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REPORT ON AN INITIAL GEOCHEMICAL BASE METAL EXPLORATION PROGRAM CARRIED OUT ON SOIL SAMPLES FROM THE MT. NANSEN AREA

F.Bianconi - R.Saager

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April 9, 1970

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by

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I. INTRODUCTION

The discovery of a very large copper mineralisation in the property of Casino Silver Mines Limited, some 70 miles to the North West of our property, during 1969, has given raise to a considerable staking rush, covering the entire Dawson Range between Mount Nansen and Casino. In The Northern Miner of March 26, 1970, Casino Silver Mines Limited reports: "an estimated 1,164,000,000 tons having an average grade of 0.30% Copper (Cu) and 0.04% molybdenite (MoS_2). Maximum values intersected in drill holes showed 1.291% Cu and 0.030% MoS_2 over 210 feet.

The fact that the Casino mineralisation occurs in an geological setting almost identical to that of the Mount Nansen area (Tertiary porphyry bodies intruding Mesozoic granites and Paleozoic to Precambrian metamorphic series) has already led the authors in November 1969 to the following conclusion: "In Anbetracht der neuentdeckten interessanten Kupfermineralisation vonCasino Mines sollten Ueberlegungen ueber die Extension solcher Vorkommen in unser Gebiet durchgefuehrt werden". (Geologisches Arbeits-Programm Periode Januar - Juni 1970 - November 27, 1969). Subsequently, various other memos and monthly reports dealing with the base metal exploration have been prepared and an initial geochemical investigation was recommended. Since a geochemical survey of silver and arsenic has earlier been carried out on about one third of our property (see Fig.6), the soil samples being stored at a local assay laboratory, the logical step was to carry out the initial geochemical program on a number of selected soil samples from the silver-arsenic survey.

It was hoped that this initial program reveals the following information:

i) Usefulness of copper, zinc and molybdenum as geochemical indicators.

ii) Relationship between silver-arsenic anomalies and copper, zinc,and molybdenum anomalies.

iii) Relationship between the local geology and the copper, zinc, and molybdenum anomalies.

For this reason, 500 soil samples have been selected from the 15,000 original samples used in the original 1967 survey. They represent a 800 ft quadratic grid over the entire area investigated during the 1967 geochemical survey. The samples were taken from the B-Horizon (residual soil below the humus layer, generally -1 foot). The samples were analysed for copper (Cu), zinc (Zn) and molybdenum (Mo) by Bondar-Clegg Laboratories

(North Vancouver, B.C.), using atomic absorption: the lower limit of detection for the three elements apparently was 1 ppm (equal 1 gram per metric ton).

II. GENERAL GEOLOGY OF THE AREA (See Fig.5)

Figure 5 illustrates the geological setting of the area. In this context it must be stated that Fig.5 was compiled from several geological maps:

- 1936 H.S. Bostock, Map 304A, Carmacks Sheet, G.S.C.
- Sept. 1958 Nansen Creek area - Geology Plan - 1" = 500' - D.D. Campbell
- March 2, 1964 Part of the Mount Nansen Area - Plan showing veins and ore shoots with generalized Geology- - 1" = 400' - W.C. Martin
- 1968 Surface and underground detailed geological mappings - 1" = 20' / 1" = 400' - G. Lamont, W. Wilkinson, F. Bianconi.

Only the immediate surroundings of the mine workings have been mapped in detail: the rest, especially the South half of the property is only covered by the regional mapping of Bostock (1936). Generally the geological mapping in the unglaciated Dawson Range is severly hampered by the almost total absence of outcrops and thick overburden (up to 50 feet). Indications of the bedörck can only be obtained from rocks collected in the float. Even this float is partly covered by decomposed organic matter, residual soil and volcanic ash. Very often the float has been found to be strongly leached and/or oxidized.

The oldest rocks in the investigated area are represented by the Yukon Group metamorphic rocks, which are believed to be of Precambrian/Paleozoic age. In the area the Yukon Group is mainly composed by banded, medium grained quartz - hornblende - gneisses and hornblende - gneisses. Quartzites and biotite schists form minor constituents of the group. These rocks generally have N-S to NE-SW strike and are dipping moderately to steep West to Northwest. The southern half of the investigated area is formed by the Yukon Group.

A thick cover of volcanic rocks overlays discordantly the Yukon Group in the North of the area. These rocks belong to the Nansen Group, which is believed to be of Jurassic age. In the investigated area the Nansen Group is essentially composed of andesitic to basaltic lava flows and of porphyritic andesites. Volcanic breccias and agglomerates form a small plug 3000 feet to the East of the Webber adit.

Porphyritic granites and granodiorites of Cretaceous age intrude the two former groups and occur between Webber Ridge and Brown-McDade and to the very North of the area. This granitic episode can be correlated with the main Cordilleran batholith.

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The youngest rocks of the area are a number of porphyry bodies which cut through all the other rocks. They are supposedly of Tertiary age. Two main types can be distinguished: quartz - feldspar porphyries and feldspar porphyries. The geological maps indicate that the gold - silver mineralisations are related to these porphyries.

A set of faults which were probably active before the intrusion of the porphyries have disturbed the original geological setting. These fault zones were zones of weakness along which the porphyries intruded. They also seem to control the gold - silver mineralisation to a certain extent.
A younger fault system has offset the mineralized zones and all geologic units.

III. RESULTS

1. Molybdenum (Mo).

In the studied area molybdenum has proven to be virtually absent in the soil samples. In only about 20% of the samples the element was detected. Generally the detected values were 1 ppm, however one sample showed 4 ppm and one 8 ppm Mo. Due to the scarcity of Mo no contour map has been drawn and no statistical analysis has been undertaken. Although Mo - analyses have not been found suitable in the present survey, we feel it worthwhile that the element is analysed in future stream sampling projects and to a limited extent in systematic soil sample studies.

2. Copper (Cu) (Fig. 1 and 3).

In all the soil samples copper values were obtained, the variation being from 4 ppm to 231 ppm. The average copper value is 18.51 ppm. The arithmetic distribution shows strong negative skewness, most values laying between 4 and 20 ppm. For this reason all the values were plotted on logarithmic scale and showed an approximate lognormal distribution (see Fig.1). The statistical evaluations of the values followed the method given by C. Lepeltier (1969).

A lognormal distribution curve is defined by two parameters; one dependent on the mean value, and the other dependent on the character of value-distribution. Generally the lognormal law fits very well for low-grade deposits; however, in the case of high-grade deposits the experimental distributions are generally negatively skewed because of the limitations towards the high values.

A cumulative frequency curve has then been plotted; it gives the integral curve of the lognormal frequency distribution.

On probability log-paper the cumulative frequency of a lognormal distribution has the form of a straight line. This is shown inFig.3, where the values for copper fit fairly well a straight line between 1% and 94%, suggesting therefore a lognormal distribution. This was checked by a graphical test to test the hypothesis H_o that the straight line does represent a lognormal distribution at a 0.95 level of confidence (not shown on Fig. 3). Since the points fall within the graphically plotted confidence limits H_o could be confirmed.

As the cumulative frequency curve fits a lognormal distribution, the following parameters can be determined:

b = background, it gives an idea of the average concentration level of an element. In the case of a perfect lognormal distribution b corresponds with the mode (most frequent value), the median (50% of the values lie above and 50% of the values below b), and the geometric mean.

s = log s', it is the scatter of the values around b, the coefficient of deviation or standard deviation. 68.26% of the population falls between b-s and b+s.

$s' = \frac{b+s}{b}$, it is the geometric deviation.

$s'' = 100 \cdot s/b$, this is the relative deviation or the coefficient of variation.

t : Since log t = (log b) + 2s it follows:
$t = b \cdot s^2$, this is the threshold value.Statistically t depends on the probability level chosen; geologically Lepeltier (1969) takes it as the upper limit of fluctuation of b. The values equal or higher than t are considered to be anomalous.

Practically t and b are read directly on the graph as the abcissa of the intersection of the distribution line with the 2.5% ordinate and the 50% ordinate respectively. In other words, in a lognormal distribution approximately 2.5% of the values are anomalous. It is important to note the importance of the deviation (s) in the estimation of the threshold, since two population might have the same background (b) but different threshold (t) if their coefficients of deviation (s) are different.

In the studied area the parameters for copper are as follows:

b = 15 ppm (background)
s' = 1.87 (geometric deviation)
s = 0.27184 (coefficient of deviation, standard deviation).

s" = 1.8% (coefficient of variation)
t = 52.5 ppm (threshold)

It is interesting to note that the background value is approximately 3 ppm lower than the arithmetic mean. 15 ppm Cu must be considered the background value for the investigated area and values above 50 ppm Cu are anomalous. To simplify the distribution pattern, in the contour map (Fig.5), two contours have been drawn, 30 ppm and 50 ppm. According to the statistical analyses all areas within the 50 ppm contour lines must be considered as anomalous.

3. Zinc (Zn) (Fig. 2 and 3).

All samples showed zinc values, the arithmetic mean being 51.86 ppm. The 500 zinc analyses were plotted and statistically treated in the same manner as copper. The lognormal distribution histogram is given in Fig.2. The zinc distribution shows the same pattern as copper but indicates higher values. This is more evident on Fig.3, where the curve of the cumulative frequency distribution is a straight line between 1.5% and 99.9%. That is between these two limits the distribution is almost perfectly lognormal. Below 1.5% the values belong to a different lognormal distribution, indicated by the break in the line at 180 ppm. The following five parameters for Zn were obtained from the graph:

b = 39 ppm (background)
s' = 2.05 (geometric deviation)
s = 0.311 (coefficient of deviation)
s" = 0.7975% (coefficient of variation)
t = 164.1 ppm (threshold)

For zinc the background is 21.86 ppm lower than the arithmetic mean. In Fig.5 the zinc values are contoured at 100 ppm and 160 ppm. All the values laying within the 160 ppm contour are anomalous. A comparison of the zinc and copper values shows that the background of Cu is about half of that of zinc. The threshold value of copper is approximately three times smaller than that of zinc. This is a statistical evidence that in the investigated area zinc occurs in excess of copper. In other words, in a randomly selected soil sample one has to expect a higher zinc than copper content.

The parameters s' and s for zinc and copper have been found to be reasonably close; this is also graphically demonstrated by the two straight lines for Cu and Zn which are almost parallel (see Fig.3). These similarities indicate that the two populations, Cu and Zn, have an almost identical lognormal distribution, which means that the scattering of the Cu and Zn

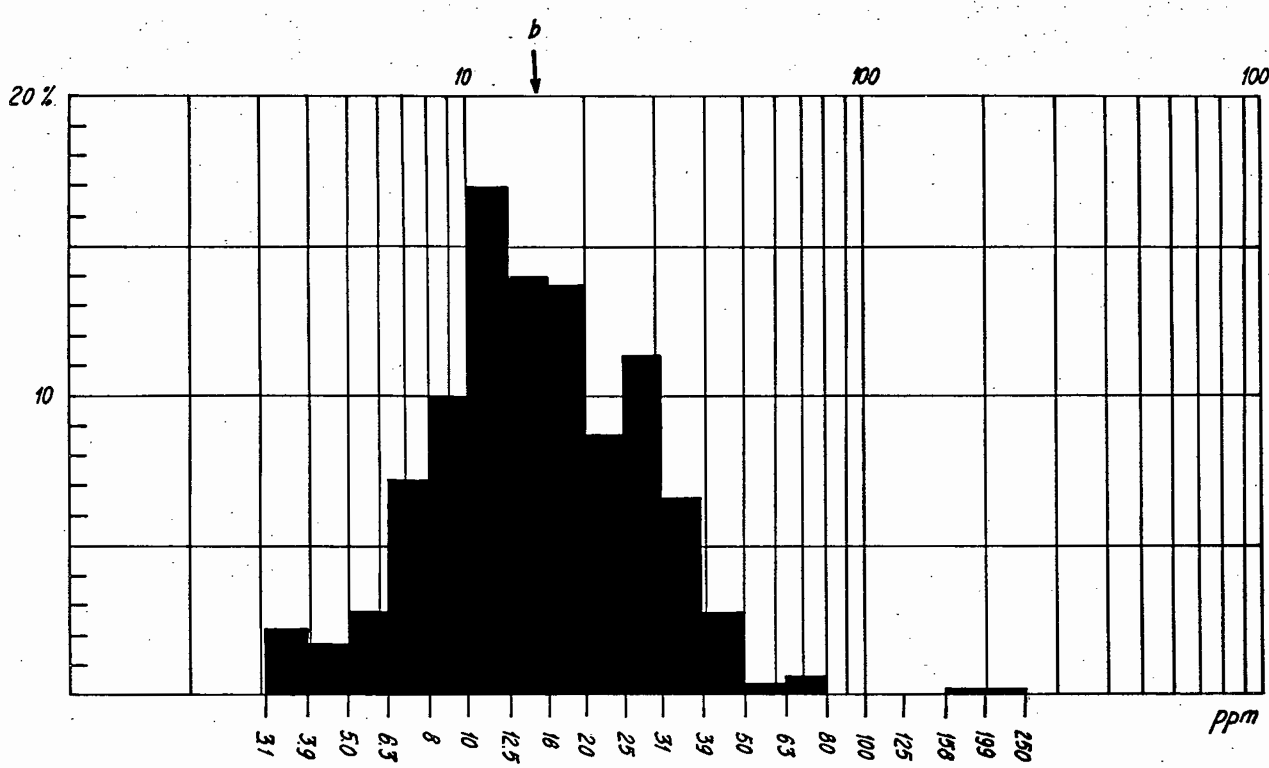


Fig. 1 : Histogram for Cu N = 499 b = 15 ppm

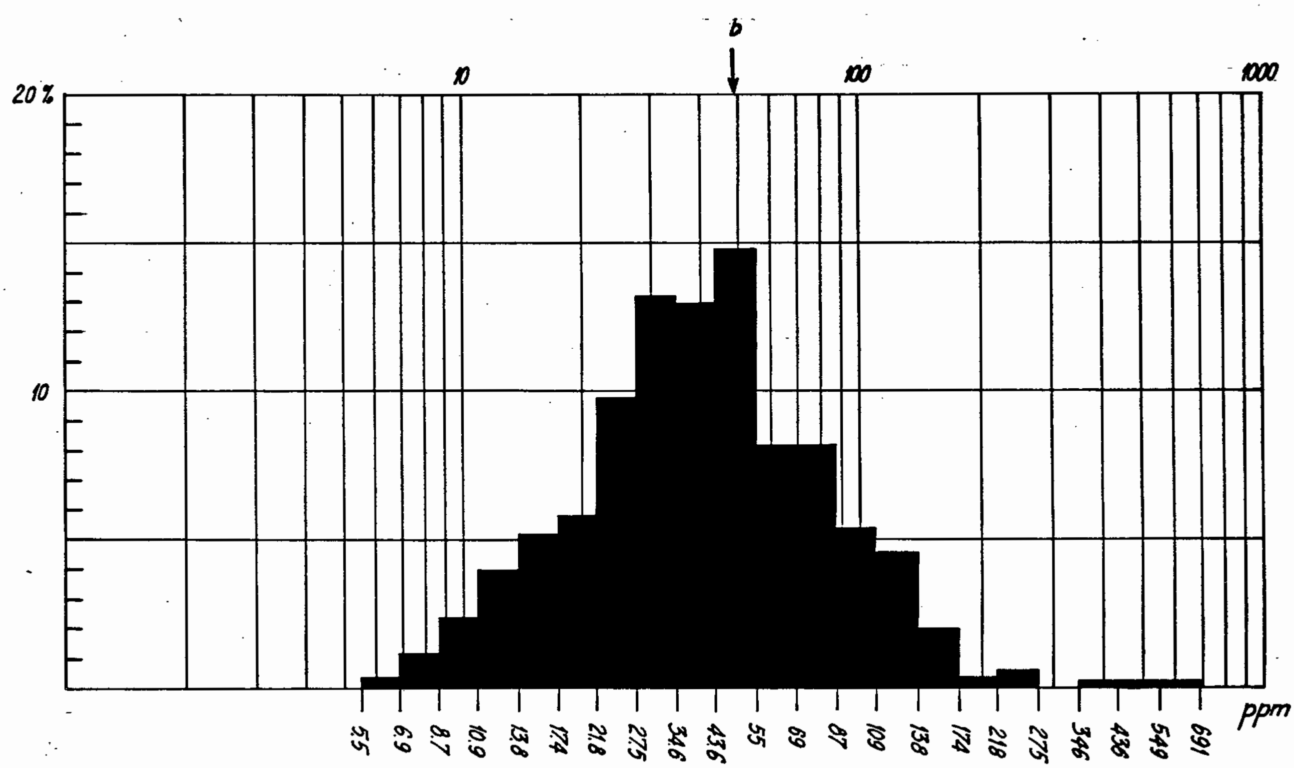


Fig. 2 : Histogram for Zn N = 499 b = 39 ppm

values around their background can be regarded as identical, even if the arithmetic values for Cu and Zn are vastly different.

IV. CORRELATION COPPER / ZINC

In a polymetallic mineralisation, with two or more elements lognormally distributed, a positive correlation between them can generally be expected. This geological relationship between two elements can be expressed by the coefficient of correlation r, which gives a rigorous measure of the degree of dependency. Lepeltier (1969) gives a graphical way to estimate r by constructing a correlation cloud in full logarithmic coordinantes. The cloud is divided into four sectors n_1, n_2, n_3, n_4 by plotting the background values of the two elements as abcissa and ordinate respectively (Fig.4). The number of points in each sector are counted and the coefficient of correlation calculated with the formula:

$$r = \sin\left[\frac{\pi}{2} \cdot \frac{N_1 - N_2}{N_1 + N_2}\right]$$

In the investigated area the coefficient of correlation between zinc and copper is:

$$r = +\ 0.62$$

The cloud has elliptical shape with the main axis sloping + 45°. Since +1 represent perfect correlation and 0 no correlation, the value +0.62 represents a rather weak positive correlation. Geologically this means that the spatial patterns of the zinc and copper distribution are similar only to a limited extent (see Fig.5). In other words, copper can not be used as a pathfinder for zinc and viceversa.

V. GEOLOGICAL IMPLICATIONS

Fig.5 shows the geochemical anomalies of copper and zinc superimposed on the general geology. Also indicated are the silver/ arsenic anomalies obtained from the original geochemical survey carried out by Dolmage, Campbell and Associates, 1967. In connection with the present study the silver and arsenic values of the 1967 survey were statistically treated in the same fashion as the Cu and Zn values. The anomalies given by Dolmage Campbell have subsequently been modified in Fig.5.

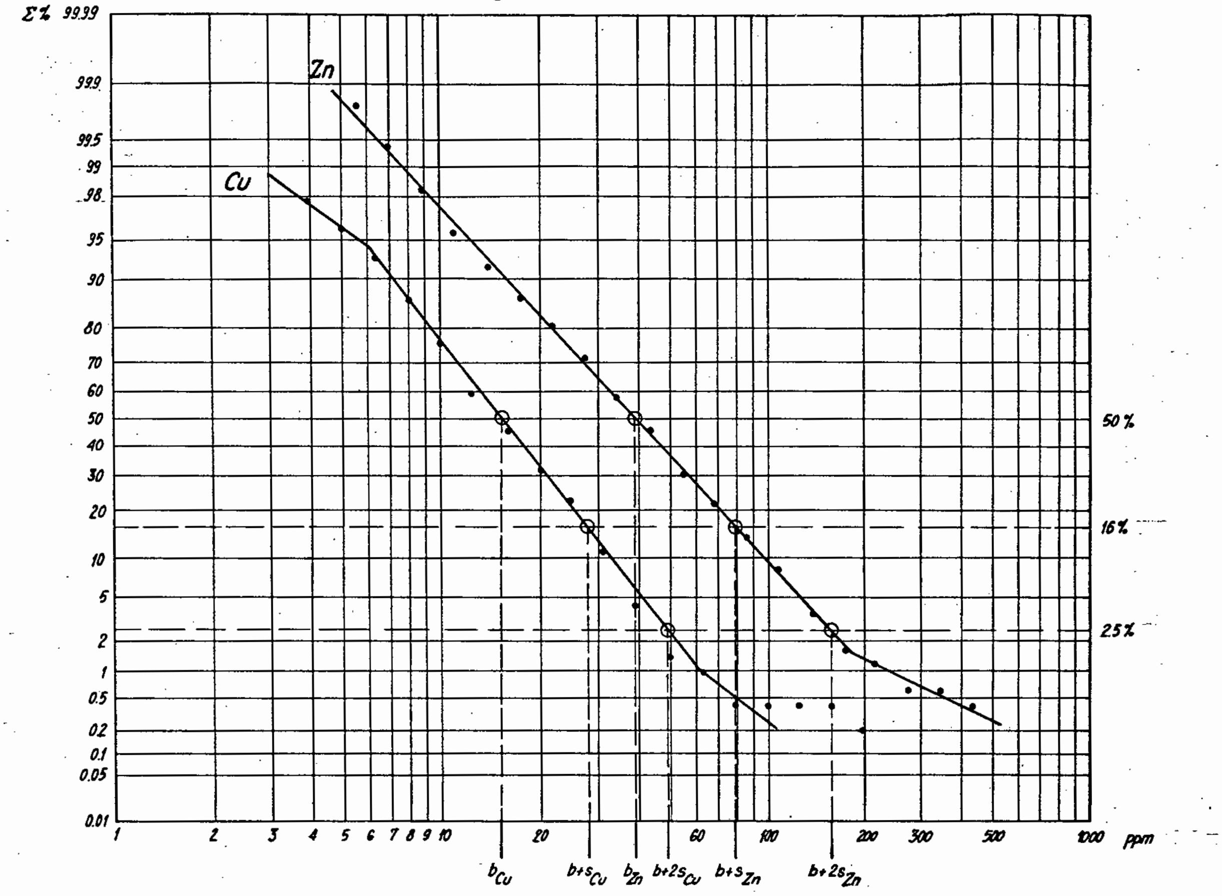


Fig. 3: Cumulative Frequency Distribution for Cu and Zn.

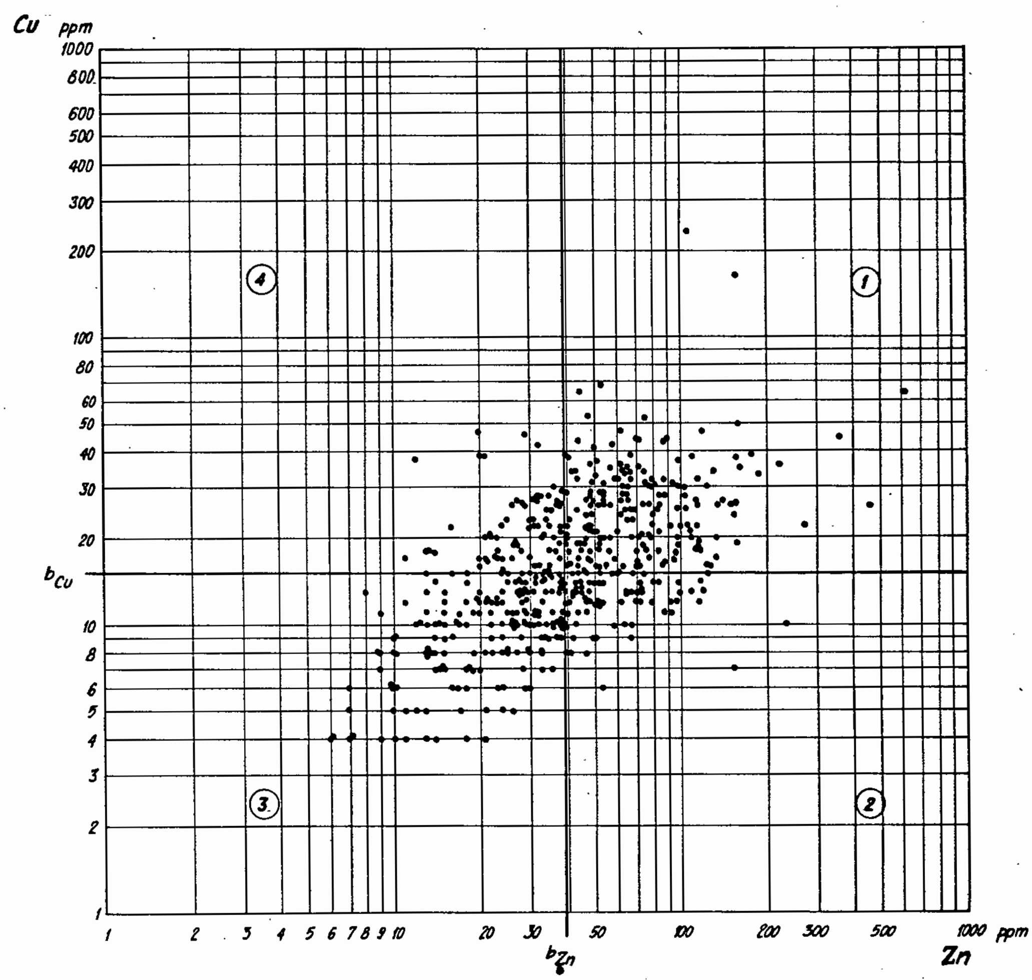


Fig. 4 : Correlation diagram Cu/Zn $r = +0.62$

Most silver/arsenic anomalies in the southern portion can only be classified as "suspected" anomalies since their values are lower than the threshold values, or not anomalous.

As indicated by Figure 5, five strong copper anomalies and eight strong zinc anomalies have been detected. In the North corner of the area two anomalies of copper and zinc are superimposed. Minor superimposed anomalies of the two elements occur in the central part of the area. All anomalies exhibit somewhat circular outlines with diameters of up to 1,500 ft. It is interesting to note that most of the common copper/zinc anomalies lie on the more linear, generally North-South trending, silver/arsenic anomalies. They furthermore seem to be associated with the porphyry plugs. From the map it also becomes apparent,that the silver/arsenic anomalies are possibly related to the porphyry intrusions,and that they are furthermore controlled by the major faults.

The geological genetical distribution of the Cu, Zn, Ag/As-anomalies indicates not only a close relationship among the four elements but also among the four elements as a group and the porphyry bodies. This suggests that the Cu anomalies might be caused by low-grade disseminated copper mineralisations within the porphyry bodies. This type of copper mineralisation has been found at Casino Silver Mines. It must be stressed, however, that firstly the anomalies are based on a too largely spaced sampling grid, and secondly that the anomalies do not give any indication on the size and grade of the copper mineralisation by which they were caused. <u>They only outline target areas for further detailed exploration</u>.

VI. <u>CONCLUSIONS</u>

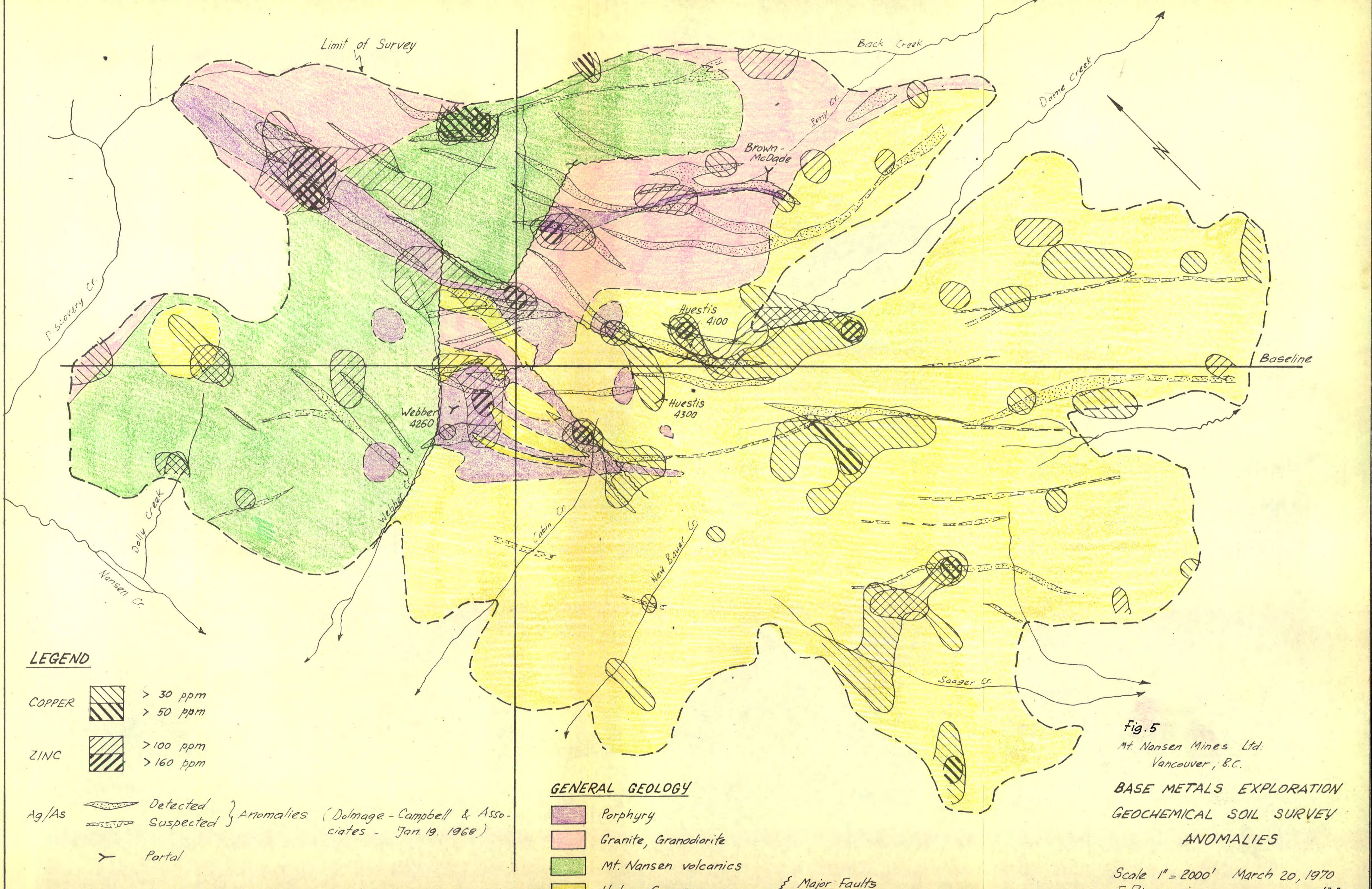
The discussed geochemical survey has been primarily undertaken to investigate the following points:

i) if the copper anomalies show a significant pattern;
ii) if they are related to the silver/arsenic anomalies;
iii) if they are related to the porphyry bodies.

As was demonstrated earlier all these points could be answered positively. There is a close relationship between copper/zinc anomalies, silver/arsenic anomalies and porphyry bodies.

VII. <u>RECOMMENDATIONS</u>

As can be seen from Figure 6 the present soil sampling survey covers only the South-East corner of our entire property. The



Limit of Survey
Back Creek
Dome Creek
Pony Cr.
Brown-McDade
Discovery Cr.
Huestis 4100
Huestis 4300
Baseline
Webber 4260
Webber Cr.
Cabin Cr.
New Bauer Cr.
Dolly Creek
Nansen Cr.
Saager Cr.
LEGEND
COPPER
> 30 ppm
> 50 ppm
ZINC
> 100 ppm
> 160 ppm
Ag/As
Detected
Suspected
Anomalies (Dolmage-Campbell & Associates - Jan. 19. 1968)
Portal
GENERAL GEOLOGY
Porphyry
Granite, Granodiorite
Mt. Nansen volcanics
Yukon Group
Major Faults
Fig. 5
Mt. Nansen Mines Ltd.
Vancouver, B.C.
BASE METALS EXPLORATION
GEOCHEMICAL SOIL SURVEY
ANOMALIES
Scale 1" = 2000'
March 20, 1970
F. Bianconi

obtained results therefore definitely warrant an extension of the geochemical exploration over the entire area. A further reason for expending the exploration is given by the presence of a large porphyry body in the Northern section of our property as indicated by the regional geologic map of Bostock (1936).

In order to avoid expensive systematical soil sampling in the presently unexplored area, it is recommended to carry out a stream sampling program. Using this method the sediments are collected systematically in all the streams and creeks. This should give almost total coverage of the whole prospecting area, since Nansen Creek and Victoria Creek together with their subsidaries drain the Mount Nansen property in an almost perfect and very detailed way (see Figure 6). By doing a stream sampling survey it is anticipated that the area can be geochemically covered in a period of about six weeks. Such a survey should then outline target areas for detailed soil sampling programs, analogous to the above discussed initial geochemical survey.

For the recommended stream sampling survey a field party of four people is considered to be a minimum, especially if some regional geological mapping is carried out. Due to the relatively large extent of the area and the rugged terrain, a versatile four-wheel drive vehicle is a <u>must</u> to give quick access to the entire area and to facilitate transport, and to minimize timeconsuming camping as much as possible. Unfortunately none of our companies is in possesion of such a vehicle which can be operated on a cheap basis. A so called "Pug" was therefore put into the attached budget. The field period for such a program is generally from the beginning of June until middle of September.

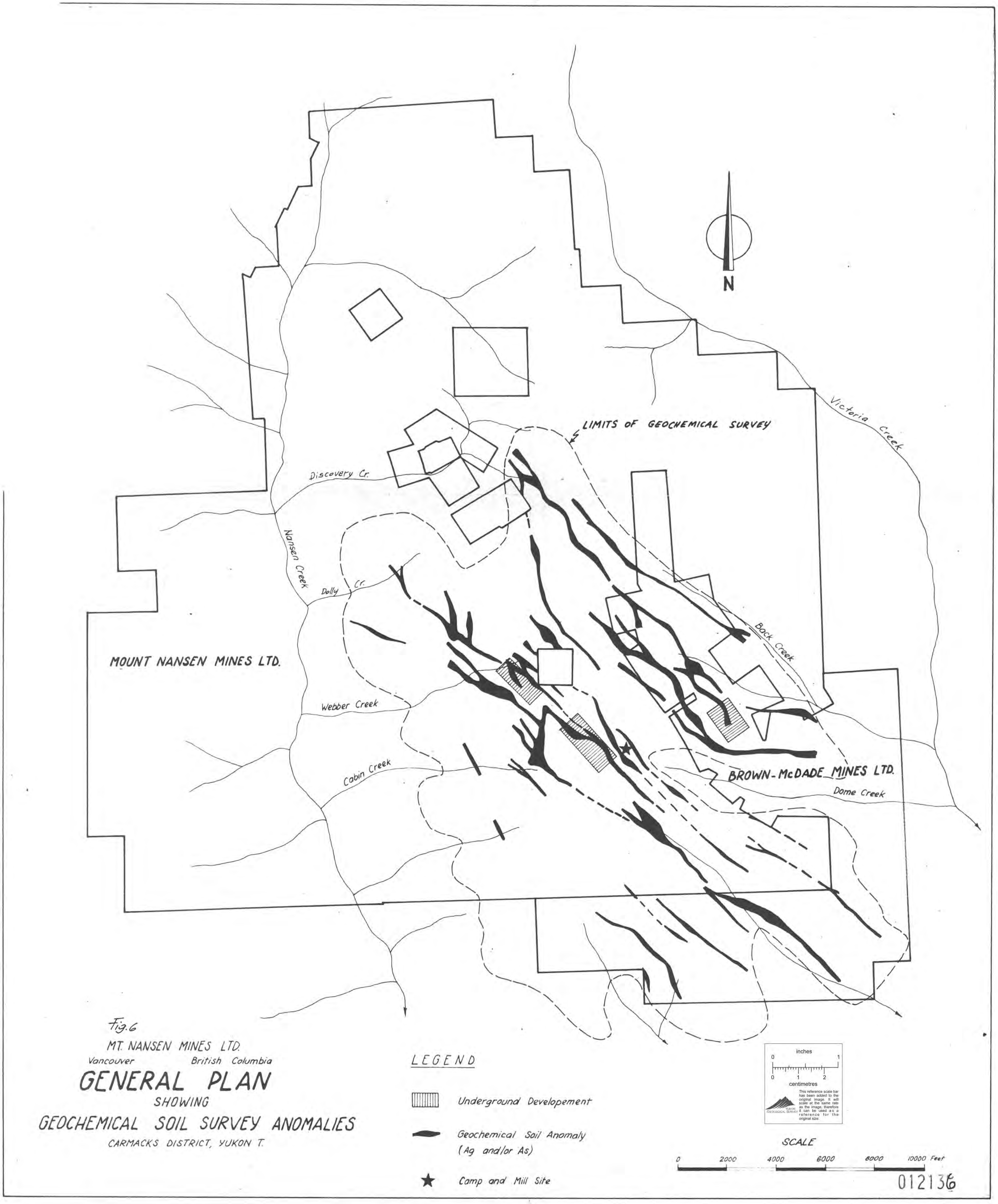


Fig. 6

MT. NANSEN MINES LTD.

Vancouver British Columbia

GENERAL PLAN

SHOWING

GEOCHEMICAL SOIL SURVEY ANOMALIES

CARMACKS DISTRICT, YUKON T.

VIII. ESTIMATED DIRECT COSTS OF STREAM SAMPLING

Equipment

1 Pug with camper 1 Tent Cooking Equipment	$ 3,500.00
Food	1,500.00
Salary (1 helper)	500.00
6 Tickets Vancouver - Whitehorse return	1,000.00
General Expenses	500.00
Gas	500.00
Field equipment (for sampling, etc.)	500.00
Chemical analyses	5,000.00
	$13,000.00
Contingencies	1,500.00
Total	$14,500.00

Fieldtime: approximately 6 weeks

Crew: 4 (R.Saager, F.Bianconi, 2 Students as helpers or 2 Students and M. Swizinsky.)

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vs

F. Bianconi — Dr. F. Bianconi

R. Saager — Dr. R. Saager