. The dark bands are coarse grained and consist mainly of hornblende, whereas light bands are fine grained and contain mainly quartz and plagioclase. Massive amphibolites with thicknesses of a few meters occur with metatuffites. They are medium to fine grained without any primary structures and may be interpreted as metavolcanic rocks.

The upper part of the Cas'kejas Formation consists of argillite units with carbonate rocks and graphitic schists. These rocks are found in the syncline in the northeastern part of the map in Figure 2.

*Intrusive rocks:* Diabase occurs both stratigraphically above and below the orebody. The diabase is folded and must have been intruded as early sills. Individual units can be up to 100 m thick. Ophitic textures and chilled margins are locally present. The diabase is a fine- to medium-grained green rock with a subophitic texture, consisting of albite, amphibole, epidote, chlorite, biotite, calcite, magnetite, pyrrhotite, and pyrite. It shows different degrees of alteration; the diabase below the orebody is strongly altered.

Recently an albitite dike has also been found in the B deposit. The dike is a reddish, coarse-grained albitite with minor amounts of pyrite and calcite, up to 5 m thick and with sharp contacts to its albitic felsite host rock.

*Alteration:* Sodid alteration, producing albitic felsites, graphitic felsites, and secondary albite in diabase, is the most important alteration type associated with the mineralization at Bidjovagge. The felsites are mainly an alteration product of argillites but also occur in carbonates, diabase, and tuffites. The albitic felsite and graphitic felsite of the Bidjovagge stratigraphic level are associated with diabase sills. These rocks are stratigraphic units and can be followed over a strike length of 8.5 km in the Bidjovagge anticline. The normal stratigraphy is a graphitic unit with albitic felsite on both sides. The



FIG. 4. Albite crystals, 1 to 2 mm in size, replacing amphiboles in metadiabase.

lower contact of the lower albitic felsite is usually sharp against a diabase, whereas the upper albitic felsite gradually turns into a tuffite upward.

The albitic felsite consists mainly of albite with small amounts of quartz and carbonate. Amphibole and micas also occur. The rock is granular and very fine grained (0.01 mm). Near the contact to the diabase it is usually massive, without internal primary structures. Near the contact to metatuffites the albitic felsite is laminated with 3- to 8-mm-thick layers.

The alteration of diabase sills is very complex and the resulting zones are enriched in albite, biotite, calcite, scapolite, and hematite. Albitization is the most common alteration; large phenocrysts of albite replacing amphibole can be seen frequently in thin section (Fig. 4). The albitization can be complete in limited zones, resulting in a coarse-grained albitite called leucodiabase by earlier authors (Hollander, 1979). A gradual change from diabase to fine-grained albitic felsite has been observed in some drill cores. The albitization is often associated with carbonatization. Calcite occurs both as disseminated ore replacing mostly amphibole and as thin veins. Hematite often occurs together with secondary calcite. Scapolitization can be fairly extensive with 30 to 50 percent of the rock consisting of

scapolite in the form of 5- to 10-mm-large poikiloblasts formed mainly at the expense of albite. Scapolitization is also a regional feature in the Kautskino greenstone belt. Biotite occurs in restricted zones together with albite, some amphiboles, and carbonate. Biotite-rich zones are more schistose and may represent metamorphosed clay-mineral alterations.

### Geology of the Ore Deposits

The Bidjovagge mine encompasses deposits of four orebodies, which are situated on the eastern limb of the Bidjovagge anticline over a strike length of 2.5 km (Fig. 2). The deposits are generally tabular with an individual strike length between 100 and 200 m. The thickness varies from less than 5 up to 35 m. Original ore reserves and ore reserves in 1986 are shown in Table 1. Copper and gold are the only metals of economic importance, with average grades of about 1 percent copper and 2 to 3 ppm gold. The geochemistry of the ores is not known in detail. The silver content is on the order of 2 to 3 ppm. The mean zinc contents in the different ores range from tens to hundreds of ppm, as do the lead contents. The mean nickel contents range from about 300 to 600 ppm, the cobalt contents from 80 to about 300 ppm.

All economic ore is hosted by albitic felsite, but the graphitic felsite is often mineralized close to its contact with the albitic felsite. Since the felsites occur within certain stratigraphic units, the mineralization can be classified as strata bound.

Three types of chalcopyrite mineralization in albitic felsite can be distinguished, but there are gradual transitions between each of them:

1. Most of the chalcopyrite occurs in veins with ankerite, actinolite, and some pyrite and pyrrotite. The veins are usually 2 to 10 cm thick and form a brecciated texture in the cherty-looking albitic felsite (Fig. 5). A few wider veins, each several meters thick, are folded and boudinaged.

2. Chalcopyrite with minor gangue minerals (ankerite and actinolite) is found in veinlets in a stock-

TABLE 1. Original Ore Reserves before Production Started and the Mineable Ore Reserves (in situ, Jan. 1, 1986)

Deposit	Original reserves (1,000 metric tons)	Mineable ore reserves 1,000 tons	Cu (%)	Au g/metric	Au g/metric ton red <sup>1</sup>
A	349	200	2.10	>1.80	>1.30
B	546	389	1.02	3.25	2.33
C	2,105				
D	2,000	208	0.94	3.30	2.39
Gold <sup>2</sup>	58	37	0.57	6.00	4.20

<sup>1</sup> red = reduced; analyses with >3 g/metric ton Au over the weighted mean are cut down to the mean

<sup>2</sup> Gold = small gold ore in the footwall of the C ore



FIG. 5. Brecciated felsite with ankerite and chalcopyrite.

worklike texture. In some areas the veinlets occur parallel to the bedding.

3. Disseminated chalcopyrite is usually observed in association with the vein mineralization.

There is always some gold in the copper mineralization, but a positive correlation between copper and gold has only been reported from the southernmost orebody (Hagen, 1977). The highest gold grades are always found in zones with low sulfide contents.

The chalcopyrite in the graphitic felsite forms very irregular veins with small amounts of gangue minerals. Copper grades are sometimes high, but low gold grades and poor recovery make mineralization in graphitic felsite uneconomic.

The four deposits are known as A, B, C, and D. During the first mining period, from 1970 to 1975, 400,000 tons of ore were mined from the A and C deposits. These two deposits have earlier been described by Hollander (1979) and Hagen (1977, 1982, 1983a) and will only be briefly described here. New information has been gained about the B and D deposits through recent diamond drilling, removal of glacial overburden, and production in the second mining period. The B and D deposits will therefore be described in some detail.

#### *B deposit*

The B deposit is the northernmost of the Bidjovagge deposits (Fig. 2). It comprises three orebodies, the main, the east, and the west ones (Fig. 6). The main and west orebodies occur as northerly continuations of a graphitic felsite, whereas the east orebody occurs on the western flank of another graphitic unit. A typical section through the B deposit is shown in Figure 7.

The main orebody continues to a depth of at least 100 m and contains some 440,000 tons with 1.1 percent copper and 3.56 ppm gold. The east ore-

body dies out at a depth of 20 to 30 m and contains on the order of 76,000 tons, carrying 0.67 percent copper and 2.0 ppm gold. The west orebody is a small gold orebody in the footwall of the main body and close to the graphitic felsite (Fig. 6). This orebody has not yet been delineated, but the size is on the order of 5,000 tons, the copper grade is about 0.1 percent, and the gold grade is 2 to 5 ppm.

The albitic felsite at the B deposit can be divided into three units. On top of the mineralized felsite is a mixed series with alternating felsite and laminated carbonate layers. The mineralized unit is a light homogeneous felsite. The felsite hosting the east orebody contains 1- to 2-m-thick albite carbonate sills. The host rock of the west orebody is reddish due to hematite and in some parts greenish due to chlorite. The footwall felsite unit is often chloritized and hematitized. The graphitic felsite in the south interfingers with the albitic felsite, and a "finger" of graphitic felsite penetrates into the main orebody for at least 50 m at a depth of 15 to 50 m in the north.

#### *D deposit*

The D deposit is situated between the A and C deposits (Fig. 2). A geologic map of the D deposit is shown in Figure 8. Diamond drilling in 1985 led to the reevaluation of the previously known low-grade copper mineralization to a mineable gold-copper orebody.

The deposit occurs as a northerly continuation of a graphitic felsite, a feature which is shared with the main and west orebodies of the B deposit; see description above. The length of the D deposit is about 100 m and the thickness is up to 35 m. The ore changes into a thin mineralized zone toward the north and at depths of 50 to 60 m below surface. The body dips 70° to the east in the north and 50° to the east in the south and contains 208,000 tons of ore, grading 0.94 percent copper and 2.36 ppm gold. A section of the D deposit is shown in Figure 9.

The host rock is a light albitic felsite with varying carbonate and actinolite contents. Coarse-grained carbonate-albite sills are common. These are folded and boudinaged, showing clearly a predeformational origin. As in the B deposit the mineralized unit is overlain by a mixed series with albitic felsite alternating with laminated carbonate layers and material of probably tuffitic origin. The footwall felsite is chloritized and hematitized. The graphitic felsite in the south interfingers with the mineralized albitic felsite. Close to the contact the albitic felsite is bleached and contains inclusions of graphitic felsite.

The northern part of the deposit is mainly copper ore, dominated by vein mineralization, with ore types 1 and 2. In the central parts type 3 ore be-

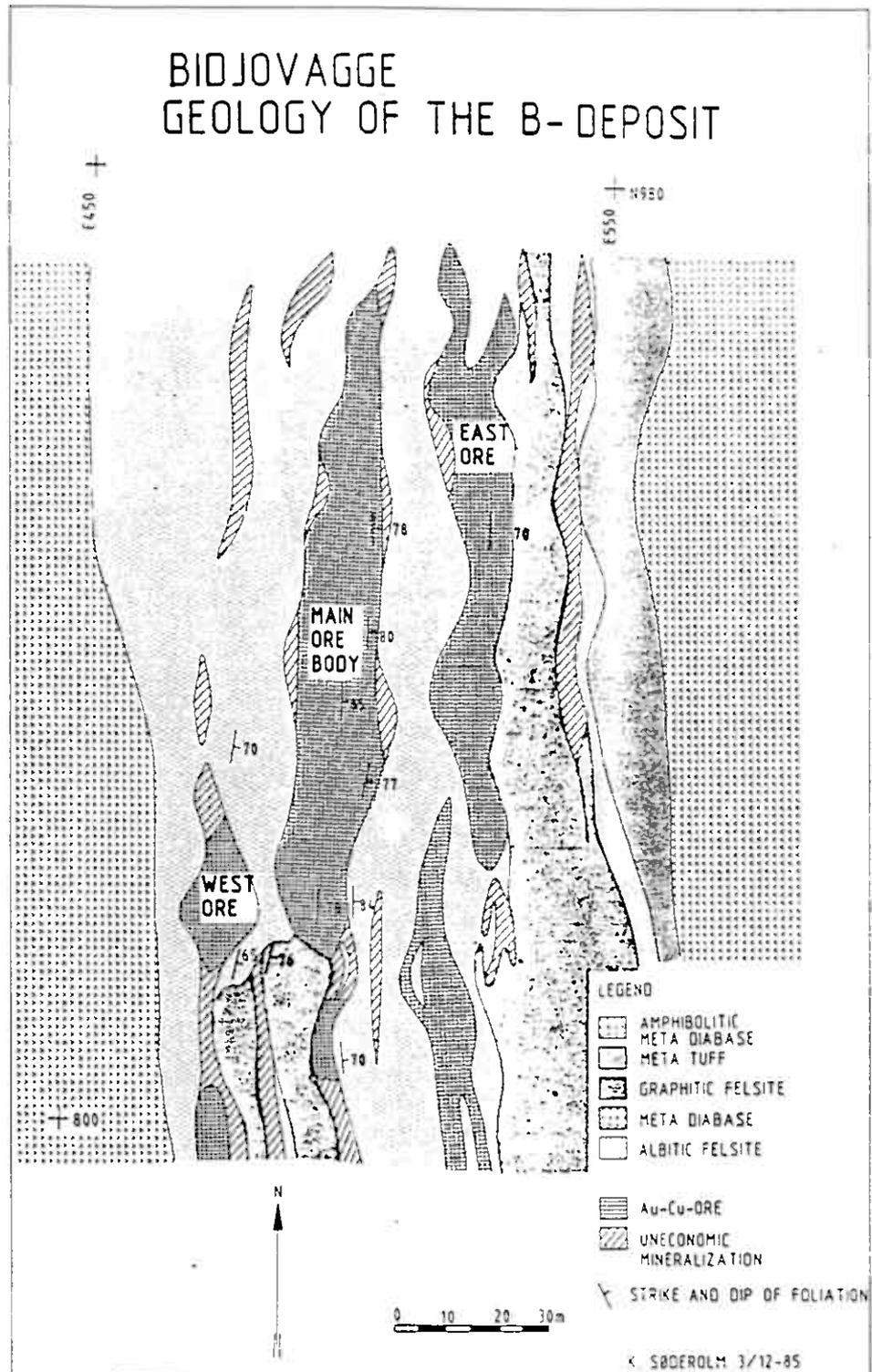


FIG. 6. Geologic map of the B deposit.

comes more abundant, and unmineralized layers of flinty albitic felsite alternate with high-grade layers, often characterized by ankerite and actinolite. To the south the ore gradually changes into a gold ore

characterized by minor sulfides and quartz veinlets with tellurides in a reddish albitic felsite. This development from north to south is demonstrated by a map showing the gold to copper ratio (Fig. 10).

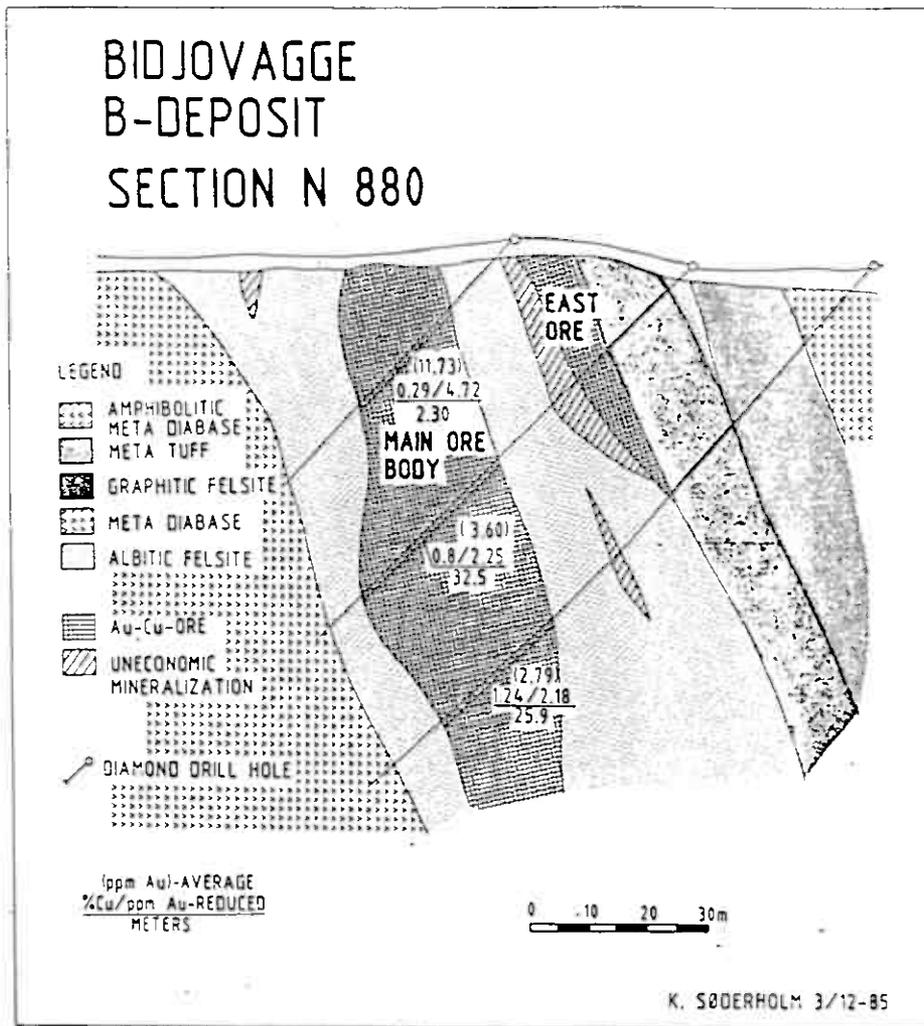


FIG. 7. Geologic cross section along profile N 800 in the B deposit.

In the D deposit there is a positive correlation between gold and radioactivity. In Figure 9, gold and radioactivity values are shown in a profile over the geologic section. High radioactivity values are related to the occurrence of davidite as a weak dissemination in the albitic felsite. The correlation between davidite and reddish to brownish albitic felsite with quartz veinlets and gold mineralization is confirmed from the west orebody of the B deposit, the footwall of the A deposit (Hagen, 1983a), and from the gold ore in the footwall of the C deposit (Hagen, 1983b).

A very gold-rich zone occurs directly below the mixed series in the hanging wall of the D deposit. The thickness of the zone is between 3 and 7 m, and the average gold grades recorded vary between 18 and 65 ppm. The zone is thin and weak at surface and does not show on the gold-copper ratio map of Figure 10. This gold ore is hosted by a carbonate-albite rock with zoned hastingsite porphyroblasts.

The rock may represent an altered carbonate bed. Also in this gold zone there is a positive radioactive anomaly.

#### A and C deposits

The A and C deposits are more copper rich than the B and D deposits. The copper grade of the A deposit is 2.10 percent (Table 1) and that of the C deposit 1.84 percent (Hollander, 1979). In other respects the A deposit is similar to the B deposit. The ore of the A deposit is mostly of types 1 and 2, and the periphery of the ore is richer in gold than the central copper-rich part. In the footwall the ore gradually changes into a gold ore with tellurides, davidite, quartz veinlets, and minor sulfides in a cherty-looking albitic felsite. Below the ore the albitic felsite is often rich in pyrite, and chloritized and hematitized zones occur.

The C ore deposit contains more iron sulfides than the other deposits. As a whole the C deposit is

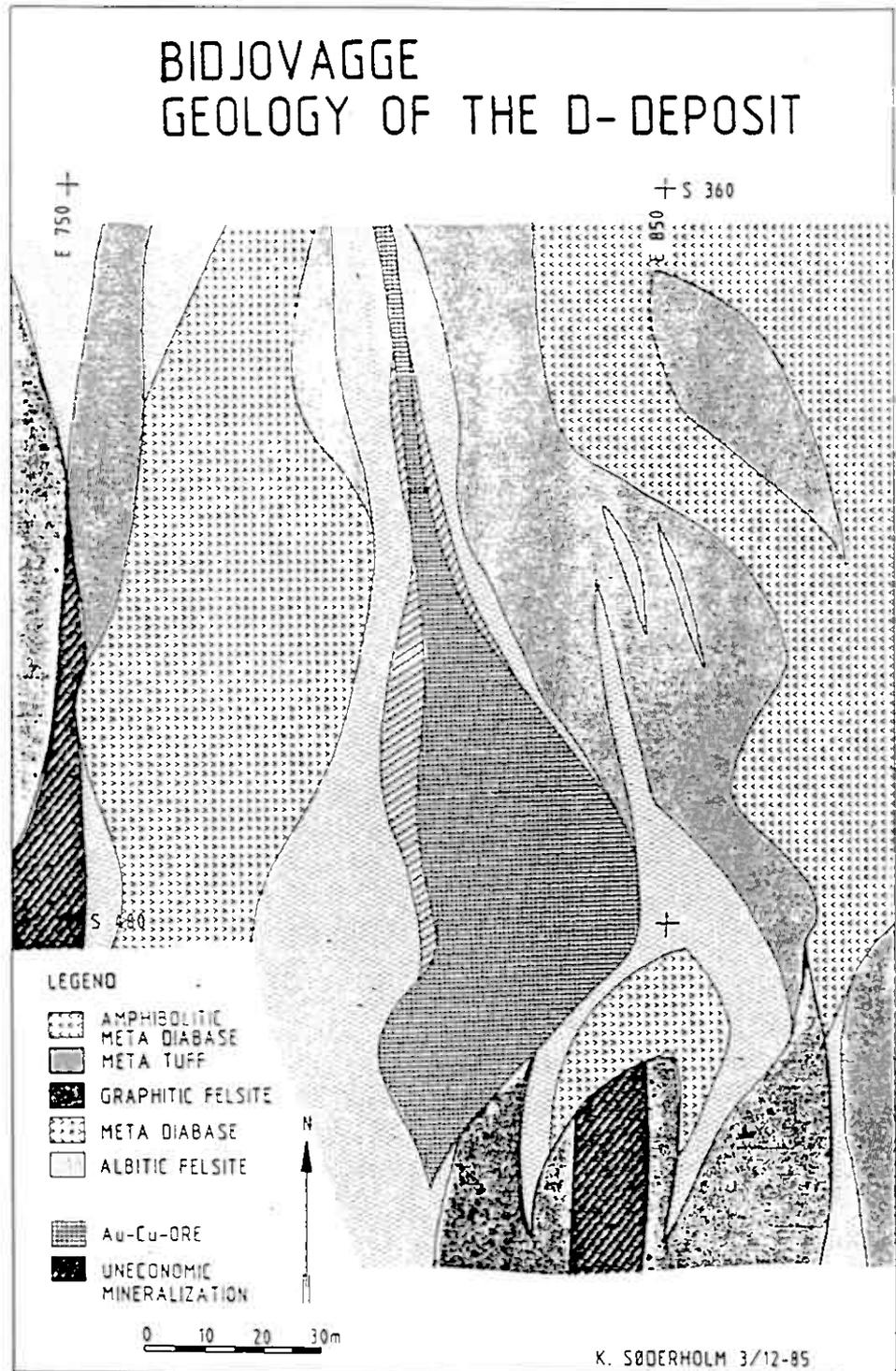


FIG. 8. Geologic map of the D deposit.

also richer in zinc, lead, nickel, and cobalt. In the footwall of the C orebody occurs a small gold-copper ore, designated "gold" in Table 1. This ore is hosted by an albitic felsite with the same features as described from the gold-rich zones in the other orebodies.

Compared to the other orebodies the tonnage of the C deposit is large (Table 1), but at present the main C ore is not considered mineable; the gold grade is low (0.5–1.0 ppm), the ore is partly hosted by graphitic felsite, and the deposit is only suitable for underground mining.

D-DEPOSIT  
SECTION S490

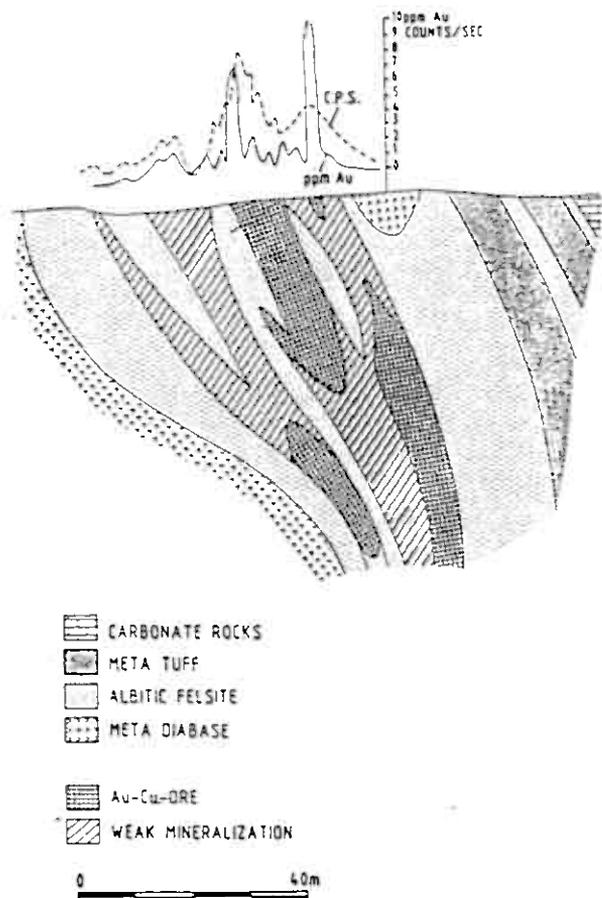


FIG. 9. Geologic cross section along profile S 490 in the D deposit, with gold analysis and radioactivity (measured by scintillometer on the surface).

*Ore mineralogy*

The main ore mineral in the copper orebodies is chalcopyrite. Its typical mode of occurrence is as coarse-grained anhedral aggregates, though individual anhedral grains of chalcopyrite are also common. Pyrite and pyrrhotite commonly occur with the chalcopyrite, but the distribution of the iron sulfides is irregular and they seldom make up more than 10 percent of the ore. Grains of chalcopyrite and pyrrhotite show mutually interpenetrating grain boundaries.

In pyrite-rich ore chalcopyrite occurs as inclusions and fracture fillings in the pyrite. Replacement of pyrite by chalcopyrite along fractures and grain boundaries is common (Fig. 11). Microprobe analyses of pyrite have recorded up to 6.9 percent nickel (Hagen, 1977) and 0.9 percent cobalt (Sotka and Hanninen, 1983). However, most of the pyrite

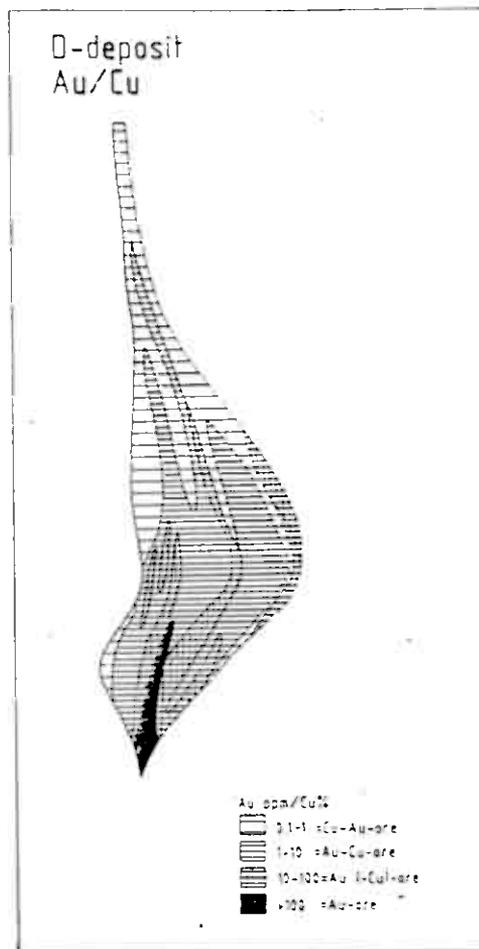


FIG. 10. Map of the distribution of gold relative to copper in the D deposit. Scale and orientation are the same as in Figure 9.

grains contain undetectable amounts of nickel and cobalt.

Gold occurs mainly as native metal. In the copper mineralization gold is commonly associated with

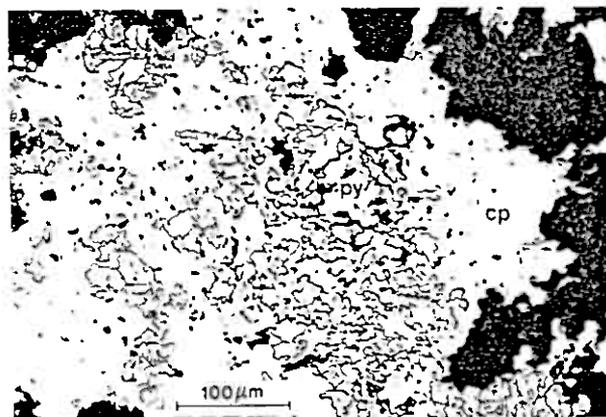


FIG. 11. Pyrite (py) replaced by chalcopyrite (cp). Reflected, plane-polarized light.

pyrite, as inclusions and fracture fillings. A positive correlation between gold and copper has, however, been proved in the C orebody (Hagen, 1977). Gold has also been observed as inclusions in chalcopyrite and in pyrrhotite.

In the zones of high gold and low copper, gold is found in an assemblage with tellurides (Fig. 12). Melonite, tellurobismuthite, and altaite are the most common tellurides, but frobergite, native tellurium, and calaverite have also been identified (Hagen, 1982). The assemblage is found in quartz-carbonate veinlets, with minor sulfides. Tellurides also occur in the copper ore, usually as inclusions in pyrite (Fig. 13). Most of the gold at Bidjovagge has a grain size of less than 0.1 mm (Hagen, 1981), but larger grains occur and the tellurides can often be seen with the naked eye.

Microprobe analyses of native gold show a marked difference in the composition of native gold in copper ore and in gold ore (Table 2). The gold in the copper ore contains more than 9 percent silver whereas the gold from the gold ore has a fineness of more than 99 percent.

Marcasite is a common accessory mineral. It occurs as subhedral grains, usually associated with pyrite. The mode of occurrence of the marcasite indicates a hypogene formation (Hagen, 1977).

Other accessory sulfides in the ore are sphalerite, galena, pentlandite, violarite, mackinawite, and molybdenite (Hagen, 1977). Sphalerite mainly occurs as anhedral inclusions in chalcopyrite and may itself contain tiny inclusions of chalcopyrite. A few observations of galena as fissure fillings in pyrite have been made. In one sample galena and chalcopyrite form lamellae in sphalerite (Fig. 14).

Bornite, chalcocite, covellite, and native copper have been observed in near-surface samples and are interpreted as products of supergene processes.

Magnetite, ilmenite, hematite, and rutile are all

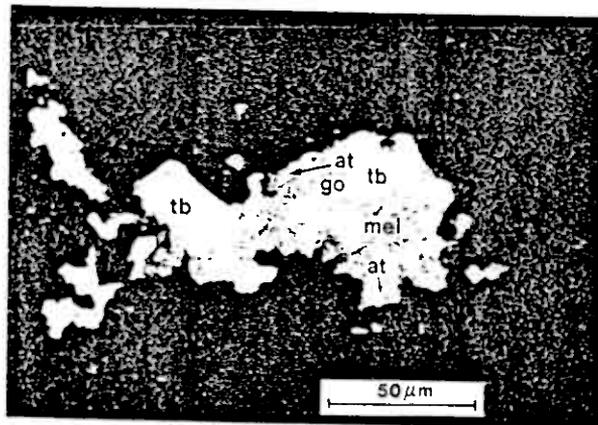


FIG. 12. Native gold (go) with tellurobismuthite (tb), melonite (mel), and altaite (at). The tellurides contain inclusions of sulfides. Reflected, plane-polarized light.

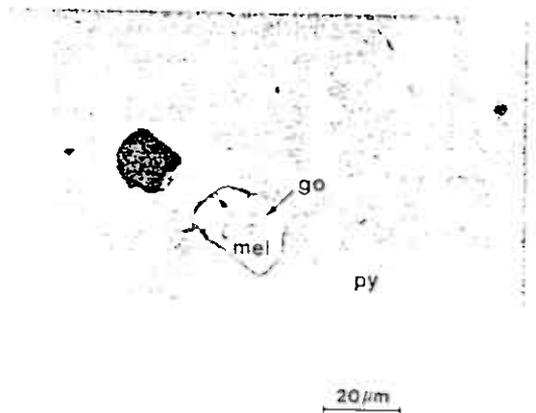


FIG. 13. Gold (go) and melonite (mel) as inclusions in pyrite. Reflected, plane-polarized light.

common accessory minerals. Magnetite often occurs as euhedral inclusions in sulfides. Larger magnetite grains are usually cataclastically deformed. In hand specimens magnetite can be seen, having a blade-like appearance which may represent a pseudomorph after hematite. Ilmenite is found as subhedral and anhedral grains both in the orebodies and in the unmineralized albitic felsite. Ilmenite grains often contain hematite lamellae in an exsolution texture. Disseminated rutile occurs in the albitic felsite and sporadically in the graphitic felsite.

Mathiesen (1969) investigated a complex titanium mineral from the A orebody. The mineral has later been identified as davidite (T. Sverdrup, pers. commun). In addition to the davidite, Mathiesen identified thortveitite, vanadiorutile, a vanadichrome spinel, gadolinite, and euxenite. The titanium-vanadium-uranium-rare earth element mineralization has later also been found in the other orebodies and may be spatially related to gold mineralization.

#### Geochemistry

The early Proterozoic volcanites of the Baltic Shield have recently been investigated by several authors. In a regional survey of the Lapland area,

TABLE 2. Microprobe Analysis of Native Gold (wt %)

	I	II
Au	90.06	99.40
Ag	9.48	0.46
Fe	0.43	0.03
Cu	n.d.	0.02
Bi	n.d.	0.34
Total	99.97	100.25

I is the average of 11 analyses of gold in copper ore. II is the average of five analyses of gold from gold ore with minor copper. n.d. = not detected

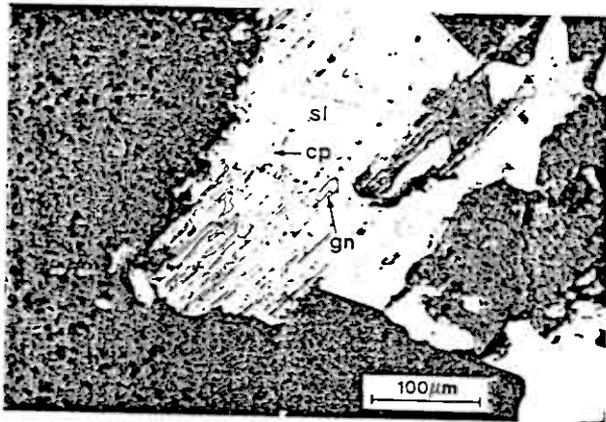


FIG. 14. Lamellae of chalcopyrite (cp) and galena (gn) in sphalerite (sl). Reflected, plane-polarized light.

Pharaoh and Pearce (1984) concluded that the metavolcanic greenstones in Finnmark are tholeiitic basalts which range from mid-ocean ridge basalts to within-plate basalts in their content of elements of high ionic potential. The association with shallow marine sediments deposited on an Archean continental basement indicates a depositional environment connected with the initial phase of opening of an ocean or a back-arc basin. A rift environment has also been suggested by Torske (1978). The volcanites and the diabase sills of the Cas'kejas Formation have been studied by Sandstad (1983) in the Bidjovagge-Kautokeino region: they are chemically similar. They also predate deformation, and the diabase may therefore be formed early, in association with volcanicity in the Cas'kejas Formation.

In the Bidjovagge mining area the diabase sills are altered to varying degrees. In order to illustrate the

chemical changes due to alteration of the diabases in the mining area, they have been compared with less altered diabases from the regional study of Sandstad (1983) in Table 3. The altered diabases can be separated into two main groups. One group is enriched in sodium and one in potassium. Sodium-enriched diabase occurs often near albitic felsite and the contact is usually transitional. The sodium-enriched diabase has a plagioclase with  $An_{0.10}$  and the occurrence of authigenic albite can be observed in thin sections. The calcium content is similar to that in weakly altered diabase in the region, but calcite has been formed at the expense of the mafic minerals. This is also shown in the high loss on ignition in the sodium-enriched samples, and it explains the reductions in the iron and magnesium contents. The potassium-enriched diabase sills are characterized in the field by an increased content of biotite and sometimes scapolite or hematite. The biotite-altered diabase has a lower calcium content than the regionally weakly altered diabase, but the calcite content is higher, indicating a replacement of amphibole by calcite and biotite. The plagioclase is sometimes replaced by scapolite. The same alterations are also observed in the Kvenangen area (Vik, 1985). The albitic felsites have an average sodium content of 7.5 percent  $Na_2O$  and an  $SiO_2$  content of 66 percent. They consist mainly of albite with minor quartz and carbonate. They have been interpreted as being primary tuffites by Hollander (1979), but field observations point to a metasomatic and contact metamorphic alteration of shales, tuffites, and carbonates.

Rare earth elements

The rare earth element content in the diabase sills and in the albite from the mining area has been

TABLE 3. Average Chemical Composition of Metadiabase and Albitic Felsite

	Metadiabase west orebody n = 18		X	Metadiabase albite alteration	Metadiabase albite alteration	Albitic felsite
	Min	Max		n = 4 X	n = 6 X	n = 3 X
SiO <sub>2</sub>	46.15-53.44		49.36	49.2	46.6	66.3
TiO <sub>2</sub>	0.53-2.31		1.22	1.4	1.5	0.6
Al <sub>2</sub> O <sub>3</sub>	12.03-15.88		13.55	12.7	13.5	14.0
Fe <sub>2</sub> O <sub>3</sub>	1.85-9.88		4.55	9.2	12.1	1.62
FeO	5.46-13.36		8.62			
MnO	0.06-0.23		0.16	0.12	0.10	0.05
MgO	3.50-9.98		6.52	5.4	7.1	1.5
CaO	4.91-10.72		8.48	8.3	6.6	3.2
Na <sub>2</sub> O	1.8-6.8		3.8	4.9	4.0	7.5
K <sub>2</sub> O	0.05-0.84		0.33	0.38	2.6	0.2
P <sub>2</sub> O <sub>5</sub>	0.03-0.19		0.09	0.12	0.12	0.06
H <sub>2</sub> O <sup>-</sup>	0.00-0.04		0.01			
H <sub>2</sub> O <sup>+</sup>	0.85-3.35		1.57			
CO <sub>2</sub>	0.02-1.01		0.28			
L.O.I.				5.4	4.0	2.9

L.O.I. = loss on ignition

analyzed at the Imperial College Reactor Centre in England. Rare earth element contents of unaltered diabase have also been published by Vik (1985) from the Kvenangen area. The diabase (gabbroic sills) in the Kvenangen area has a flat rare earth element pattern with a weak Eu depletion implying that the magma is derived by partial melting of a primitive mantle with little or no enrichment or depletion of the light or heavy rare earth elements (Cullers and Graf, 1984). The potassium-enriched diabase (Fig. 15, group II; Table 3) has a more irregular pattern compared with unaltered diabase, but it also has a fairly flat rare earth element distribution and a weak Eu depletion. One sample of biotite-altered diabase, which is not included in group II, is enriched in light rare earth elements and has a rare earth element distribution more similar to the albitic felsite.

The albitized diabase is characterized by a marked Ce depletion (Fig. 15) and a lower La/Lu ratio compared with unaltered diabase and potassium-enriched diabase. Seawater has also a marked Ce depletion and basalt with a Ce depletion is interpreted either to be altered by seawater or to have been formed by partial melting of seawater-altered rocks (Humphris, 1984).

The diabase sills were probably associated with the volcanites in the Cas'kejas Formation (Sandstad, 1983). The sills may have been intruded at very shallow depth partly into unconsolidated sediments, where a high water content would give a

relatively high water/rock ratio. The temperature during alteration in unconsolidated sediments may have been higher than during alteration on the sea floor, due to a more restricted circulation of seawater. The Ce depletion in Bidjovagge only occurs in the sodium-enriched diabase and may relate this albitization to seawater alteration.

The albitic felsite has a totally different rare earth element distribution with an enrichment of light rare earth elements. The same pattern for albitic felsite and for graphitic felsite has been published by Vik (1985) from the Kvenangen area. Sediments can have an enrichment in the light rare earth elements, and the rare earth element pattern may therefore reflect a primary distribution of rare earth elements before albitization.

Field observations indicate that albitization of the diabase and sediments and tuffites was part of the same process. The low content of light rare earth elements in the albitized diabase favors therefore a primary high content of light rare earth elements in the albitized sediments.

This preliminary study will be followed up by a more detailed analytical program where the rare earth element content will be correlated with the contents of U, Au, and Cu.

#### Lead isotopes

Galena occurs mainly in the C deposit where the lead content can be up to 0.5 percent in individual analyses. The galena occurs late in the paragenetic sequence, often as fissure fillings in pyrite and chalcopyrite.

Five samples of galena from the C orebody were separated and the analyses were performed by Geospec Consultants, Edmonton, Alberta, Canada. All analytical data have been corrected for mass discrimination by comparison to the National Bureau of Standards CRM-981 common lead standard. The  $2\sigma$  error limits for the ratios  $^{206}\text{Pb}/^{204}\text{Pb}$ ,  $^{207}\text{Pb}/^{204}\text{Pb}$ , and  $^{208}\text{Pb}/^{207}\text{Pb}$  are 0.87, 1.95, and 1.44 per mil, respectively. The correlation coefficient between ratios is 0.82. Two of the samples were analyzed in duplicate, because of the initial values obtained and the linearity of the plotted data. In one case the repeat analysis lies outside the expected error limits (Table 4, sample 65226), but the variation is not sufficient to alter the slope of the straight-line array to any significant degree. The results are plotted in Figure 16.

The five galenas define a secondary isochron for which a calculated slope of  $0.132 \pm 0.059$  was obtained. The most radiogenic sample 65226 falls somewhat below the line defined by the four other samples (Fig. 17). If sample 65226 is excluded, a slope of 0.159 is obtained. The slope and the  $^{207}\text{Pb}/^{204}\text{Pb}$  and  $^{206}\text{Pb}/^{208}\text{Pb}$  ratios are similar to results published from sandstone-lead deposits along the

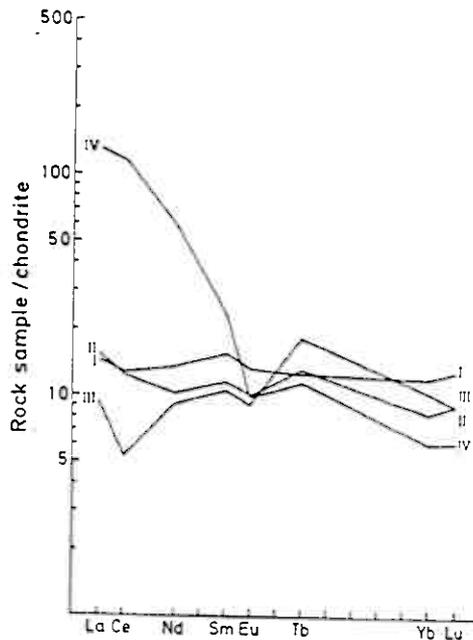


FIG. 15. Chondrite-normalized rare earth element contents of unaltered diabase (I), potassium-enriched diabase II, albitized diabase III, and albitic felsite IV. Chondrite values are from Even- sen et al. (1978).

TABLE 4. Lead isotope composition of Galenas from Bidjovagge

Sample no.	Sample identification no.	<sup>206</sup> Pb/ <sup>204</sup> Pb	<sup>207</sup> Pb/ <sup>204</sup> Pb	<sup>208</sup> Pb/ <sup>204</sup> Pb	Comments
4467	64175	22.203	16.132	41.425	
4469	65204	22.426	16.160	41.506	
4470	65210	22.569	16.190	41.602	
4471	65226	23.880	16.361	42.217	
4666		23.849	16.348	42.171	Preferred value
4468	65202	22.946	16.249	41.797	
4465		22.944	16.251	41.799	Preferred value

Caledonian front in Scandinavia. In particular, a large variation in the data from one individual deposit has been found in the Osen deposit in south-eastern Norway (Bjørlykke and Thorpe, 1981). Five samples from the Osen deposit define a secondary isochron with a slope of  $0.1237 \pm 0.056$ . A slope of 0.132 gives a maximum time of approximately 2,125 m.y. and a minimum time of 1,290 m.y. If we use 530 m.y. for the age of formation of the galena, similar to an age found at Osen (Bjørlykke and Thorpe, 1981), the age of the source rock will be 1,850 m.y. A slope of 0.159, using the four least radiogenic samples, will give a maximum time of 2,445 and a minimum of 1,495 m.y. If one again

uses 530 m.y. as an age of mineralization, the source of the lead must be 2,200 m.y.

Field evidence shows that the main mineralization was pre- or syndeformation (1,700–1,900 m.y.). The results from the lead isotope data give a much younger age for the galena. Even if the secondary isochron is a mixing line, the <sup>207</sup>Pb/<sup>206</sup>Pb ratio shows that some of the radiogenic isotopes have been formed relatively recently. The galena must therefore partly be later than the main mineralization event.

The Bidjovagge mine is situated just below the Cambrian-Precambrian unconformity. Many occurrences of galena are known from this unconformity in Finnmark (Bjørlykke et al., 1985) and radiogenic lead could have been contributed to the C deposit during the peneplanization. The source of the lead would then be rocks of the Cas'kejas Formation and this is in agreement with a maximum time between 1,800 and 2,200 m.y. and a minimum of 500 to 600 m.y. Also the relatively large variation in the isotopic ratios support this model.

Summary and Conclusions

The Bidjovagge copper-gold deposit occurs in an early Proterozoic rift or back-arc environment. Several occurrences of Bidjovagge-type mineralization have been found in the Kautokeino greenstone belt, and they are all related to diabase sills and associated albitic felsite. The main mineralization occurs in the lower part of the Cas'kejas Formation above a thick dolomite unit, but mineralizations stratigraphically higher up in the Cas'kejas Formation are also known.

At Bidjovagge, diabase sills occur in a sequence of primary shallow marine sediments with dolomites, black shales, gray-green shales, limestones, tuffites, and thin greenstones. The albitization of the diabase and the surrounding sediments may be related to the diabase intrusion; the rare earth element distribution indicates that the alteration may have been caused by seawater circulation or by a sodium-rich brine of seawater origin. Gradual transitions to albitic felsite can be observed in the diabase and in the sediments. Black shales are also albitized in graphitic felsites. Limestone beds are less albitized than the shale beds. Preliminary results of the rare

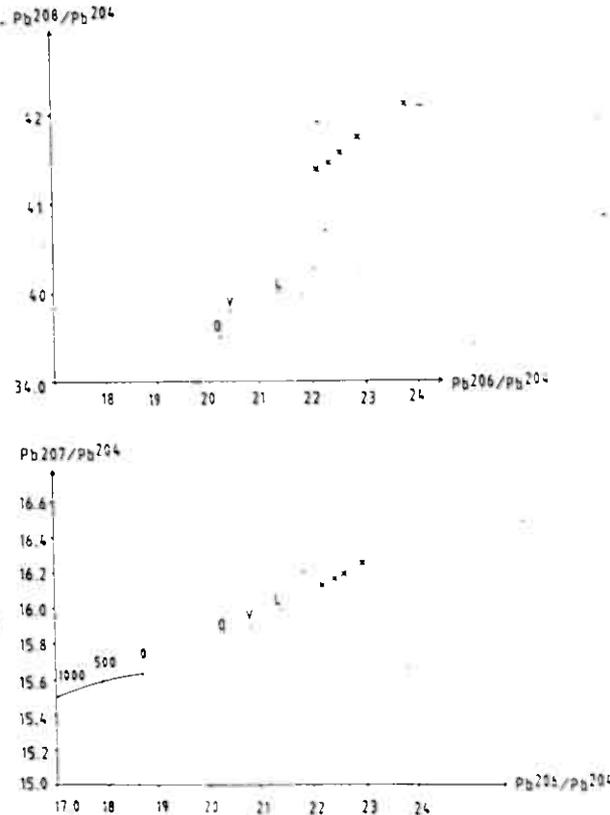


FIG. 16. Lead isotope composition of galena from Bidjovagge compared with samples from Caledonian sandstone lead deposit. L = Laisvall, V = Vassbo, and O = Osen. (Bjørlykke and Thorpe, 1981).

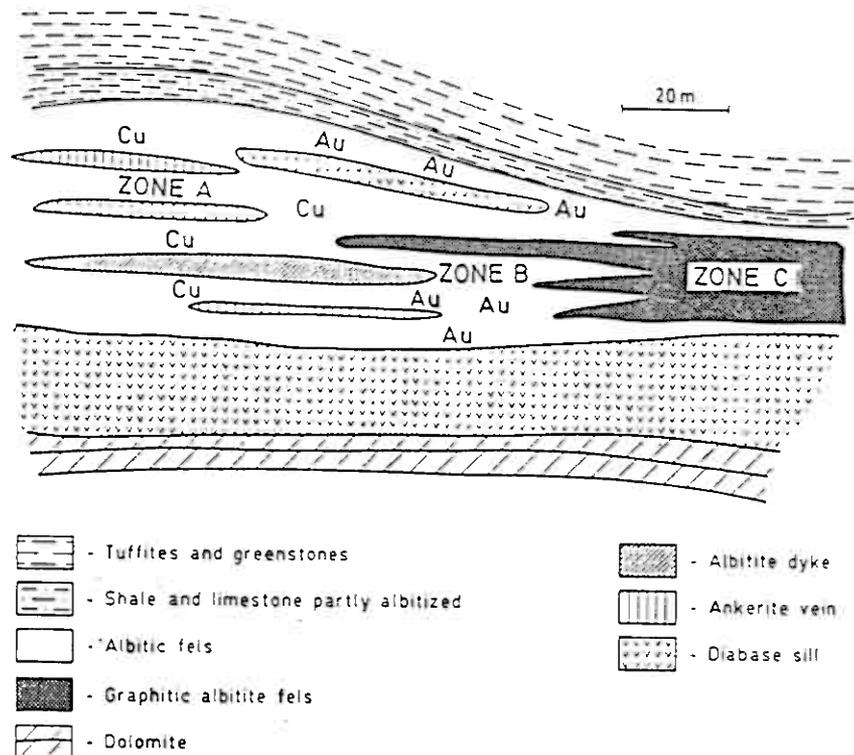


FIG. 17. A schematic map of the D deposit with the main zones of mineralizations.

earth element distribution in the albitic felsite indicate an enrichment in light rare earth elements in these beds before albitization.

Along the Bidjovagge anticline the orebodies are situated at discontinuities in the self-potential anomalies and in low magnetic anomalies (Mathiesen, 1972). Field observations suggest that the main mineralizations are restricted to the oxidized part of the albitic felsite, where hematite deposition has occurred in the footwall rocks. This suggests an ore-forming solution within the stability field of hematite. The self-potential and electromagnetic anomalies are displaced at the A, B, and D deposits (Mathiesen, 1972). This indicates the possibility that small-scale faults acted as channelways for the ore-forming solutions. Within an ore deposit there are three main zones of mineralization (see Fig. 17). Zone A consists mainly of chalcopyrite and occurs in the center of the light albitic felsite. Zone B contains gold, some copper, minor uranium, and occurs in light albitic felsite near the border of graphitic fels. Zone C contains pyrite and chalcopyrite in graphitic felsite near the border of light albitic felsite.

The most important copper mineralization event seems to be related to brecciation of the host rock (in zone A), formation of ankerite-actinolite veins, and oxidation of the graphitic felsite. The relation between the albitite dikes and the mineralization is still uncertain, but dissemination of chalcopyrite

also occurs in albitite dikes, and the dikes are sometimes cut by late carbonate veins. The ankerite-actinolite veins with chalcopyrite are clearly folded and boudinaged, and the main mineralization seems therefore to have occurred between the period of diabase intrusion and the Svecofennian deformation (1,900–1,750 m.y.).

The intense brecciation and the precipitation of carbonates indicate that boiling of the ore-forming solution could have been an important factor in ore genesis. Actinolite occurs as disseminations, in thin veins, and along the border between ankerite and albitic felsite in the larger veins. Actinolite may therefore be formed by alteration of albitic felsite by the ore-forming solution.

The gold-rich mineralization (in zone B) is hosted in gray and reddish albitic felsite, often near the contact to graphitic felsite. In zone B the host rock is less brecciated; the carbonate actinolite veins are thinner and not so frequent as in zone A. The mineralization occurs partly in the veins and partly in veinlets and disseminations near these veins. The gold content is often correlated with the uranium content; davidite, tellurides, and chalcopyrite are parts of the same paragenesis. The gold-rich zones in the footwall of the mineralization are often associated with an actinolite-chlorite-hematite alteration.

The spatial separation of mineralization in zones A and B and the poor correlation between gold and

copper indicate that the precipitation of the two metals was controlled by different factors. Boiling and a drop in temperature may have been an important factor for the formation of copper mineralization, some gold being precipitated together with the sulfides. Some of the reduced sulfur may have been in the felsite before the mineralization. The increased gold content near the oxidation front of the graphitic felsite indicates that changes in oxygen fugacity or pH may have been responsible for the gold-rich paragenesis. A study including stable isotopes is now in progress and it should give some answers to these questions.

The lead isotope composition is markedly radiogenic and the  $^{207}\text{Pb}/^{206}\text{Pb}$  gives a maximum age for the galena of approximately 1,500 m.y. Radiogenic lead must therefore have been added either continuously by decay of uranium and thorium in the mineralization and/or by an episodic contribution; for example during the Cambrian peneplanation.

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**APPENDIX # 1b : *Au-Cu Soil Results***  
**- *Corrected computer data***

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
-2800	625	72	10
-2800	650	5	10
-2800	675	5	10
-2800	700	6	10
-2800	725	6	10
-2800	750	3	10
-2800	775	9	10
-2800	800	12	10
-2800	825	8	10
-2800	850	5	10
-2800	875	5	10
-2800	900	22	10
-2800	975	6	10
-2800	1000	4	10
-2800	1025	8	10
-2800	1050	13	10
-2800	1100	11	10
-2800	1125	61	10
-2800	1150	24	100
-2800	1150	24	10
-2700	600	74	10
-2700	625	6	10
-2700	650	3	10
-2700	675	4	10
-2700	700	3	10
-2700	725	9	10
-2700	750	13	10
-2700	775	6	10
-2700	800	8	10
-2700	825	28	10
-2700	875	7	10
-2700	900	39	10
-2700	925	4	10
-2700	950	4	20
-2700	975	9	10
-2700	1000	8	10
-2700	1025	12	10
-2700	1050	10	10
-2700	1075	44	10
-2700	1100	25	10
-2700	1125	51	10
-2700	1150	56	10
-2700	1175	51	10
-2700	1200	24	10
-2600	600	3	10
-2600	625	3	10
-2600	650	6	10
-2600	675	38	10
-2600	700	9	40
-2600	725	7	10
-2600	750	7	10
-2600	775	10	10
-2600	850	5	10
-2600	875	5	10
-2600	900	11	10
-2600	925	14	10
-2600	950	17	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
-2600	975	9	10
-2600	1000	12	50
-2600	1025	12	10
-2600	1050	29	10
-2600	1075	8	10
-2600	1100	31	10
-2600	1125	13	10
-2600	1150	29	10
-2600	1175	10	10
-2600	1200	24	10
-2500	400	10	10
-2500	450	5	10
-2500	475	10	10
-2500	500	300	10
-2500	525	25	10
-2500	550	5	10
-2500	575	5	10
-2500	600	4	10
-2500	625	5	10
-2500	650	20	10
-2500	675	7	10
-2500	700	6	10
-2500	725	10	10
-2500	950	8	10
-2500	975	20	10
-2500	1000	9	10
-2500	1025	3	10
-2500	1050	24	10
-2500	1075	9	10
-2500	1100	21	10
-2500	1125	22	10
-2500	1150	13	10
-2500	1175	14	10
-2300	325	24	30
-2300	350	34	10
-2300	375	14	10
-2300	400	45	10
-2300	425	119	10
-2300	450	13	10
-2300	475	11	10
-2300	500	46	10
-2300	525	16	10
-2300	550	6	10
-2300	575	4	10
-2300	600	5	10
-2300	625	8	10
-2300	650	7	10
-2300	675	7	10
-2300	725	3	10
-2300	775	6	10
-2300	825	5	10
-2300	850	3	10
-2300	875	4	10
-2300	900	18	10
-2300	925	16	10
-2300	950	14	10
-2300	975	23	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
-2300	1025	25	60
-2300	1050	69	20
-2300	1075	46	10
-2300	1100	56	10
-2300	1125	55	10
-2300	1150	24	20
-2300	1175	10	20
-2300	1200	64	20
-2200	525	12	10
-2200	550	25	10
-2200	575	16	10
-2200	600	5	10
-2200	625	5	10
-2200	650	5	10
-2200	675	7	10
-2200	700	6	10
-2200	775	4	10
-2200	800	10	10
-2200	825	6	10
-2200	850	6	10
-2200	875	6	10
-2200	925	5	10
-2200	950	15	10
-2200	975	13	10
-2200	1000	9	10
-2200	1025	9	10
-2200	1050	79	10
-2200	1075	31	20
-2200	1100	73	10
-2200	1125	102	10
-2200	1150	89	10
-2200	1175	84	10
-2200	1200	25	10
-2100	355	212	10
-2100	378	206	10
-2100	409	7	10
-2100	434	33	10
-2100	459	58	10
-2100	484	10	10
-2100	509	18	10
-2100	535	7	10
-2100	560	5	10
-2100	585	5	10
-2100	609	7	80
-2100	635	9	10
-2100	661	33	10
-2100	686	37	10
-2100	718	9	10
-2100	753	5	10
-2100	784	82	30
-2100	816	70	10
-2100	851	18	10
-2100	886	10	10
-2100	910	4	10
-2100	940	14	10
-2100	973	13	10
-2100	1005	14	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
-2100	1040	44	10
-2100	1075	21	10
-2100	1103	42	10
-2100	1125	50	10
-2100	1156	161	10
-2100	1218	77	10
-1900	900	13	10
-1900	925	8	10
-1900	950	14	10
-1900	975	11	10
-1900	1000	6	10
-1900	1025	21	10
-1900	1050	11	10
-1900	1075	29	10
-1900	1100	25	10
-1800	900	11	10
-1800	925	16	250
-1800	950	30	10
-1800	975	49	10
-1800	1000	22	10
-1800	1025	56	20
-1800	1050	30	10
-1800	1075	61	20
-1800	1100	18	10
-1700	900	17	10
-1700	925	21	10
-1700	950	168	10
-1700	975	184	20
-1700	1000	29	20
-1700	1025	43	10
-1700	1050	39	20
-1700	1075	50	30
-1700	1100	40	10
-1600	900	125	10
-1600	925	118	20
-1600	950	18	10
-1600	975	9	10
-1600	1000	28	10
-1600	1025	25	20
-1600	1050	53	30
-1600	1075	31	40
-1600	1100	104	20
-1500	900	61	10
-1500	925	138	20
-1500	950	36	10
-1500	975	23	10
-1500	1000	50	10
-1500	1025	47	60
-1500	1050	77	10
-1500	1075	18	10
-1500	1100	71	10
-820	350	3100	320
-820	375	27	10
-820	400	30	10
-820	425	47	10
-820	450	33	130
-820	475	38	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
-820	500	39	20
-820	525	16	10
-820	575	20	10
-820	600	24	10
-820	625	11	10
-820	650	25	10
-800	25	55	10
-800	50	12	10
-800	75	38	5
-800	100	13	30
-800	125	15	5
-800	150	20	10
-800	175	41	10
-800	200	29	10
-800	225	35	10
-800	250	23	10
-800	275	3000	360
-800	300	5100	920
-800	325	216	20
-720	350	52	10
-720	375	16	10
-720	400	12	10
-720	450	27	10
-720	500	16	10
-720	525	11	10
-720	550	14	10
-720	575	59	320
-720	600	49	10
-720	625	13	10
-720	650	33	10
-620	350	7	40
-620	375	24	10
-620	400	51	10
-620	425	11	10
-620	450	35	120
-620	500	18	10
-620	525	21	10
-620	550	28	10
-620	575	16	10
-620	600	33	80
-620	625	30	10
-620	650	350	20
-600	50	36	10
-600	75	40	20
-600	100	30	5
-600	125	36	10
-600	150	42	5
-600	175	56	10
-600	200	58	5
-600	225	67	5
-600	250	43	5
-600	275	71	10
-600	300	88	5
-600	325	50	5
-520	350	22	10
-520	375	13	30
-520	400	8	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
-520	425	10	10
-520	475	40	10
-520	500	10	10
-520	525	26	10
-520	550	15	50
-520	575	19	10
-520	600	5	10
-520	625	8	10
-520	650	12	10
-420	350	13	10
-420	375	31	10
-420	400	19	10
-420	425	9	10
-420	475	199	10
-420	550	75	10
-420	600	14	10
-420	625	5	10
-420	675	12	100
-420	700	9	10
-400	100	20	5
-400	125	18	5
-400	150	27	5
-400	175	32	5
-400	200	13	5
-400	225	12	5
-400	250	290	40
-400	275	54	5
-400	300	7	5
-400	325	17	10
-320	350	13	10
-320	375	20	10
-320	400	19	10
-320	425	33	10
-320	450	166	10
-320	475	107	10
-320	500	119	10
-320	525	97	10
-320	550	34	10
-320	575	8	10
-320	600	12	40
-320	625	11	10
-320	650	5	10
-320	675	4	10
-320	700	5	50
-220	350	18	10
-220	375	15	10
-220	400	11	10
-220	425	21	10
-220	450	188	10
-220	475	375	10
-220	500	123	10
-220	525	164	10
-220	550	19	10
-220	575	8	10
-220	600	8	10
-220	625	16	10
-120	300	8	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
-120	325	12	10
-120	350	15	10
-120	375	18	10
-120	400	15	10
-120	425	25	10
-120	450	20	10
-120	475	141	10
-120	500	10	10
-120	525	68	30
-120	550	12	210
-120	575	11	10
-120	600	30	10
-120	625	7	10
-20	300	13	10
-20	325	8	10
-20	350	10	10
-20	375	17	10
-20	400	21	10
-20	425	32	10
-20	450	52	30
-20	500	14	10
-20	525	106	30
300	300	6	10
300	400	7	10
300	425	7	10
300	450	29	10
300	500	3400	1690
300	525	9	10
300	550	10	10
300	575	11	10
300	600	17	10
300	625	32	10
400	300	21	10
400	325	25	10
400	350	34	10
400	375	22	10
400	400	30	10
400	425	16	10
400	450	18	10
400	475	26	10
400	500	154	10
400	525	183	10
400	550	113	10
400	575	21	10
400	600	20	10
400	625	17	10
400	650	5	10
400	675	15	10
400	725	22	10
400	750	22	10
400	775	71	10
400	800	7	10
500	300	16	10
500	325	34	10
500	350	36	10
500	375	28	10
500	400	33	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
500	425	93	20
500	450	61	10
500	475	32	10
500	500	15	10
500	525	57	10
500	550	217	10
500	575	49	10
500	600	80	10
500	625	36	10
500	700	6	10
500	725	4	10
500	750	5	10
500	775	98	10
500	800	6	10
500	825	2	10
500	850	11	10
500	875	6	10
500	900	3	10
500	925	4	10
500	950	6	10
500	975	5	10
600	300	27	10
600	325	37	10
600	350	50	10
600	375	39	10
600	400	18	10
600	425	280	10
600	450	26	10
600	475	32	10
700	300	40	10
700	325	26	10
700	350	18	20
700	375	24	10
700	400	67	10
700	425	25	10
700	450	55	10
800	300	56	10
800	325	76	10
800	350	55	10
800	375	32	10
1000	-350	7	20
1000	1193	46	40
1005	-375	6	10
1005	1169	24	10
1010	-400	6	10
1010	1144	20	10
1015	-425	6	10
1015	1120	35	10
1020	-450	9	10
1020	1095	18	10
1025	-475	8	10
1025	1071	16	10
1030	-500	6	10
1030	1046	7	10
1035	-525	5	10
1035	1021	16	10
1040	-550	9	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
1040	996	7	10
1045	-575	7	10
1045	972	7	10
1050	-600	6	10
1051	947	6	10
1055	-625	5	10
1056	922	8	10
1060	-650	3	10
1062	897	10	10
1065	-675	5	10
1068	873	20	10
1070	-700	5	10
1074	848	11	460
1075	-725	5	10
1077	823	76	10
1080	-750	4	10
1080	798	10	10
1085	-775	9	10
1085	774	14	110
1093	749	15	10
1100	724	67	10
1110	675	30	10
1115	650	330	180
1125	600	176	20
1128	575	280	40
1133	550	910	220
1135	525	37	10
1143	500	59	10
1146	475	142	10
1153	450	41	20
1160	-340	7	10
1160	425	212	40
1165	-365	6	10
1170	-390	8	10
1173	375	44	10
1175	-415	7	10
1180	-440	6	10
1180	350	20	10
1185	-465	6	10
1187	325	26	10
1190	-490	5	10
1190	300	40	10
1195	-515	8	10
1195	275	24	10
1198	400	320	20
1200	-540	8	10
1200	250	12	10
1205	-565	11	10
1205	225	8	10
1210	-590	6	10
1210	200	8	10
1215	-615	5	10
1220	-640	5	80
1220	150	24	10
1225	-665	9	10
1225	125	24	10
1230	-690	8	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
1230	100	10	10
1235	-715	5	10
1235	75	9	10
1240	50	10	10
1245	25	6	10
1250	0	45	10
1255	-25	12	10
1260	-50	9	10
1265	-75	20	10
1270	-100	4	30
1275	-125	3	20
1275	700	6	10
1277	675	38	10
1280	-150	6	10
1280	600	490	110
1280	625	147	10
1280	650	44	10
1285	-175	7	10
1285	500	38	20
1285	525	39	10
1285	550	29	10
1285	575	45	20
1285	1190	18	10
1290	475	57	10
1290	1165	44	10
1295	400	138	20
1295	425	107	30
1295	450	127	30
1295	1140	14	10
1300	1115	62	10
1305	350	30	10
1310	325	69	10
1310	1095	27	10
1315	300	10	10
1315	1065	19	10
1320	-275	5	10
1320	275	4	10
1320	1040	9	10
1323	250	11	10
1325	-300	39	10
1325	1020	15	10
1326	225	7	10
1329	200	102	10
1330	-325	5	10
1330	994	14	10
1335	-350	10	10
1335	969	25	10
1340	-375	9	10
1340	944	28	30
1345	-400	9	10
1345	920	8	20
1350	-425	10	10
1350	895	21	10
1355	-450	8	10
1360	-475	6	10
1360	870	28	10
1365	-500	6	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
1365	846	26	10
1370	-525	5	10
1370	822	164	10
1375	-550	5	10
1375	797	48	10
1380	-575	1	10
1380	772	21	40
1385	-600	4	10
1385	748	25	10
1390	-625	6	10
1392	724	16	10
1395	-650	6	10
1398	699	26	10
1400	-675	5	10
1405	-700	5	10
1405	674	56	10
1410	-725	5	10
1410	650	115	10
1415	-750	6	10
1415	625	24	10
1420	-775	7	10
1420	600	25	10
1425	575	50	10
1430	550	28	10
1435	525	32	10
1440	-240	6	10
1440	500	19	10
1445	-265	4	10
1447	475	50	10
1455	-315	8	170
1455	450	44	10
1460	-340	20	10
1462	425	141	30
1465	-365	20	10
1470	-390	8	10
1470	400	25	30
1475	-415	7	10
1475	375	16	10
1480	-440	5	10
1480	350	9	10
1485	-465	8	10
1485	325	15	10
1490	-490	16	10
1495	-515	4	10
1500	-540	5	10
1500	275	16	10
1505	-565	7	10
1505	250	19	10
1510	230	91	10
1515	205	25	10
1520	180	11	10
1520	750	3	10
1525	155	10	10
1530	-5	8	10
1530	140	12	10
1530	725	18	10
1535	110	12	10

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
1539	700	10	10
1540	90	8	10
1545	65	4	10
1548	675	5	10
1550	40	11	10
1555	15	12	10
1557	650	400	20
1565	-30	17	10
1565	625	21	10
1570	-55	3	10
1574	600	55	10
1575	-85	3	20
1580	-110	4	10
1581	575	14	10
1584	550	18	10
1585	-130	4	10
1590	-155	2	10
1590	525	24	10
1595	-180	2	10
1600	325	31	10
1600	350	5	10
1600	375	23	10
1600	425	76	10
1600	450	51	10
1600	475	44	10
1600	500	22	10
1600	775	26	5
1600	800	16	10
1600	825	88	5
1600	850	73	5
1600	875	104	5
1600	915	66	30
1600	940	9	5
1600	950	30	5
1600	975	23	10
1600	1000	36	10
1600	1025	33	10
1600	1050	16	10
1600	1075	35	10
1600	1100	14	5
1600	1125	6	10
1600	1150	6	5
1630	-275	3	10
1635	-300	4	10
1640	-325	5	10
1645	-350	10	10
1650	-375	9	10
1655	-400	9	10
1660	-425	12	10
1665	-450	4	20
1670	-475	5	10
1675	-500	9	50
1675	1075	33	20
1679	1050	21	20
1680	-525	10	20
1682	1025	25	20
1685	-550	8	40

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
1685	1000	53	40
1690	-575	7	10
1690	975	103	30
1695	-600	9	10
1695	925	158	40
1700	-625	10	10
1700	900	93	30
1703	875	39	10
1705	-650	13	20
1705	850	29	10
1708	825	49	10
1712	775	69	10
1715	750	33	10
1719	725	59	10
1728	675	115	10
1728	700	56	10
1730	650	130	390
1735	625	153	10
1740	600	92	10
1745	575	37	10
1748	550	46	10
1753	525	32	10
1760	500	110	20
1765	475	28	10
1770	450	90	10
1776	425	17	10
1795	865	9	10
1800	-500	9	10
1800	-475	4	10
1800	-450	4	10
1800	-425	7	10
1800	-400	8	10
1800	-375	7	10
1800	-350	11	10
1800	-325	13	10
1800	-300	16	10
1800	-275	20	100
1800	-250	21	10
1800	-225	9	10
1800	-200	30	10
1801	845	108	10
1808	820	23	10
1813	795	86	10
1820	775	26	10
1828	750	89	10
1835	725	205	10
1842	700	134	10
1850	675	25	10
1868	625	204	20
1874	600	100	10
1880	575	29	10
1890	550	17	10
1895	525	17	10
1900	900	61	5
1900	925	61	5
1900	950	50	5
1900	975	11	5

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
1900	1000	213	30
1900	1025	51	10
1900	1050	55	5
1902	800	52	10
1902	825	35	5
1902	850	30	5
1902	875	35	5
1902	900	29	5
1902	925	6	5
1902	950	3	5
1902	975	7	5
1902	1000	9	5
1902	1025	65	20
1902	1050	7	5
1902	1075	7	5
1902	1100	6	5
1950	-500	3	10
1950	-475	4	10
1950	-450	4	10
1950	-425	15	10
1950	-400	5	10
1950	-375	2	10
1950	-350	8	10
1950	-325	7	10
1950	-300	4	10
1950	-275	3	10
1950	-250	16	10
1950	-225	6	10
1950	-200	2	10
1950	-175	16	10
1950	-150	3	10
2050	400	13	5
2050	425	24	5
2050	450	25	5
2050	475	25	5
2050	525	15	5
2050	550	12	5
2050	575	6	5
2050	600	11	20
2050	625	47	50
2050	650	50	5
2050	675	24	5
2050	700	22	5
2050	725	11	5
2050	750	34	40
2050	775	9	5
2050	800	64	5
2050	825	49	5
2050	850	11	10
2050	875	50	5
2050	900	55	10
2050	925	22	10
2050	950	11	5
2050	975	10	5
2050	1000	6	5
2050	1025	5	5
2050	1050	9	5

NORTHINGS	EASTINGS	Cu (ppm)	Au (ppb)
2050	1075	10	5
2050	1100	15	5
2200	500	11	10
2200	525	5	10
2200	550	6	10
2200	575	26	10
2200	600	12	10
2200	625	17	10
2200	675	20	10
2200	700	41	10
2200	725	12	10
2200	750	10	10
2200	775	29	10
2200	800	11	10
2200	825	59	10
2200	850	44	10
2200	875	61	10
2200	900	86	10
2200	925	30	40
2200	950	13	10
2200	975	10	10
2200	1000	4	10
2200	1025	16	10
2200	1050	10	10
2200	1075	12	10
2200	1125	19	10
2200	1150	37	10
2200	1175	12	10
2200	1200	21	10

**APPENDIX # 1c : *Lab Results***  
**- *Soil Geochemistry***

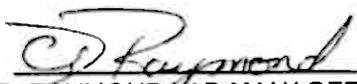
DATE: July 15, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96014

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
9608890	<0.01	18
9608891	0.02	118
9608892	<0.01	125
9608893	0.01	61
9608894	0.02	138
9608895	0.01	36
9608851	<0.01	17
9608852	<0.01	17
9608853	<0.01	29
9608854	<0.01	100
9608855	0.02	204
9608856	NO SAMPLE	
9608857	<0.01	25
9608858	0.01	134
9608859	<0.01	205
9608860	0.01	89
9608861	0.22	26
9608862	<0.01	46
9608863	0.01	23
9608864	<0.01	108
9608865	<0.01	9
9608896	<0.01	23
9608897	0.01	50
9608898	0.06	42
9608899	0.01	77
9608900	<0.01	18
9608751	0.01	71

  
C.D. RAYMOND LAB MANAGER

DATE: July 15, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96014

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
9607847	0.02	18
9607848	<0.01	26
9607849	<0.01	40
9607850	0.01	56
9607901	<0.01	76
9607902	<0.01	55
9607903	<0.01	32
9607904	0.03	141
9607905	0.03	25
9607906	0.01	16
9607907	0.01	9
9607908	<0.01	15
9607909	0.01	31
9607910	0.01	5
9607911	<0.01	23
9608866	<0.01	18
9608867	0.02	61
9608868	0.01	30
9608869	0.02	56
9608870	<0.01	22
9608871	0.01	49
9608872	<0.01	30
9608873	0.25	16
9608874	<0.01	11
9608875	0.01	17
9608876	<0.01	21
9608877	0.01	168
9608878	0.02	184
9608879	0.02	29
9608880	0.01	43
9608881	0.02	39
9608882	0.03	50
9608883	0.01	40
9608884	0.02	104
9608885	0.04	31
9608886	0.03	53
9608887	0.02	25
9608888	<0.01	28
9608889	<0.01	9

  
C.D. RAYMOND LAB MANAGER

DATE: July 15, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96014

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
9607917	<0.01	18
9607918	<0.01	14
9607919	<0.01	55
9607920	0.01	21
9607921	0.02	400
9607922	<0.01	5
9607923	0.01	10
9607924	0.01	18
9607925	<0.01	3
9607926	<0.01	69
9607927	<0.01	33
9607928	<0.01	59
9607929	<0.01	56
9607930	<0.01	115
9607931	0.39	130
9607932	<0.01	153
9607933	<0.01	92
9607934	<0.01	37
9607935	<0.01	46
9607936	<0.01	32
9607937	0.02	110
9607938	<0.01	28
9607939	<0.01	90
9607940	0.01	17
9607832	<0.01	36
9607833	0.01	34
9607834	0.04	16
9607835	<0.01	32
9607836	<0.01	26
9607837	0.01	280
9607838	<0.01	18
9607839	0.01	39
9607840	<0.01	52
9607841	<0.01	37
9607842	<0.01	27
9607843	<0.01	55
9607844	<0.01	25
9607845	<0.01	67
9607846	<0.01	24

  
G.D. RAYMOND LAB MANAGER

DATE: July 15, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96014

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
9607808	<0.01	7
9607809	<0.01	7
9607810	<0.01	6
9607811	1.69	3400
9607812	<0.01	9
9607813	0.01	113
9607814	0.01	183
9607815	<0.01	154
9607816	<0.01	26
9607817	<0.01	18
9607818	<0.01	16
9607819	<0.01	30
9607820	<0.01	22
9607821	0.01	34
9607822	<0.01	25
9607823	<0.01	21
9607824	0.01	217
9607825	0.01	57
9607826	0.01	15
9607827	<0.01	32
9607828	0.01	61
9607829	0.02	93
9607830	<0.01	33
9607831	<0.01	28
9607941	<0.01	32
9607942	<0.01	28
9607943	<0.01	50
9607944	0.01	25
9607945	0.01	24
9607946	<0.01	115
9607947	<0.01	56
9607948	<0.01	26
9607949	<0.01	16
9607950	<0.01	25
9607912	<0.01	76
9607913	<0.01	51
9607914	<0.01	44
9607915	<0.01	22
9607916	<0.01	24

  
C.D. RAYMOND LAB MANAGER

DATE: July 15, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96014

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
9607774	<0.01	55
9607775	<0.01	51
9607776	0.01	24
9607777	0.01	59
9607778	<0.01	37
9607779	0.22	910
9607780	0.04	280
9607781	0.02	176
9607782	0.19	330
9607783	<0.01	30
9607784	<0.01	14
9607785	<0.01	142
9607786	0.02	41
9607787	0.04	212
9607788	0.02	320
9607789	<0.01	44
9607790	<0.01	20
9607791	<0.01	26
9607792	0.02	38
9607793	<0.01	57
9607794	0.03	127
9607795	0.03	107
9607796	0.02	138
9607797	0.01	30
9607798	0.09	60
9607799	<0.01	10
9607800	0.01	37
9607851	<0.01	29
9607852	<0.01	45
9607853	0.11	490
9607854	0.01	147
9607855	<0.01	44
9607856	<0.01	38
9607857	0.01	6
9607858	<0.01	19
9607859	<0.01	50
9607860	<0.01	44
9607806	0.02	310
9607807	<0.01	29

  
C.D. RAYMOND LAB MANAGER

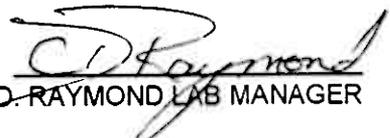
DATE: July 15, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96014

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
9607490	<0.01	13
9607491	<0.01	14
9607492	<0.01	9
9607493	0.02	4
9607494	<0.01	4
9607495	<0.01	31
9607496	<0.01	7
9607497	<0.01	28
9607498	<0.01	8
9607499	<0.01	6
9607500	<0.01	13
9607801	<0.01	9
9607802	<0.01	3
9607803	<0.01	4
9607804	<0.01	3
9607805	<0.01	6
9607751	<0.01	6
9607752	0.08	5
9607753	<0.01	5
9607754	<0.01	3
9607755	<0.01	4
9607756	<0.01	18
9607757	0.01	16
9607758	<0.01	14
9607759	0.01	23
9607760	0.06	25
9607761	0.02	69
9607762	<0.01	46
9607763	<0.01	56
9607764	<0.01	55
9607765	0.02	24
9607766	0.02	10
9607767	0.02	64
9607768	<0.01	8
9607769	0.01	12
9607770	<0.01	10
9607771	<0.01	44
9607772	<0.01	25
9607773	0.01	51

  
C.D. RAYMOND LAB MANAGER

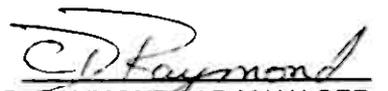
DATE: July 15, 1996

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BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96014

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
9607451	<0.01	5
9607452	<0.01	7
9607453	<0.01	7
9607454	<0.01	8
9607455	<0.01	5
9607456	<0.01	4
9607457	<0.01	6
9607458	0.01	16
9607459	<0.01	46
9607460	<0.01	11
9607461	<0.01	13
9607462	0.01	119
9607463	<0.01	45
9607464	<0.01	14
9607465	<0.01	34
9607466	0.03	24
9607467	0.01	6
9607468	<0.01	7
9607469	<0.01	20
9607470	0.01	5
9607471	<0.01	4
9607472	<0.01	5
9607473	<0.01	5
9607474	<0.01	25
9607475	<0.01	300
9607476	<0.01	41
9607477	<0.01	10
9607478	<0.01	5
9607479	<0.01	5
9607480	<0.01	10
9607481	<0.01	10
9607482	<0.01	20
9607483	<0.01	8
9607484	<0.01	9
9607485	<0.01	3
9607486	<0.01	24
9607487	<0.01	9
9607488	<0.01	21
9607489	<0.01	22

  
C.D. RAYMOND LAB MANAGER

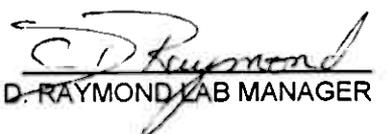
DATE: July 17, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96015

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
L2200S 850 E	<0.01	6
875 E	<0.01	6
900 E	<0.01	5
925 E	<0.01	5
950 E	<0.01	15
975 E	<0.01	13
1000 E	<0.01	9
1025 E	<0.01	9
1050 E	<0.01	79
1075 E	0.02	31
1100 E	<0.01	73
1125 E	<0.01	102
1150 E	<0.01	89
1175 E	<0.01	84
1200 E	<0.01	25
L2400S 500 E	<0.01	12
525 E	<0.01	6
550 E	<0.01	6
575 E1	<0.01	6
575 E2	<0.01	7
600 E1	<0.01	10
600 E2	<0.01	6
625 E	<0.01	5
650 E TO 675 E	NO SAMPLES	
700 E	<0.01	6
725 E	0.02	6
750 E	0.01	4
775 E	<0.01	8
ROCK BIDJ 96-5	1.34	38500

  
C.D. RAYMOND LAB MANAGER

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L2100S 650 E	<0.01	5
675 E	<0.01	5
700 E	0.08	7
725 E	<0.01	9
750 E	<0.01	33
775 E	<0.01	38
800 E	<0.01	5
825 E	0.01	5
850 E	0.03	82
850 EW	0.03	90
875 E	<0.01	10
900 E	<0.01	18
925 E	<0.01	10
950 E	<0.01	4
975 E	<0.01	14
1000 E	<0.01	13
1200 E	<0.01	77
L1900S 900 E	<0.01	13
925 E	<0.01	8
950 E	<0.01	14
975 E	<0.01	11
1000 E	<0.01	6
1025 E	<0.01	21
1050 E	<0.01	11
1075 E	<0.01	29
1100 E	<0.01	25
L2200S 525 E	<0.01	12
550 E	<0.01	25
575 E	<0.01	16
600 E	<0.01	5
625 E	<0.01	5
650 E	<0.01	5
675 E	<0.01	7
700 E	<0.01	6
725 E	NO SAMPLE	
750 E	NO SAMPLE	
775 E	<0.01	4
800 E	<0.01	10
825 E	<0.01	6

DATE: July 17, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96015

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L2200N 600 E	<0.01	12
625 E	<0.01	17
650 E	NO SAMPLE	
675 E	<0.01	20
700 E	<0.01	41
725 E	<0.01	12
750 E	<0.01	10
775 E	<0.01	29
800 E	<0.01	11
825 E	<0.01	59
850 E	<0.01	44
875 E	<0.01	61
900 E	<0.01	86
925 E	0.04	30
950 E	<0.01	13
975 E	<0.01	10
1000 E	<0.01	4
1025 E	<0.01	16
1050 E	<0.01	10
1075 E	<0.01	12
1100 E	NO SAMPLE	
1125 E	0.01	19
1150 E	<0.01	37
1175 E	<0.01	12
1200 E	<0.01	21
L2100S 1025 E	0.01	14
1050 E	0.49	44
1075 E	0.01	21
1100 E	<0.01	42
1125 E	<0.01	50
1150 E	<0.01	161
L2100S 450 E	<0.01	217
475 E	<0.01	206
500 E	<0.01	7
525 E	<0.01	33
550 E	<0.01	58
575 E	<0.01	10
600 E	<0.01	18
625 E	<0.01	7

  
C.D. RAYMOND LAB MANAGER

DATE: July 17, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96015

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L1450N 1150 E	<0.01	14
1175 E	0.01	44
1200 E	<0.01	18
L1450N 300 W	<0.01	3
325 W	0.01	4
350 W	<0.01	5
375 W	<0.01	10
400 W	<0.01	9
425 W	<0.01	9
450 W	<0.01	12
475 W	0.02	4
500 W	0.01	5
525 W	0.03	9
550 W	0.02	10
575 W	0.04	8
600 W	0.01	7
625 W	<0.01	9
650 W	<0.01	10
675 W	0.02	13
L1750N 825 E	<0.01	49
850 E	<0.01	29
875 E	0.01	39
900 E	0.03	93
925 E	0.04	158
950 E	NO SAMPLE	
975 E	0.03	103
1000 E	0.04	53
1025 E	0.02	25
1050 E	0.02	21
1075 E	0.02	33
1100 E	<0.01	33
1125 E	<0.01	10
1150 E	<0.01	16
1175 E	<0.01	8
1200 E	<0.01	11
L2200N 500 E	0.01	11
525 E	<0.01	5
550 E	<0.01	6
575 E	<0.01	27

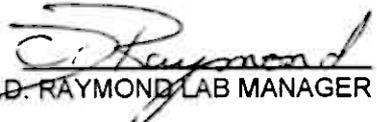
DATE: July 17, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96015

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
L1150N 550 W	<0.01	6
575 W	<0.01	6
600 W	<0.01	5
625 W	<0.01	5
650 W	<0.01	5
675 W	<0.01	6
700 W	<0.01	7
700 EW	<0.01	18
L1300N 200 W	<0.01	6
225 W	<0.01	4
250 W	NO SAMPLE	
280 W	0.17	8
300 W	<0.01	20
325 W	<0.01	20
350 W	<0.01	8
375 W	<0.01	7
400 W	<0.01	5
425 W	<0.01	8
450 W	<0.01	6
475 W	<0.01	5
500 W	<0.01	6
525 W	<0.01	7
550 W	<0.01	2
L1450N 775N	0.04	21
800 E	<0.01	48
825 E	<0.01	164
850 E	<0.01	26
875 E	<0.01	28
900 E	<0.01	21
925 E	0.02	8
950 E	0.03	28
975 E	<0.01	25
1000 E	<0.01	14
1025 E	<0.01	15
1050 E	<0.01	9
1075 E	<0.01	19
1100 E	<0.01	27
1125 E	<0.01	62

  
C.D. RAYMOND LAB MANAGER

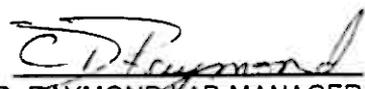
DATE: July 17, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96015

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L1000N 450 W	<0.01	6
475 W	<0.01	5
500 W	0.08	4
525 W	<0.01	9
550 W	<0.01	8
575 W	<0.01	5
L1150N 725 E	<0.01	67
750 E	<0.01	15
775 E	0.11	14
800 E	<0.01	10
825 E	0.01	76
850 E	0.46	11
875 E	<0.01	20
900 E	<0.01	10
925 E	<0.01	8
950 E	<0.01	6
975 E	<0.01	7
1000 E	<0.01	7
1025 N	<0.01	16
1050 E	<0.01	7
1075 E	<0.01	16
1100 E	<0.01	18
1125 E	<0.01	35
1150 E	<0.01	20
1175 E	0.01	24
1200 E	0.04	46
L1150N 200 W	<0.01	5
225 W	0.01	39
260 W	<0.01	5
275 W	<0.01	10
300 W	<0.01	9
325 W	<0.01	9
350 W	<0.01	10
375 W	<0.01	8
400 W	0.01	6
425 W	<0.01	6
450 W	<0.01	5
475 W	<0.01	5
500 W	<0.01	1
525 W	<0.01	4

  
C.D. RAYMOND LAB MANAGER

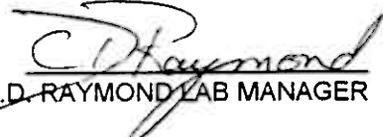
DATE: July 17, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96015

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L300N 575 E	<0.01	10
600 E	<0.01	11
625 E	<0.01	17
650 E	<0.01	32
L400N 575 E	<0.01	21
600 E	<0.01	20
625 E	0.01	17
650 E	<0.01	5
675 E	<0.01	15
700 E	NO SAMPLE	
725 E	<0.01	22
750 E	<0.01	22
775 E	<0.01	71
800 E	<0.01	7
L500N 575 E	<0.01	49
600 E	<0.01	80
615 E	0.01	36
625 E TO 675 E	NO SAMPLE	
700 E	<0.01	6
725 E	<0.01	4
750 E	<0.01	5
775 E	<0.01	98
800 E	<0.01	6
825 E	<0.01	2
850 E	<0.01	11
875 E	<0.01	6
900 E	<0.01	3
925 E	<0.01	4
950 E	<0.01	6
975 E	<0.01	5
L1000N 205 W	<0.01	7
225 W	<0.01	6
225 EW	<0.01	6
250 W	<0.01	8
275 W	<0.01	7
300 W	<0.01	16
325 W	<0.01	6
350 W	<0.01	5
375 W	<0.01	8
400 W	<0.01	8
425 W	<0.01	11

  
C.D. RAYMOND LAB MANAGER

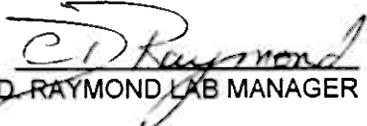
DATE: July 23 , 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96019

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
L2800s 725 E	0.01	6
750 E	<0.01	3
775 E	<0.01	9
800 E	0.01	12
825 E	<0.01	6
850 E	<0.01	5
875 E	<0.01	5
900 E	<0.01	22
925 E	NO SAMPLE	
950 E	NO SAMPLE	
975 E	<0.01	6
1000 E	<0.01	4
1025 E	<0.01	8
L2800S 1050 E	<0.01	13
1075 E	NO SAMPLE	
1100 E	<0.01	11
1125 E	<0.01	61
1150 E	<0.01	24
L000 300 E	<0.01	13
325 E	<0.01	8
350 E	0.01	10
375 E	0.01	17
400 E	<0.01	21
425 E	<0.01	32
450 E	0.03	52
475 E	NO SAMPLE	
500 E	<0.01	14
525 E	0.03	106
ROCK BIDJ 96 6	<0.01	95
ROCK BIDJ 96 7	0.01	310

  
C.D. RAYMOND LAB MANAGER

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
L2400S 800 E	<0.01	5
850 E	<0.01	7
875 E	<0.01	6
900 E	<0.01	16
925 E	<0.01	19
950 E	<0.01	47
975 E	<0.01	82
1000 E	<0.01	16
1025 E	<0.01	39
L2600S 600 E	0.04	9
625 E	<0.01	38
650 E	<0.01	6
675 E	<0.01	3
L2600S 700 E	<0.01	3
725 E	<0.01	7
750 E	<0.01	7
775 E	<0.01	10
800 E	NO SAMPLE	
825 E	NO SAMPLE	
850 E	<0.01	5
875 E	<0.01	5
900 E	<0.01	11
925 E	<0.01	14
950 E	<0.01	17
975 E	<0.01	9
1000 E	0.05	12
1025 E	<0.01	12
1050 E	<0.01	29
1075 E	<0.01	8
1100 E	0.01	31
1125 E	<0.01	13
1150 E	<0.01	29
1175 E	<0.01	10
1200 E	<0.01	24
L2700S 600 E	<0.01	79
L2800S 625 E	<0.01	72
650 E	<0.01	5
675 E	<0.01	5
700 E	<0.01	6

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L600S 350 E	0.04	7
375 E	<0.01	24
400 E	<0.01	51
425 E	<0.01	11
450 E	0.12	35
475 E	NO SAMPLE	
500 E	<0.01	18
525 E	<0.01	21
550 E	<0.01	28
575 E	<0.01	16
600 E	0.08	33
625 E	<0.01	30
650 E	0.02	350
L700S 350 E	<0.01	52
375 E	<0.01	16
400 E	<0.01	12
425 E	NO SAMPLE	
450 E	0.01	27
475 E	NO SAMPLE	
500 E	<0.01	16
525 E	0.06	11
550 E	<0.01	14
575 E	0.32	59
600 E	<0.01	49
625 E	<0.01	13
650 E	0.01	33
L800S 350 E	0.32	3100
375 E	<0.01	27
400 E	<0.01	30
425 E	0.01	47
450 E	0.13	33
475 E	<0.01	38
500 E	0.02	39
525 E	<0.01	16
550 E	NO SAMPLE	
575 E	0.01	20
600 E	<0.01	24
625 E	<0.01	11
650 E	<0.01	25

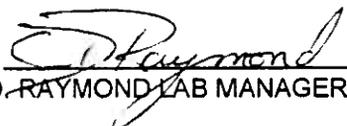
DATE: July 23 , 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96019

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L300S 500 E	<0.01	119
525 E	<0.01	97
550 E	0.01	34
575 E	<0.01	8
600 E	0.04	12
625 E	<0.01	11
650 E	<0.01	5
675 E	<0.01	4
700 E	0.05	5
L400S 350 E	<0.01	13
375 E	<0.01	31
400 E	0.01	19
425 E	<0.01	9
450 E	NO SAMPLE	
475 E	0.01	199
500 E	NO SAMPLE	
525 E	NO SAMPLE	
550 E	<0.01	75
575 E	NO SAMPLE	
600 E	<0.01	14
625 E	<0.01	5
650 E	NO SAMPLE	
675 E	0.10	12
700 E	<0.01	9
L500S 350 E	<0.01	22
375 E	0.03	13
400 E	<0.01	8
425 E	0.01	10
450 E	NO SAMPLE	
475 E	<0.01	40
500 E	0.01	10
525 E	<0.01	26
550 E	0.05	15
575 E	<0.01	19
600 E	<0.01	5
625 E	0.01	8
650 E	<0.01	12

  
C.D. RAYMOND LAB MANAGER

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L950N 325 W	<0.01	2
350 W	<0.01	5
375 W	<0.01	15
400 W	<0.01	4
425 W	<0.01	4
450 W	<0.01	3
L100S 300 E	<0.01	8
325 E	<0.01	12
350 E	<0.01	15
375 E	0.01	18
400 E	<0.01	15
425 E	0.07	25
450 E	<0.01	20
475 E	<0.01	141
500 E	<0.01	10
525 E	0.03	68
550 E	0.21	12
575 E	<0.01	11
600 E	<0.01	30
625 E	0.01	7
L200S 350 E	<0.01	18
375 E	<0.01	15
400 E	<0.01	11
425 E	<0.01	21
450 E	<0.01	108
475 E	0.01	310
500 E	<0.01	123
525 E	<0.01	164
550 E	0.01	19
575 E	<0.01	8
600 E	<0.01	8
625 E	<0.01	16
L300S 350 E	<0.01	13
375 E	<0.01	20
400 E	0.01	19
425 E	<0.01	33
450 E	<0.01	166
475 E	<0.01	107

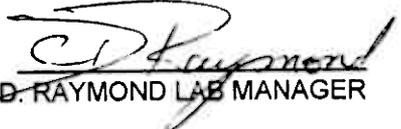
DATE: July 23, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96019

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L800N 150 W	<0.01	30
175 W	<0.01	9
200 W	<0.01	21
225 W	0.10	20
250 W	<0.01	16
275 W	<0.01	13
300 W	<0.01	11
325 W	<0.01	7
350 W	<0.01	8
375 W	<0.01	7
400 W	<0.01	4
425 W	<0.01	4
450 W	<0.01	9
L850N 150 W	0.02	7
175 W	<0.01	6
200 W	<0.01	6
225 W	0.01	6
250 W	<0.01	9
275 W	<0.01	8
300 W	<0.01	6
325 W	<0.01	5
350 W	0.01	9
375 W	<0.01	7
400 W	<0.01	6
425 W	<0.01	5
450 W	<0.01	3
475 W	<0.01	5
500 W	<0.01	5
525 W	<0.01	5
550 W	<0.01	4
575 W	<0.01	9
600 W	<0.01	2
L950N 100 W	<0.01	3
125 W	<0.01	16
150 W	<0.01	2
175 W	<0.01	6
200 W	<0.01	16
225 W	<0.01	3
250 W	<0.01	4
275 W	<0.01	7
300 W	<0.01	8

  
C.D. RAYMOND LAB MANAGER

DATE: July 29, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96021

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L1450N 225 E	<0.01	25
250 E	0.01	91
275 E	<0.01	19
300 E	<0.01	16
325 E	<0.01	27

  
C.D. RAYMOND LAB MANAGER

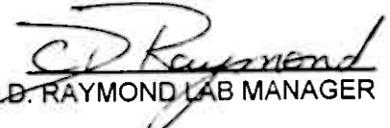
DATE: July 29, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96021

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L1150N 025 W	0.01	12
050 W	0.01	9
075 W	<0.01	20
100 W	0.03	4
125 W	0.02	3
150 W	<0.01	6
175 W	<0.01	7
L1150N 00 E	<0.01	45
025 E	<0.01	6
050 E	<0.01	10
075 E	<0.01	9
100 E	<0.01	10
125 E	<0.01	24
150 E	<0.01	24
175 E	NO SAMPLE	
200 E	<0.01	8
225 E	<0.01	5
250 E	0.01	12
275 E	<0.01	24
300 E	<0.01	40
L1300N 200 E	0.01	107
225 E	<0.01	7
250 E	0.01	11
275 E	0.01	4
L1450N 025 W	<0.01	8
050 W	<0.01	17
075 W	0.01	3
100 W	0.02	3
125 W	<0.01	4
150 W	0.01	4
175 W	<0.01	2
200 W	<0.01	2
L1450N 000 E	<0.01	12
025 E	<0.01	11
050 E	<0.01	4
75 E	<0.01	6
100 E	0.01	12
125 E	<0.01	12
150 E	<0.01	10
175 E	<0.01	11
200 E	0.01	14

  
C.D. RAYMOND LAB MANAGER

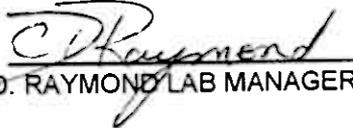
DATE: Aug. 2 , 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96029

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L1600N 775 E	<0.01	28
800 E	0.01	16
825 E	<0.01	88
850 E	<0.01	73
875 E	<0.01	184
900 E	NO SAMPLE	
915 E	0.03	66
940 E	<0.01	9
950 E	<0.01	30
975 E	0.01	23
1000 E	0.01	36
1025 E	0.01	33
1050 E	0.01	16
1075 E	0.01	35
1100 E	<0.01	14
1125 E	0.01	6
1150 E	<0.01	6

  
C.D. RAYMOND LAB MANAGER

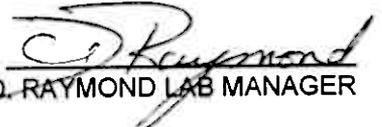
DATE: Aug. 7, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96031

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
L2050N 875 E	<0.01	50
900 E	0.01	55
925 E	0.01	22
950 E	<0.01	11
975 E	<0.01	10
1000 E	<0.01	6
1025 E	<0.01	3
1050 E	<0.01	9
1075 E	<0.01	10
1100 E	<0.01	15

  
C.D. RAYMOND LAB MANAGER

DATE: Aug. 7, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96031

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
L1900N 900 E	<0.01	61
925 E	<0.01	61
950 E	<0.01	60
975 E	<0.01	11
1000 E	0.03	213
1025 E	0.01	81
1050 E	<0.01	85
L1902N 800 E	0.01	52
825 E	<0.01	38
850 E	<0.01	30
875 E	<0.01	36
900 E	<0.01	29
925 E	<0.01	6
950 E	<0.01	3
975 E	<0.01	7
1000 E	<0.01	9
1025 E	0.02	68
1050 E	<0.01	7
1075 E	<0.01	7
1100 E	<0.01	6
L2050N 400 E	<0.01	13
425 E	<0.01	24
450 E	<0.01	26
475 E	<0.01	25
500 E	NO SAMPLE	
525 E	<0.01	18
550 E	<0.01	12
575 E	<0.01	8
600 E	0.02	11
625 E	0.06	47
650 E	<0.01	80
675 E	<0.01	24
700 E	<0.01	22
725 E	<0.01	11
750 E	0.04	34
775 E	<0.01	9
800 E	<0.01	84
825 E	<0.01	48
850 E	0.01	11

  
C.D. RAYMOND LAB MANAGER

DATE: Aug. 13, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96038

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
400S 100 E	<0.01	20
125 E	<0.01	18
150 E	<0.01	27
175 E	<0.01	32
200 E	<0.01	13
225 E	<0.01	12
250 E	0.04	290
275 E	<0.01	54
300 E	<0.01	7
325 E	0.01	17
600S 050 E	0.01	38
075 E	0.02	40
100 E	<0.01	30
125 E	0.01	36
150 E	<0.01	42
175 E	0.01	56
200 E	<0.01	58
225 E	<0.01	67
250 E	<0.01	43
275 E	0.01	71
300 E	<0.01	88
325 E	<0.01	50
800S 025 E	0.01	55
050 E	0.01	12
075 E	<0.01	36
100 E	0.03	13
125 E	<0.01	15
150 E	0.01	20
175 E	0.01	41
200 E	0.01	29
225 E	0.01	35
248 E	0.01	23
275 E	0.36	3000
300 E	0.92	5100
325 E	0.02	216

  
C.D. RAYMOND LAB MANAGER

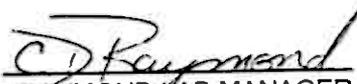
DATE: Aug. 27, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96048

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
1900S 223 E	<0.01	34
250 E	<0.01	36
275 E	<0.01	8
300 E	0.01	9
325 E	<0.01	30
350 E	<0.01	62
375 E	<0.01	197
400 E	NO SAMPLE	
425 E	<0.01	85
450 E	<0.01	18
475 E	<0.01	44
500 E	<0.01	69
525 E	<0.01	45
550 E	<0.01	22
575 E	<0.01	6
2000S 200 E	<0.01	31
225 E	<0.01	28
245 E	<0.01	23
275 E	<0.01	12
300 E	<0.01	7
325 E	<0.01	19
350 E	<0.01	26
375 E	0.07	600
400 E	<0.01	14
425 E	<0.01	18
450 E	<0.01	43
475 E	<0.01	39
500 E	<0.01	8
525 E	<0.01	6
550 E	<0.01	12
575 E	<0.01	9
600 E	<0.01	8
625 E	<0.01	50
650 E	<0.01	47

  
C.D. RAYMOND LAB MANAGER

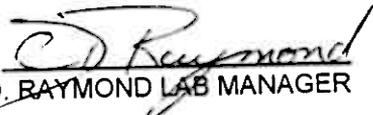
DATE: Aug. 27, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96051

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	ASSAY	GEOCHEM
	Cu %	Cu %
B96 2 32.5	1.28	1.31
B96 2 60	2.82	2.83
B96 2 66.6	1.79	1.78
B96 5 108	1.16	1.00
ROCK 96-8	2.18	2.35

  
C.D. RAYMOND LAB MANAGER

DATE: Sept. 3, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96054

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
1300S 725 E	<0.01	29
750 E	<0.01	26
775 E	0.11	429
800 E	0.02	32
825 E	<0.01	8
850 E	0.01	15
875 E	<0.01	11
900 E	<0.01	11
925 E	<0.01	5
950 E	<0.01	3
975 E	<0.01	9
1000 E	<0.01	9
1700S 1125 E	0.11	46
1150 E	<0.01	14
1175 E	<0.01	22
1200 E	<0.01	41
1225 E	<0.01	16
1250 E	<0.01	51
1275 E	0.06	102
1300 E	<0.01	14
1900S 1125 E	<0.01	96
1150 E	<0.01	64
1175 E	0.03	90
1200 E	<0.01	196
1225 E	<0.01	72
1250 E	<0.01	64
1275 E	<0.01	62
1300 E	0.02	64

  
C.D. RAYMOND LAB MANAGER

DATE: Sept. 14, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96063

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
96-08752	0.02	79
1300S 1125 E	<0.01	62
1150 E	<0.01	24
1175 E	0.01	47
1200 E	0.02	21
1225 E	0.01	57
1250 E	0.01	116
1275 E	<0.01	59
1300 E	0.01	20
1325 E	<0.01	76
1350 E	<0.01	57
1400S 975 E	<0.01	46
1000 E	0.02	55
1025 E	0.01	62
1050 E	0.01	72
1075 E	0.04	184
1100 E	0.01	76
1500S 1125 E	0.02	123
1150 E	0.01	20
1175 E	<0.01	59
1200 E	0.02	62
1225 E	<0.01	320
1250 E	<0.01	61
1275 E	0.03	21
1300 E	0.02	60
1325 E	0.01	52
1350 E	<0.01	20

  
C.D. RAYMOND LAB MANAGER

***APPENDIX # 1d : Stockpile Sampling  
- Lab Results***

DATE: Aug. 2, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96030

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
96 11991 A	0.78	5870
96 11991 B	1.03	9460
96 11991 C	1.15	7890
<b>AVERAGE</b>	<b>0.99</b>	<b>7740</b>
96 11992 A	2.21	7690
96 11992 B	0.74	5240
96 11992 C	0.76	4920
<b>AVERAGE</b>	<b>1.24</b>	<b>5950</b>
96 11993 A	1.43	5140
96 11993 B	1.15	5660
96 11993 C	1.68	5270
<b>AVERAGE</b>	<b>1.42</b>	<b>5357</b>
96 11994 A	3.15	4690
96 11994 B	1.27	3600
96 11994 C	5.50	3760
<b>AVERAGE</b>	<b>3.31</b>	<b>4017</b>
96 11995 A	2.68	4360
96 11995 B	3.54	5560
96 11995 C	3.02	4230
<b>AVERAGE</b>	<b>3.08</b>	<b>4717</b>
96 11997 A	1.32	3430
96 11997 B	1.59	2660
96 11997 C	1.47	3000
<b>AVERAGE</b>	<b>1.46</b>	<b>3030</b>
96 11998 A	2.52	2980
96 11998 B	3.08	2360
96 11998 C	0.91	2140
<b>AVERAGE</b>	<b>2.17</b>	<b>2493</b>

DATE: Aug. 2, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96030

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
O 96001 A	3.23	9900
O 96001 B	1.88	8200
O 96001 C	1.18	10840
<b>AVERAGE</b>	<b>2.10</b>	<b>9647</b>
F 96003 A	0.28	3590
F 96003 B	0.12	356
F 96003 C	0.24	808
<b>AVERAGE</b>	<b>0.21</b>	<b>1585</b>
F 96004 A	0.28	1743
F 96004 B	0.22	3110
F 96004 C	0.10	2600
<b>AVERAGE</b>	<b>0.20</b>	<b>2484</b>
G 96005 A	1.98	7860
G 96005 B	1.19	12750
G 96005 C	1.29	3730
<b>AVERAGE</b>	<b>1.49</b>	<b>8113</b>
G 96006 A	1.42	5240
G 96006 B	1.45	8100
G 96006 C	1.98	6650
<b>AVERAGE</b>	<b>1.62</b>	<b>6663</b>
I 96007 A	0.45	5020
I 96007 B	0.62	4400
I 96007 C	0.73	4480
<b>AVERAGE</b>	<b>0.60</b>	<b>4633</b>
I 96008 A	0.63	5510
I 96008 B	0.43	5150
I 96008 C	0.93	4600
<b>AVERAGE</b>	<b>0.66</b>	<b>5087</b>
C 96009 A	1.18	8190
C 96009 B	18.90	8560
C 96009 C	1.36	9360
<b>AVERAGE</b>	<b>7.15</b>	<b>8703</b>
C 96010 A	12.40	12580
C 96010 B	3.82	19130
C 96010 C	3.19	13730
<b>AVERAGE</b>	<b>6.47</b>	<b>15147</b>

  
C.D. RAYMOND LAB MANAGER

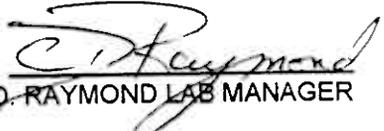
DATE: Aug. 7, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96033

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm	WEIGHT (g)
O 96002 A	2.32	10660	4568
O 96002 B	1.49	10250	4917
O 96002 C	1.88	7520	4934
<b>AVERAGE</b>	<b>1.90</b>	<b>9477</b>	
96 11999 A	4.09	6230	4761
96 11999 B	2.87	7760	4748
96 11999 C	6.34	7780	4553
<b>AVERAGE</b>	<b>4.43</b>	<b>7257</b>	
96 12000 A	2.07	7370	4028
96 12000 B	1.52	7700	3726
96 12000 C	2.15	7270	3876
<b>AVERAGE</b>	<b>1.91</b>	<b>7447</b>	
96 11996 A	2.03	4210	2681
96 11996 B	2.01	4390	2626
96 11996 C	2.16	4970	2894
<b>AVERAGE</b>	<b>2.07</b>	<b>4523</b>	
<b>ROCK</b>			
L1900N 800E	<0.01	58	
BIDJ 1	1.30	13560	
BIDJ 2	1.32	9350	
BIDJ 3	3.08	36800	
BIDJ 4	0.10	5080	

  
C.D. RAYMOND LAB MANAGER

DATE: Sept. 14, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96061

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
R575N -425E	0.04	530
R575N- -425E	0.09	12
R575N- 425E	0.05	1165
R575N/ 425E	0.06	197
R1160N-590E	6.23	2235
R1250N-470E	0.14	2790
R1650N/-625E	1.75	10380
R1980N/-600E	0.21	9350
EJ-1	0.01	57
EJ-2	0.02	196

  
C.D. RAYMOND LAB MANAGER

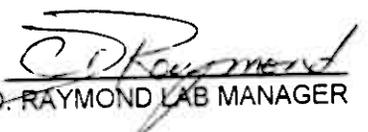
DATE: Sept. 14, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96062

BCLX CONSULTING Ltd.  
Mr. GARTH PIERCE

Sample Number	Au ppm	Cu ppm
P-01N	0.25	4570
P-01E	0.19	1325
P-02N	0.16	2130
P-02E	0.24	2160
P-03N	0.11	2040
P-03E	0.33	1745
P-04N	0.12	2010
Q-01N	1.08	6280
Q-01E	1.19	9540
Q-02N	0.46	1895
Q-02E	0.63	975
Q-03N	0.27	1850
Q-03E	0.84	1575
Q-04N	0.85	3230

  
C.D. RAYMOND LAB MANAGER

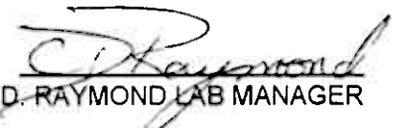
DATE: Sept. 16, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96065

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
H-01N	1.71	3030
H-01E	1.10	5450
H-02N	1.18	2380
H-02E	1.84	4570
H-03N	1.42	1880
H-03E	0.48	2040
H-04N	0.90	4020
H-04E	0.65	2150
X-01E	1.14	2220
X-02N	0.71	3440
X-02E	0.70	6890
X-03E	0.55	2890

  
C.D. RAYMOND LAB MANAGER

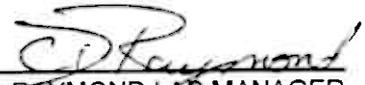
DATE: Sept. , 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.:96076

**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm
F2-1N	0.75	5090
F2-1E	1.17	3120
F2-2N	0.77	6530
F2-2E	0.50	7960
F2-3N	0.72	9710
BD-YN1	2.41	10600
BD-YE1	2.61	10600
BD-YN2	1.56	11700
BD-YE2	3.90	13400
BD-YN3	1.75	3850
BD-2Y-1N	3.12	12700
BD-2Y-2N	1.74	7700
BD-2Y-1W	1.29	10500
BD-2Y-2W	0.99	15600
BD-2Y-3W	1.38	5800

  
C.D. RAYMOND LAB MANAGER

DATE: Oct. 18, 1996

M-TECH INCORPORATED  
BOX 182, ELMSDALE N.S.

CERTIFICATE OF ANALYSIS  
REPORT No.: 96088

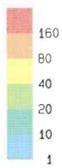
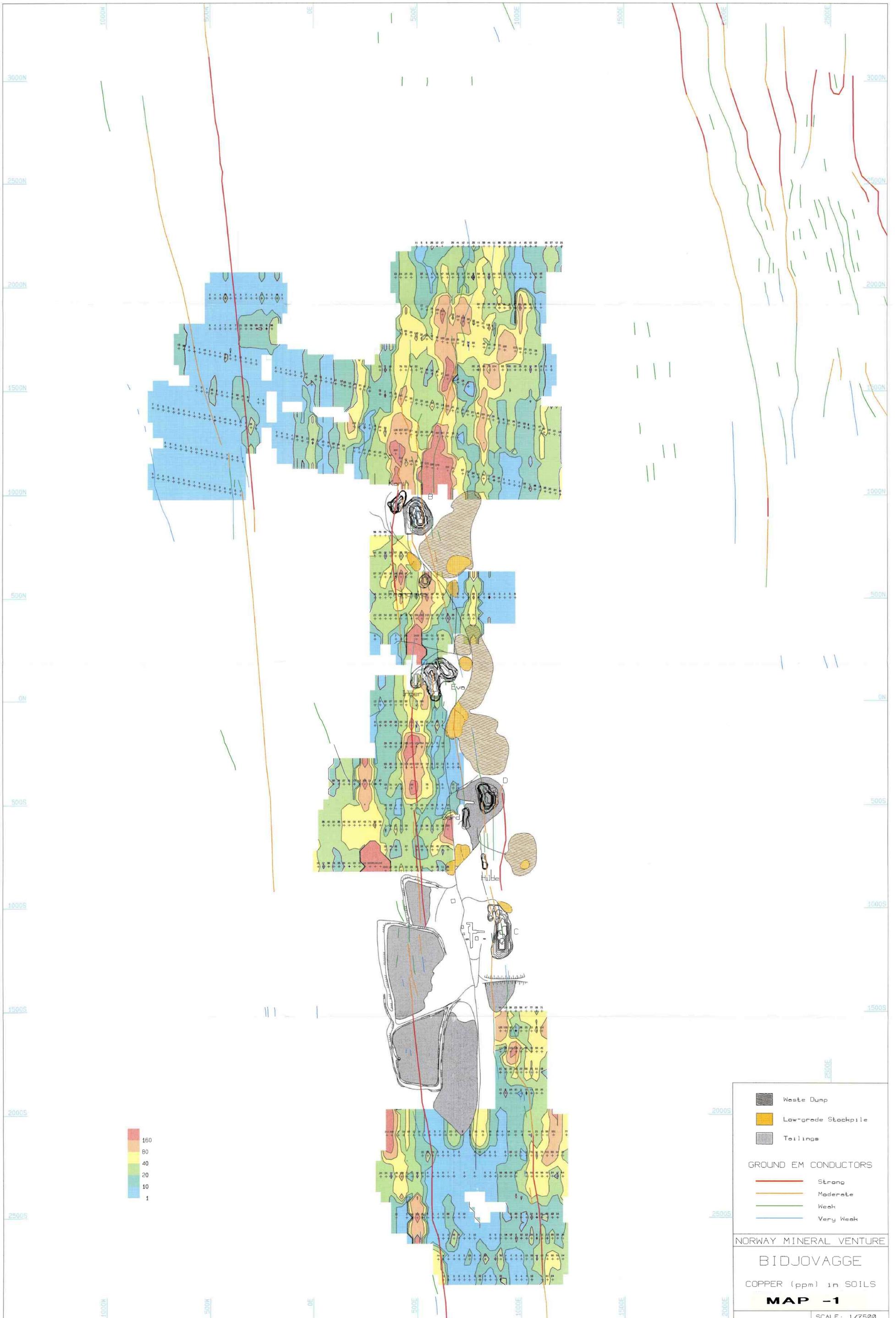
**BCLX CONSULTING Ltd.**  
**Mr. GARTH PIERCE**

Sample Number	Au ppm	Cu ppm	Ag ppm
BC-1	139.00	NR	360.0
BC-2	107.00	NR	367.0
K-1	0.88	20600	NR

NR: NOT REQUESTED

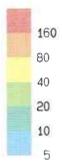
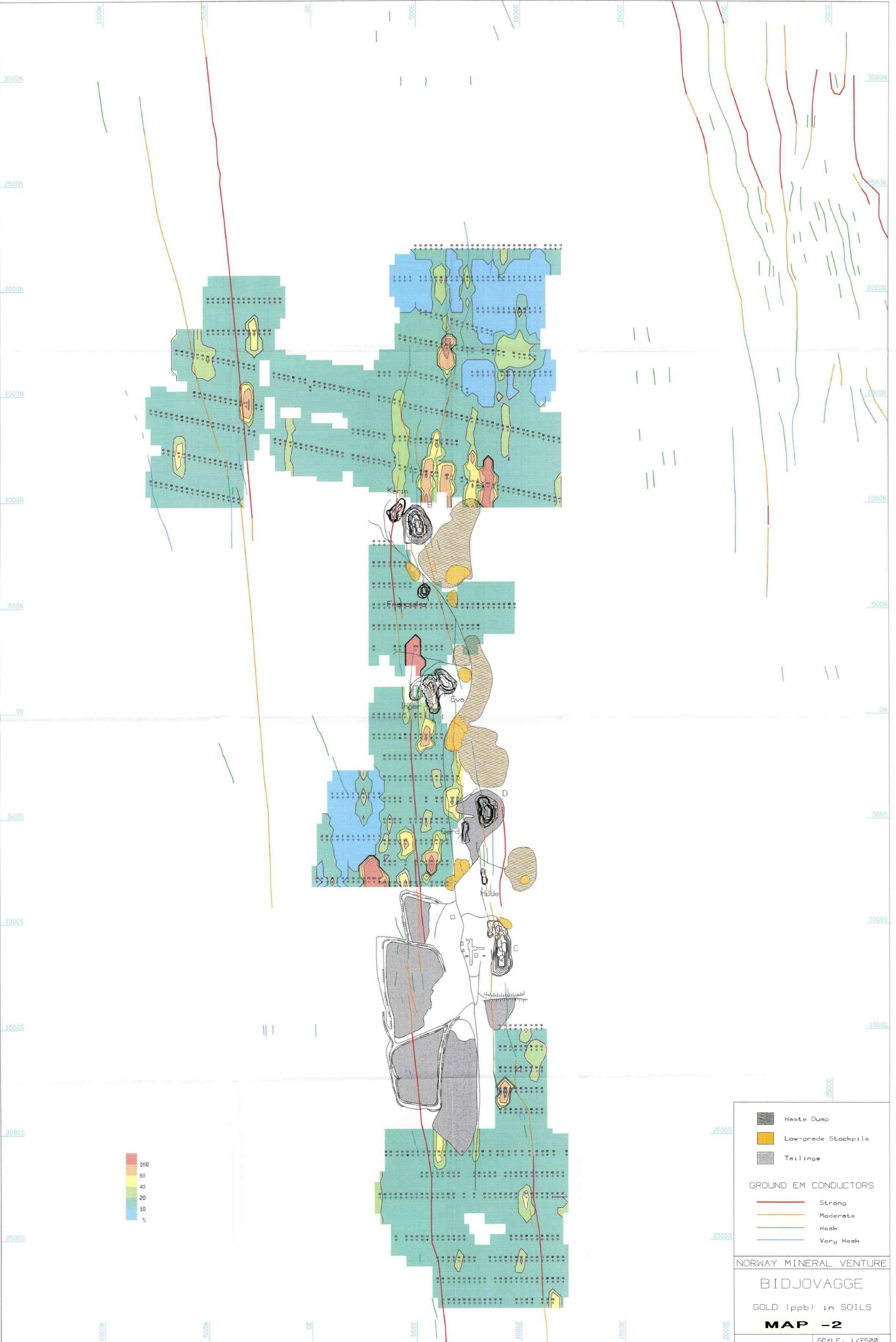
Page 1

  
C.D. RAYMOND LAB MANAGER



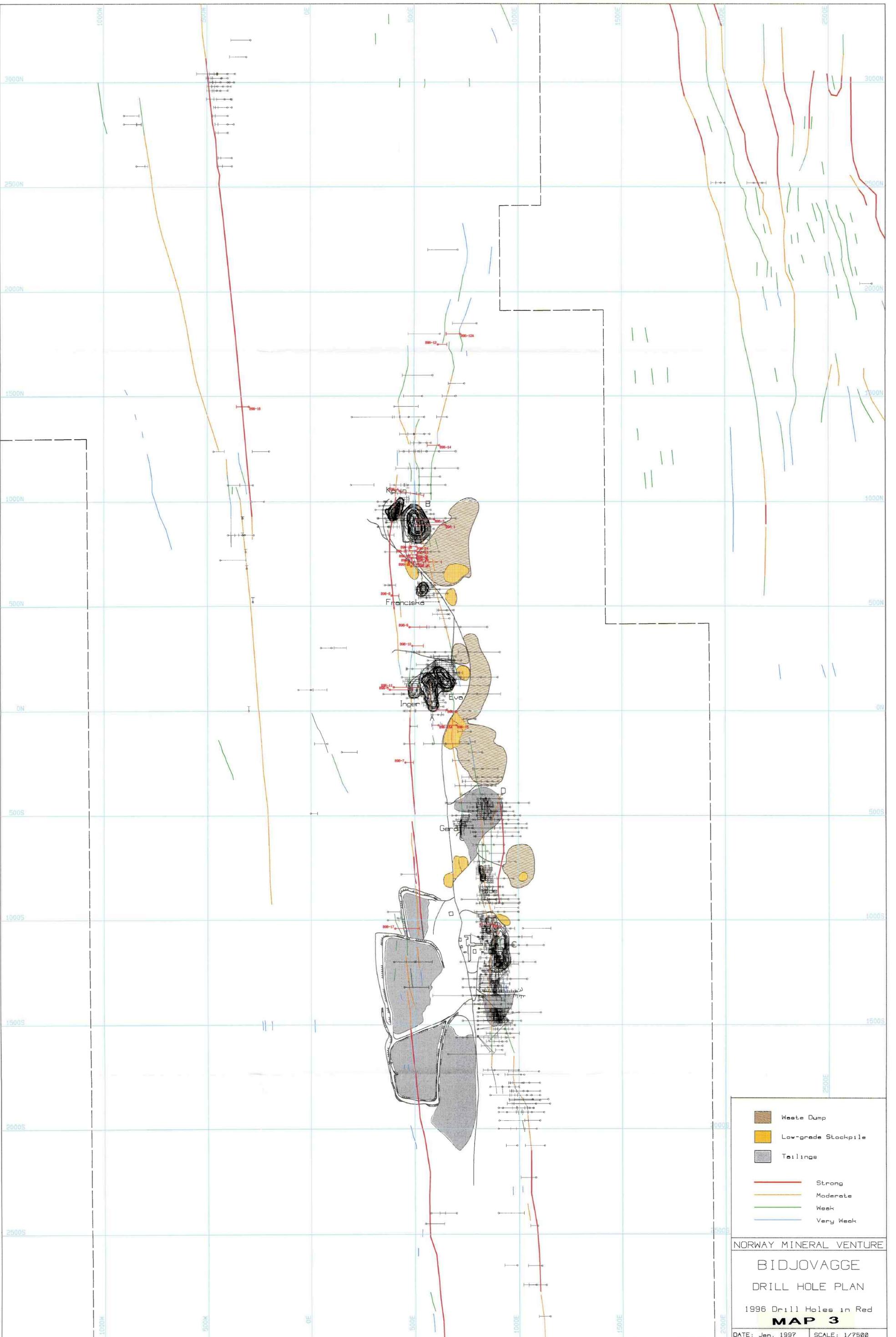
-  Waste Dump
  -  Low-grade Stockpile
  -  Tailings
- GROUND EM CONDUCTORS
-  Strong
  -  Moderate
  -  Weak
  -  Very Weak

NORWAY MINERAL VENTURE  
 BIDJOVAGGE  
 COPPER (ppm) in SOILS  
**MAP -1**  
 SCALE: 1/7500



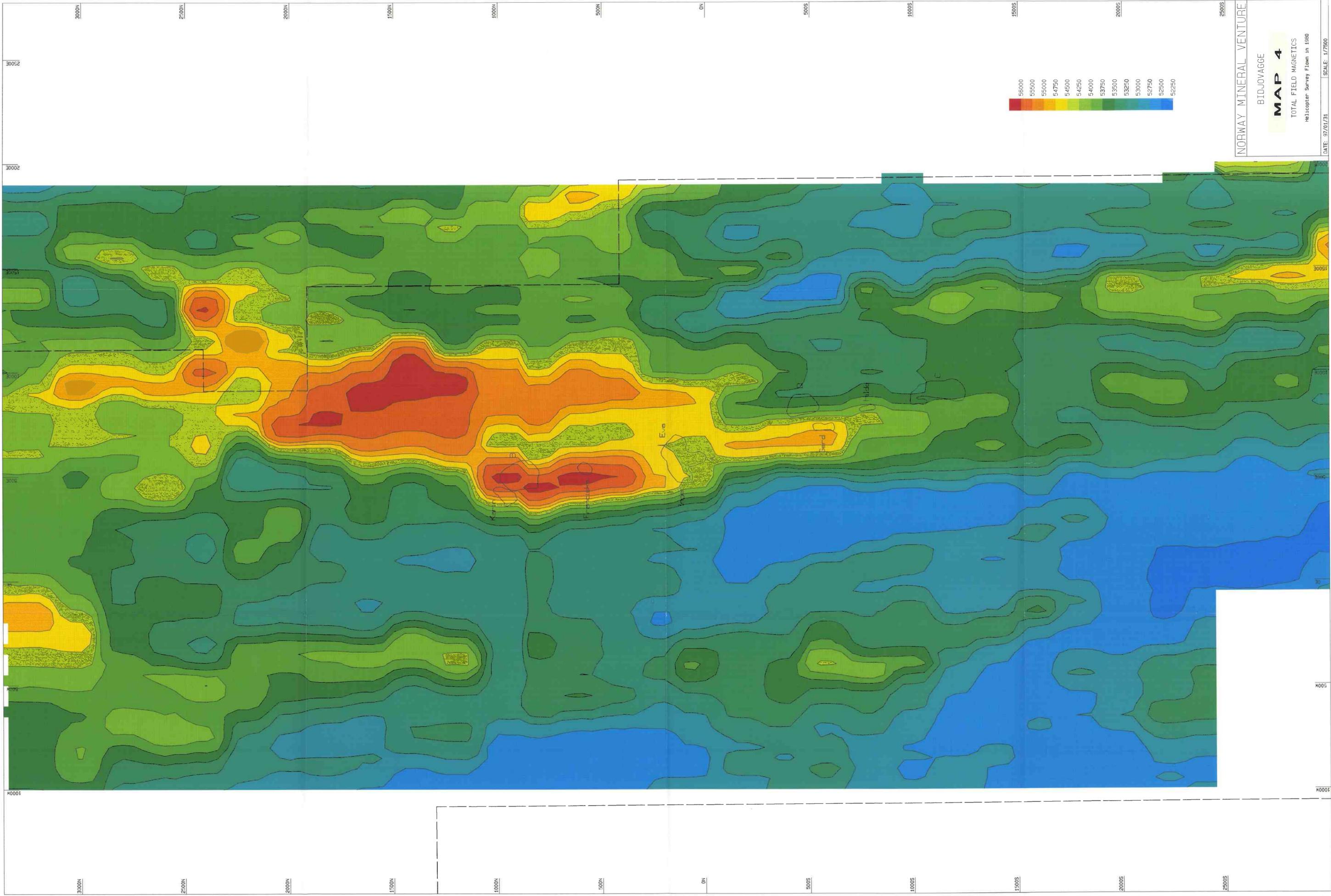
-  Waste Dump
  -  Low-grade Stockpile
  -  Tailings
- GROUND EM CONDUCTORS
-  Strong
  -  Moderate
  -  Weak
  -  Very Weak

NORWAY MINERAL VENTURE  
 BIDJOVAGGE  
 GOLD (ppb) in SOILS  
**MAP -2**  
 SCALE: 1/7500



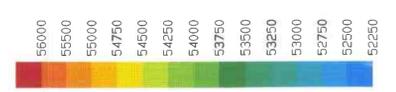
- Waste Dump
- Low-grade Stockpile
- Tailings
- Strong
- Moderate
- Weak
- Very Weak

NORWAY MINERAL VENTURE  
 BIDJOVAGGE  
 DRILL HOLE PLAN  
 1996 Drill Holes in Red  
**MAP 3**  
 DATE: Jan. 1997    SCALE: 1/7500

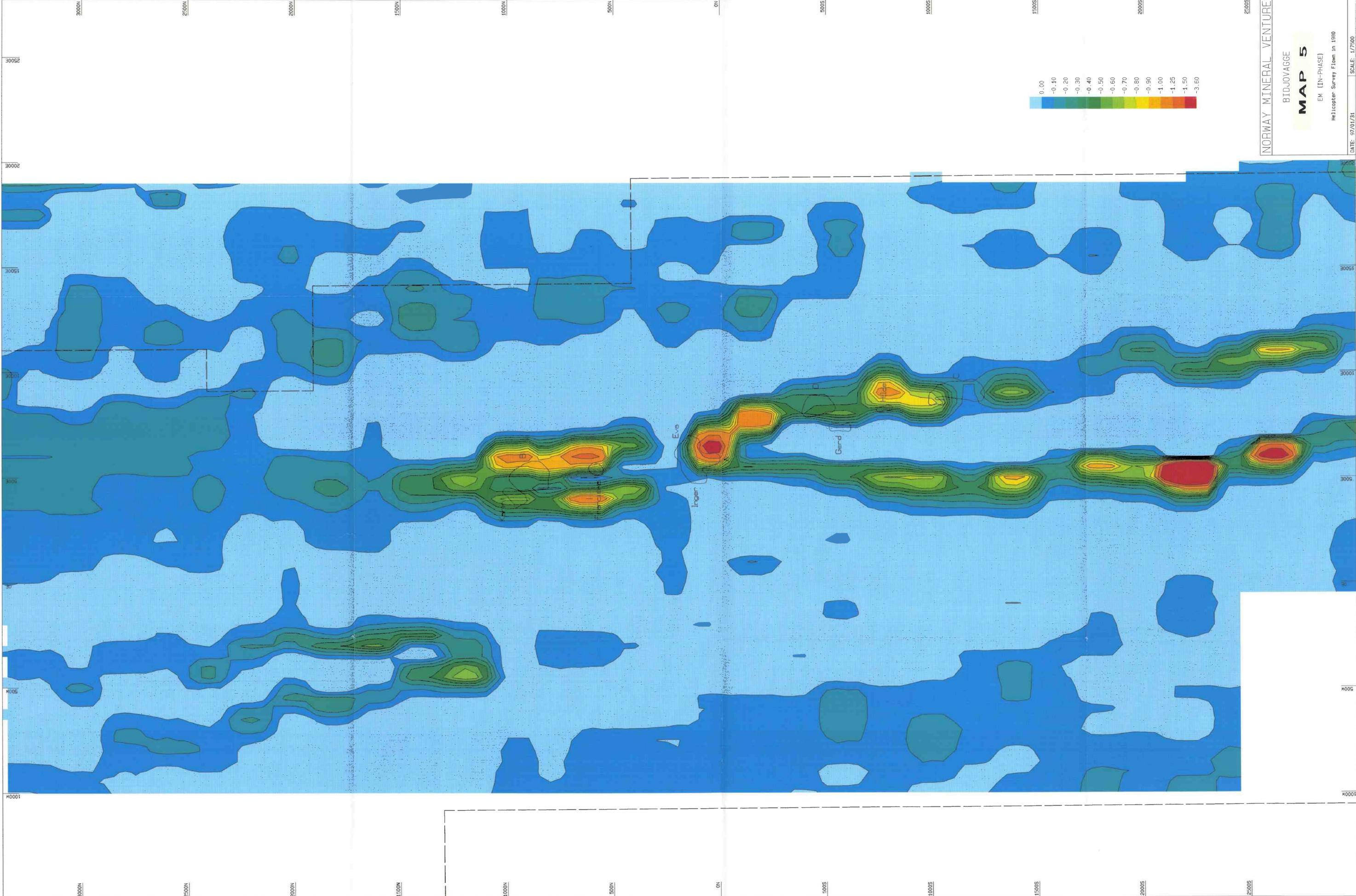


3000N 2500N 2000N 1500N 1000N 500N 0N 500S 1000S 1500S 2000S 2500S

3000E 2500E 2000E 1500E 1000E 500E 0E 500W 1000W 1500W 2000W 2500W



NORWAY MINERAL VENTURE  
BIDJUVAGGE  
**MAP 4**  
TOTAL FIELD MAGNETICS  
Helicopter Survey Film in 1980  
DATE: 97/01/31 SCALE: 1/7500



NORWAY MINERAL VENTURE

BIDJUVAGGE

**MAP 5**

EM (IN-PHASE)

Helicopter Survey Flown in 1990

DATE: 97/01/31 SCALE: 1/7500