

1667

REPORT ON
AIRBORNE GEOPHYSICAL SURVEYS
BLACK MOUNTAIN AREA, B.C.
ON BEHALF OF
NORANDA EXPLORATION COMPANY
LIMITED

432 - 1/10

by

Jan Klein, M.Sc., P.Eng.

October 15, 1968

CLAIMS:

Some WEST, AN, CHERYL, C.V., OLD SHO, LAD,
HAY, MF, HIN, BLACK MT, MAC, CHAIN, SAM,
ST, PEQU, PAT, LUCKY LADY, AL, BUG, DN,
LIN and PY Claims. (See Appendix "B")

LOCATION:

About six miles northwest of Perow and four
miles west of Findlay Lake, British Columbia
126° 54' NE
Omineca Mining Division

DATES:

June, July 1968

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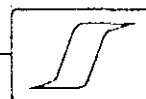
APPENDIX 'B'

<u>NAMES</u>	<u>RECORD NO.</u>
WEST 1 to 14	49943 to 49956
WEST 15 to 24	50146 to 50155
AN 1 to 12	48788 to 48797
AN 14	48798
AN 39, 40	49325, 49326
AN 42 to 53	49747 to 49758
AN 54 to 61	49909 to 49916
AN 64 to 73	49933 to 49942
AN 74 to 83	50156 to 50165
CHERYL 1 to 8	49917 to 49924
C.V. 1 to 4	40318 to 40321
OLD SHO 1 to 6	48799 to 48804
LAD 1 to 6	49961 to 49966
HAY 1 to 10	49967 to 49976
MF 1 to 8	49977 to 49984
MF 11 to 14	49991 to 49994
HIH 1 to 8	50166 to 50173
BLACK MT. 1, 2	32926, 32927
BLACK MT. 3, 4	49381, 49382
BLACK MT. 5, 6	41383, 41384
MAC 1, 2	49907, 49908
LUCKY LADY	40317, 40322
PAT 1 to 4	49957 to 49960
PENU 1 to 8 PEHU	49923 to 49932
CHAIN 1 to 8	49877 to 49884
SAM 1 to 12	49885 to 49896
ST 1 to 6	50180 to 50185
ST 7 to 14	51349 to 51356
AL 1 to 6	50284 to 50289
PY 1, 2	59503, 59504
BUG 1 to 4	49985 to 49988
D.N. 1, 2	49989, 49990
LIN 1 to 6	50174 to 50179

SUMMARY

Helicopter-borne electromagnetic and magnetometer surveys were executed over approximately 55 square miles in the Black Mountain area, British Columbia. A number of conductors with favourable electrical characteristics have been revealed. In several cases a corresponding magnetic response is evident.

Lacking detailed geological information, only general recommendations for ground follow-up have been made.



REPORT ON AIRBORNE GEOPHYSICAL SURVEYS
BLACK MOUNTAIN AREA, BRITISH COLUMBIA
ON BEHALF OF
NORANDA EXPLORATION COMPANY LIMITED

INTRODUCTION

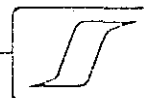
During June and July 1968 airborne geophysical surveys were executed on behalf of Noranda Exploration Company Limited in the Black Mountain area, British Columbia, covering approximately 55 square miles (see fig. 1).

The airborne survey included electromagnetic and magnetometer measurements. The former employed a Scintrex HEM-701 electromagnetic unit and the latter a Scintrex NPM-1 nuclear resonance, total intensity magnetometer.

Appendix A, attached, gives full technical details of the airborne geophysical equipment, the ancillary equipment employed, as well as the treatment of data resulting from these surveys. In the case of the present survey a Bell Jet Ranger 206A helicopter, on charter from Pegasus Airlifts (Burlington, Ontario), was employed as the basic transport vehicle.

The electromagnetic survey lines were flown at 1/4 mile intervals, oriented east-west at a mean terrain clearance of 200 ft.

Flight navigation and flight path recovery have been based



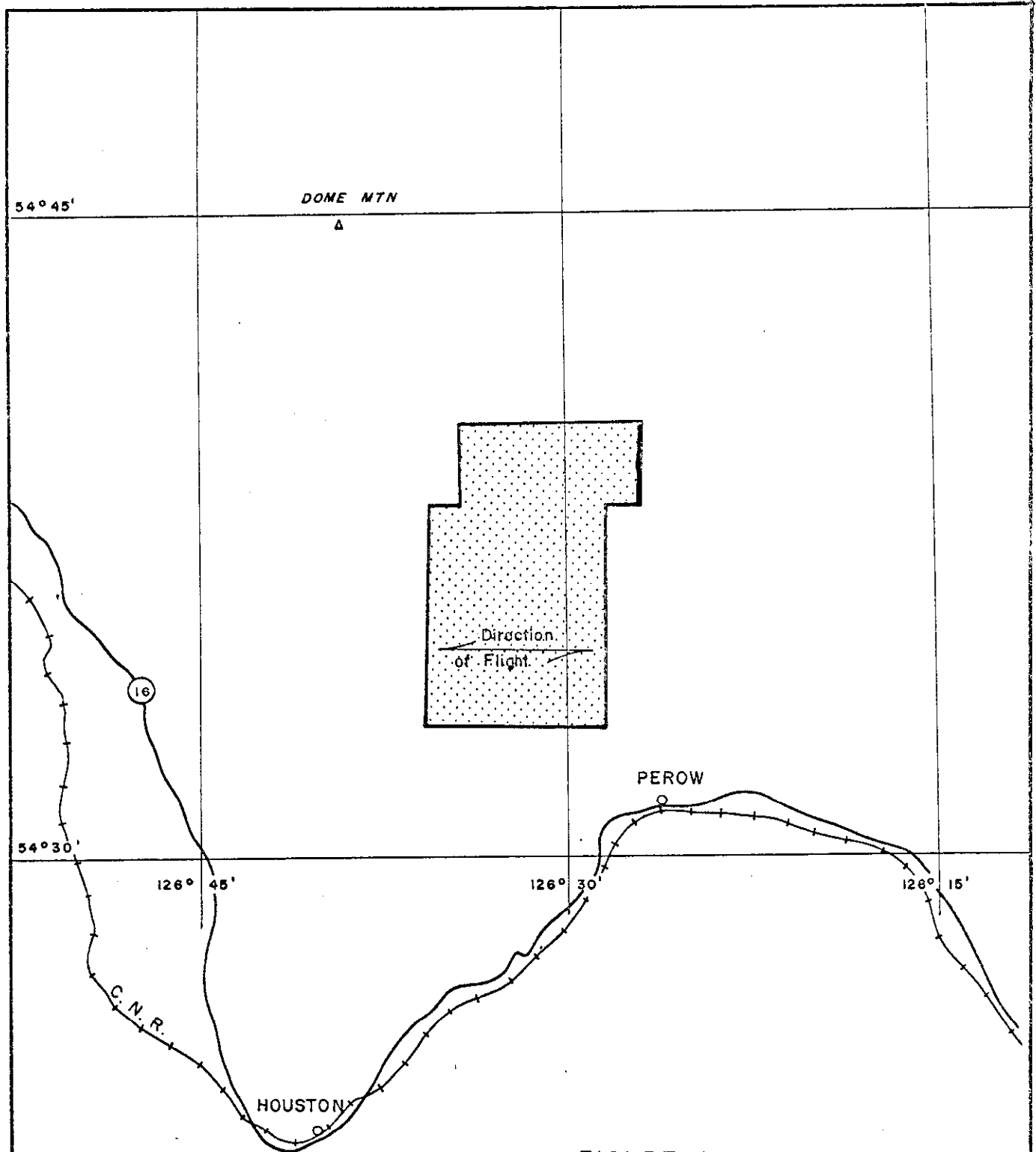


FIGURE 1
 NORANDA EXPLORATION COMPANY LIMITED
 BLACK MOUNTAIN AREA, B. C.

LOCATION PLAN
 AIRBORNE GEOPHYSICAL SURVEY

SCALE : 1" = 4 MILES

SURVEY BY SEIGEL ASSOCIATES LIMITED
 JUNE - JULY 1968

upon photomosaics on the scale of approximately 1" = 1/2 mile. Plate 2 on the scale of 1" = 1/2 mile shows the flight lines in relation to the claims location.

The magnetometer sensor and the EM "bird" were flown separately behind the helicopter.

The purpose of the present survey was to map the distribution of subsurface conductors in the area covered. In the Black Mountain area the targets of economic interest are metallic sulphide bodies. The electromagnetic data provide the basic information relating to the possible presence of such bodies. The purpose of the magnetometer survey results is primarily one of correlation with conductors.

PRESENTATION OF DATA

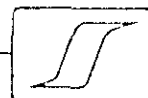
The results of the geophysical surveys are presented on Plates 1a and 1b on the scale of 1" = 1320 ft. On the plates are shown some topographic features and flight lines.

Plate 1a shows the magnetic contours. The contours are at an interval of 100 gammas or less, according to magnetic relief.

Plate 1b shows the electromagnetic results. Conductor half-widths and peak locations are shown, coded as described in Appendix A.

The in-phase amplitude, in-phase/out-of-phase ratio and magnetic correlation (if any), are indicated for each conductor intersection.

The EM and magnetometer data are presented together with altimeter and fiducial recording on a dual trace Moseley recorder.



The original geophysical traces are on the following scales:

EM	1" = 100 parts per million
Magnetometer	100 gammas, with automatic steps of 500 gammas. The magnetic base level is 58,000 gammas.

DISCUSSION OF RESULTS

The electromagnetic responses of interest obtained during the current survey are listed in Table 1.

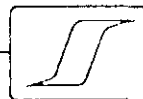
Eight of the nine conductors fall in the third category. They show, in general, medium conductivity.

Conductors have been connected between flight lines where this appeared logical (conductor systems A and B). Some conductors display a corresponding magnetic response, which may be due either to a higher magnetite or pyrrhotite mineralization, both known to be present in this part of British Columbia. The higher magnetic intensities are likely due to magnetite.

Electromagnetic disturbances due to turbulence and sudden altitude differences of the system, resulting in changes in coil configuration in respect to the target area, are also present.

No geological information was available at the time of writing of the present report to comment upon the geological significance of the electromagnetic results.

As a first approximation the selection of targets for ground follow-up could be based on the above considerations, weighted by all



geological information available to Noranda Exploration Company Limited.

To examine selected targets on the ground and determine their precise location, a combination of surveys on small grids, possibly comprising geological, geochemical, Turam electromagnetic and magnetometer investigations, is recommended.

Respectfully submitted,

Jan Klein
Jan Klein, M.Sc., P. Eng.
Geophysicist.

Toronto, Ontario.
October 15, 1968.

Richard O. Crosby, P. Eng.
Consulting Geophysicist

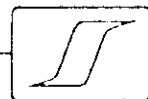


TABLE 1 - Noranda Exploration Company Limited, Black Mountain Area, B. C.

Line No.	Anomaly	Peak Fiducial	Electrical Character	Magnetic Character
0	A	5409	Category 3, medium ratio	correlation
6	A	4893	Category 3, medium ratio	correlation
	B	4970	Category 3, medium ratio	no correlation
8	A	4671	Category 3, medium ratio	no correlation
10	A	4532	Category 3, poor ratio	no correlation
54	A	1439	Category 3, medium ratio	no correlation
64	A	464	Category 3, medium ratio	no correlation
		466	Category 2, poor ratio	correlation
66	A	354	Category 3, medium ratio	no correlation
68	A	25	Category 3, medium ratio	no correlation
	B	107	Category 3, good ratio	no correlation

APPENDIX 'A'

DESCRIPTION OF AIRBORNE SYSTEMS

ELECTROMAGNETIC SYSTEM - SCINTREX HEM-701

Equipment

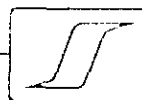
The Scintrex HEM-701 is a solid state, fixed-configuration, electromagnetic system especially designed for helicopter transport. It consists of two coaxial coils, one serving as transmitter and the other as receiver, which are mounted, 30 ft. apart, in a rigid "bird" with their axes horizontal and in the direction of flight. The bird is towed approximately 100 ft. below the helicopter, by means of a suitable cable which also carried electrical signals and power to and from the bird.

The system operates at 1600 Hertz. Changes in the alternating magnetic field at the receiver coil are observed and these changes are converted into two components, one whose phase is the same as that of the transmitted signal (the "In-Phase" component), and the other whose phase is 90° apart (the "Out-of-Phase" component). These changes are expressed in terms of the normal undistorted primary field. They are so small as to be expressed usually in parts-per-million or p. p. m.

The In-Phase and Out-of-Phase variations are presented in graphic time-shared form on a single channel of a graphic recorder. The full scale chart width employed is commonly 1000 p. p. m., although in areas of low geologic noise levels 500 p. p. m. may be employed. At one or more points during each flight the scale sensitivity is checked by means of calibration signals, usually 100 p. p. m. on each trace.

The reference or "zero" level for each EM trace is an arbitrary one and is obtained empirically from the regional level of each trace. These levels may drift slowly during a flight because of temperature changes affecting the bird dimensions. These drifts are very gradual and are readily distinguishable from much quicker, local changes due to conductors of a geologic origin. Similarly, severe turbulence effects sometimes introduce low-order, primarily in-phase disturbances which are of such short period that they may also readily be distinguished from the effects of geologic conductors.

Man-made disturbances are often to be seen, including power lines, pipe lines, metal fences, railways, etc. The former are



generally recognizable as such because they usually show through as cyclic noise of irregular shape and phase relationship. Non-energized, grounded power lines (e. g. 3 phase systems) may also give rise to proper conductor indications, however. Such indications, as well as those from pipe lines and metal fences, etc. are usually of short duration and can be distinguished from proper geologic sources except for very narrow, near-surface lenses. In some instances ground investigation may be necessary in order to resolve the ambiguity of possible source. Whereas the airborne geophysical crew attempts to note visible man-made conductors of the above types, the ground moves by so rapidly at the low flight elevation employed that 100% recognition of such sources cannot be expected from the air.

The normal terrain clearance of the bird is 100 ft. - 200 ft. depending on the surface topography and tree cover, etc., with the helicopter 100 ft. above. The established useful depth of detection of the system for moderate-to-large conducting bodies is about 350 ft. sub-bird under conditions of low extraneous geologic noise, i. e. where the general level of conductivity of the overburden and rock types of the area is low. The useful depth of detection of the system is therefore between 150 ft. and 250 ft. beneath the ground surface under these conditions.

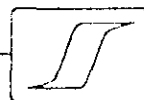
Interpretation of Results

The EM records are interpreted to determine the presence of conducting bodies and to obtain some information relating to their character. The intervalometer time marks (see below) are synchronized with the positioning camera film strip (also see below) and thereby permit the relating of the conductors with appropriate ground locations. The altimeter data (see below) indicate, for each conductor, what the terrain clearance was at the time of detection.

A plan is prepared, either using a subdued photo-mosaic ("grayflex") or an overlay from a mosaic or topographic plan as base. The flight path of each survey line is obtained by means of "tie points", which are features on the mosaic or topographic plan which are also recognizable on the positioning camera film. The flight path is interpolated between these tie points.

For each conductor the following quantities are measured and recorded.

- a) Half width. This is the distance between the points of half the maximum conductor disturbance. For a very thin, steeply dipping body or pipe line, etc., the half width will be about 1.6 times its depth below the bird. If the bird is at a mean conductor clearance of 150 ft. the half width would be about 250 ft. Larger half widths reflect either more deeply buried or, more likely,



thicker conductors.

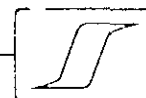
Flat-lying conductors (e. g. overburden) characteristically give large half widths.

The conductor half width is indicated on the plan by an open bar symbol along the flight line. In the event of very narrow conductors only the peak location may be shown (see below).

- b) Peak Location. The in-phase conductor peak location is shown on the plan by a circle in the appropriate location. In the case of broad conductors or closely spaced multiple conductor zones there may be more than one peak, in which event all major peaks are shown. If a conductor is of short half width there may be no room for a half width bar and only the peak circle will be shown. A conductor which is likely man-made will be indicated by an X rather than by a circle.
- c) In-Phase and Out-of-Phase Amplitudes. These amplitudes are scaled from the EM traces and noted in parts per million. On the flight plan, opposite each peak location (circle) will be given the peak in-phase amplitude and the ratio of peak in-phase to peak out-of-phase response (see below).
- d) Conductor Coding. Conductor intersections are graded in electrical categories 1, 2 and 3, based on the in-phase amplitude but taking into account the terrain clearance. For tabular bodies such as sheet-like ore deposits, strata bound conductors and overburden, their response drops off almost in accordance with the inverse cube power of the elevation. Assuming an average 50 ft. of overburden, a category 1 conductor has a peak in-phase response equivalent to 350 p. p. m. or over at 100 ft. bird terrain clearance. A category 2 conductor has a peak in-phase response under similar conditions of between 100 p. p. m. and 350 p. p. m. A category 3 conductor has an equivalent peak in-phase response of less than 100 p. p. m.

The respective peak circles are shaded to reflect their electrical category, with category 1 fully shaded, category 2 half shaded and category 3 unshaded.

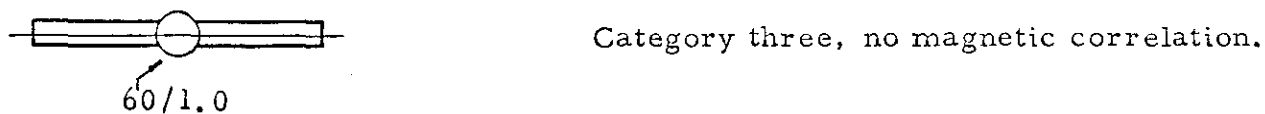
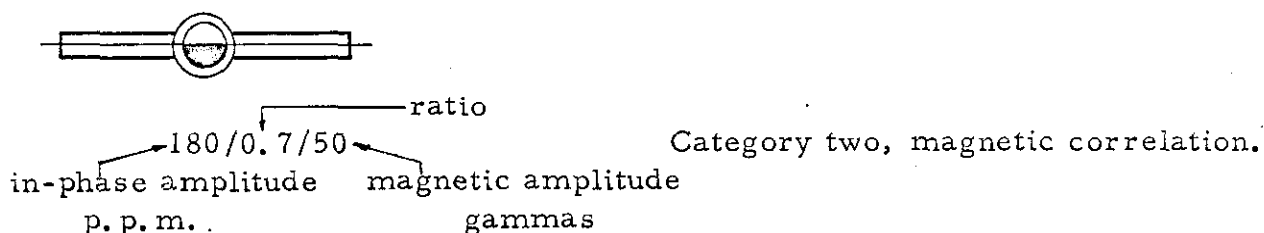
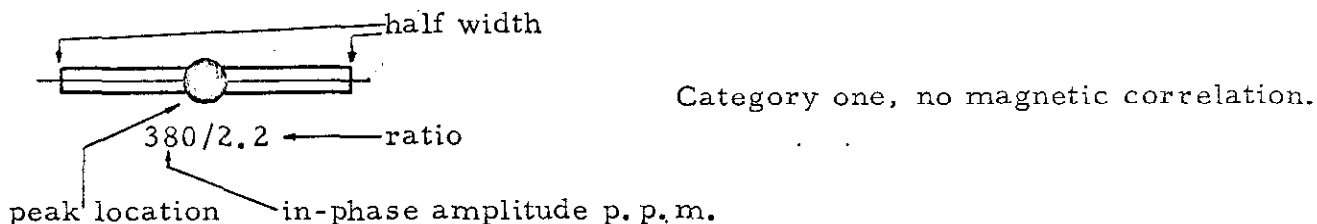
For each conductor peak the ratio of peak in-phase to peak out-of-phase amplitude is calculated and plotted on



the plan. This ratio is indicative of a conductivity-size factor for the conductor. Large, high conducting bodies such as massive sulphides or graphite and seawater, etc., generally have ratios of 3 or over. Moderate conductivity-size bodies will have ratios between 1 and 3. Poor conductivity bodies (e.g. most overburden and some sulphide and graphitic zones) will have ratios of less than 1. In areas where there is a clear differentiation in conductivity between the targets of potential economic interest and other possible conductors, the ratio is a diagnostic feature. In some areas, however, there is an overlap of conductivity ranges and then the ratio cannot be too rigidly relied upon.

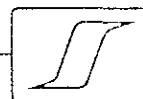
Where magnetic data is available, preferably from a coincident recording magnetometer, any correlating magnetic activity will be noted for the pertinent conductor peak. A conductor peak with apparently direct magnetic correlation will be indicated by a double concentric circle. Although a conducting body which is appreciably magnetic is more likely to be a sulphide body than one which is non-magnetic, there are many very important base metal ore bodies which are quite non-magnetic.

Examples of conductor coding are given below.



X

Probably man-made conductor.



MAGNETOMETER - SCINTREX NPM-1

The Scintrex NPM-1 nuclear resonance airborne magnetometer is based on a Newmont modification of a Varian Associates magnetometer and is produced under license to both companies. It is a very light weight, solid state unit, especially designed for use in a helicopter or light fixed-wing aircraft where weight is an important consideration.

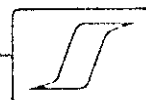
Its cycle period is 1.1 seconds. Each cycle it measures the total intensity of the earth's magnetic field and this quantity, in gammas, is recorded, in analogue form, on a suitable graphic recorder. The full scale sensitivity is usually 1000 gammas and the recorder automatically steps each 500 gammas. In very active areas a full scale sensitivity of 5000 gammas with steps of 2,500 gammas may be employed. Only the magnetic variations are actually recorded although the absolute base level may be established from the NPM-1 as well.

The magnetic sensing head may be on a cable as much as 100 ft. below the aircraft or, in some installations, may be rigidly attached to the aircraft on a suitable boom.

The intrinsic noise level of each reading is about 5 gammas.

Where it is intended to contour the NPM-1 information it is customary to fly tie lines across the survey grid. A fixed magnetic field monitor is often used as well, on the ground, primarily to indicate periods of magnetic storms during which the aeromagnetic data should be considered as unreliable.

The aeromagnetic data may be contoured if desired, using a contour interval of 25 gammas or up, depending on the amount of magnetic relief. Alternatively they may be used simply for purposes of correlation with simultaneously obtained electromagnetic data to determine which conductor zones are appreciably magnetic.



ANCILLARY EQUIPMENT

1. Altimeter

A Bonzer, high frequency solid state radioaltimeter is employed to continuously indicate the mean terrain clearance of the helicopter or other transporting aircraft. The altimeter is installed in the aircraft (unless otherwise indicated) so that the elevation of the sensing birds (electromagnetic or magnetic) will be less by the usual vertical displacement of these birds below the aircraft.

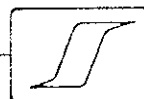
The output of the Bonzer may be expressed in analogue form on a suitable graphic recorder, or may be, for convenience, converted to a semi-digital form on a recorder side pen. In the latter event the altimeter record is a series of spaced pulses whose separation is proportional to the mean terrain clearance.

2. Positioning Camera

A Vinten Mark 3 16 mm positioning camera is employed with a wide angle lens. Photographs of the ground are taken with sufficient frequency to give a complete record of the flight path of the aircraft or helicopter. The frequency of exposure is controlled by the intervalometer referred to below.

3. Intervalometer

A Scintrex IA-2 intervalometer provides regularly spaced timing pulses which drive the positioning camera exposure mechanism and produces synchronous "fiducial marks" on the side pen of the geophysical graphic recorder or recorders. Because of the synchronization of the geophysical traces and the positioning camera it is then possible to relate the geophysical events of interest to their proper ground location. The timing pulse frequency may be adjusted in accordance with the ground speed of the aircraft so that an adequate flight path record is obtained.



DOMINION OF CANADA:
PROVINCE OF BRITISH COLUMBIA.
TO WIT:

In the Matter of a geophysical survey on behalf of
Noranda Exploration Company Limited

I, **R. O. Crosby**

of **750 - 890 West Pender Street, Vancouver**

in the Province of British Columbia, do solemnly declare that an airborne geophysical survey has been executed on some WEST, AN, CHERYL, C.V., OLD SHO, LAD, HAY, MF, HIH, BLACK MT, MAC, CHAIN, SAM, ST, PENU, PAT, LUCKY LADY, AL, BUG, DN, LIN and PY claims in the Black Mountain area, British Columbia, during June and July, 1968. The following expenses were incurred:

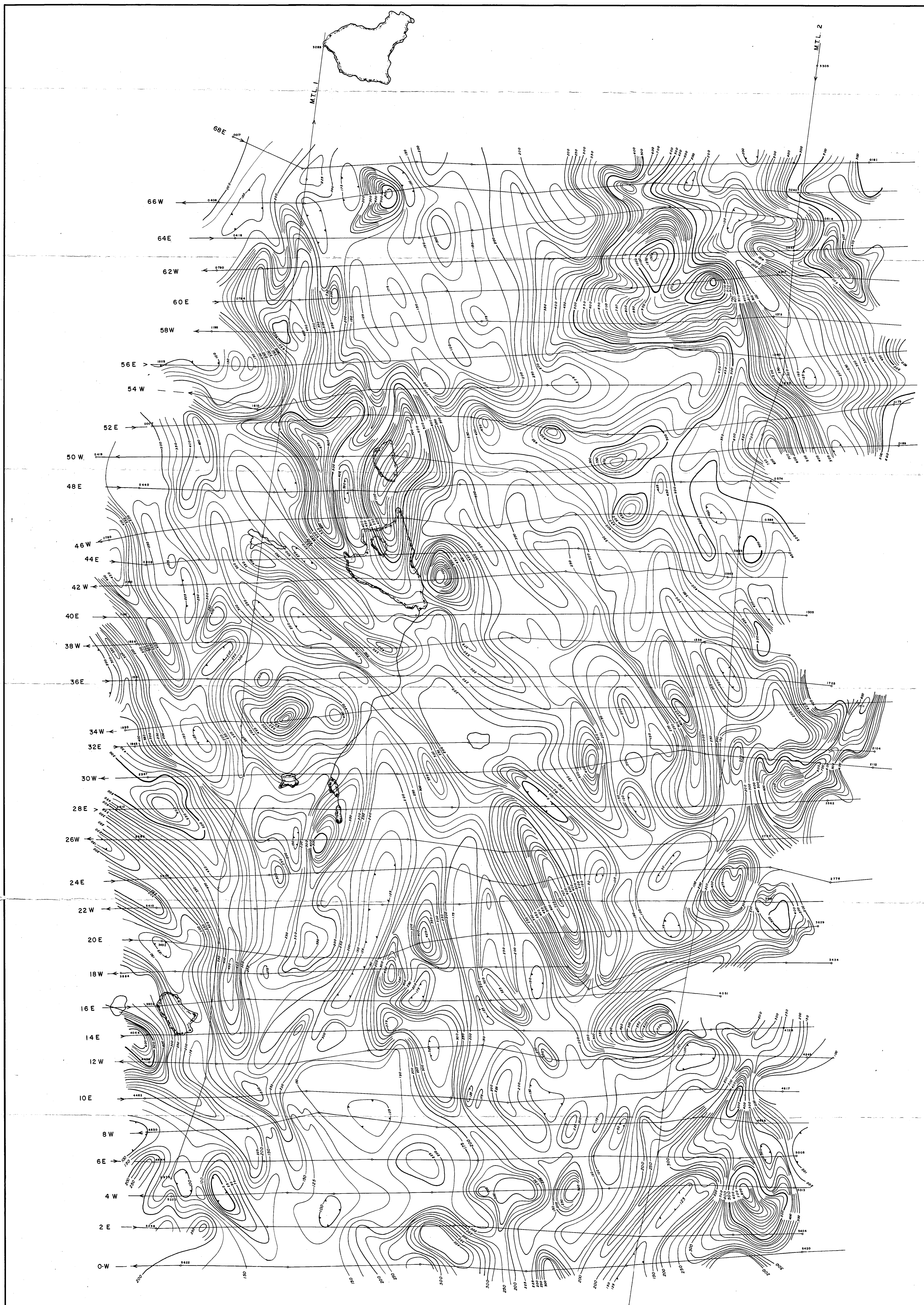
1) Mobilization & demobilization	\$1,000.00
2) Line Mileage Charge 202.6 miles @ \$17.50 per mile	3,545.50
3) Helicopter Charges 7.1 hours @ \$150.00 per hour	1,065.00
4) Food and Lodging	148.50
5) Consulting Fees 2 days @ \$150.00 per day	<u>300.00</u>
(R.O. Crosby, B.Sc., P.Eng.) (Geophysicist)	\$6,059.00

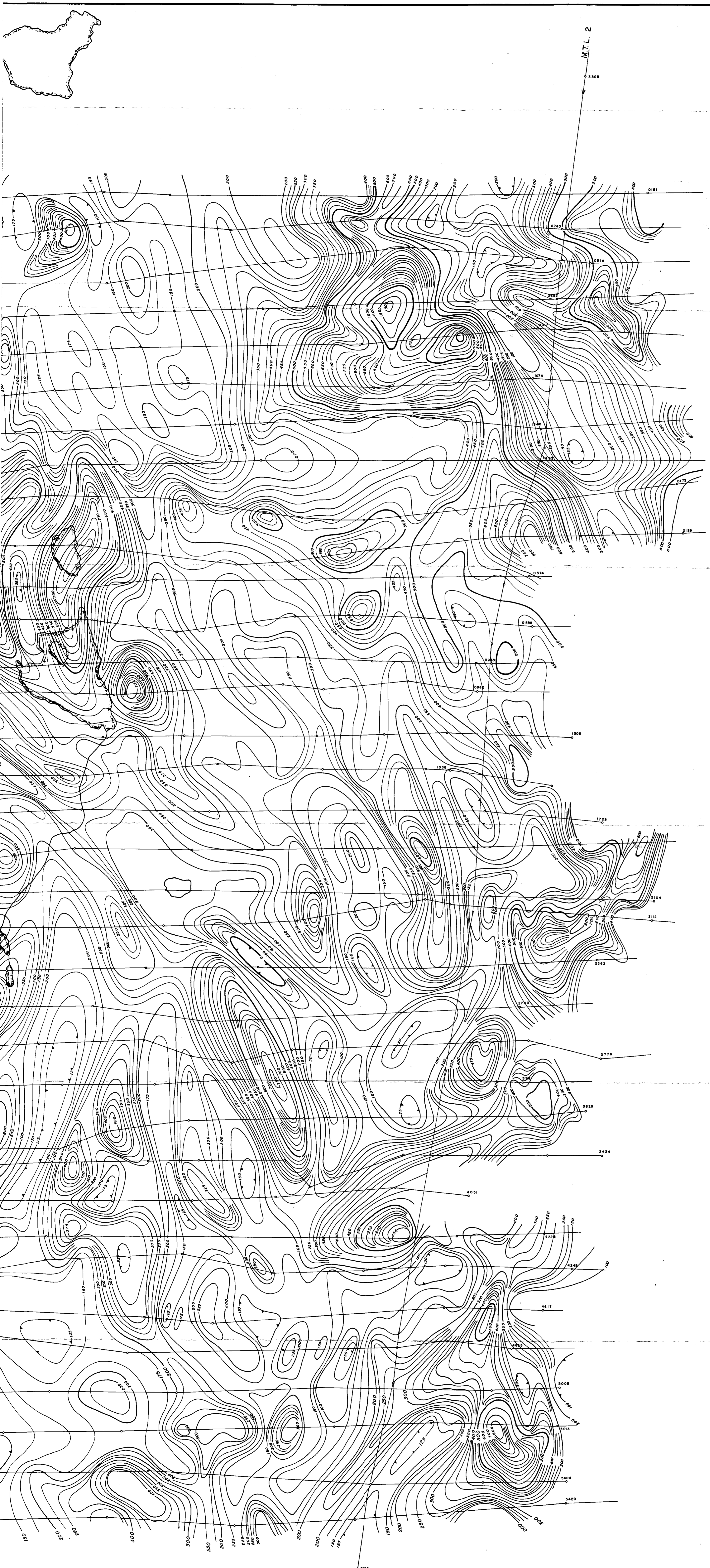
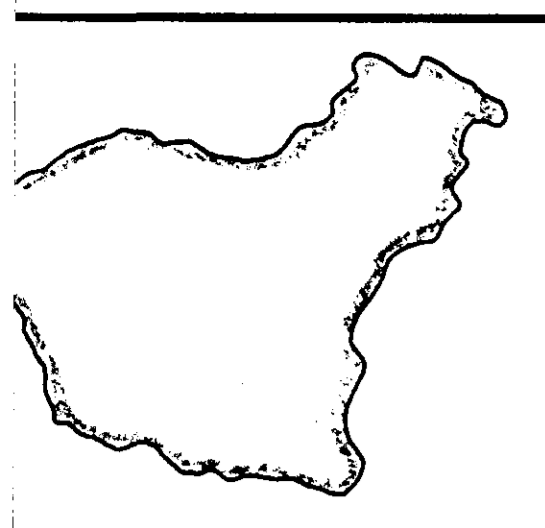
And I make this solemn declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the "Canada Evidence Act."

Declared before me at the **City**
of **Vancouver**, in the
Province of British Columbia, this **24**
day of **October, 1968**, A.D.

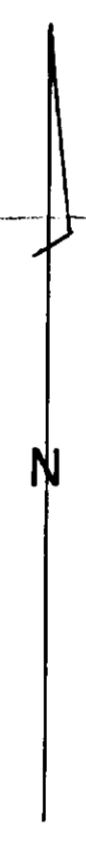
Richard O. Crosby

J. Paul SUB-MINING RECORDER
A Commissioner for taking Affidavits for British Columbia or
A Notary Public in and for the Province of British Columbia.





Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1667 MAP 1



LEGEND:

26 W ← 5800 FLIGHT LINE, FLIGHT LINE NUMBER & FLIGHT DIRECTION WITH NUMBERED CONTROL POINT

— 25 — 25 GAMMA ISOMAGNETIC CONTOUR INTERVAL

— 100 — 100 GAMMA ISOMAGNETIC CONTOUR INTERVAL

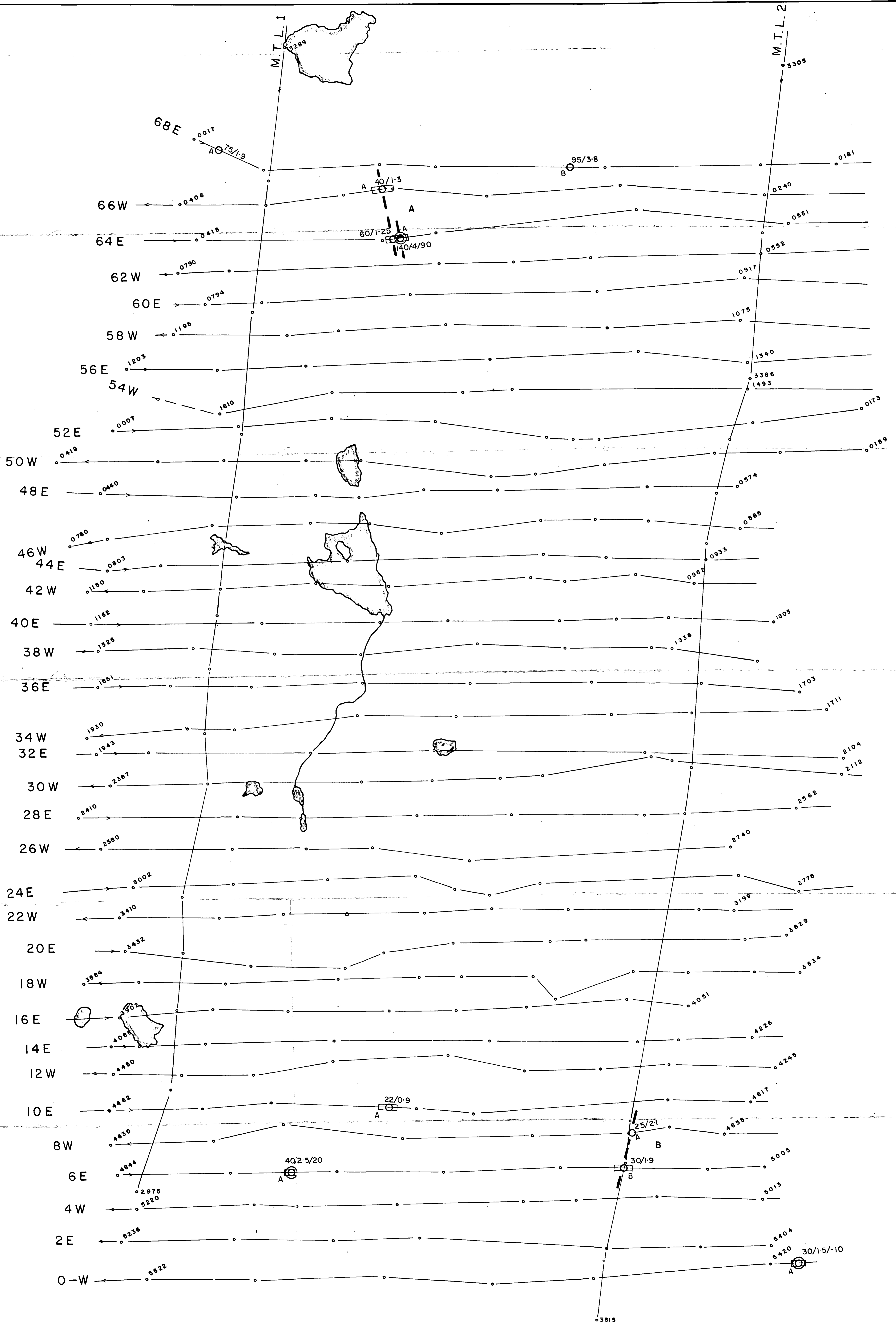
○ 75 ○ MAGNETIC LOW

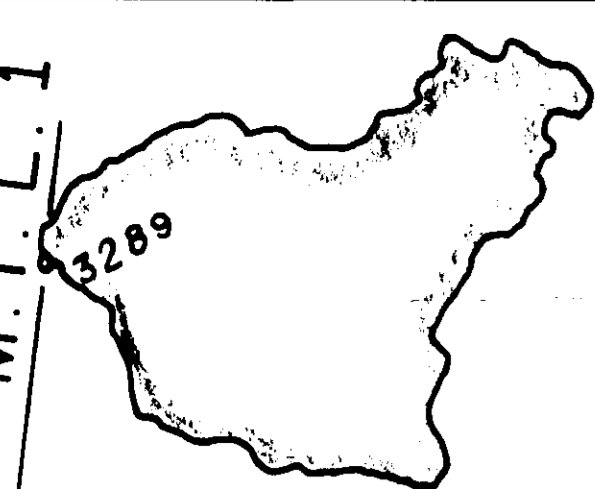
○ REFERENCE LEVEL 58,000 GAMMAS

PLATE 1d
NORANDA EXPLORATION COMPANY LIMITED
 BLACK MOUNTAIN AREA, B.C.
HELICOPTER MAGNETOMETER SURVEY
 N.P.M.-1
 SCALE 1" = 1320' APPROX.
 SURVEY BY SEIGEL ASSOCIATES LIMITED
 * MEAN FLIGHT ALTITUDE OF HELICOPTER 200'
 MEAN FLIGHT LINE SPACING 1320 FEET

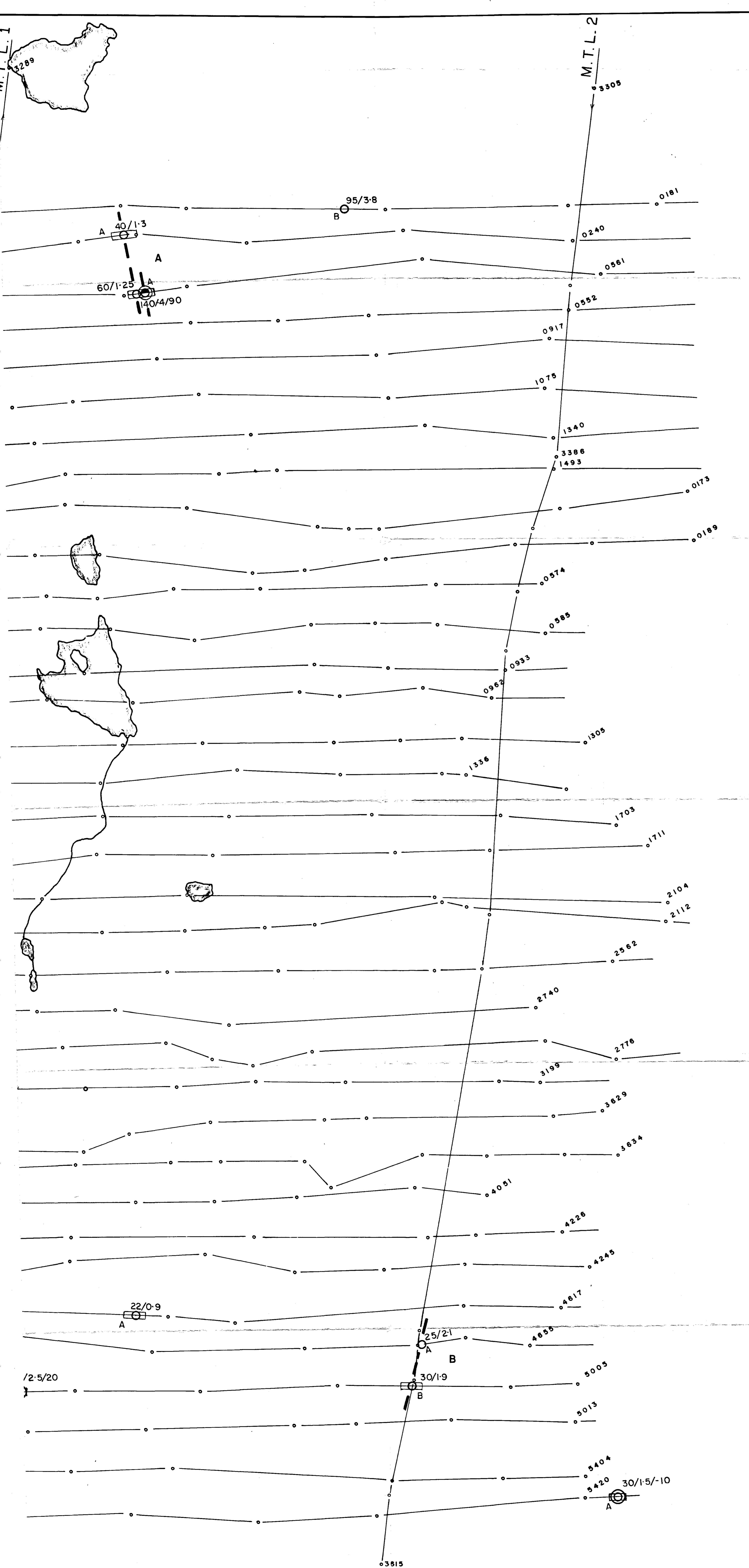
1667

Richard O. Seigel





Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1667 MAP 2

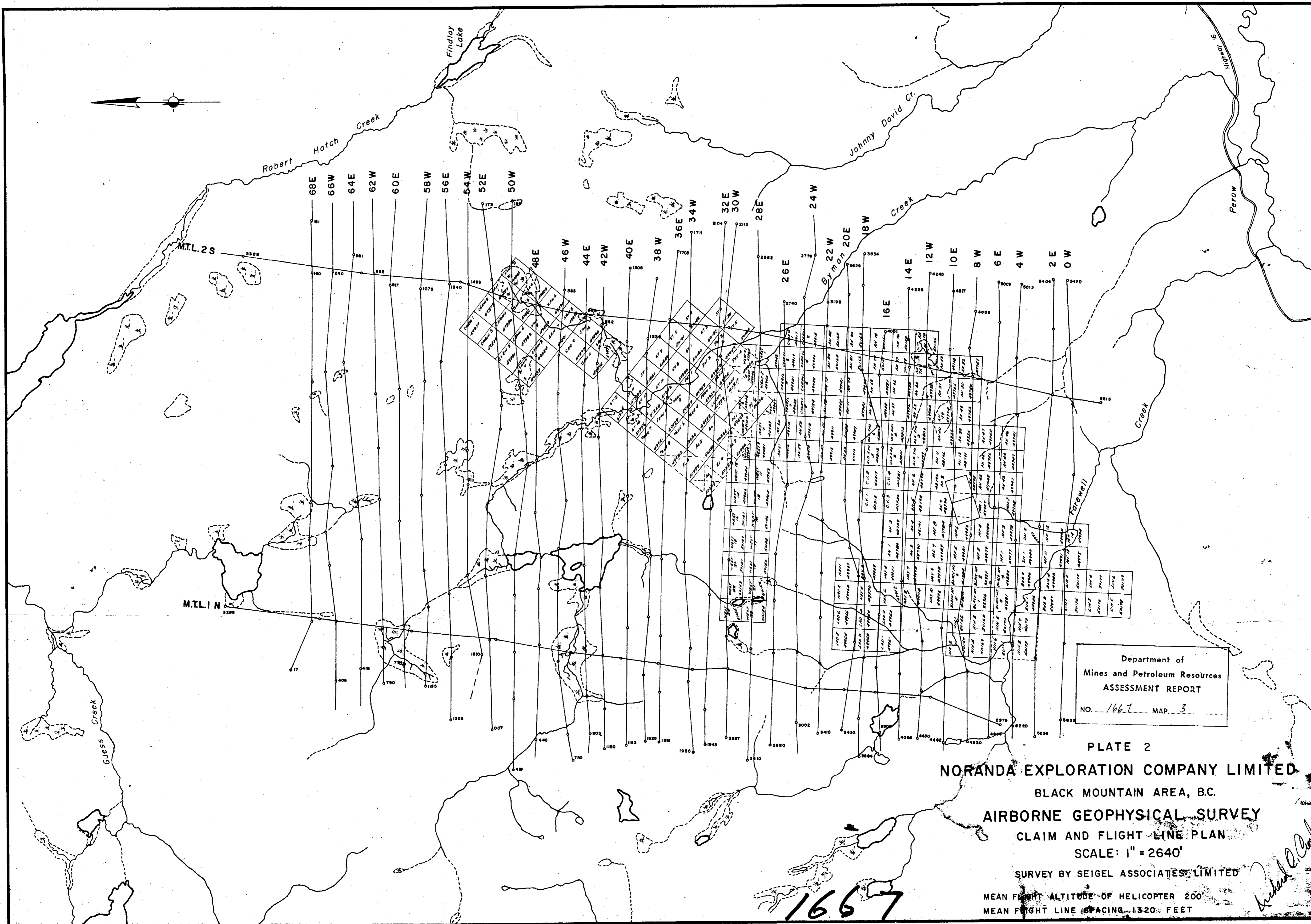


LEGEND:

- 26 W ← 2100
- FLIGHT LINE, FLIGHT LINE NUMBER & FLIGHT DIRECTION WITH NUMBERED CONTROL POINT
- 1st CATEGORY H.E.M. ANOMALY
- 2nd CATEGORY H.E.M. ANOMALY
- 3rd CATEGORY H.E.M. ANOMALY
- ⊙ H.E.M. ANOMALY WITH MAGNETIC CORRELATION and 72 PPM Ratio of IN-PHASE / Magnetic Correlation IN-PHASE / OUT OF PHASE / AMPLITUDE IN GAMMAS
- EXTENT OF H.E.M. ANOMALY AND PEAK LOCATION
- CONDUCTOR AXIS

PLATE 1b
NORANDA EXPLORATION COMPANY LIMITED
BLACK MOUNTAIN AREA, B.C.
HELICOPTER ELECTROMAGNETIC SURVEY
H.E.M. - 701
SCALE 1" = 1320' APPROX.
SURVEY BY SEIGEL ASSOCIATES LIMITED
MEAN FLIGHT ALTITUDE OF HELICOPTER 200'
MEAN FLIGHT LINE SPACING 1320 FEET

1667
R. O. Seigel



Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1667 MAP 3

PLATE 2
NORANDA EXPLORATION COMPANY LIMITED
BLACK MOUNTAIN AREA, B.C.
AIRBORNE GEOPHYSICAL SURVEY
CLAIM AND FLIGHT LINE PLAN
SCALE: 1" = 2640'
SURVEY BY SEIGEL ASSOCIATES LIMITED

MEAN FLIGHT ALTITUDE OF HELICOPTER 200
MEAN FLIGHT LINE SPACING 1320 FEET

1667

Richard A. [unclear]