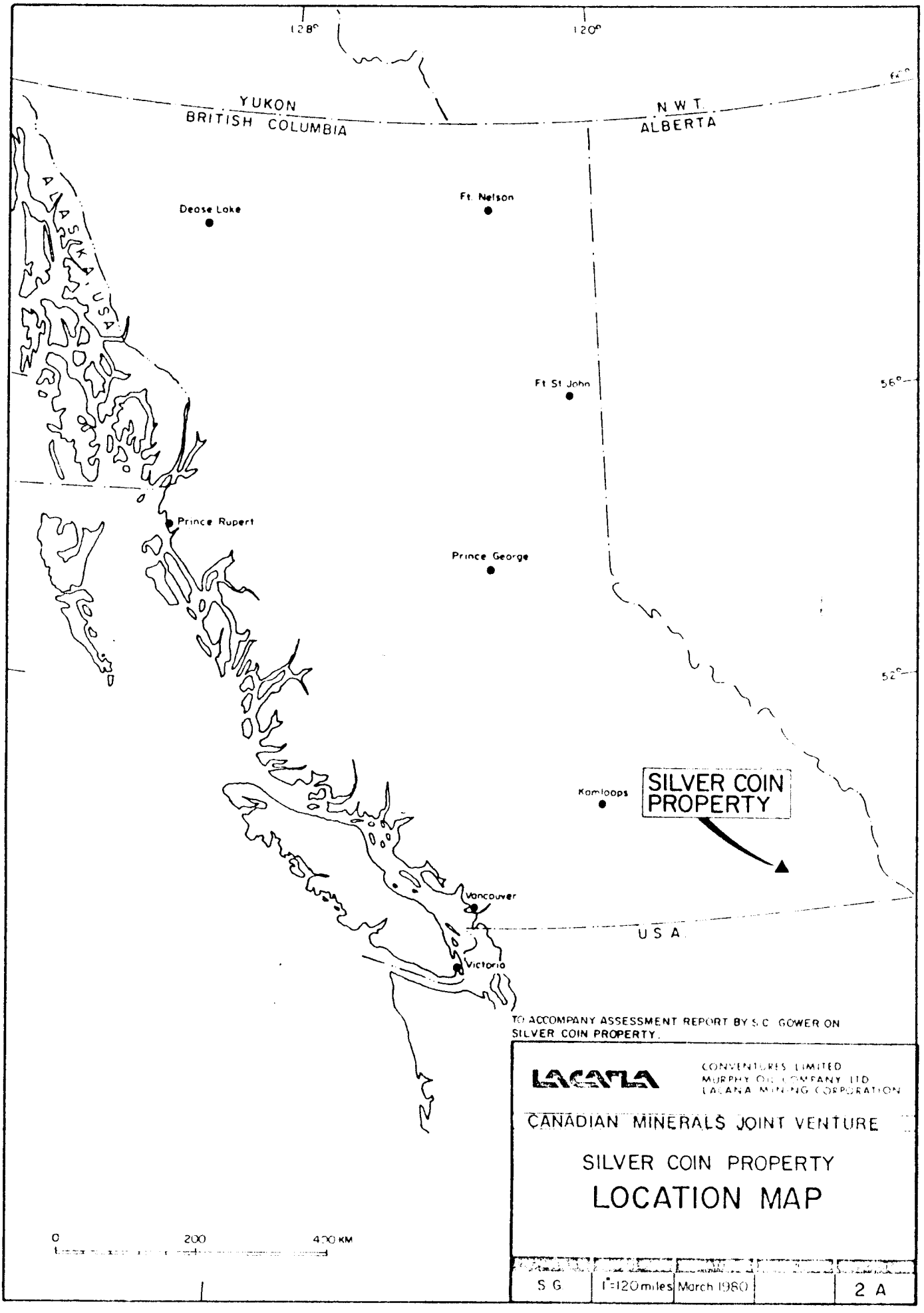
GEOLOGICAL, GEOCHEMICAL AND GEOPHYSICAL REPORT ON THE SILVER COIN PROPERTY BALFOUR AREA, B.C. NTS 82F/15W

S.C. Gower
Vancouver, B.C.
December, 1980



TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY.

LACANA

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CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY

LOCATION MAP

S.G.	1"=120 miles	March 1980		2 A

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Cont'd

Statement of Qualifications

S.C. Gower:

B.Sc. Geology, U.B.C. 1970

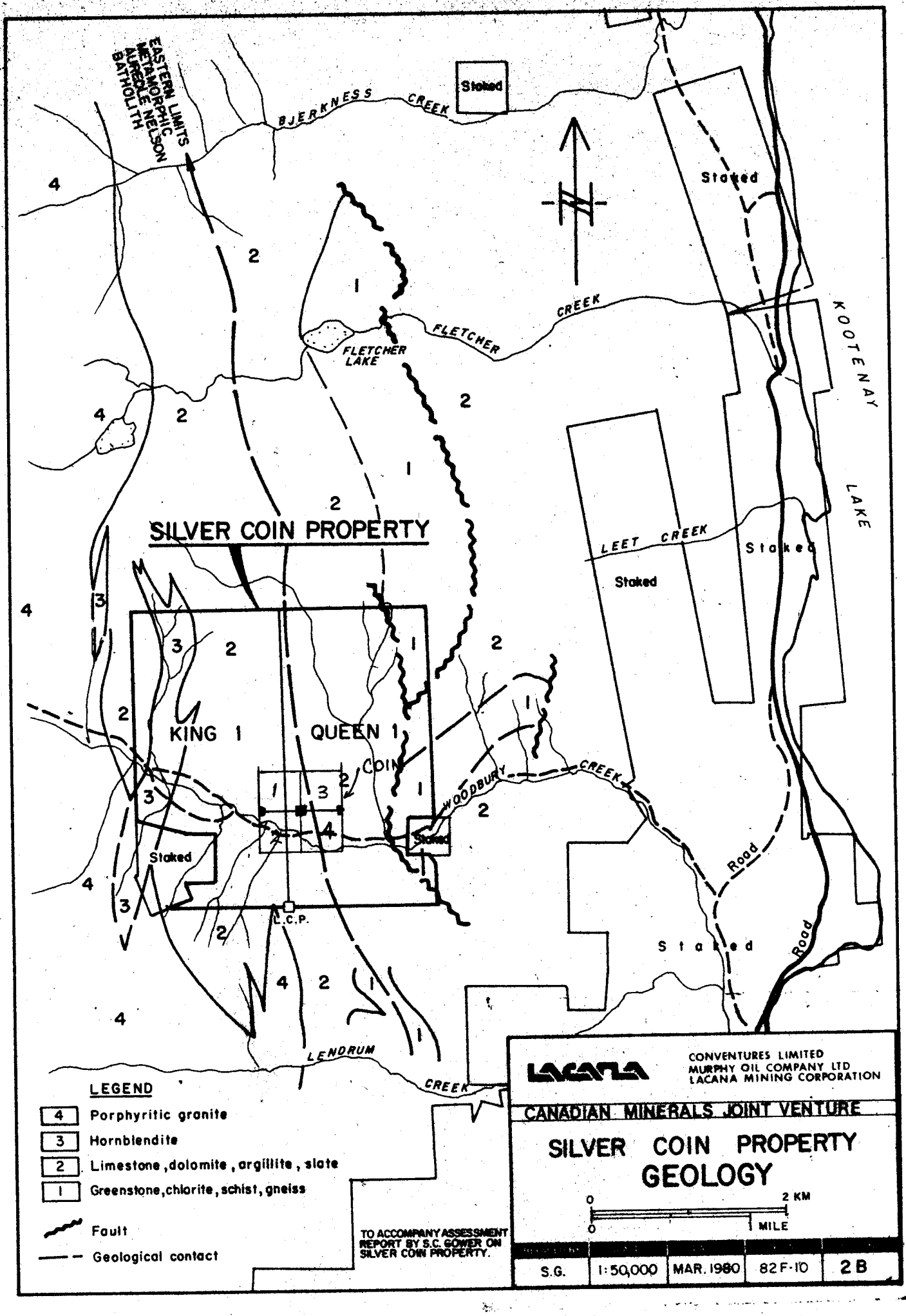
1970 – 1977 with Kennco (Western).

1977 – present with Lacana, Sr. Geologist.

P.P. Neilsen:

B.Sc. Geophysics, U.B.C., 1969

Consultant.


EASTERN LIMITS METAMORPHIC AUREOLE NELSON BATHOLITH
BJERKNESS CREEK
Staked
Staked
FLETCHER CREEK
FLETCHER LAKE
KOOTENAY LAKE
SILVER COIN PROPERTY
LEET CREEK
Staked
Staked
KING 1
QUEEN 1
COIN
WOODBURY CREEK
Staked
Staked
L.C.P.
Staked
Road
Road
LENDRUM CREEK
LEGEND
4 Porphyritic granite
3 Hornblendite
2 Limestone, dolomite, argillite, slate
1 Greenstone, chlorite, schist, gneiss
Fault
Geological contact
TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY.
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SILVER COIN PROPERTY
GEOLOGY
0 2 KM
0 MILE
S.G. | 1:50,000 | MAR. 1980 | 82F-10 | 2B

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APPENDICES

SUMMARY

An extensive program of evaluation has been completed on the SILVER COIN property. The potential of the property has been tested in detail with geological mapping of underground and surface features and extensive utilization of silt, soil and rock geochemistry. It is reasonable to expect, taking into consideration surface depletion of silver due to weathering that the shear zone between levels #2 and #5, a vertical distance of 85 metres, averages about 4 oz./ton Ag. over a distance of 2 metres. High grade sections in level #4 average 40 oz./ton Ag. over 25-30 cm. Gold values are generally low, ranging between 0.003 to 0.009 oz./ton. Based on the limited tonnages of material indicated and the high cost of exploration, the decision has been made to terminate the option agreement on the property without drill testing.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Silver mineralization on the property appears to be confined to a single shear zone which trends north across the property. The zone averages about 2 metres in thickness and is generally accompanied by a calcareous hanging wall and a chert breccia footwall. A silicious zone with en echelon stringers of quartz generally accompanies the shear zone. Silver values are extremely erratic even in the higher grade sections. It is not uncommon over a distance of several metres for values to fluctuate from less than 1.0 to over 40.0 oz./ton Ag. The shear zone is mineralized over a vertical distance of 85 metres between adit levels #2 to #5. Based on sampling of dumps, weathered outcrops and underground workings it is reasonable to expect an average assay of 4.0 oz./ton Ag. would be representative of the shear material in the silver zone.

RECOMMENDATIONS

The property and all contiguous ground staked by Lacana should be returned to the owner. Assessment work must be applied to hold the claims as per the agreement with Bill Carter.

INTRODUCTION

The property was presented to Lacana for option by prospector Bill Carter. Subsequent examination by S.C. Gower resulted in the recommendation being made to acquire the ground. Preliminary evaluation of the mineralization by Bacon, Donaldson & Assoc., indicated straightforward recovery of the silver.

A detailed program of geology, geophysical geochemistry and prospecting was carried out on the property during the 1980 field season. Underground workings were mapped in detail and much attention was focused on understanding the structure with regard to ore controls.

HISTORY OF PREVIOUS WORK

Little documentation of the history of the property is present in the literature. Based on verbal communications with local residents and field observations. the history can be pieced together. In the late 1890's prospectors discovered float boulders in Woodbury Creek of quartz, mineralized with native silver. Prospecting upslope of the float resulted in the discovery of quartz stringers in a shear zone which contained strong values in lead-zinc and silver. Underground work was carried out with hand steel on five levels over a period of 40 years. Apparently the owners of the property didn't work well together so they singularly worked on different levels. Production from the property was achieved from only levels #4 and #5. High grade ore was selected from the shear material mined which from 32 tons shipped, returned 4,597 oz./ton silver, 7,111 pounds of lead and 1,958 pounds of zinc. The remaining material was deposited on the dumps. During the middle 1950's, the property was explored by a junior mining company under the name of Silver Coin Exploration, at which time a shipment of 15 tons averaging 20.0 oz./ton Ag. was mined from level #3. Shortly after the shipment the promoter on the property left the country taking with him all available funds. Sampling of the dumps was undertaken during the 1960's by a consulting geologist, the results of which reportedly assayed around 10-15 oz./ton Ag. The property remained inactive until work commenced in 1980 by Lacana.

PROPERTY STATUS, LOCATION AND ACCESS

The property consists of 4 old style two post claims and two four post claims each containing 18 units.

COIN #1	51.65 acres
COIN #2	51.65 acres
COIN #3	51.65 acres
COIN #4	51.65 acres
KING #1	61.78 x 18 = 1,112.04 acres
QUEEN #1	61.78 x 18 = 1,112.04 acres

Total 2,430.68 acres

The SILVER COIN is located 4 miles west of Kootenay Lake on the north side of Woodbury Creek. Access to the property is via 4-wheel drive road along Woodbury Creek at a point where it leaves Highway 31 north from Balfour. The center of the property may be reached by a winding bulldozer road which extends almost to Adit level #2.

GENERAL GEOLOGY

Geological evaluation indicates the silver mineralization on the SILVER COIN property appears to be related to hornblendite phases of the Nelson Batholith contained within a metamorphic aureole. Hornblendite grading to hornblende diorite occurs as lenticular dyke-like masses along the margin of the batholith near Woodbury Creek. North of the creek the hornblendite forms medium to coarse grained outcrops which weathers into peculiar rounded forms. The hornblendite contains biotite, hornblende and minor amounts of andesine. South of Woodbury Creek the lenses consist of mottled diorites locally containing minor quartz. One of the lenses north of Woodbury Creek cuts porphyritic rock of the Nelson Batholith which has a chilled margin. In other locations the hornblendite contains inclusions of granodiorite which indicates intrusion after the batholith was consolidated.

A zone of thermal metamorphism encloses most of the known occurrences of silver on the property. This zone of contact metamorphism follows the eastern side of the batholith and reaches its greatest width on the SILVER COIN property, (½ mile). South of Woodbury Creek the zone narrows and south of Coffee Creek it appears to be less than 20 feet wide.

The contact metamorphism has been described one mile north of the SILVER COIN property by Templeman-Kluit (1961). In the lowest grade of metamorphism, argillaceous rocks contain quartz, biotite, muscovite, albite and eipdote, and calcareous rocks contain tremolite. Higher grade argillaceous rocks closer to the batholith contain minor amounts of cordierite, andalusite and locally hornblende. In the highest grade of metamorphism, garnet and sillimanite are found in the calcareous rocks and diopside, garnet scapolite and plagioclase occur in the calcareous rocks.

MINERALIZATION AND MINERAL PROCESSING

Mineralization observed in the shear zone consists of galena, sphalerite, chalcopyrite, pyrite, azurite, malachite and hydrozincite. Polished section examination of material from level #4 indicated the major silver mineral present was in the native form. Preliminary test work by Bacon, Donaldson & Assoc. indicates that the silver can be liberated from the crushed rock after grinding in a rod mill for five minutes and then jigging. Liberated particle size of the silver ranged from 0.2 mm. to 0.5 mm.

It appears that recovery of silver from this material should be very straightforward. A jig in closed circuit with a ball mill would be required to ensure the recovery of coarse silver. The rest of the processing operation would consist of some combination of flotation and/or cyanidation. It is anticipated that silver recoveries greater than 90% should be achieved. The final decision as to the circuit would be based on testwork designated to provide recovery-grade relations as well as residence times in the case of cyanidation.

Cyanide consumption is not expected to be excessive but it should be recognized that cyanidation of silver generally requires longer times than for gold.

WORK PROGRAM

GEOLOGY (Fig 2B)

The property is underlain by argillaceous and limey units of the Slocan sedimentary series where they are in contact with the basal volcanics of the Kaslo series. The sediments are cut by ultramafic dykes probably related to the nearby hornblendite intrusive rocks. The shear zone is hosted in mauve-grey calcareous argillites on the hanging wall and a siliceous chert breccia unit on the footwall. Between the chert breccia and the Kaslo volcanics which form the hinge for a major anticlinal structure is an enclosed bed of altered limestone. The shear zone traverses across the western limb of the anticline progressing towards the hinge as it travels upslope. East of the hinge, altered Slocan black argillites are in contact with an intrusive sill.

GEOPHYSICS (Fig 2B,2C)

A limited amount of C.E.M. Horizontal Shootback coverage (9 km.) was carried out in the vicinity of the adits to determine if the method would respond to the narrow low sulphide silver veins observed in the adits. A coil separation of 50 metres and an operating frequency of 5010 Hz. were utilized based on the known parameters such as low sulphide content, narrowness of shear zones and the time constraint. In general it was discovered that the shear zones possessed a strong E.M. response. The altered Kaslo volcanics in the hinge of the anticline also formed a good conductor due to the presence of thick continuous seams of graphite.

A McPhar M-700 magnetometer survey (8 km.) was carried out utilizing the existing soil geochemical survey grid. Readings were taken along lines spaced 50 metres apart and at a station interval of

GEOPHYSICS (Fig. 2B) CONT'D

10 metres. Values varied between 260 gammas to 520 gammas over the entire survey grid. Considering the steep terrain, the magnetic response was very flat and uninteresting except for a small high at line 1 + 50N, station 0 + 25W and a dipolar feature at line 3 + 50N, station 0 + 10E, which appears to be related to the E.M. conductor along the baseline in that area. Slightly lower values along the western ends of the survey lines reflect a change from argillaceous to quartzitic rocks.

GEOCHEMISTRY (Fig. 2D,2I)

A strong lead-zinc-silver in silt and soil anomaly is related to the mineralized shear zone. Anomalous values along the road near Woodbury Creek are probably related to contamination from the dumps below the workings. High silver in soil values above Adit level #5 are probably directly reflecting the underlying shear zone and provide a logical trenching target for further exploration. Background values for silver in silt and soil are generally 0.5 - 1.5 ppm., values are considered anomalous greater than 5.0 ppm. Some values occur as high as 133.2 ppm. that are not related to dump contamination.

OLD WORKINGS (Fig. 2J)

Workings were rehabilitated on five levels by removal of cave material at or near the portals. The adits were then mapped and sampled on a scale of 1 cm. = 1 m.

Level #1 (Fig. 2K)

Elevation - 1,045 metres. Length - 53 metres. This adit follows a shear zone approximately 2 metres in width consisting of broken argillite cemented with gouge and calcite veining. Massive calcite veins 30 to 40 cm. wide are intersected near the end of the adit. Sample values ranged from 0.12 to 0.32 oz./ton Ag.

OLD WORKINGS CONT'D

Level #2 (Fig. 2L)

Elevation - 1,110 metres. Length - 80 metres. This working follows the same structure as intersected by Level #1. Hanging and footwalls consist of argillite. The zone consists of fractured argillite cemented by gouge and calcite. The working was sampled in detail, with results ranging from trace to 2.25 oz./ton Ag. A raise follows the zone for a distance of about 15 metres towards the surface.

Level #3

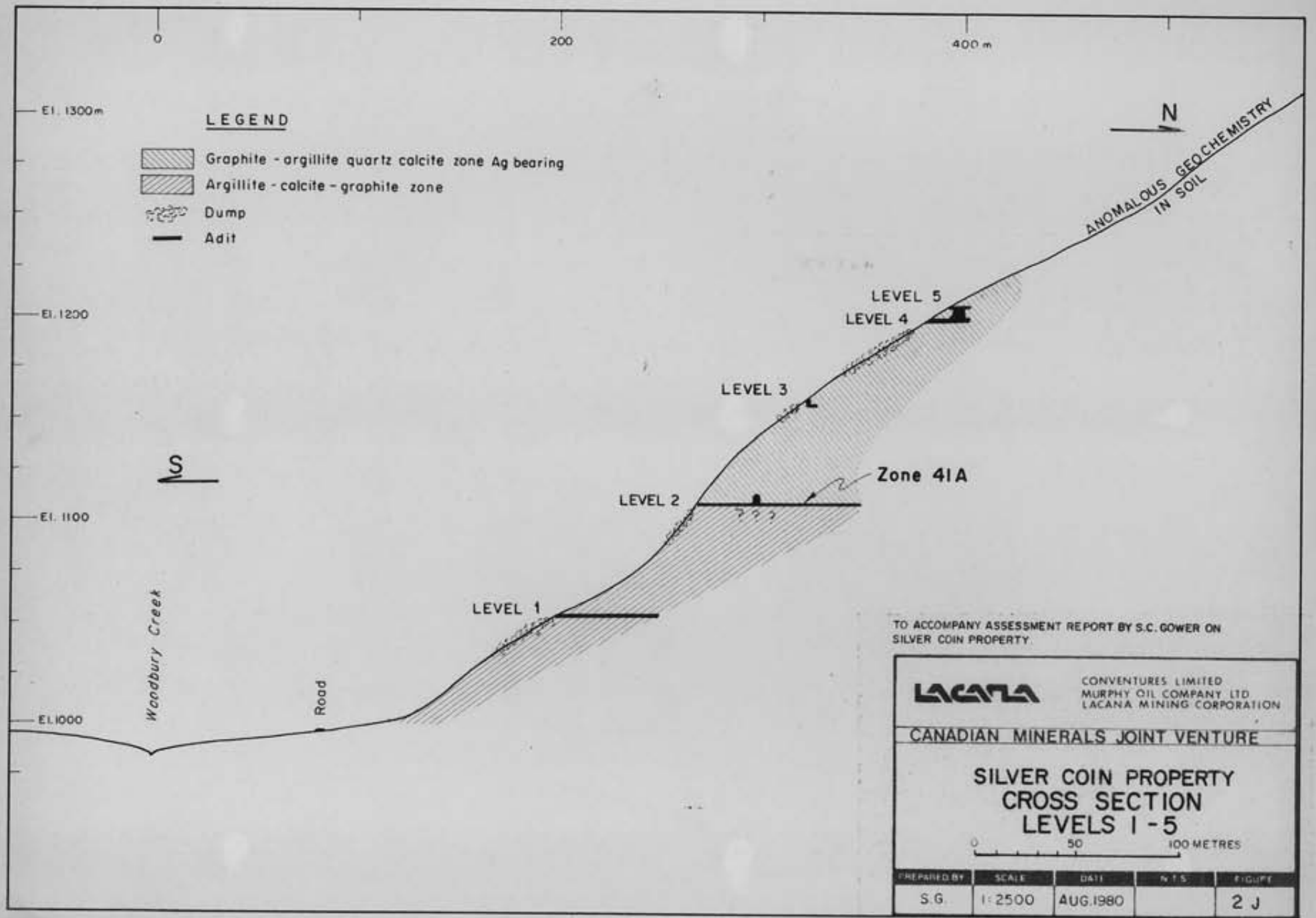
Elevation - 1,150 metres. Length - 3 metres. Access to this level was achieved by digging out an old shaft 4 metres deep. Samples from the shaft assayed 0.18 to 1.12 oz./ton Ag., in leached material. The zone consists of shattered argillite cut by veinlets of quartz and calcite cemented by gouge. Level #3 appears to be the in the position of a horsetailing fault which connects Levels #1 and #2 with #3 and #4. The zone is approximately 3 metres in width and is the same structure as cut by Levels #4 and #5.

Level #4 (Fig. 2N)

Elevation - 1,190 metres. Length - 23 metres to cave-in. This level follows a shear zone approximately 1 - 1½ metres in width, cemented by gouge and veinlets of quartz and calcite. Quartz veins and gouge zones carry values up to 173.0 oz./ton Ag. Previous sampling by S.C. Gower in 1979 returned values from 14.0 to 20.0 oz./ton Ag. over widths totalling greater than one metre. A realistic average value for the zone is about 4.0 oz./ton Ag. This correlates well with samples assayed from the dump.

Level #5 (Fig 2N)

Elevation - 1,200 metres. Length - nil. This level has been stoped into from Level #4, and access from surface is



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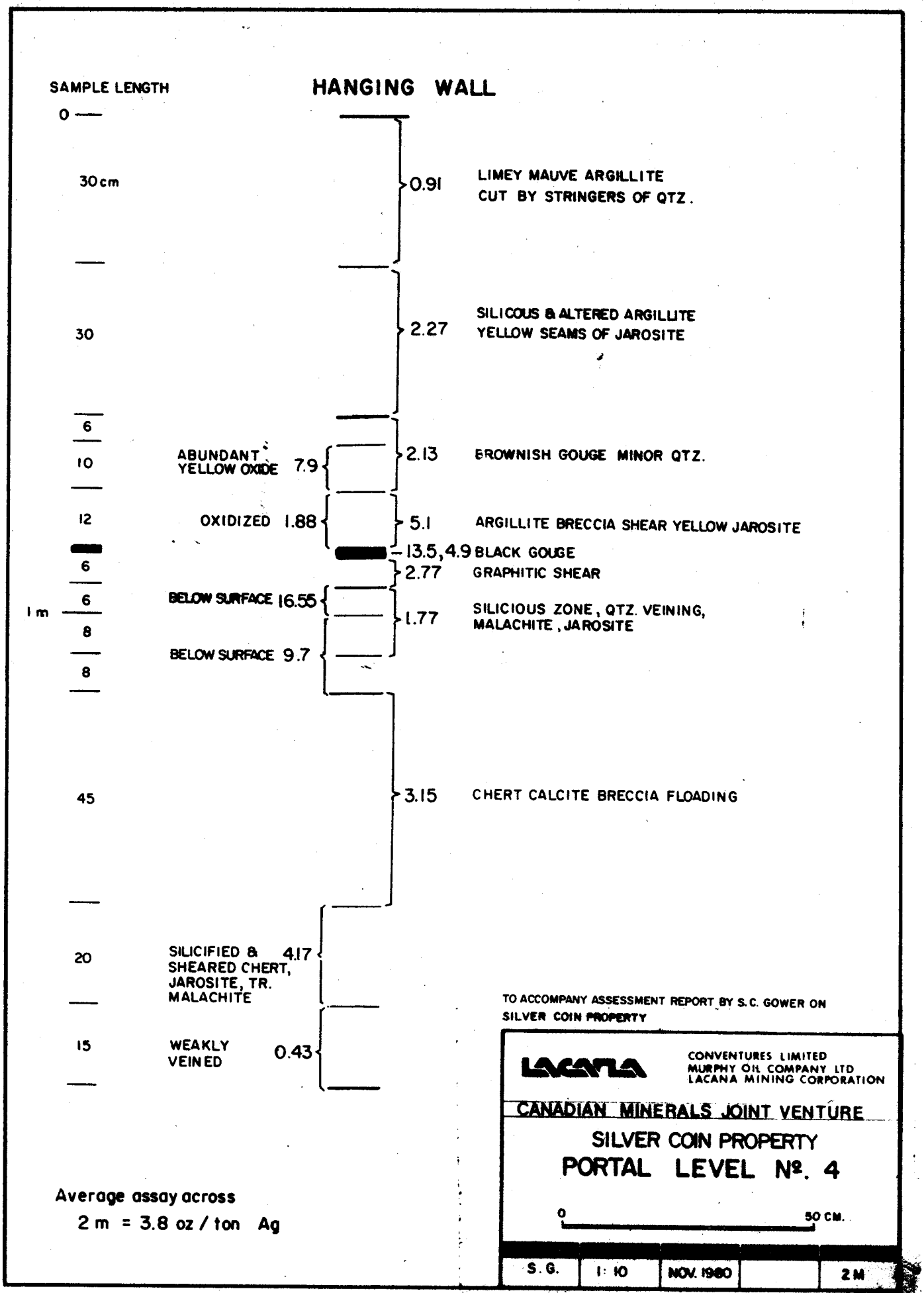
CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY
CROSS SECTION
LEVELS 1 - 5

0 50 100 METRES

PREPARED BY	SCALE	DATE	N.T.S.	FIGURE
S.G.	1:2500	AUG. 1980		2 J



Average assay across
2 m = 3.8 oz / ton Ag

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SILVER COIN PROPERTY

PORTAL LEVEL Nº. 4

0 50 CM.

S.G.	1:10	NOV. 1980		2M

OLD WORKINGS CONT'D

Level #5 (Fig. 2N) Cont'd

blocked by caved material. Attempts to dig out the caved soil and rock resulted in additional slumping. Access to Level #5 was attempted via the raise from Level #4, however the two levels do not appear to intersect. The zone that has been mined is about 1 metre in width and consists of shattered argillite cemented with gouge and quartz or calcite veining.

SAMPLING

Preliminary sampling was undertaken to test the silver content of the dumps on the property. Insufficient data were collected to allow any estimation of the tonnage and grade of the dumps, however the assays available do correlate well with data collected by Lacana and historical data. Samples were taken at 2 metre spacings across the dumps from an average depth of one foot.

Adit #1 Samples U-80-227 to U-80-230, (233-234)
Values returned, 0.16, 0.17, 0.11, 0.16, 0.18 oz./ton Ag.
Average = 0.15 oz./ton Ag.

Adit #2 Samples U-80-200 to U-80-212
Values returned, 4.94, NS, 5.82, 1.47, 1.09, 0.74, 0.21, 1.59 oz./ton Ag.
Average = 2.5 oz./ton Ag.

Adit #3 Samples U-80-176 to U-80-189
Values returned, 26.2, 10.2, 2.31, 35.3, 17.1, 24.1, 51.5, 22.1, 15.0, 20.2, 3.8, 6.18 oz./ton Ag.
Average = 19.5 oz./ton Ag.

Adit #4 Samples U-80-221 to U-80-226
Values returned, 1.87, 3.50, 8.15, 3.72, 5.40, 3.95 oz./ton Ag.
Average = 4.5 oz./ton Ag.

SAMPLING CONT'D

Adit #5 — Samples U-80-213 to U-80-220
Values returned, 2.44, 8.85, 9.80, 5.52, 9.05, 1.68, 3.51, 3.70 oz./ton Ag.
Average = 5.5 oz./ton Ag.

DRILLING

No drilling has been carried out on the property. If drilling is attempted it should consist of two holes which cut the argillaceous hanging wall, the shear zone, the chert breccia, the limestone and into the hinge volcanics at a point west of Adit #3 and Adit #5. The DDH's should strike east at a 45° dip and would have a length of about 150 metres. A drill access road would have to be constructed to facilitate travel to the sites and to remove core.

Stephen C. Tower

Reconnaissance Horizontal Shootback C.E.M. Survey
Silver Coin Property, Ainsworth area, B.C., by P. Neilsen

INTRODUCTION

A limited amount of C.E.M. Horizontal Shootback coverage was carried out in the vicinity of the adits to determine if the method would respond to the narrow low sulphide silver veins observed in the adits. When considering all the known parameters such as low sulphide content observed, bi-furcating veins, limited geochemical results at the time, narrowness of veins, limited time, short lines, etc. It was decided that a coil separation of 50 metres and an operating frequency of 5010 Hz. (hi freq.) would be used.

A test traverse was executed along the main lower road to determine the survey parameters and to check out the new operators.

DISCUSSION OF RESULTS

A preliminary interpretation was made on the basis of this very limited coverage. Lines 0 + 50 and 1 + 00N indicated two sub-parallel, narrow, near vertical conductors whose depth extent to their tops should not exceed 10 metres, but more likely sub-outcrops. Line 0 + 00 was not run but the more easterly of these to conductors could continue south to the interpreted conductor at station 0 + 50E on the lower road.

No significant response was observed in the adit area of L1 + 00N. It is possible that there is a truncation of the above mentioned conductors at or near this line. The -10^{o} reading on L1 + 00N at station 0 + 50W is probably related to a corresponding positive response not yet observed further to the west. The line must be extended to close off this feature.

The eastern interpreted conductor between L2 + 00N and L3 + 00N is somewhat tenuous in that it is barely closed off on one line only but is interesting when superimposed with recent geochemical results in that area. At L2 + 00N, station 0 + 75E, the conductor is narrow, near surface (ie; less than 15 metres to top) and dipping 60^{o} - 70^{o} to the south (downhill).

FLUXGATE MAGNETOMETER SURVEY

INTRODUCTION

A fluxgate magnetometer (veritcal field) survey was carried out concurrently with the E.M. survey with readings being taken along lines spaced 50 metres apart and at a station interval of 10 metres. Values varied from 260 gammas (8's) to 520 8's over the entire survey grid.

DISCUSSION OF RESULTS

In view of the steep terrain the magnetic results are very flat and un-interesting except for a small high at L1 + 50N station 0 + 25W and a dipolar feature at L3 + 50N, station 0 + 10E which appears to be related to the E.M. conductor along the baseline in that area.

Slightly lower values along the western ends of the survey lines could be due to a change in rock type.

RECOMMENDATIONS AND CONCLUSIONS

Although the magnetometer results are non-diagnostic, and un-interesting, the coverage should be extended to that to the eventual E.M. coverage. The method is fast and inexpensive and could add information to the north.

P.P. Neilson

Appendix I

CONCLUSIONS AND RECOMMENDATIONS

In view of the strong geochemical anomalies east of the base-line, some high values of which are coincident with E.M. anomalies, further detailed E.M. coverage is warranted. Also, further lines must be installed and surveyed with E.M. to the north of the present E.M. grid to test the high geochem.

Should time permit, all lines with readings 7 $\pm$ 5^0 resultant dip angle at their ends should be closed off until background levels are reached. All survey lines should be extended with CEM shootback coverage to the east past the limit of anomalous geochem and again until background E.M. values are attained. This coverage also applies to the north using the same line spacing and station intervals.

All further coverage should use an E.M. station interval of 10 metres and both Med. and High frequency. In areas of interesting response, a coil separation of 100 metres (both frequencies) should be used.

Further detail will also assist in a more accurate dip estimation as near narrow, sub-parallel conductors are difficult to interpret at any stage of detail.

Two operating frequencies will assist in determining conductivity although the highest conductive zones will not necessarily yield the most economically important veins in the environment observed to date.

The vertical loop E.M. method should be used over the more interesting conductors to more accurately determine their near surface trace for possible future drilling.

P.P. Neilson B.Sc.
Geophysicist
June 13/80

DATA REVIEW - SILVER COIN
By Geophysicist/Geologist Lee Barker

LINE 3+00N - Requires additional readings at either end. The survey should extend at least 3 stations either side of the shoulders of the anomaly to establish what the background noise levels are.

LINE 2+50N - There is a shallow conductive axis apparently centred on the B-L and possibly dipping steeply to the west. The profile is incomplete on the east side and would benefit by more readings at both ends, and some in-between readings across the anomalous zone.

LINE 2+00N - The profile is incomplete on the west side; the eastern axis may be valid, but unless you can see clearly that there is no evidence for it, the offset of the western axis, apparently from the B-L 2+50N point to 25 west on 2+00N may be a fault effect, or there could be an echelon arrangement of conductive zones caused by isoclinal folding of a graphitic horizon, perhaps with some faulting.

LINE 1+50N - This profile really shows nothing, it should be extended in both directions, especially to the west.

LINE 1+00N - 0+50N - The profiles here look like two narrow parallel zones slightly less than the coil separation apart, (perhaps 25 to 40 m. apart), and very close to surface. Both profiles should be extended to either side. Vertical loop fixed transmitter might be more accurate.

LINE 0+00 - Not run due to steep slopes.

Appendix II

PROFILE ALONG THE ROAD

This line has the best profile viz-a-viz a good run in at each end, but detail would benefit from fill-in readings in the anomalous area between B-L and 1+50E.

GENERAL

As the maximum resultant dip angles at 5010 Hz. frequency are only about 10-15 degrees, the conductivity of the zones does not seem to be really high. Certainly this frequency is the best one to use to look for shears, but a second frequency should be re-read to provide comparative data.

The mag seems to show a low associated with the adit trend, but as with the E.M. , it would benefit greatly from longer lines, ie; more data to the east and west. This would put your mineralized zone into a broader pattern of perspective and hopefully allow better interpretation of any structures.

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ANALYTICAL PROCEDURE REPORTS FOR ASSESSMENT WORK

PROCEDURE FOR GOLD GEOCHEMICAL ANALYSIS.

Geochemical samples for Gold processed by Min-En Laboratories Ltd., at 705 W. 15th St., North Vancouver Laboratory employing the following procedures.

After drying the samples at 95°C soil and stream sediment samples are screened by 80 mesh sieve to obtain the minus 80 mesh fraction for analysis. The rock samples are crushed and pulverized by ceramic plated pulverizer.

A suitable sample weight 5.0 or 10.0 grams are pre-treated with HNO_3 and $HClO_4$ mixture.

After pretreatments the samples are digested with Aqua Regia solution, and after digestion the samples are taken up with 25% HCl to suitable volume.

At this stage of the procedure copper, silver and zinc can be analysed from suitable aliquote by Atomic Absorption Spectrophotometric procedure.

Further oxidation and treatment of at least 75% of the original sample solutions are made suitable for extraction of gold with Methyl Iso-Butyl Ketone.

With a set of suitable standard solution gold is analysed by Atomic Absorption instruments. The obtained detection limit is 5 ppb.

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ANALYTICAL PROCEDURE REPORTS FOR ASSESSMENT WORK

PROCEDURES FOR Mo, Cu, Cd, Pb, Mn, Ni, Ag, Zn, As, F

Samples are processed by Min-En Laboratories Ltd., at 705 W. 15th St., North Vancouver Laboratory employing the following procedures.

After drying the samples at 95°C soil and stream sediment samples are screened by 80 mesh sieve to obtain the minus 80 mesh fraction for analysis. The rock samples are crushed by a jaw crusher and pulverized by ceramic plated pulverizer.

1.0 gram of the samples are digested for 6 hours with HNO_3 and $HClO_4$ mixture.

After cooling samples are diluted to standard volume. The solutions are analyzed by Atomic Absorption Spectrophotometers.

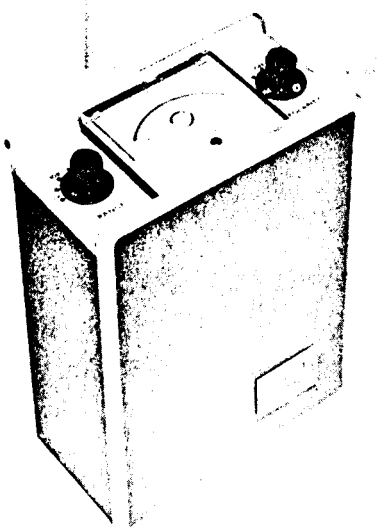
Copper, Lead, Zinc, Silver, Cadmium, Cobalt, Nickel and Manganese are analysed using the CH_2H_2-Air flame combination but the Molybdenum determination is carried out by C_2H_2-N_2O gas mixture directly or indirectly (depending on the sensitivity and detection limit required) on these sample solutions.

For Arsenic analysis a suitable aliquote is taken from the above 1 gram sample solution and the test is carried out by Gutzit method using Ag $CS_2N(C_2H_5)_2$ as a reagent. The detection limit obtained is 1. ppm.

Fluorine analysis is carried out on a 200 milligram sample. After fusion and suitable dilutions the fluoride ion concentration in rocks or soil samples are measured quantitatively by using fluorine specific ion electrode. Detection limit of this test is 10 ppm F.

INSTRUCTION MANUAL

McPHAR



M700 MAGNETOMETER

SECTION 1

INTRODUCTION

The M700 Magnetometer is a vertical field magnetometer employing the flux gate principle. The instrument is self-levelling, and a self-cancelling circuit permits rapid, accurate measurement of the earth's magnetic field from a meter, without adjustments or calculations.

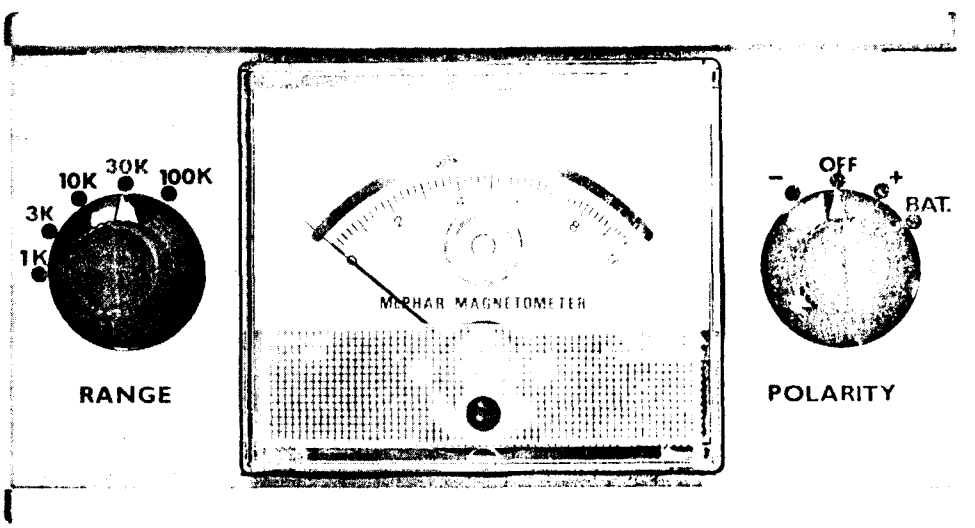
The self-levelling feature of this electronic magnetometer eliminates the need for bulky tripods and time consuming fine levelling procedures. Further, the instrument is practically insensitive to orientation. Errors are as low as 25 gammas for 180 degree rotation in a 15,000 gamma horizontal field.

Since the instrument can be adjusted electronically to measure vertical fields from plus 100,000 gammas to minus 100,000 gammas, there is no need for auxiliary magnets or complicated latitude adjustments.

The operation of the M700 is very simple. The reading on the meter is set to zero at a chosen base station by operating the latitude adjustment control. This can be done to an accuracy of 5 gammas. Next, as successive stations are occupied, the instrument is held roughly level, and the increase or decrease in the vertical component of the earth's magnetic field is read directly from the meter. Five scale ranges are available and on the most sensitive range the accuracy is 5 gammas.

The M700 Magnetometer is the result of extensive engineering based on rugged field requirements. It incorporates the latest advances in solid state components and has built in temperature stability. The instrument provides rapid, accurate, repeatable measurements.

An accessory socket broadens the applications of the M700. Optional accessories available from McPhar permit the same console to be used, for example, as a base station monitor or an airborne recording magnetometer.



SECTION 2

SPECIFICATIONS

2–1 MAXIMUM SENSITIVITY

20 gammas per scale division on 1,000 gamma range.
Readability is 1/4 scale division or 5 gammas.

2–2 MAXIMUM MEASUREMENT

Zero to ± 100,000 gammas in five ranges.

Range Switch Position	Full Scale In Gammas	Gammas Per Scale Division
1K	1,000	20 black scale
3K	3,000	50 red scale
10K	10,000	200 black scale
30K	30,000	500 red scale
100K	100,000	2,000 black scale

2–3 MEASUREMENT POLARITY

The above ranges can be reversed in polarity as a simple function of the Polarity switch.

2–4 LATITUDE ADJUSTMENT

The latitude adjustment permits cancelling the earth's field up to a magnitude of ± 100,000 gammas. The adjustment control is a ten revolution precision potentiometer located under the sliding side panel. A positive type locking lever on the control removes the hazard of accidentally dislodging the setting.

2–5 SELF-LEVELLING SENSING HEAD

The unique self-levelling sensing head of this magnetometer is inserted as a plug-in unit. It is easily detached so that the same magnetometer can be used with other types of sensing heads such as the airborne gyro stabilized head etc.
It is recommended that the instrument be re-calibrated at our servicing depot, each time the sensing head is changed.

2–6 ORIENTATION ERROR

The orientation error is set at the factory to 25 gammas or less in the presence of a 15,000 gamma horizontal field. It is possible to adjust the orientation error and the procedure is explained in the section 9–2 under Maintenance.

2–7 TEMPERATURE STABILITY

Over the temperature range of –35 to +55 degrees centigrade the temperature drift is limited to less than 50 gammas. See section 4–6 on Minimizing Temperature Drift.

2–8 BATTERY SUPPLY

The M700 Magnetometer is powered by two internally mounted 9 volt batteries. Any pair of the following batteries may be used.

Eveready No. 276
Mallory No. M1603
Burgess No. D6
R. C. A. No. VS306

For sub-zero operation the batteries may be transferred to an external battery case and carried under clothing to keep them from freezing. **See section 6, Operation with External Batteries.**

Two types of external battery cases are available **see accessory list, section 11.** One type is for the above batteries. Another type of case will accommodate the equivalent in flashlight cells for use in countries where the normal batteries are difficult to obtain.

2–9 ACCESSORY RECEPTACLE

A Cannon receptacle is located on the side of the instrument under the sliding panel. This increases the versatility of the instrument so it can be used in a number of ways in addition to its normal vertical field ground magnetometer function. See section 8, under Extended Applications and section 11, under Accessories.

2–10 ACCESSORY & LATITUDE SWITCH

This is a double function switch. The first function is to permit operation north or south of the equator by simply changing one step

2–10 ACCESSORY & LATITUDE SWITCH (Cont'd.)

on the switch. By switching an additional step, the accessory socket is brought into connection and accessories can be applied to the instrument.

2–11 WEIGHT

The weight of the magnetometer is distributed as follows:–

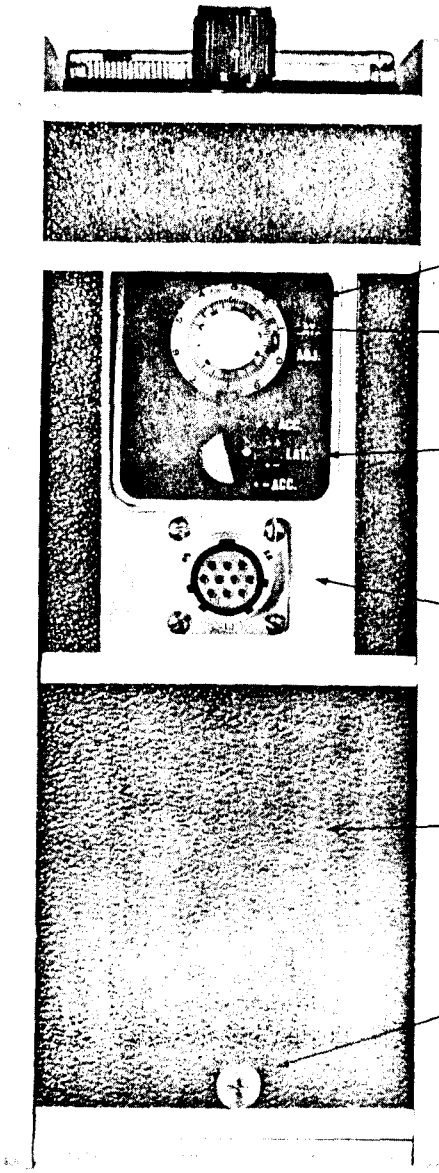
Console:	6 pounds
Batteries:	1–1/4 pounds **2 type Eveready 276**
Carrying Case:	2 pounds

2–12 MAGNETOMETER DIMENSIONS

Width:	6–7/8 inches
Depth:	3–3/4 inches
Height:	9–5/8 inches

2–13 TRANSIT CASE

The magnetometer is shipped in a foam fitted transit case. The case is designed to accommodate the magnetometer in its leather case, spare batteries, external battery cable and battery case and instruction manual.



SECTION 3

GENERAL DESCRIPTION AND APPLICATIONS

The field sensitivity of the M700 magnetometer originates in a flux gate element mounted so that its axis of maximum sensitivity is maintained in the vertical plane. The flux gate element contains an excitation winding and a detector winding. In addition there are auxiliary windings around the element which carry D.C. currents. With the auxiliary windings, a D.C. flux is created to cancel the earth's field. **Latitude adjust control and automatic cancelling.**

The flux gate element is continuously excited between saturation levels by an A.C. current. A detector winding consisting of differentially wound coils, picks up zero voltage when the resultant D.C. flux through the elements is zero.

When the external D.C. field changes in magnitude, a corresponding phase-reversible second harmonic output voltage is produced across the detector winding. The second harmonic output voltage is fed to a phase sensitive rectifier system and used to provide a cancelling D.C. current to oppose the external field attempting to unbalance the flux gate element.

The system therefore is a self-cancelling one and at all times approximates a condition of zero flux about the flux gate element.

The D.C. current fed back to maintain the zero flux condition is measured on the display meter and is directly proportional to the change in the earth's field. The meter, then, can be calibrated directly in gammas.

Five meter ranges are provided to permit the measurement of a change of field of up to 100,000 gammas. Because the field at any new measurement station may increase or decrease, a polarity reversal on the on-off switch is provided.

The main application of the instrument is for general ground surveying. Because of the lack of any set-up requirements and the rapid direct meter read out, it provides the fastest and most economical geophysical surveying available compared to any other type of instrument or technique.

With the accessory receptacle the M700 lends itself to many other applications. These are covered in Section 8, under Extended Applications.

SECTION 4
OPERATING INSTRUCTIONS

4–1 INSPECTION

After the instrument is unpacked, it should be carefully inspected for damage received during transit.

Particularly check for meter pointer damage and sensing head damage. The meter pointer can be inspected visually. To check the orientation error properly, requires an accurate turntable and controlled conditions. However, to quickly check for shipping damage, place the magnetometer on a flat surface away from any ferromagnetic material. Rotate it 180 degrees. If the self levelling arrangement in the sensing head has been damaged by severe shock, the orientation error will be several hundred gammas. If performing this check in a building, allow for the possibility of large field gradients. That is, after rotation, the magnetometer may end up in a different position and give a different reading.

It may be worthwhile mentioning at this point that, sometimes, when an instrument has been shipped some distance lying on its side, a hysteresis effect occurs on the self-levelling arrangement. The orientation error will consequently be somewhat larger than that set at the factory. This error will disappear if the instrument is allowed to stand vertical overnight.

If any shipping damage is found, immediately file a claim for **damage in shipment** with the carrier.

4–2 CONTROLS AND THEIR FUNCTION

There are four controls on the magnetometer and only two of these are operating controls used during the survey. For this reason, only these two controls are located on the top panel. The other two controls are located on the side of the instrument and protected by a sliding panel.

4–2–1 TOP PANEL CONTROLS

Polarity
This is a four position switch marked –, **OFF**, + and **BAT**. When the instrument is turned to + and a meter reading is indicated, then the earth's field intensity can be read on one of the scale ranges. If, on the other hand, the meter pointer deflects to the left of zero, the switch position is moved to – to obtain a scale reading.

The fourth position is a battery test position. The battery voltage is indicated directly on the black, 0 to 10, scale of the meter.

Range
This is a five position switch that selects the read-out scale of the magnetometer. If the **Range** switch is in the **3K** position, then full scale on the meter represents 3,000 gammas and the red, 0 to 30, meter scale is used. If the **Range** switch is in the **10K** position, then full scale on the meter represents 10,000 gammas and the black, 0 to 10, scale is used. See section 2–2 for the complete range to meter scale relationship.

4–2–2 SIDE PANEL CONTROLS

Latitude Adjust
This is a ten revolution precision potentiometer with a positive type locking lever. Operation of this control varies the magnitude of a D.C. current passing through one of the auxiliary coils wound around the flux gate element. This current sets up a magnetic field in opposition to the earth's field.

It is possible then, to cancel the earth's field at any given location so that the magnetometer meter reads zero. This allows the use of the most sensitive scale ranges for highest reading accuracy. Vertical fields of up to ± 100,000 gammas may be cancelled in conjunction with the reversing feature of the **Latitude and Accessory** switch.

When the **Polarity** switch is in the – position, turning the latitude control clockwise will cause the meter pointer to move clockwise or to the right of zero.

When the + position is used the clockwise rotation of the **latitude** control will

cause the meter pointer to be displaced to the left.

Note that when the **latitude** control is fully clockwise, no cancelling current is applied to the sensing head. The resulting reading obtained with the magnetometer under these conditions represents the absolute magnitude of the earth's field.

Latitude and Accessory Switch
This control is the one least used. It is marked ± **Latitude** and + **Accessory** and **–Accessory,** using the abreviations of **Lat.** and **Acc.** respectively.

The markings simply indicate that north of the equator, only the two positions marked + are used. South of the equator only the two positions marked – are used. The + **Acc** or –**Acc** positions are only employed when an accessory such as a recorder and, or, external batteries are connected to the magnetometer.

4–3 CANCELLING THE EARTH'S MAGNETIC FIELD

Prior to the start of a magnetic survey it is desirable to cancel out the earth's field at some chosen location which will be designated as the base station. All future measurements in the area will then remain relative to this key point.

By cancelling out the earth's background field, the more sensitive scales of the magnetometer can be used along with the greater reading accuracy available with the more sensitive ranges.

By referring back to the base station from time to time, a check on the accuracy of the survey and diurnal variations is obtained. The process of magnetic closures is also an effective control procedure. Cancelling the earth's magnetic field is a simple procedure. Rest the Magnetometer on a stump or other convenient location which is to serve as the base station site. Turn the instrument on and select a **range** switch position that gives an on-scale reading.

Open the leather side flap and drop the slide panel to expose the **Latitude Adjust** control and the **Latitude and Accessory** switch. Check to see that the **Latitude** switch is in the appropriate position, **+ for northern hemisphere and – for southern hemisphere.**

Release the locking lever on the **Latitude Adjust** dial and operate the control so the meter reading decreases to zero. As zero is approached progressively select more sensitive ranges and finally adjust for zero on the 1000 gamma range. It is not essential to be exactly on zero. Simply record the residual reading after locking the control. Make sure the instrument is held approximately level during this adjustment or while taking the residual reading.

The instrument is now ready for the survey and all future readings will be relative to this point.

4–4 TAKING A READING

Hold the instrument in both hands, slightly away from the body and both elbows pressed to the side of the body. Brace the feet slightly apart. Switch the instrument to the appropriate **ON** position and adjust the **range** switch to the most sensitive range that gives an **on scale** reading. Center the level bubble and while holding the instrument approximately level and steady, note the reading on the meter.

4–5 MINIMIZING FLUCTUATION DURING A READING

No ferrous objects such as steel belt buckles, pant zippers, pocket knives, lighters, etc., can be allowed in the vicinity of the sensing head. Such items will cause random meter fluctuations as the magnetometer moves relative to the body during a reading. Check all metal objects for magnetic effect beforehand using the magnetometer as an indicator.

There is a preferred body stance with respect to the horizontal direction of the earth's field. If the operator stands so his shoulders are roughly parallel to the direction of the earth's field, then back and forth motion of the body during a reading least affects the magnetometer. As the body moves, the sensing head, in its self-levelling suspension, is continually in motion.

The resulting angular rotation is at right

angles to the horizontal field vector and results in minimum variation from this source. The use of the preferred direction is particularly effective on windy days.

The general direction of the earth's field in a given area may be found using the magnetometer. One way is to hold the magnetometer roughly level, then deliberately induce slight back and forth motion and note the meter fluctuations. Rotate the body to a new position and repeat. Do this until a point is found where the meter fluctuations are a minimum as the magnetometer is deliberately moved. This is the point where the shoulders are approximately parallel to the horizontal field vector.

Another way is to set the latitude adjust control fully clockwise. The magnetometer is now reading the absolute magnitude of the earth's field. Raise the bottom of the magnetometer so the case is parallel to the ground. Raise the bottom an additional five degrees to take up the angle of play in the sensing head and bring the sensing head approximately horizontal. The magnetometer can now be used to find the direction of the horizontal field vector by rotating the body and stopping where the meter gives a maximum reading. This is not necessarily the absolute magnitude because there is no guarantee the sensing head was horizontal but it does adequately indicate the direction. In this way the magnetometer can be used as a compass for emergency reckoning.

4–6 MINIMIZING TEMPERATURE DRIFT

The temperature stability of the M700 is very good and can be of the order of ½ gamma per degree centigrade. However, where sudden large temperature changes are experienced, allow half an hour for the magnetometer to stabilize before proceeding with a survey. Failure to do this will result in all of the temperature drift occurring during the early readings.

When operating in sub-zero temperatures it is sometimes more desirable to leave the magnetometer outdoors overnight, taking only the batteries indoors. This eliminates any requirement for stabilization and the resulting temperature drift will be small.

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C E M

THE CRONE ELECTROMAGNETIC INSTRUMENT DESIGNED TO BE USED WITH THE HORIZONTAL SHOOTBACK EM METHOD AS WELL AS VERTICAL LOOP AND HORIZONTAL LOOP METHODS.

- The Shootback EM Method is a simple field method that does not require accurate survey lines. It retains its effectiveness even in rugged terrain areas. The method has been in use since 1957 and has located many mineral deposits. Interpretative model study curves are available.
- The equipment is flexible in that it can be used with the Shootback, Vertical Loop or Horizontal Loop, (in phase only), EM Methods with coil separations up to 200 meters, (600').
- The equipment is rugged, reliable and easy to operate.

• EQUIPMENT SALES AND RENTALS •

CEM SPECIFICATIONS

The complete CEM instrument consists of two identical coils both capable of receiving and transmitting alternating magnetic fields at three fixed frequencies. Battery supply is contained in a aluminum box mounted on a magnesium packframe.

Coil dimensions and weight: Diameter of 56 cm (22"); 3.8 Kg (8.3 lb).

Complete unit shipped in two wooden shipping boxes:
Dimensions and weight of one empty box: 31 x 61 x 77 cm (12" x 24" x 30"), 13 Kg (29 lb).
Weight of one shipping box complete with coil, packframe, batteries and earphones: 23 Kg (51 lb).
Shipping weight of complete unit (2 boxes): 46 Kg (102 lb).

Standard Frequencies: 390, 1830 and 5010 Hz (others available upon request).
Field tilt measurement by visual null on field strength meter and audio null through crystal earphones.
Inclinometer range of 200° , accuracy $\pm$ 0.5 degrees.
Receiver gain control: Linear calibrated 10 turn pot.
Field strength measurements from meter.
Operating range of coils: Up to 200 meters (600').

Battery Supply: 3 of 6 volt lantern batteries, Eveready #731 weight per battery; 1.3 Kg (2.8 lb).
audio battery supply; 1 of 9 volt, Eveready #216
Normal operational lifetime of battery supply – 3 to 6 weeks.

OPTIONAL EXTRAS

- Recharge battery supply and audio pack – 3 of 6 volt Gel cells
- Clip on battery pack (two of 9 volt Eveready #216) for use of coil as a visual receiver only (Vertical loop surveys).
- Plug in battery supply and audio pack for use of coil as audio and visual receiver only (Vertical loop surveys).
- Canvas knapsack for carrying coil with above options.

Note that the CEM coil is used as a receiver with the Crone VEM – large Vertical Loop system with a range of 800 meters, (2600').

MODEL TEST STUDIES WITH THE SHOOTBACK ELECTROMAGNETIC METHOD

Introduction

The Shootback EM method was developed in 1957 as the result of a research project by Noranda Mines Limited. The aim of the project was to produce an EM method that could be used in rugged, heavily timbered terrain. The Shootback idea proved a simple and effective solution producing a method that was completely accurate under conditions where the elevation, separation and direction between the transmitting coil and receiving coil are highly variable.

"The Shootback Method"

The Shootback method as described in Canadian Patent #631,506, U.S. Patent #110,974 involves two identical coils each being capable of transmitting and receiving. When transmitting the coils are accurately held with the same angle of tilt and their axies roughly in the same plane. Both coils, in turn transmit and then measure the dip angle at their positions. The two dip angles are added together. The inclinometers and procedure are such that if no conductors are present the "resultant dip angle", being the sum of the two readings, equals "0". The reading is recorded at the mid point between the two operators.

The Shootback Method Equipment

The first field equipment was designed for surveys in mountainous areas therefore was very small and light. The complete equipment for one man weighed 9-1/2 lbs., with single frequency coils (1800 Hz), audio null and a 200' range. The equipment was called Junior EM or JEM and proved to be rugged and reliable - some are still in use today, 13 years later.

The method was soon extended to electromagnetic coverage in flat as well as mountainous terrain. A new JEM was therefore built with two frequencies 480 and 1800 Hz, for conductivity measurement and a range of 300' for increased penetration. This unit retained the audio null and a 15° tilt off the vertical transmit position that the original JEM employed.

To answer the demand for still greater penetration and increased sensitivity to fracture filling type sulphide bodies a new instrument was designed. The CEM has a visual as well as audio null, 3 frequencies 390,1830 and 5010 Hz and a range of 600'.

The real advancement was the capability of the CEM unit to operate as a Vertical Shootback (vertical transmit position) or Horizontal Shootback (horizontal transmit position) unit. Previous equipment could not use the Horizontal Shootback method due to difficulty in obtaining an audio null in the presence of the increased out-of-phase signal with this method. This problem is solved through use of the visual field strength meter. This meter also permits a quantitative measurement of the out-of-phase signal in the null position.

Model Test Equipment

The model tests were conducted by F. Hiebert a University of Waterloo student.

Two minature coils were used spaced 1.0' apart. This is the coil spacing "a". Frequency used for most of the tests was 5010 Hz with aluminum sheets acting as infinitely good conductors at this frequency. Dimensions of the aluminum sheets were 2' x 4' x .04" of T-6 material. For wide conductors a folded aluminum cap was placed over two parallel sheets.

With the conductive overburden tests aluminum foil was used directly below the coils. Readings were taken at all three operating frequencies 390,1830 and 5010 Hz. The response from the aluminum foil approximated the response obtained from the conductive clay at our test site outside Toronto - with a 400' Horizontal Shootback spread this is 5010 Hz = -104°, 1830 Hz = -64°, 390 Hz = -16°. The discrepancy between field and model results at the 390 Hz is probably due to the limitation of thin aluminum foil to represent a thick clay conductor. The out-of-phase measurement is the minimum field strength reading at the null position, taken by both operators and averaged. Both coils were set at 100% field strength at maximum coupling with no conductors present.

Interpretation of Field Results Using the Model Test Curves

Interpretation is best derived by comparison of the field profiles with the model test profiles. This is a three step process:

Step 1 Depth determination to the top of the conductor, into catagories .125a, .250a or .500a - "a" being the coil separation. The shallow conductors (.125a) that are not flat, and have good conductivity will contain strong positive resultant dip angles in almost all cases. At depths of .250a the positive portion of the curve is small or non-existent leaving two negative peaks spaced

1.0a to 2.0a apart (peak to peak) with the central portion of the profile approaching 0 ± 15°. For depths of .50a or greater, only negative resultant dip angles are produced.

Step 2 Dip determination into catagories vertical, 60° and 30°. Vertical profiles are symmetrical about the mid point, as the dip becomes shallower the hanging wall negative portion of the profile increases in magnitude and extent, the footwall negative decreases. Match the field profile to a model profile for best curve fit.

Step 3 The horizontal width is again determined by matching the field profile with the set of curves for a particular depth and dip. The Horizontal and Vertical Shootback methods vary in their response characteristics to increasing width of conductor.

With the Horizontal Shootback method both negative and positive resultant dip angles increase with increasing width reaching a maximum at 0.75a. The distance between cross-over points does not increase with width for a solid conductor. For the case of two parallel narrow conductors the cross-over distance increases. Parallel banded conductors can also be sorted out from solid conductors by the magnitude of the negative resultant dip angles which stay at the narrow conductor magnitude for banded conductors (except for the separation = coil spacing case that is readily recognized). The Horizontal Shootback method is particularly responsive to wide conductors at depth.

With the Vertical Shootback method an increase in width causes an increase in the area of negative response, and a spreading of the negative peaks. The spreading of the peaks also occurs with the two parallel narrow conductors. With the parallel narrow conductors whe area of negative response does not increase over that of a single narrow sheet and the cross over distance does increase with increased separation.

Flat Dipping Conductors

Flat conductors produce predominately negative resultant dip angle profiles with positive angles only occuring over the edge of near suface, high conductivity conductors. Conductive clay overburden produces entirely negative response, the magnitude depending on the depth to the top of the conductor and its conductivity-thickness value.

Flat conductors are best outlined by contouring the negative resultant dip angles.

Vertical loop or VLF-EM coverage is strongly recommended in cases of predominately negative dip angle responses for anomalies considered of high enough conductivity to be potential targets. The cross-over will occur at the upper edge of the conductor providing an indication of dip. The CEM unit can be used as a vertical loop for this detail work.

An example of the effect of conductive overburden is modelled showing the edge effects at three frequencies and the case of a wide, excellent conductor below an infinite sheet of conductive overburden. In this case the background effect at 5010 and 1830 Hz is too large to produce an effective survey and should not be used for basic coverage. The 390 Hz frequency should be used measuring both the dip angle and out of phase response at this frequency. The resultant dip angle profile at 390 Hz is almost identical to the response obtained with the conductive overburden sheet removed. The out-of-phase response at this frequency drops to near zero immediately over the excellent conductor.

Effect of Conductivity

The model curves assume an infinitely good conductor, this is the saturation point where an increase in frequency does not produce any further increase in the size of the anomaly. It exists in practice with a massive sulphide zone where the maximum resultant dip angles at 390, 1830 and 5010 Hz are all the same magnitude. If the conductivity is below this level then the model curves will produce a correct dip but the actual depth to the top of the conductor will be less than the value derived from model curves.

The same situation holds true with the width measurement, the actual width for a poor conductor being wider than the value obtained from the infinitely good conductor curves.

Further model tests are planned to enable more accurate interpretation for the moderate to poor conductivity case.

Effect of Change in Direction of Traverse from Perpendicular

Our experience and Wunan Lin's model study both indicate that a change in traverse direction up to 45° does not seriously change the interpretation. The negative portions of the profiles are increased in lateral extent, the conductor appearing wider than it actually is.

June 1972 J. Duncan Crone

References

J. Duncan Crone, 1966 - "The Development of a New Ground EM Method for Use as a Reconnaissance Tool" SEG Mining Geophysics, Volume I.

F.J. Grant and G.F. West - "Interpretation Theory in Applied Geophysics, page 448, McGraw Hill, 1965.

Wunan Lin - "A Model Study of the Crone Shootback EM Method", University of California, College of Engineering Thesis, 1969.

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CEM INSTRUCTION AND INTERPRETATION BOOKLET

This equipment can be used with 4 standard EM methods:

1. Horizontal Shootback (Transmit Coils Horizontal)
2. Co-Axial Shootback (Transmit Coils Vertical)
3. Vertical Loop
4. Horizontal Loop - In phase only (no cable)

We recommend basic coverage with the Horizontal Shoot-back method with detail coverage using the Vertical loop or Horizontal loop methods depending on depth of target, terrain conditions and information required. See the enclosed report "Deep Electromagnetic Exploration with the Horizontal Shoot-back Method" by J. Duncan Crone. Strong thunderstorm activity may require the use of the older Co-axial or JEM Shootback system as it is less affected by this noise than the Horizontal Shootback method.

1. HORIZONTAL SHOOTBACK EM METHOD

With this method both operators traverse along the same line (perpendicular to the expected strike direction). Both operators in turn transmit and receive - measuring the dip angle of the field. The two dip angles are then added together and equal "0" if no conductors are present. The station measured is the mid-point between the two men. The separation between the two men can vary from 100' to 600' (30 meters to 200 meters). Readings are generally taken at two frequencies if a conductor is detected. The ratio of the resultant dip angles permits an evaluation of the conductivity of the body.

OPERATION: The way the coils are held in the transmit and receive positions is very important and is as follows:

The two operators proceed along the survey line until they reach their positions. The leading operator receives first (switch at Rx). The trailing operator who is the chief operator (he records the readings) places his coil in the transmit posi-tion - accurately horizontal - and switches it on Tx. Note both operators must face perpendicular to the line of traverse with the other operator always on his left hand side.

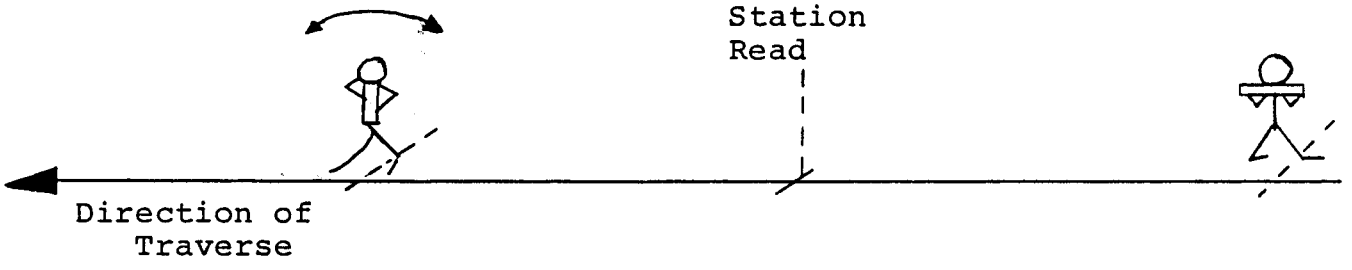
The gain control position is not critical - if the field strength meter remains off scale when the coil is rotated, then the gain is set too high.

(1) OPERATOR RECEIVING

- Switch at Rx
- Coil moved to Null
- Inclinometer read on red scale (Example -8°)
- Other operator to his left

OPERATOR TRANSMITTING

- Switch at Tx
- Coil Horizontal
- Inclinometer accurately kept on red T mark
- Other operator to his left



(2) LEADING OPERATOR shouts "OFF" and calls reading -8° to chief (over 300' use Walki-Talkies)

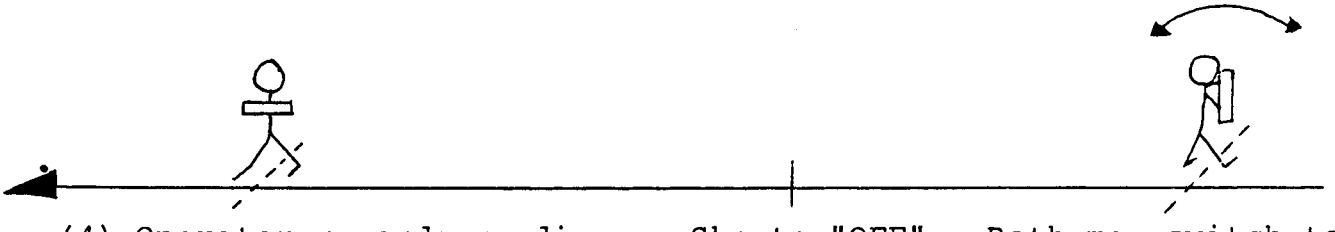
(3) Both operators remaining in the same position and facing in the same direction reverse the procedure

LEADING OPERATOR TRANSMITTING

- Switch at Tx
- Coil Horizontal
- Inclinometer accurately kept on red T mark
- Other operator to his left

OPERATOR RECEIVING

- Switch at Rx
- Coil moved to Null
- Inclinometer read on red scale (Example +8°)
- Other operator to his left



(4) Operator records readings - Shouts "OFF" - Both men switch to "OFF" and move to next station

FREQUENCIES:

In most areas use 1830 Hz for basic coverage and 390 Hz in anomalous areas. In areas of highly conductive background conditions where the 1830 Hz frequency produces -5° to -20° readings over wide areas then both 390 Hz and 1830 Hz frequencies should be used for basic coverage. In the exploration for weak conductors use 5010 Hz and 1830 Hz.

OUT OF PHASE MEASUREMENT: (Seldom Used)

This reading is sometimes helpful in separating overburden effects from subsurface conductors particularly in areas of very high or very low surface conductivity. The reading is simply the minimum Field Strength reading when the coil is in the null position. If the coil is set for a Field Strength reading of 100 (by means of the volume control) when both coils are horizontal, then the out-of-phase is read as a percent of the normal field. Usually the reading is taken only by the Chief operator who must be careful with his notes since the resultant dip angle reading is recorded at the station mid-way between the two men and the out-of-phase at his own location.

(2) VERTICAL LOOP

This is an excellent method for detailing deep conductors particularly its help in the the determination of dip. It is also a back-up method if one of the coils has an amplifier or transmitter failure.

The coil is held accurately vertical while on transmit and orientated such that the receiver is in the plane of the coil. Detailed instructions and interpretation curves are provided by most standard textbooks.

(3) HORIZONTAL LOOP EM (Seldom Used)

With this equipment the standard Horizontal loop configuration is used but the Total Vertical Field Component is measured at two frequencies rather than the In-phase and Out-of-phase at one. The interpretation curves are identical to the standard published curves. This method has the great advantage that the two coils do not have to be joined with a cable.

When using this method the power supply should consist of 3 fresh batteries. This assures minimum drift of the readings.

The coils transmit and receive while being held in the horizontal position. Two frequencies are normally used, 5010 and 390 Hz. The receive coils are set up such that the Field Strength is 100% in a non-conductive area, one coil always receiving 5010 and the other coil 390. A rope may be used for accurate spacing of the two men since no cable is required. Operation and interpretation otherwise identical to a standard horizontal loop survey.

January 1979.

Appendix VI

STATEMENT OF COSTS

Albert August	- May 8,9,10,11,12,14,15,16,18,19,21, 23,24,25,26,29, June 1,2,18,20 20 days @ $62.50/day	$ 1,240.00
Mike McPhail	- May 8,9,10,11,12,14,15,16,17,18,19, 21,23,24,25,26,29,30 June 1,2,18, 19,20,21,23,24 26 days @ $50/day	1,300.00
Fred Gower	- May 10,11,20,21,23,25,26,27,28,29, 30 June 1,2,18,19,21,23,24 18 days @ $50/day	900.00
S.C. Gower	- May 11,14,16,19,23,26,28 June 1,19 20,21,23,24 13 days @ $150/day	1,950.00
Gary Lepp	- May 8,9,10,11,12,16,18,21,23,25,26, 27,28, June 1,19,20,21,23,24 19 days @ $72.50/day	1,377.50
Ludek Uher	- May 11,14,16,17,18,19,20,23,25,26, 27,28 June 2,18,20,21,24 19 days @ $62.50/day	1,187.50
Support	- 115 man/days @ $35/day	4,025.00
Analysis	- 528 silts and soils @ 2.30/sample	1,214.40
	- Rock assays 107 adit samples @ $5/sam.	535.00
	- 22 dump assays @ $29/sample	638.00
	- 60 dump assays @ $2.50/sample	150.00
Truck Rental	26 days @ $45/day	1,170.00
Gas and Oil	26 days @ $10/day	260.00
C.E.M. Rental	4 days @ $99.65/day	398.60
Magnetometer Rental	6 days @ $15/day	90.00
Drafting	46.4 hours @ $10/hour	464.00
	TOTAL	$16,900.00

Stephen C. Gower

Appendix VII

MIN-EN LABORATORIES LTD.
705 WEST 15TH STREET
NORTH VANCOUVER, B.C.
Phone: 980-5814

Certificate of Assay

TO: Lacana Mining Corp.,
312-409 Granville St.,
Vancouver, B.C.

Attn: S. Gower
PROJECT No.
DATE July 8/80.
File No. 0-369

SAMPLE No.	Pb %	Zn %	Ag oz/ton	As %	Au oz/t
U80-213	.09	.12	2.44	.001	.00
214	.36	.32	8.85	.003	.00
215	3.00	.34	9.80	.003	.00
216	.30	.38	5.52	.002	.00
217	.55	.56	9.05	.003	.00
218	.08	.08	1.68	.002	.00
219	.11	.18	3.51	.001	.00
220	.08	.13	3.70	.001	.00
221	.22	.38	3.95	.003	.00
222	.34	.52	5.40	.002	.00
223	.13	.25	3.72	.001	.00
224	.49	.56	8.15	.004	.00
225	.17	.26	3.50	.003	.00
226	.06	.24	1.87	.002	.00
227	.01	.03	.18	.002	.00
228	.01	.03	.16	.001	.00
229	.02	.03	.11	.001	.00
230	.01	.03	.12	.001	.00
231	.01	.03	.30	.001	.00
232	.12	.08	1.36	.001	.00
233	.02	.03	.17	.001	.00
U80-234	.02	.03	.16	.002	.00

MIN-EN Laboratories Ltd.

CERTIFIED BY .....

COMP: Lacana Mining

PROJECT NO.: Silver Coin

ATTENTION: S. Gower

GEOCHEMICAL ANALYSIS DATA SHEET

MIN-EN Laboratories Ltd.

705 WEST 15TH ST., NORTH VANCOUVER, B.C. V7M 1T2

PHONE (604) 980-5814

NO.: 0-369

DATE: July 9, 1980.

Sample Number	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ni ppm	Co ppm	Ag ppm	Fe ppm	Hg ppb	As ppm	Mn ppm	Au ppb	Sb ppm	
U80-200			29	174			21		25	<1		<5	70	
201			47	310			17		25	<1		5	75	
202			43	350			23		25	15		5	80	
203			7350	10200			1680		1700	15		15	215	(20 mesh)
204			5400	8500			1980		1480	<1		20	240	(40 mesh)
205			1340	3650			500		1280	5		10	165	
206			1050	2950			370		450	7		5	125	
207			720	2100			250		470	10		<5	155	(40 mesh)
208			53	159			72		35	22		5	260	
209			1480	2750			540		500	8		<5	220	(20 mesh)
U80-212			118	530			54		100	23		5	55	

Appendix VII

L 3+00N

Narrow vert. cond.
depth = 0 - 15 metres

?

L 2+00N

Narrow, near surface
Eastern dipping cond.

60°

ROAD

Creek A80-13

System pinches
out up slope

2 parallel narrow vert.
conductors 40 metres
apart 6 - 10 metres deep

L 1+00N

RESULTANT DIP ANGLE (degrees)

+15
+10
+5
0
-5
-10
-15

L 0+00

Narrow conductor
depth = 6 - 10 metres
dips : 60° easterly (apparent)

60°

Along road

1+00W

B/L

1+00E

Coil sampling (a) = 50 metres
Operating freq. - 5010 Hz.

N

LACANA

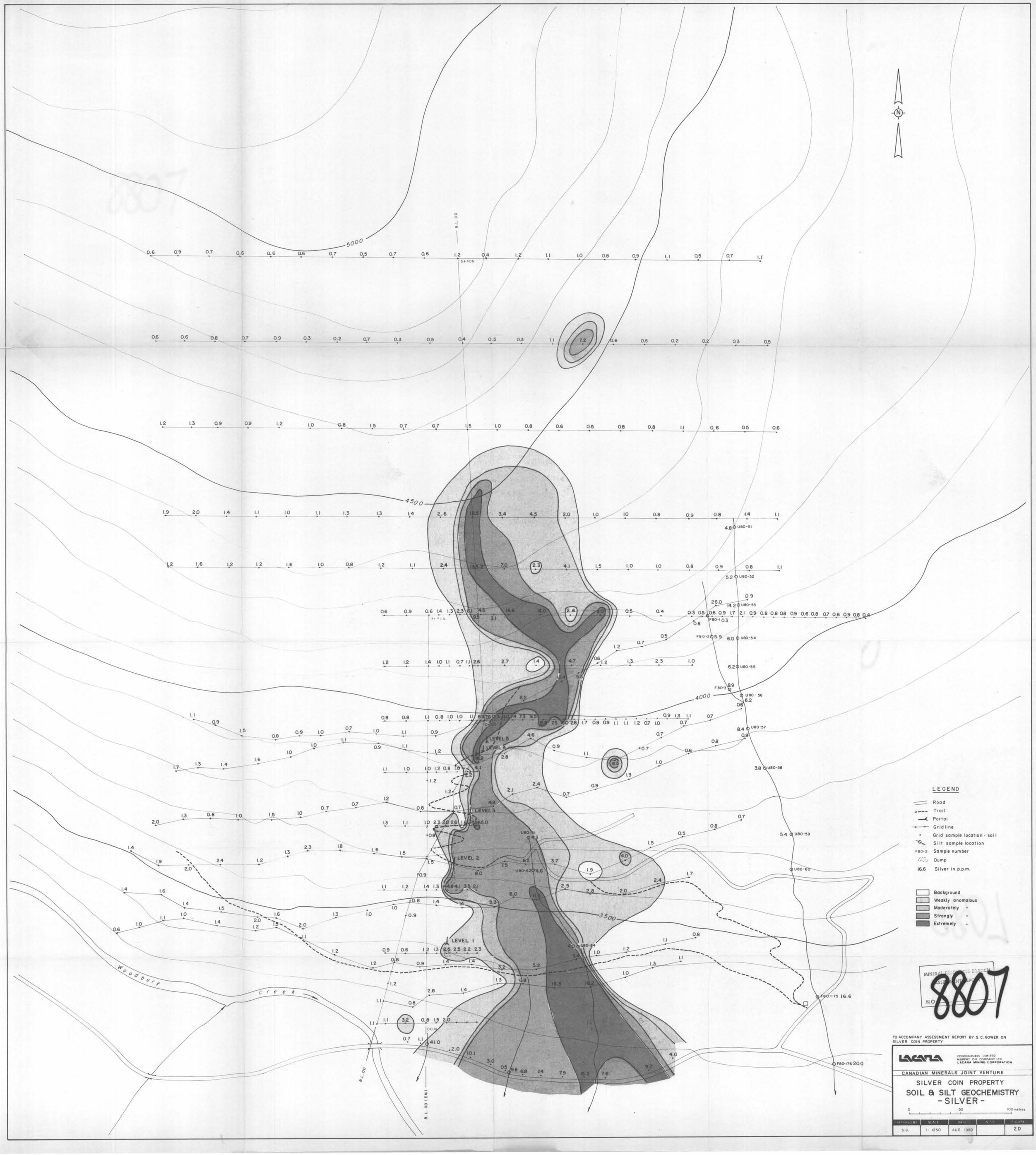
CONVENTURES LIMITED
MURPHY OIL COMPANY LTD
LACANA MINING CORPORATION

CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY
HOR. SHOOTBACK E.M. SURVEY
AINSWORTH AREA, B.C.

0 50 metres

PREPARED BY	SCALE	DATE	N T S	FIGURE
S.G.	1:1250	DEC. 1980		20



MINERAL RESOURCES BRANCH ASSESSMENT REPORT NO. 8807

TO ACCOMPANY ASSESSMENT REPORT BY S. C. GOWER ON SILVER COIN PROPERTY

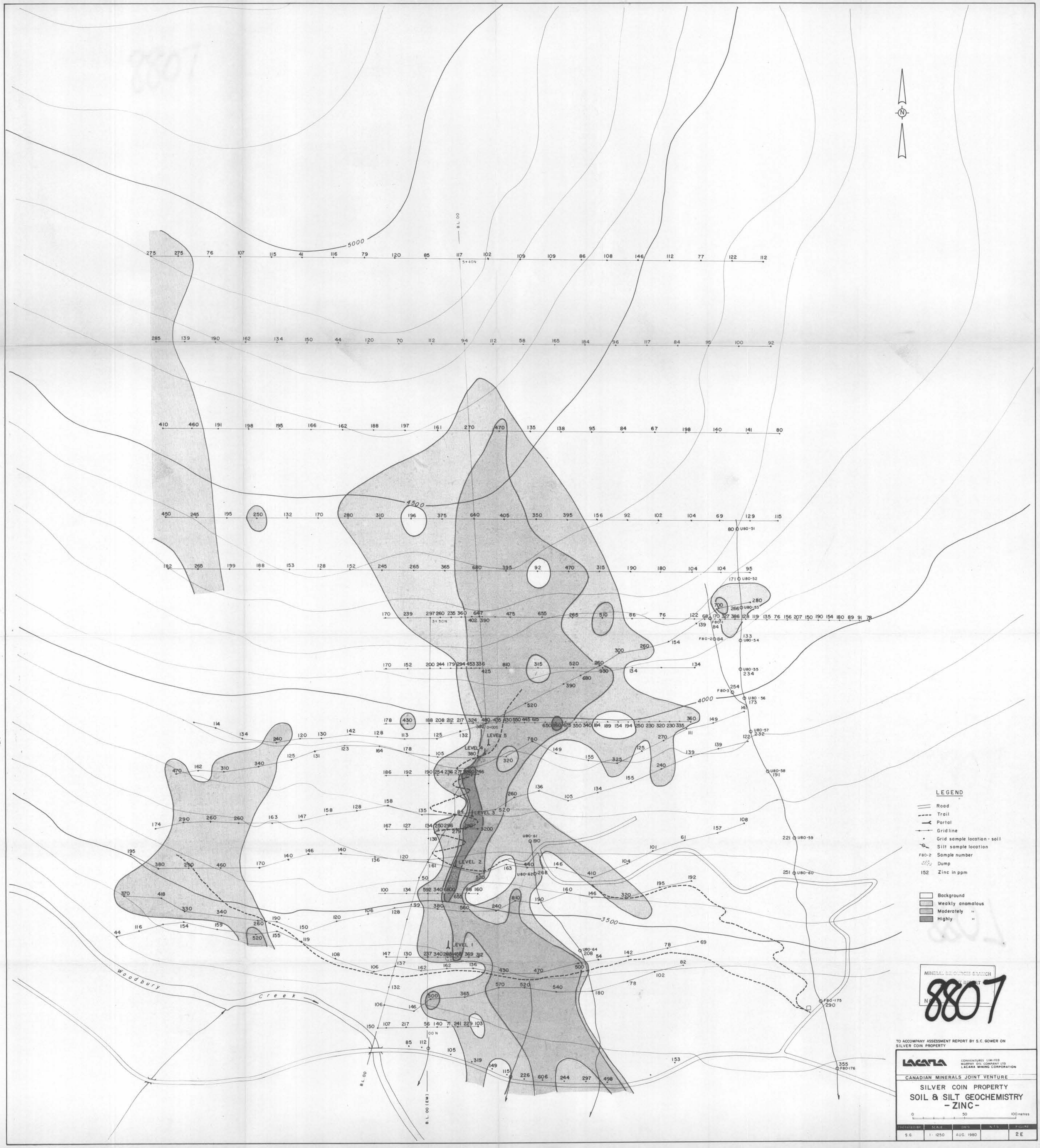
LACANA — CONVENTURES LIMITED, MURPHY OIL COMPANY LTD, LACANA MINING CORPORATION

CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY
SOIL & SILT GEOCHEMISTRY - SILVER -

0 50 100 metres

PREPARED BY	SCALE	DATE	N.T.S.	FIGURE
S.G.	1:1250	AUG. 1980		2.D


5000
4500
4000
3500
B.L. 00
5+40N
3+50N
00 N
B.L. 00 (EM)
LEVEL 1
LEVEL 2
LEVEL 3
LEVEL 4
LEVEL 5
Woodbury
Creek
LEGEND
Road
Trail
Portal
Grid line
Grid sample location - soil
Silt sample location
F80-2 Sample number
Dump
152 Zinc in ppm
Background
Weakly anomalous
Moderately "
Highly "
MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 8807
TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY
LACANA
CONVENTURES LIMITED
MURPHY OIL COMPANY LTD
LACANA MINING CORPORATION
CANADIAN MINERALS JOINT VENTURE
SILVER COIN PROPERTY
SOIL & SILT GEOCHEMISTRY
- ZINC -
0 50 100 metres
PREPARED BY S.G.
SCALE 1:1250
DATE AUG. 1980
N.T.S.
FIGURE 2E

LEGEND

- Road
- Trail
- Portal
- Grid line
- Grid sample location - soil
- Silt sample location
- F80-2 Sample number
- Dump
- 106 Lead in ppm

- Background
- Weakly anomalous
- Moderately "
- Highly "

TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY

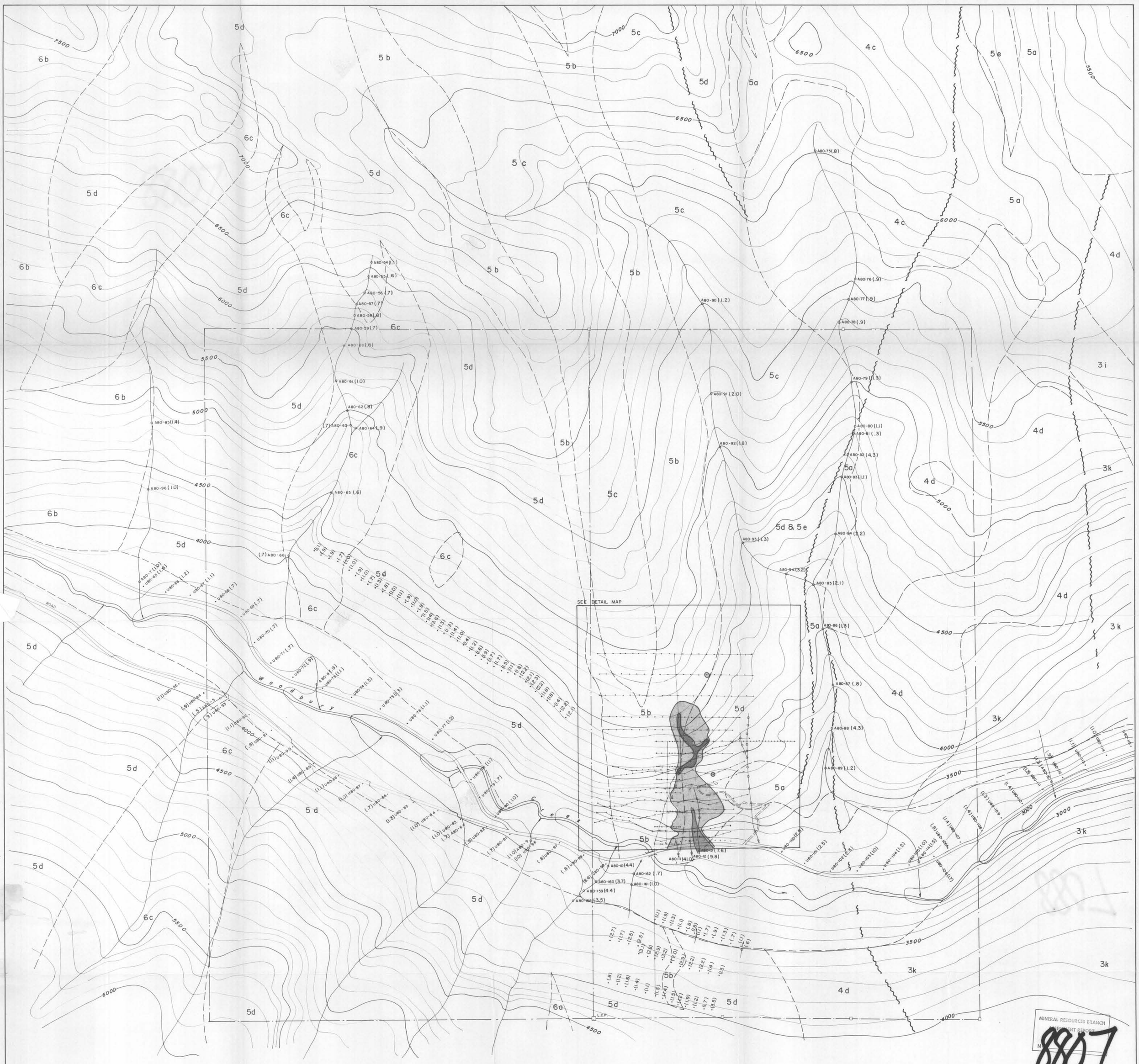
LACANA CONVENTURES LIMITED
MURPHY OIL COMPANY LTD
LACANA MINING CORPORATION

CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY
SOIL & SILT GEOCHEMISTRY
—LEAD—

0 50 100 metres

DRAWN BY	SCALE	DATE	N.T.S.	FIGURE
S.G.	1 : 1250	AUG. 1980		2F



LEGEND

- Area of little or no outcrop
- 6c Hornblendite
- 6b Porphyritic granodiorite
- 6a Granitic sill and lenses
- 5e Mainly fine-grained grey dolomite
- 5d Fine grained grey limestone
- 5c Blue grey limestone and black argillite
- 5b Purplish grey massive argillite
- 5a Mainly black argillite
- 4d Interlayered chert, argillite and green volcanic rocks
- 4c Massive green phyllite
- 3k Fine grained grey fetid limestone
- 3i Dark grey slate, argillite and limestone

CONTOUR INTERVAL 10 FEET

Geological contact
Fault
Soil sample
Silt sample
U80-86 Sample No.
Portal
Road
(1.5) Silver in p.p.m.

Background
Weakly anomalous
Anomalous

Background
Moderately anomalous
Highly anomalous

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
NO. 8807

TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY

LACANA — CONVENTURES LIMITED, MURPHY OIL COMPANY LTD, LACANA MINING CORPORATION

CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY

SILT & SOIL GEOCHEMISTRY - SILVER -

0 300 METRES

REVISED BY	SCALE	DATE	N.T.S.	FIGURE
S.G.	1:5000	AUG. 1980		2G

SEE DETAIL MAP

L.C.P.

LEGEND

- Area of little or no outcrop
- 6c Hornblendite
- 6b Porphyritic granodiorite
- 6a Granitic sill and lenses
- 5e Mainly fine-grained grey dolomite
- 5d Fine grained grey limestone
- 5c Blue grey limestone and black argillite
- 5b Purplish grey massive argillite
- 5a Mainly black argillite
- 4d Interlayered chert, argillite and green volcanic rocks
- 4c Massive green phyllite
- 3k Fine grained grey fetid limestone
- 3i Dark grey slate, argillite and limestone

CONTOUR INTERVAL 10 FEET

- Geological contact
- Fault
- Soil sample
- Silt sample
- U80-86 Sample No.
- Portal
- Road
- (200) Zinc value in p.p.m.

- Background
- Moderately anomalous
- Highly anomalous

- Background
- Weakly anomalous
- Anomalous

MINERAL RESOURCES BRANCH
8807

TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY

LACANA
CONVENTURES LIMITED
MURPHY OIL COMPANY LTD.
LACANA MINING CORPORATION

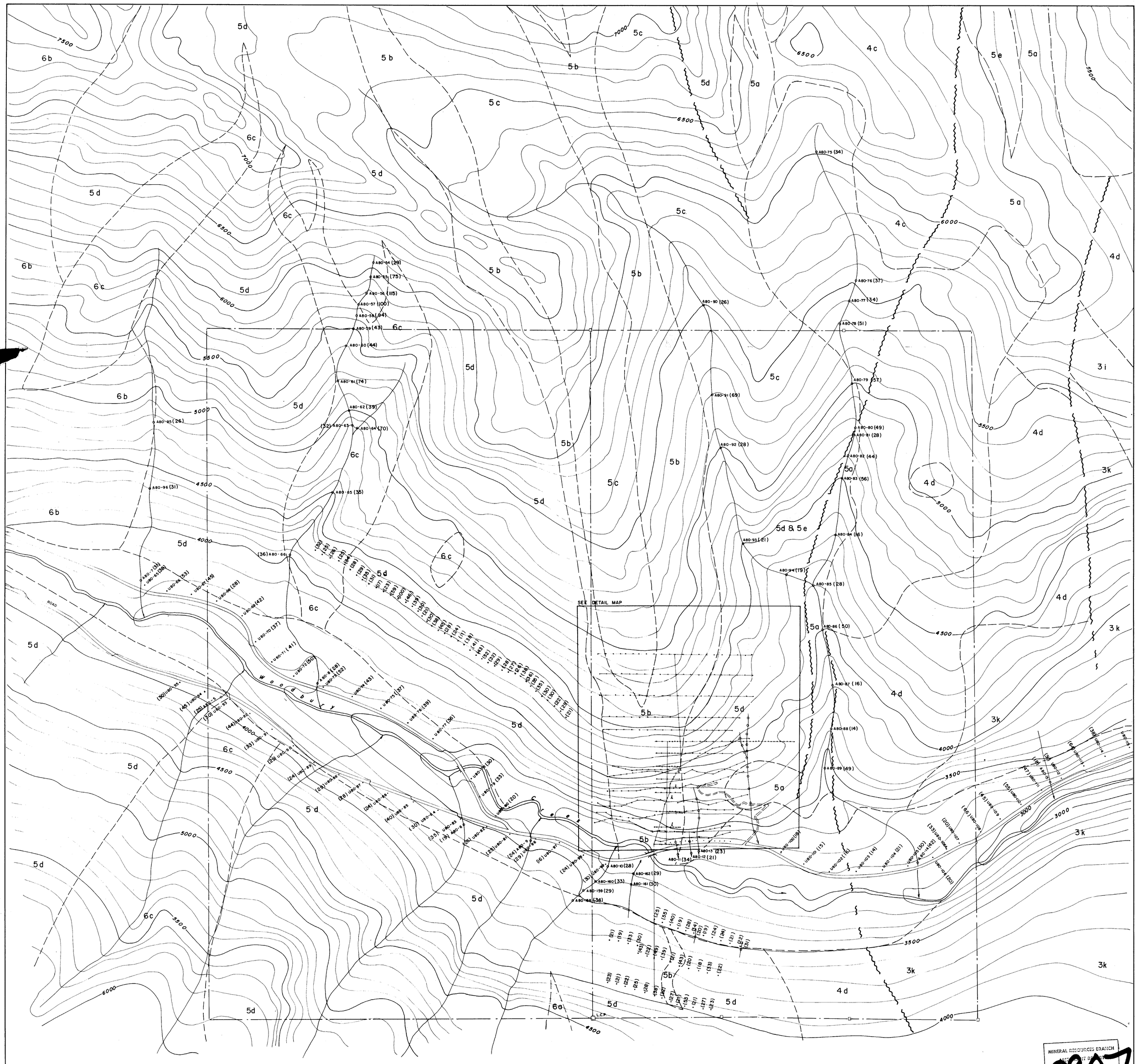
CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY

SILT & SOIL GEOCHEMISTRY
– ZINC –

0 300 METRES

PREPARED BY	SCALE	DATE	N.T.S.	FIGURE
S.G.	1:5000	AUG. 1980		2-H



LEGEND

- Area of little or no outcrop
- 6c Hornblendite
- 6b Porphyritic granodiorite
- 6a Granitic sill and lenses
- 5e Mainly fine-grained grey dolomite
- 5d Fine grained grey limestone
- 5c Blue grey limestone and black argillite
- 5b Purplish grey massive argillite
- 5a Mainly black argillite
- 4d Interlayered chert, argillite and green volcanic rocks
- 4c Massive green phyllite
- 3k Fine grained grey fetid limestone
- 3i Dark grey slate, argillite and limestone

Geological contact
Fault
Soil sample
Silt sample
U80-86 Sample No
Portal
Road
(28) Copper value in p.p.m.

- Background
- Moderately anomalous
- Highly anomalous

CONTOUR INTERVAL 10 FEET

TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY

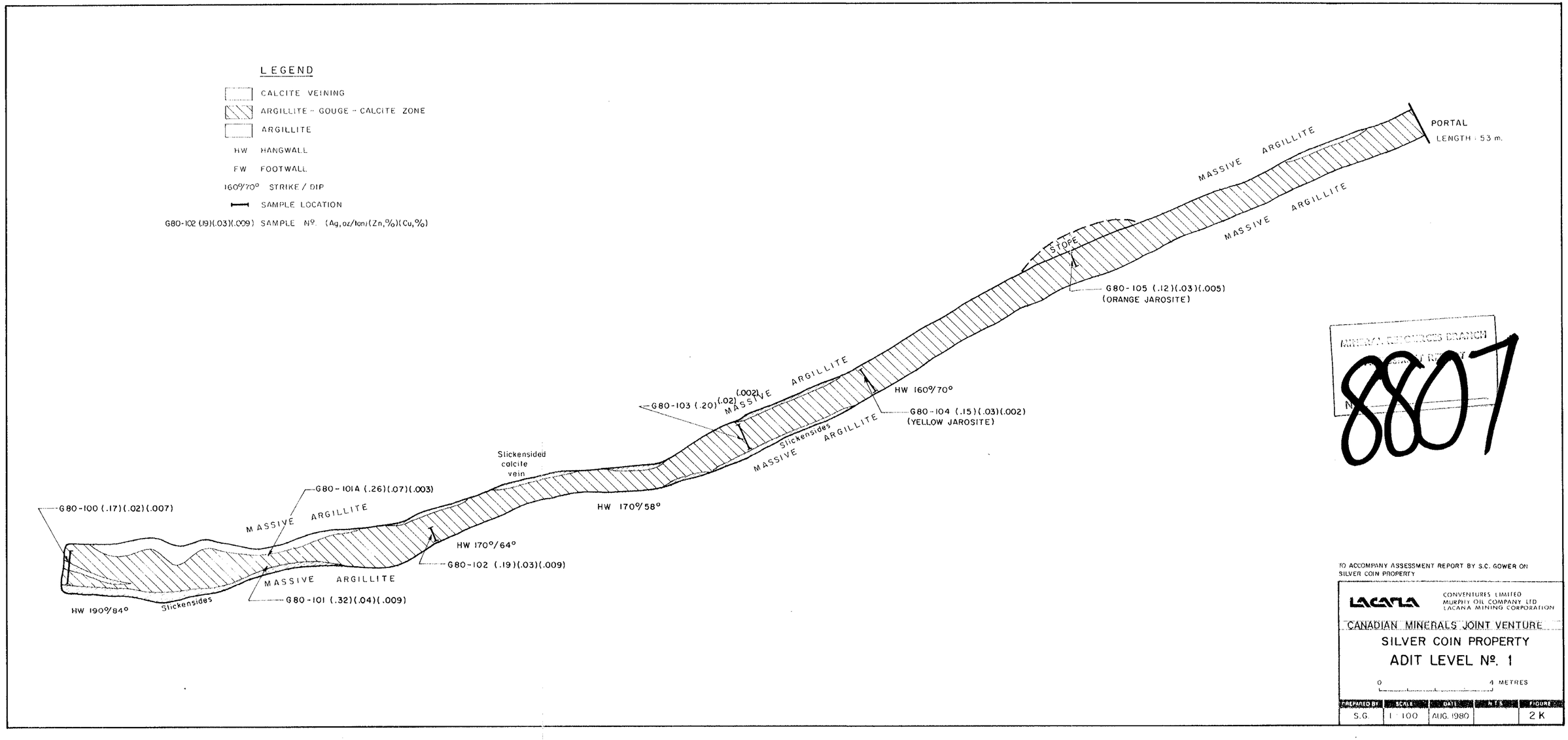
LACANA — CONVENTURES LIMITED, MURPHY OIL COMPANY LTD, LACANA MINING CORPORATION

CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY
SILT & SOIL GEOCHEMISTRY
- COPPER -

0 300 METRES

DRAWN BY	SCALE	DATE	REVISED	DWG.
S.G.	1:5000	AUG. 1980		21



TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY

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CONVENTURES LIMITED
MURPHY OIL COMPANY LTD
LACANA MINING CORPORATION

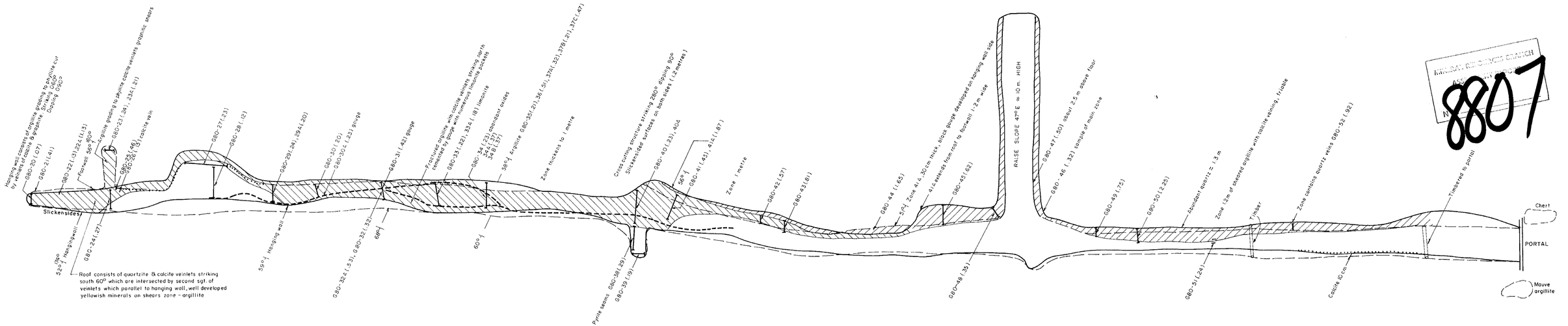
CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY

ADIT LEVEL Nº. 1

0 4 METRES

PREPARED BY	SCALE	DATE	N.T.S.	FIGURE
S.G.	1 100	AUG. 1980		2K



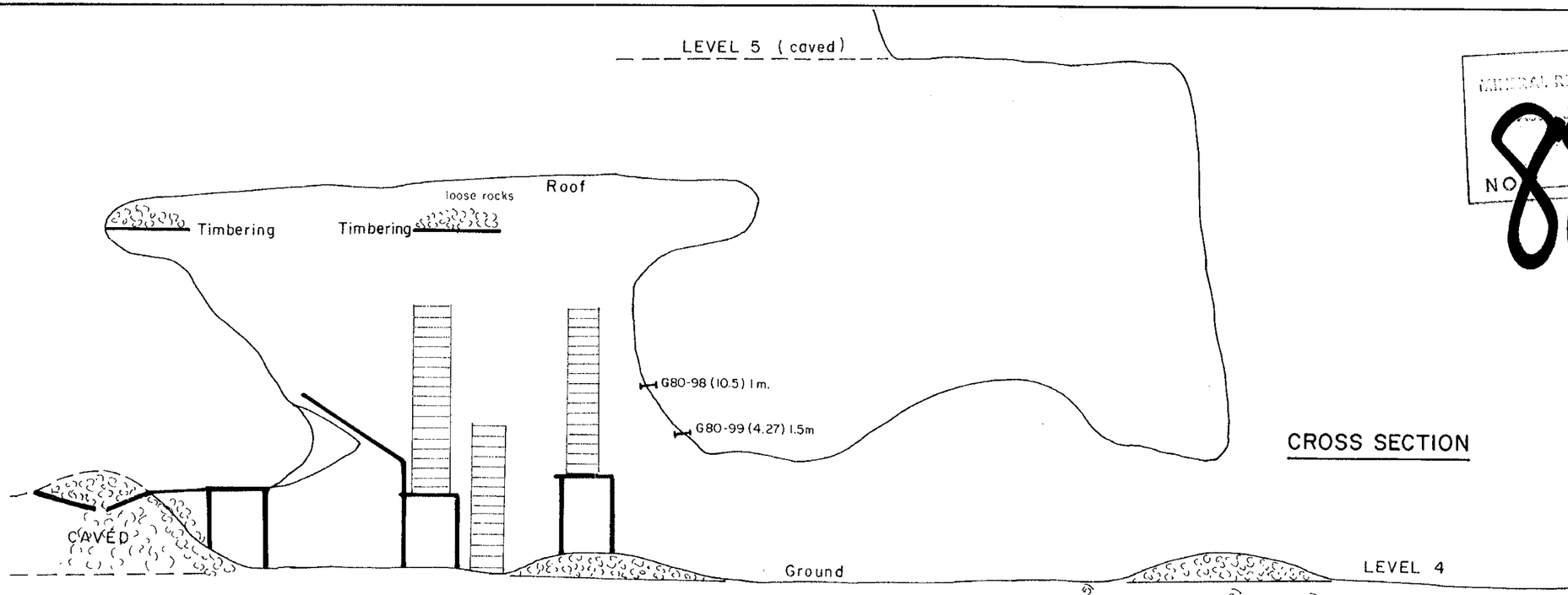
TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY

LACANA — CONVENTURES LIMITED, MURPHY OIL COMPANY LTD, LACANA MINING CORPORATION

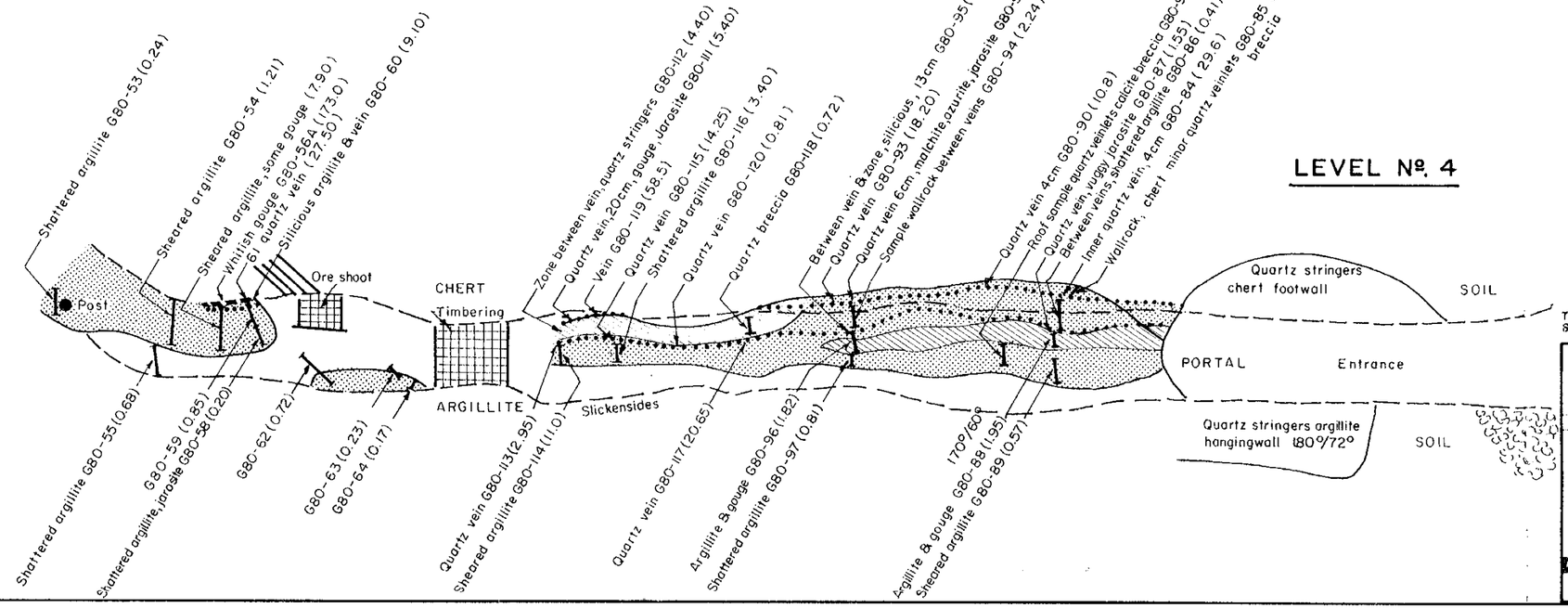
CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY
ADIT LEVEL Nº. 2

PREPARED BY	SCALE	DATE	N.T.S.	FIGURE
S.G.	1:100	AUG. 1980		2L



CROSS SECTION



LEVEL Nº. 4

LEGEND

- MAUVE ARGILLITE
- CHERT
- SHEAR ZONE
- ZONE OF QUARTZ STRINGERS
- QUARTZ VEIN
- GOUGE
- 170°/60° STRIKE / DIP
- SAMPLE LOCATION
- G80-54 (1.21) SAMPLE Nº. (SILVER, oz/ton)
- ROOF
- FLOOR

TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY.

LACANA
CONVENTURES LIMITED
MURPHY OIL COMPANY LTD
LACANA MINING CORPORATION

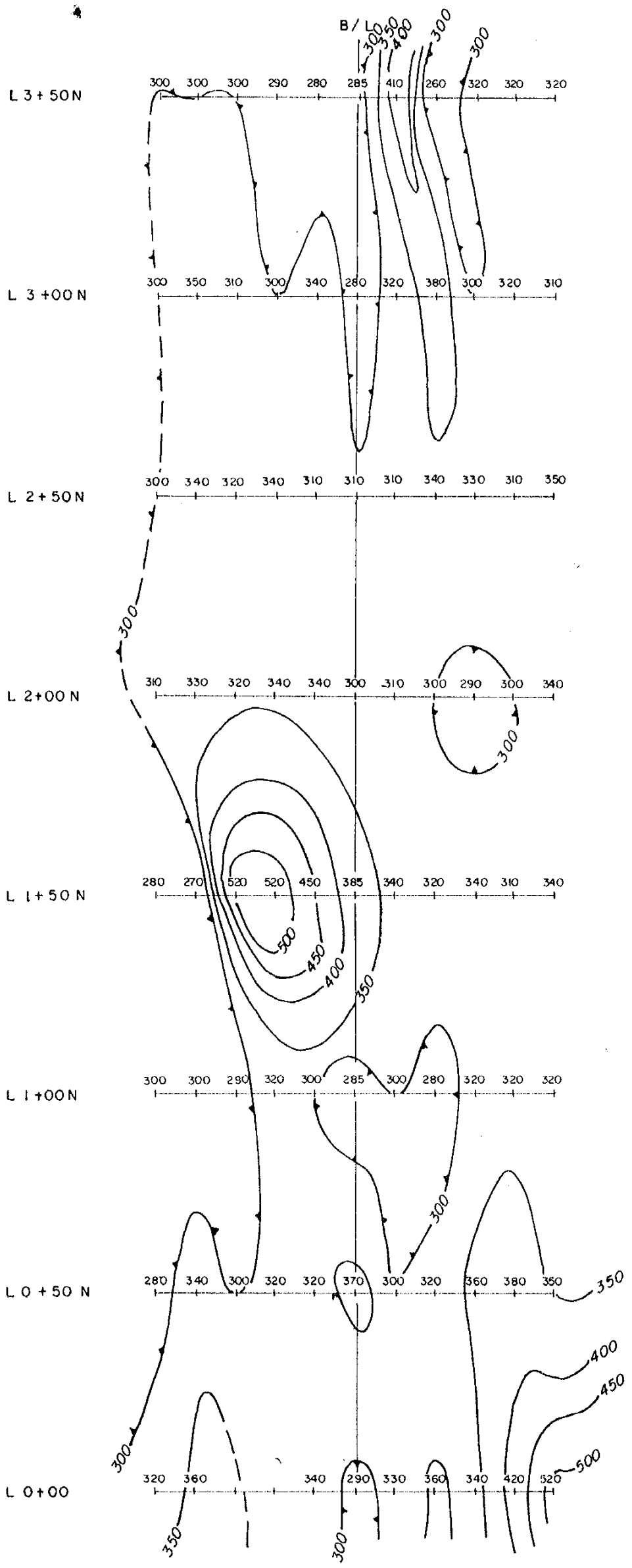
CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY

ADIT LEVELS Nº. 4 & 5

0 4 METRES

PREPARED BY	SCALE	DATE	N.T.S.	FIGURE
S.G.	1:100	AUG. 1980		2 N



N

Instrument used: McPhar M-700, fluxgate : absolute value of vert. field not known.
vert. field 8 values relatives

Grid bias 1:5

TO ACCOMPANY ASSESSMENT REPORT BY S.C. GOWER ON SILVER COIN PROPERTY

LACANA

CONVENTURES LIMITED
MURPHY OIL COMPANY LTD
LACANA MINING CORPORATION

CANADIAN MINERALS JOINT VENTURE

SILVER COIN PROPERTY
FLUXGATE MAGNETOMETER SURVEY

0 50 METRES

PREPARED BY	SCALE	DATE	N.T.S.	FIGURE
S.G.	1:1250	NOV. 1980		2 0