REPORT

ON A
COMBINED HELICOPTER BORNE
MAGNETIC, ELECTROMAGNETIC and RADIOMETRIC SURVEY

NAK AND TAK PROPERTIES
BRITISH COLUMBIA

FOR

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J9628

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All maps show the survey area boundary and a UTM grid. The black line maps show a screened topographic base. The colour maps show planimetry digitized from 1:50,000 scale topographic maps.

Map types are as follows:

Black Line Maps Scale 1:10,000

1. Topographic base
2. Compilation
3. Total magnetic field
4. Vertical magnetic gradient (calculated from 3)
5A. Apparent resistivity - 4600 Hz
5B. Apparent resistivity - 4175 Hz

Colour Maps Scale 1:10,000

1. Total magnetic field
2. Vertical magnetic gradient (calculated from 1)
3A. Apparent resistivity - 4600 Hz
3B. Apparent resistivity - 4175 Hz
4A. EM offset profiles - 935 and 865 Hz
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Derivative Colour Maps Scale 1:10,000

1. Shadowgraph of the total magnetic field
2. Ternary radiometrics

All but the base, shadow, radiometric and ternary maps show the flight path and EM anomaly centres. Colour contour maps show colour fill plus superimposed line contours.

REPORT ON A COMBINED HELICOPTER MAGNETIC, ELECTROMAGNETIC AND RADIOMETRIC SURVEY NAK AND TAK PROPERTIES, BRITISH COLUMBIA

1. INTRODUCTION

This report describes a helicopter-borne geophysical survey carried out on behalf of Lucero Resource Corp. by Aerodat Inc. under an agreement dated March 6, 1996. Principal geophysical sensors included a five frequency electromagnetic system, a high sensitivity cesium vapour magnetometer and a multi channel gamma ray spectrometer. Ancillary equipment included a GPS navigation system with GPS base station, a colour video tracking camera, radar and barometric altimeters, power line monitor and a base station magnetometer.

The survey involved the NAK and TAK claim blocks in the Babine Lake area of central British Columbia. The NAK survey block consists of 10 claims with a total area of about 3200 hectares (32 square kilometres). The TAK survey block consists of 14 claims with a total area of about 56 square kilometres. The survey was flown with a traverse line spacing of 100 metres. The field work was done in the period August 9 to 26, 1996. Total coverage (traverse plus tie lines) as measured within the survey boundaries was 403 km (NAK property) and 639 km (TAK property) for a total of 1042 kilometres. Costs for the survey are summarised in Appendix 1. The Aerodat job number is J9628.

The overall objectives of the survey include 1) correlating survey results with known mineralization, 2) the identification of targets with potential economic significance unrelated to known mineral occurrences, and 3) utilizing the results in structural and geological mapping.

This report describes the survey, the data processing and presentation. The results are reviewed working from the regional geology and exploration target as defined by Dawson Geological Consultants. The geophysical setting and expression of mineral deposits or prospects in the survey areas are discussed. Lithological units and structural features with a distinct geophysical expression are transferred to 1:10,0000 scale compilation maps. Promising exploration targets are highlighted and discussed.

2. SURVEY AREAS AND SPECIFICATIONS

Location maps are shown in figure 1. Maps of the NAK and TAK claim blocks are reproduced here as figures 2 and 3. The isolated claim - NAK 10 - was not flown. The 2 km^2 area between claims NAK 6 and NAK 8 was included in the survey.

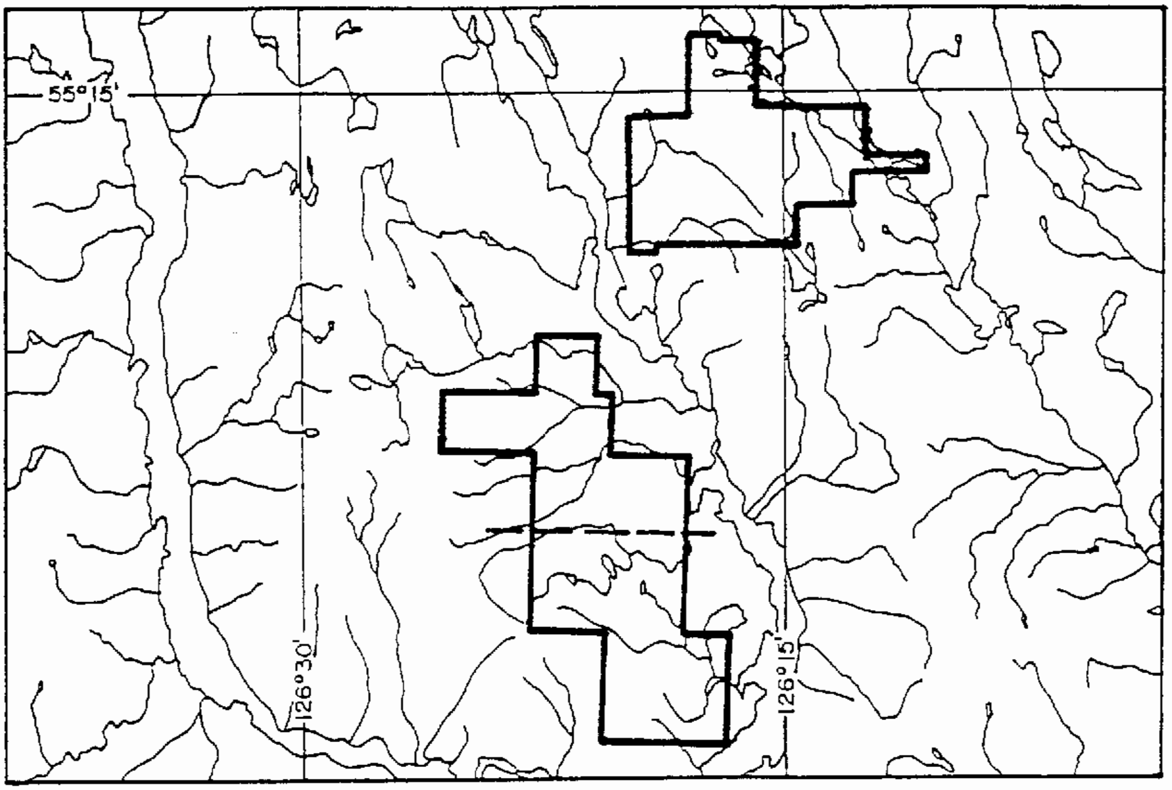


Figure 1 : Location Map
HEM, magnetic and radiometric surveys
NAK and TAK Properties
Lucero Resource Corp.
J9628

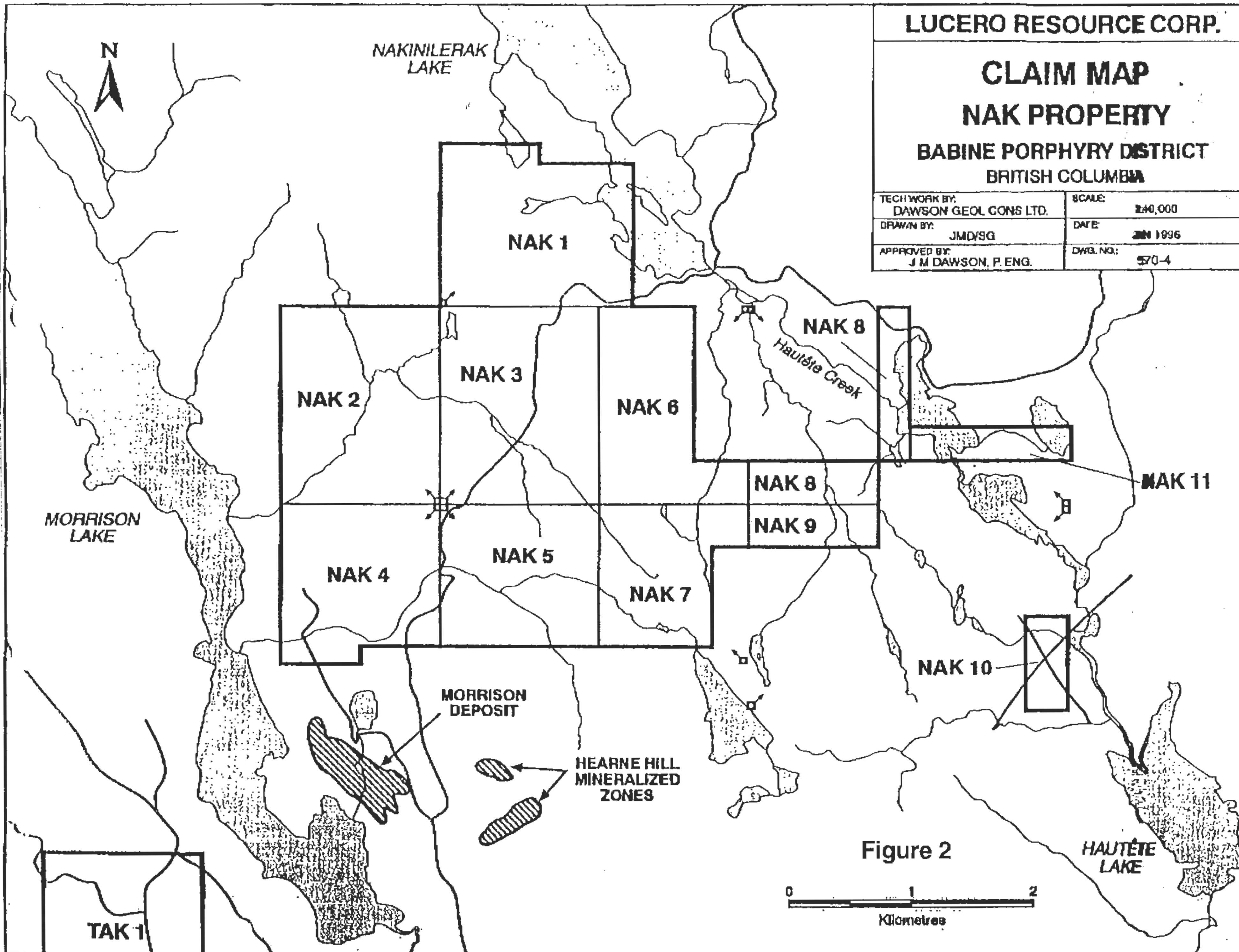
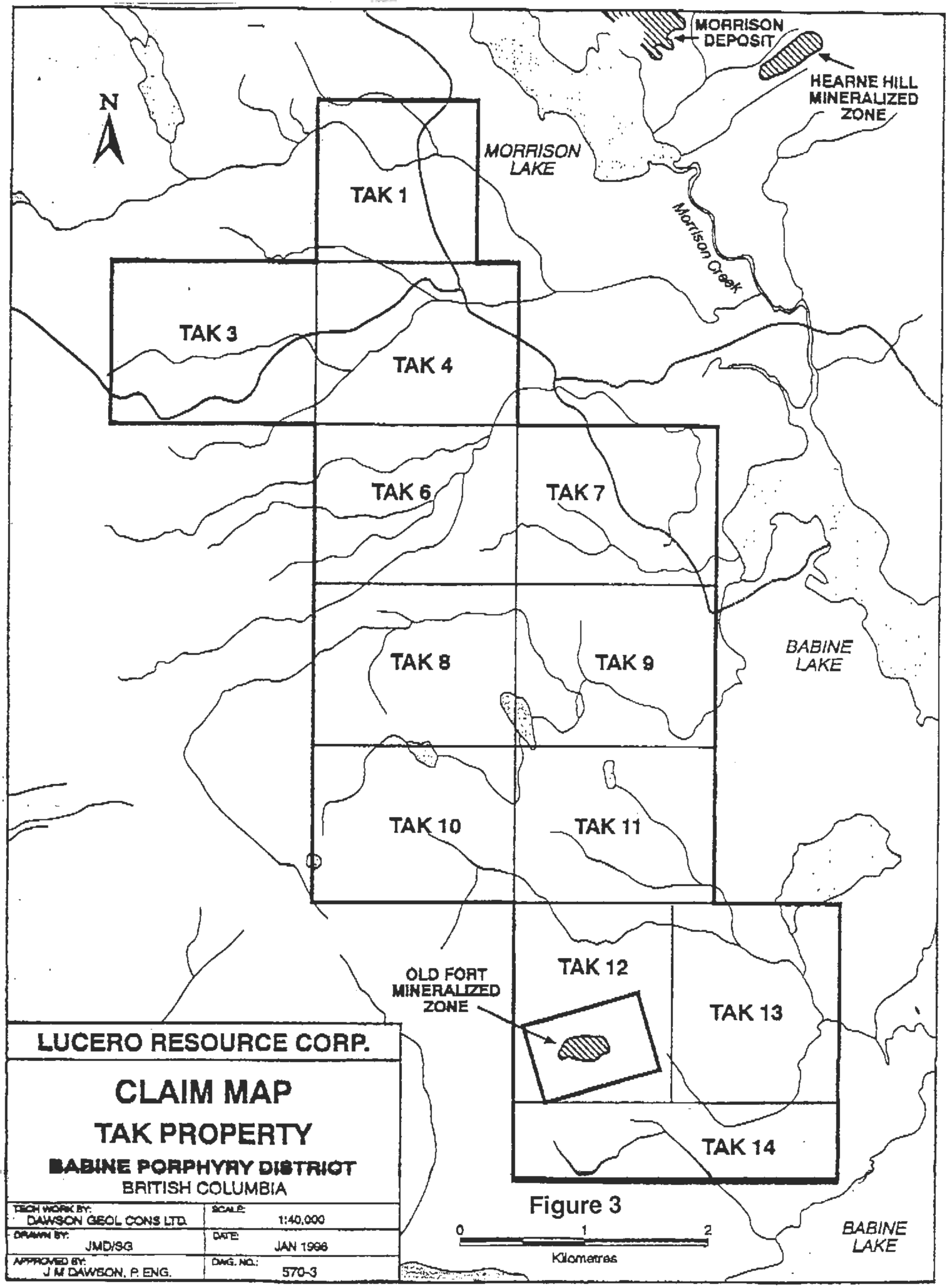

LUCERO RESOURCE CORP.
CLAIM MAP
NAK PROPERTY
BABINE PORPHYRY DISTRICT
BRITISH COLUMBIA
TECH WORK BY: DAWSON GEOL CONS LTD.
SCALE: 40,000
DRAWN BY: JMD/SG
DATE: 1996
APPROVED BY: J M DAWSON, P. ENG.
DWG. NO.: 570-4
N
NAKINILERAK LAKE
MORRISON LAKE
HAUTÊTE LAKE
Hautête Creek
NAK 1
NAK 2
NAK 3
NAK 4
NAK 5
NAK 6
NAK 7
NAK 8
NAK 8
NAK 9
NAK 10
NAK 11
TAK 1
MORRISON DEPOSIT
HEARNE HILL MINERALIZED ZONES
0
1
2
Kilometres

Figure 2


MORRISON DEPOSIT
HEARNE HILL MINERALIZED ZONE
N
MORRISON LAKE
Morrison Creek
TAK 1
TAK 3
TAK 4
TAK 6
TAK 7
TAK 8
TAK 9
BABINE LAKE
TAK 10
TAK 11
TAK 12
OLD FORT MINERALIZED ZONE
TAK 13
TAK 14
LUCERO RESOURCE CORP.
CLAIM MAP
TAK PROPERTY
BABINE PORPHYRY DISTRICT
BRITISH COLUMBIA
TECH WORK BY: DAWSON GEOL CONS LTD.
SCALE: 1:40,000
DRAWN BY: JMD/SG
DATE: JAN 1996
APPROVED BY: J M DAWSON, P. ENG.
DWG. NO.: 570-3
0 1 2
Kilometres
BABINE LAKE
Figure 3

Topographic relief over both blocks is moderate with most elevations in the range of 2500 to 4000 feet. The highest point is Old Fort Mountain at just over 5000 feet. The areas are free of major roads, railroads or power lines.

Starting in the southwest corner and advancing clockwise, the survey area corners expressed in UTM coordinates are

NAK Property

1.	669 700 e	6 120 300 n
2.	669 500 e	6 124 950 n
3.	671 550 e	6 125 000 n
4.	671 500 e	6 127 100 n
5.	672 800 e	6 127 150 n
6.	672 900 e	6 126 950 n
7.	674 000 e	6 126 990 n
8.	674 050 e	6 125 100 n
9.	677 600 e	6 125 250 n
10.	677 650 e	6 123 700 n
11.	679 750 e	6 123 800 n
12.	679 800 e	6 123 300 n
13.	677 300 e	6 123 250 n
14.	677 350 e	6 122 150 n
15.	675 200 e	6 122 050 n
16.	675 250 e	6 120 800 n
17.	670 750 e	6 120 600 n
18.	670 750 e	6 120 350 n

TAK Property

1.	669 400 e	6 104 200 n
2.	669 400 e	6 107 700 n
3.	666 900 e	6 107 700 n
4.	666 900 e	6 113 700 n
5.	664 200 e	6 113 700 n
6.	664 200 e	6 115 800 n
7.	666 800 e	6 115 800 n
8.	666 800 e	6 117 800 n
9.	668 900 e	6 117 800 n
10.	668 900 e	6 115 800 n
11.	669 400 e	6 115 800 n
12.	669 400 e	6 113 800 n
13.	672 000 e	6 113 800 n
14.	672 000 e	6 107 800 n

15.	673 600 e	6 107 800 n
16.	673 600 e	6 104 200 n

These corners are based on transferring the sketch maps of figure 2 and 3 to local topographic maps. They are therefore best estimates of the claim corners but are not necessarily the true values.

Local topographic maps are based on the North American 1927 datum - Clarke 1866 spheroid with datum shifts to WGS 84 of -7 m (dx), 162 m (dy) and 188 m (dz). UTM coordinates are based on UTM zone 9 with the central meridian at 129° west.

The survey blocks are centered at about 126.3° east, 55.2° north. For an elevation of 4000 feet and a 1996.6 date, the geomagnetic field is given as

Total field :	57,690 nT
Inclination :	74.5°
Declination :	magnetic north is 24.1° east of geographic north
Latitude gradient :	2.49 nT/km to the north
Longitude gradient :	1.46 nT/km to the east
Elevation gradient :	28.98 nT/km

Specifications

Traverse line spacing :	100 metres
Traverse line direction :	east / west
Tie line spacing :	2 kilometres (approx.)
Tie line direction :	north / south
Nominal survey ground speed :	60 knots (31 metres per second)
Data sampling rates	
EM and magnetics :	0.1 seconds
Radiometrics and GPS :	1 second
Nominal sensor terrain clearances	
EM :	30 metres
Magnetometer :	45 metres
Radiometrics :	60 metres

Tolerances

1. The distance between adjacent traverse lines will not exceed 1.25 times specified line spacing for a distance of more than 1 kilometre along any flight line.

2. The nominal EM sensor height will be 30 metres and will be consistent with safety of aircraft and crew. The magnetometer sensor height will be 45

metres. The nominal terrain clearance of the helicopter and radiometric system will be 60 metres.

3. EM noise levels are generally less than 1 ppm excluding spherics. The magnetometer samples the total field every 0.1 s with a maximum noise level of 0.1 nT.

4. Flying will be terminated during times of diurnal variation greater than 10 nT over a 2 minute chord.

5. Reflights will be attempted wherever lines or part lines are noted in the field to be beyond the agreed tolerances and unacceptable. All reflights will commence and end beyond tie lines.

3. SURVEY PERSONNEL AND PROCEDURES

The survey was flown in the period August 9 to 26, 1996. 16 flights were needed to complete the project. The field personnel are listed in Appendix 2.

The flight line spacing was 100 metres. The flight line direction was east/west. Tie lines were flown north/south approximately every 2 km. The aircraft ground speed was maintained at approximately 60 knots (31 metres per second). The nominal helicopter terrain clearance was maintained at 60 m (sensor terrain clearances of 30 m - EM, 45 m - magnetometer and 60 m - gamma ray spectrometer).

Navigation was assisted by a GPS receiver and data acquisition system which update WGS 84 latitude and longitude coordinates every second, direct the pilot over a pre-programmed survey grid and record current position. A base station records static GPS positions for later differential correction of the airborne record.

The field work is governed by a series of pre-survey, daily, pre-flight and in-flight tests and calibration procedures. These procedures are most important for the HEM and radiometric systems. Of particular importance are phasing and gain settings in the EM system, pre-flight sample checks of the radiometric system and in-flight backgrounds for both the EM and radiometric systems.

Verification and Quality Control

The analog records were inspected after every flight to check noise levels and general data quality. The airborne records are checked to insure proper in-flight calibration procedures, recording scales and chart speed and that all data are within specifications. Noise levels in the raw EM and magnetic data are the main concerns. Lines or segments thereof in which noise in any channel exceeded specifications were noted and added to the list of reflights.

4. DELIVERABLES

The survey is described in a report which is provided in 2 copies. Folded copies of the black line maps are bound with the report. Two copies of all colour maps are provided. The colour maps and stable base originals of the black line maps are rolled and delivered in map tubes.

The survey results are presented at 1:10,000. The NAK property is covered in 1 map sheet. The TAK property is covered in 2 map sheets.

All maps show the survey area boundary and a UTM grid. The black line maps show a screened topographic base. The colour maps show planimetry digitized from 1:50,000 scale topographic maps.

Map types are as follows:

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Derivative Colour Maps Scale 1:10,000

1. Shadowgraph of the total magnetic field
2. Ternary radiometrics

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The final digital archives of the survey results are provided on CD ROMs (ISO 9660). The profile data are written in ASCII format. The gridded data are written in SURFVIEW format.

All original analog records, base station magnetometer records and flight path video tape are delivered at the end of the project.

5. AIRCRAFT AND EQUIPMENT

5.1 Aircraft

An Aerospatiale Lama helicopter - registration CF-JJW - owned and operated by Turbo West Helicopters of Calgary was used for the survey. Installation of the geophysical and ancillary equipment was carried out by Aerodat. The survey aircraft was flown at a nominal terrain clearance of 60 metres.

5.2 Electromagnetic System

The electromagnetic system was an Aerodat 5-frequency system. Two vertical coaxial coil pairs were operated at 935 and 4600 Hz and three horizontal coplanar coil pairs at 865, 4175 and 33,000 Hz. The transmitter-receiver separation was approximately 7 metres. Inphase and quadrature signals were measured simultaneously for the 5 frequencies with a time constant of 0.1 seconds. The HEM bird was towed 30 metres below the helicopter.

5.3 Magnetometer

The magnetometer employed a Scintrex cesium vapour, optically pumped magnetometer sensor. The sensitivity of this instrument is 0.01 nanoTeslas at a 0.1 second sampling rate. The sensor was towed in a bird 15 metres below the helicopter.

5.4 Radiometric System

An Exploranium GR820 gamma-ray spectrometer coupled to an Exploranium GPX 1024/256 sensor package was used to record seven channels of radiometric data. The sensor has four 4" x 4" x 16" downward looking crystals for a total sensor volume of 1024 cubic inches (17.8 litres). One 256 cubic inch crystal is dedicated to measuring non terrestrial counts. Gain stabilization is maintained on each crystal separately by following the K photopeak.

Channels recorded and their energy windows were as follows:

Channel	Window
Total Count	0.41 to 2.81 MeV
Potassium	1.37 to 1.57 MeV
Uranium	1.66 to 1.86 MeV
Thorium	2.41 to 2.81 MeV
Uranium up	1.66 to 1.86 MeV
Cosmic	3.0 MeV and above

All channels of radiometric data were recorded at a 1 second update rate (counts per second - cps). Digital recording resolution is 1 cps.

5.5 Ancillary Systems

Base Station Magnetometer

A base station magnetometer was set up to record diurnal variations of the earth's magnetic field. It used a Scintrex cesium vapour sensor coupled to an Aerodat M82 counter, PC and printer. The clock of the base station was synchronized with that of the airborne system to facilitate later correlation. Digital recording resolution was 0.01 nT. The update rate was 1 second.

External magnetic field variations are recorded on a printer plot and in digital form. The printer plot shows the total magnetic field plotted at a vertical scale of 4 nT/inch. Chart speed is 25 inches/hour. The date and chart settings are given at the start of the record.

Radar Altimeter

A Terra TRA 3000 radar altimeter was used to record terrain clearance. The output from the instrument is a linear function of altitude.

Barometric Altimeter

A Rosemount 1241M 3 B1 barometric altimeter recorded elevation above sea level in feet. This unit is factory calibrated based on a standard atmosphere of about 1 millibar per 10 metres. As normal daily pressure variations are on the order of ± 10 millibars, the absolute accuracy of the barometric elevation is about ± 100 m. The relative accuracy is better.

Tracking Camera

A Sony colour video camera and Samsung recorder were used to record flight path on standard VHS video tape, NTSC format. The camera was operated in continuous mode. The flight number, 24 hour clock time (to 0.1 second) manual fiducial number and WGS 84 x/y or latitude/longitude are encoded on the video tape.

GPS Navigation System

The navigation system consisted of

- Magnavox MX 9212 GPS receiver + laptop PC to log data in the air and generate steering indicators for the pilot.

- Novatel 3151R GPS receiver + laptop PC as base station.

GPS data are recorded both in the air and at the base station to allow post-flight differential corrections of the flight path record.

The airborne GPS antenna is mounted on the magnetometer bird, 15 m down the tow cable.

Analog Recorder

An RMS dot matrix recorder was used to display the data during the survey. Record contents are as follows:

Label	Contents	Scale
GEOPHYSICAL SENSOR DATA		
MAGF	Total Field Magnetics, Fine	2.5 nT/mm
MAGC	Total Field Magnetics, Coarse	25 nT/mm
L9XI	935 Hz, Coaxial, Inphase	2.5 ppm/mm
L9XQ	935 Hz, Coaxial, Quadrature	2.5 ppm/mm

M4XI	4600 Hz, Coaxial, Inphase	2.5 ppm/mm
M4XQ	4600 Hz, Coaxial, Quadrature	2.5 ppm/mm
L8PI	865 Hz, Coplanar, Inphase	10 ppm/mm
L8PQ	865 Hz, Coplanar, Quadrature	10 ppm/mm
M4PI	4174 Hz, Coplanar, Inphase	10 ppm/mm
M4PQ	4175 Hz, Coplanar, Quadrature	10 ppm/mm
H3PI	33000 Hz, Coplanar, Inphase	20 ppm/mm
H3PQ	33000 Hz, Coplanar, Quadrature	20 ppm/mm
TCDN	Total Count	50 cps/mm
K-40	Potassium	5 cps/mm
URDN	Uranium	2.5 cps/mm
TH	Thorium	2.5 cps/mm
URUP	Uranium (upward looking crystal)	2.5 cps/mm

ANCILLARY DATA

RALT	Radar Altimeter	10 ft/mm
BALT	Barometric Altimeter	50 ft/mm
GALT	GPS Altitude	50 ft/mm
PWRL	50/60 Hz Power line monitor	-

The zero of the radar altimeter is 5 cm (5 large divisions) from the top of the analog chart. The full analog range for the radar altimeter is therefore 500 feet. A flying height of 60 m (197 feet) gives an analog trace which is three large divisions (3 cm) below the top of the analog record.

Chart speed is 2 mm/second. The 24 hour clock time is printed every 20 seconds. The total magnetic field value is printed every 30 seconds. The WGS 84 GPS coordinates are printed every minute.

Vertical lines crossing the record are operator activated manual fiducial markers. The start of any survey line is identified by two closely spaced manual fiducials. The end of any survey line is identified by three closely spaced manual fiducials. Manual fiducials are numbered in order. Every tenth manual fiducial is indicated by its number, printed at the bottom of the record.

Calibration sequences are located at the start and end of each flight and at intermediate times when needed.

Digital Recorder

An RMS data acquisition system recorded the digital survey data on magnetic media. Contents and update rates were as follows:

Data Type	Sampling	Resolution
Magnetometer	0.1 s	0.001 nT
HEM	0.1 s	0.03 ppm (935, 4600 Hz) 0.12 ppm (865, 4175 Hz) 0.24 ppm (33000 Hz)
Radiometrics	1 s	1 cps
Position	1 s	0.1 m
Altimeters	0.2 s	0.1 m
Power Line Monitor	0.2 s	-
Manual Fiducial		
Clock Time		

6. DATA PROCESSING AND PRESENTATION

Personnel involved in the data processing were

George McDonald	-	overall supervision
Will Icay	-	data processing
Ian Johnson	-	interpretation and reporting

These names are also shown in Appendix 2.

6.1 Base Maps

The base maps for the black line presentation have been prepared by combining NTS 1:50,000 scale topographic maps 93 M/1 and 93 M/8. They show latitude and longitude coordinates and a UTM grid. These maps were published in 1992 and are based on infomration current to 1986.

Base maps are constructed by joining 1:50,000 topographic map sheets. Photographic processes are used to produce screened mylar copies at 1:10,000. Prominent water courses are digitized to form a planimetric base for the colour maps.

Base maps are constructed assuming the scale of the topographic maps is correct to within the accuracy required - normally better than 0.5 %. When registering the airborne results to the base maps, a larger scale error may be detected and the bases are redone. The scale of the airborne results as given by GPS latitude and longitude may be assumed to be exact.

6.2 Flight Path and Registration

The raw flight path record, expressed as WGS 84 latitude/longitude, is differentially corrected using the base station GPS data. The corrected flight path is translated to the local datum - NAD 1927 - using datum shifts of 7 m (dx), -162 m (dy) and -188 m (dz). Registration to the topography is based on the theoretical translation to the local datum confirmed by a 'best fit' with digital terrain maps, manual fiducials or control points identified from the video tape (see below).

The flight path is drawn using linear interpolation between x,y positions from the navigation system. Processing includes speed checks to identify spikes and offsets which are removed. Positions are updated every second and expressed as longitude or UTM eastings (x) and latitude or UTM northings (y). Units are decimal degrees or metres.

Manual fiducials are shown as small circles labelled by fiducial number. The 24 hour clock time is shown as a small square, plotted every 30 seconds. Large tick marks are shown every 10 seconds. Small tick marks are plotted every 2 seconds.

The survey line and flight numbers are given at the start and end of each survey line. Line numbers are

10010 15 to 10680 11 : 68 traverse lines, NAK Property
81010 15 to 81060 15 : 6 tie lines, NAK Property

20021 6 to 20980 4 : 97 traverse lines, south part, TAK Property
10990 3 to 11370 1 : 39 traverse lines, north part, TAK Property
82010 15 to 82050 15 : 5 tie lines, TAK Property

Registration

The positioning or registration of the airborne results onto area topographic maps is done by translation of WGS 84 coordinates to local latitude / longitude or UTM systems. The registration is checked using a 'best fit' between topographic maps and digital terrain maps, manual fiducials or control points taken from the video tape.

6.3 Electromagnetic Data

Essential steps in the processing of the EM data were

1. adjust all data to a 7 m coil separation
2. apply spherics rejection filter to profile data
3. apply 7 point Hanning filter to 0.1 s profile data
4. level profile data using high altitude background determinations. Make minor manual adjustments based on offset profiles or preliminary apparent resistivity maps.

Local sferic activity can produce sharp, large amplitude events that cannot be removed by conventional filtering procedures. The sferics filter involves an algorithm with searches out and rejects major sferic events. The signal to noise ratio was further enhanced by the application of a low pass digital filter. This filter suppresses only variations with a wavelength less than about 0.25 seconds.

Following the filtering process, a base level correction was made using EM zero levels determined during high altitude calibration sequences. The correction applied is a linear function of time that ensures the corrected amplitude of the various inphase and quadrature components is zero when no conductive or permeable source is present. The filtered and levelled data were used in the determination of apparent resistivity (see below).

The EM data are presented as 1:10,000 scale offset profiles with vertical scales of 2 ppm/mm (935 and 4600 Hz), 8 ppm/mm (865 and 4175 Hz) and 32 ppm/mm (33 kHz).

Apparent Resistivity

Essential steps in generating apparent resistivity maps at any frequency were

1. invert inphase and quadrature amplitudes for apparent resistivity and depth of burial (pseudo-layer model).
2. interpolate along track onto a square grid using an Akima spline technique. Grid cell size = 25 m.
3. apply Hanning 7 x 7 smoothing filter to grid.
4. contour using logarithmically spaced line contours and equal area colour contouring. Make minor adjustments as necessary. Plot finals.

The contour interval is 0.1 log(ohm.m). This translates to contour lines at 100, 126, 158, 200, 251, 316, 398, 501, 631 and 794 ohm.m and multiples of 10. Thicker contour lines are used for 100, 316 ohm.m and multiples of 10.

Apparent resistivity maps were generated for the two middle frequency coil pairs - 4600 (coaxial) and 4175 (coplanar) Hz. Where the inphase response amplitude is less than 3 ppm, the apparent resistivity is calculated from the quadrature response alone. This arises where the resistivities are very high or negative inphase responses due to magnetite (or pyrrhotite) are common. In this case, the conductive layer is assumed to be at surface. Where the inphase is less than 3 ppm and the quadrature is less than 1 ppm, a default value of 5000 ohm.m is assumed.

The highest measurable resistivity is approximately equal to the transmitter frequency. The lower limit on resistivity is rarely encountered.

6.4 Magnetic Data

Essential steps in processing the magnetic data were

1. spike detection and removal
2. apply diurnal correction from base station record
3. apply lag correction of 0.5 seconds
4. interpolate onto a square grid using an Akima spline technique. Grid cell size = 25 m
5. apply Hanning 5 x 5 smoothing filter
6. generate preliminary total field contour maps and make small manual adjustments as necessary
7. plot finals

The aeromagnetic data were corrected for diurnal variations by adjustment with the recorded base station magnetic values. The corrected profile data were interpolated on to a square grid using an Akima spline technique. This grid provided the basis for preparing preliminary contour maps. These maps are used to judge the quality of the total field grid from which the final maps are derived. The total field grid is contoured as presented with a minimum contour interval of 2 nT.

Hanning profile and grid filters are used extensively in processing airborne geophysical data. These are cosine shaped, low pass or smoothing filters which reduce noise with minimal signal distortion. Coefficients for a 7 point Hanning profile filter for example are .0625, .125, .1875, .25, .1875, .125 and .0625.

Vertical Magnetic Gradient

The vertical magnetic gradient was calculated from the gridded total field magnetic data. The calculation is based on a 17 x 17 point convolution operator. The filtered data is further subject to a 5 x 5 Hanning grid filter. The results are contoured using a minimum contour interval of 0.2 nT/m. The grid cell size is the same as that used in processing the total field data.

Shadow Maps

The shadow component is produced by calculating and displaying the reflectance of a surface defined by the total magnetic field grid. The reflectance of a surface is a measure of the proportion of illuminating light which will be reflected back to an observer from the surface. The reflectance at each grid cell is given by the cosine of the angle between the surface normal and a specified illumination direction.

The most important setting in producing shadow maps is the illumination direction or declination. The illumination direction is 85° west of north in both areas.

6.5 Radiometric Data

The four channels of radiometric data are subject to a number of corrections and filters. They are:

- low pass profile filter (9 point Hanning)
- back ground removal (cosmic + atmospheric)
- terrain clearance correction
- compton scattering correction
- low pass grid filter (5 x 5 Hanning)

The radiometric data were levelled using high altitude zeroes and traditional inspection methods. Minor adjustments were made after review of preliminary contour maps.

The Compton stripping factors used were

alpha	-	0.221 (Th into U)
beta	-	0.384 (Th into K)
gamma	-	0.720 (U into K)
a	-	0.048 (U into Th)
b	-	0.002 (K into Th)
g	-	0.005 (K into U)

where alpha, beta and gamma are the forward stripping coefficients and a, b, g are the backward stripping coefficients. These coefficients are taken from the test pad calibrations done in Toronto before the survey.

The altitude attenuation coefficients used were 0.0058 (TC), 0.0068 (K), 0.0051 (U) and 0.0064 (Th). The units are m^{-1}. These coefficients are taken from in-field flight tests and are in reasonable agreement with coefficients published by the GSC for similar radiometric systems.

Radiometric data were corrected to a mean terrain clearance of 60 m. The terrain clearance correction was limited to 150 m. For terrain clearances more than 150 m, the 150 m correction was used. This prevents extreme amplification of low amplitude signals from high altitudes.

The corrected data were interpolated onto a 25 m grid using an Akima spline technique. The grids provided the basis for threading the presented contours. The minimum contour intervals are 10 cps (TC), 2 cps (K) and 1 cps (U and Th).

The fully corrected count rates may be used to estimate the ground concentrations of the three radioelements - K, U and Th. For systems with this crystal volume flying at this height, the following equivalence factors may be used

Potassium :	38 cps / % K
Uranium :	4 cps / ppm eU
Thorium :	3 cps / ppm eTh

Ternary Map

Ternary radiometric maps were developed as a means of presenting three element radiometric ratios after the introduction of high resolution large format colour plotters. Ternary maps are produced by using different colours to represent the potassium, uranium and thorium ground concentration (Broome et al, 1987). Colour assignments are commonly red for potassium, blue for uranium and yellow for thorium.

The general principle is to examine the K, U and Th values at each grid cell. These values may be expressed as a vector in K-U-Th space. The vector may be described by its amplitude and direction. Surfaces of constant amplitude are 1/8 sections of a sphere or a distorted triangle if viewed from above its center. If this surface is filled with an orderly array of colour with primary colours (red, blue and yellow) at the corners, any grid cell sample may be assigned a colour based on the relative values of K, U and Th. A map showing all these colour assignments should act as a surface radioelement geochemical map which might be used to characterise and separate different geological units.

In practice, a number of processing steps are needed to condition the data before colour assignment. The most important is histogram equalization - a process which amplifies small variations near the mean but which limits using the ternary map as a quantitative interpretation tool. The basic processing steps (Broome et al (1987)) are as follows (grids of K, U and Th in ground concentration are assumed although experience has shown this not to be critical - nearly identical results are produced when the input grids are in cps).

1. Normalize data at each grid cell as follows;

   $$K' = K/sum$$
   $$U' = U/sum$$
   $$Th' = Th/(4 \times sum)$$

   where $sum = K + U + Th/4$

   The factor 4 is used as K in %, U in ppm eU and Th in ppm eTh are commonly seen in the ratio 1:1:4.

2. The normalized radiometric grids are nonlinearly quantized using histogram equalization. The number of quantization levels is determined by the colour plotter and its ability to produce different colour intensities - the calcomp plotters used here can produce up to 17 colour intensities (for the same colour hue). A ternary map results when the three primary colour intensities at each grid cell are mixed to give a unique colour hue.

3. In low count rate areas, the ternary map would show erratic colour variations. To avoid this, the overall colour intensities are reduced for low overall amplitudes. The range of amplitudes are divided into five levels using histogram equalization applied to the grid sum values. The colour intensities in the final ternary map are then varied according to these levels.

The final ternary map is therefore a combination of colour hue (representing relative radioelement concentration) and colour intensity (representing overall response amplitudes). The double application of histogram equalization makes translation of any ternary colour hue/intensity into absolute numerical values or quantified radioelement signatures difficult. Ternary maps are used to suggest differences in relative radioelement concentrations although these differences cannot be quantified.

References

Broome, J., Carson, J.M., Grant, J.A. and Ford, K.L., 1987, A modified ternary radioelement mapping technique and its application to the south coast of Newfoundland, Geol. Surv. of Canada, paper 87-14

6.6 EM Anomaly Selection and Analysis

The purpose of EM anomaly selection is to identify possible bedrock conductors, regardless of shape, size, depth of burial or conductance. In practice, EM anomaly selection is guided by the exploration target and the geological and geographical setting.

Type responses from a variety of conductors are shown in Appendix 5. Vertical thin sheet conductors give a positive anomaly in the coaxial EM channels with a coincident low in the coplanar channels of the same frequency. Flat lying or flat topped conductors give a coplanar peak with coaxial peaks on either side.

EM anomalies due to gradual changes in overburden thickness or resistivity are ignored. For such anomalies, the coaxial and coplanar channels (either inphase or quadrature) for the same operating frequency move together and no separation is seen. This information is best seen in the contour maps of apparent resistivity.

A second type of EM response is a negative inphase response due to near surface concentrations of magnetite (or pyrrhotite). For a half space with a uniform weight percent magnetite (W_m) and an EM sensor clearance of 30 metres, the coaxial inphase response (R) is approximately

$$R = -2.5 * W_m \text{ ppm.}$$

A half space of 1% by weight magnetite produces a coaxial inphase response of -2.5 ppm (and a coplanar inphase response of -10 ppm). This is independent of operating frequency. It is sensitive to sensor height.

Anomaly Selection

EM anomaly centers were picked from the offset profiles. The selection process is as follows:

1. Offset profiles of the power line monitor are plotted at 1:10,000. No power line responses were seen.

2. Pick all negative inphase responses from the low frequency profiles. These are 'magnetite' responses.

3. Pick all normal anomalies on the 935/865 Hz offset profiles. Conductor geometry may be vertical or dipping thin sheet, flat lying or flat topped of undetermined depth extent. Flat lying conductors are indistinguishable from flat topped conductors of arbitrary depth extent.

4. Check that 'normal' anomalies picked in step 3 show reasonable agreement with the 4600/4175 Hz data. EM anomalies, clearly seen only in the middle frequency inphase channels are added. Very weak EM anomalies, only seen in the middle frequency quadrature channels are ignored.

The results show a variety of weak EM anomalies, most of which are unconvincing as thin sheet conductors. In some cases, they are may be due to a lateral change in resistivities. The only convincing 'magnetite' indications are in the NAK property.

Analysis

The picked anomalies are digitized by location and type (normal or magnetite). The 4600 Hz inphase and quadrature anomaly amplitudes are recovered for the locations given. Normal anomalies are modelled as a vertical thin sheet conductor in a resistive host using an automated version of the phasor diagram shown in Appendix 5. Inversion returns estimates of source conductance and depth of burial. Anomaly centres showing the conductance range and inphase response are plotted on selected map products.

Magnetite responses are shown as an open circle with an 'M' printed inside.

All anomalies are catalogued in the anomaly listings - see Appendix 4. These listings show the flight, survey line, anomaly letter, conductance category, 4600 Hz inphase and quadrature amplitudes, conductance, depth of burial, sensor terrain clearance and UTM coordinates.

7. INTERPRETATION

7.1 Area Geology and Mineral Occurrences

Dawson Geological Consultants has provided a summary of the geological setting of the survey areas and the exploration target - porphyry copper/gold deposits related to Tertiary Babine intrusions. A 1:250,000 sketch map of the claim blocks and surrounds is reproduced here as figure 4.

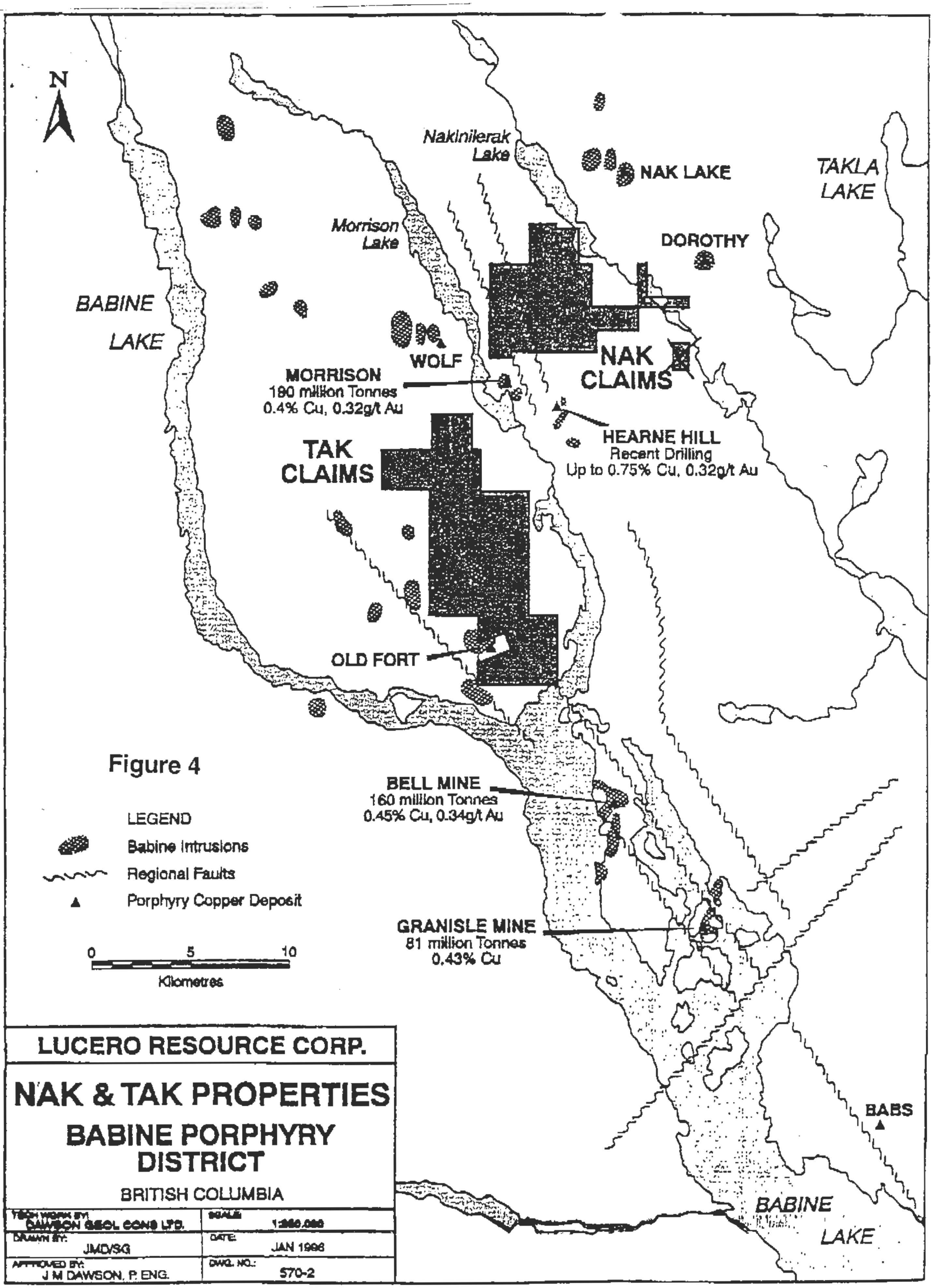
Reading from the summary provided by Dawson Geological Consultants

"The Babine District has been actively prospected since the early 1900's and was intensely explored during the porphyry copper boom of the 1960 and '70's. This activity brought about the development of the Granisle Mine in 1966 (total production 214,300 tonnes of copper, 200,000 oz. of gold and 2,010,000 oz. of silver) and the Bell Mine in 1971 (total production 303,277 tonnes of copper, 384,000 oz. of gold and 834,000 oz. of silver). Recently there has been renewed interest in the district because of new discoveries at the Babs property (Northern Dynasty and Pacific Sentinel) and the Hearne Hill property (Booker Gold). The NAK and TAK claims were acquired during a staking rush following a new discovery at the Hearne Hill property in October, 1995.

In the Babine Lake area, porphyry type mineralization is associated with four distinct ages of intrusive activity. However the most significant deposits and occurrences are temporally and spatially related to Tertiary Babine intrusions. These host more than a dozen deposits and occurrences in addition to the past producting Bell and Granisle open pit mines.

Babine intrusions occur as small stocks, plugs and dike swarms emplaced along northwest trending regional faults developed in a Mesozoic volcanic and sedimentary assemblage. The dominant hostrock for copper-gold mineralization is a biotite feldspar porphyry of granodiorite composition. This mineralization occurs as disseminations within and marginal to such intrusions. Markedly higher copper grades are associated with intrusive breccias within several of the known deposits, e.g. Hearne Hill.

Although most of the known porphyry deposits and occurrences were found by basic prospecting and stream sediment geochemistry, subsequent exploration in the district has been hampered by extensive glacial cover. However, airborne geophysical surveys as well as recent refinements in ground geophysics and geochemistry have proved to be more useful in detecting intrusive bodies and in defining drill targets.



N
BABINE LAKE
Nakinilerak Lake
Morrison Lake
NAK LAKE
TAKLA LAKE
DOROTHY
WOLF
NAK CLAIMS
MORRISON
180 million Tonnes
0.4% Cu, 0.32g/t Au
HEARNE HILL
Recent Drilling
Up to 0.75% Cu, 0.32g/t Au
TAK CLAIMS
OLD FORT
Figure 4
BELL MINE
160 million Tonnes
0.45% Cu, 0.34g/t Au
LEGEND
Babine Intrusions
Regional Faults
Porphyry Copper Deposit
GRANISLE MINE
81 million Tonnes
0.43% Cu
0 5 10
Kilometres
LUCERO RESOURCE CORP.
NAK & TAK PROPERTIES
BABINE PORPHYRY DISTRICT
BRITISH COLUMBIA
DRAWN BY: JMD/SG
DATE: JAN 1996
APPROVED BY: J M DAWSON, P. ENG.
DWG. NO.: 570-2
BABS
BABINE LAKE

The NAK and TAK properties are located along two of the major fault trends which seem to control the emplacement of the favourable biotite feldspar porphyry intrusives (see figure 4). Both claim blocks cover large areas of relatively low lying, overburden-obscured terrain which up until now have not been tested by drilling. Given the density of significant mineralized occurrences along these trends, there is excellent potential for the discovery of significant mineralization on the subject claim blocks."

From figures 2 and 3, dimensions for the mineralized zones are

Old Fort - 200 x 400 m
Hearne Hill - 200 x 600 m
Hearne Hill - 150 x 300 m
Morrison - 300 x 1000 m

Figure 4 suggests the intrusion associated with the Old Fort deposit is larger with a diameter of more than 1 km. The mineralized zone is on the southeast edge of the intrusion.

The Bell and Granisle intrusives, 5 and 10 km southeast of the TAK claim block, have dimensions on the order of 300 x 1000 m. The average diameter of the more than 30 Babine intrusions shown in figure 4 is about 750 m.

The survey covers all or part of two known Babine intrusions - both in the TAK claim block. The survey covers the eastern half of the Old Fort intrusion and all of the Old Fort mineralized zone. A 1 x 2 km intrusion is shown on the border of TAK 8 and TAK 9.

Porphyry Copper Deposits : Airborne Geophysical Characteristics

A more detailed discussion of the airborne geophysical expression of many porphyry copper deposits is given in Appendix 5. The main airborne geophysical features of many classical porphyry systems which are at surface or under a thin cover of transported overburden are

- a circular magnetic low with low magnetic relief over the intrusive with or without a magnetic high around its edge. The low represent the altered granodiorite core and is normally only well expressed when mafic volcanics make up a significant fraction of the country rock. The magnetic high represents a magnetite skarn on the edge of the intrusive. Any well defined, discordant magnetic high or low of appropriate diameter is usually of exploration interest, particularly in sedimentary areas where overall magnetic relief is low.

- the magnetic low or high is often in a topographic low of similar dimensions. Relative to host volcanics, the altered granodiorite is less resistive to weathering. The surrounding country rocks may show doming around the intrusive.

- the altered core of the intrusive is commonly more porous than the country rock and may show up as a resistivity low. It may be difficult to separate the altered granodioirite stock from the normal low resistivity expected from the unconsolidated sediments in a topographic low.

- if the porphyry system is exposed, it may show up as a potassium high. This may still hold in areas of residual soils but will probably not apply where the intrusive is under any thickness of transported overburden. Some porphyry copper deposits are within circular potassium highs of regional extent that may only be clear at regional scales.

7.2 General Comments - NAK Property

Magnetics

The total field map shows a mean of 57,570 nT with two thirds of the readings within ± 100 nT of this value. Extreme highs and lows are more than 200 nT from the mean.

The results are dominated by a regional magnetic high with high magnetic relief which coincides with the northwest trending ridge in the NAK 6 and NAK 7 claims. Overall total field amplitudes are elevated and Individual magnetic anomalies with peak amplitudes of more than 200 nT are common. The vertical gradient map highlights the strongest, near-surface sources and ignores what may be the larger sources at depth.

Although flat lying mafic volanics are possible, the better explanation for this dominant magnetic feature is large blocks of mafic intrusives. These intrusives correspond with a prominent topographic high and this suggests little or no overburden and good bedrock exposures. Chances that any exposed intrusives have not been prospected seem slight and are therefore presumed to be of less exploration interest.

Intrusives under any thickness of overburden (as inferred from the terrain or resistivity maps) are of interest. This includes any part of what may appear to be one large intrusive. Different phases within a zoned intrusive, some of which may be mineralized, are possible.

Sediments northeast and west of this large intrusive show low magnetic relief and intermediate amplitudes. Linear sources within the sediments to the west may be steeply dipping mafic volcanic units or sills.

There are a number of other magnetic features which hold promise as possible discordant intrusives. This includes the arcuate magnetic high in NAK 4 and other smaller features in the southwest part of the claim block. At least two anomalously strong magnetic lows may be reversely polarized intrusive centers. The eastern end of NAK 11 is over what may be a large mafic intrusive.

Faults taken from the vertical gradient map trend north northwest, northwest and northeast. North northwest breaks in NAK 1 and NAK 3 and northest trending faults through the large block of intrusives in NAK 6 and 7 are clearest. The two north northwest trending faults shown in figure 4 have no clear magnetic expression.

EM

The resistivity maps reflect the terrain with resistivity highs over topographic highs and lows over the valleys. In the absence of conductive metasediments, most variations in apparent resistivity are caused by variations in the thickness and/or conductivity of the overburden. In the simplest terms, resistivity maps may be viewed as maps of overburden thickness.

Apparent resistivities over the hills are commonly more than 1000 ohm.m and often more than 2000 ohm.m. Resistivities over the valleys are in the range of 100 to 300 ohm.m with extreme values less than 50 ohm.m. Very low resistivities are difficult to explain without wet clays or conductive sediments.

The one noted exception to the relationship between apparent resistivity and topography is in the Hautête Creek valley where a 500 m wide band of high resistivities suggests resistive bedrock with little or no cover.

The EM anomaly centers represent weak and uncertain conductive features, few of which are convincing as discrete bedrock conductors. In most cases, they are thought to represent no more than an abrupt lateral change in overburden thickness or resistivity. The string of EM anomalies which runs north/south through the center of the claim block may be an exception. This long string is consistent with the magnetics and may represent a weakly conductive metasedimentary unit.

As expected in these latitudes, most of the 'magnetite' anomalies fall on the peaks of the stronger magnetic anomalies. Although these unusual EM features may be of little exploration interest (except for magnetite skarns), they do indicate where magnetic sources are at or near surface.

Radiometrics

Mean count rates are 270 cps (TC), 30 cps (K) and about 6 cps (U and Th). The potassium channel is the most active and the total count and potassium maps are similar. With few exceptions, the uranium and thorium channels remain at background levels. The one exception of note is the high thorium immediately east of the narrow ridge (magnetic high + magnetite anomalies) in the eastern part of NAK 7. Thorium count rates over this feature are up to 13 cps or twice backgrounds. The same is true of potassium but less so for uranium.

As an overall comment, radioelement concentrations are low and the radiometric results do not show any systematic correlation with the terrain, the magnetics or the resistivity results. The large block of presumed intrusives in NAK 6 and 7 does not have a distinct radiometric expression. The largest radiometric anomaly is in the eastern part of NAK 8 and NAK 9. Potassium count rates are over 50 cps with peaks over 60 cps. The radiometric high is about 500 x 1000 m in area and is largely over an area of low magnetic amplitudes and relief and high resistivities. Although this radiometric feature warrants investigation, its magnetic setting is not promising and the high resistivities suggest little or no overburden. A non-magnetic, high K intrusive would be an innocent explanation.

7.3 General Comments - TAK Property

Magnetics

The total field maps show a mean value of 57,460 nT with two thirds of the readings within ± 100 nT of this value. Extreme highs and lows are more than 200 nT from the mean. Although the mean value is 110 nT less than in the NAK area, the range of readings is similar.

Much of the TAK claim block shows the low magnetic relief expected of a thick sequence of non-magnetic sediments (or felsic volcanics). This is particularly so in the north (TAK 1, TAK 3 and TAK 4) and in the southeast (TAK 13). Occasional linear magnetic features which trend north/south may be steeply dipping mafic volcanic units. Peak amplitudes over these magnetic units are commonly in the range of 10 to 25 nT.

The strongest magnetic anomalies are in the central and southwest parts of the claim block. Peak amplitudes over the magnetic highs along the south side of TAK 10 and the west side of TAK 12 are 800 to 1000 nT. Most of the strongest magnetic anomalies are associated with Old Fort Mountain or the smaller ridge to the east. The implication is that Old Fort Mountain is the center of a large mafic intrusive, most of which is outside the survey area. Individual magnetic anomalies represent the shallowest part of the intrusive. Low magnetic gradients in the western part of TAK 14 suggest the intrusives are at depth.

Total field amplitudes over the linear magnetic high in the center of the claim block are somewhat less - 150 to 350 nT - but still well above most of the magnetic features in the claim block. This feature is made up of at least 3 linear magnetic units which might be mistaken for volcanics if the magnetic amplitudes were less.

There may be another large block of mafic intrusives along the eastern edge of TAK 13 and TAK 14. A number of other smaller magnetic highs may be of interest as possible Babine intrusions. One of the Hearne Hill mineralized zones is only 150 x 300 m and possible intrusions of this size should not be ignored.

Faults, as inferred from breaks, lineations or interruptions in the vertical gradient maps, trend north northwest and northeast. Any such features are poorly expressed in the southern and extreme northern part of the area where overall magnetic relief is lower.

EM

To a first approximation, high resistivities are seen over the hills and low resistivities are over the valleys. Apparent resistivities over the northern flank of Old Fort Mountain, for example, are commonly more than 2000 ohm.m. High resistivities are usually interpreted as indicating little or no conductive cover and good access to resistive bedrock.

Resistivities over much of the flat terrain in the north and southeast parts of the claim block are around 50 ohm.m. These are low values for transported overburden without clays but uniform, flat lying conductive sediments over such large areas seem improbable. Islands of very low resistivities - less than 25 ohm.m - in TAK 12 may represent conductive sediments.

As in the NAK property, most of the EM anomaly centers represent weak and uncertain features which are most likely caused by a lateral change in overburden thickness or resistivity. There is little evidence for discrete, near-vertical bedrock conductors. The major exceptions are in the areas of very low resistivity where the EM anomalies may represent graphitic sediments.

Radiometrics

Mean count rates over the claim block are 260 cps (TC), 30 cps (K) and 6 cps (U and Th). These numbers are close to those seen over the NAK area and the general character of the radiometric data in both claim blocks is similar.

The strongest variations are in potassium with little or no significant responses in the uranium or thorium channels. As in the NAK property, the potassium results show no clear correlation with the magnetics or resistivity data. The strongest potassium anomaly, with count rates over 70 cps, is over the hill in the northwest corner of TAK 3. High resistivities over part of this high K anomaly suggest bedrock is at surface. The local magnetic relief is very low and there is no magnetic evidence of a porphyry system at this location.

Old Fort Mineralized Zone

The Old Fort Mineralized zone is on the eastern side of a prominent magnetic high with peak amplitudes of 700 to 800 nT. The magnetic high is some 1000 m east/west by 600 m north/south with 3 well defined peaks. The magnetic high is part of what may be a much larger feature seen along the western edge of TAK 12 and the southern edge of TAK 10. A large mafic intrusive, centered over Old Fort Mountain, has been proposed. If so, it is much larger than the Babine intrusion shown in figure 4.

The western end of the mineralized zone coincides with one of three magnetic peaks. The magnetic expression of this porphyry is therefore not the classical magnetic low ringed by narrow magnetic highs. The area of the mineralized zone is dominated by high magnetic amplitudes and there is no evidence of the magnetic low seen over many porphyry systems.

The mineralized zone is on the flank of a 3900 foot hill and does not have a distinct topographic expression. High resistivities over most of the mineralized zone and the larger magnetic high suggest little or no conductive cover and good access to bedrock. There are no EM anomalies associated with the mineralized zone. Anomaly center groups to the north and southwest may imply conductive sediments.

All radiometric maps show anomalies over the western end of the mineralized zone with peak count rates of 480 cps (TC), 50 cps (K) and 8 cps (U and Th). The potassium is almost twice area means and continues to the west. The radiometric high is in the southern part of a larger area of high resistivities. This is a good sign as it suggests the high potassium is due to a distinct rock type or alteration and not simply to ourcrop.

Babine Intrusion - TAK 8 / TAK 9 Boundary

The Babine intrusion 4 km north of the Old Fort mineralized zone is in the center of a larger, north northwest trending magnetic high. The magnetic high is made up of at least 3 narrow sources with a total strike length of 2.5 km and a width of up to 500 m. With peak amplitudes of 150 to 350 nT, the magnetic anomalies associated with this intrusive stand out against the low relief and intermediate amplitudes over the surrounding volcanics and sediments.

This central magnetic feature is in a long, topographic low marked by two small lakes. It also coincides with a narrow but weak resistivity low. Resistivities are not extreme and the low is only noticeable because of the high values to the northeast and southwest. The moderately lower resistivities may be caused by a modest increase in overburden thickness or the higher porosity of a porphyry system. The strongest resistivity low centered at line 50 (15:07:57) is a potential drill target. This location is near the southern edge of the Babine intrusion shown in figure 4.

The small lakes show high resistivities. There are no EM anomalies associated with the magnetic highs. Radiometric count rates are at or below area means in all channels - as expected with any thickness of transported overburden.

7.4 Compilation Maps

Prominent aspects of the airborne geophysical results have been extracted from various map products and fine drawn on 1:10,000 scale compilation maps. The maps show the flight path and anomaly centers plus the following features

- the outline of large intrusive masses. Taken from large areas of high total field amplitudes and therefore includes a rough approximation of intrusives at depth.

- magnetic sources as defined by the vertical gradient. Roughly subdivided as strong and weak. Reversely polarized sources in the NAK property are shown with a negative sign. Discordant magnetic sources of any polarity may be small Babine intrusions.

- possible faults. Taken largely from breaks and interruptions in the vertical gradient maps.

- areas of high apparent resistivity - generally more than 1500 ohm.m. These are areas where the probability of exposed bedrock and a record of prospecting is highest. By default, all other areas are probably covered and may be of greater exploration interest.

- conductor axes through strings of neighbouring EM anomaly centers. Strings should show some promise as possible bedrock conductors and should be consistent with local magnetic trends.

- areas of high potassium - generally more than 40 cps.

- targets, outlined and labelled NA to NH in the NAK claim block and TA to TG in the TAK claim block. See sections 7.5 and 7.6 for a discussion.

Page size copies of the compilation maps are attached.

7.5 Recommendations - NAK Property

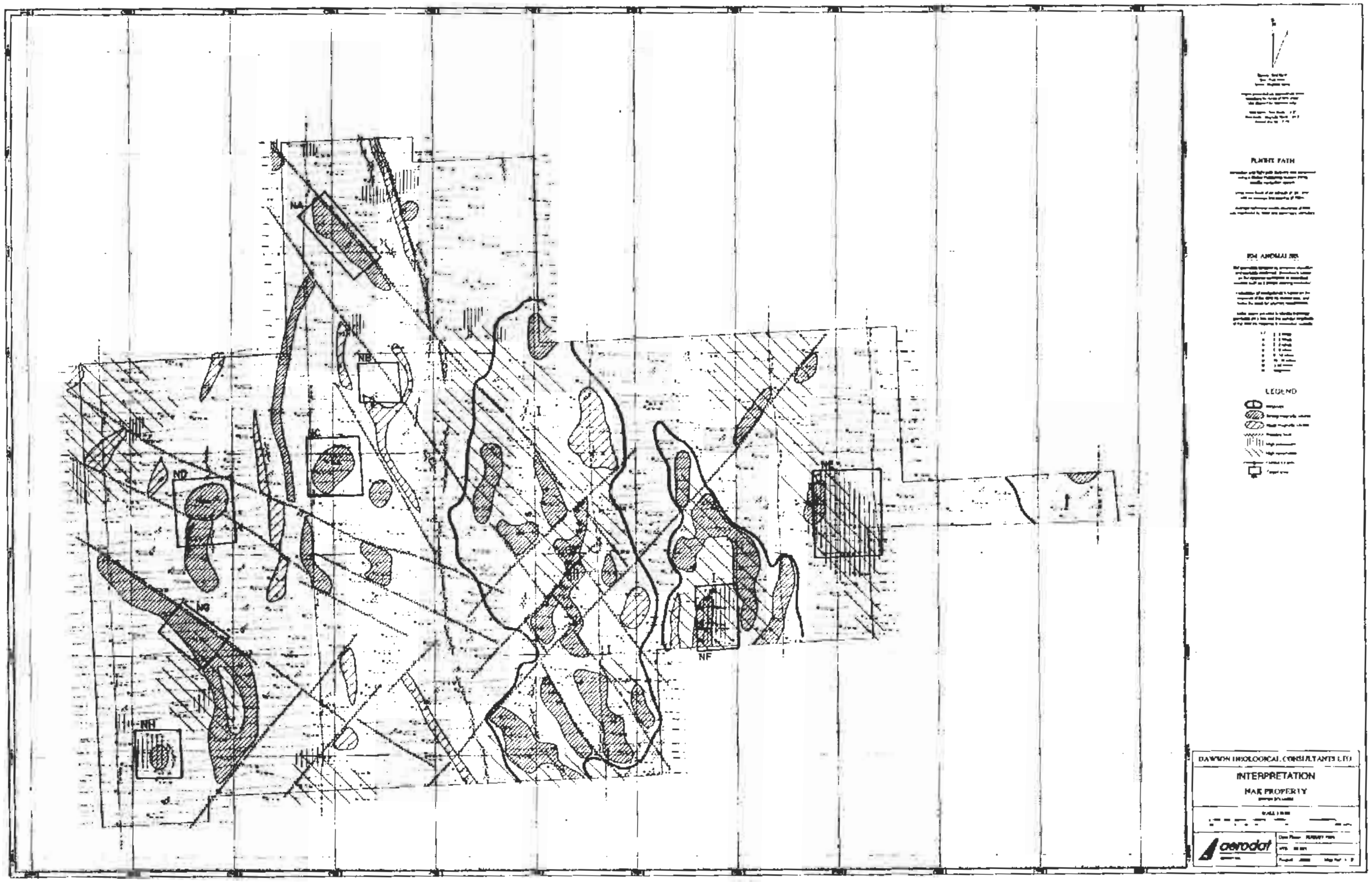
Based on the results over the Old Fort mineralized zone, the best targets are on the edge of what appear to be large mafic intrusives. The whole intrusive mass may have dimensions of several kilometres and be an order of magnitude larger than the mineralized zone. All or part of the mineralized zone also shows moderate to high resistivities and high potassium. Its topographic setting is not distinct.

The Old Fort mineralized zone is only one example and may not be typical for the district. All discordant magnetic sources, regardless of size, are potential Babine intrusions and there may be no strong reason to favour the edge of the largest intrusions. The high resistivities suggest little or no overburden and exposed mineralization which might have been discovered by basic prospecting. The airborne survey is directed more at porphyry systems under transported overburden.

Based on a variety of criteria, 8 targets are proposed. They are labelled NA to NH and outlined on the compilation map. Ordering is from north to south and does not reflect ranking. Each target is identified by the line (time) at the center of the feature of interest.

NA : line 60 (22:41:06)

A 200 x 1000 m magnetic high and possible Babine intrusion which trends north northwest and may run along a regional fault. The location given is at the center of the strongest total field anomaly with a peak amplitude of about 250 nT. Area resistivities of 200 ohm.m and quiet radiometrics imply some thickness of overburden. The target is in a neutral topographic setting.


NA
NB
NC
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EM ANOMALIES
LEGEND
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HAK PROPERTY
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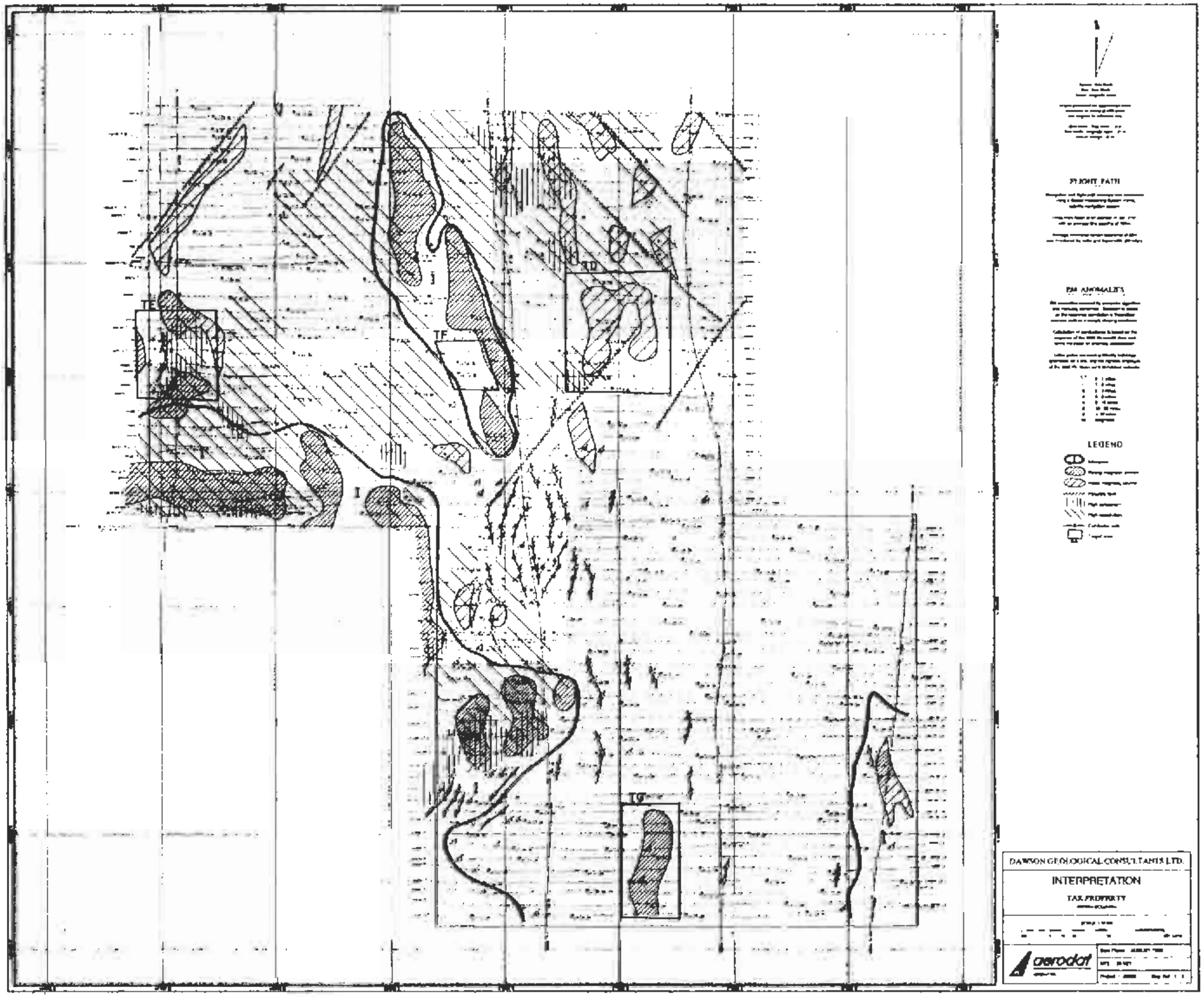
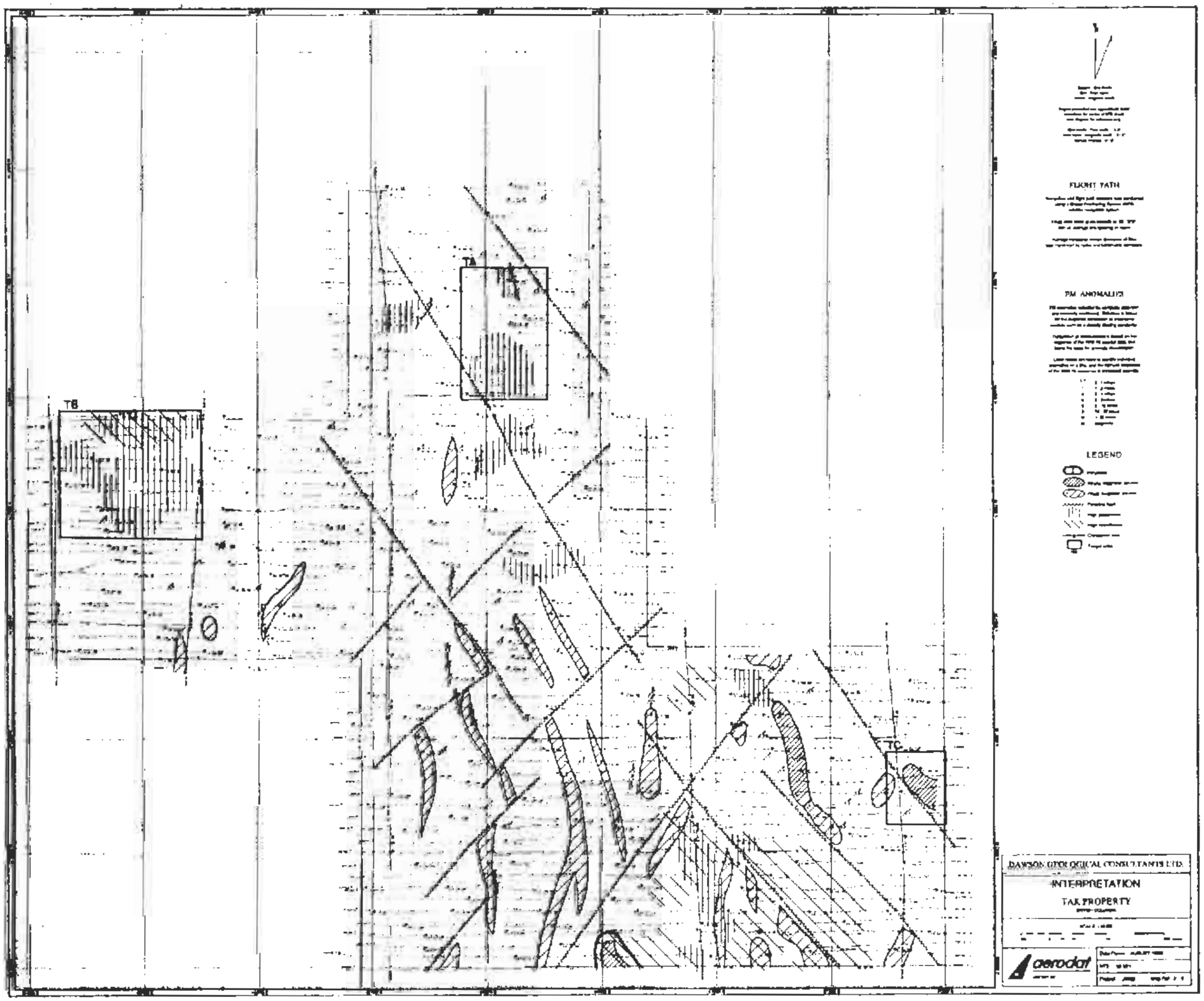


TE
TF
TD
TG
FLIGHT PATH
EM ANOMALIES
LEGEND
DAWSON GEOLOGICAL CONSULTANTS LTD.
INTERPRETATION
TAX PROPERTY
aerodat



TA
T8
FLIGHT PATH
EM ANOMALIES
LEGEND
DAWSON GEOLOGICAL CONSULTANTS LTD.
INTERPRETATION
TAK PROPERTY
aerodat

NB : line 44 (23:28:17)

A 400 to 500 m diameter magnetic low, ringed by magnetic highs. This is the classical magnetic signature of some porphyry copper deposits although its small size adds uncertainty. Local resistivities are around 200 ohm.m and the potassium is near area means. The topographic setting is neutral.

NC : line 36 (20:50:04)

One of two unusually strong magnetic lows which are proposed as small, reversely polarized intrusives. The source is roughly 300 x 500 m and in an attractive topographic low. Peak amplitudes are 200 nT below local backgrounds. Local resistivities are around 200 ohm.m and the potassium is low.

ND : line 33 (21:08:03)

This is the second of the small negative magnetic anomalies. The source is up to 400 m in diameter and has a peak response which is 500 nT below local backgrounds. Local resistivities are around 300 ohm.m and the potassium is below area means. The magnetic high immediately to the south might also be considered. Its nearest total field peak is at line 29 (23:08:33).

NE : line 27 (23:25:12)

A large 400 x 1000 m potassium high in the eastern part of the claim block. This is the strongest potassium anomaly in the survey area and is worth some consideration despite high resistivities and an uncertain magnetic setting. The small magnetic high at the northwest end of the target area adds interest. The location given is for the center of a broad magnetic low and coincides with a small valley.

NF : line 19 (18:07:04)

This is the 100 x 400 m high potassium and thorium anomaly immediately east of a prominent ridge with coincident magnetic anomaly and magnetite indications. Area magnetic relief is high and there is little to recommend this target other than its radiometric response. Area resistivities are high.

NG : line 20 (18:02:10)

The target is a long, arcuate magnetic high with a total strike length of 2.5 km. The location is over one of the stronger peaks at 300 nT. Apparent resistivities over part of this feature are high and ground checks might initially concentrate on these areas of less cover. Potassium is not anomalous and the whole feature has is in an unattractive topographic setting.

NH : line 7 (18:59:49)

A small, 100 m diameter magnetic anomaly with peak amplitudes of 50 nT. The source is small and may be no more than a small mafic plug. High potassium makes it a target over other small isolated plugs in the claim block. Local resistivities are low at around 125 ohm.m.

7.6 Recommendations - TAK Property

As in the NAK block, a variety of targets are proposed. Target selection is based primarily on the magnetics with a preference for responses which might indicate discordant intrusives of appropriate dimensions. There is more interest in areas with low to moderate resistivities as these may indicate poor access to bedrock. All potassium anomalies are of some interest.

Targets are labelled TA to TG. Labelling advances from north to south and does not reflect ranking. Targets are identified by the line (time) of the center of the feature of interest.

TA : line 128 (19:08:16)
line 122 (19:22:20)

Two uncertain targets in the TAK 1 claim which are only 600 m apart. The first is a 500 m diameter, 10 nT magnetic low with high potassium on its northeast edge. The low is framed by weak magnetic highs. The pattern is that of a small porphyry although magnetic amplitudes are small and unconvincing. Area resistivities are around 150 ohm.m . A weak resistivity high over the target adds interest.

The second target is a very weak, 500 m diameter, magnetic feature with coincident high potassium. Area resistivities are low - 50 ohm.m - and this argues for conductive overburden and a spurious potassium anomaly. The topographic setting of both targets is neutral.

TB : line 115 (19:46:30)

This target is defined entirely by very high potassium over a hill and may be no more than a curiosity. Other than the potassium, which peaks at over 80 cps, there is no magnetic evidence of an intrusive. Area magnetic relief is extremely flat. The highest potassium is over an area of high resistivities and probable outcrop.

TC : line 84 (21:09:08)

A small, 150 nT magnetic anomaly on the survey boundary which would be ignored except the total field amplitude is larger than most of its neighbours. The source is more linear than circular and is not at depth. The hope is that this feature represents a magnetite skarn with the associated porphyry somewhere nearby. Potassium is not anomalous and resistivities are low to moderate. The topographic setting is neutral.

TD : line 54 (14:50:57)

A relatively weak magnetic high with peak amplitudes of only 60 nT. The feature is roughly 400 x 700 m and may be made up of three neighbouring, north/south trending magnetic axes. Magnetic relief in the area from TC to TD is confused and it is difficult to separate possible mafic volcanics and intrusives. High potassium to the north northwest adds interest and confusion. Resistivities over the center of the target area are moderate - 500 ohm.m - and some cover is possible. The local topography is neutral.

In some ways, this is the least attractive target of those picked in the TAK claim block. It is not particularly convincing as a confined intrusive, has few of the magnetic features common to many porphyry systems and is in an area of moderate to high resistivities.

TE : line 51 (15:02:35)

A strong, 600 m diameter magnetic low, framed by magnetic highs, including the large Old Fort intrusive to the south. Conductive surficial material covers the western half of the target. A weak potassium anomaly covers the eastern half. The target area is on the steep flank of the northern extension to Old Fort Mountain.

Given the setting of the Old Fort mineralized zone and the regional extent of the associated intrusive, other features along the edge of this intrusive in the southern part of the TAK 10 claim may be of interest. High resistivities along most of this edge suggest little or no cover. Given a long prospecting history in the district, this may be a discouraging attribute.

TF : line 50 (15:07:57)

This location is in the center of a moderate resistivity low over the large, central magnetic high which has been interpreted as a group of north northwest trending Babine intrusions. The resistivity low is some 200 x 400 m and may be explained by moderately thicker or more conductive overburden. Speculation is that it represents the more deeply weathered core of a porphyry system. Magnetic relief in the target area is low with evidence of mafic intrusives at depth.

TG : line 8 (22:47:15)

The target area is centered over a linear, north/south trending magnetic axis which is open to the south. Peak amplitudes at this location are 150 nT above area means. Potassium is not anomalous and resistivities are near 100 ohm.m. This target is similar to TC and the reasons for selection are the same. The magnetic high may represent a magnetite skarn on the edge of a porphyry.

8. CONCLUSIONS

A helicopter-borne geophysical survey has been completed over the NAK and TAK properties in the Babine Lake area of central British Columbia. Sensors included a 5 frequency EM system, a high sensitivity magnetometer and a gamma ray spectrometer . Total coverage (traverse plus tie lines) as measured inside the survey boundaries was 1042 line kilometres. Results have been presented as colour and black line maps at 1:10,000.

The results have been reviewed based on geological and exploration data provided by Dawson Geological Consultants. The airborne geophysical expression and setting of the known mineral deposits or prospects have been documented. Prominent lithological and structural features have been extracted from various map products and transferred to 1:10,000 scale compilation maps.

The exploration target is copper/gold porphyries in areas where much of the bedrock is not exposed and traditional prospecting methods have been unsuccessful. Recent mineral discoveries which are on-strike with the claim blocks are encouraging.

Fifteen targets have been proposed - 8 in the NAK and 7 in the TAK claim blocks. Most of these targets have some distinct magnetic expression which suggests either a small, buried intrusion or a related porphyry system. The resistivity and radiometric results, particularly the potassium, have played a supporting role.

Respectfully submitted,

Ian Johnson, Ph.D.,P.Eng.
Aerodat Inc.

October 28, 1996
J9628

LICENSED PROFESSIONAL ENGINEER
I. M. JOHNSON
PROVINCE OF ONTARIO

APPENDIX 1

COST SUMMARY

A helicopter borne electromagnetic, magnetic and radiometric survey of the NAK and TAK properties was flown in August, 1996 on behalf of Dawson Geological Consultants Ltd. by Aerodat Ltd. Invoicing by Aerodat for the survey was based on a fixed mobilization / demobilization fee of $7,500 plus a survey charge of $80 per line kilometre with an estimated total coverage of 1000 line kilometres.

Actual coverage (traverse and tie lines) as measured within the survey boundaries was 1042 line kilometres (403 km over the NAK property and 639 km over the TAK property). The cost of this survey is therefore

1. Mobilization / demobilization	$ 7,500.00
2. Survey charges (NAK - 403 km at $80 / km)	$ 32,240.00
3. Survey charges (TAK - 639 km at $80 / km)	$ 51,120.00

Total	$ 90,860.00

APPENDIX 2

PERSONNEL

FIELD

Flown	August 9 to 26, 1996
Pilot(s)	Brian Johnstone Del Rokosh
Operator(s)	Mark Barry Mike Watson

OFFICE

Processing	Will Icay George McDonald
Reporting	Ian Johnson

APPENDIX 3

CERTIFICATE OF QUALIFICATIONS

I, IAN JOHNSON, certify that:

1. I am registered as a Professional Engineer in the Province of Ontario.

2. I reside at 11 Hale Street in the hamlet of Port Bruce, Ontario.

3. I hold a Ph.D. in Geophysics from the University of British Columbia, having graduated in 1972.

4. I have been continuously engaged in both professional and managerial roles in the minerals industry in Canada and abroad for the past twenty years.

5. The accompanying report was prepared from published or publicly available information and material supplied by Aerodat Inc. in the form of proprietary airborne exploration data. I have not personally visited the specific property.

6. I have no interest, direct or indirect, in the property described nor in Lucero Resource Corp.

7. I hereby consent to the use of this report in a Statement of Material Facts of the Company and for the preparation of a prospectus for submission to the appropriate securities commission and/or other regulatory authorities.

Signed,

Ian Johnson, Ph.D., P. Eng.

LICENSED PROFESSIONAL ENGINEER
I. M. JOHNSON
PROVINCE OF ONTARIO

J9628
Port Bruce, Ontario

October 28, 1996

APPENDIX 4

EM ANOMALY LISTINGS

J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY		CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
15	10030	A		1	48.1	71.2	1.0	0	28	670332.6	6120554.0
15	10040	A		0	5.3	15.8	0.1	0	35	673303.9	6120767.5
15	10040	B		0	6.3	15.2	0.2	0	39	673510.0	6120779.5
15	10040	C		0	6.6	13.8	0.3	0	44	674916.9	6120818.5
15	10040	D		0	21.0	32.9	0.7	0	36	675147.5	6120833.5
15	10040	E		0	23.9	40.9	0.6	0	35	675303.8	6120821.5
14	10050	A		0	19.3	25.0	0.9	0	40	675189.7	6120971.5
14	10050	B		0	9.9	20.0	0.3	1	35	674963.0	6120937.0
14	10050	C		0	5.5	12.5	0.2	0	45	673493.8	6120883.0
14	10060	A		0	12.3	24.1	0.4	4	29	673485.7	6120997.5
14	10060	B		0	6.0	12.4	0.2	2	40	674614.9	6121028.0
14	10060	C		0	15.2	32.7	0.4	0	32	675007.1	6121035.5
14	10060	D		0	19.8	27.1	0.8	2	33	675180.7	6121030.0
14	10070	A		0	16.5	34.7	0.4	0	34	675251.0	6121124.0
14	10070	B		0	15.8	31.7	0.4	0	35	675055.3	6121121.0
14	10070	C		0	7.3	20.5	0.2	0	34	674636.1	6121104.0
14	10070	D	FEO	0	-1.8	16.3	0.0	0	31	674185.4	6121066.0
14	10070	E		0	8.4	26.6	0.1	2	26	673464.5	6121055.5
14	10070	F		0	12.0	23.1	0.4	0	42	670404.2	6120960.5
14	10080	A		0	15.1	18.8	0.8	0	46	670378.8	6121058.5
14	10080	B		0	19.4	33.9	0.6	0	38	673008.6	6121162.5
14	10080	C		0	10.4	22.5	0.3	9	25	673394.9	6121181.5
14	10080	D		0	6.4	38.6	0.0	0	28	674003.3	6121206.0
14	10080	E		0	6.3	17.3	0.2	0	38	674639.6	6121224.5
14	10080	F		0	15.3	30.1	0.4	0	37	675089.6	6121227.0
14	10080	G		0	19.1	37.4	0.5	0	36	675241.9	6121245.0
14	10090	A		0	15.7	25.6	0.6	0	42	675230.0	6121354.0
14	10090	B	FEO	0	-1.4	23.8	0.0	0	22	674775.9	6121334.5
14	10090	C		0	10.6	31.4	0.2	0	31	673978.2	6121293.0
14	10090	D		0	7.1	20.0	0.2	0	36	673371.6	6121287.0
14	10090	E		0	25.8	39.7	0.8	0	42	672583.8	6121229.5
14	10100	A		0	6.8	14.6	0.2	8	31	673366.8	6121363.0
14	10100	B		0	9.0	25.2	0.2	0	38	673966.4	6121399.5
14	10110	A		0	8.7	15.8	0.4	7	33	675167.3	6121550.5
14	10110	B	FEO	0	-8.0	6.8	0.0	0	26	674239.1	6121522.0
14	10110	C		0	7.7	20.6	0.2	3	29	673328.6	6121505.5

Estimated depth may be unreliable because the stronger part of the conductor may be deeper or to one side of the flight line, or because of a shallow dip or overburden effects.

J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY		CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
14	10110	D		0	16.1	29.8	0.5	2	29	671982.3	6121438.0
14	10120	A		0	11.0	21.7	0.4	0	37	671940.3	6121507.0
14	10120	B		0	11.7	26.6	0.3	0	33	672920.6	6121537.0
14	10120	C		0	6.2	17.9	0.1	0	35	673277.1	6121580.5
14	10120	D		0	14.4	33.0	0.3	0	32	673955.9	6121624.5
14	10120	E	FEO	0	-2.7	1.6	0.0	0	32	674165.9	6121614.5
14	10130	A		0	7.9	21.1	0.2	1	32	675125.2	6121730.5
14	10130	B		0	3.8	6.9	0.2	24	29	674923.8	6121737.0
14	10130	C		0	6.7	25.5	0.1	4	23	674769.1	6121725.5
14	10130	D	FEO	0	0.3	16.2	0.0	0	27	674445.3	6121715.5
14	10130	E	FEO	0	-3.5	18.0	0.0	0	23	674124.0	6121705.0
14	10130	F		0	14.4	44.3	0.2	1	22	673981.3	6121693.0
14	10130	G		0	6.4	22.3	0.1	0	41	673257.9	6121657.0
14	10130	H		0	10.4	26.6	0.2	0	33	673022.9	6121648.5
14	10130	J		0	11.7	30.0	0.3	0	34	672778.4	6121651.5
14	10130	K		0	9.0	21.3	0.2	1	33	671947.6	6121602.5
14	10130	M		0	11.1	17.2	0.5	7	33	671333.6	6121601.0
14	10130	N		0	31.8	47.2	0.9	0	30	669928.2	6121470.5
11	10140	A		0	12.4	23.5	0.4	0	39	673222.8	6121729.0
11	10140	B		0	25.5	48.6	0.6	0	29	673839.1	6121768.5
11	10140	C		0	8.7	13.6	0.5	12	31	674104.5	6121774.5
11	10140	D		0	11.6	22.2	0.4	10	25	674331.1	6121780.5
11	10140	E		0	13.2	22.4	0.5	11	25	674923.3	6121755.0
14	10151	A	FEO	0	-0.3	3.2	0.0	0	42	671160.3	6121807.0
14	10151	B		0	14.2	28.0	0.4	0	34	671642.3	6121811.0
14	10151	C		0	8.1	30.2	0.1	0	35	673218.3	6121854.0
14	10151	D		0	5.9	17.6	0.1	0	37	675187.8	6121922.5
14	10160	A	FEO	0	0.2	12.0	0.0	0	32	671072.6	6121896.0
14	10170	A		0	22.5	35.1	0.7	1	30	671561.3	6122009.0
14	10170	B		0	8.6	21.3	0.2	0	33	673168.9	6122064.0
14	10170	C	FEO	0	-7.7	3.2	0.0	0	24	675640.2	6122138.5
14	10170	D		0	6.4	9.0	0.5	25	26	677278.8	6122215.0
14	10181	A	FEO	0	-6.8	2.7	0.0	0	29	675633.5	6122254.0
14	10181	B		0	6.4	19.6	0.1	2	30	674004.4	6122149.5
14	10181	C		0	6.1	21.9	0.1	0	29	673350.7	6122149.5
14	10181	D		0	5.3	13.2	0.2	4	35	673142.9	6122146.0
14	10190	A		0	12.6	20.9	0.5	0	40	673109.8	6122232.5

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY		CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
14	10190	B		0	5.6	15.8	0.1	2	33	673975.9	6122256.0
14	10190	C	FEO	0	1.8	11.5	0.0	0	33	674058.1	6122262.0
14	10190	D		0	3.9	21.6	0.0	0	32	674320.3	6122293.5
14	10190	E	FEO	0	2.4	14.2	0.0	0	30	674366.1	6122296.5
14	10190	F	FEO	0	-6.5	0.1	0.0	0	27	675646.6	6122315.5
14	10201	A	FEO	0	-1.1	1.9	0.0	0	37	675646.6	6122454.0
14	10201	B	FEO	0	-0.2	7.7	0.0	0	31	674323.9	6122371.0
14	10201	C		0	7.2	24.5	0.1	0	35	673923.2	6122372.0
14	10201	D		0	8.3	23.4	0.2	4	27	673384.3	6122340.5
14	10201	E		0	5.6	13.5	0.2	0	43	673144.1	6122331.5
14	10201	F		0	18.0	36.0	0.5	0	31	671109.6	6122271.5
13	10210	A		0	9.6	13.4	0.6	0	48	673100.1	6122445.5
13	10210	B		0	11.4	21.5	0.4	1	35	673878.2	6122509.5
13	10210	C	FEO	0	1.4	11.0	0.0	0	35	674110.7	6122494.0
13	10210	D	FEO	0	0.9	10.2	0.0	2	24	674350.3	6122467.0
13	10210	E	FEO	0	-8.7	4.5	0.0	0	35	675706.3	6122548.5
13	10220	A	FEO	0	-3.4	5.3	0.0	0	28	675762.8	6122633.5
13	10220	B	FEO	0	-1.7	7.5	0.0	0	30	674123.6	6122570.5
13	10220	C		0	6.2	17.8	0.1	0	49	673887.5	6122558.5
13	10220	D		0	8.9	15.9	0.4	8	32	673104.6	6122532.5
13	10220	E		0	11.6	33.0	0.2	7	20	672405.0	6122552.5
13	10220	F		0	29.8	51.0	0.7	3	23	671126.2	6122468.5
13	10230	A		0	23.1	40.7	0.6	1	27	670908.1	6122586.0
13	10230	B		0	14.8	19.0	0.8	0	42	673082.9	6122619.0
13	10230	C	FEO	0	-2.8	6.5	0.0	0	25	674250.2	6122677.0
13	10240	A	FEO	0	2.1	13.5	0.0	1	27	675574.3	6122858.0
13	10240	B		0	7.1	20.1	0.2	0	33	675382.1	6122837.0
13	10240	C		0	5.9	22.1	0.1	4	25	674579.3	6122821.5
13	10240	D	FEO	0	-8.0	10.4	0.0	0	26	674322.2	6122801.5
13	10240	E		0	6.5	24.5	0.1	0	28	673580.1	6122793.0
13	10240	F		0	9.3	32.6	0.1	3	23	673493.8	6122801.5
13	10240	G		0	15.8	25.5	0.6	3	31	673072.8	6122782.5
13	10240	H		0	9.8	27.1	0.2	0	33	672605.6	6122760.5
13	10240	J	FEO	0	4.0	17.2	0.0	6	24	672337.2	6122754.5
13	10250	A		0	13.5	17.4	0.8	0	50	673061.8	6122859.0
13	10250	B		0	9.2	20.8	0.3	3	31	673485.4	6122864.5
13	10250	C	FEO	0	-3.0	8.2	0.0	0	34	674344.3	6122918.5
13	10260	A		0	15.7	38.7	0.3	0	37	675064.8	6123023.5

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY		CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
13	10260	B		0	8.5	24.3	0.2	15	15	674779.1	6123031.5
13	10260	C	FEO	0	-14.4	14.9	0.0	0	26	674377.3	6123005.5
13	10260	D		0	22.3	42.2	0.5	0	35	673033.9	6122950.5
13	10260	E		0	20.6	60.4	0.3	1	21	671093.1	6122863.5
13	10260	F		0	-1.6	17.3	0.0	0	26	670518.0	6122853.0
13	10260	G		0	3.0	26.7	0.0	0	32	670397.3	6122842.0
13	10270	A		0	15.2	20.7	0.7	0	38	673038.7	6123029.0
13	10270	B		0	2.6	12.3	0.0	0	45	674165.1	6123059.5
13	10270	C	FEO	0	-3.7	4.6	0.0	0	38	674421.2	6123065.0
13	10280	A		0	11.3	21.3	0.4	0	42	676252.9	6123247.5
13	10280	B		0	4.4	14.8	0.1	6	28	675482.1	6123235.5
13	10280	C		0	11.4	22.8	0.4	0	48	675207.3	6123220.5
13	10280	D	FEO	0	-5.5	18.2	0.0	0	25	674447.9	6123227.0
13	10280	E	FEO	0	-6.9	9.8	0.0	0	27	673851.0	6123204.0
13	10280	F		0	6.1	25.2	0.1	0	29	673331.5	6123183.0
13	10280	G		0	16.3	27.5	0.6	0	40	673045.5	6123178.5
13	10280	H		0	14.4	39.4	0.3	0	26	672039.9	6123147.0
13	10280	J		0	7.2	19.2	0.2	4	30	670800.4	6123074.0
13	10280	K		0	6.4	16.9	0.2	0	43	670571.1	6123056.0
13	10280	M		0	15.5	32.6	0.4	0	46	670207.9	6123040.5
13	10295	A		0	9.1	17.5	0.3	0	39	670550.1	6123174.5
13	10295	B		0	9.3	19.6	0.3	9	27	670792.1	6123179.0
13	10295	C		0	13.9	19.5	0.7	0	43	673045.6	6123240.5
13	10295	D	FEO	0	-3.1	9.2	0.0	0	25	674446.1	6123294.0
13	10295	E		0	15.5	35.6	0.3	0	36	676452.6	6123368.5
13	10295	F		0	12.8	25.2	0.4	0	41	679557.9	6123439.0
13	10300	A		0	18.0	42.7	0.4	0	31	679480.3	6123564.0
13	10300	B	FEO	0	1.2	11.0	0.0	3	25	676799.9	6123487.5
13	10300	C		0	30.1	51.6	0.7	0	36	676295.8	6123453.0
13	10300	D		0	9.4	14.2	0.5	0	46	675809.2	6123448.0
13	10300	E		0	11.1	17.3	0.5	0	44	675034.0	6123405.5
13	10301	A	FEO	0	-4.3	5.6	0.0	0	27	674422.8	6123427.5
13	10301	B	FEO	0	-0.5	8.9	0.0	0	39	673945.0	6123395.5
13	10301	C		0	12.3	22.1	0.4	0	42	673001.1	6123350.5
13	10301	D		0	17.0	37.9	0.4	4	24	672104.1	6123300.0
13	10301	E		0	27.2	57.7	0.5	0	24	671076.7	6123268.0
13	10301	F		0	22.1	40.6	0.6	9	19	670913.6	6123259.5
13	10301	G		0	12.0	24.0	0.4	0	35	670596.3	6123258.5
13	10301	H		0	17.4	29.3	0.6	0	38	670271.6	6123236.0
13	10310	A		0	12.7	24.0	0.4	4	30	670800.8	6123393.0

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
13	10310	B	0	25.4	60.7	0.4	0	31	671672.3	6123406.5
13	10310	C	0	12.4	15.5	0.8	0	54	673063.0	6123461.5
13	10310	D FEO	0	1.4	12.0	0.0	0	38	674078.4	6123502.5
13	10310	E FEO	0	-9.3	8.8	0.0	0	30	674471.8	6123499.5
13	10310	F	0	17.7	27.0	0.7	0	38	676225.3	6123516.5
13	10310	G FEO	0	0.0	6.5	0.0	0	28	676795.8	6123520.0
13	10310	H	0	17.7	34.7	0.5	0	33	678442.1	6123608.0
12	10320	A	0	7.0	14.4	0.3	6	34	673270.4	6123551.0
12	10320	B FEO	0	0.6	10.8	0.0	0	27	676755.2	6123682.5
12	10320	C	0	17.1	30.8	0.5	0	31	678393.8	6123704.5
12	10330	A FEO	0	0.9	9.6	0.0	0	43	674117.6	6123635.0
12	10330	B	0	4.0	11.3	0.1	7	33	673883.9	6123623.5
12	10330	C	0	13.9	18.5	0.7	0	49	673096.6	6123674.5
12	10330	D	0	17.5	40.9	0.4	3	23	672079.6	6123594.5
12	10330	E	0	14.3	26.0	0.5	0	36	671039.2	6123565.0
12	10330	F	0	10.4	19.1	0.4	6	31	670831.3	6123545.5
12	10330	G	0	12.7	23.4	0.4	4	30	670674.4	6123546.0
12	10340	A	0	9.0	18.2	0.3	0	38	670792.3	6123694.0
12	10340	B	0	23.2	39.0	0.7	0	36	673108.2	6123753.5
12	10350	A	0	14.9	20.2	0.7	0	50	675634.6	6123961.0
12	10350	B	0	10.2	15.7	0.5	0	44	675352.7	6123941.0
12	10350	C	0	13.7	24.5	0.5	0	48	673118.8	6123865.0
12	10350	D	0	16.0	34.3	0.4	0	36	672996.7	6123861.5
12	10350	E	0	16.6	34.2	0.4	0	35	671383.1	6123798.0
12	10350	F	0	10.7	25.4	0.3	0	37	670984.7	6123782.0
12	10350	G	0	11.9	23.1	0.4	2	32	670756.6	6123765.0
12	10350	H	0	8.6	21.3	0.2	0	37	670299.8	6123750.0
12	10350	J	0	4.4	12.3	0.1	0	42	669969.6	6123743.0
12	10360	A	0	11.4	24.4	0.3	0	47	670762.3	6123848.5
12	10360	B	0	14.9	26.0	0.5	0	38	672938.9	6123941.0
12	10360	C	0	15.3	25.2	0.6	4	31	673096.3	6123960.0
12	10360	D	0	16.0	29.2	0.5	0	42	676131.6	6124057.0
12	10370	A	0	11.6	20.1	0.5	0	49	676040.8	6124157.0
12	10370	B	0	19.2	26.5	0.8	0	43	675866.2	6124136.5
12	10370	C	0	5.2	11.7	0.2	13	29	673608.4	6124052.0
12	10370	D	0	8.0	13.7	0.4	0	50	673117.4	6124028.5
12	10370	E	0	17.5	34.5	0.5	0	30	672460.2	6123993.5
12	10370	F	0	16.6	36.1	0.4	0	34	671348.8	6123977.5
12	10370	G	0	10.2	21.3	0.3	0	37	670742.4	6123933.0

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
12	10380	A	0	9.3	18.8	0.3	0	51	670746.6	6124007.0
12	10380	B	0	14.0	28.2	0.4	0	33	671334.7	6124052.5
12	10380	C	0	10.5	17.8	0.4	5	33	673095.3	6124117.5
12	10380	D	0	6.8	28.2	0.1	0	29	674675.1	6124211.5
12	10380	E	0	15.1	23.8	0.6	0	41	675617.5	6124239.0
12	10380	F	0	14.2	26.8	0.4	0	42	675993.9	6124243.5
12	10390	A	0	7.1	12.8	0.3	0	57	673132.4	6124206.0
12	10390	B	0	17.3	24.8	0.7	0	43	672731.4	6124200.5
12	10390	C	0	7.8	19.6	0.2	0	35	670177.8	6124139.5
12	10400	A	0	14.8	19.3	0.8	0	43	672821.1	6124335.0
12	10400	B	0	4.5	18.2	0.0	0	41	673896.2	6124381.5
12	10410	A	0	5.2	13.0	0.2	6	33	673919.6	6124467.0
12	10410	B	0	4.6	10.6	0.2	14	29	673479.9	6124432.5
12	10410	C	0	11.4	19.8	0.5	1	37	672376.1	6124419.0
12	10410	D	0	17.6	31.2	0.5	0	34	671777.9	6124410.0
12	10420	A	0	13.0	22.6	0.5	0	38	672394.9	6124477.5
12	10420	B	0	12.3	15.1	0.8	0	45	672846.7	6124490.5
12	10420	C	0	8.2	26.9	0.1	0	33	674530.9	6124564.0
12	10430	A	0	14.7	19.2	0.8	0	42	672411.9	6124569.0
11	10440	A	0	20.0	24.9	0.9	0	39	675175.9	6124810.5
11	10440	B	0	3.4	13.2	0.0	10	24	673627.8	6124731.5
11	10440	C	0	20.2	26.8	0.9	0	39	672941.0	6124739.5
11	10440	D	0	15.0	27.0	0.5	6	27	672801.0	6124727.0
11	10440	E	0	22.2	39.9	0.6	0	31	670759.8	6124662.0
11	10450	A	0	6.4	17.9	0.1	0	33	672708.3	6124837.5
11	10450	B	0	11.5	20.2	0.4	0	42	673120.9	6124837.0
11	10450	C	0	8.0	14.9	0.3	0	47	675527.1	6124920.0
11	10460	A	0	8.9	15.2	0.4	0	44	675518.8	6124981.5
11	10460	B	0	6.5	12.0	0.3	5	39	673124.6	6124924.0
11	10460	C	0	15.4	29.5	0.4	2	29	670807.3	6124891.5
11	10470	A	0	14.5	24.6	0.5	3	32	670810.9	6124956.5
11	10470	B	0	18.7	36.9	0.5	0	34	672240.3	6124991.0
11	10470	C	0	20.8	28.5	0.8	6	29	672953.6	6125013.0
11	10470	D	0	13.5	20.2	0.6	4	34	673121.3	6125004.0
11	10480	A	0	11.5	19.5	0.5	9	28	673975.1	6125202.5

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
11	10480	B	0	6.6	8.8	0.5	30	22	673354.5	6125156.5
11	10480	C	0	11.2	15.7	0.6	9	34	673100.9	6125125.0
11	10480	D	0	14.1	20.9	0.6	0	43	672970.3	6125105.5
11	10490	A	0	16.1	32.7	0.4	0	34	672137.8	6125198.0
11	10490	B	0	14.5	22.2	0.6	4	33	673025.3	6125252.5
11	10500	A	0	10.2	16.8	0.5	14	26	673062.1	6125319.5
11	10500	B	0	10.5	24.6	0.3	5	27	672239.8	6125276.0
11	10510	A	0	14.9	21.3	0.7	0	38	672936.9	6125424.5
11	10520	A	0	16.6	24.8	0.7	3	32	672952.1	6125507.0
11	10530	A	0	10.9	18.3	0.5	0	45	672929.2	6125628.5
11	10540	A	0	7.4	23.4	0.1	0	36	673993.4	6125772.5
11	10540	B	0	5.5	21.5	0.1	0	41	673322.1	6125696.5
11	10540	C	0	8.2	15.1	0.4	3	38	672939.4	6125710.0
11	10550	A	0	9.6	25.0	0.2	0	40	671797.1	6125797.5
11	10550	B	0	14.7	24.9	0.5	0	35	672891.8	6125787.5
11	10550	C	0	6.5	29.7	0.1	0	32	673898.2	6125865.0
11	10560	A	0	7.3	17.0	0.2	4	32	672910.6	6125926.0
11	10570	A	1	28.2	32.3	1.2	0	39	672582.1	6126006.0
11	10570	B	0	11.5	21.5	0.4	0	38	672865.4	6126025.5
11	10580	A	0	11.3	20.3	0.4	3	34	672886.9	6126098.0
11	10580	B	1	18.4	19.2	1.2	0	47	672514.8	6126092.0
11	10580	C	0	16.1	25.2	0.6	0	39	672165.4	6126068.5
11	10590	A	0	19.4	34.2	0.6	0	37	672741.8	6126247.5
11	10600	A	1	23.6	29.5	1.0	0	45	672570.3	6126310.5
11	10600	B	0	14.3	30.2	0.4	0	32	671900.1	6126284.0
11	10610	A	0	23.1	33.9	0.8	0	38	672712.8	6126408.0
11	10620	A	1	23.6	30.4	1.0	0	35	672658.7	6126511.0
11	10620	B	1	31.7	33.8	1.4	0	35	672541.8	6126507.5
11	10630	A	1	28.1	36.1	1.0	0	36	672611.0	6126592.0
11	10640	A	0	13.1	29.6	0.3	0	36	673709.1	6126775.0

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
11	10640	B	0	23.2	32.6	0.8	1	31	672594.0	6126728.0
11	10640	C	1	25.8	30.6	1.1	0	40	672397.9	6126724.5
11	10650	A	1	26.9	35.6	1.0	0	38	672388.9	6126828.5
11	10650	B	1	35.5	44.5	1.2	0	34	672502.0	6126824.0
11	10650	C	0	20.2	34.8	0.6	0	34	672848.9	6126827.0
11	10650	D	0	13.3	31.4	0.3	0	37	673699.1	6126873.0
11	10660	A	1	34.8	44.8	1.1	0	35	672484.5	6126889.0
11	10660	B	1	44.0	56.0	1.2	0	31	672387.9	6126879.5
11	10670	A	1	28.8	39.4	1.0	0	37	672315.4	6126985.0
11	10670	B	1	46.0	58.1	1.3	0	31	672443.6	6126989.5
11	10680	A	1	22.4	27.2	1.0	0	45	672280.6	6127115.5
9	20021	A	2	36.2	28.9	2.1	7	30	672948.3	6104343.5
9	20021	B	1	17.2	17.4	1.2	0	54	670270.8	6104303.0
9	20040	A	0	14.7	19.0	0.8	0	43	669809.4	6104501.5
9	20050	A	1	20.3	19.0	1.4	1	41	671188.9	6104593.5
9	20050	B	1	25.0	23.4	1.5	0	39	671910.1	6104596.0
9	20050	C	2	30.1	23.8	2.0	0	41	672895.6	6104605.0
9	20060	A	2	36.8	28.8	2.2	3	33	672907.9	6104678.5
9	20060	B	1	21.2	20.6	1.3	1	40	671936.0	6104718.0
9	20060	C	0	16.5	23.5	0.7	2	34	669744.3	6104690.0
9	20070	A	1	19.6	23.2	1.0	8	30	669598.1	6104783.0
9	20080	A	1	43.1	53.0	1.3	3	25	673378.5	6104890.0
9	20080	B	1	27.1	30.8	1.2	0	35	671247.4	6104866.5
9	20080	C	0	19.9	26.5	0.8	0	48	669921.1	6104898.0
9	20080	D	1	21.1	25.6	1.0	7	30	669548.3	6104929.0
10	20100	A	2	31.4	18.3	3.1	9	33	670108.5	6105120.5
10	20100	B	2	26.3	14.9	3.0	21	24	670041.8	6105114.0
10	20100	C	2	29.6	15.4	3.5	8	36	669839.6	6105099.0
10	20110	A	3	29.3	13.6	4.1	2	43	669344.3	6105202.5
10	20110	B	2	25.8	16.2	2.6	5	39	669481.9	6105206.0
10	20110	C	3	51.3	23.1	5.1	5	32	669583.1	6105206.0
10	20110	D	3	33.7	14.8	4.6	9	35	669974.5	6105193.0
10	20120	A	3	36.1	13.6	5.8	2	41	669946.3	6105282.0

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
10	20120	B	3	26.9	10.2	5.2	4	43	669691.2	6105288.5
10	20120	C	4	35.0	8.9	9.6	0	50	669615.4	6105292.0
10	20120	D	3	29.6	8.5	7.8	0	50	669550.4	6105296.0
10	20120	E	3	19.4	7.7	4.4	3	51	669465.4	6105300.5
10	20130	A	2	38.2	24.4	2.9	6	32	669436.9	6105379.5
10	20130	B	2	45.1	26.5	3.4	6	31	669504.6	6105375.0
10	20130	C	3	58.3	25.7	5.4	3	33	669582.3	6105369.5
10	20130	D	3	40.8	20.2	4.1	1	38	669904.9	6105344.0
10	20130	E	1	22.9	21.5	1.5	9	31	671615.7	6105353.0
10	20140	A	1	30.0	25.6	1.8	9	29	671614.3	6105517.5
10	20140	B	2	25.3	18.7	2.1	2	40	670812.0	6105532.5
10	20140	C	3	37.5	13.7	6.0	0	44	670455.6	6105540.5
10	20140	D	2	23.3	14.7	2.5	0	48	670070.1	6105526.0
10	20140	E	2	25.3	16.1	2.5	0	51	669966.9	6105523.5
10	20140	F	2	29.0	19.1	2.6	2	40	669878.7	6105516.0
10	20140	G	1	14.6	15.8	1.0	0	51	669544.2	6105511.0
10	20150	A	0	17.3	24.6	0.7	2	34	669483.0	6105583.0
10	20150	B	0	16.4	25.9	0.6	7	27	669715.6	6105574.5
10	20150	C	2	24.5	12.3	3.5	0	50	670467.6	6105619.0
10	20150	D	1	30.2	29.2	1.5	3	32	673230.4	6105615.5
10	20160	A	1	27.0	27.2	1.4	6	31	673184.3	6105714.5
10	20160	B	1	28.2	29.6	1.3	2	33	671081.8	6105712.0
10	20160	C	1	19.1	15.2	1.7	0	48	670847.4	6105710.5
10	20160	D	0	3.9	9.5	0.1	0	52	669934.8	6105716.0
10	20160	E	0	14.2	18.6	0.8	0	48	669463.0	6105719.0
10	20170	A	0	17.7	33.0	0.5	9	22	669517.0	6105850.0
10	20170	B	1	16.9	13.6	1.6	0	49	670811.9	6105841.5
10	20170	C	2	30.1	23.6	2.1	10	29	671580.8	6105850.5
10	20180	A	2	38.0	24.4	2.9	5	34	671609.5	6105927.0
10	20180	B	0	4.9	14.9	0.1	15	21	669676.6	6105882.0
10	20180	C	0	5.7	11.1	0.3	13	31	669617.9	6105877.5
10	20190	A	0	4.1	15.5	0.0	0	42	669609.0	6105981.0
10	20190	B	2	24.1	14.1	2.8	9	37	671601.1	6106021.0
10	20200	A	1	29.7	24.5	1.9	5	34	670823.2	6106151.0
10	20200	B	0	3.5	13.2	0.0	10	25	670093.0	6106165.0
10	20210	A	0	6.5	10.7	0.4	0	50	669623.6	6106188.0

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
10	20211	A	1	20.1	16.8	1.6	8	36	670844.8	6106214.0
10	20220	A	1	15.1	13.2	1.4	6	41	671310.8	6106336.0
10	20220	B	2	25.1	15.4	2.7	4	41	671077.3	6106336.5
10	20220	C	1	19.3	16.0	1.6	4	41	670777.3	6106343.0
10	20230	A	0	9.9	12.7	0.7	0	47	669879.3	6106470.5
10	20230	B	1	19.1	18.6	1.3	3	39	670738.1	6106432.0
10	20230	C	1	18.8	17.1	1.4	5	38	671061.1	6106413.0
10	20230	D	0	17.5	21.9	0.9	6	33	671287.0	6106410.0
100	20240	A	1	27.9	31.6	1.2	1	33	671067.5	6106498.0
100	20240	B	1	21.3	20.4	1.4	0	42	670729.8	6106500.5
100	20240	C	0	14.1	20.8	0.6	0	51	669574.4	6106502.0
10	20250	A	0	20.7	26.6	0.9	0	39	669624.5	6106630.5
10	20250	B	1	20.5	18.1	1.5	6	37	669779.5	6106632.5
10	20250	C	0	13.5	15.8	0.9	1	43	669930.1	6106640.5
10	20260	A	0	9.8	11.4	0.8	0	49	669452.8	6106705.5
10	20270	A	0	9.4	19.9	0.3	0	49	669463.1	6106759.0
10	20270	B	0	18.7	31.6	0.6	0	39	669552.5	6106771.0
10	20270	C	0	20.9	28.3	0.8	0	38	669619.5	6106765.5
10	20270	D	0	12.6	14.8	0.8	0	52	669800.9	6106768.5
10	20270	E	0	11.5	16.4	0.6	0	44	669890.9	6106767.5
10	20280	A	1	6.5	5.7	1.0	5	60	669885.6	6106890.0
10	20280	B	1	9.9	9.6	1.0	0	55	669708.4	6106879.5
10	20290	A	0	4.1	8.6	0.2	0	55	669761.0	6107023.5
10	20290	B	1	12.4	10.9	1.3	0	57	669864.3	6107036.0
10	20290	C	1	11.7	8.2	1.7	5	51	669930.2	6107036.0
10	20290	D	1	11.0	7.4	1.7	3	55	670247.4	6107034.5
10	20300	A	3	14.8	3.7	7.7	8	53	670748.8	6107124.5
10	20300	B	3	19.1	6.6	5.3	0	59	670570.9	6107125.5
10	20300	C	3	19.3	5.3	7.2	11	45	670339.8	6107141.5
10	20300	D	6	11.7	0.4	98.3	17	54	670167.3	6107142.0
10	20300	E	3	12.9	4.5	4.6	6	56	669861.3	6107145.0
10	20300	F	1	10.1	6.4	1.8	9	52	669779.3	6107151.5
10	20310	A	0	7.7	8.2	0.8	12	44	669738.6	6107222.5
10	20310	B	2	14.7	7.1	3.1	10	47	669865.7	6107235.5

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
10	20310	C	5	15.8	1.4	31.9	14	48	670126.0	6107253.5
10	20310	D	6	24.5	1.5	60.5	3	51	670286.8	6107257.5
10	20310	E	5	27.4	2.9	28.6	3	49	670420.6	6107259.5
10	20310	F	5	27.7	4.1	18.8	2	49	670603.4	6107250.5
10	20310	G	3	21.9	6.0	7.5	7	46	670767.8	6107250.0
10	20320	A	3	24.7	7.7	6.5	0	54	670721.0	6107331.0
10	20320	B	3	45.6	14.9	7.4	0	49	670621.3	6107335.0
10	20320	C	5	40.9	5.9	21.5	0	49	670470.6	6107343.0
10	20320	D	5	44.3	5.3	28.4	0	48	670326.5	6107339.0
10	20320	E	6	39.4	2.5	64.4	0	50	670267.1	6107334.5
10	20320	F	5	23.8	3.1	21.3	2	52	670123.4	6107328.0
10	20320	G	2	19.0	12.6	2.2	7	41	669854.2	6107323.0
10	20330	A	6	14.2	0.4	138.5	7	59	670075.8	6107422.5
10	20330	B	6	21.0	0.0	999.9	0	61	670249.6	6107419.0
10	20330	C	0	20.3	-0.6	0.0	0	58	670452.4	6107414.0
10	20330	D	4	26.9	6.3	10.0	2	48	670612.1	6107414.5
10	20340	A	3	37.7	13.9	6.0	7	36	670522.9	6107520.5
10	20340	B	4	32.0	5.8	14.6	5	42	670406.7	6107525.0
10	20340	C	4	27.5	4.9	14.4	6	44	670238.2	6107524.5
10	20340	D	5	39.8	5.6	22.2	4	40	670147.3	6107522.5
10	20340	E	3	18.6	5.5	6.4	5	51	669956.9	6107518.5
8	20350	A	4	24.7	5.7	9.8	1	51	669880.9	6107606.0
8	20350	B	4	30.4	5.4	14.9	0	48	669970.6	6107606.5
8	20350	C	5	48.6	7.6	20.2	0	46	670073.4	6107606.5
8	20350	D	4	35.4	8.2	11.0	4	41	670384.2	6107607.5
8	20350	E	3	33.5	12.5	5.7	5	39	670478.9	6107607.5
8	20360	A	4	42.7	10.9	10.1	2	40	670411.1	6107704.0
8	20360	B	5	47.1	8.7	16.0	0	47	670098.8	6107697.0
8	20360	C	5	38.5	6.5	17.1	0	49	669959.3	6107692.5
8	20360	D	4	30.2	5.9	13.1	0	51	669864.6	6107689.5
8	20370	A	3	29.0	11.9	4.8	0	51	670539.9	6107772.5
8	20370	B	3	32.1	12.4	5.3	0	46	670417.3	6107780.5
8	20370	C	2	47.2	26.6	3.7	3	33	670150.9	6107790.5
8	20370	D	3	32.3	10.5	6.8	8	38	669999.4	6107799.0
8	20370	E	3	32.1	10.7	6.5	0	49	669842.4	6107794.5
8	20370	F	0	7.1	16.5	0.2	0	36	669030.2	6107799.0
8	20380	A	3	26.9	10.9	4.8	0	51	669865.4	6107884.5
8	20380	B	3	35.4	14.5	5.1	2	41	670018.1	6107877.0

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
8	20380	C	3	27.7	10.6	5.2	6	42	670393.7	6107866.5
8	20380	D	2	29.3	14.6	3.7	1	44	670521.7	6107872.0
8	20380	E	1	26.9	21.8	1.9	1	39	670706.5	6107878.5
8	20380	F	2	37.3	26.7	2.5	7	30	670931.6	6107887.0
8	20380	G	1	31.7	28.0	1.8	4	32	671761.8	6107903.0
8	20390	A	2	30.4	24.5	2.0	5	33	671743.3	6107926.5
8	20390	B	2	45.5	29.6	3.0	6	30	670942.1	6107951.0
8	20390	C	2	38.5	22.1	3.4	8	31	670482.4	6107939.5
8	20390	D	2	41.5	21.6	3.9	8	31	670373.9	6107939.0
8	20390	E	3	33.6	15.1	4.5	6	37	670067.8	6107964.0
8	20390	F	3	46.7	20.9	4.9	7	31	669947.6	6107973.5
8	20390	G	3	38.8	15.0	5.6	4	38	669791.6	6107981.0
8	20400	A	1	20.7	20.4	1.3	4	37	669766.2	6108079.5
8	20400	B	2	29.2	20.9	2.3	5	36	669952.2	6108073.5
8	20400	C	2	25.7	14.7	2.9	11	34	670090.5	6108072.5
8	20400	D	2	17.2	10.1	2.5	5	46	670273.8	6108081.0
8	20400	E	1	24.1	18.9	1.9	1	41	670472.9	6108084.0
8	20410	A	1	16.3	17.8	1.0	2	40	670431.4	6108183.5
8	20410	B	1	21.8	19.3	1.5	3	39	670223.8	6108185.5
8	20421	A	0	8.3	19.1	0.2	0	45	669000.7	6108345.0
8	20430	A	1	26.8	35.5	1.0	0	32	670847.6	6108367.5
8	20430	B	1	29.6	40.6	1.0	1	30	670700.8	6108373.5
8	20430	C	0	22.5	30.3	0.9	1	33	670455.1	6108375.5
8	20450	A	1	24.1	25.6	1.3	10	28	670426.7	6108647.5
8	20451	A	0	4.9	11.0	0.2	5	38	666942.6	6108574.0
7	20460	A	0	13.2	17.7	0.7	8	33	670436.9	6108729.0
7	20460	B	0	9.2	15.3	0.4	1	40	669551.6	6108756.5
7	20460	C	0	18.9	38.6	0.4	0	30	666958.5	6108699.0
7	20470	A	0	7.4	17.0	0.2	0	41	666940.2	6108874.5
7	20480	A	0	2.2	7.7	0.0	14	29	667110.4	6108930.0
7	20480	B	0	16.6	22.9	0.7	5	32	666938.4	6108933.0
7	20490	A	1	15.4	12.7	1.5	0	61	667000.1	6109063.5
7	20500	A	0	16.2	24.5	0.6	3	32	669899.7	6109133.0

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY		CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
7	20500	B		1	35.3	39.3	1.4	0	32	667042.5	6109117.5
7	20500	C		1	28.2	33.6	1.1	3	31	666886.3	6109106.0
7	20510	A		0	15.1	26.1	0.5	0	44	667038.4	6109247.0
7	20520	A		0	18.7	38.9	0.4	0	30	667017.6	6109322.0
7	20520	B		0	14.2	29.4	0.4	8	23	666929.8	6109326.0
7	20530	A		0	5.3	13.1	0.2	0	52	667097.4	6109405.5
7	20540	A		0	7.9	12.6	0.4	0	55	668981.3	6109536.0
7	20550	A		0	13.1	25.0	0.4	2	32	671516.7	6109636.0
7	20610	A		0	8.1	26.1	0.1	0	43	668062.6	6110165.0
7	20610	B		0	7.0	26.3	0.1	0	36	669505.3	6110171.5
7	20620	A		0	20.8	34.5	0.6	2	29	667052.7	6110266.5
6	20630	A		0	6.3	14.7	0.2	0	48	668062.7	6110420.5
6	20640	A		0	12.6	17.8	0.6	10	30	671617.7	6110540.5
6	20640	B		0	11.5	20.4	0.4	11	25	671265.8	6110531.5
6	20640	C		0	5.8	12.1	0.2	0	44	670128.6	6110505.0
6	20650	A		0	4.4	22.4	0.0	0	27	670084.5	6110617.5
6	20660	A		0	8.0	15.2	0.3	10	30	667966.1	6110717.5
6	20670	A		0	2.5	13.4	0.0	0	46	668032.6	6110809.0
6	20700	A	FEO	0	1.0	10.8	0.0	4	22	670456.2	6111098.5
6	20720	A	FEO	0	4.4	13.2	0.1	20	17	670375.2	6111303.5
3	10990	A		0	27.3	44.7	0.7	0	28	666038.2	6113971.5
3	11000	A		1	28.0	36.5	1.0	1	31	666023.0	6114095.5
3	11010	A		1	28.3	33.4	1.2	0	36	668091.4	6114192.5
3	11010	B		1	26.6	30.2	1.2	4	31	667340.6	6114178.5
3	11010	C		1	22.6	28.2	1.0	0	39	666187.4	6114170.0
3	11020	A		1	30.9	34.4	1.3	0	38	665239.2	6114329.5
3	11020	B		1	28.6	30.0	1.4	0	37	665999.4	6114314.5

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
3	11020	C	1	36.5	41.4	1.3	0	33	667677.8	6114317.5
2	11030	A	1	47.7	73.6	1.0	1	23	667694.0	6114420.5
2	11040	A	1	16.6	17.1	1.1	0	46	665485.1	6114541.0
2	11050	A	1	25.9	32.3	1.0	3	31	665677.1	6114665.5
2	11060	A	1	31.3	37.5	1.2	7	25	665691.2	6114700.0
2	11080	A	0	21.9	30.4	0.8	0	34	664656.4	6114914.5
2	11090	A	1	17.0	18.7	1.0	0	48	665999.4	6114989.5
2	11100	A	0	27.7	40.4	0.9	0	32	667367.0	6115136.5
2	11120	A	1	25.8	33.7	1.0	0	34	667913.1	6115334.5
2	11130	A	1	29.9	39.9	1.0	0	30	667939.3	6115457.0
2	11140	A	0	33.9	50.3	0.9	3	24	667767.6	6115532.5
2	11140	B	0	35.0	54.5	0.9	1	26	667431.7	6115542.5
2	11160	A	1	26.1	30.2	1.2	0	40	668379.0	6115722.5
2	11160	B	1	25.9	28.6	1.2	0	35	666650.0	6115737.5
2	11240	A	0	14.1	20.1	0.7	0	46	667053.1	6116538.0
2	11250	A	1	21.0	25.8	1.0	3	33	667414.8	6116662.5
2	11260	A	0	14.7	17.6	0.9	0	45	667490.1	6116732.5
2	11270	A	1	12.1	12.3	1.0	3	45	667505.9	6116800.5
2	11270	B	1	27.4	28.9	1.3	0	44	668863.9	6116797.5
2	11280	A	1	30.5	38.1	1.1	0	36	668442.7	6116918.0
2	11280	B	0	23.4	35.2	0.8	0	34	668264.0	6116904.0
2	11290	A	0	11.5	20.2	0.4	0	36	667974.1	6117044.5
2	11290	B	0	15.7	20.6	0.8	'1	38	668232.8	6117017.5
2	11300	A	1	11.3	10.2	1.2	1	51	668215.9	6117107.5
2	11310	A	1	47.1	60.7	1.2	3	24	667977.5	6117240.0
1	11360	A	1	33.0	32.4	1.6	0	36	668503.3	6117729.5

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J9628 ANOMALY LISTING

FLIGHT	LINE	ANOMALY		CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
6	20700	A	FEO	0	1.0	10.8	0.0	4	22	670456.2	6111098.5
6	20720	A	FEO	0	4.4	13.2	0.1	20	17	670375.2	6111303.5
6	20760	A		1	30.3	35.3	1.2	4	28	668073.5	6111707.5
6	20770	A		1	18.3	19.3	1.1	5	36	668048.5	6111819.0
6	20770	B		0	18.7	25.0	0.8	0	38	668698.8	6111813.5
6	20780	A		0	24.3	37.7	0.7	4	26	668701.3	6111916.0
6	20790	A		0	11.7	38.4	0.2	1	23	669581.9	6112027.0
5	20810	A		1	24.2	19.0	1.9	0	50	671103.9	6112222.0
5	20810	B		0	17.5	29.0	0.6	1	32	669126.5	6112226.5
5	20810	C		1	24.7	29.7	1.1	3	32	668190.1	6112238.0
5	20820	A		0	15.2	29.2	0.4	0	33	669127.0	6112285.5
5	20820	B		0	18.3	49.8	0.3	0	23	669472.9	6112294.0
5	20820	C		1	34.8	38.6	1.4	5	27	671672.8	6112335.0
5	20830	A		1	29.8	33.5	1.3	0	40	671146.4	6112426.0
5	20830	B		0	31.7	45.2	0.9	1	28	670798.1	6112408.0
5	20830	C		0	24.8	34.4	0.9	0	32	668019.2	6112415.0
5	20840	A		1	24.8	32.4	1.0	1	32	668672.2	6112503.5
5	20840	B		0	17.8	40.1	0.4	0	29	669334.7	6112532.0
5	20840	C		1	40.4	40.6	1.6	0	34	671237.7	6112515.0
5	20840	D		1	39.8	43.3	1.5	7	24	671484.4	6112516.5
5	20850	A		0	23.9	48.5	0.5	3	23	669256.2	6112639.5
5	20850	B		0	30.9	45.0	0.9	6	23	668711.3	6112618.0
5	20860	A		0	30.7	76.0	0.4	0	23	669264.4	6112705.0
5	20860	B		0	25.4	37.8	0.8	5	26	670571.3	6112713.0
5	20870	A		1	34.6	35.8	1.5	0	37	670722.4	6112823.0
5	20870	B		0	32.7	47.6	0.9	4	24	670449.8	6112832.0
5	20870	C		0	21.0	31.0	0.8	5	27	669547.1	6112806.0
5	20870	D		1	29.7	31.9	1.3	0	36	668822.3	6112798.0
5	20880	A		2	38.3	31.8	2.1	6	29	667618.1	6112897.5
5	20890	A		1	21.8	24.6	1.1	3	35	670402.8	6113021.0

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FLIGHT	LINE	ANOMALY		CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
4	20900	A		1	24.5	23.4	1.5	4	35	667892.3	6113132.0
4	20910	A		1	25.8	23.9	1.5	2	36	667863.4	6113211.5
4	20920	A		0	13.0	16.5	0.8	6	37	669433.2	6113326.5
4	20920	B		1	27.9	23.7	1.8	4	35	667747.6	6113273.5
4	20930	A		2	23.7	17.9	2.0	1	42	667728.8	6113364.0
4	20930	B		0	17.9	25.9	0.7	2	33	669438.3	6113380.5
4	20930	C		1	45.3	68.7	1.0	0	25	670830.6	6113406.0
4	20940	A		1	30.8	26.1	1.9	2	35	667672.8	6113533.0
4	20950	A		2	30.2	22.2	2.2	6	34	667656.6	6113641.0
4	20950	B		1	21.4	21.4	1.3	0	40	670484.8	6113595.0
4	20970	A		1	25.3	21.4	1.7	1	40	667652.8	6113771.5
4	20980	A		1	35.3	42.3	1.2	0	32	668116.9	6113848.5
4	20980	B		0	22.0	37.0	0.6	0	34	666067.8	6113874.5
14	10070	D	FEO	0	-1.8	16.3	0.0	0	31	674185.4	6121066.0
14	10090	B	FEO	0	-1.4	23.8	0.0	0	22	674775.9	6121334.5
14	10110	B	FEO	0	-8.0	6.8	0.0	0	26	674239.1	6121522.0
14	10120	E	FEO	0	-2.7	1.6	0.0	0	32	674165.9	6121614.5
14	10130	D	FEO	0	0.3	16.2	0.0	0	27	674445.3	6121715.5
14	10130	E	FEO	0	-3.5	18.0	0.0	0	23	674124.0	6121705.0
14	10151	A	FEO	0	-0.3	3.2	0.0	0	42	671160.3	6121807.0
14	10160	A	FEO	0	0.2	12.0	0.0	0	32	671072.6	6121896.0
14	10170	C	FEO	0	-7.7	3.2	0.0	0	24	675640.2	6122138.5
14	10181	A	FEO	0	-6.8	2.7	0.0	0	29	675633.5	6122254.0
14	10190	C	FEO	0	1.8	11.5	0.0	0	33	674058.1	6122262.0
14	10190	E	FEO	0	2.4	14.2	0.0	0	30	674366.1	6122296.5
14	10190	F	FEO	0	-6.5	0.1	0.0	0	27	675646.6	6122315.5
14	10201	A	FEO	0	-1.1	1.9	0.0	0	37	675646.6	6122454.0

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FLIGHT	LINE	ANOMALY		CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
14	10201	B	FEO	0	-0.2	7.7	0.0	0	31	674323.9	6122371.0
13	10210	C	FEO	0	1.4	11.0	0.0	0	35	674110.7	6122494.0
13	10210	D	FEO	0	0.9	10.2	0.0	2	24	674350.3	6122467.0
13	10210	E	FEO	0	-8.7	4.5	0.0	0	35	675706.3	6122548.5
13	10220	A	FEO	0	-3.4	5.3	0.0	0	28	675762.8	6122633.5
13	10220	B	FEO	0	-1.7	7.5	0.0	0	30	674123.6	6122570.5
13	10230	C	FEO	0	-2.8	6.5	0.0	0	25	674250.2	6122677.0
13	10240	A	FEO	0	2.1	13.5	0.0	1	27	675574.3	6122858.0
13	10240	D	FEO	0	-8.0	10.4	0.0	0	26	674322.2	6122801.5
13	10240	J	FEO	0	4.0	17.2	0.0	6	24	672337.2	6122754.5
13	10250	C	FEO	0	-3.0	8.2	0.0	0	34	674344.3	6122918.5
13	10260	C	FEO	0	-14.4	14.9	0.0	0	26	674377.3	6123005.5
13	10270	C	FEO	0	-3.7	4.6	0.0	0	38	674421.2	6123065.0
13	10280	D	FEO	0	-5.5	18.2	0.0	0	25	674447.9	6123227.0
13	10280	E	FEO	0	-6.9	9.8	0.0	0	27	673851.0	6123204.0
13	10295	D	FEO	0	-3.1	9.2	0.0	0	25	674446.1	6123294.0
13	10300	B	FEO	0	1.2	11.0	0.0	3	25	676799.9	6123487.5
13	10301	A	FEO	0	-4.3	5.6	0.0	0	27	674422.8	6123427.5
13	10301	B	FEO	0	-0.5	8.9	0.0	0	39	673945.0	6123395.5
13	10310	D	FEO	0	1.4	12.0	0.0	0	38	674078.4	6123502.5
13	10310	E	FEO	0	-9.3	8.8	0.0	0	30	674471.8	6123499.5
13	10310	G	FEO	0	0.0	6.5	0.0	0	28	676795.8	6123520.0
12	10320	B	FEO	0	0.6	10.8	0.0	0	27	676755.2	6123682.5
12	10330	A	FEO	0	0.9	9.6	0.0	0	43	674117.6	6123635.0
6	20700	A	FEO	0	1.0	10.8	0.0	4	22	670456.2	6111098.5
6	20720	A	FEO	0	4.4	13.2	0.1	20	17	670375.2	6111303.5

Estimated depth may be unreliable because the stronger part of the conductor may be deeper or to one side of the flight line, or because of a shallow dip or overburden effects.

Appendix 5

GENERAL CONSIDERATIONS: AIRBORNE GEOPHYSICS FOR PORPHYRY COPPER DEPOSITS

1. Introduction

Porphyry copper deposits make up more than half of the world's copper resources. By comparison, massive sulfide deposits hold about 10% of the world's copper. Porphyry copper deposits are the most important source of copper and the long term interest in finding new deposits is high.

Most of the world's largest porphyry deposits are accompanied by vein, skarn or replacement orebodies which were worked first. The large supergene copper deposits often found over the central porphyritic intrusion were considered uneconomic because of grade. This limitation was overcome in the early twentieth century thanks to engineering and metallurgical advances which led in the 1950's and 1960's to porphyry copper deposits achieving their current dominance.

Porphyry copper deposits are large orebodies of low grade. Because of disseminated metallic sulfides in the unweathered porphyry, IP has been a common geophysical survey method in many porphyry exploration programs. Airborne surveys have traditionally been considered valuable in defining the regional (mostly magnetic) setting or porphyries but limited as a direct detection method.

Several things have changed since these earlier perceptions - airborne geophysical surveys are now an important part of many porphyry exploration programs. Airborne geophysical methods have changed a lot over the last ten years. Advancements in sensor technology, navigation systems, data processing, presentation and analysis mean a range of physical properties can be more efficiently and more reliably mapped over large areas. Based on porphyry models and airborne survey experience, a common or probable geophysical signature of coincident responses from a variety of sensors can be established. This signature may be used in the direct detection of other porphyries.

2. The Geology of Porphyry Copper Deposits

Porphyry deposits are associated with intrusive granitic bodies which were emplaced relatively near surface. The granitoid rocks exhibit a porphyritic texture. The primary mineralization is dispersed in veinlet and fracture stockworks that have formed late in the emplacement of the intrusive. The mineralization and hydrothermal alteration normally form symmetrical patterns that reflect the shape of the intrusion. The granitic stock, veinlet and fracture stockworks, breccia bodies and hydrothermal alteration are all part of one system closely related in age - the porphyry system.

Gross characteristics of many porphyry copper deposits are

- grades of less than 1% copper.
- at least 50 million tonnes of ore. The very large deposits may contain more than 1 billion tonnes of ore.
- a circular or elliptical outline with a typical area of 1 to 2 square kilometres. Alteration effects may cover 10 to 20 times the area of the ore zone.
- secondary enrichment in the supergene zone. This enrichment zone, which makes many porphyries economic, may be absent.

Porphyry copper deposits are found principally within linear mountain belts of Mesozoic and Cenozoic age - see figure 1 (from Sutherland-Brown and Cathro, 1976). Within these mountain belts, they occur most commonly in terrains displaying both orogenic volcanic rocks and granitic bodies emplaced near surface. This distribution is apparently controlled by factors such as distance from subduction zones of convergent crustal plate margins, distribution of faults transverse to the mountain belts and the chance results of erosion of burial.

The classical porphyry deposit model is often credited to Lowell and Guilbert (1970). Figure 2, which shows simplified alteration, mineralization and sulfide occurrence zoning for the Kalamazoo porphyry in Arizona, is originally from Lowell and Guilbert (1970). The San Manuel - Kalamazoo deposit is a 1 by 2 km oval plain view. Of the 200 million tonnes of ore, 70% is in the igneous host rock and 30% is in the pre-ore metasediments. Metal values include 0.45% Cu in the protore or hypogene zone and 0.35% Cu in the supergene enrichment zone.

The original orebody and its alteration envelope were formed in an upright bullet shaped configuration. The upper reaches of the porphyry environment reached depths of 1 km or so. More than 50 million years of erosion exposed the porphyry and built up the supergene enrichment zone. Faulting and tilting have split the deposit and altered the simple vertical pipe geometry of the original porphyry.

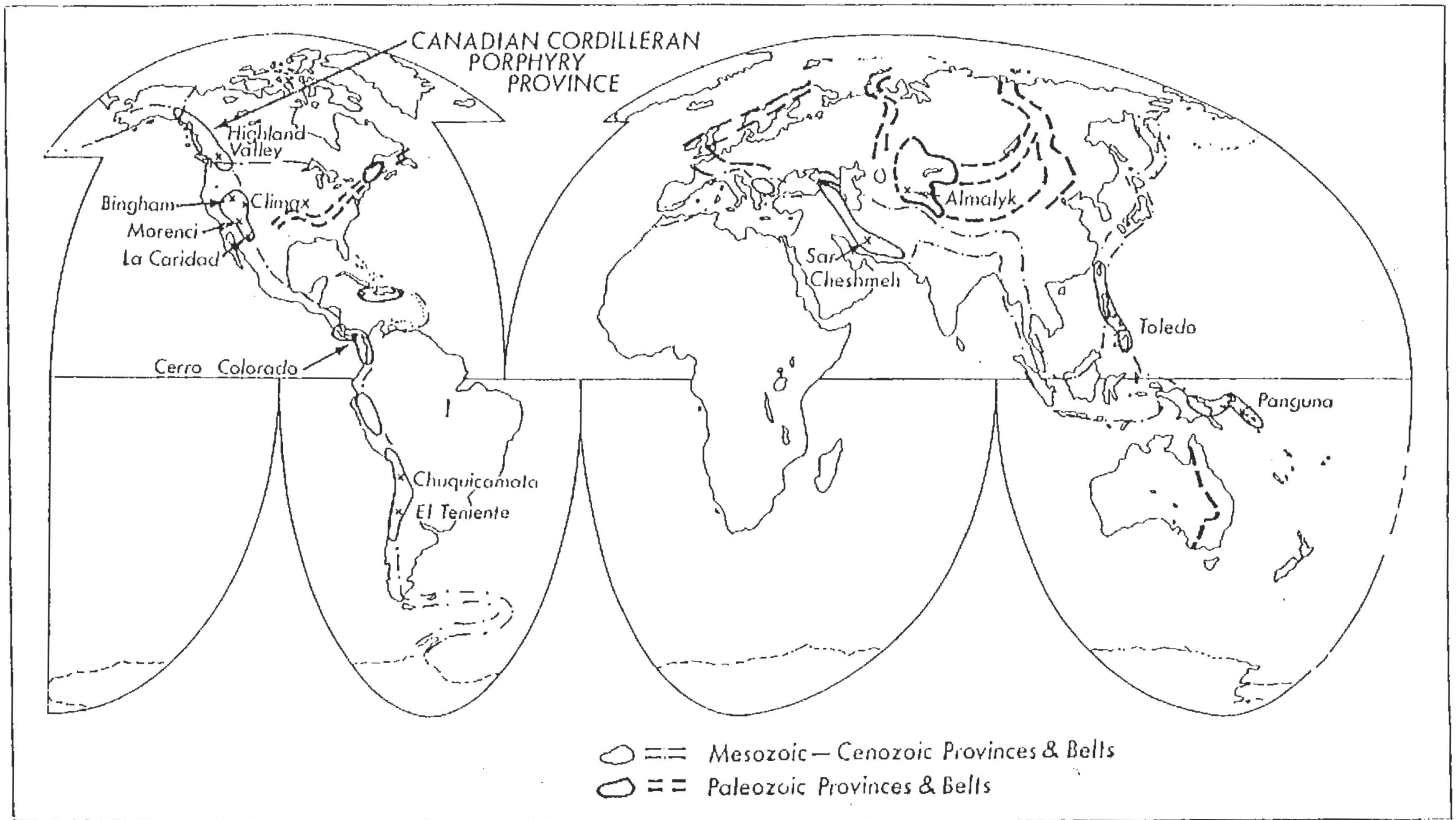

Figure 1: Porphyry provinces of the world and related mountain belts (from Sutherland-Brown, 1976)

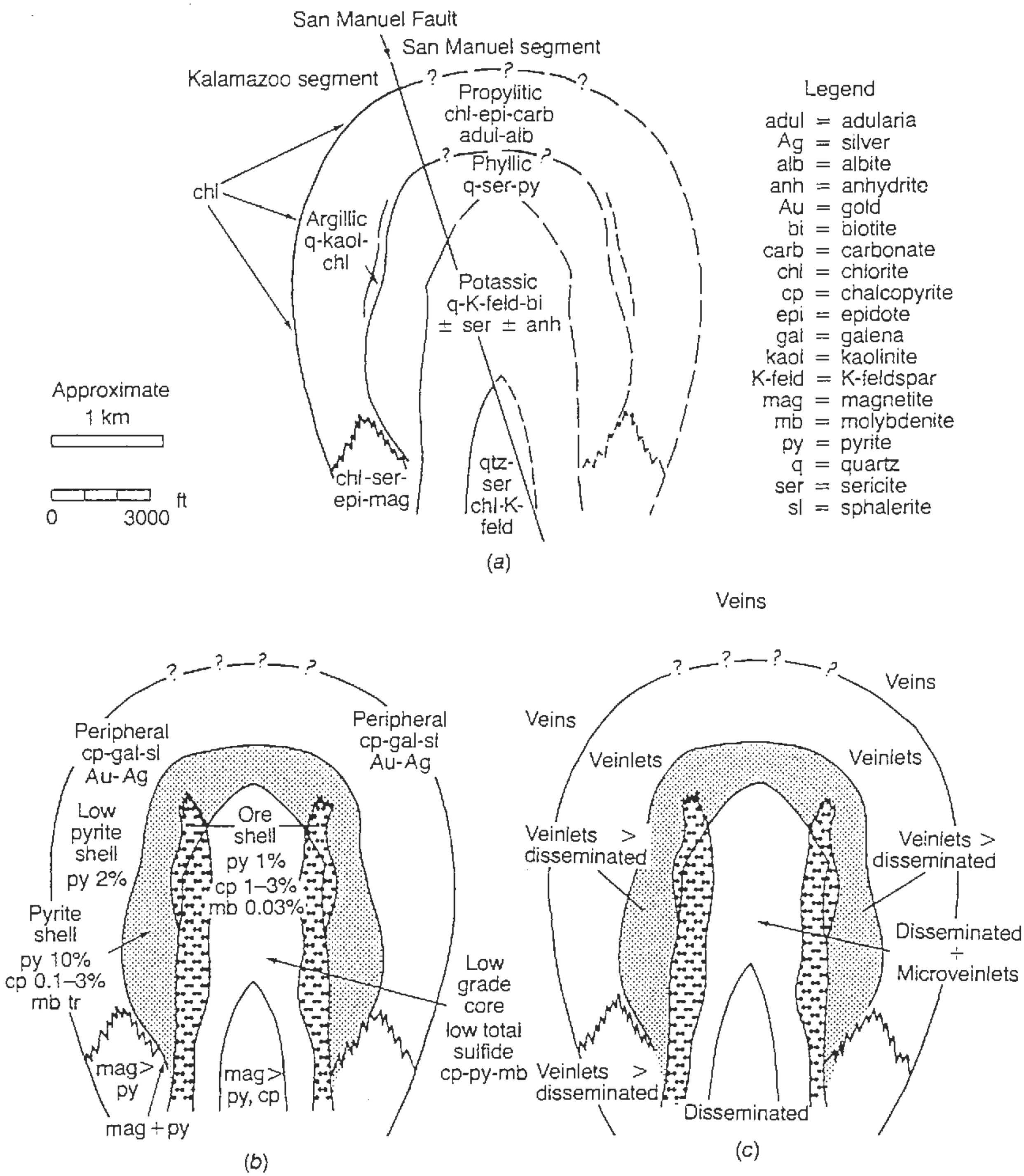

Figure 2: Alteration, mineralization and mineral occurrence zoning model of the San Manuel-Kalamazoo porphyry copper deposit (from Guilbert and Park, 1986)

This brief description of porphyry deposits is a poor reflection of the many articles and books which have been written on the geology of porphyries. Selected articles are listed at the end of this appendix.

3. Airborne Geophysical Methods

Airborne geophysical methods are grouped by type of aircraft - fixed wing or helicopter - and sensor - magnetic, electromagnetic, VLF and radiometric. Fixed wing surveys are used over usually large, flat areas. Helicopter surveys are used for areas of rough terrain although this may be expanded if there is a clear need for the high resolution geophysical maps possible from a helicopter survey.

Sensor types and what they detect are as follows:

- Magnetics: The total magnetic field is the response to variations in the distribution of magnetite. For all practical purposes, the depth of exploration is unlimited. Filtering may be used to highlight magnetic sources at surface or at depth. The vertical magnetic gradient, calculated from the total field, for example, highlights near-surface magnetic features and hence near-surface geology.

- Electromagnetics: EM systems respond to lateral and depth variations in electrical resistivity. Resistivity is a function of porosity/permeability, water content, groundwater conductivity and clay content. Airborne EM methods are generally considered effective to a depth of about 100 metres.

- VLF: VLF is an EM method which operates at a very high frequency. In areas of conductive overburden, the depth of exploration is limited. The VLF method is best suited to detecting weak, near-vertical conductors, such as faults or shear zones in a resistive environment - an uncommon target and setting for most porphyry copper deposits.

- Radiometrics: Radiometric methods measure the surface concentration of the three principal naturally occurring radioelements - potassium, uranium and thorium. No direct information about the subsurface radioelement geochemistry is gained and almost any alluvial cover will mask bedrock radiometric signatures.

Magnetic, EM and radiometric methods are used in porphyry copper exploration. Common responses over porphyry deposits are:

- a total magnetic field low (in high geomagnetic latitudes) and a coincident area of very low magnetic relief (as seen in the vertical magnetic gradient).

These responses reflect the absence of magnetite at depth (total field) and near-surface (VG). An annular ring of highs due to magnetite skarns or other alteration effects around the porphyry is seen over some deposits.

- a resistivity low due to the increased porosity of the fractured and altered intrusive stock and/or the relatively thick capping of alluvium/colluvium, weathered and supergene zones.

- a potassium high due to alteration effects in the core of the porphyry.

This response model is a simplification which will be violated in many cases. The magnetic response will be lost if the porphyry is overlain by any thickness of volcanics. If the original porphyry is part of a larger intrusive complex and that complex is more magnetic than the country rock, the porphyry will be seen as a local total field magnetic low superimposed on a broader regional magnetic high. The potassium high may be missing for a porphyry under as little as 1 metre of alluvial cover.

Using one airborne geophysical method will return a number of favourable targets with a level of uncertainty which reflects the often non-unique magnetic, electromagnetic or radiometric response of most porphyries. Using all three methods will reduce this uncertainty - targets are identified by promising responses from three airborne methods, each of which measures an independent physical property of the porphyry.

Most is known about the airborne magnetic response to porphyry copper deposits. There is relatively little documentation on the airborne resistivity characteristics. The three airborne geophysical methods and their role in porphyry copper exploration is discussed separately.

3.1 Magnetics

Conventional wisdom says that the hydrothermal alteration of the porphyry system will convert magnetite in the host rocks to pyrite, hematite or some other non-magnetic form. As long as the surrounding rocks are magnetic, the porphyry is a magnetic low in high magnetic latitudes. The dimensions of the low reflect the dimensions in plan of the porphyry system. This concept applies to a number of porphyries but not all.

The total field magnetic low is a characteristic airborne geophysical expression of porphyry copper deposits in the southwest U.S. In this setting, many of the mineralized porphyries are associated with Laramide quartz monzonite intrusives which are very weakly magnetic - average magnetite of about 0.04% (Brant, 1966). Older granites and basic volcanics have 0.4 to 4% magnetite. On a regional scale, the low is a property of the preferred intrusive host and may have little to do with the hydrothermal alteration in some localized part of the intrusion which holds the porphyry deposit. In contrast, porphyry deposits in other parts of North America (eg. Butte, Highland Valley), are found within intrusive batholiths - large scale features which are relatively magnetic high. These deposits are seen as a 'local' magnetic low in a regional magnetic high. The regional magnetic high reflects the intrusive center or complex. The local magnetic low reflects younger mineralized intrusives which are intrinsically less magnetic or are lacking in magnetism altogether due to hydrothermal alteration (Gay, 1970).

Gay (1970) examined the aeromagnetic response of 36 copper and molybdenum porphyry deposits in North America. The magnetic data was largely from older fixed wing surveys - results which were unsuited to modern enhancement techniques. He concluded that aeromagnetic responses were of four types. The types and their relative occurrences were:

1. Deposits marked by alteration lows - 50 to 65%
2. Deposits marked by regional magnetic highs over nearby intrusive centers - 30%
3. Deposits lying on recognized aeromagnetic lineaments - 15%
4. Deposits marked by skarn highs - 5%

These findings are based on regional aeromagnetic results taken from surveys conducted with wide line spacings - 1 to 2 km - and high terrain clearances - 200 to 1000 m.

Conclusions based on modern high resolution geophysical survey results would probably place more emphasis on low magnetic relief as a diagnostic porphyry response.

Total field aeromagnetic maps reflect variations in the distribution in magnetite at all depths. The mixture of signals may mask or confuse a distinct magnetic signature of the porphyry system. The vertical magnetic gradient, calculated from the total field, focuses on lateral variations in magnetite in the top 100 to 200 metres. As long as the porphyry is at or near-surface, the VG map often shows an area of extremely low magnetic relief over the porphyry and its alteration halo.

The original Lowell and Guilbert porphyry model (see figure 2) shows a ring of magnetite at depth. Assuming sufficient erosion, this feature could be shallow enough to register in the aeromagnetic maps and would be seen as an annular ring of magnetic highs. This response pattern could also be due to magnetite skarns - metasomatic effects at the contact of the intrusion with the country rock.

Many porphyry deposits are associated with regional faults (although the relationship with the intrusion is often unclear). One example is the West Fissure, a major fault with kilometres of strike slip displacement along which lie five Chilean porphyries including Chuquicamata. These regional tectonic features may be interpreted from the total field results, or, more confidently, from breaks and interruptions in the vertical gradient.

Many porphyries are found in orogenic volcanic terrains and this presents an important aeromagnetic interpretive problem. Volcanics are often more magnetic than intrusives and may mask porphyry magnetic signatures if not the whole intrusive center. Filtering, which separates near-surface from deep seated magnetic sources, is one method used to acknowledge, if not remove, this mask. An understanding of the magnetic susceptibility of rock units in the survey area is basic to interpreting the aeromagnetic results. Magnetic susceptibilities from physical property studies are ideal.

In low magnetic latitudes, the absence of magnetite will be seen as a total field high - magnetic sources give total field lows. This feature is often corrected using a pole reduction filter which simulates what the total field map would look like if the local reduction filter were vertical. The resulting maps are easier to read. For data collected at very low magnetic latitudes - i.e. inclinations of less than 20° - the interpretation must allow for the loss of information inherent in the pole reduction process.

Figure 3 is a standard set of total field and vertical gradient profiles over a vertical tabular body at a variety of geomagnetic latitudes. The body strikes east-west. The south side of the body is on the left in northern magnetic latitudes. The north side of the body is on the left in southern magnetic latitudes. These models are based on a source which is more magnetic than the host. Many porphyries might best be modelled as a near-vertical solid cylinder which is less magnetic than the host. The magnetic response for such models cannot be easily modelled - a simple sign reversal of the response curves in figure 3 is not correct. The only approach which can be used is to use figure 3 to model the edge of the porphyry system - the contact with the unaltered host rock. In most cases, this contact is gradual, however, and quantitative modelling is difficult.

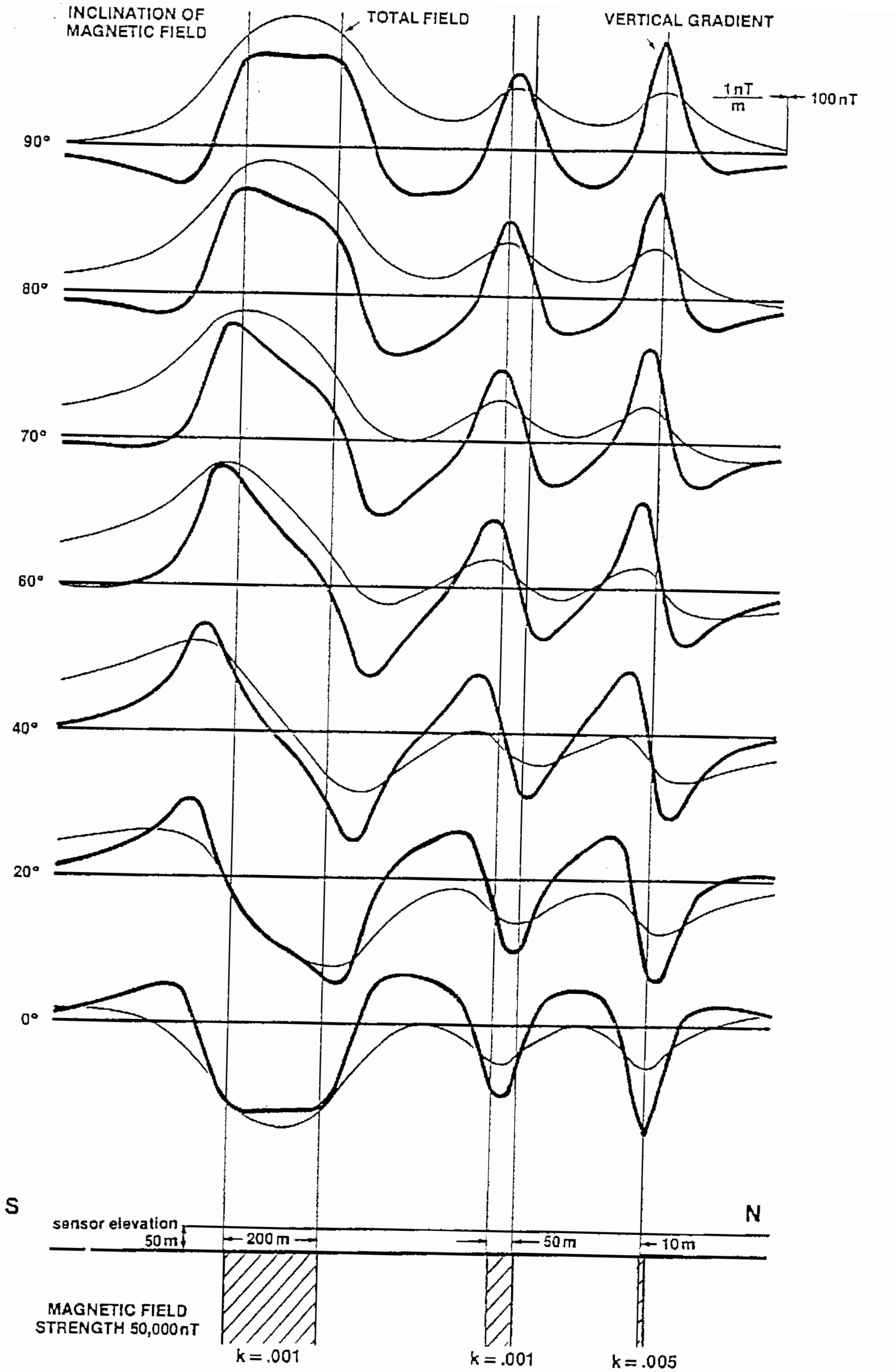

Figure 3: Total field and vertical gradient magnetic responses from a vertical tabular source at different geomagnetic latitudes.

3.2 Electromagnetics

Modern helicopter EM systems measure lateral and depth variations in electrical conductivity or resistivity. There are two classes of conductors - electronic conductors such as massive metallic sulfides and electrolytic conductors where the secondary currents are carried by ions in the groundwater. The electrical resistivity of most soil and rock forming minerals is very high and the mineralogical properties of any rock have no bearing on its resistivity.

The resistivity of most rocks and soils is determined by their porosity, water content and electrical conductivity and clay content of the groundwater. An altered and broken granodiorite stock intruding competent unaltered volcanics should appear as an apparent resistivity low if only because of the increased porosity of the porphyry system. In addition, many porphyries under residual soils, show a thick cap of weathered material (the oxide zone) and a supergene enrichment zone. The total thickness of these two porous layers may be over 100 metres.

Airborne EM methods are of limited value in areas of thick alluvial cover. In mountainous areas, resistivity lows may be common over topographic lows - the response to increased groundwater in unconsolidated valley fill. A resistivity low with coincident low magnetic relief as seen in the VG map is a more attractive target.

Helicopter EM systems carry a number of coil pairs operating at different frequencies and coil geometrics. The coaxial/coplanar coil pairs give diagnostic responses over near-vertical and dipping thin sheet conductors. These are sketched in figure 4. The interpretation of conductance and depth of burial is based on the phasor diagram shown in figure 5.

Apparent resistivities are calculated for any coil pair using the phasor diagrams shown in figures 6 and 7. The lower operating frequencies penetrate to a greater depth and apparent resistivity maps derived from the low frequency results are more diagnostic of the low resistivity core of the porphyry system. In some cases, the variation of apparent resistivity with depth may be of interest. This may be derived by calculating the apparent resistivity at a number of frequencies, assigning each value to a different depth and interpolating over the whole depth range. Pseudo-sections of apparent resistivity may be drawn.

3.3 Radiometrics

Studies of variations in potassium, uranium and thorium over selected porphyry copper deposits are reported by Davis and Guilbert, (1973). Their conclusions were:

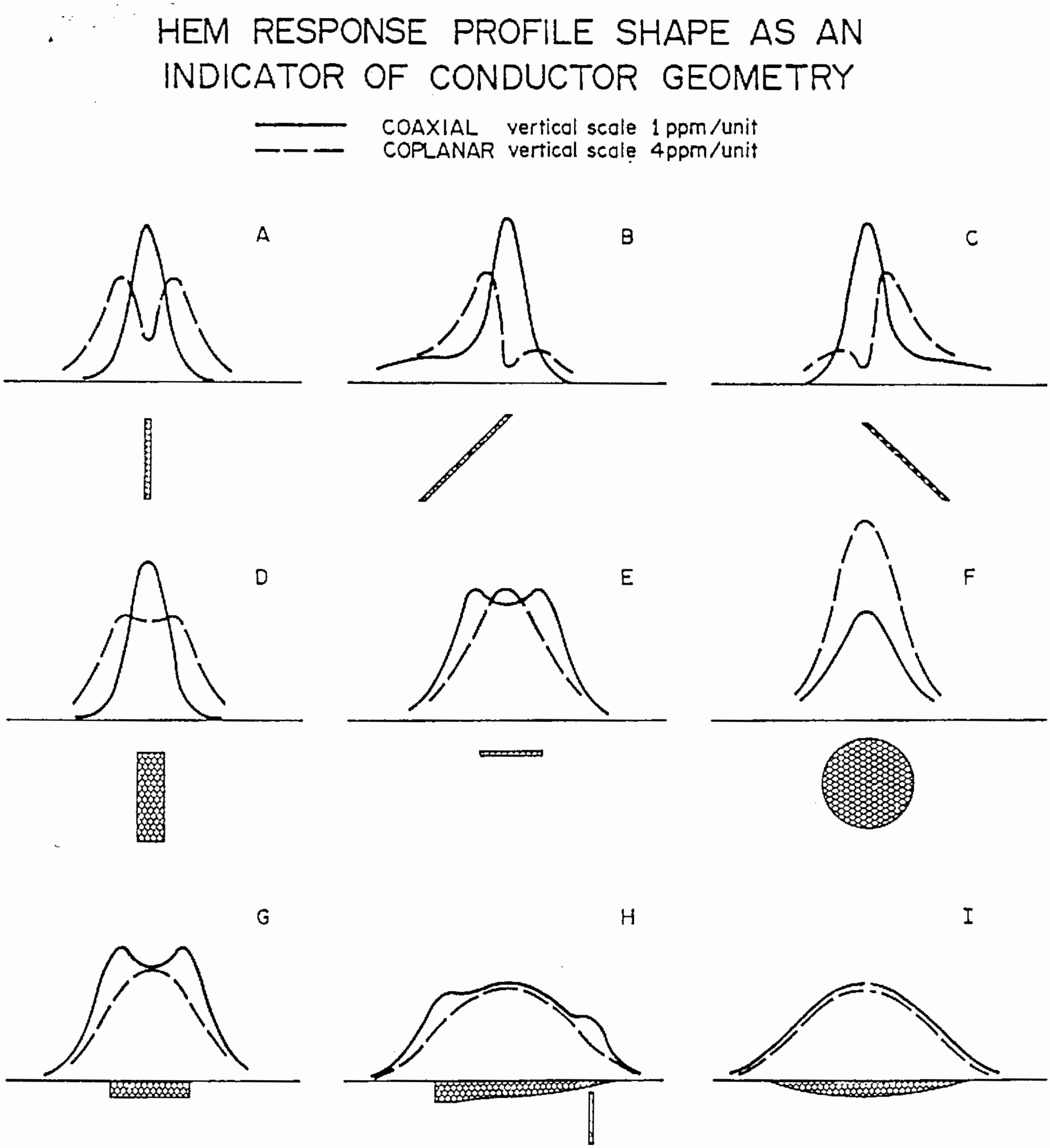

Figure 4: EM response shapes from simple conductor models.

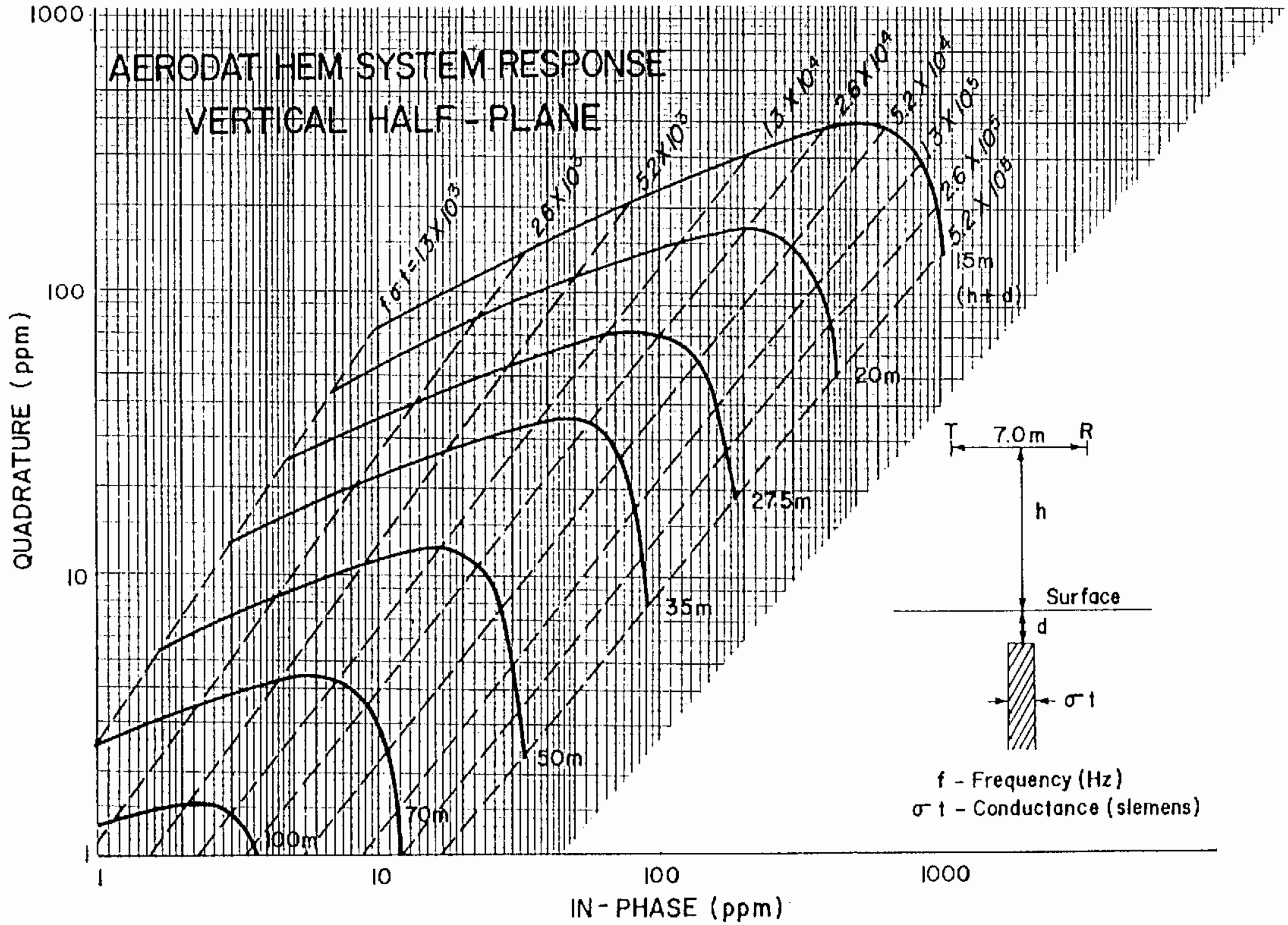

Figure 5: Phasor diagram for a vertical thin sheet conductor.

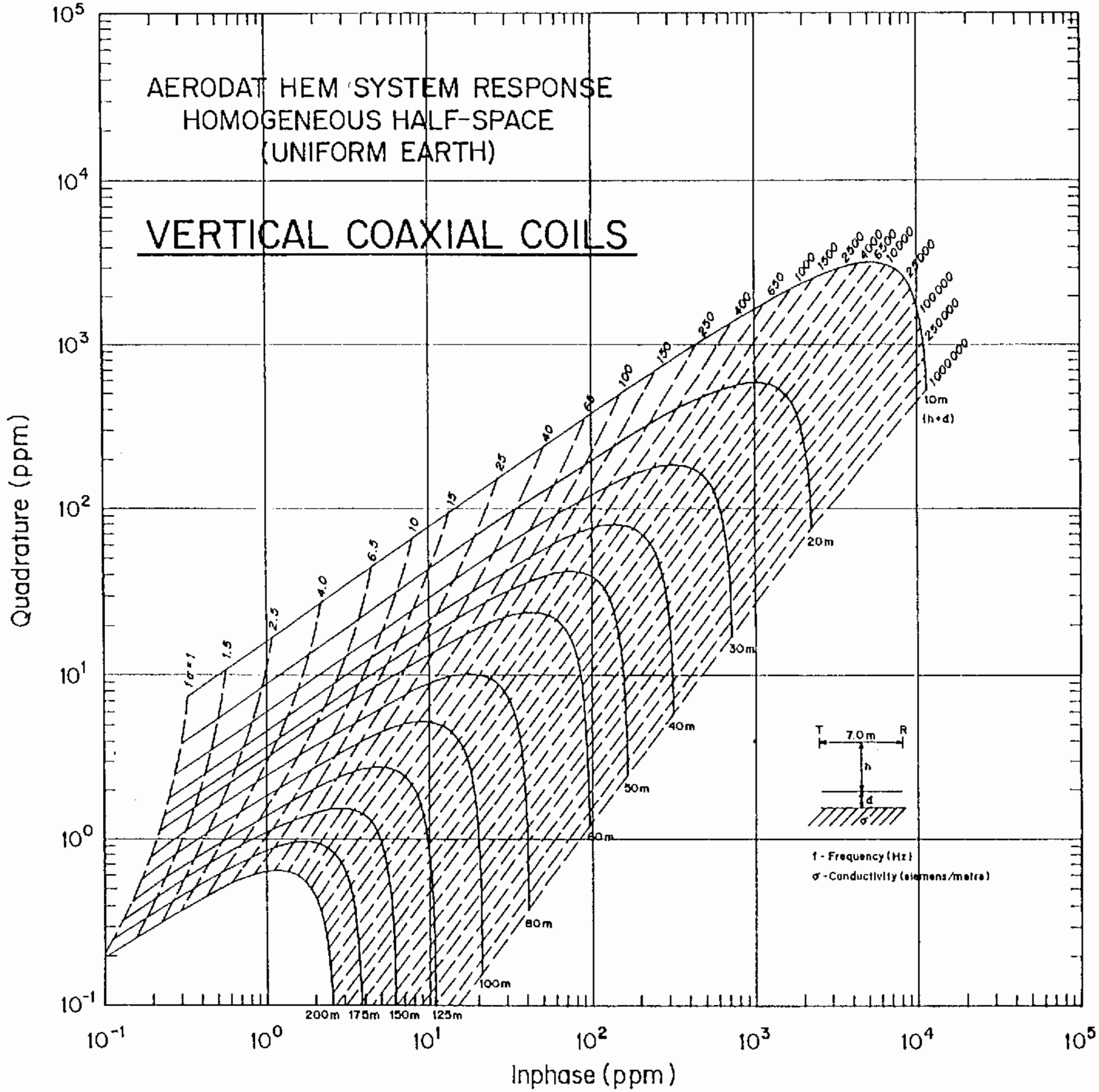

Figure 6: Phasor diagram for a homogeneous earth - coaxial coil geometry.

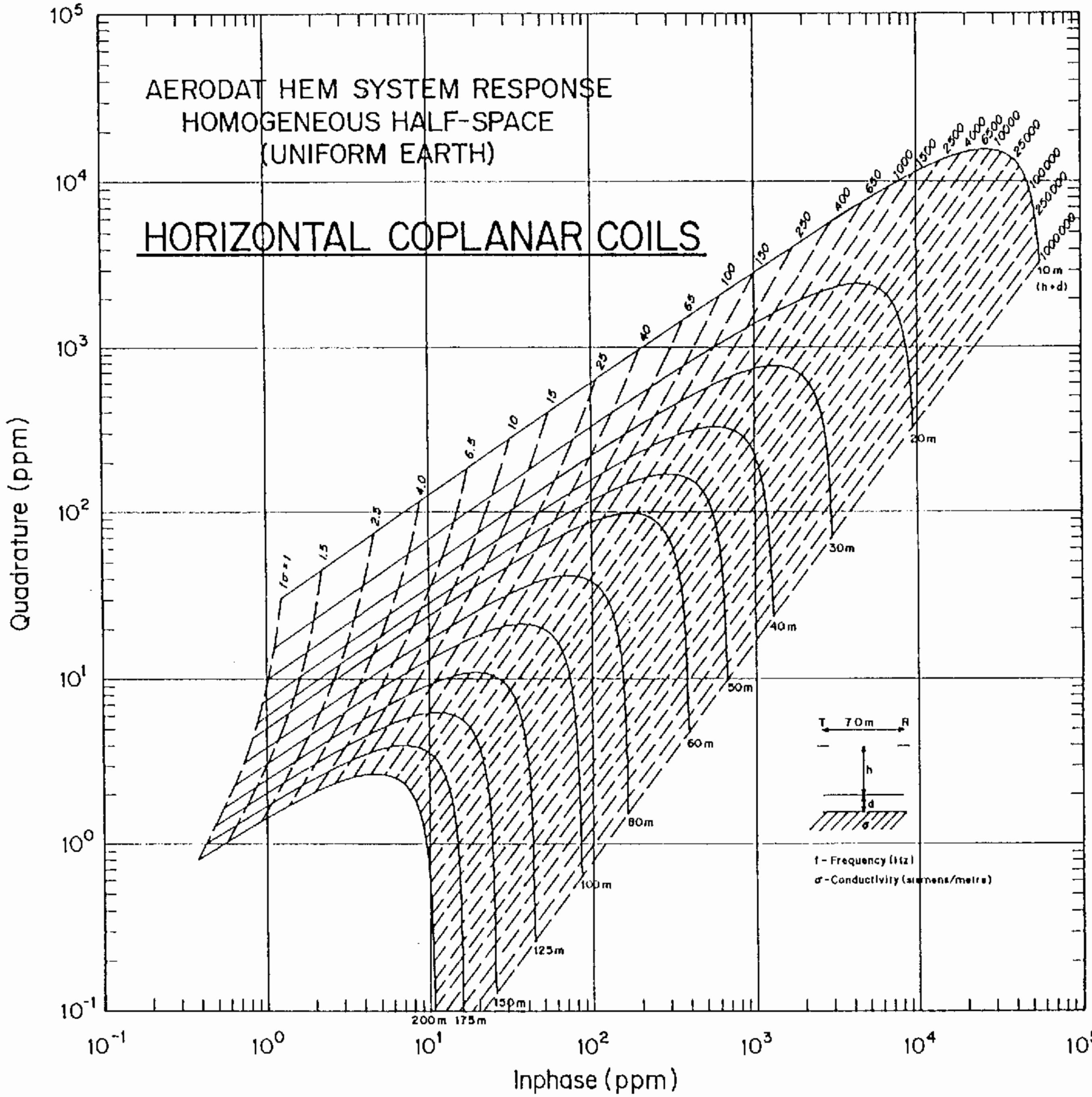

Figure 7: Phasor diagram for a homogeneous earth - coplanar coil geometry.

1. Potassium shows a zonal distribution which is consistent with current alteration models. Uranium and thorium may be zonally distributed but their relationship to established alteration zones is less clear.

2. Potassium highs are generally centrally located in the intrusive mass or ore-forming system.

3. Potassium is discernably more abundant by factors of 1.2 to 3 in mineralized stocks than in nearby temporally and chemically similar unmineralized stocks, while uranium and thorium are not significantly or systematically enriched.

4. The measured anomalies are as valid over undisturbed surface as they are in open pit mines.

5. Supergene enrichment mechanisms do not leach potassium sufficiently to eradicate potassium anomalies.

6. Radiometric measurement of potassium is a valid exploration tool in the search for porphyry base metal deposits. Analysis for uranium and thorium does not appear to be of any consistent value. Traverses over porphyry molybdenum deposits and airborne gamma-ray spectrometer surveys over both types should be carried out.

These conclusions, based on four deposits, support the use of airborne radiometrics in porphyry copper exploration. The potassium enrichment factor of 1.2 to 3 is interesting as the airborne response should be proportional to this factor. Airborne radiometric survey results should show 20 to 300% potassium anomalies of over mineralized stocks -relative to unmineralized intrusives.

Variations in radiometric response levels of 20 to 300% due to changes in rock type may be common, however, and highs on a potassium contour map are not all porphyries. A potassium high and coincident non-anomalous uranium or thorium may be a more diagnostic response. Radiometric ratio maps (K/Th or K/(U + Th)) or ternary maps would highlight only those locations of relative potassium enrichment and weed out radiometric anomalies where all three radioelements are equally anomalous.

4. Conclusions

Airborne geophysical surveys are useful in porphyry copper exploration. The most useful map products are of the total magnetic field (pole reduced if necessary), the calculated vertical magnetic gradient, apparent resistivity, potassium and relative potassium. The preferred signature is:

- a local total field low (may be within or near a broad regional magnetic high)
- an area of low magnetic relief (possible annular ring of magnetic highs)
- a resistivity low
- potassium enrichment (absolute and relative)

This combination of geophysical features may not apply in all cases and it cannot be applied blindly to all porphyry exploration programs. Deviations must be anticipated through an understanding of the local geology and porphyry deposit models.

Ian Johnson
Geonex Aerodat Inc.
February, 1993

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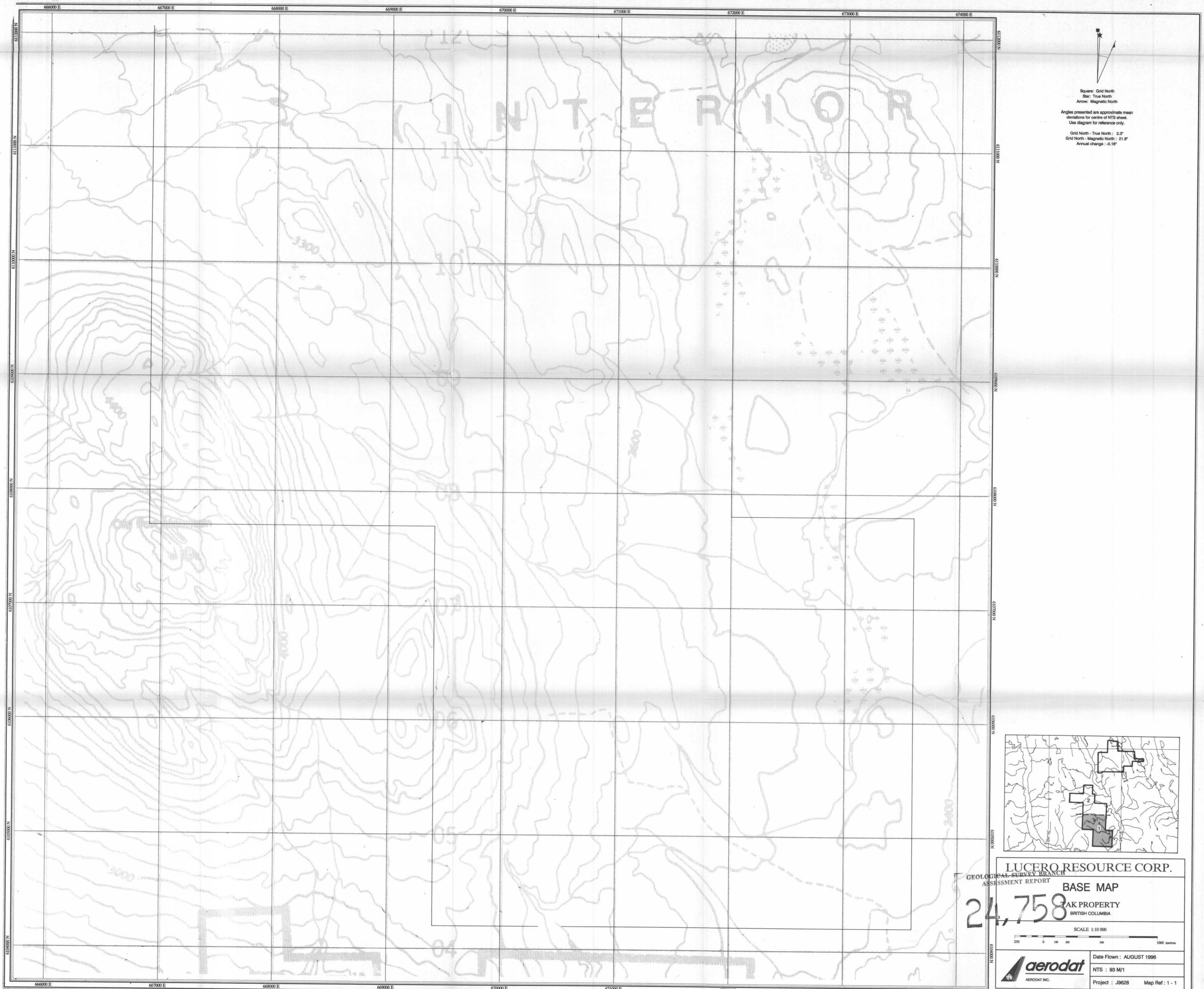


LUCERO RESOURCE CORP.

GEOLOGICAL SURVEY BRANCH
ASSESSMENT REPORT

24,758

BASE MAP

TAK PROPERTY
BRITISH COLUMBIA

SCALE 1:10 000

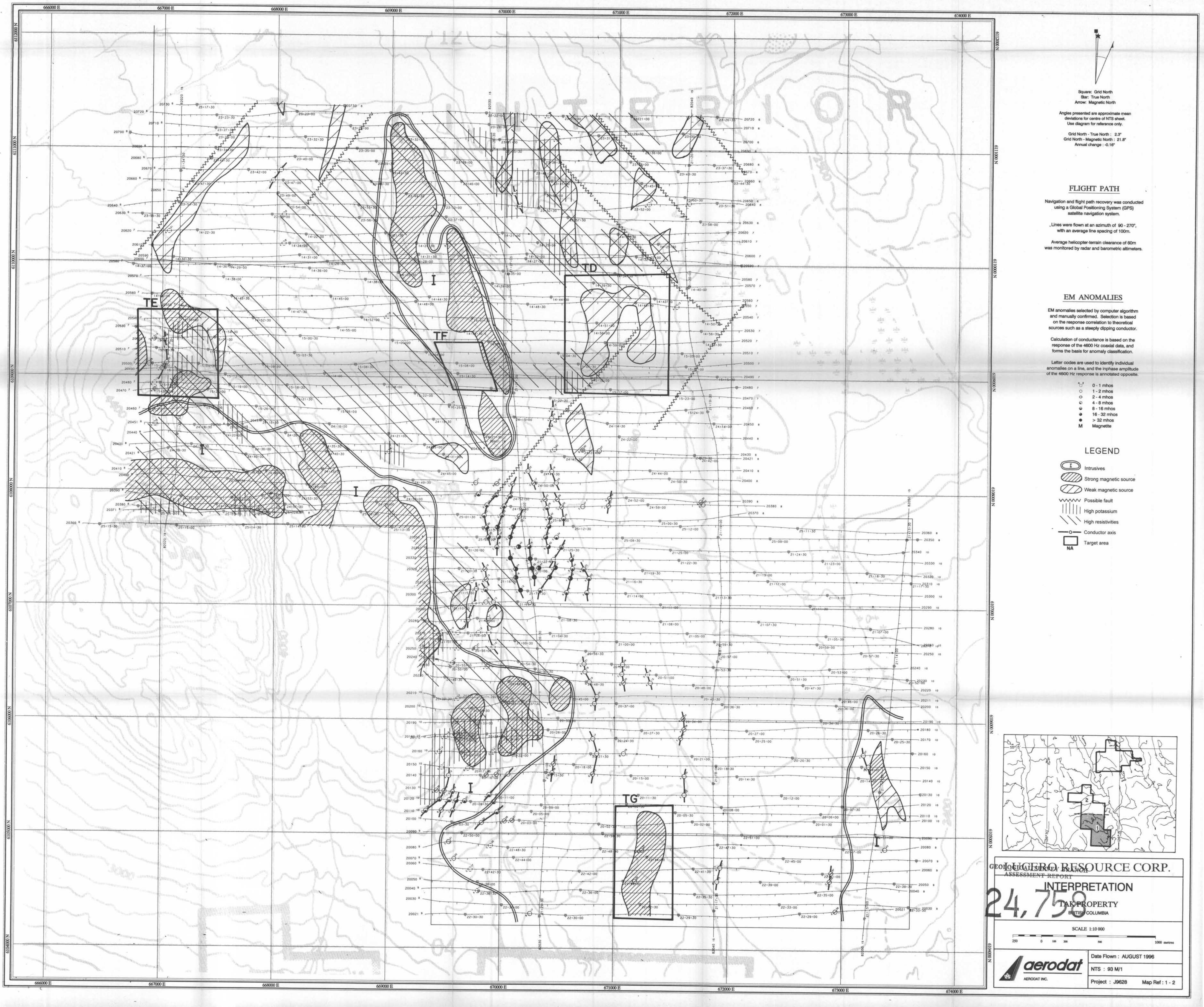
250 0 100 200 500 1000 metres

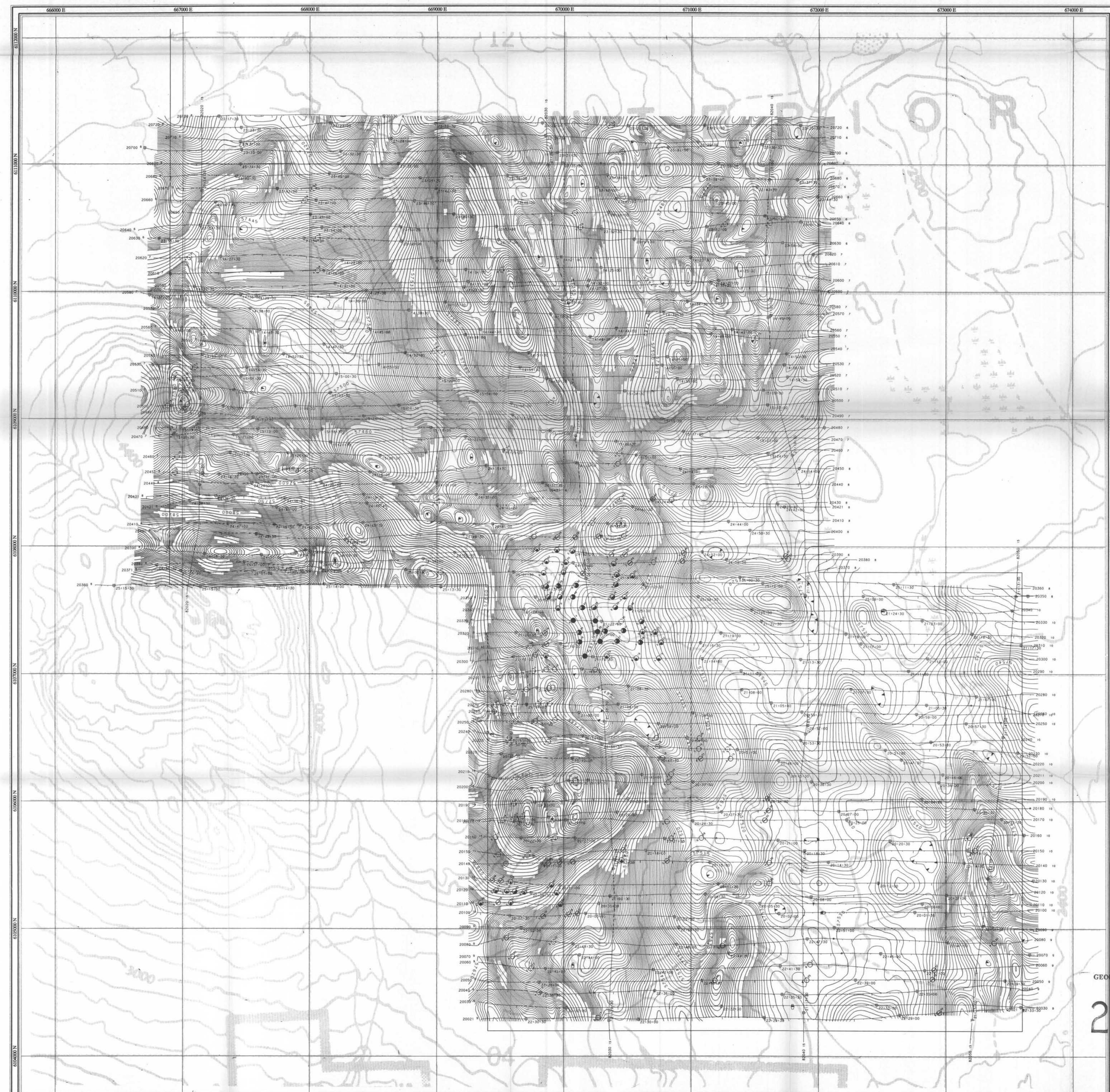
aerodat
AERODAT INC.

Date Flown : AUGUST 1996

NTS : 93 M/1

Project : J9628 Map Ref : 1 - 1


INTERIOR
TE
TF
TD
TG
Square: Grid North
Star: True North
Arrow: Magnetic North
Angles presented are approximate mean deviations for centre of NTS sheet. Use diagram for reference only.
Grid North - True North : 2.3°
Grid North - Magnetic North : 21.8°
Annual change : -0.16°
FLIGHT PATH
Navigation and flight path recovery was conducted using a Global Positioning System (GPS) satellite navigation system.
Lines were flown at an azimuth of 90 - 270°, with an average line spacing of 100m.
Average helicopter-terrain clearance of 60m was monitored by radar and barometric altimeters.
EM ANOMALIES
EM anomalies selected by computer algorithm and manually confirmed. Selection is based on the response correlation to theoretical sources such as a steeply dipping conductor.
Calculation of conductance is based on the response of the 4600 Hz coaxial data, and forms the basis for anomaly classification.
Letter codes are used to identify individual anomalies on a line, and the inphase amplitude of the 4600 Hz response is annotated opposite.
0 - 1 mhos
1 - 2 mhos
2 - 4 mhos
4 - 8 mhos
8 - 16 mhos
16 - 32 mhos
> 32 mhos
M Magnetite
LEGEND
Intrusives
Strong magnetic source
Weak magnetic source
Possible fault
High potassium
High resistivities
Conductor axis
Target area
NA
GEOLOGICAL SURVEY BRANCH
ASSESSMENT REPORT
24,758
LUCERO RESOURCE CORP.
INTERPRETATION
TAK PROPERTY
BRITISH COLUMBIA
SCALE 1:10 000
250 0 100 200 500 1000 metres
aerodat
AERODAT INC.
Date Flown : AUGUST 1996
NTS : 93 M/1
Project : J9628
Map Ref : 1 - 2



Square: Grid North
Star: True North
Arrow: Magnetic North

Angles presented are approximate mean deviations for centre of NTS sheet. Use diagram for reference only.

Grid North - True North : 2.3°
Grid North - Magnetic North : 21.8°
Annual change : -0.16°

TOTAL FIELD MAGNETICS

Total field magnetic intensity contour data, measured by a cesium high sensitivity magnetometer at an average sensor elevation of 45m, and corrected for diurnal variation.

Map contours are in nanoTeslas, and are multiples of those listed below:

1 nT
5 nT
25 nT
100 nT
500 nT

FLIGHT PATH

Navigation and flight path recovery was conducted using a Global Positioning System (GPS) satellite navigation system.

Lines were flown at an azimuth of 90 - 270°, with an average line spacing of 100m.

Average helicopter-terrain clearance of 60m was monitored by radar and barometric altimeters.

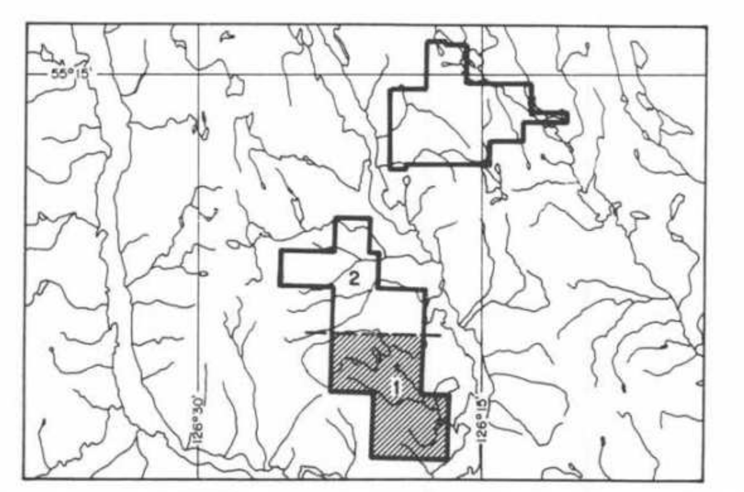
EM ANOMALIES

EM anomalies selected by computer algorithm and manually confirmed. Selection is based on the response correlation to theoretical sources such as a steeply dipping conductor.

Calculation of conductance is based on the response of the 4600 Hz coaxial data, and forms the basis for anomaly classification.

Letter codes are used to identify individual anomalies on a line, and the inphase amplitude of the 4600 Hz response is annotated opposite.

0 - 1 mhos
1 - 2 mhos
2 - 4 mhos
4 - 8 mhos
8 - 16 mhos
16 - 32 mhos
> 32 mhos
M Magnetite



LUCERO RESOURCE CORP.

GEOLOGICAL SURVEY BRANCH
ASSESSMENT REPORT

24,758

TOTAL FIELD MAGNETICS

TAK PROPERTY
BRITISH COLUMBIA

SCALE 1:10 000

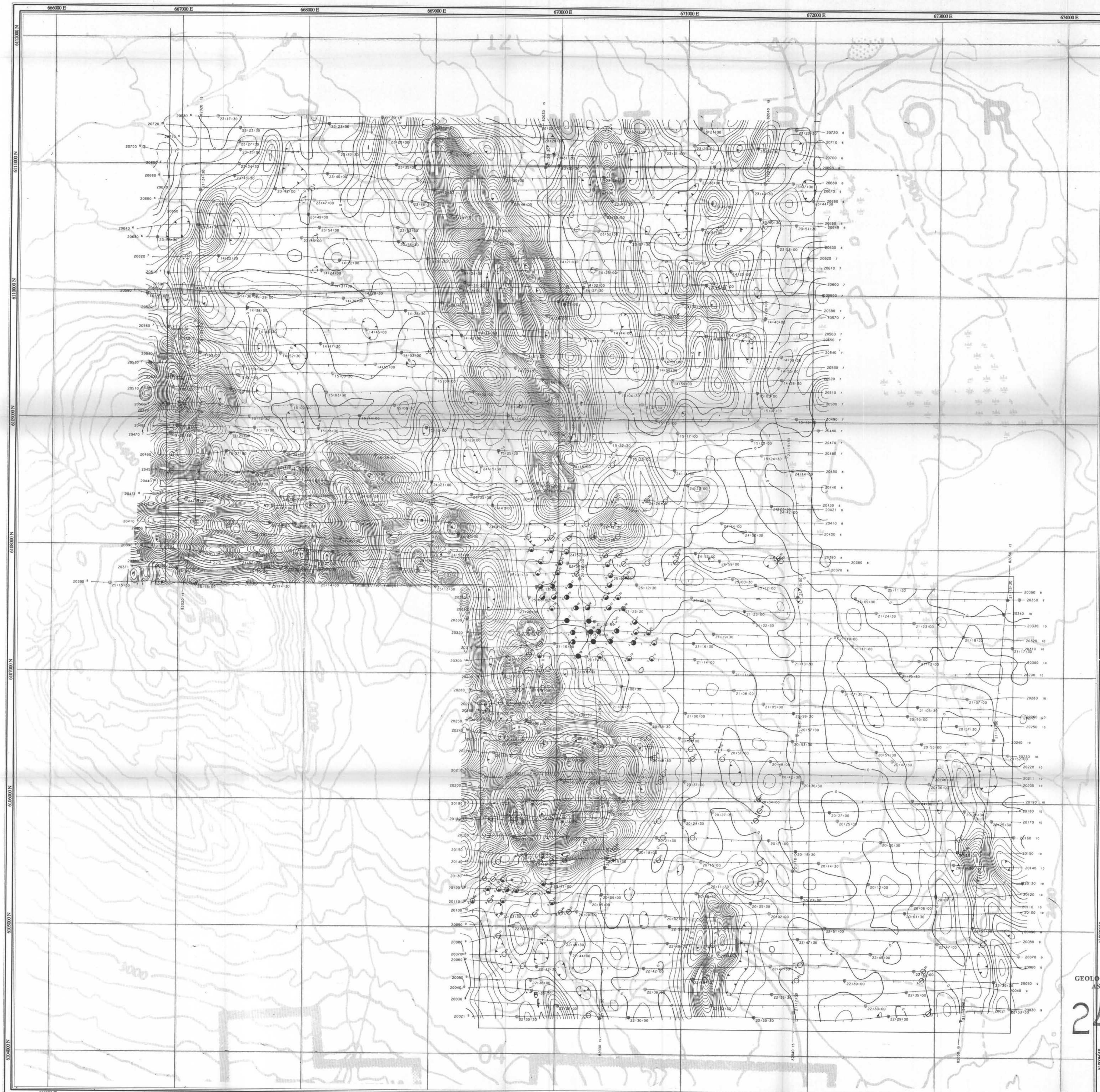
250 0 100 200 500 1000 metres

aerodat
AERODAT INC.

Date Flown : AUGUST 1996

NTS : 93 M/1

Project : J9628 Map Ref : 1 - 3



Square: Grid North
Star: True North
Arrow: Magnetic North

Angles presented are approximate mean deviations for centre of NTS sheet. Use diagram for reference only.

Grid North - True North : 2.3°
Grid North - Magnetic North : 21.8°
Annual change : -0.16°

VERTICAL GRADIENT

Vertical magnetic gradient contour data, calculated from the gridded total field magnetics data by an FFT algorithm.

Map contours are in nanoTeslas/metre, and are multiples of those listed below:

- 0.05 nT/m
- 0.25 nT/m
- 1.00 nT/m
- 5.00 nT/m
- 25.0 nT/m

FLIGHT PATH

Navigation and flight path recovery was conducted using a Global Positioning System (GPS) satellite navigation system.

Lines were flown at an azimuth of 90 - 270°, with an average line spacing of 100m.

Average helicopter-terrain clearance of 60m was monitored by radar and barometric altimeters.

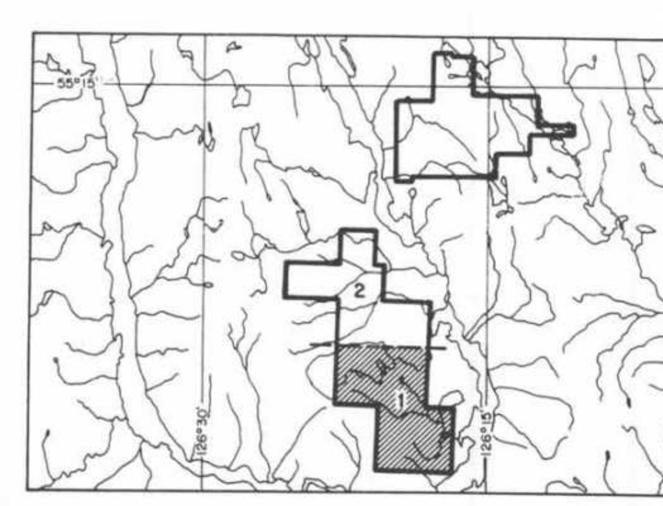
EM ANOMALIES

EM anomalies selected by computer algorithm and manually confirmed. Selection is based on the response correlation to theoretical sources such as a steeply dipping conductor.

Calculation of conductance is based on the response of the 4600 Hz coaxial data, and forms the basis for anomaly classification.

Letter codes are used to identify individual anomalies on a line, and the inphase amplitude of the 4600 Hz response is annotated opposite.

- 0 - 1 mhos
- 1 - 2 mhos
- 2 - 4 mhos
- 4 - 8 mhos
- 8 - 16 mhos
- 16 - 32 mhos
- > 32 mhos
- M Magnetite



LUCERO RESOURCE CORP.

VERTICAL MAGNETIC GRADIENT

TAK PROPERTY
BRITISH COLUMBIA

SCALE 1:10 000

250 0 100 200 500 1000 metres

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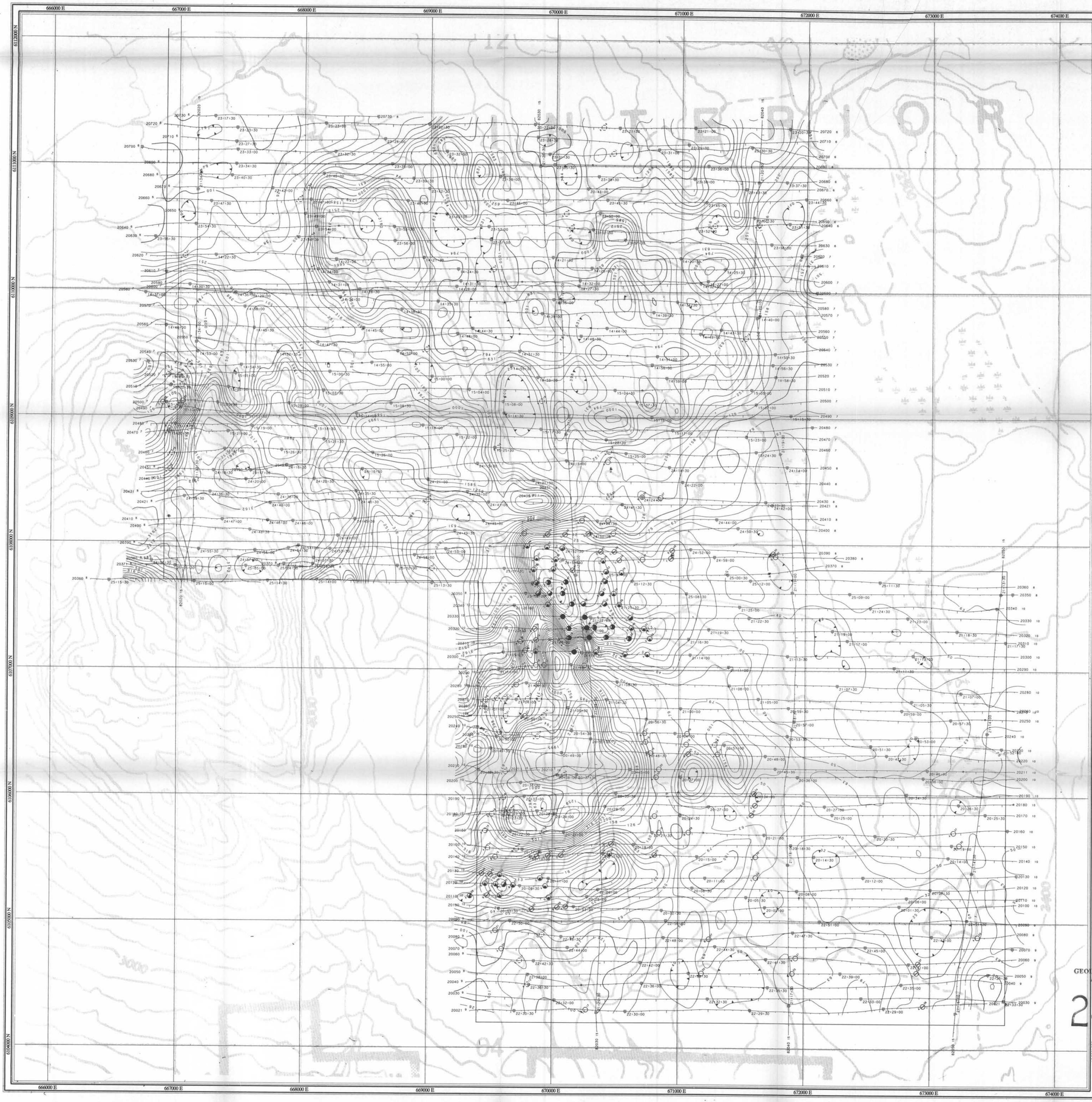
Date Flown : AUGUST 1996
NTS : 93 M/1
Project : J9628 Map Ref : 1 - 4

GEOLOGICAL SURVEY BRANCH
ASSESSMENT REPORT

24,758



Square: Grid North
Star: True North
Arrow: Magnetic North

Angles presented are approximate mean deviations for centre of NTS sheet. Use diagram for reference only.

Grid North - True North : 2.3°
Grid North - Magnetic North : 21.8°
Annual change : -0.16°

APPARENT RESISTIVITY

Apparent resistivity calculated from the measured 4600 Hz coaxial EM response, assuming a resistive half-space (200m) model. Average sensor elevation was 30m.

Map contours are in ohm·m, at logarithmic intervals, in multiples of those listed below:

0.1 log(ohm·m)
0.5 log(ohm·m)
2.0 log(ohm·m)

FLIGHT PATH

Navigation and flight path recovery was conducted using a Global Positioning System (GPS) satellite navigation system.

Lines were flown at an azimuth of 90 - 270°, with an average line spacing of 100m.

Average helicopter-terrain clearance of 60m was monitored by radar and barometric altimeters.

EM ANOMALIES

EM anomalies selected by computer algorithm and manually confirmed. Selection is based on the response correlation to theoretical sources such as a steeply dipping conductor.

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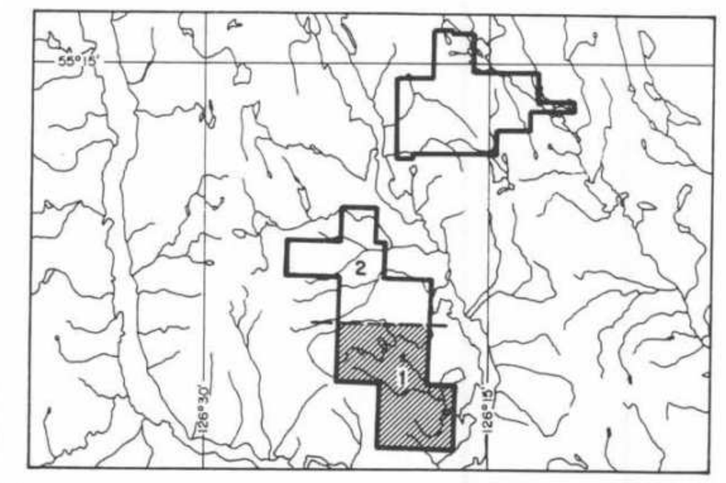
0 - 1 mhos
1 - 2 mhos
2 - 4 mhos
4 - 8 mhos
8 - 16 mhos
16 - 32 mhos
> 32 mhos
M Magnetite



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GEOLOGICAL SURVEY BRANCH
ASSESSMENT REPORT

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APPARENT RESISTIVITY

4600 Hz COAXIAL

TAK PROPERTY

BRITISH COLUMBIA

SCALE 1:10 000

250 0 100 200 500 1000 metres

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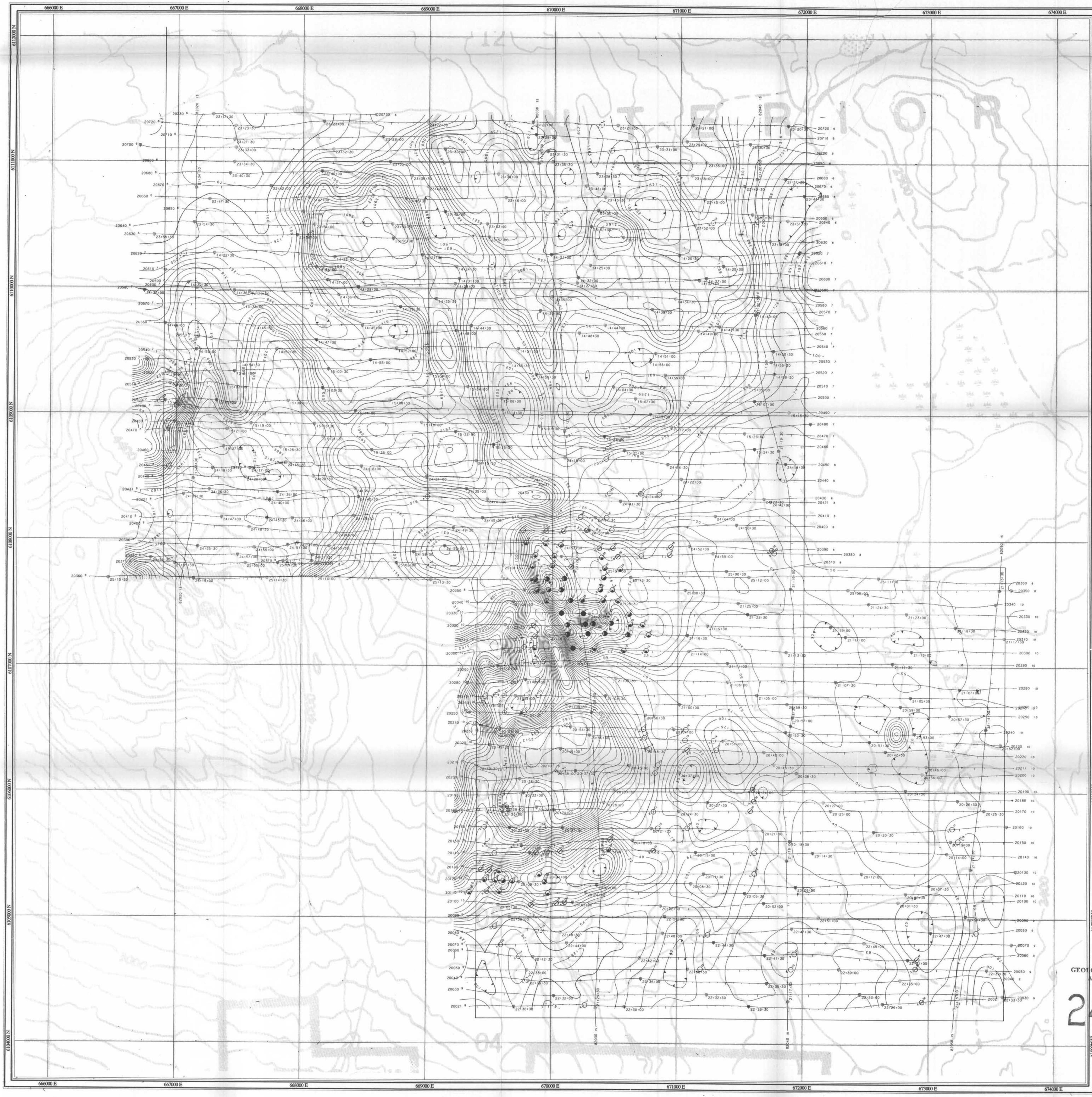
Date Flown : AUGUST 1996

NTS : 93 M/1

Project : J9628 Map Ref : 1 - 6



Angles presented are approximate mean deviations for centre of NTS sheet. Use diagram for reference only.

Grid North - True North : 2.3°
Grid North - Magnetic North : 21.8°
Annual change : -0.16°

APPARENT RESISTIVITY

Apparent resistivity calculated from the measured 4175 Hz coplanar EM response, assuming a resistive half-space (200m) model. Average sensor elevation was 30m.

Map contours are in ohm·m, at logarithmic intervals, in multiples of those listed below:

- 0.1 log(ohm·m)
- 0.5 log(ohm·m)
- 2.0 log(ohm·m)

FLIGHT PATH

Navigation and flight path recovery was conducted using a Global Positioning System (GPS) satellite navigation system.

Lines were flown at an azimuth of 90 - 270°, with an average line spacing of 100m.

Average helicopter-terrain clearance of 60m was monitored by radar and barometric altimeters.

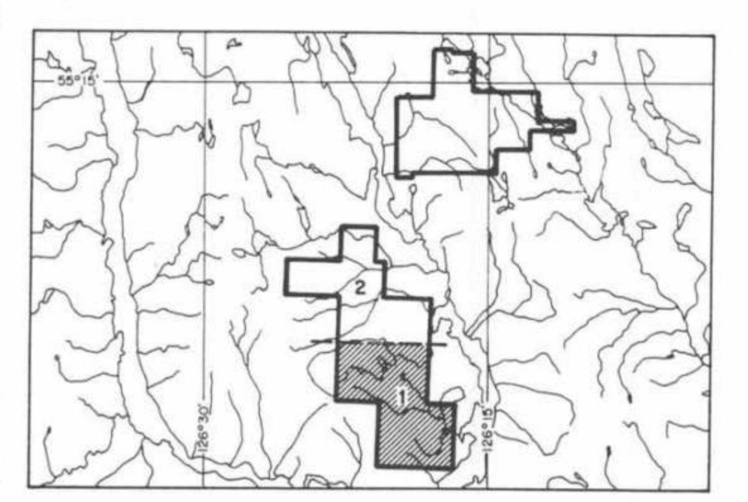
EM ANOMALIES

EM anomalies selected by computer algorithm and manually confirmed. Selection is based on the response correlation to theoretical sources such as a steeply dipping conductor.

Calculation of conductance is based on the response of the 4600 Hz coaxial data, and forms the basis for anomaly classification.

Letter codes are used to identify individual anomalies on a line, and the inphase amplitude of the 4600 Hz response is annotated opposite.

- 0 - 1 mhos
- 1 - 2 mhos
- 2 - 4 mhos
- 4 - 8 mhos
- 8 - 16 mhos
- 16 - 32 mhos
- > 32 mhos
- M Magnetite



LUCERO RESOURCE CORP.

APPARENT RESISTIVITY
4175 Hz COPLANAR

TAK PROPERTY
BRITISH COLUMBIA

GEOLOGICAL SURVEY BRANCH
ASSESSMENT REPORT

24,758

SCALE 1:10 000

250 0 100 200 500 1000 metres

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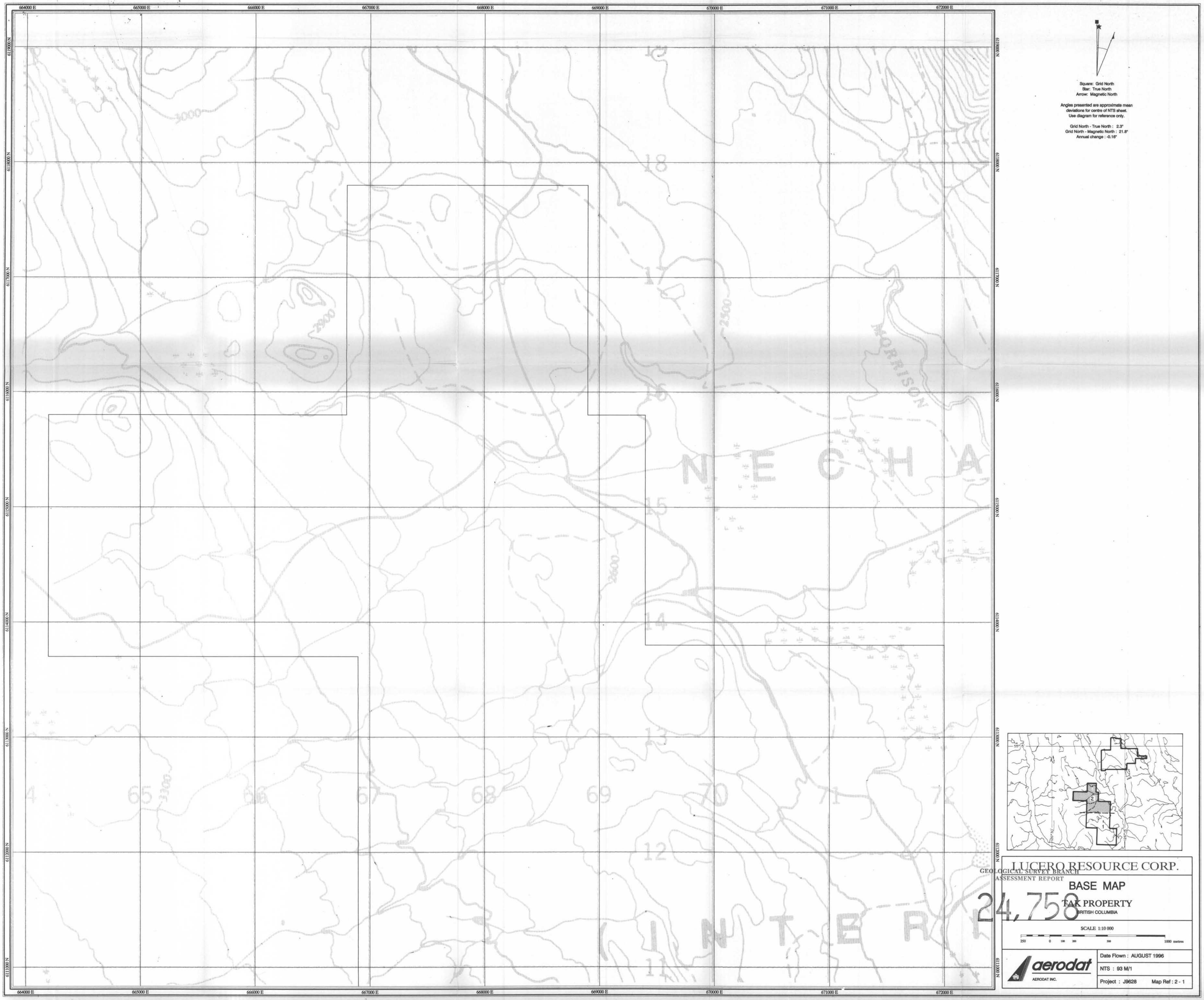
Date Flown : AUGUST 1996	
NTS : 93 M/1	
Project : J9628	Map Ref : 1 - 7



664000 E
665000 E
666000 E
667000 E
668000 E
669000 E
670000 E
671000 E
672000 E
6119000 N
6118000 N
6117000 N
6116000 N
6115000 N
6114000 N
6113000 N
6112000 N
6111000 N
Square: Grid North
Star: True North
Arrow: Magnetic North
Angles presented are approximate mean deviations for centre of NTS sheet. Use diagram for reference only.
Grid North - True North : 2.3°
Grid North - Magnetic North : 21.8°
Annual change : -0.18°
3000
2900
2500
2600
3300
MORRISON
N E C H A
I N T E R I
LUCERO RESOURCE CORP.
GEOLOGICAL SURVEY BRANCH
ASSESSMENT REPORT
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BASE MAP
TAK PROPERTY
BRITISH COLUMBIA
SCALE 1:10 000
1000 metres
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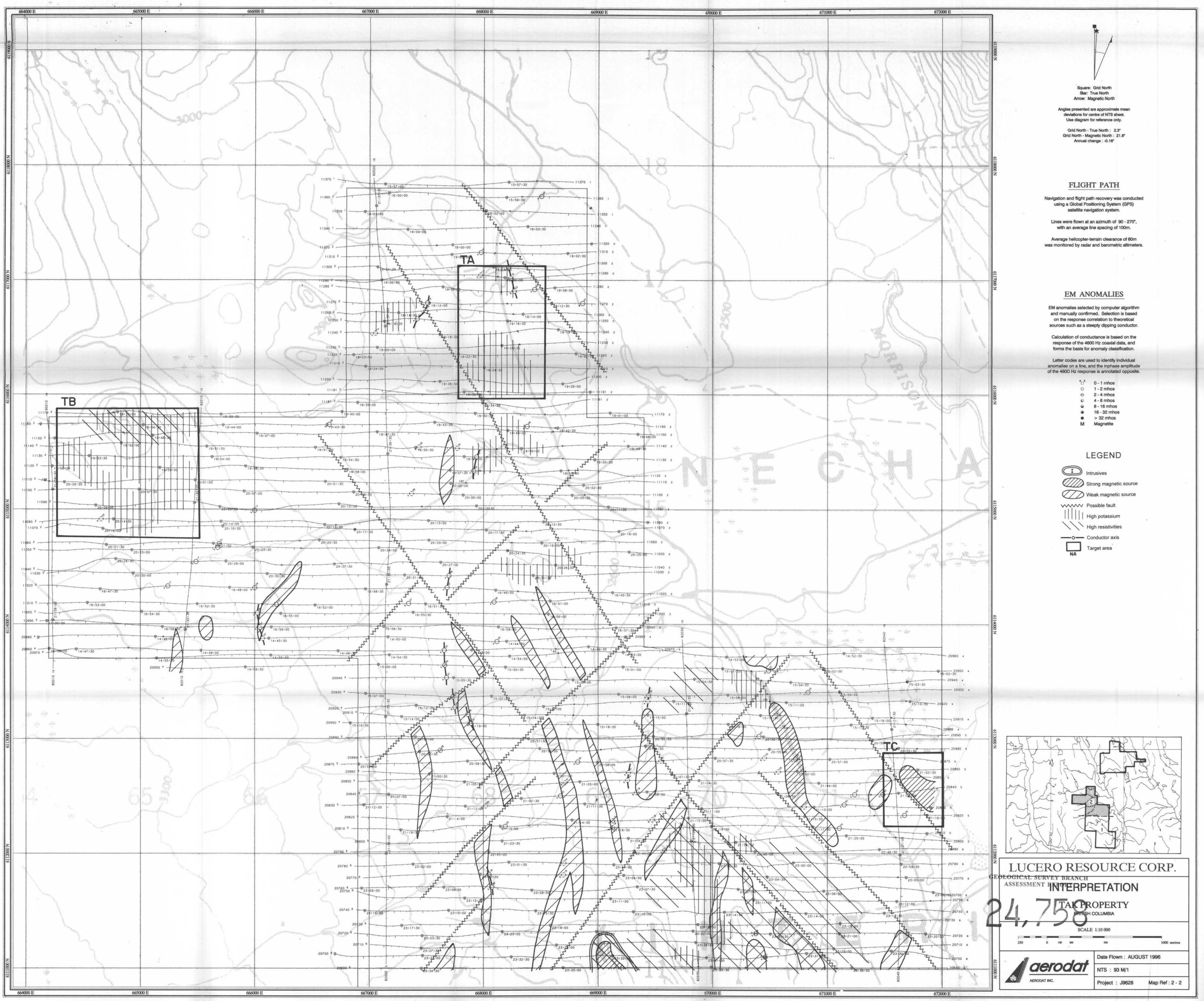
Date Flown : AUGUST 1996
NTS : 93 M/1
Project : J9628
Map Ref : 2 - 1


TA
TB
TC
NECHA
MORRISON
Square: Grid North
Star: True North
Arrow: Magnetic North
Angles presented are approximate mean deviations for centre of NTS sheet. Use diagram for reference only.
Grid North - True North : 2.3°
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Annual change : -0.16°
FLIGHT PATH
Navigation and flight path recovery was conducted using a Global Positioning System (GPS) satellite navigation system.
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0 - 1 mhos
1 - 2 mhos
2 - 4 mhos
4 - 8 mhos
8 - 16 mhos
16 - 32 mhos
> 32 mhos
M Magnetite
LEGEND
Intrusives
Strong magnetic source
Weak magnetic source
Possible fault
High potassium
High resistivities
Conductor axis
Target area
NA
LUCERO RESOURCE CORP.
GEOLOGICAL SURVEY BRANCH
ASSESSMENT REPORT
INTERPRETATION
24,758
TAK PROPERTY
BRITISH COLUMBIA
SCALE 1:10 000
250 0 100 200 500 1000 metres
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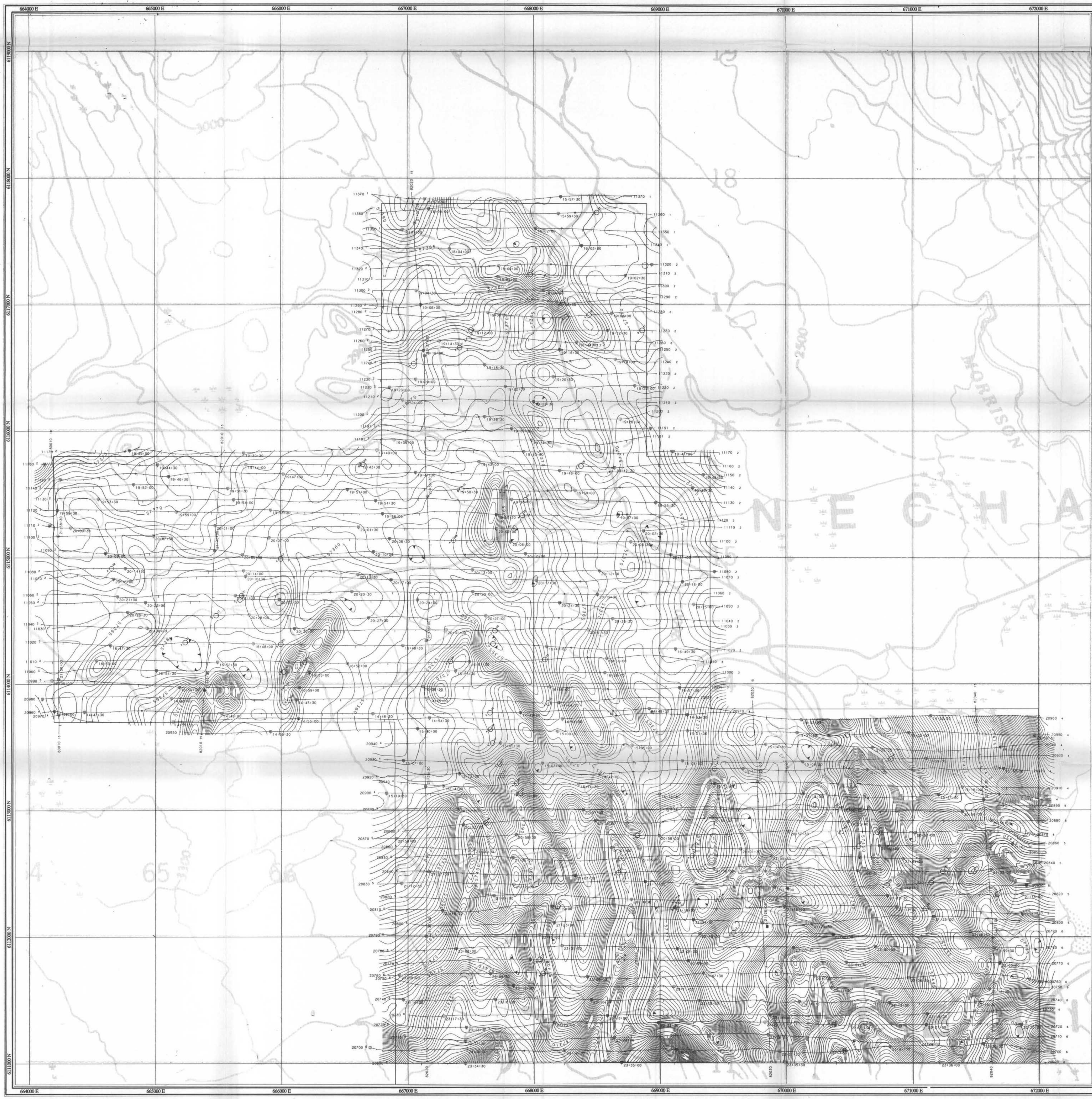
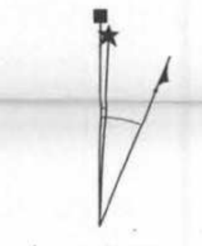
Date Flown : AUGUST 1996
NTS : 93 M/1
Project : J9628
Map Ref : 2 - 2





Square: Grid North
Star: True North
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Grid North - True North : 2.3°
Grid North - Magnetic North : 21.8°
Annual change : -0.16°

TOTAL FIELD MAGNETICS

Total field magnetic intensity contour data, measured by a cesium high sensitivity magnetometer at an average sensor elevation of 45m, and corrected for diurnal variation.

Map contours are in nanoTeslas, and are multiples of those listed below:

1 nT
5 nT
25 nT
100 nT
500 nT

FLIGHT PATH

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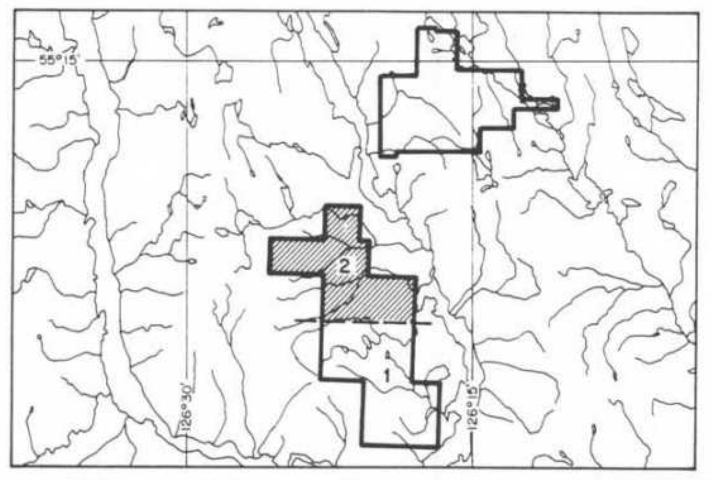
4 - 8 mhos
8 - 16 mhos
16 - 32 mhos
> 32 mhos
M Magnetite



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GEOLOGICAL SURVEY BRANCH
ASSESSMENT REPORT

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TOTAL FIELD MAGNETICS

TAK PROPERTY
BRITISH COLUMBIA

SCALE 1:10 000

250 0 100 200 500 1000 metres

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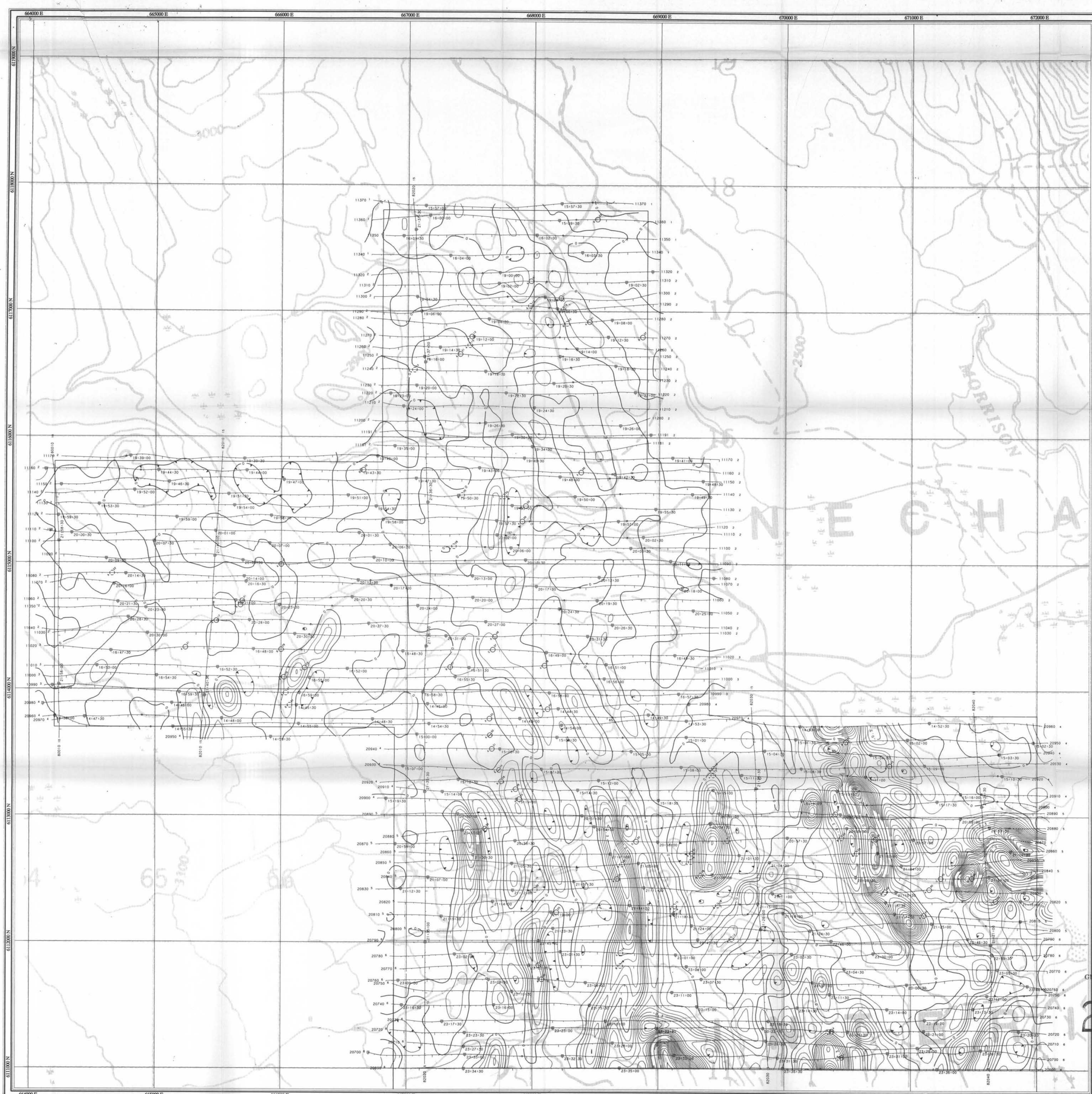
Date Flown : AUGUST 1996

NTS : 93 M/1

Project : J9628 Map Ref : 2 - 3



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Grid North - Magnetic North : 21.8°
Annual change : -0.16°

VERTICAL GRADIENT

Vertical magnetic gradient contour data, calculated from the gridded total field magnetics data by an FFT algorithm.

Map contours are in nanoTeslas/metre, and are multiples of those listed below:

0.05 nT/m
0.25 nT/m
1.00 nT/m
5.00 nT/m
25.0 nT/m

FLIGHT PATH

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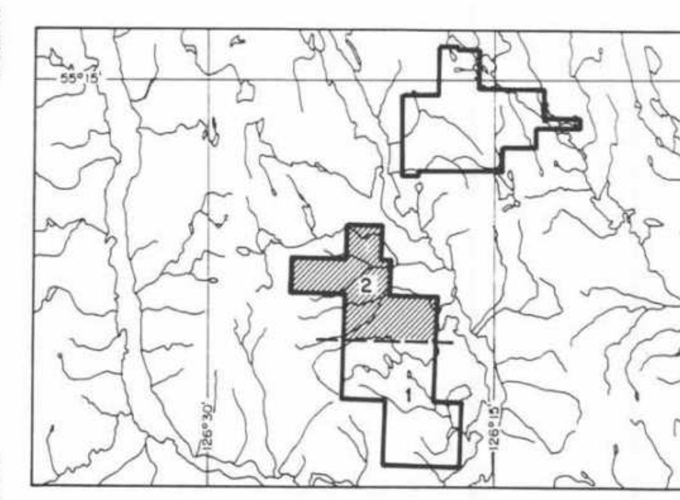
16 - 32 mhos
> 32 mhos
M Magnetite



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GEOLOGICAL SURVEY BRANCH
ASSESSMENT REPORT

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VERTICAL MAGNETIC GRADIENT

TAK PROPERTY
BRITISH COLUMBIA

SCALE 1:10 000

250 0 100 200 500 1000 metres

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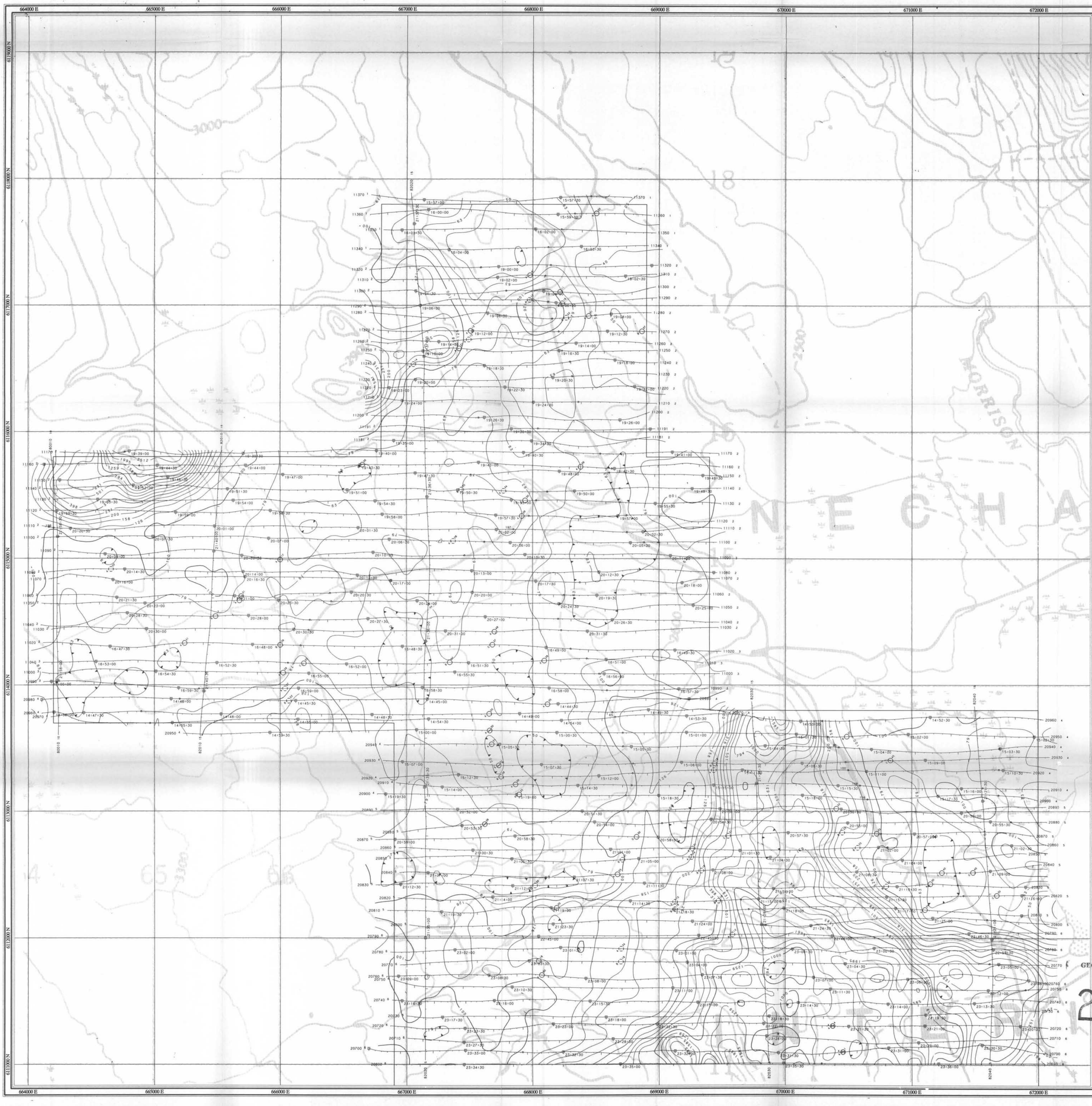
Date Flown : AUGUST 1996
NTS : 93 M/1
Project : J9628 Map Ref : 2 - 4



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APPARENT RESISTIVITY

Apparent resistivity calculated from the measured 4600 Hz coaxial EM response, assuming a resistive half-space (200m) model. Average sensor elevation was 30m.

Map contours are in ohm-m, at logarithmic intervals, in multiples of those listed below:

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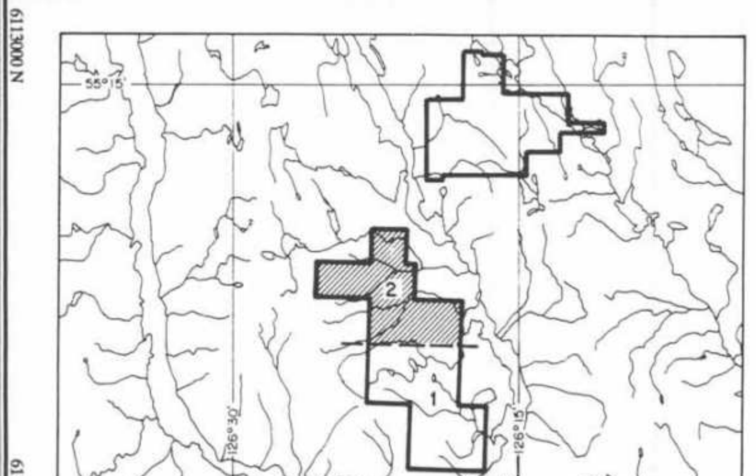
> 32 mhos
M Magnetite



LUCERO RESOURCE CORP.

APPARENT RESISTIVITY
4600 Hz COAXIAL

TAK PROPERTY
BRITISH COLUMBIA

SCALE 1:10 000

250 0 100 200 500 1000 metres

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Date Flown : AUGUST 1996
NTS : 93 M/1
Project : J9628 Map Ref : 2 - 6