Dept. of Indian Affairs & Northern Development
Resource & Economic Development Group
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Whitehorse Mining District
Office of The Mining Recorder

GEOLOGICAL, GEOCHEMICAL, & GEOPHYSICAL REPORT ON THE PDM 1-144 CLAIM GROUP 105-J-13 FOR PHELPS DODGE CORPORATION OF CANADA, LTD.

BY
R.G. HILKER LTD.

OCTOBER 23, 1972

This report has been examined by the Geological Evaluation Unit and is recommended to the Commissioner to be considered as representation work in the amount of $ 26,993.13

Resident ~~Geologist~~ or
~~Resident Mining Engineer~~

Considered as representation work under Section 53 (4) Yukon Quartz Mining Act.

Commissioner of Yukon Territory

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RES. 668-2822
AREA CODE 403

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GEOLOGICAL, GEOCHEMICAL AND GEOPHYSICAL REPORT ON THE

PDM1-144 (Y56385-Y56464, Y56313-Y56376) YUKON QUARTZ MINERAL CLAIMS

SOUTH MACMILLAN RIVER AREA
YUKON TERRITORY

LATITUDE 62°51' N

LONGITUDE 131°38' W

N.T.S. DESIGNATION
105-J-13
WATSON LAKE MINING DIVISION

JUNE 16th to AUGUST 7th, 1972

FOR

PHELPS DODGE CORPORATION OF CANADA, LIMITED
TORONTO, ONTARIO - VANCOUVER, B.C.

BY

R.G. HILKER, P.ENG.
AND
G.G. CARLSON, P.ENG.
R.G. HILKER LIMITED

OCTOBER 23, 1972

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INTRODUCTION

The PDM 1 - 144 claim group is located 5 miles north of the South Macmillan River, Yukon Territory, on claim sheet 105-J-13, Watson Lake Mining Division (see Sketch no. 1). The nearest settlement, Ross River, is located 66 miles to the south-southwest.

The claims were staked during the fall of 1971 over an intrusive plug and adjacent sediments that coincide with a geochemical anomaly defined by a regional soil sampling program. The claims are centered at approximately 62°51' N Latitude and 131°38' W Longitude (see Sketch no. 2).

The present field program, conducted between June 21 and August 7, 1972, consisted of geological mapping, soil and silt sampling, local magnetometer surveys, and a blasting and trenching program in the area of mineralization.

The field crew consisted of two geologists, two prospectors, two geochemical sampling crews of two members each, a camp helper and pH tester, a cook, and helicopter crew consisting of pilot and helper. A total of 40 geology traverses, 30 prospecting traverses, 43 geochemical sampling traverses and 4 magnetometer traverses were conducted. Approximately half of the PDM claim posts were tagged. Four trenches were blasted in an effort to reach solid, unweathered bedrock for sampling.

The geology, geochemistry and magnetometer survey information has been plotted on the accompanying plans. Four base maps, at 400 feet to the inch (approximately) cover the claim group and the surrounding area. Reconnaissance sampling has been plotted

at ½ mile to the inch. A more detailed map, at approximately 200 feet to the inch, was prepared in the field to cover the area of the intrusive plug, particularly in areas of strongest mineralization.

Pyrrhotite and chalcopyrite mineralization occurs within the intrusive in an apparently discontinuous northeasterly trending band. The sulfides are disseminated, in low concentration, over a large portion of the surface exposure of the intrusive. More heavily mineralized zones, within which the sulfides occur both along fractures and as disseminations, occur more locally within this area. Assays of surface and trench samples indicate that the grade of copper mineralization within these higher grade zones is below economic consideration.

The geochemistry survey successfully outlines mineralized zones within the intrusive. Copper is apparently concentrated within the thin soils on the mountain slopes, and thus extremely well defined copper anomalies are obtained.

Both a copper and a molybdenum halo anomaly occur within the area of the sedimentary rocks adjacent to the intrusive. Other more localized copper anomalies within this area have no apparent association, except possibly with the fracture set which is host to mineralization within the intrusive.

A magnetometer survey within the valley adjacent to the campsite, north of Thunderhead Peak, failed to detect the strong, north-south aeromagnetic anomaly (G.S.C. Paper 4391G). A detailed magnetometer

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survey within the intrusive body shows weak anomalies which correlate well with the mineralized zones and the geochemistry anomalies.

Following is a brief discussion of the geology and mineralization and the geochemistry and magnetics results.

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LIST OF PERSONNEL

The following personnel of the firm of R.G. Hilker Limited were directly involved in the exploration program on the PDM 1 - 144 claim group, on behalf of Phelps Dodge Corporation of Canada, Limited:

Name	Address	Date	Position
R.G. Hilker	Box 4008 Whitehorse, Y.T.	June 16 - Aug. 9	Supervision
G.G Carlson	Box 4008 Whitehorse, Y.T.	June 16 - Aug. 20	Geologist
B.E. Slater	3509 Centre "B" St. N.W., Calgary, Alta.	June 15 - Aug. 9	3rd year Student Geologist
J.I. Greer	11 Koidern Ave. Whitehorse, Y.T.	June 15 - Aug. 6	Soil sampler
G.E. Hillson	306 - 503 Hoge St. Whitehorse, Y.T.	June 15 - Aug. 6	Soil sampler
J.R. Metcalfe	6 Tutshi Rd. Whitehorse, Y.T.	June 30 - Aug. 6	Soil sampler
N.I. Larsen	Parry, Sask.	June 30 - Aug. 5	Soil sampler
W.G. McTaggart	Box 580 Stettler, Alta.	June 30 - Aug. 6	Sampler assistant
G.R. Craft	Box 28 Atlin, B.C.	June 18 - July 24	Prospector
P. Nieman	Box 4472 Whitehorse, Y.T.	June 15 - July 22	Cook
L. Roy	General Delivery Whitehorse, Y.T.	July 24 - Aug. 7	Cook
M.L. Smith	51 Liard Rd. Whitehorse, Y.T.	June 1 - Oct. 4	Draftsman

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LOCATION AND ACCESS

The PDM 1 - 144 claim group is located 66 miles northeast of Ross River on the north side of the South Macmillan River. A small lake, located approximately three miles north of the claim group, is suitable for landing a float equipped Beaver aircraft. A twelve man camp was established on the small lake and was named "Watson Lake". Access to Watson Lake was by a Territorial Airways Ltd. Beaver aircraft and a Bell 8-2 helicopter which was based at the campsite. Transportation of field personnel was by helicopter from the campsite on Watson Lake to the PDM claim group.

The claim group, latitude 62°51'N longitude 131°38'W is situated about 24 miles west of Mile 62 of the North Canol Road (north of Ross River). Mile 62, North Canol Road, is located on the south end of Dragon Lake.

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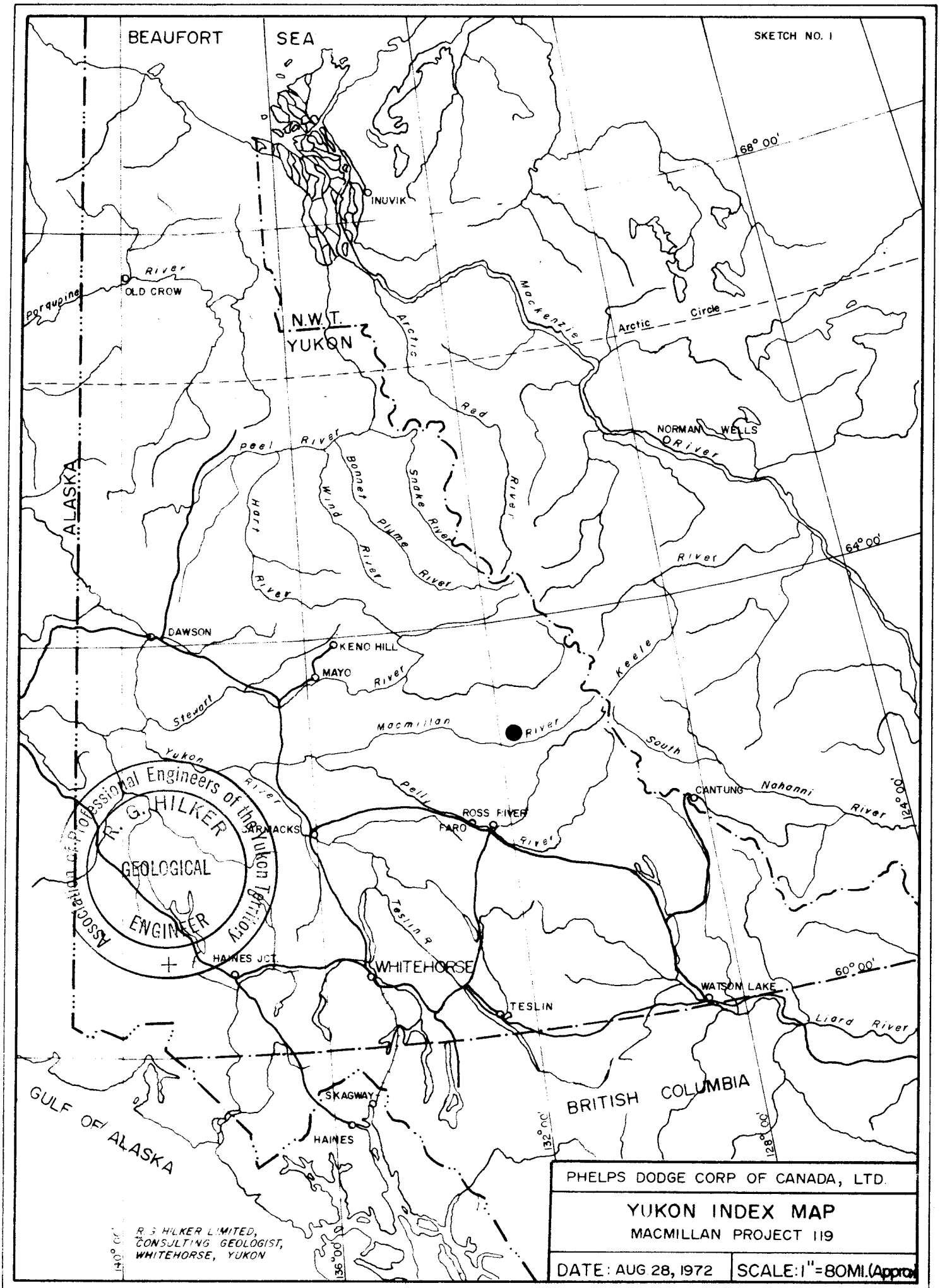
SKETCH NO. 1
BEAUFORT SEA
INUVIK
OLD CROW
Porcupine River
N.W.T.
YUKON
ALASKA
Arctic Circle
Mackenzie
Arctic
Red River
Peel River
Hart River
Wind River
Bonnet Plume River
Snake River
NORMAN WELLS
River
68° 00'
64° 00'
DAWSON
KENO HILL
MAYO
Stewart River
Macmillan River
Keele
South Nahanni River
CANTUNG
124° 00'
ROSS RIVER
FARO
Pelly River
Yukon River
CARMACKS
Teslin R.
HAINES JCT.
WHITEHORSE
TESLIN
WATSON LAKE
60° 00'
Liard River
BRITISH COLUMBIA
SKAGWAY
HAINES
GULF OF ALASKA
132° 00'
128° 00'
136° 00'
Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL
ENGINEER
R. G. HILKER LIMITED,
CONSULTING GEOLOGIST,
WHITEHORSE, YUKON
PHELPS DODGE CORP OF CANADA, LTD.
YUKON INDEX MAP
MACMILLAN PROJECT 119
DATE: AUG 28, 1972
SCALE: 1" = 80MI. (Approx)

CLAIMS

The following claims are located north of the Macmillan River on Sheet 105-J-13 in the Watson Lake Mining District, Y.T., Latitude 62°51'N and Longitude 131°38'W. The registered owner of the claims is Phelps Dodge Corporation of Canada, Limited.

Claim Name & No.	Grant Number	Anniversary Date
PDM 1 - 24	Y56385 - Y56408 (incl.)	Nov. 12, 1972
PDM 25 - 48	Y56409 - Y56432 (incl.)	Nov. 12, 1972
PDM 49 - 64	Y56433 - Y56448 (incl.)	Nov. 12, 1972
PDM 65 - 80	Y56449 - Y56464 (incl.)	Nov. 12, 1972
PDM 81 - 96	Y56313 - Y56328 (incl.)	Oct. 28, 1972
PDM 97 - 112	Y56329 - Y56344 (incl.)	Oct. 28, 1972
PDM 113 - 128	Y56345 - Y56360 (incl.)	Oct. 28, 1972
PDM 129 - 144	Y56361 - Y56376 (incl.)	Oct. 28, 1972

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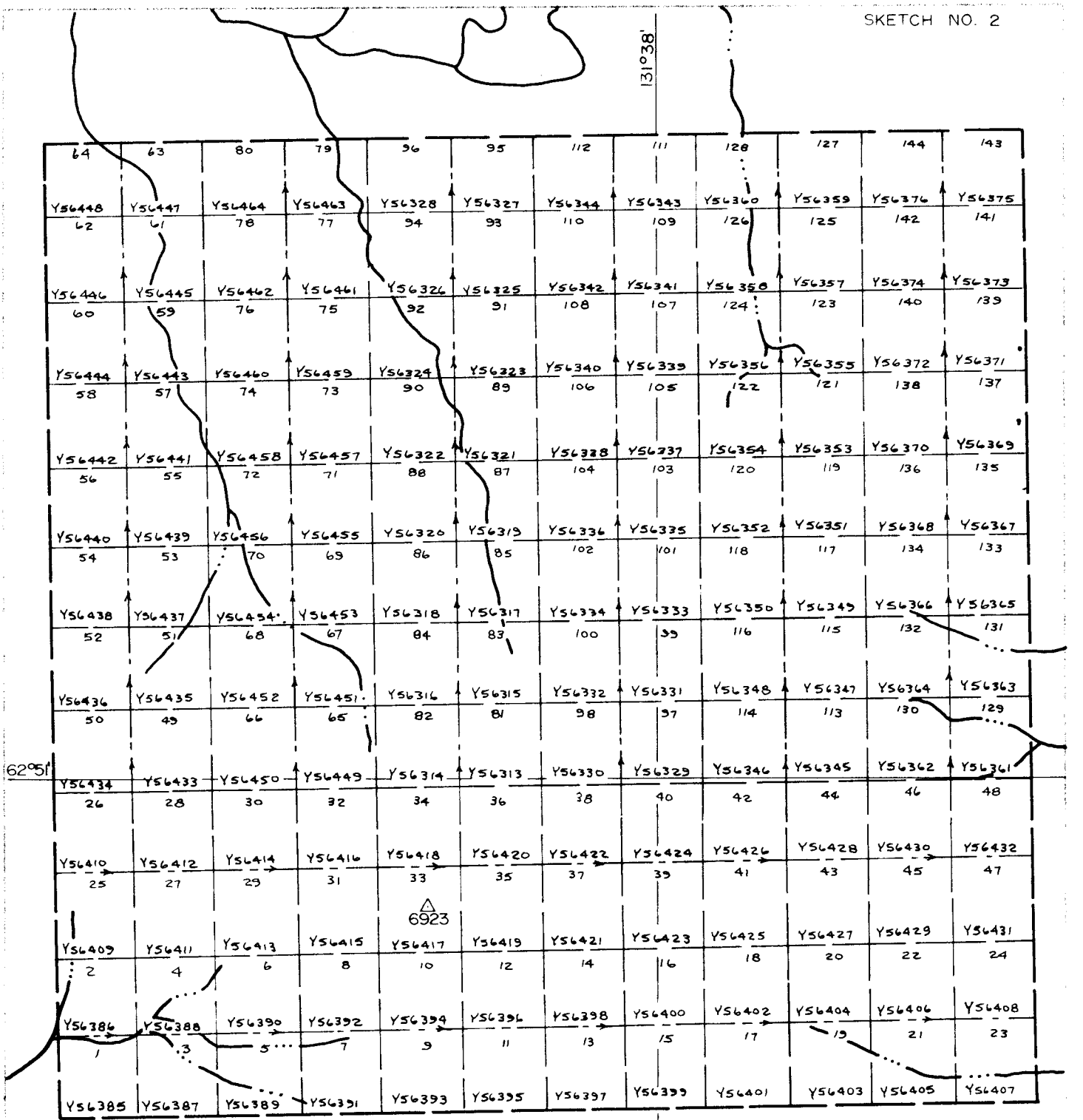
SKETCH NO. 2



Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL
ENGINEER

SKETCH NO. 2

CLAIMS SKETCH - PDM 1-144

GEOLOGY

TABLE OF FORMATIONS

CENOZOIC

QUATERNARY

3 Unconsolidated alluvial deposits, unconsolidated glacial and alluvial deposits.

MESOZOIC

CRETACEOUS (?)

2 Intrusive, biotite hornblende granodiorite, quartz monzonite.

PALAEOZOIC

ORDOVICIAN AND SILURIAN

1 Sedimentary rocks:
1q - quartzite, 1h - chert, 1c - conglomerate,
1p - cherty pebble conglomerate, 1m - metasediments,
1t - slate, 1s - shaley (banded) siltstone.

After J.A. Roddick and L.H. Greene
Map 12-1961 Geology Sheldon Lake

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REFERENCE TO PUBLISHED GEOLOGY & GEOPHYSICS

The PDM 1 - 144 claim group is located within the Sheldon Lake geology map sheet. The area has also been covered by airborne magnetics.

1. Geology Map 12-1961, Sheldon Lake, Yukon Territory - Scale: 1 inch to Four miles 1/253,440. Geology by J.A. Roddick 1958, 1960 and L.H. Green, 1960 - Geological Survey of Canada, 1961.
2. Paper 45-21 Geological Survey of Canada
   Map P45-21A Geological Survey of Canada
3. Geophysics Paper 4391
   Map 4391G - Sheet 105-J-13, Yukon Territory - Scale: 1" = 1 mile
   Geological Survey of Canada

GEOLOGY

The sediments within the claim group are a part of a thick sequence of Ordovician and Silurian cherts, shales, fragmental and related rocks. Slaty siltstone and quartzite, chert and cherty pebble conglomerate are dominant within the claim group. Bedding and banding show a dominant northwest trend with very steep dips. A typical metamorphic aureole is not strongly evident adjacent to the intrusive. However, a strong pyrite halo has been developed, with associated minor copper, as indicated by the strong gossan zones and preliminary geochemical results.

Structurally, the sediments show little deformation. A strong slaty cleavage is frequently developed parallel to the banding. Relatively tight drag folding, with a horizontal east-west fold axis, is evident in some beds. Rarely, this folding shows subsequent deformation by a gentle undulation with an approximate north-south axis, although this feature is vague.

No strong marker horizon was observed within the sediments, and therefore fault activity especially associated with the intrusive, is uncertain. An abundance of siliceous fragmental rocks on the west side of the intrusive, with no observed counterpart along strike on the eastern side of the intrusive, may be an indication of displacement along a north-south plane through the intrusive or it may be simply a stratigraphic feature.

The intrusive itself is an oval shaped body, with dimensions 10,000 feet by 6,000 feet, and long axis striking approximately 80 degrees. All contacts dip steeply outwards except at higher

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elevations where the dip becomes more shallow, indicating that possibly the very top of the intrusive is here exposed.

The intrusive appears to have been passively emplaced, with the incorporation of abundant sedimentary material as indicated by small to medium sized mafic to siliceous xenoliths scattered in clusters through the exposed intrusive mass. The intrusive consists mainly of relatively fresh fine to medium grained biotite hornblende granodiorite to quartz monzonite. The biotite is typically coarse euhedral crystals, as is the plagioclase. Hornblende is frequently in long lathes, to one inch in length. Quartz and K-feldspar are mainly interstitial. Plagioclase averages 30 to 50 percent of the rock and orthoclase 10 to 15 percent, while quartz varies from 20 to 30 percent, biotite from 10 to 20 percent and hornblende from 5 to 10 percent.

Variations in the amounts of quartz, feldspars and mafics are evident within the intrusive. The Sanford thesis study (Bachelor's thesis at U.B.C., 1969) notes two trends. Orthoclase and plagioclase increase to the southeast with quartz and specific gravity increasing to the northwest. This concurs with the field observation that mineralization appears to be associated with quartz-lean rocks, and the mineralized zone is predominantly within the southeastern half of the intrusive body.

Also, third order trend surfaces indicate a roughly circular pattern within the intrusive, with quartz increasing and mafic minerals decreasing outwards. This effect is explained by Sanford as the result of the incorporation of siliceous sedimentary

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material along the contact zones.

Jointing and fracturing are strongly developed through most of the intrusive, and three dominant directions have been noted. The strongest of these, with average spacing frequently as low as 2 inches, strikes approximately 15° with vertical or steep westerly dip. The second is also strongly developed but is more widely spaced and is observed only locally within the intrusive. It is near vertical and strikes roughly parallel to the dominant trend in the sediments, at approximately 115°. The third direction is the most vague and is difficult to record. It is near horizontal, with gentle southerly and easterly dips, is very widely spaced and is observable mainly from a distance. Local small scale faulting and shearing parallels the 15° trend.

The detailed mapping of the intrusive (1" = 200', Detail Geology Plan) involved mainly the collection of samples and the measurement of fracture planes. Fracture density was defined as the number of observed fractures of a specific set in a three foot width. This information has been plotted on the Detail Geology Plan using symbols of variable length. Highest fracture density parallels the zones of strongest mineralization. The observed fractures are also frequently more intense along the ridges where weathering effects are stronger.

Alteration within the intrusive is not pronounced. An increase in the K-feldspar and greenish colouration of the plagioclase crystals is observed along fracture planes and up to ¼ inch into the rock. Alteration is strongest in the mineralized zones.

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Quartz fills many fractures, especially those with associated sulfides, although the fracture filling rarely exceeds 1/8 inch. Quartz also occurs with arsenopyrite in a small number of veins from ½ to 4 inches in width.

Mineralization within the intrusive occurs either as fine disseminations or small blebs within the rock, frequently associated closely with the mafic minerals, mainly hornblende, and along fractures with quartz. The most abundant sulfide is pyrrhotite, then chalcopyrite, arsenopyrite, and pyrite.

Disseminated sulfides, in extremely small trace amounts, can be observed through most of the intrusive. The strongest sulfides, however, occur along fractures. This type of mineralization is restricted in area of occurrence, and it is associated with a sharp increase in the amount of disseminated sulfides. The extent of these zones of significant mineralization has not been well defined due to highly broken and rather limited rock exposure in some areas and poor accessibility in others. The widespread zone of disseminated mineralization and the more localized zones of fracture and disseminated mineralization have been outlined on the Detail Geology Plan.

Field evidence indicates that mineralization, both iron and copper sulfides, have been leached to some extent from surface exposures of the granitic rocks. This has affected mainly the fracture mineralization and, to a lesser extent, the disseminated mineralization. The depth of the effect is uncertain, but it may be several tens of feet on the strongest fractures.

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Four trenches were blasted. Three of these, C-1 to C-3, are on top of the arête which crosses the 'Col Zone' and the fourth, Q-1, is on the southern edge of the 'Cirque Zone' on the upper cirque floor. All trenches were sampled except C-1, in which no significant mineralization was observed. The col trenches failed to penetrate truly fresh bedrock, although the density of open weathered fractures tends to decrease quite rapidly in the first two to five feet. The intensity of mineralization appears to be relatively consistent with depth in these trenches to a maximum depth of ten feet, except in the first one or two feet where all sulfides may be totally leached.

No sulfides were visible on the surface at the site of Q-1, although fracturing (fracture density 10 - 15) with minor associated quartz filling was observed. At a few inches depth, pyrrhotite and chalcopyrite are present thinly smeared along fractures spaced at 1½ to 3 inches. The depth of the trench is one to two feet and the length approximately five feet.

The following is a list of assay results with sample descriptions:

Sample No.	Description	Copper (%)
3365	C2-1 - Surface chip sample - 6 feet	0.046
3366	C2-2 - Random chip sample from muck	0.086
3367	C2-3 - Chip sample - 6 foot length, one foot depth	0.13
3368	C2-4 - Chip sample - 6 foot length, three foot depth	0.20
3369	C2-5 - Chip sample - 6 foot length, five foot depth	0.081

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Sample No.	Description	Copper (%)
3370	C3-1 - Chip sample - representative, 10 foot depth	0.02
3371	C3-2 - Chip sample - mineralized, fresh rock	0.05
3372	Q-1 - Chip sample - from one boulder	0.03

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GEOCHEMISTRY SURVEY

INTRODUCTION

The systematic sampling of soils and the subsequent analysis of these samples for trace amounts of copper and molybdenum has been successfully used throughout the Cordilleran region in the search for porphyry-type copper-molybdenum mineralization. This success has been extended to the Dawson Range, where several mineralized zones, including the Casino Silver Mines deposit, have been outlined by this technique.

For the successful application of a soil sampling survey, however, a careful study of all factors which might affect the geochemical characteristics of the soils, referred to here as the geochemical environment, must be undertaken. This environment is defined mainly by the characteristics of the soil, which are closely related to both topography and vegetation. A detailed description of these factors, along with the survey procedures and the interpretation of results follows.

FIELD METHODS

The soil sampling program was carried out using four samplers and one assistant. Samples were taken along traverses at 100 foot intervals and silt samples were collected from adjoining drainage systems. Sample material was taken, wherever possible, from the upper sand or clay soil horizon, at least a few inches below the upper humus layer using a 2½ lb. grubhoe. When soil material was not available for sampling, in areas of extensive outcrop or frost heaved and scree boulders which have obviously not been displaced too far downslope, a sample of three or four rock chips was collected. The sample material was collected in a pre-numbered Kraft paper sample bag, while notes on location, soil color and type, slope and grade direction, vegetation and any other pertinent data, were taken at each station. The samples were strung on wire, with approximately 30 samples per string, and hung at camp for partial drying.

In addition, the pH of each sample collected throughout the traverse area was tested using a LaMotte-Morgan Soil pH Testing Kit. Values are measured colorometrically to the nearest 0.2 pH unit, with an extimated accuracy of plus or minus 0.2 pH units.

SAMPLE HANDLING, ASSAYS & TREATMENT OF DATA

After collection, samples were wired in strings of 30 to 40 samples, partially dried, and then packed in burlap sacks for shipment to Whitehorse. At Whitehorse, the samples were crated and sent via CPAir Freight to the Phelps Dodge Laboratory in North Vancouver, where they were analyzed for copper. A limited number of molybdenum determinations were made on samples collected in June.

The analytical procedure at the geochemistry laboratory consists of drying and sieving the samples, saving the -80 mesh fraction. One gram of this fraction is digested using perchlorate and is then dissolved in hot aqua regia. This solution is evaporated to dryness overnight. The residual is dissolved in hydrochloric acid and this solution is brought to volume for final analysis. The solution is run for the specified elements on a Techtron AA-5 Digital atomic absorption unit. Results of the determinations of the elements were returned to Whitehorse by First Class Mail.

Certificates of Analysis, for all soil samples tested, from the Phelps Dodge Laboratory, are on file at the office of R.G. Hilker Limited, #8 Northern Metalic Bldg., Whitehorse, Yukon Territory.

The interpretation of geochemical data is often done with the calculation of a few simple statistics. The arithmetic mean and standard deviation have been calculated for all assay values, using the following formulae:

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$$\bar{x} = \frac{ppm}{n}$$

$$s = ((n\ ppm^2 - (ppm)^2)/(n(n-1)))^{1/2}$$

where: n = total number of values

ppm = sum of values

$\bar{x}$ = arithmetic mean

ppm^2 = sum of squares of values

s = standard deviation

For the present survey, extremely high values have been reduced to a common maximum value for the calculations. This is done to avoid the misleading influence these values have on the overall characteristics of the population.

The statistics, mean and standard deviation, are useful in the definition of statistical anomalies which may or may not be relevant in the survey area. Experiment and field experience have indicated that, assuming a lognormal distribution of values, and a value greater than $\bar{x}$ + 1s is statistically "possibly anomalous" and a value greater than $\bar{x}$ + 2s is "probably anomalous". These values, as calculated for the present survey, have been used as guidelines in contouring the geochemical survey maps (see Pocket).

The assumed lognormal distribution is monomodal. That is, there is ideally one set of values with its arithmetic mean substantially greater than its geometric mean (mode). However, field experience has shown that a true lognormal distribution rarely occurs, and that most trace metal populations* are a

*NOTE: "Population" is used here to mean the set of all measured values for any one element within the survey area, while "set" means any sub-set within a population as defined above.

combination of two or more distinct sets of values which reflect various bedrock and soil conditions.

A histogram on normal graph paper has been constructed for copper (Sketch #3). On the histogram, each separate set is indicated by a divergence from a typical lognormal curve. This is usually a hump in the curve which represents the approximate modal value of the set.

GEOCHEMISTRY INTERPRETATION

A total of 1752 soil, silt and rock chip samples were collected within the survey area and on reconnaissance traverses surrounding the survey area. The pH was determined colormetrically on all samples except the rock chips. The first few hundred samples were analyzed for copper and molybdenum, while the latter samples were analyzed only for copper. Results for the reconnaissance traverses are plotted on Sketches 4 to 15. Within the survey area, most results are plotted on the four 1 inch to 400 feet Geochemistry Survey Plans, while those results from over the intrusive rocks are plotted on the one inch to 200 feet Detail Geochemistry Plan.

It is obvious from a visual examination of results that the copper values have a very wide range and that a strong difference exists between the geochemistry over the granitic rocks and over the adjacent sediments.

Thus the histograms (Sketch #3) and the simple statistics have been computed in two groups, for values over the intrusive and over the sediments, and also for the combined values. The calculated statistics are as follows:

	Sediments	Intrusive	Combined
No. of values	1021	590	1611*
Mean	108	304	180
Standard Deviation	99	354	247

*NOTE: Not all results were available at the time of calculations of these statistics.

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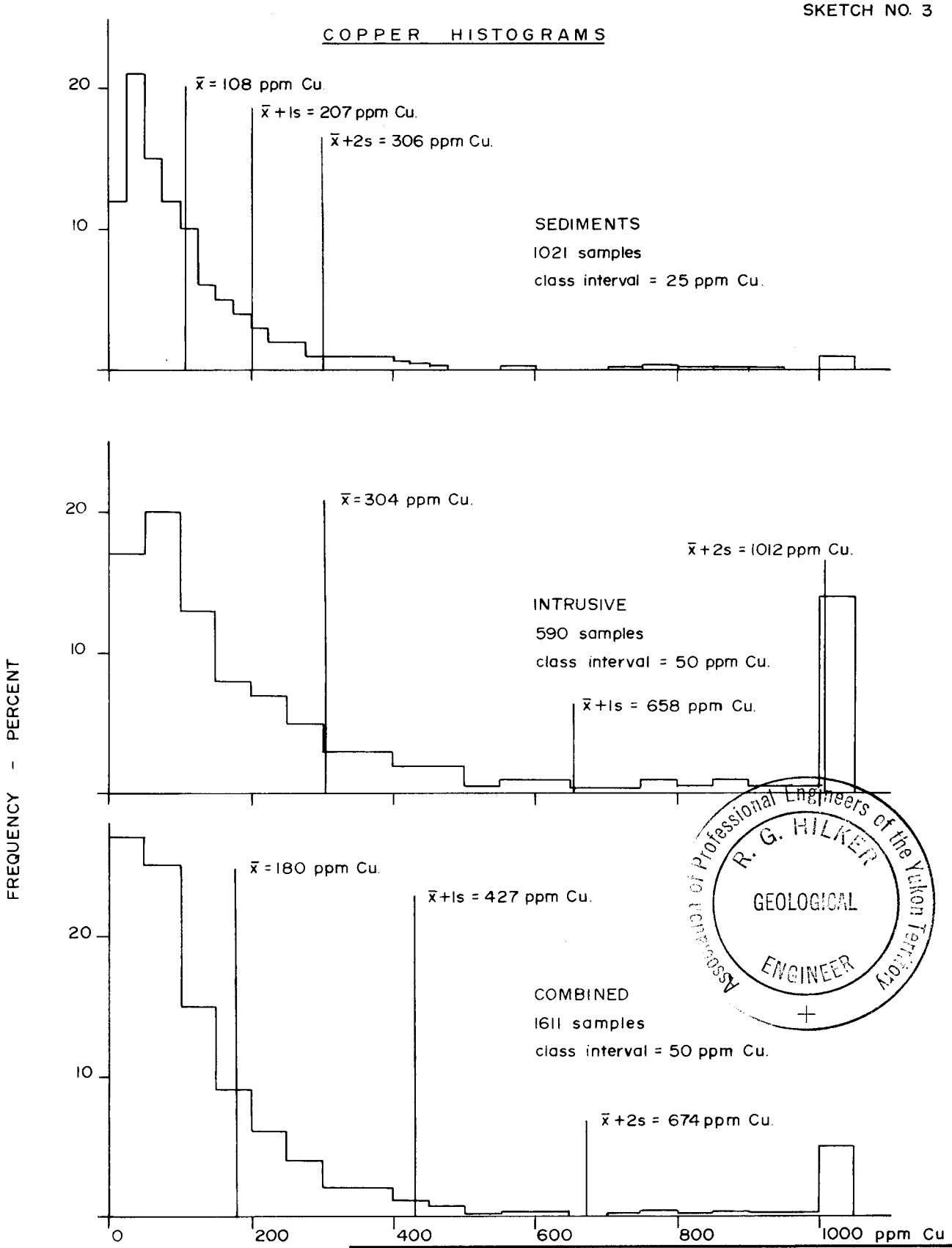
SKETCH NO. 3

COPPER HISTOGRAMS



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$\bar{x}$ = mean

s = standard deviation

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

COPPER HISTOGRAMS

NTS SHEET 105-J-13

SCALE:	DATE:	SURVEYED BY:	DRAWN BY:
AS SHOWN	AUG. 28, 1972	G.G.C.	MLS

Due to the irregular density of sample stations within the survey area, contouring of the data is rather difficult and probably not significant. However, an attempt was made to delineate anomalous zones on the Detail Geochemistry Plan by outlining areas of values predominantly greater than the mean plus two standard deviations (for the intrusive rocks) or 1000 p.p.m. copper.

The geochemistry over the sediments is relatively simple, although not fully explained. The pH depends on the pyrite content of the rock, and varies mainly from 4.0 to 6.2. Two types of copper anomaly are evident. The most extensive of these is a halo type anomaly around the intrusive and within ½ mile of the contact. Values range mainly between 200 and 600 p.p.m. copper, with associated high molybdenum. The second anomaly type is more localized with higher values. Two anomalies of this type occur north of the intrusive, on sheets 2 and 4. Molybdenum is quite strong with these two anomalies. These have been labelled Zone 2-1 and Zone 4-1 respectively. No anomalies were located by the reconnaissance traverses outside the survey area.

Rock samples were collected from both anomaly type areas and non-anomaly areas, and analyzed for copper (Sample nos. 15243 to 15262, 2101 to 2126 - traverse G-1, and 2127 to 2135). It was found that all copper values were the same or lower in the rock samples and that no strongly anomalous values were obtained. Thus it appears that the anomalous copper is derived not from the rocks but rather from the fracture systems which are associated probably with the

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intrusive. The stronger more localized anomalies are roughly on strike with the mineralized zone within the intrusive.

Distribution of copper values from over the intrusive rocks shows an extremely strong positive skew (see Histograms, sketch no. 3). When a maximum truncation value of 1000 p.p.m. is used in calculations, fourteen percent of all values are greater than the mean plus two standard deviation value of 1012 p.p.m. copper. This top fourteen percent of values is readily defined as the 'probably anomalous' values and it correlates strongly with the observed mineralization (see Detail Geochemistry Plan). However, these values are, as a rule, much higher than the concentration of copper in surface bedrock as determined by assay.

The few molybdenum values determined over the intrusive rocks are generally low, and this is consistent with the lack of observed molybdenite within the intrusive rocks.

The pH of the soils over the granitic rocks ranges mainly between 5.0 and 6.0, with some values as high as 7.2 and as low as 4.2. Thus, the copper should be somewhat chemically mobile. The reason for the concentration of copper in the fine soil fraction in these areas appears to be a result of the preferential weathering and dissolution of the copper sulfides, mainly along the accessible fracture planes, followed rapidly by co-precipitation with chemically stable hydrous iron oxides.

Thus the major dispersion of copper is through mechanical means down slope and in stream sediments. Although the surface rock

rock samples have been leached to some extent of their copper mineralization, it is felt that some of the soil values encountered, especially those in the 5000 p.p.m. to 8000 p.p.m. copper range, have been concentrated beyond the amounts originally present in bedrock.

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MAGNETICS SURVEY

INSTRUMENTATION

The field survey instrument used was a Scintrex Model MF-2 vertical field fluxgate magnetometer, Serial Number 002132. This is a second generation transistorized, integrated circuit instrument which retains the sensitivity of the older MF-1 units, but has greater temperature stability. A copy of the manufacturer's specification sheet is found in the Appendix of this report.

For the field survey, the MF-2 magnetometer was set to read 1600 gammas full scale, or 50 gammas per scale division. Normal field practice is to read to ½ of a scale division, giving rise to a readability of 25 gammas. This precision was maintained throughout the survey.

The Scintrex MF-2 vertical field fluxgate Magnetometer used to conduct the magnetic survey over the area has the following instrument manufacturer's specifications:

Maximum sensitivity: 20 gammas per scale division on 1000 gamma range
50 gammas per scale division on 3000 gamma range

Readability: 10 gamma or ½ scale division on 1000 gamma range and 25 gammas or ½ scale division on 3000 gamma range

Ranges: 1,000 - 3,000 - 10,000 - 30,000 - 100,000 gammas

Maximum range: ± 100,000 gammas

Latitude Adjustment Ranges: 10,000 to 75,000 gammas: Northern Hemisphere

Power Source: 12 "C" cell flashlight batteries

The fluxgate magnetometer as defined by M.B. Dobrin in the text book "Introduction to Geophysical Prospecting," is as follows:

"The fluxgate magnetometer, also known as the saturable reactor, makes use of a ferromagnetic element of such high permeability that the earth's field can induce a magnetization that is a substantial proportion of the saturation value. If this field is superimposed upon a cyclic field induced by a sufficiently large alternating current in a coil around the magnet, the resultant field will saturate the core. The phase of each energizing cycle at which saturation is reached gives a measure of the earth's ambient field."

The MF-2 Fluxgate Magnetometer measures the vertical component of total magnetic field. The instrument does not require a tripod and only needs to be oriented in the general north magnetic pole direction. The sensitivity of the instrument cannot be changed except by rough handling of the instrument. The MF-1 magnetometer reads directly in gammas.

The following is quoted from the Scintrex Data Sheet:

"The MF-2 is a completely new concept in vertical force fluxgate magnetometers. These instruments which are designed for fast and accurate mineral ground surveys, are orientation independent, self levelling, and require no tripod."

The MF-2 combines in one compact 5½ pound package electronics, sensor, and rechargeable batteries. With the latest I.C. and F.E.T. circuitry and high precision components, a temperature stability better than 1 gamma per degree is standard (with .24 gamma on

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special order) over a range of -40° to +40° centigrade.

The instrument has a built-in hemisphere polarity switch providing two overlapping ranges. For the Northern hemisphere the full range is +80,000 to -20,000 gammas, and reversible for the Southern hemisphere.

A calibrated feedback system can be provided which makes it possible to determine the total vertical component strength.

Measuring accuracy, on the 100 gamma scale is 0.5 gamma, and on the 1000 gamma scale 5 gammas. The Scintrex MF series of magnetometers has been in use for many years in varied applications, e.g. ground reconnaissance, base station recording and monitoring, study of magnetic properties of rocks, observatory monitoring and recording of both vertical and horizontal components.

PERSONNEL

The field work was conducted by Mr. B. Slater, during the period of June 15th to August 8th, 1972, inclusive, under the supervision of R. G. Hilker, Consulting Geologist and Professional Engineer, Whitehorse, Yukon Territory. Mr. Hilker supervised the data calculations and presentation of results. The magnetics interpretation was written by R.G. Hilker and G.G. Carlson, P.Eng. The preparation work was done in Whitehorse between August 8th and October 1st, 1972.

MAGNETICS FIELD METHOD

The magnetics survey was carried out by taking a magnetometer reading at each 100 foot station over the mineralized zones within the intrusive rock area. The geochemistry soil stations were used for horizontal control.

A Base Control Station (BCS), was located at the campsite, and given an arbitrary value of 2000 gammas. From this BCS station, secondary Control Stations (CS1, CS2, CS3) were carefully established from the BCS in the "Spire" and "Cirque" Zones.

The gamma value at a CS was determined by taking an instrument reading at the BCS, then at the CS, and a return check instrument reading at the BCS in the minimum length of time to fly by helicopter between the two points. The difference was averaged and the procedure repeated several times to ensure an accurate difference in gamma value was established between the arbitrary 2000 gamma value at the BCS and the CS that was being determined.

During the actual survey, a check reading was taken at the CS periodically in order that the magnetic diurnal variations in the magnetic field could be determined and calculated, plus or minus for the correct value of each 100 foot spaced station.

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MAGNETICS RESULTS

A strong north-south trending aeromagnetic anomaly, extending north from the intrusive, is indicated on G.S.C. Map 4391G. A reconnaissance ground magnetometer survey was conducted in the vicinity of camp in order to define this anomaly, but no trace of it was found. Results of this survey are plotted on the Reconnaissance Magnetometer Survey Sketch (see Sketch #16).

A detailed magnetometer survey, plotted at 1" = 200' (Detail Magnetometer Survey Plan) was conducted over the mineralized zones within the intrusive, using the soil sample stations for magnetometer stations. The background here is 3000 to 3200 gammas, while variable intensity pyrrhotite mineralization is indicated by 3200 to 3500 gammas. Local values higher than 3500 gammas, and up to 9000 gammas, may be due either to local concentrations of pyrrhotite or to pods of magnetite with later quartz veins.

Since the pyrrhotite is relatively closely correlated with chalcopyrite, the magnetic anomalies provide good definition of mineralized zones. This is confirmed by both the geological mapping and the geochemistry survey.

CONCLUSIONS

The Cretaceous granitic stock within the PDM 1 - 144 claim group is extensively mineralized with pyrrhotite and chalcopyrite. Low grade mineralization, mainly disseminated, occurs over a broad north to northeast trending belt approximately 7200 feet by 4200 feet. Within this area are local higher grade zones with sulfides both disseminated and on fracture faces. These zones are effectively delineated by geological mapping, soil and rock chip sampling, and magnetics, except where surface exposure is inaccessible because of rugged terrain.

Surface and near surface trench sampling have indicated a maximum grade of approximately 0.3% copper in the high grade zones. Although these samples have probably been leached to some extent, there is no evidence to indicate a significant increase in grade with depth. Since diamond drilling would be necessary as the next stage of exploration on the property, the present results do not appear to be substantial enough to warrant further recommended work.

CERTIFICATION

I, ROBERT G. HILKER of #6 Chalet Crescent, Hillcrest, in the City of Whitehorse, in the Yukon Territory, DO HEREBY CERTIFY:

1. THAT I am a Consulting Geologist, with an office located at #8 Northern Metalic Building, and postal address P.O. Box 4008, in the City of Whitehorse, in the Yukon Territory.

2. THAT I am a graduate of the Michigan Technological University located in Houghton, Michigan, U.S.A., where I obtained a Bachelor of Science degree in Geological Engineering (Exploration Option) in 1962.

3. THAT I am a registered member in good standing of The Association of Professional Engineers of the Yukon Territory.

4. THAT I have practised my profession as an engineer and geologist for the past ten years.

5. THAT I have personally supervised the geological-geochemical and magnetics evaluation conducted by G.G. Carlson, geologist, on the PDM 1 - 144 claim group, in the Watson Lake Mining Division of the Yukon Territory, from June 16th to August 8th, 1972 and was on the claim group during exploration on June 19, 1972. Report preparation and field work is acknowledged to G.G. Carlson, a graduate geologist, Professional Engineer of the Yukon Territory, and who is in my employ.

6. THAT I have no direct or indirect interest in the property or securities of Phelps Dodge Corporation of Canada, Limited.

DATED this 23rd day of October, A.D. 1972

R.G. Hilker, P.Eng.

Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL
ENGINEER

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SUMMARY OF EXPENDITURES - Macmillan Project 119

The following expenditures were made on the PDM 1 - 144 claim group and surrounding area for the purpose of geological evaluation of the claim group. The following costs are expenditures by R.G. Hilker Limited, Consultant Geologist, and do not include transportation costs.

June 26, 1972	Invoice #2120	$8,098.75
June 31, 1972	Invoice #2123	11,891.72
August 31, 1972	Invoice #2132	5,043.05
August 31, 1972	Invoice #2133	445.50
October 23, 1972	Invoice #2141	1,451.11
	Total Expenditures	$26,930.13

WHITEHORSE, YUKON
NOV 20 1972

Notary Public

R. G. Hilker, P. Eng
Consultant Geologist

PHONE: OFFICE 667-2819
RES. 668-2822
AREA CODE 403

R. G. HILKER
LIMITED
CONSULTING GEOLOGIST . . . PROFESSIONAL ENGINEER
P.O. Box 4008, WHITEHORSE
YUKON TERRITORY, CANADA
"LAND OF THE MIDNIGHT SUN"

Mr. F.M. Smith
Phelps Dodge Corporation of Canada, Limited
7 - 106 Main St.
Whitehorse, Y.T.

June 7, 1972

INVOICE #2116

Drafting - May 9 through June 7

Watson River Project #101	
37.0 hours @ $4.75/hr	$176.00
Casca Project #106	
9.58 hours @ $4.75/hr	45.50
I & E	
3.0 hours @ $4.75/hr	14.25
Sub-total	235.75
50% overhead	117.80
Total	$353.55

Labour - Prospector

G.R. Craft - May 16 - 31	
Watson River Project #101	$437.50
45% Management Fee	157.50
Total	$595.00

Total Invoice $948.55

PHONE: OFFICE 667-2819
RES. 668-2822
AREA CODE 403

H

R. G. HILKER
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Mr. F.M. Smith
Phelps Dodge Corporation of Canada, Limited
7 - 106 Main St.
Whitehorse, Y.T.

June 26, 1972 Re: Projects #119 and 106

INVOICE #2120

Exploration Crew - Labour

Prospector - Project I&E June 1 - 6 ----	$175.00		
Project #106 June 7 - 17 ---	321.00		
Project #119 June 18 - 30 --	379.00		
45% Management Fee ---------	315.00		
	$1,190.00	-------	$1,190.00
Senior Geologist -			
Project #106 June 1 - 15 --	625.00		
Project #119 June 16 - 30 --	625.00		
75% Management Fee ---------	750.00		
	$2,000.00	-------	2,000.00
Junior Geologist -			
Project #119 June 15 - 30 --	466.00		
75% Management Fee ---------	262.50		
	$728.50	-------	728.50
2 Soil Samplers -			
Project #119 June 15 - 30 --	734.00		
75% Management Fee ---------	417.50		
	$1,151.50	-------	1,151.50
Cook - Project #119 June 16 - 30 --	437.50		
75% Management Fee ---------	262.50		
	$700.00	-------	700.00
R.G. Hilker - 2 days supervision May 25 - June 30 ----------			300.00

Drafting -	Project #101 June 8 - 21		
	14¼ hrs @$4.75 ---	$69.00	
	Project I&E June 12 - 13, June 21		
	4½ hrs @$4.75 ----	20.25	
	Project #106 June 12		
	1 hr @$4.75 ------	4.75	
	Project #119 June 8 - 30 ----	425.00	
	Drafting Supplies - print paper, acetate, sepia -	179.00	
		$698.00 ------	698.00
R.G. Hilker Limited - vehicle, camp supplies, field equipment, and crew expenses ----------			3,037.50
R.G. Hilker Limited - mobilization vehicle rental -------			338.20
R.G. Hilker Limited - telephone ----------			10.05
Total Invoice ---------			$10,153.75

PHONE: OFFICE 667-2819
RES. 668-2822
AREA CODE 403

R. G. HILKER
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P.O. Box 4008, WHITEHORSE
YUKON TERRITORY, CANADA
"LAND OF THE MIDNIGHT SUN"

Mr. F.M. Smith
Phelps Dodge Corporation of Canada, Limited
7 - 106 Main St.
Whitehorse, Y.T.

July 31, 1972 Re: Projects #119 and #106

INVOICE #2123

Exploration Crew Labour

Prospector - Project #119 July 1 - 24 --	$700.00	
45% Management Fee --------	250.00	
	950.00	950.00
Senior Geologist		
- Project #119 July 3 - 31 -	1,250.00	
60% Management Fee -------	600.00	
	1,850.00	1,850.00
Junior Geologist		
- Project #119 July 1 - 31 --	875.00	
60% Management Fee --------	420.00	
	1,295.00	1,295.00
Soil Samplers		
- samplers - Project #119		
July 1 - 31 ----------	1,375.00	
75% Management Fee		
July 1 - 15 ----------	412.00	
60% Management Fee		
July 16 - 31 ----------	330.00	
- 2 samplers - Project #119		
June 30 - July 31 -----	1,413.00	
75% Management Fee -------	825.00	
	4,355.00	4,355.00
Cook		
- Project #119 July 1 - 31 --	875.00	
60% Management Fee --------	420.00	
	1,295.00	1,295.00

Drafting - Project I&E July 5-13, 14			
2 hrs @ $4.75 ----------	9.50		
Project #106 July 14-17, 18	71.25		
15 hrs @ $4.75			
Project #119 July 1-31 ----	200.00		
50% overhead - drafting ---	140.00		
	420.75		420.75
R.G. Hilker Limited - Project #119			
Vehicle, camp, field supplies, radio ----------	1,197.35		
Packing & expediting soil samples	75.00		
Rental Fluxgate Magnetometer July 6 - 31 ----------	464.50		
Xerox copies #119 and #106--------	20.10		
Telephone ----------	9.90		
	1,766.85		1,766.85
Geochemical Samples - #119			
CPAir Freight - July 3 ----------	9.35		
July 12 ----------	7.90		
July 15 ----------	43.50		
July 25 ----------	13.12		
July 28 ----------	20.05		
Shipping Cartons July 24 ----------	3.40		
July 14 ----------	2.55		
	99.87		99.87
Total Invoice -----			$12,032.47

PHONE: OFFICE 667-2819
RES. 668-2822
AREA CODE 403

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YUKON TERRITORY, CANADA
"LAND OF THE MIDNIGHT SUN"

Mr. F.M. Smith
Phelps Dodge Corporation of Canada, Limited
7 - 106 Main St.
Whitehorse, Y. T.

August 31, 1972 Project #119

INVOICE #2132

Senior Geologist			
Project #119	August 1 - 20	- 667.00	
	25% Fringe benefits	- 166.75	
	45% Management fee	- 300.15	
		1,133.90	1,133.90
Junior Geologist			
Project #119	August 1 - 9	- 210.00	
	25% Fringe benefits	- 52.50	
	60% Management fee	- 126.00	
		388.50	388.50
Soil Samplers			
Project #119	August 1 - 6	- 440.00	
	25% Fringe benefits	- 110.00	
	60% Management fee	- 264.00	
		814.00	814.00
Cook			
Project #119	July 25 - Aug. 8	- 350.00	
	25% Fringe benefits	- 87.50	
	60% Management fee	- 210.00	
		647.50	647.50
R.G. Hilker - Supervision			
Project #119	July 1 - August 31	- 300.00	300.00
Drafting			
Project I&E Aug 9, 10, 14, 18, 19, 20, 28			
	16 hrs @4.75	- 76.00	
Project #119	August 1 - 29	- 375.00	
	50% overhead - drafting	- 225.00	
		676.00	676.00

... 2

Preliminary Report - prints of 16 sketches, 18 plans; Xerox text; typing and report folders ----------	425.00
Geochemical Samples Freight August 7 - 16.10 R.G. Hilker Ltd. - 25.00 41.10 ----------	41.10
Vehicle Transportation - R.G. Hilker Ltd. ----------	110.40
Purchase of Tent - Project #119 ----------	162.50
Demobilization of equipment - Yukon Territorial Ventures ----------	282.00
Telephone August 4 - 1.45 August 4 & 5 - 1.80 1.85 2.15 August 7 - 1.25 August 30 - 1.00 9.50 ----------	9.50
Balance Travel Expenses ----------	52.65
	$5,043.05
Total Invoice ---	$5,043.05

PHONE: OFFICE 667-2819
RES. 668-2822
AREA CODE 403

R. G. HILKER
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CONSULTING GEOLOGIST . . . PROFESSIONAL ENGINEER
P.O. Box 4008, Whitehorse
Yukon Territory, Canada
"Land of the Midnight Sun"

Phelps Dodge Corporation of Canada, Limited
7 - 106 Main St.
Whitehorse, Y.T.

October 23, 1972 Project 119

INVOICE #2141

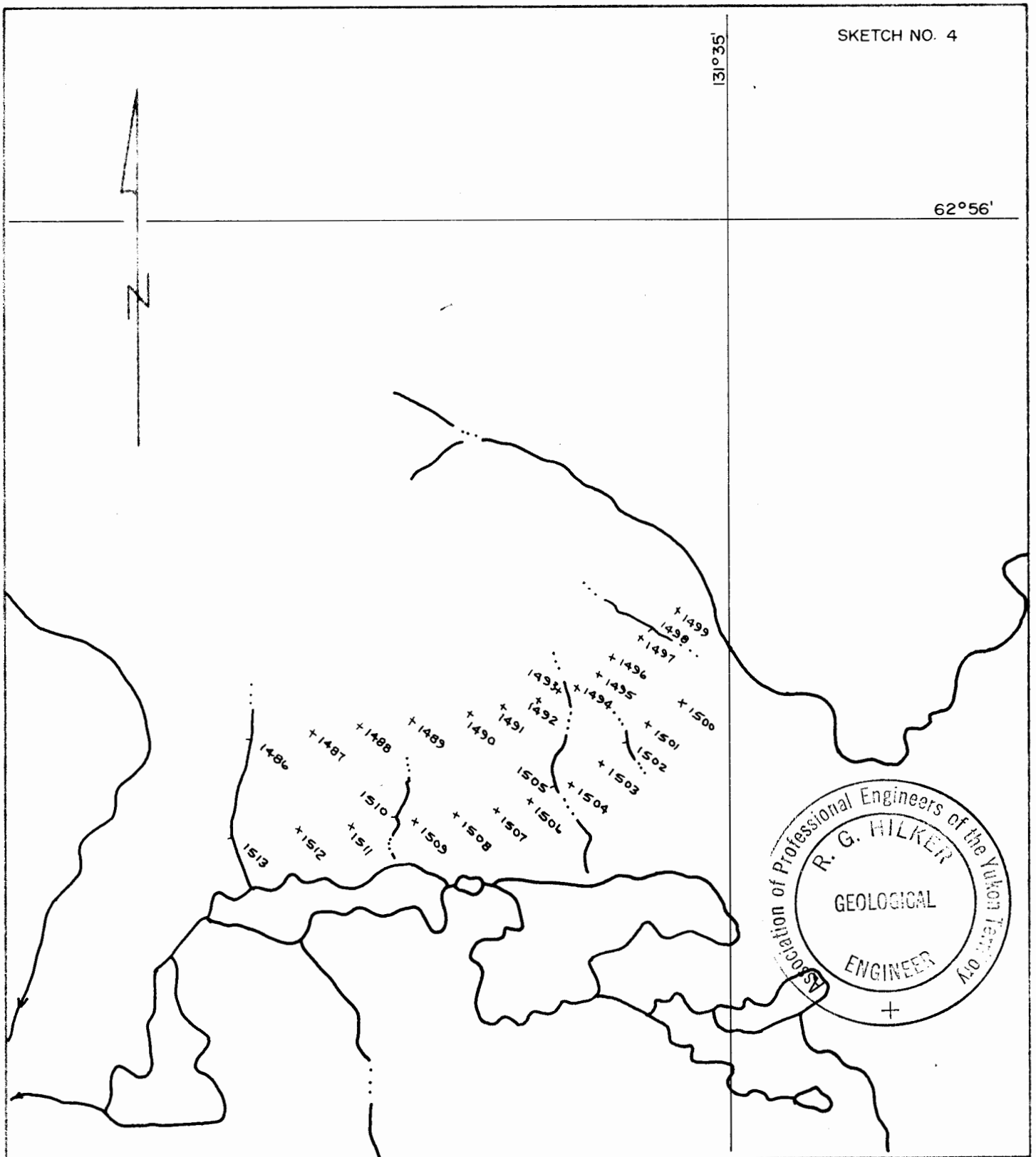
Travel Expenses - Project 119	$66.50
Assessment Work Report - 4 copies complete and two copies text.	575.00
Drafting Supplies - 17.60 + 19.71 + 7.65 = 44.96	44.96
Telephone	3.95
Xerox - Casca #106	10.70
R.G. Hilker - report preparation and supervision Project #119 - Sept. 1 - Oct. 23, 1972 - 5 days	750.00
Total Invoice	$1,451.11

APPENDIX

SKETCH NO. 4

131°35'

62°56'



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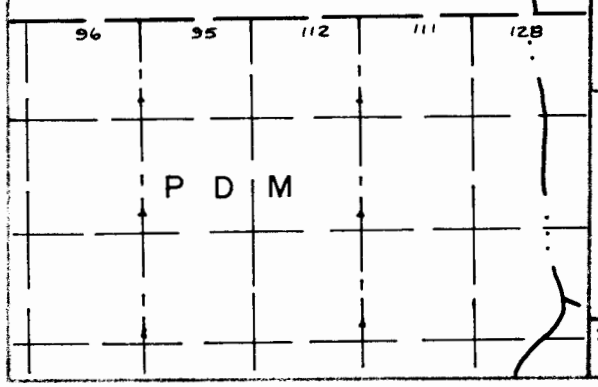
ENGINEER



PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

TRAVERSE A 15

SAMPLE LOCATION SKETCH

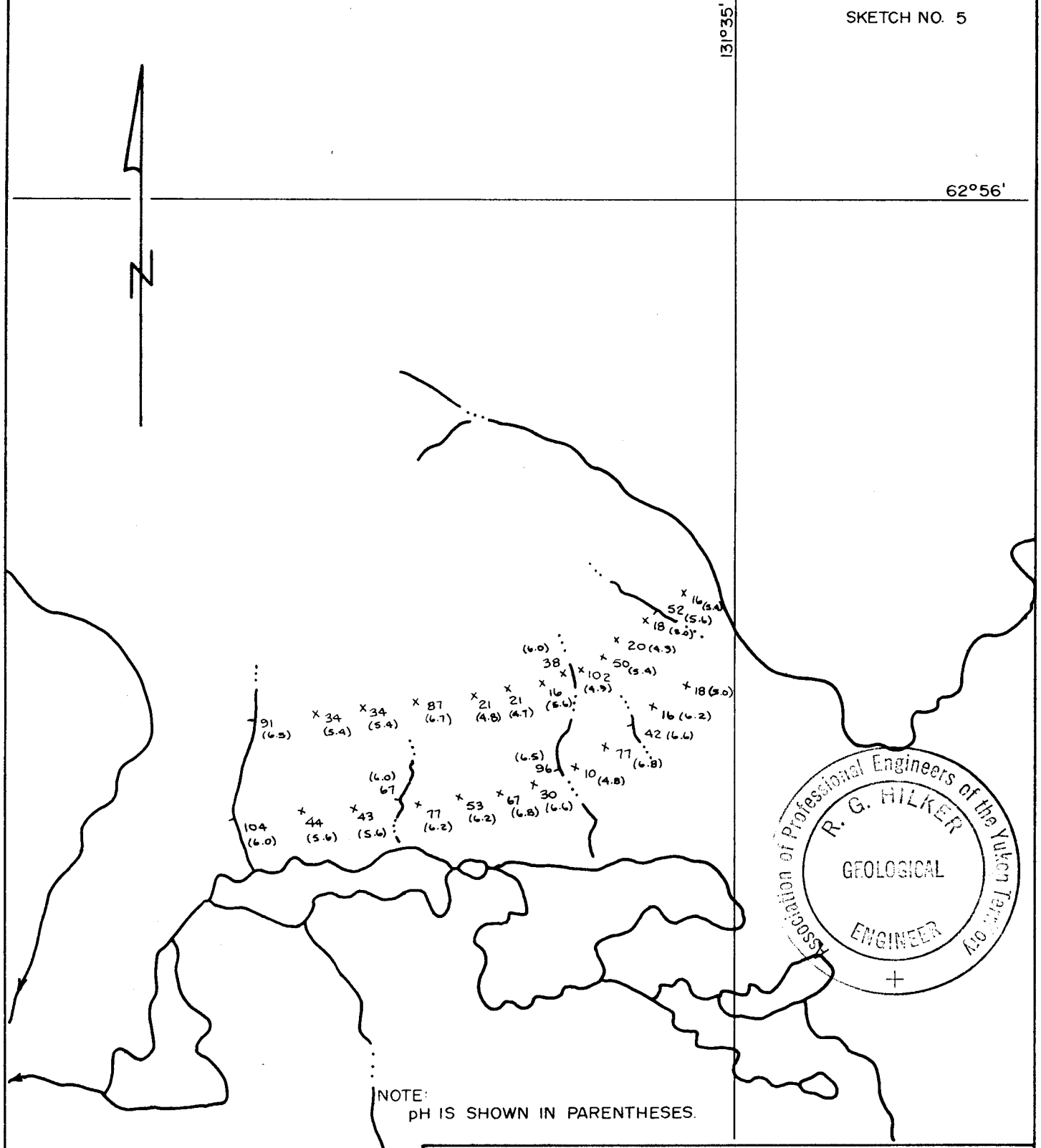
NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 1/2 mile	JULY 1972	R.G. HILKER LTD	MLS

SKETCH NO. 5

131°35'

62°56'



NOTE:
pH IS SHOWN IN PARENTHESES.

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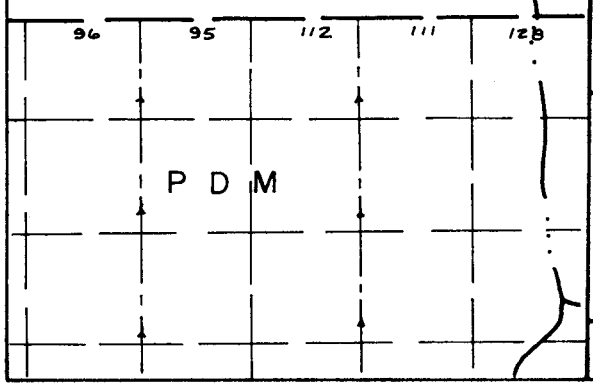
R. G. HILKER
GEOLOGICAL
ENGINEER



PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

TRAVERSE A 15

GEOCHEMISTRY - COPPER P.P.M.

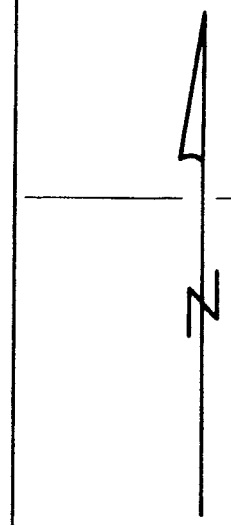
NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 1/2 mile	JULY 1972	RG HILKER LTD	MLS

SKETCH NO. 6

131°35'

62°56'



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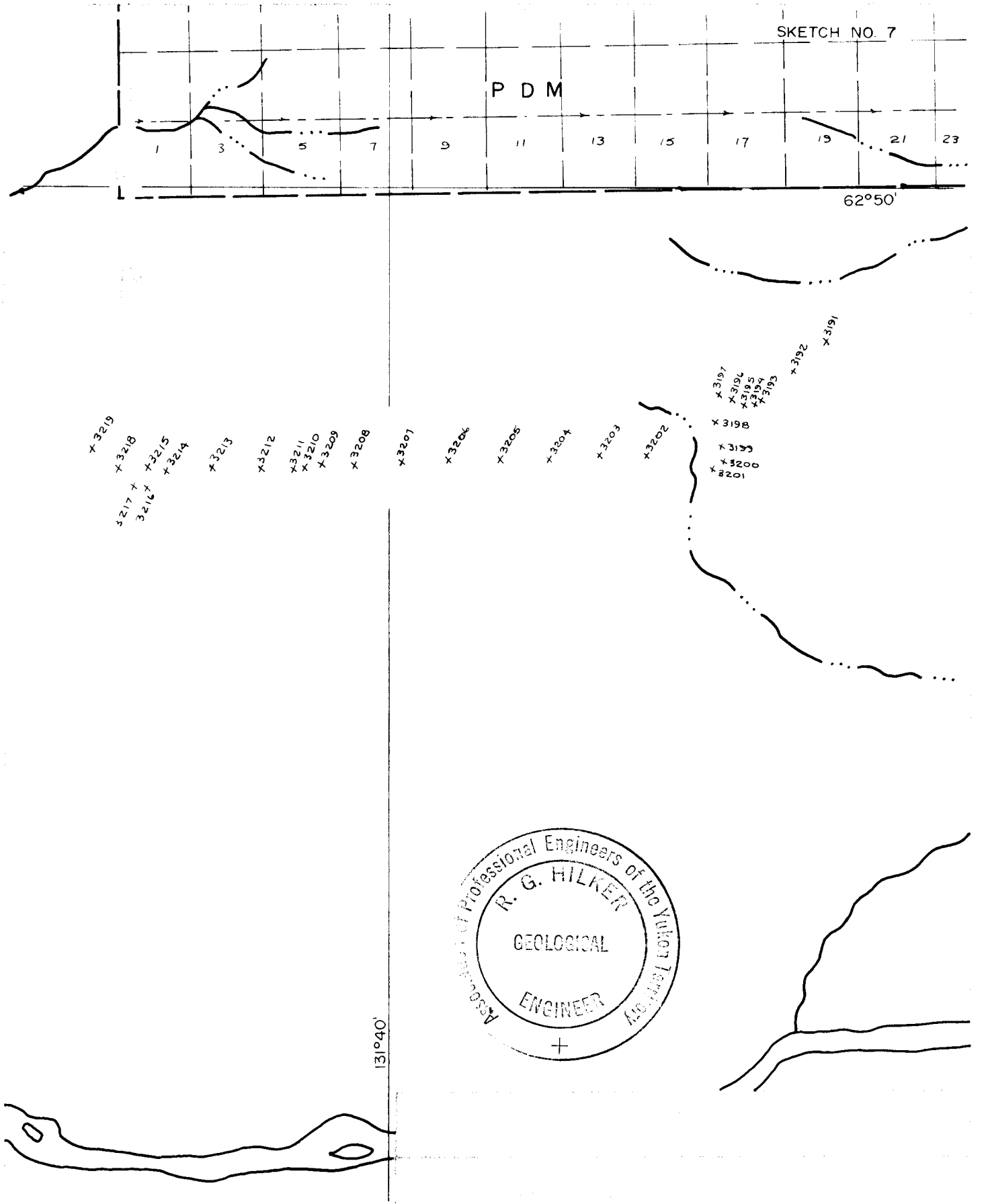

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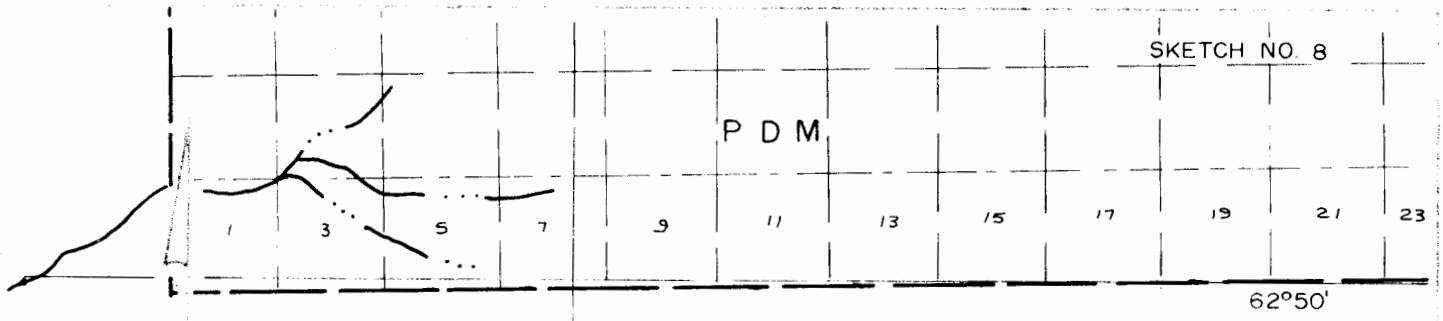
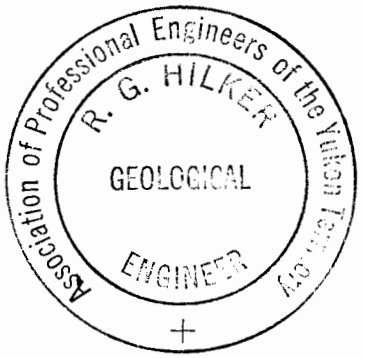
SAMPLE LOCATION SKETCH

SKETCH NO. 8





131°40'

NOTE: pH IS SHOWN IN PARENTHESES

SHELL CANADA RESOURCES LIMITED
WHITEHORSE OFFICE

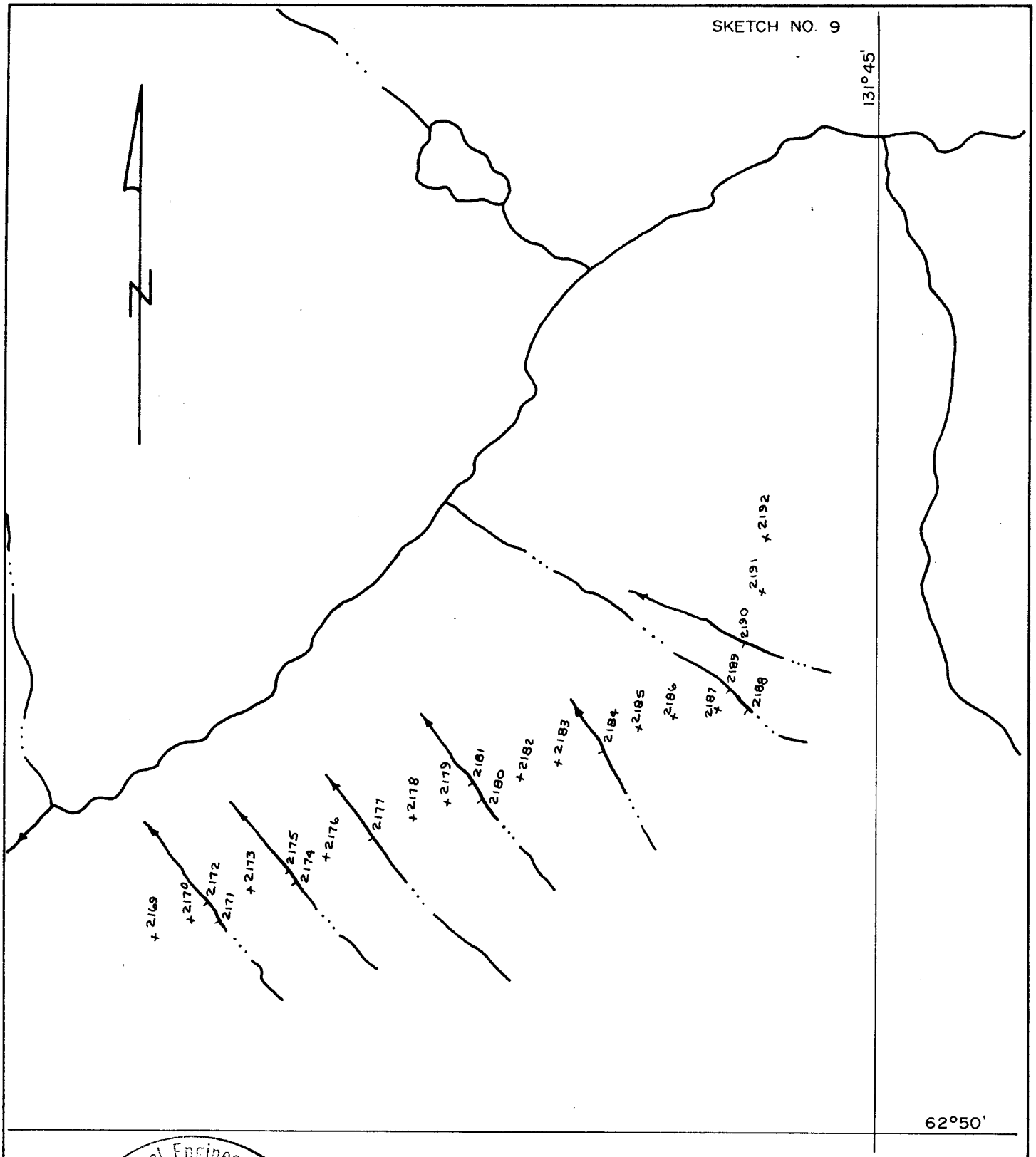
MACMILLAN PROJECT

FIGURE A 24

GEOCHEMISTRY - COPPER P.P.M.

SCALE	DATE	DRAWING NUMBER	DRAWN BY

SKETCH NO. 9



Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL
ENGINEER

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WHITEHORSE OFFICE

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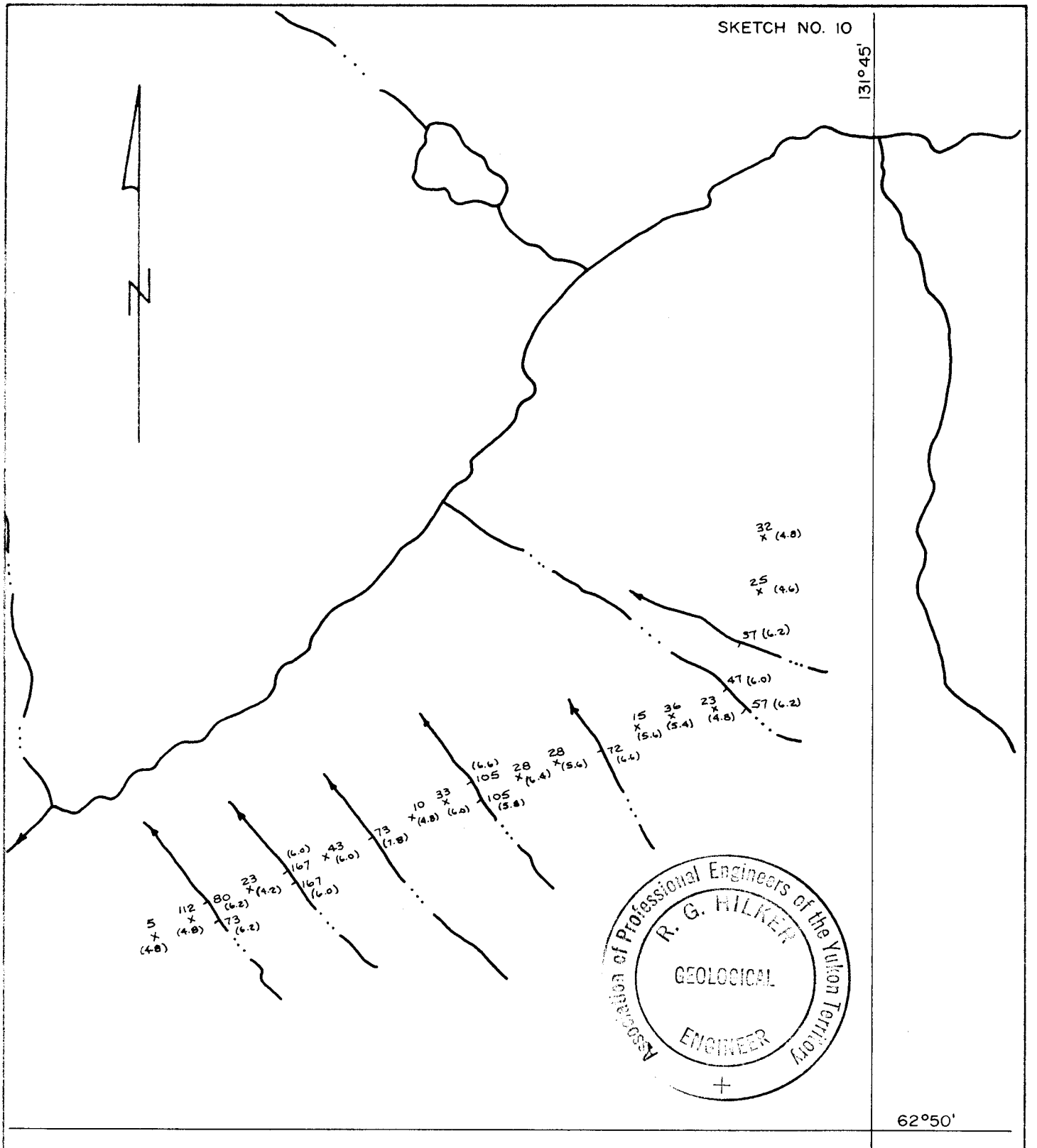
TRAVERSE B 7

SAMPLE LOCATION SKETCH

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 1/2 mile	JULY 1972	R.G. HILKER LTD	MLS

SKETCH NO. 10



NOTE:
pH IS SHOWN IN PARENTHESES.

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

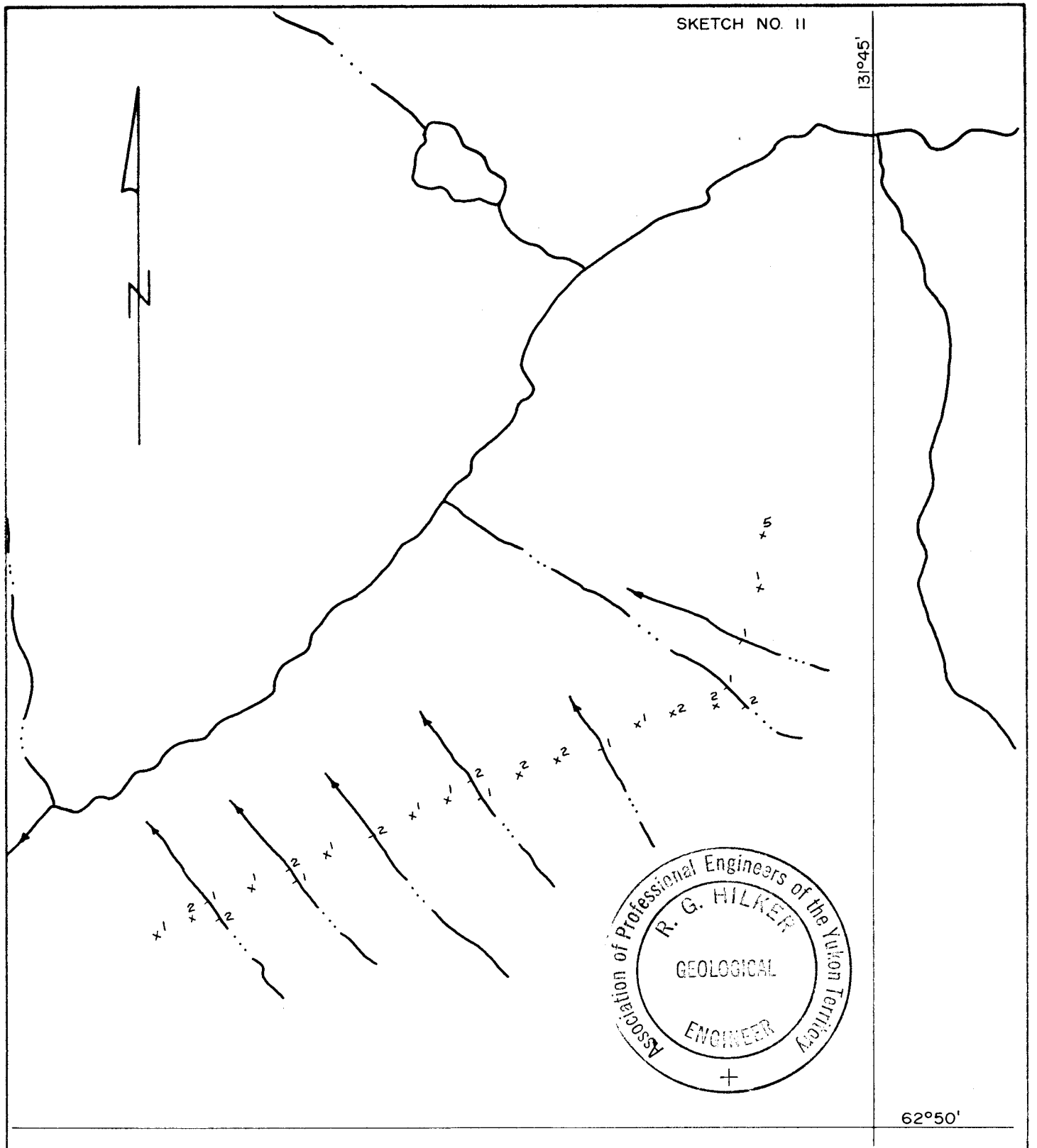
MACMILLAN PROJECT 119

TRAVERSE B 7

GEOCHEMISTRY - COPPER P.P.M.

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 1/2 mile	JULY 1972	RG HILKER LTD	M.L.S



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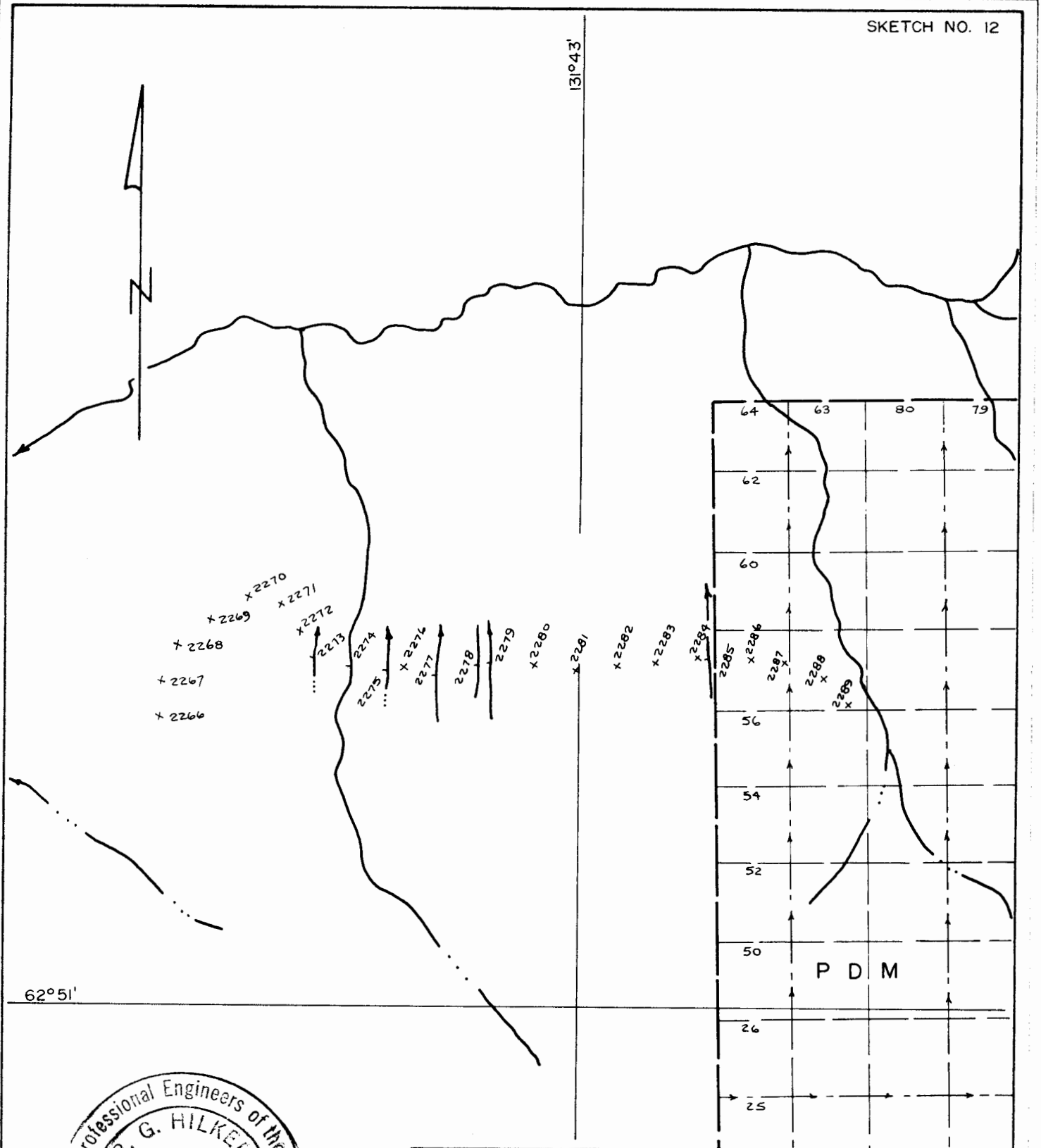
TRAVERSE B 7

GEOCHEMISTRY - MOLYBDENUM P.P.M.

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 1/2 mile	JULY 1972	RG HILKER LTD	MLS

SKETCH NO. 12



Association of Professional Engineers of the Yukon Territory
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GEOLOGICAL
ENGINEER

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

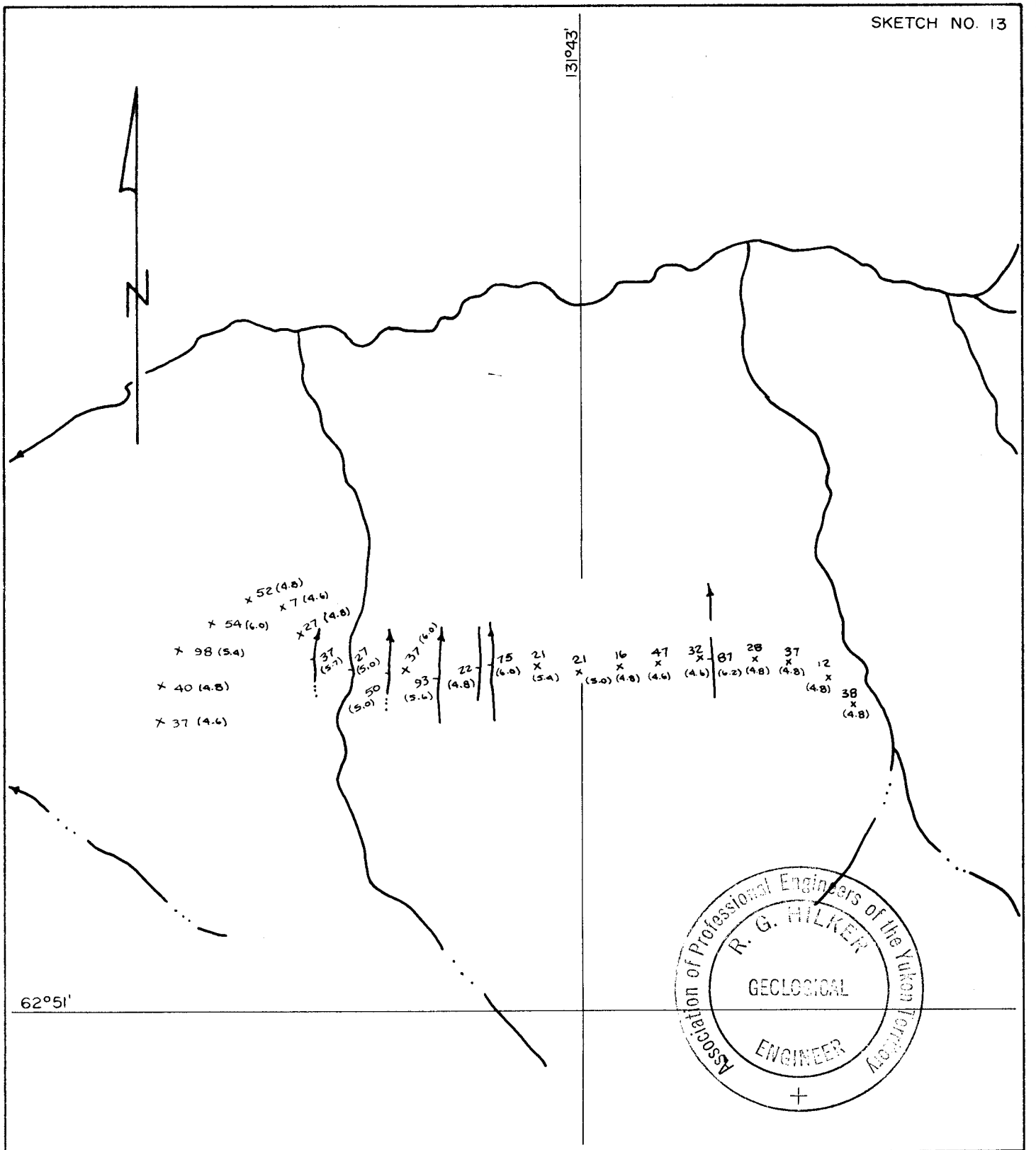
TRAVERSE B 10

SAMPLE LOCATION SKETCH

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 1/2 mile	JULY 1972	R.G. HILKER LTD	MLS

SKETCH NO. 13



NOTE: pH IS SHOWN IN PARENTHESES.

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

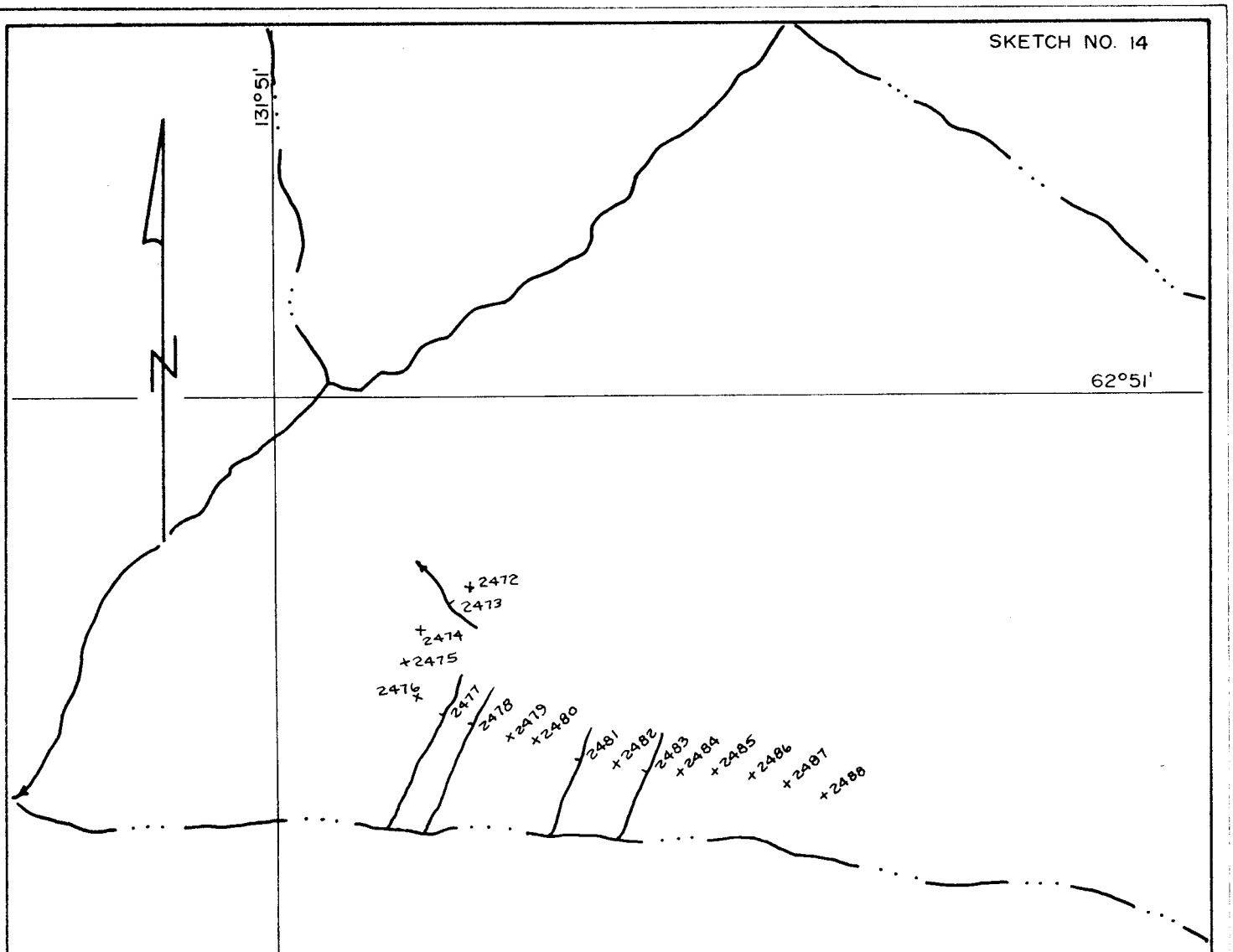
TRAVERSE B 10

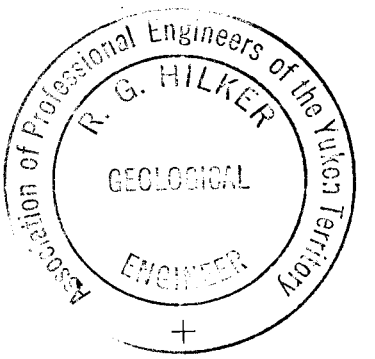
GEOCHEMISTRY - COPPER P.P.M.

NTS SHEET 105-J-13

SCALE:	DATE:	SURVEYED BY:	DRAWN BY:
1" = 1/2 mile	JULY 1972	R.G. HILKER LTD	M.L.S

SKETCH NO. 14





PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

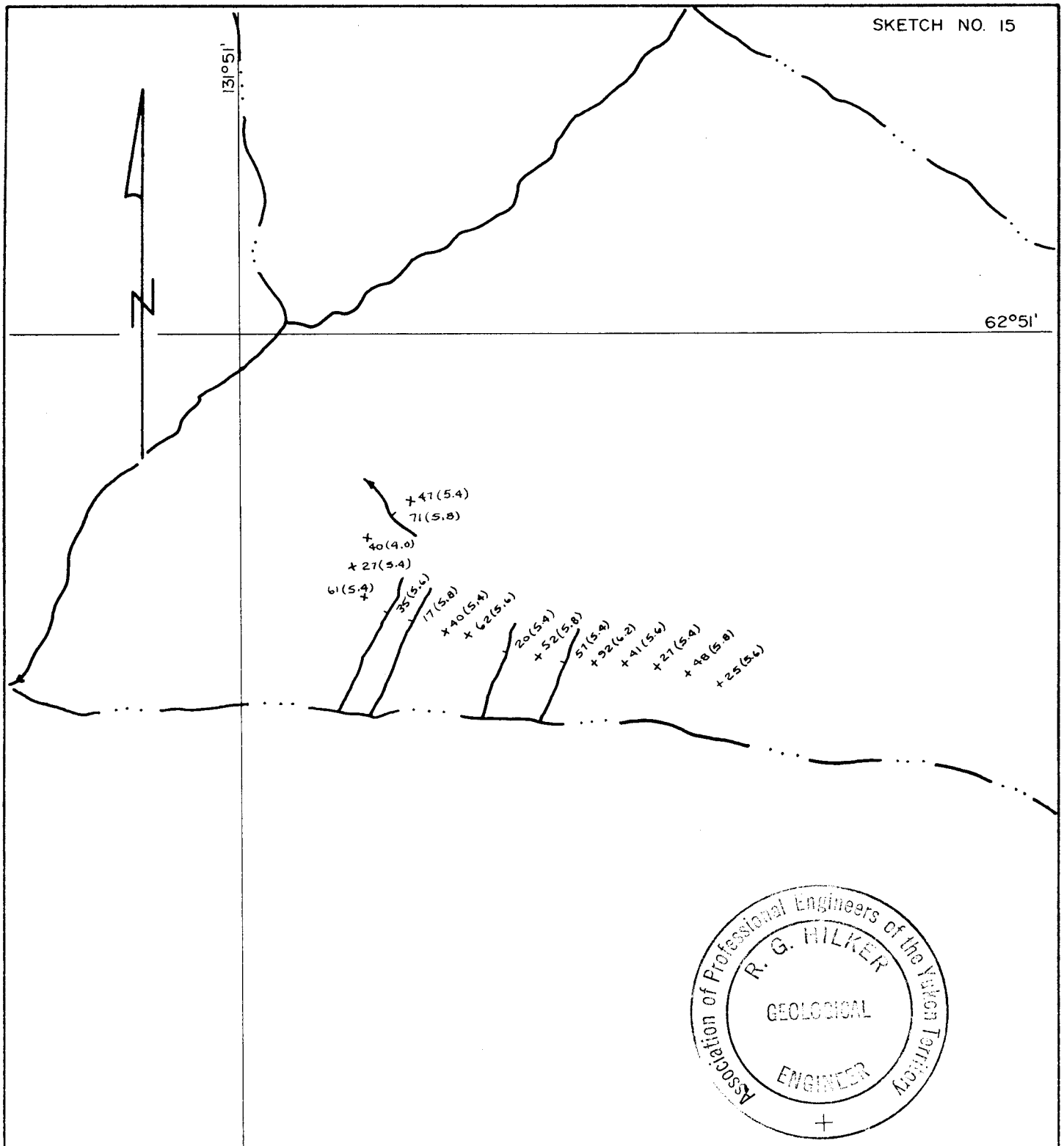
TRAVERSE B 16

SAMPLE LOCATION SKETCH

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 1/2 mile	JULY 1972	R.G. HILKER LTD	MLS

SKETCH NO. 15



Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL
ENGINEER

NOTE: pH IS SHOWN IN PARENTHESES.

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

TRAVERSE B 16

GEOCHEMISTRY - COPPER P.P.M.

NTS SHEET 105-J-13

SCALE:	DATE:	SURVEYED BY:	DRAWN BY:
1" = 1/2 mile	JULY 1972	R.G. HILKER LTD	M.L.S

SCINTREX

FLUXGATE MAGNETOMETER

The MF-2 is a completely new concept in vertical force fluxgate magnetometers. These instruments, which are designed for fast and accurate mineral ground surveys, are orientation independent, self levelling and require no tripod.

The MF-2 combines in one compact 5½ lb. package electronics, sensor and rechargeable batteries. With the latest I.C. and F.E.T. circuitry and high precision components, a temperature stability better than 1 gamma per degree is standard (with .25 gamma on special order) over a range of —40° to +40° centigrade.

The instrument has a built-in hemisphere polarity switch providing two overlapping ranges. For the Northern hemisphere the full range is +80,000 to —20,000 gammas, and reversible for the Southern hemisphere.

A calibrated feedback system can be provided which makes it possible to determine the total vertical component strength.

Measuring accuracy, on the 100 gamma scale is 0.5 gamma, and on the 1000 gamma scale 5 gammas.

The Scintrex MF series of magnetometers have been in use for many years in varied applications, e.g. ground reconnaissance, base station recording and monitoring, study of magnetic properties of rocks, observatory monitoring and recording of both vertical and horizontal components.

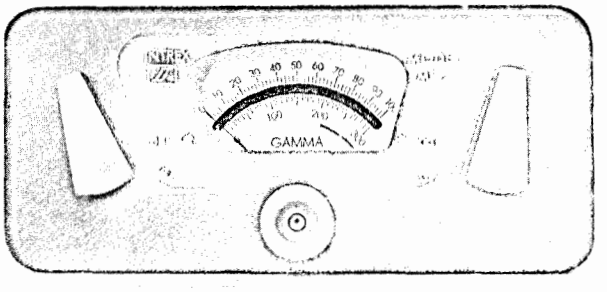
OPTIONAL

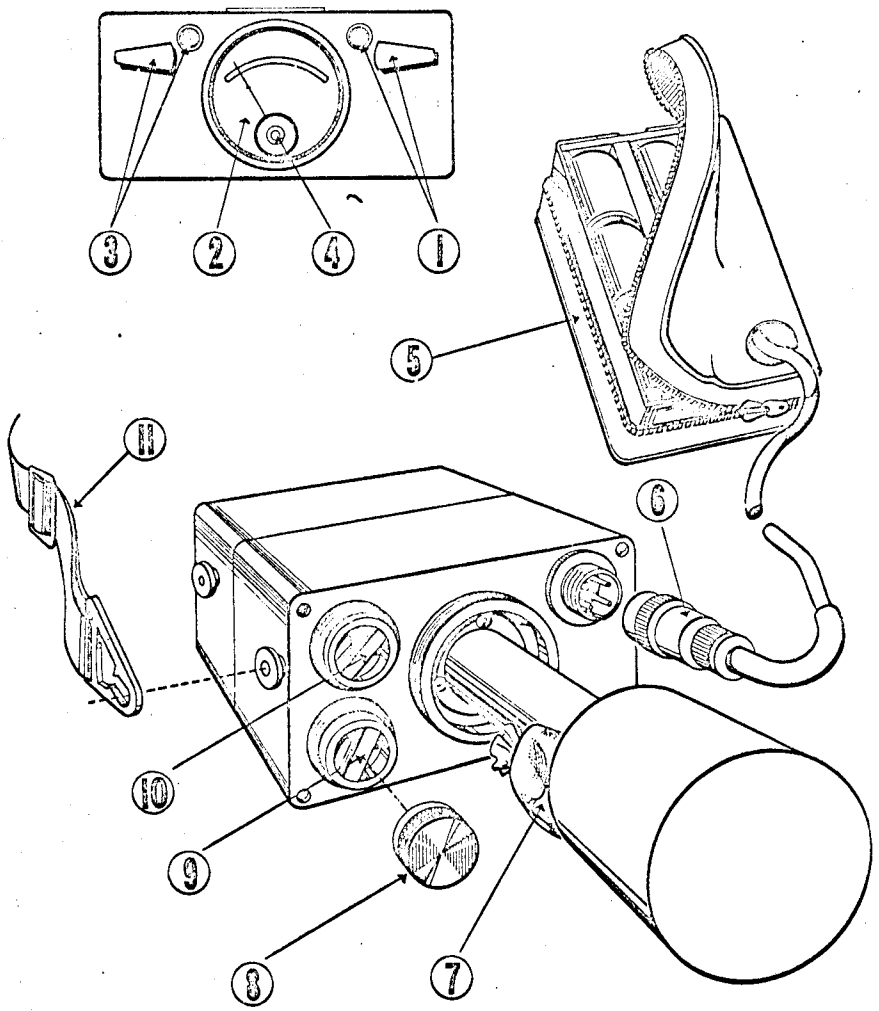
a) MF-2G

The MF-2G Fluxgate Magnetometer has the same electronics and specifications as the MF-2, but the sensor is detached and enclosed in a small cylindrical tube which permits it to be oriented and tilted in any desired direction. A 25 foot cable connects the sensor to the instrument housing. This version is particularly suitable for the study of the magnetic properties of rocks, and the measurement of magnetic field components of any orientation, etc.

b) MF-2GS

The MF-2GS Magnetometer again has the same electronics and specifications as the MF-2 but has two sensors, the enclosed self-levelling sensor of the MF-2 as well as the detached geoprobe of the MF-2G, either one of which can be employed at any one time. Thus, this instrument can be employed as the standard MF-2 as well as for vertical gradient measurements, and for the determination of the magnetic properties of rocks, etc.





1. Range Switch
2. Meter
3. Main Switch
4. Level
5. Battery Pack
6. Battery Connector
7. Silica Gel
8. Protection Cap
9. Latitude Adjustment Control Fine
10. Latitude Adjustment Control Coarse
11. Carrying Strap

MODEL MF-1 FLUXGATE MAGNETOMETER

E. J. SHARPE INSTRUMENTS OF CANADA LIMITED
P.O. Box 279, Willowdale, Ontario

MODEL MF-1 FLUXGATE MAGNETOMETER

Operation of the Meter

1.) Remove all magnetic objects from operator's person, e.g. keys, coins, buttons, etc. Zippers should be non-magnetic.
2.) Connect Battery Cable, Figure 6, to magnetometer receptacle on bottom of main housing. This connection must be secured by lock-ring.
3.) Attach battery pack (Fig. 5) either in back pocket or on belt behind operator.
4.) Switch on Main Switch (Fig. 3) to first position, which is the battery check. Indicating meter needle should rest within red arc. Replace batteries if reading below red arc.
5.) Latitude Adjustment - To adjust the latitude setting to read 0 gammas is a simple operation.
   a. After indicating meter needle (fig.2) shows voltage okay, switch Main Switch (Fig.3) to next position which is the positive reading with the Range Switch (Fig. 1) set at the 100K step. (100,000 gamma range)
   b. If needle goes full arc to left past 0, switch main switch (Fig. 3) to last position which is the negative reading range.
   c. Figures 10 and 9 indicate the latitude adjustment controls - Coarse control is Fig. 10 and Fine control is Fig. 9. If scale reading is more than ± 7,000 gammas rotate coarse control (Fig. 10) in steps of 7,000 and switch range down to more sensitive range until scale is reading less than ± 7,000 gammas. Remove protection cap on fine control (Fig. 8) by pulling straight off. Then rotate fine control switch (Fig. 9) until scale reading is 0 gammas. Check reading by switching main switch from positive to negative (or vice versa) to ensure 0 reading both polarities. Replace fine control protection cap.
6.) Calibration - This meter is calibrated at the factory prior to delivery. Field tests show that only by severe misuse (i.e. constant dropping, rough handling, improper shipping) can the calibration of this instrument be effected. It is therefore not necessary to recalibrate in the field and if through misuse calibration becomes necessary, the meter should be returned to the factory. *All parts are guaranteed against defect for a period of one year and will be replaced free of charge.
   * This guarantee does not apply to batteries or the connecting cable.
7.) Trouble Shooting - Under normal conditions the only field problem will be batteries or the connecting cable. If after completion of step (4) under "Operation of the Meter" the meter still does not indicate voltage, check cable for faulty connection or broken cable. If after this procedure, meter still does not indicate current, return unit immediately to your supplier or directly to the factory.

Regional Latitude Settings

Normally each unit is pre-set at the factory for the Northern Hemisphere. However, if the unit is required for Equatorial or Southern Hemispheric regions, the unit will be pre-set at the factory for these areas. If a unit is going from one of the above regions to another, reset instructions will be supplied on request.

Field Procedure

1.) Select Base Control station. This station should be selected in relation to one or both of two things.
   1. General magnetic background (i.e. not anomalous) if possible.
   2. Accessibility in relation to area being surveyed.
2.) Set magnetometer to read between 0 and 200 gammas. (For contouring and to avoid small negative readings, an arbitrary value of 1000-800 gammas should be added to all readings.
3.) For effective diurnal control, control stations should be permanently marked and readings should be taken at the same height and location each time; a simple method is to have the control stations' pickets hammered into the ground with the top about waist height. Rest the probe end of the magnetometer on the top of the picket. In barren country, a mound or large piece of rock or some other material should be used.
4.) Continue survey the same as any other method of magnetic surveying.
5.) Remove and replace Silica-Gel (Fig.7) when deteriorated. The silica gel is located in the removable probe housing.
   The Silica bag should not be placed on the bottom of the probe housing.
6.) Do not pass powerful magnet closer than 1 foot to instrument.
7.) During winter operation, batteries should be kept in pocket or under parka.

***Warning: - Do not leave batteries in battery case when unit is being stored. Always be be sure meter is turned off after use. Disconnect battery cable when meter not in use.

edge of aerial photo

edge of aerial photo

SKETCH NO. 4,5,6

SKETCH NO. 16

CAMPSITE

PLAN NO. 7,8,9
SHEET 1

PLAN NO. 10,11,12
SHEET 2

SKETCH NO. 12, 13

SKETCH NO. 9, 10, 11

PLAN NO. 6

PLAN NO. 2,3,4,5

SKETCH NO. 14, 15

SHEET 3
PLAN NO. 13, 14, 15

SKETCH NO. 7, 8

SHEET 4
PLAN NO. 16, 17, 18

SOUTH MACMILLAN RIVER

edge of aerial photo

Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL ENGINEER

PLAN NO. 1

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

TRAVERSE LOCATION PLAN

NTS SHEET 105-J-13

SCALE:	DATE:	SURVEYED BY:	DRAWN BY:
approx. 1"=1/2 mile	Aug. 7, 1972	R.G. HILKER LTD.	MLS

PLAN NO. 2

N

ROCK

GLACIER

THUNDERHEAD PEAK

ZONE OF
HIGHER GRADE
MINERALIZATION

CIRQUE ZONE

ZONES OF
HIGHER GRADE
MINERALIZATION

SPIRE
ZONE

COL ZONE

ZONE OF
HIGHER GRADE
MINERALIZATION

PINNACLES

OUTLINE OF LOW GRADE MINERALIZATION

INTRUSIVE CONTACT

M-1 M-2 M-3 M-4 M-5 M-6 M-7 M-8 M-9 M-10 M-11 M-12 M-13 M-15

CS-1 CS-2

C1 C2 C3

LEGEND

		Length	Fracture Density
fracture strike and dip		2/10"	0-5
survey control station		3/10"	6-10
trench		4/10"	11-15
arête		5/10"	16-20
		6/10"	20+

Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL
ENGINEER

PLAN NO. 2

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

DETAIL GEOLOGY PLAN

NTS SHEET 105-J-13

SCALE:	DATE:	SURVEYED BY:	DRAWN BY:
1" = 200'	AUG. 14, 1972	R.G. HILKER LTD.	MLS

PLAN NO. 3

ROCK

GLACIER

CIRQUE ZONE

SPIRE ZONE

COL ZONE

PINNACLES

THUNDERHEAD PEAK

LEGEND

- x Soil sample station
- ⊠ Rock chip sample station
- ○ Survey control station
- Trenches
- Arête
- (A9) Traverse number

Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL
ENGINEER

PLAN NO. 3

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

DETAIL GEOCHEMISTRY PLAN
SAMPLE NUMBERS

NTS SHEET 105-J-13			
SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 200'	AUG 14, 1972	RG HILKER LTD	MLS

N

ROCK

GLACIER

THUNDERHEAD PEAK

CIRQUE ZONE

SPIRE ZONE

COL ZONE

PINNACLES

CONTACT

INTRUSIVE

NOTE:
Copper is shown in p.p.m.
pH is in parentheses.

LEGEND

- Soil sample station
- Rock chip sample station
- Survey control station
- Trenches
- Grids
- (A8) Traverse number
- anomalous geochem areas mainly > X̄ +2s or 1000ppm Cu for values over intrusive only

Registered Professional Engineer of the Province of British Columbia
R. G. HILKER
GEOLOGICAL ENGINEER

PLAN NO. 4

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

DETAIL GEOCHEMISTRY PLAN
COPPER

NTS SHEET 105-J-15			
SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 200'	AUG. 14, 1972	RG HILKER LTD	MLS

N

ROCK GLACIER

THUNDERHEAD PEAK

CIRQUE ZONE

SPIRE ZONE

COL ZONE

PINNACLES

INTRUSIVE CONTACT

M-1 M-2 M-3 M-4 M-5 M-6 M-7 M-8 M-9 M-10 M-11 M-12 M-13 M-15

CS-1 CS-2 CS-3

LEGEND

- less than 3200 gammas
- 3200-3399 gammas
- 3400 gammas or greater
- Intrusive boundary

NOTE:
MF2 magnetometer readings are shown in gammas. Stations correspond to geochemistry sample stations.

Association of Professional Engineers — R. G. HILKER — GEOLOGICAL ENGINEER — Yukon Territory

PLAN NO. 5

PHELPS DODGE CORPORATION OF CANADA, LIMITED WHITEHORSE OFFICE			
MACMILLAN PROJECT 119			
DETAIL MAGNETOMETER SURVEY PLAN			
NTS SHEET 105-J-15			
SCALE: 1" = 200'	DATE: AUG. 14, 1972	SURVEYED BY: RG HILKER LTD.	DRAWN BY: MLS

PLAN NO. 6

SHEET NO. 1 | SHEET NO. 2
SHEET NO. 3 | SHEET NO. 4

CIRQUE ZONE

SPIRE ZONE

COL ZONE

PINNACLES

TABLE OF FORMATIONS
2 Intrusive – biotite hornblende granodiorite/quartz monzonite.
1 Sedimentary rocks lq – quartzite; lh – chert; lc – conglomerate; lp – cherty pebble conglomerate; lm – metasediment; lt – slate; ls – shaley (banded) siltstone.

LEGEND

- strike and dip of bedding and/or cleavage.
- strike and dip of joints
- small fold axis with plunge
- lineation with plunge
- outline of intrusive

Association of Professional Engineers of the Yukon Territory
R. G. HILMER
GEOLOGICAL ENGINEER

PLAN NO. 6

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

GEOLOGY PLAN

CLAIM SHEET 105-J-13			
SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 400'	AUG 28, 1972	RG HILMER LTD	MLS

PLAN NO. 7

LEGEND

- □ located claim posts
- ○ assumed location of claim posts

NOTE All locations are approximate due to photo distortion and inaccuracies in mosaic. No control lines were used.

KEY PLAN

2	
3	4

PLAN NO. 7

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT 119

GEOCHEMISTRY SURVEY PLAN
SAMPLE NUMBERS

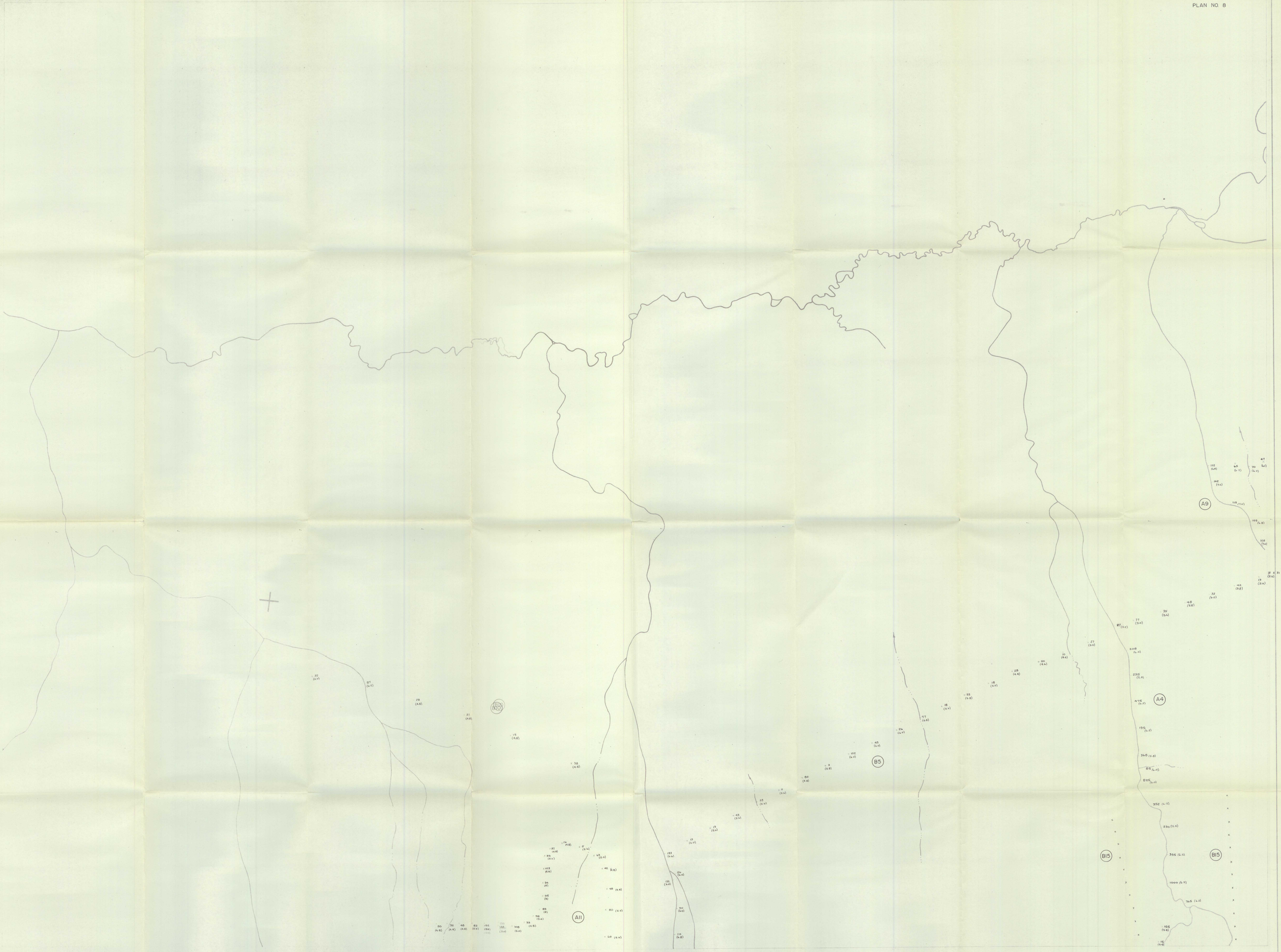
R.G. HILKER
Association of Professional Engineers
GEOLOGICAL
ENGINEER
Province of Yukon

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
approx 1"=400'	AUG. 7, 1972	R.G. HILKER LTD.	M.L.S

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

PLAN NO. 8



NOTE:
COPPER IS SHOWN IN PPM.
pH IS IN PARENTHESES.

KEY PLAN

PLAN NO. 8

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT

GEOCHEMISTRY SURVEY PLAN GEOLOGICAL
COPPER

Association of Professional Engineers of the Province of Yukon
R. G. HILKER
ENGINEER

N.T.S. SHEET 105 D/13

SCALE	DATE	SURVEYED BY	DRAWN BY
approx. 1" = 400'	AUG. 7, 1972	R.G. HILKER LTD.	MLS

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

PLAN NO. 9

NOTE:
MOLYBDENUM WAS NOT DETERMINED ON LATER TRAVERSES, HENCE THE SAMPLE STATIONS WITH NO VALUES.

MOLYBDENUM IS SHOWN IN P.P.M.

KEY PLAN

1	2
3	4

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

PLAN NO. 9

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT 119.

GEOCHEMISTRY SURVEY PLAN
MOLYBDENUM

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
approx. 1"=400'	AUG 7, 1972	R.G. HILKER LTD.	MLS

PLAN NO. 10

LEGEND

□ located claim posts
○ assumed location of claim posts

NOTE : All locations are approximate due to photo distortion and inaccuracies in mosaic. No control lines were used.

KEY PLAN

1	2
3	4

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

Associate of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL ENGINEER

PLAN NO. 10

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT 119

GEOCHEMISTRY SURVEY PLAN
SAMPLE NUMBERS

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
approx 1" = 400'	AUG. 7, 1972	R.G. HILKER LTD.	MLS

PLAN NO. II

CAMPSITE

ZONE 2-1

A9

B2

B3

B8

B9

NOTE:
COPPER IS SHOWN IN P.P.M.
pH IS IN PARENTHESES

KEY PLAN

Association of Professional Engineers of Yukon
R. G. HILKER
GEOLOGICAL
ENGINEER

PLAN NO. II

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT 119

GEOCHEMISTRY SURVEY PLAN
COPPER

NTS SHEET 105 J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
1:2400	AUG. 7, 1972	R.G. HILKER LTD.	MLS

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

PLAN NO. 12

CAMPSITE

A9

B3

ZONE 2-1

B8

A9

B2

B3

B9

B9

NOTE:
MOLYBDENUM WAS NOT DETERMINED ON LATER TRAVERSES, HENCE THE SAMPLE STATIONS WITH NO VALUES.

MOLYBDENUM IS SHOWN IN PPM.

KEY PLAN

1	2
3	4

N

Association of Professional Engineers of the Province of British Columbia
R. G. HILKER
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PLAN NO. 12

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT 118

GEOCHEMISTRY SURVEY PLAN
MOLYBDENUM

NTS SHEET 105-J-15

SCALE	DATE	SURVEYED BY	DRAWN BY
approx 1"=400'	AUG. 7, 1972	R.G. HILKER LTD.	M.L.S.

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

PLAN NO. 13

KEY PLAN

1	2
3	4

PLAN NO. 13

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT 119

GEOCHEMISTRY SURVEY PLAN
SAMPLE NUMBERS

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
approx. 1" = 400'	AUG. 7, 1972	R.G. HILKER LTD.	M.L.S

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

Association of Professional Engineers of Yukon
R. G. HILKER
GEOLOGICAL ENGINEER

PLAN NO. 14

INTRUSIVE CONTRACT

A1 A2 A3 A4 A5 A10 A14 A16 A17 A22 A23 A25 B14 B111

NOTE:
COPPER IS SHOWN IN PPM.
pH IS IN PARENTHESES.

KEY PLAN

1 2
3 4

Association of Professional Engineers of the Yukon
R. G. HILKER
GEOLOGICAL ENGINEER

PLAN NO. 14

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT 119

GEOCHEMISTRY SURVEY PLAN
COPPER

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
approx. 1" = 400'	AUG. 7, 1972	R.G. HILKER LTD.	MLS

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

PLAN NO. 15

NOTE:
MOLYBDENUM WAS NOT DETERMINED ON LATER TRAVERSES, HENCE THE SAMPLE STATIONS WITH NO VALUES.

MOLYBDENUM IS SHOWN IN PPM.

KEY PLAN

1	2
3	4

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

Professional Engineers Act — R. G. HILKER — GEOLOGICAL ENGINEER — Province of British Columbia

PLAN NO 15

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT 119

GEOCHEMISTRY SURVEY PLAN
MOLYBDENUM

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
approx 1" = 400'	AUG. 7, 1972	R.G. HILKER LTD.	MLS

PLAN NO. 16

LEGEND

□ located claim posts
○ assumed location of claim posts
NOTE - All locations are approximate due to photo distortion and inaccuracies in mosaic
No control lines were used.

KEY PLAN

1	2
3	4

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL ENGINEER

PLAN NO. 16

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT 119

GEOCHEMISTRY SURVEY PLAN
SAMPLE NUMBERS

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
approx 1" = 400'	AUG. 7, 1972	R.G. HILKER LTD.	MLS

PLAN NO. 17

ZONE 4-1

CONTACT

INTRUSIVE

NOTE:
COPPER IS SHOWN IN PPM.

pH IS IN PARENTHESES.

DETAIL TRAVERSES FROM THE AREA OF THE INTRUSIVE ARE SHOWN ON THE 1" = 200' DETAIL GEOCHEMISTRY PLAN (PLAN NOS. 3 & 4).

KEY PLAN

1	2
3	4

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

PLAN NO. 17

PHELPS DODGE CORPORATION OF CANADA, LIMITED

MACMILLAN PROJECT 119

GEOCHEMISTRY SURVEY PLAN
COPPER

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
approx 1" = 400'	AUG. 7, 1972	R.G. HILKER LTD.	M.L.S.

ASSOCIATION OF Professional Engineers OF BRITISH COLUMBIA
R. G. HILKER
GEOLOGICAL
ENGINEER

PLAN NO. 18

ZONE 4-1

NOTE:
MOLYBDENUM WAS NOT DETERMINED ON LATER TRAVERSES, HENCE THE SAMPLE STATIONS WITH NO VALUES.

MOLYBDENUM IS SHOWN IN P.P.M.

R.G. HILKER LTD. CONSULTING GEOLOGIST
WHITEHORSE, Y.T.

KEY PLAN

1	2
3	4

Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL ENGINEER

PLAN NO. 18

PHELPS DODGE CORPORATION OF CANADA, LIMITED

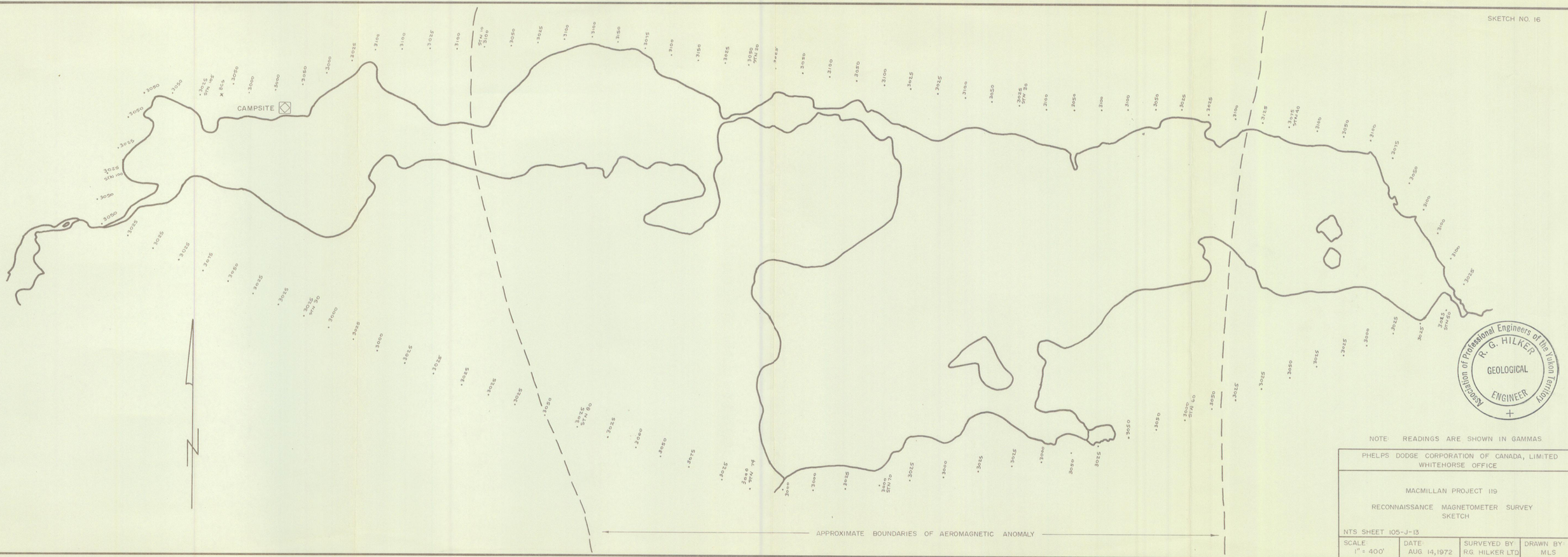
MACMILLAN PROJECT 119

GEOCHEMISTRY SURVEY PLAN
MOLYBDENUM

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
approx. 1" = 400'	AUG. 7, 1972	R.G. HILKER LTD.	MLS

SKETCH NO. 16



Association of Professional Engineers of the Yukon Territory
R. G. HILKER
GEOLOGICAL
ENGINEER

NOTE: READINGS ARE SHOWN IN GAMMAS

PHELPS DODGE CORPORATION OF CANADA, LIMITED
WHITEHORSE OFFICE

MACMILLAN PROJECT 119

RECONNAISSANCE MAGNETOMETER SURVEY
SKETCH

NTS SHEET 105-J-13

SCALE	DATE	SURVEYED BY	DRAWN BY
1" = 400'	AUG 14, 1972	R.G. HILKER LTD	MLS