Investigation of a Reported Copper-Silver Showing in Section 30, T50N, R26W, Marquette County, Michigan

by
David W. Snider
Geology and Minerals Research Unit

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This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards or nomenclature.

Abstract

A geophysical and geological investigation of a reported copper-silver occurrence was conducted during July, 1976. The area investigated was confined to the NE1/4 section 30, T50N, R26W, Marquette County, Michigan.

No mineralization was located which proved to be as rich as that indicated by early reports. The combined evidence, however, suggests that the area has the potential both structurally and geologically to host sulfide mineralization.

Acknowledgements

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Introduction

This project was designed to investigate a previously-reported copper-silver occurrence near Sauk Head Lake in northeastern Marquette County, Michigan.

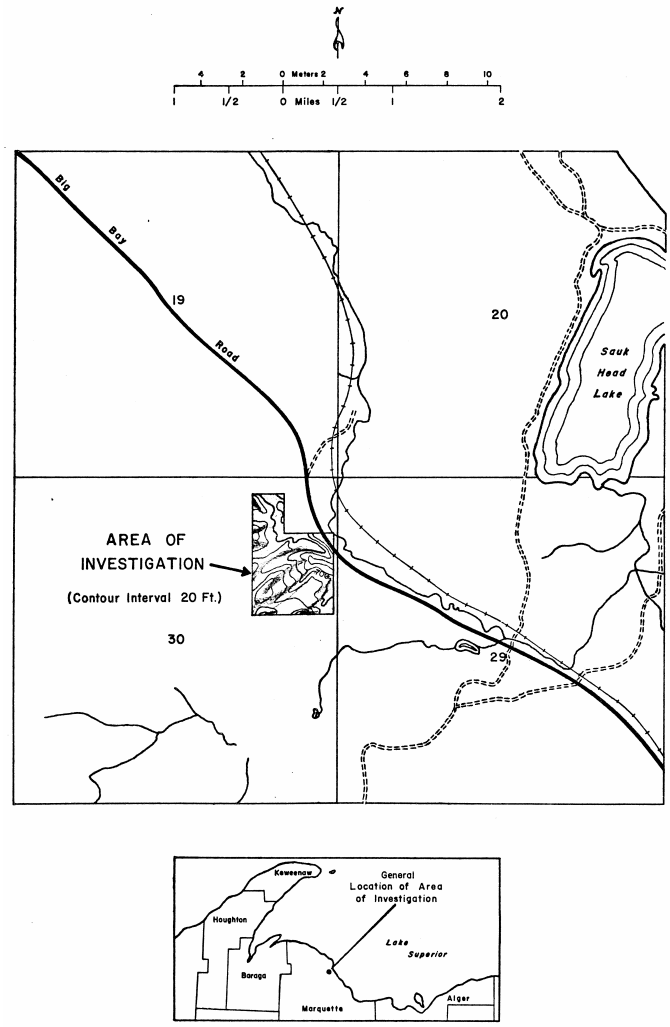
The occurrence is described in an annual report of the Michigan Commissioner of Mineral Statistics for the year 1899 (p. 289). The report is brief but describes a mineralized gash vein in granite. One sample reportedly assayed 23.8% copper and 1.75 ounce per ton silver. It is assumed that the mineralization was in the form of sulfides.

The only location given in the report is NE1/4 Section 30, T50N, R26W. The report states that several test pits were dug, as was a 50-ft. shaft. The mineralization evidently terminated, however, since no other surface work was reported.

The area was visited in an attempt to locate the pits and shaft in order to investigate the occurrence further. No shaft nor pits were located. There is, however, a rather deep ravine cut into granite which may have been at least in part due to early surface work. The ravine is located near the center of the NE1/4 Section 30.

Since no direct evidence of the mineral occurrence was found it was decided that a grid survey be conducted in the eastern half of the NE1/4 of Section 30 (Figure 1). It was hoped that any similar mineral occurrence in the immediate area would show up geophysically. The following describes the results of this investigation.

Figure I – LOCATION OF THE AREA OF INVESTIGATION IN T.50N. R.26W.



Geologic Setting

The project area is located in the southern part of the Huron Mountain Massif and is composed of Lower Precambrian (Precambrian W) granites and gneisses. The area lies about 2.4 Km west of the northwest trending contact of the Jacobsville sandstone. (See Figure 2).

The lower and middle Precambrian rocks of the Peshekee Massif, Huron Mountain Massif, the Dead River Basin, Baraga Basin and the Clark Creek Basin have all been intruded by Keweenawan (Precambrian Y) diabase dikes. The dikes typically have a reverse magnetic polarity. The dikes tend to group themselves

in a swarm or concentrated area 29 Km by 82 Km. (See Figure 2). One such dike exhibiting strongly reversed magnetism was encountered in the course of this project and is located near the southern border of the project area.

Post Keweenawan faulting has displaced the diabase dike within the project area and may have played an important role in the localization of the reported copper-silver mineralization.

Methods of Investigation

The methods of investigation included magnetic and VLF-EM surveys of the area, as well as outcrop sampling.

A survey grid pattern was developed in order to cover the area of suspected mineralization which encompasses a total area of 0.1825 Km^2 (See Figure 3). The collected rock samples were submitted for various chemical analyses as well as thin-sectioning for microscopic examination.

Figure 2 – GENERAL REGIONAL GEOLOGIC MAP

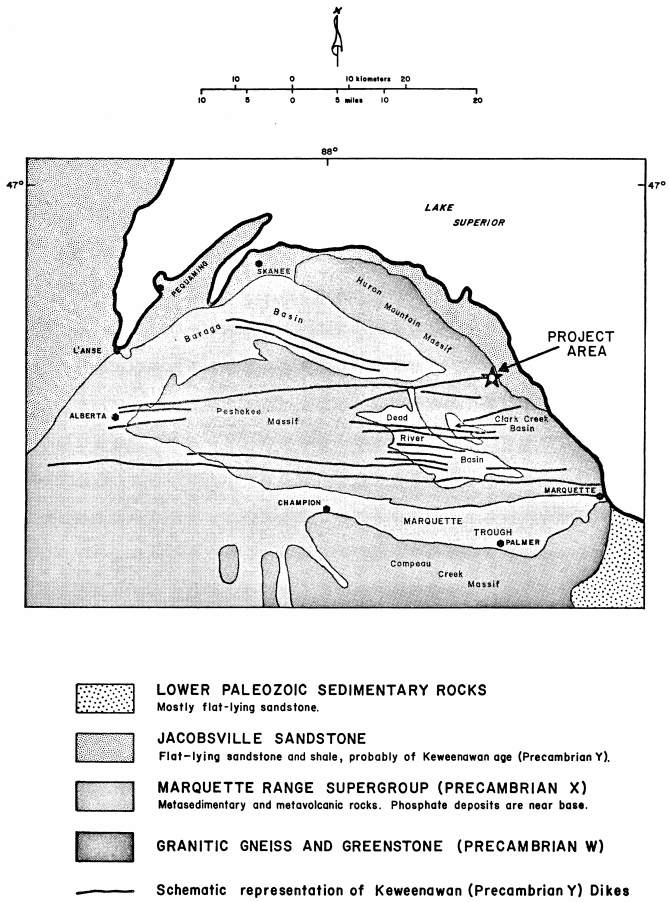
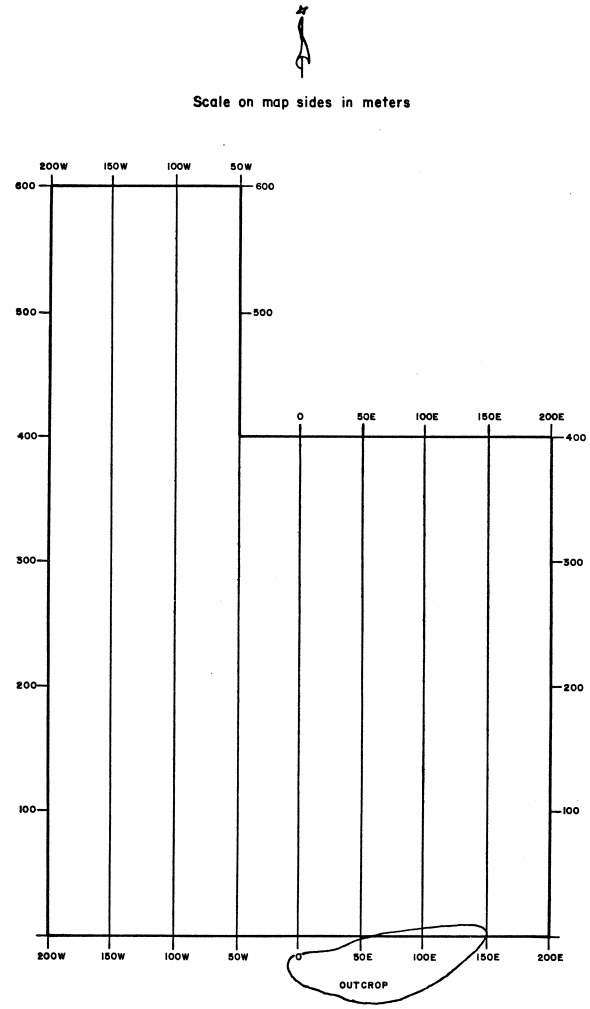


Figure 3 – LOCATION OF TRAVERSE GRID USED IN THIS PROJECT



Stations were spaced 20 meters apart, with all readings taken facing north.

Results

Magnetic Surveys

The results of the magnetic surveys are illustrated on a magnetic map of the project area (Figure 4).

The magnetic data indicate the presence of a reversely polarized dike in the southern portion of the area. The values range from a high 60,651 gammas (140 meters north along line 50W) to a low of 57,200 gammas (located along the baseline at the 150 E station). The high value associated with the area immediately north of the negative anomaly is most likely a dipolar-effect caused by the position of the dike with respect to the earth's magnetic field. The low values, however, are probably due to the negative remnant magnetism of the dike material itself.

The magnetic response from the dike is abruptly terminated by an apparent N-S fault zone. The fault is most noticeable from 0 to about 100 meters north along

line 100 W. It may extend north from the base line for a distance of about 250 meters.

There appear to be some curious “lows” or anomalous areas which are also interpreted as faults. These features trend about N 80° E from the projected N-S fault (Figure 6). This second fault begins about 200 m north along line 50 W and extends N 80° E for a distance of at least 150 meters and perhaps more. This smaller fault is interpreted as a secondary fault branching from the major N-S fault.

The secondary fault also coincides with a steep ravine which is cut into mafic gneiss and which may be a surface expression of that fault.

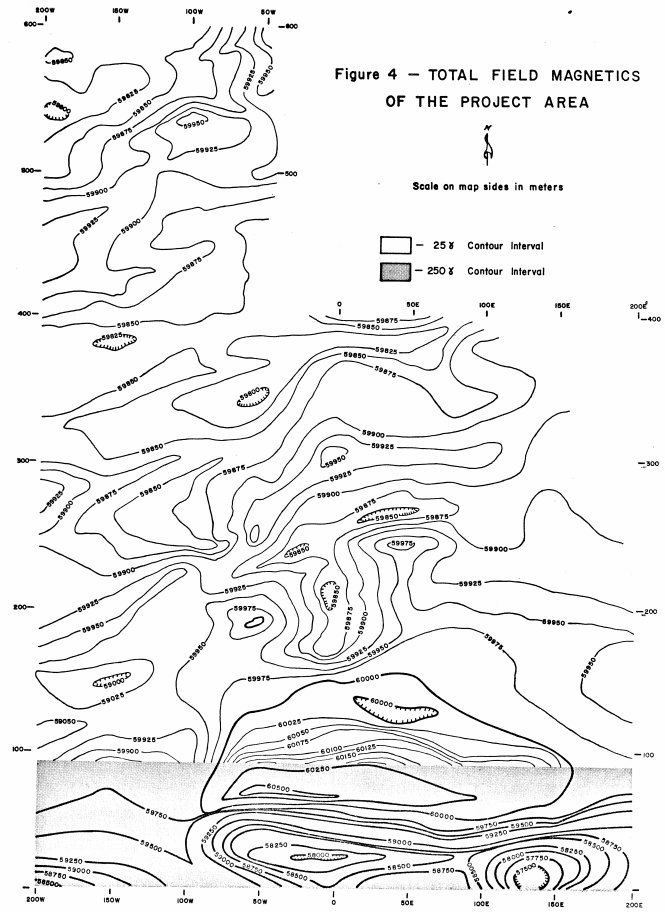


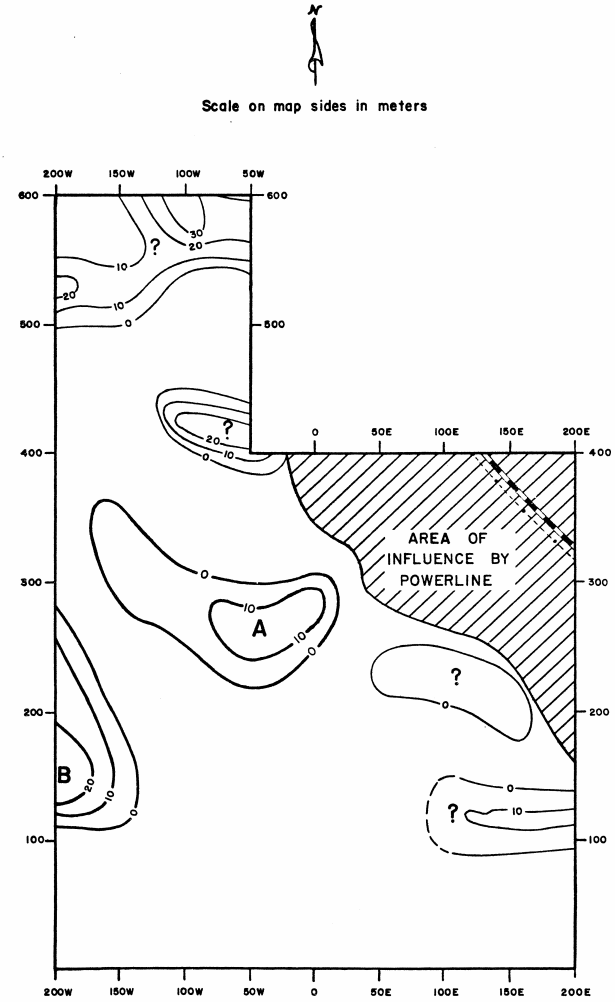
Figure 4 — TOTAL FIELD MAGNETICS OF THE PROJECT AREA

Another small negative magnetic anomaly also exists which may indicate an additional secondary fault. This feature is parallel to line “0” and is apparently connected to the previously mentioned secondary fault and extends south for a distance of about 100 meters. VLF-EM Surveys

Data generated by the VLF-EM surveys were plotted on consecutive profiles containing not only the VLF-EM results, but also magnetics and topography. These composite profiles may be viewed at the Lansing office of the Michigan Geological Survey. The VLF-EM results are illustrated on a map (Figure 5). The map is contoured on values from filtered data. The filter operation used is similar to that described by Fraser (1969).

Two anomalies which may indicate anomalous conductivity exist on the map and are designated A and B. The cause of these anomalies remains unknown. Anomaly B is listed only because it is rather distinct and reaches a local intensity of more than 30 arbitrary filtered units.

Figure 5 — RESULTS OF THE VLF-EM SURVEY SHOWING POSITIVE IN-PHASE ANOMALIES



Anomalies A, B indicate areas of possible conductive mineralization.

Other closed features (?) may be due to distortion caused by nearby electrial powerlines.

Anomaly A is related to a magnetic low. In the previous section of this report, the magnetic low has been interpreted as being due possibly to local faulting. If indeed faulting has taken place at the anomaly A area, the conductivity could be due to mineralized waters filling the interstices of the fault zone. The apparent conductivity also could be due to sulfide deposition again, associated with the fault. However, more geophysical studies would have to be made in order to reliably determine the cause of VLF-EM anomaly A.

There is one notable, very evident feature concerning the VLF-EM results. That feature is VLF-EM instrument interference caused by a local power line. The secondary field generated by the current flow in the

power line distorted the VLF-EM results to such an extent that a large part of the data appear to be useless. The power line affect is noticeable on the filtered VLF-EM profiles and perhaps most obvious on the raw VLF-EM profiles. The minimum extent of power line distortion is shown on the VLF-EM map.

Since the maximum extent of power line interference is not known, the VLF-EM interpretations concerning anomalies A and B should be considered preliminary and subject to change pending investigation by EM methods which are immune to this power line effect.

RESULTS AND OUTCROP SAMPLING

The location of the various outcrops and associated rock types are shown on Figure 6. The project area is covered by varying amounts of glacial drift. Most of the bedrock in the area is composed of lower Precambrian (Precambrian W) granites and mafic gneisses. An area of granite, located 140 meters north along the 50 E line, may have intruded the lower Precambrian rock and hence may be younger. This granite is locally rich in quartz with visible sulfides varying from 3 to 6% (volume percent).

In the southern portion of the project area an east-west trending, Keweenawan (Precambrian Y) diabase dike has intruded the Precambrian W rock and, as discussed previously, is terminated in the project area by a north-south trending fault.

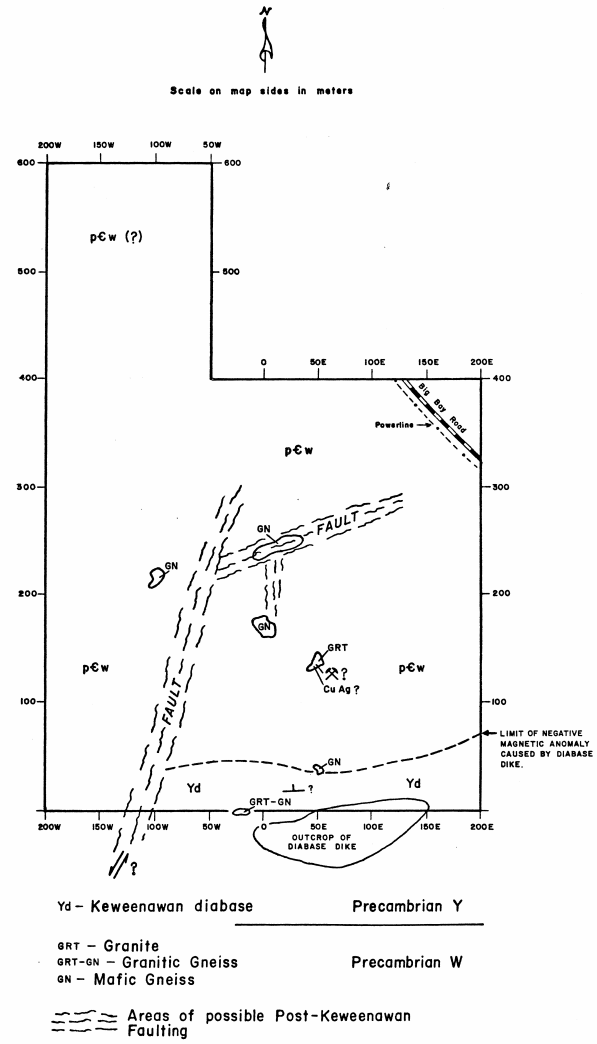
The post-emplacement faulting of the dike was evidently accompanied by the intrusion of additional mafic rock which filled numerous fracture systems. This feature is noticeable on the large outcrop of the dike located south of the baseline from about the zero point to about 150 E. (See Figure 6).

The mafic rock that fills the fractures varies in texture from diabasic to basaltic, the latter being restricted to chill margins near fracture walls.

The basaltic portion of the mafic material typically has oriented, zoned plagioclase lathes varying in length up to 0.2 mm in a field of black glass. There are visible sulfides evenly distributed throughout the glass averaging about .05 mm in diameter. The average amount of sulfides in the black glass is estimated at about 1% (volume percent). Locally small fractures exist which are totally filled with basaltic material and contain no associated diabase.

The sulfides present in the previously mentioned quartz-rich granite may be somehow genetically related to the basalt, i.e. the two sulfide occurrences may have been emplaced at essentially the same time. This period of sulfide mineralization which may be related to fracturing tends to support or lend credence to the reported Ag-Cu occurrence listed in the old Commission report. The old report mentioned that the mineralization was not disseminated throughout the host rock, but rather was confined to gash veins which could well be related to the faulting and fracturing evident on the dike outcrop.

Figure 6 – GENERALIZED OUTCROP DISTRIBUTION AND INFERRED FAULTING WITHIN PROJECT AREA



Perhaps the strongest evidence that sulfide mineralization was related to the fracturing and subsequent intrusion of basaltic material is the fact that analyses of the basalt material averaged about 440 ppm copper, which is about twice the amount detected in the diabase.

The volume percent mineralogy of the observed samples is shown in Table 1.

Result of the Chemical Analysis

The results of the various chemical analyses are shown on Tables 2, 3, and 4. Other than the previously mentioned copper analyses no anomalous results were indicated.

Table 1 - Volume Percent Mineralogy of the Various Rocktypes in the Project Area

Rock Type	Hornblende	Plagioclase	Chlorite	Leucoxene/ Ilmenite	Carbonate	Quartz	Biotite	Black Glass	Sulfides	Epidote	Pyroxene	K-feldspar	Muscovite	Sample No.
Metadiabase I (dike-rock)	43	43	9	3	1									DK-1
Metadiabase II (fracture-filling within metadiabase dike)	47	42	5	4	0.3	1.2	0.5							DK-2
Basalt (fracture-filling material within dike		40			1			70	1	8	10			DK-4
Granite		22	0.2		1	31						44	0.2	DK-6A
Mafic Gneiss	93					6								DK-7
Quartz Vein in Granite									3					DK-6B
Contact of Mafic Gneiss Ground Mass at Chlorite-Tremolite-Granite-Quartz vein Quartz and K-feldspar									6					DK-6C

Summary and Conclusion

Although the reported occurrence of rich copper-silver mineralization was not located, certain features about the area tend to indicate that potential for such mineralization does exist.

The geophysical surveys of the area indicated certain explainable features such as the described faulting. The VLF-EM surveys, however, indicated two areas of anomalous conductivity that could not be related to surface features. These conductive anomalies should be considered tenuous since the magnetic field generated by a local power line severely distorted the VLF-EM results.

The various chemical analyses resulted in no values anywhere near the 28% copper reported in the 1899 report of the Commission of Mineral Statistics.

Inasmuch as there may have been a period of local sulfide mineralization related to post-Keweenawan fracturing, it is suggested that additional detailed investigations be conducted in the same area. All future electro-magnetic investigations, however, should employ equipment which is designed to be immune from power line interference. Only equipment of this type can be expected to yield reliable results in this project area.

References

Newett, G. A., 1899, Mines and Mineral Statistics for the Year 1898; Mich. Commission of Mineral Statistics, Ishpeming, MI., p. 289.

	Job No. M-4104		Job No. M-4200	
Element	DK-1	DK-4	DK-5	DK-6
Fe	10%	5%	2%	10%
Ca	3%	2%	.3%	7%
Mg	5%	1.5%	.5%	3%
Ag	<1	<1	<1	<1
As	<500	<500	<500	<500
B	10	<10	10	30
Ba	50	20	1,000	150
Be	<2	<2	<2	<2
Bi	<10	<10	<10	<10
Cd	<50	<50	<50	<50
Co	30	20	<5	30
Cr	100	50	10	200
Cu	150	300	20	150
Ga	15	10	10	15
Ge	<20	<20	<20	<20
La	<20	<20	<20	<20
Mn	1,000	700	200	2,000
Mo	<2	<2	<2	2
Nb	<20	<20	<20	<20
Ni	70	30	10	70
Pb	<10	<10	30	50
Sb	<100	<100	<100	<100
Sc	50	30	<10	50
Sn	<10	<10	<10	<10
Sr	150	100	100	300
Ti	2,000	3,000	500	3,000
V	150	100	20	300
W	<50	<50	<50	<50
Y	20	15	<10	20
Zn	200	<200	<200	200
Zr	30	30	30	20

Table 2 - Results of Spectrographic Semiquantitative Analyses

Sample Number

	Job No. M-4104	Job No. M-4200
Item (%)	DK-3	DK-7
SiO_2	46.9	45.2
Al_2O_3	11.9	11.9
MgO	4.6	5.6
CaO	8.5	11.2
Na_2O	2.4	0.67
K_2O	0.76	1.9
Fe_2O_3	3.3	1.8
FeO	12.6	11.6
P_2O_5	0.17	0.07
MnO	0.27	0.3
F	0.058	0.039
L.O.I. @ 1000°C	0.1	0.7
Moisture @ 105°C	<0.01	<0.2
CO_2	<0.1	<0.1
TiO_2	3.7	1.8
SrO		0.022
Rb_2O		0.009
Total	95.368	93.11

Table 3 - Results of the Whole Rock Analyses

Job No. M-4104

Sample No.	Cu (ppm)	Ag (ppm)	Rock type
DK-1	150	0.2	Metadiabase (dike material)
DK-2	230	0.2	Metadiabase (fracture-filling material within the dike)
DK-3	430	0.2	Basalt (fracture-filling material within the dike)
DK-4	450	0.4	Basalt (fracture-filling material within the dike)
DK-5	20	<0.2	Granitic to Mafic Gneiss
Job No. M-4200			
DK-6		<0.2	Granite
DK-7		0.2	Hornblende - Quartz Gneiss

Table 4 - Results of the Trace Element Analysis

(Atomic Absorption Method)