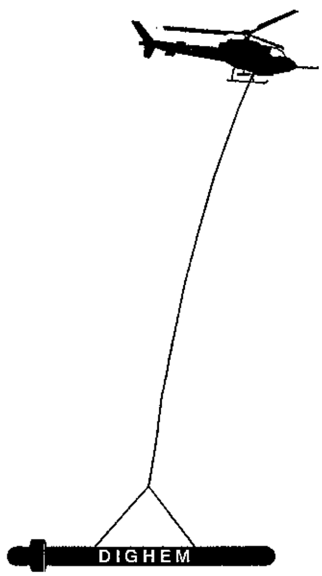
Report #1318

093989

DIGHEM[V] SURVEY FOR INTERNATIONAL BARYTEX RESOURCES LTD. BARB PROPERTY-FRANCES LAKE YUKON

NTS 105H/6,11



Geoterrex-Dighem, A division of CGG Canada Ltd.
Mississauga, Ontario
September 30, 1998

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1 of 2

This report has been examined by
the Geological Evaluation Unit
under Section 53 (4) Yukon Quartz
Mining Act and is allowed as
representation work in the amount
of $ 21,000.

for Regional Manager, Exploration and
Geological Services for Commissioner
of Yukon Territory.

SUMMARY

This report describes the logistics and results of a DIGHEM^V airborne geophysical survey carried out for International Barytex Resources Ltd., over the Barb property located near Frances Lake, Yukon. Total coverage of the survey block amounted to 172 km. The survey was flown from September 5 to September 6, 1998.

The purpose of the survey was to detect zones of conductive mineralization and to provide information that could be used to map the geology and structure of the survey area. This was accomplished by using a DIGHEM^V multi-coil, multi-frequency electromagnetic system, supplemented by a high sensitivity cesium magnetometer. The information from these sensors was processed to produce maps which display the magnetic and conductive properties of the survey area. A GPS electronic navigation system ensured accurate positioning of the geophysical data with respect to the base maps. Visual flight path recovery techniques were used to confirm the location of the helicopter where visible topographic features could be identified on the ground.

The survey property contains several anomalous features which are considered to be of moderate to high priority as exploration targets. Most of the inferred bedrock conductors appear to warrant further investigation using appropriate surface exploration techniques. Areas of interest may be assigned priorities on the basis of supporting geophysical, geochemical and/or

geological information. After initial investigations have been carried out, it may be necessary to re-evaluate the remaining anomalies based on information acquired from the follow-up program.

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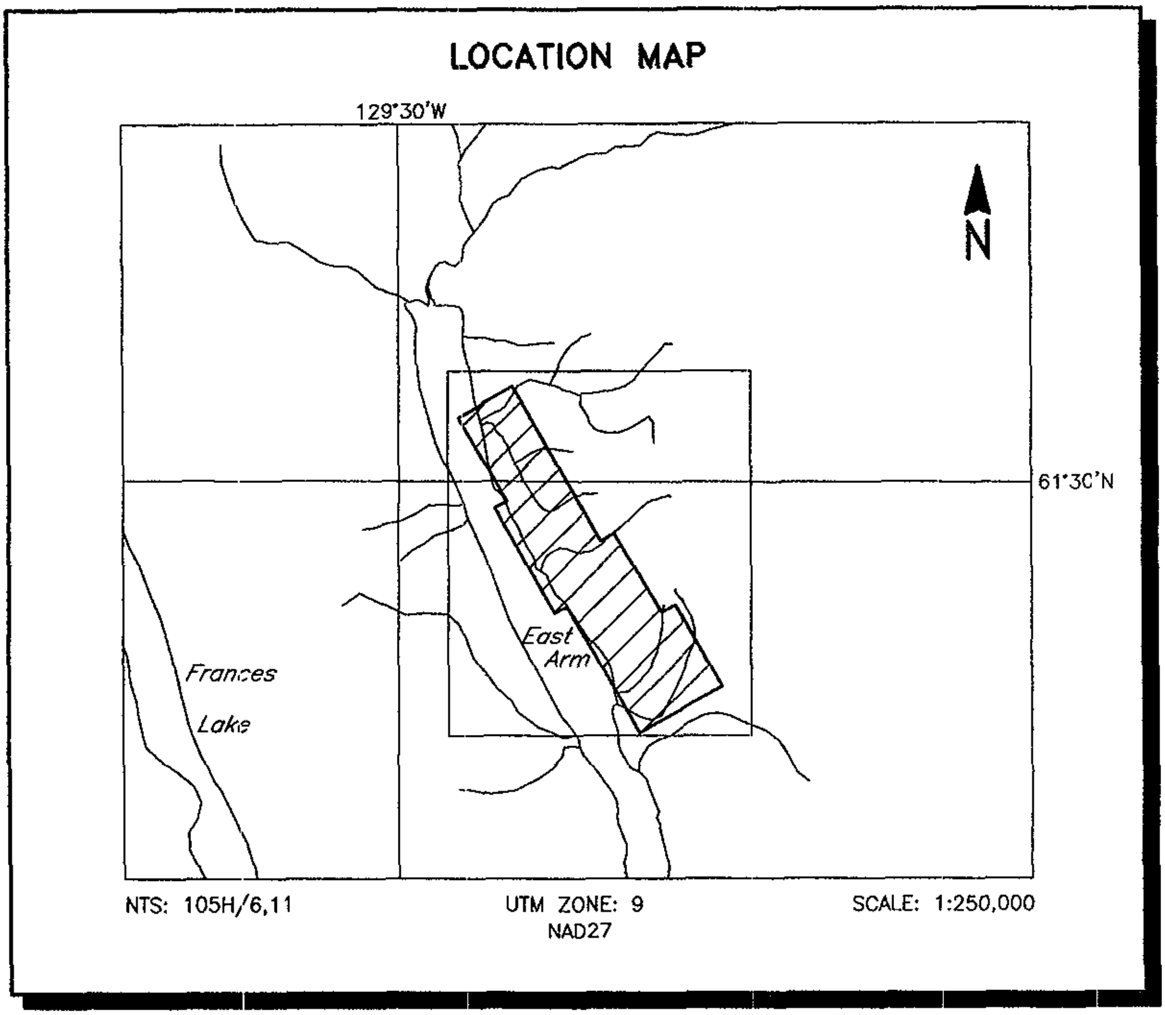

FIGURE 1
INTERNATIONAL BARYTEX RESOURCES LTD.
BARB PROPERTY-FRANCES LAKE, YUKON
JOB #1318

INTRODUCTION

A DIGHEM^V electromagnetic/resistivity/magnetic survey was flown for International Barytex Resources Ltd., from September 5 to September 6, 1998, over a survey block located near Frances[1] Lake, Yukon. The survey area can be located on NTS map sheets 105H/6,11 (Figure 1).

Survey coverage consisted of approximately 172 line-km, including tie lines. Flight lines were flown in an azimuthal direction of 60° with a line separation of 200 metres.

The survey employed the DIGHEM^V electromagnetic system. Ancillary equipment consisted of a magnetometer, radar altimeter, pressure sensor, video camera, analog and digital recorders, and an electronic navigation system. The instrumentation was installed in an AS350B turbine helicopter (Registration CG-JIX) which was provided by Questral Helicopters Ltd. The helicopter flew at an average airspeed of 100 km/h with an EM and magnetic sensor height of approximately 30 m.

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[1] The spelling of "Frances" used on the maps and report is taken from the government topographic map sheets.

Section 2 provides details on the survey equipment, the data channels, their respective sensitivities, and the navigation/flight path recovery procedure. Noise levels of less than 2 ppm are generally maintained for wind speeds up to 35 km/h. Higher winds may cause the system to be grounded because excessive bird swinging produces difficulties in flying the helicopter. The swinging results from the 5 m^2 of area which is presented by the bird to broadside gusts.

In some portions of the survey area, the steep topography forced the pilot to exceed normal terrain clearance for reasons of safety. It is possible that some weak conductors may have escaped detection in areas where the bird height exceeded 120 m. In difficult areas where near-vertical climbs were necessary, the forward speed of the helicopter was reduced to a level which permitted excessive bird swinging. This problem, combined with the severe stresses to which the bird was subjected, gave rise to aerodynamic noise levels which are slightly higher than normal on some lines. Where warranted, reflights were carried out to minimize these adverse effects.

SURVEY EQUIPMENT

This section provides a brief description of the geophysical instruments used to acquire the survey data and the calibration procedures employed.

Electromagnetic System

Model: DIGHEM^V

Type: Towed bird, symmetric dipole configuration operated at a nominal survey altitude of 30 metres. Coil separation is 8 metres for 900 Hz, 5500 Hz and 7200 Hz, and 6.3 metres for the 56,000 Hz coil-pair.

Coil orientations/frequencies:

orientation	nominal	actual
coaxial /	900 Hz	1,052 Hz
coplanar /	900 Hz	881 Hz
coaxial /	5,500 Hz	5,487 Hz
coplanar /	7,200 Hz	7,323 Hz
coplanar /	56,000 Hz	56,120 Hz

Channels recorded:
5 inphase channels
5 quadrature channels
2 monitor channels

Sensitivity:
0.06 ppm at 900 Hz
0.10 ppm at 5,500 Hz
0.10 ppm at 7,200 Hz
0.30 ppm at 56,000 Hz

Sample rate: 10 per second, equivalent to 1 sample every 3 m, at a survey speed of 110 km/h.

The electromagnetic system utilizes a multi-coil coaxial/coplanar technique to energize conductors in different directions. The coaxial coils are vertical with their axes in the flight direction. The coplanar coils are horizontal. The secondary fields are sensed simultaneously by means of receiver coils which are maximum coupled to their respective transmitter coils. The system yields an inphase and a quadrature channel from each transmitter-receiver coil-pair.

The Dighem calibration procedure involves four stages; primary field bucking, phase calibration, gain calibration, and zero adjust. At the beginning of the survey, the primary field at each receiver coil is cancelled, or "bucked out", by precise positioning of five bucking coils.

The phase calibration adjusts the phase angle of the receiver to match that of the transmitter. A ferrite bar, which produces a purely in-phase anomaly, is positioned near each receiver coil. The bar is rotated from minimum to maximum field coupling and the responses for the in-phase and quadrature components for each coil pair/frequency are measured. The phase of the response is adjusted at the console to return an in-phase only response for each coil-pair. Phase checks are performed daily.

The gain calibration uses external coils designed to produce an equal response on in-phase and quadrature components for each frequency/coil-pair. The coil parameters and distances are designed to produce pre-determined responses at the receiver, due to the current induced in the calibration coil by the transmitter when a switch closes the loop at the coil. The gain at the console is adjusted to yield secondary responses of exactly 100 ppm. Gain calibrations are carried out at the beginning and end of the survey.

The phase and gain calibrations each measure a relative change in the secondary field, rather than an absolute value. This removes any dependency of the calibration procedure on the secondary field due to the ground, except under circumstances of extreme ground conductivity.

During each survey flight, internal (Q-coil) calibration signals are generated to recheck system gain and to establish zero reference levels. These calibrations are carried out at intervals of approximately 20 minutes with the system out of ground effect. At a sensor height of more than 250 m, there is no measurable secondary field from the earth. The remaining residual is therefore established as the zero level of the system. Linear system drift is automatically removed by re-establishing zero levels between the Q-coil calibrations.

Magnetometer

Model:	Picodas 3340 or MEP-710 processor with Geometrics G822 or G823 or Scintrex CS2 sensor
Type:	Optically pumped cesium vapour
Sensitivity:	0.01 nT
Sample rate:	10 per second

The magnetometer sensor is housed in the EM bird, 30 m below the helicopter.

Magnetic Base Station

Model:	GEM Systems GSM-19T
Type:	Digital recording proton precession
Sensitivity:	0.10 nT
Sample rate:	0.2 per second

Model:	Picodas MEP-710 processor with Geometrics G822 or G823 or Scintrex CS2 sensor
Type:	Digital recording cesium vapour

Sensitivity:	0.01 nT
Sample rate:	1 per second

Two base stations were operated simultaneously to ensure coverage. A digital recorder is operated in conjunction with each base station magnetometer to record the diurnal variations of the earth's magnetic field. The clock of each base station is synchronized with that of the airborne system to permit subsequent removal of diurnal drift.

Radar Altimeter

Manufacturer:	Honeywell/Sperry
Model:	AA 330
Type:	Short pulse modulation, 4.3 GHz
Sensitivity:	0.3 m

The radar altimeter measures the vertical distance between the helicopter and the ground. This information is used in the processing algorithm which determines conductor depth.

Barometric Pressure and Temperature Sensors

Model:	DIGHEM D 1300	
Type:	Motorola MPX4115AP analog pressure sensor AD592AN high-impedance remote temperature sensors	
Sensitivity:	Pressure: Temperature:	150 mV/kPa 100 mV/°C or 10 mV/°C (selectable)
Sample rate:	10 per second	

The D1300 circuit is used in conjunction with one barometric sensor and up to three temperature sensors. Two sensors (baro and temp) are installed in the EM console in the aircraft, to monitor internal operating temperatures. At least one other temperature sensor is located in the EM bird to record temperature variations at the receiver coils.

The information is recorded by the digital acquisition system, but is not displayed on the analog chart records.

Analog Recorder

Manufacturer:	RMS Instruments
Type:	DGR33 dot-matrix graphics recorder

Resolution: 4x4 dots/mm

Speed: 1.5 mm/sec

The analog profiles are recorded on chart paper in the aircraft during the survey. Table 2-1 lists the geophysical data channels and the vertical scale of each profile.

Table 2-1. The Analog Profiles

Channel Name	Parameter	Scale units/mm	Designation on Digital Profile
1X9I	coaxial inphase (900 Hz)	2.5 ppm	CXI (900 Hz)
1X9Q	coaxial quad (900 Hz)	2.5 ppm	CXQ (900 Hz)
3P9I	coplanar inphase (900 Hz)	2.5 ppm	CPI (900 Hz)
3P9Q	coplanar quad (900 Hz)	2.5 ppm	CPQ (900 Hz)
2P7I	coplanar inphase (7200 Hz)	5 ppm	CPI (7200 Hz)
2P7Q	coplanar quad (7200 Hz)	5 ppm	CPQ (7200 Hz)
4X7I	coaxial inphase (5500 Hz)	5 ppm	CXI (5500 Hz)
4X7Q	coaxial quad (5500 Hz)	5 ppm	CXQ (5500 Hz)
5P5I	coplanar inphase (56000 Hz)	10 ppm	CPI (56 kHz)
5P5Q	coplanar quad (56000 Hz)	10 ppm	CPQ (56 kHz)
ALTR	altimeter (radar)	3 m	ALTR
ALTB	altimeter (barometric)	3 m	ALTB
CMGC	magnetics, coarse	20 nT	MAG
CMGF	magnetics, fine	2.0 nT	
CXSP	coaxial sferics monitor		CXS
CPSP	coplanar sferics monitor		CPS
CXPL	coaxial powerline monitor		CXP
CPPL	coplanar powerline monitor		CPP

Digital Data Acquisition System

Manufacturer:	RMS Instruments
Model:	DGR 33
Recorder:	Conner 80 Mb removable hard drive

The data are stored on a removable hard drive and are downloaded to the field workstation PC at the survey base for verification, backup and preparation of in-field products.

Video Flight Path Recording System

Type:	Panasonic VHS Colour Video Camera (NTSC)
Model:	AG 2400/WVCD132

Fiducial numbers are recorded continuously and are displayed on the margin of each image. This procedure ensures accurate correlation of analog and digital data with respect to visible features on the ground.

Navigation (Global Positioning System)

Model:	Ashtech Glonass GG24
Type:	SPS (L1 band), 24-channel, C/A code at 1575.42 MHz, S code at 0.5625 MHz, Real-time differential.
Sensitivity:	-132 dBm, 0.5 second update
Accuracy:	Better than 10 metres real-time

Model:	Sercel NR106
Type:	SPS (L1 band), 12-channel, C/A code, 1575.42 MHz. Real-time or post-survey differential positioning
Sensitivity:	-132 dBm, 0.5 second update
Accuracy:	Better than 5 metres in differential mode, $\pm$ 50 metres in S/A (non differential) mode

The Ashtech GG24 is a line of sight, satellite navigation system which utilizes time-coded signals from at least four of forty-eight available satellites. Both Russian GLONASS and American NAVSTAR satellite constellations are used to calculate the position and to provide real time guidance to the helicopter.

The Sercel NR106 utilizes time-coded signals from at least four of the twenty-four NAVSTAR satellites. In the differential mode, two GPS receivers are used. The base station unit is used as a reference which transmits real-time corrections to the mobile unit in the aircraft, via a UHF radio datalink. The on-board system calculates the flight path of the helicopter while providing real-time guidance. The raw XYZ data are recorded for both receivers, thereby permitting post-survey processing for accuracies of approximately 5 metres.

The Ashtech and/or Sercel receivers are coupled with a PNAV navigation system for real-time guidance.

Although the base station receiver is able to calculate its own latitude and longitude, a higher degree of accuracy can be obtained if the reference unit is established on a known benchmark or triangulation point. For this survey, the GPS station was located at latitude 61°27.45133, longitude 130°35.851247 at an elevation of 1409.51 a.m.s.l. The GPS records data relative to the WGS84 ellipsoid, which is the basis of the revised North American Datum (NAD83). Conversion software is used to transform the WGS84 coordinates to the system displayed on the base maps.

Field Workstation

Manufacturer:	Dighem
Model:	FWS: V2.80
Type:	Pentium PC

A portable PC-based field workstation is used at the survey base to verify data quality and completeness. Flight data are transferred to the PC hard drive to permit the creation of a database. This process allows the field operators to display both the positional (flight path) and geophysical data on a screen or printer.

PRODUCTS AND PROCESSING TECHNIQUES

Table 3-1 lists the maps and products which have been provided under the terms of the survey agreement. Other products can be prepared from the existing dataset, if requested. These include magnetic enhancements or derivatives, percent magnetite digital terrain or resistivity-depth sections. Most parameters can be displayed as contours, profiles, or in colour.

Base Maps

Base maps of the survey area have been produced from published topographic maps. These provide a relatively accurate, distortion-free base which facilitates correlation of the navigation data to the UTM grid. The original topographic maps are scanned to a bitmap format and combined with geophysical data for plotting the final maps.

Electromagnetic Anomalies

EM data are processed at the recorded sample rate of 10 samples/second. If necessary, appropriate spheric rejection median or Hanning filters are applied to reduce

Table 3-1 Survey Products

1. Final Transparent Maps (+3 prints) @ 1:20,000

   Dighem EM anomalies
   Total magnetic field
   Apparent resistivity (900 Hz)

2. Colour Maps (2 sets) @ 1:20,000

   Total magnetic field
   Apparent resistivity (900 Hz)

3. Additional Products

   Digital XYZ archive in Geosoft format (CD-ROM)
   Digital grid archives in Geosoft format (CD-ROM)
   Survey report (3 copies)
   Multi-channel stacked profiles
   Analog chart records
   Flight path video cassettes

Note: Other products can be produced from existing survey data, if requested.

noise to acceptable levels. EM test profiles are then created to allow the interpreter to select the most appropriate EM anomaly picking controls for a given survey area. The EM picking parameters depend on several factors but are primarily based on the dynamic range of the resistivities within the survey area, and the types and expected geophysical responses of the targets being sought.

Anomalous electromagnetic responses are selected and analysed by computer to provide a preliminary electromagnetic anomaly map. This preliminary map is used by the geophysicist, in conjunction with the computer-generated digital profiles, to produce the final interpreted EM anomaly map. This map includes bedrock surficial and cultural conductors. A map containing only bedrock conductors can be generated, if desired.

Apparent Resistivity

The apparent resistivity in ohm-m can be generated from the inphase and quadrature EM components for any of the frequencies, using a pseudo-layer halfspace model. A resistivity map portrays all the EM information for that frequency over the entire survey area. This contrasts with the electromagnetic anomaly map which provides information only over interpreted conductors. The large dynamic range makes the resistivity parameter an excellent mapping tool.

The preliminary resistivity maps and images are carefully inspected to locate any lines or line segments which might require levelling adjustments. Subtle changes between in-flight calibrations of the system can result in line to line differences, particularly in resistive (low signal amplitude) areas. If required, manual levelling is carried out to eliminate or minimize resistivity differences which can be caused by changes in operating temperatures. These levelling adjustments are usually very subtle, and do not result in the degradation of anomalies from valid bedrock sources.

After the manual levelling process is complete, revised resistivity grids are created. The resulting grids can be subjected to a microlevelling filter in order to smooth the data for contouring. The coplanar resistivity parameter has a broad 'footprint' which requires very little filtering.

The calculated resistivities for the three coplanar frequencies are included in the XYZ and grid archives. Values are in ohm-metres on all final products.

Total Magnetic Field

The aeromagnetic data are corrected for diurnal variation using the magnetic base station data. Manual adjustments are applied to any lines that require levelling, as indicated by shadowed images of the gridded magnetic data or tie line/traverse line intercepts. The IGRF gradient can be removed from the corrected total field data, if requested.

Multi-channel Stacked Profiles

Distance-based profiles of the digitally recorded geophysical data are generated and plotted by computer. These profiles also contain the calculated parameters which are used in the interpretation process. These are produced as worksheets prior to interpretation, and are also presented in the final corrected form after interpretation. The profiles display electromagnetic anomalies with their respective interpretive symbols. Table 3-2 shows the parameters and scales for the multi-channel stacked profiles.

In Table 3-2, the log resistivity scale of 0.06 decade/mm means that the resistivity changes by an order of magnitude in 16.6 mm. The resistivities at 0, 33 and 67 mm up from the bottom of the digital profile are respectively 1, 100 and 10,000 ohm-m.

Table 3-2. Multi-channel Stacked Profiles

Channel Name (Freq)	Observed Parameters		Scale Units/mm
MAG5	total magnetic field (fine)		5 nT
MAG50	total magnetic field (coarse)		50 nT
BIRDHITE	EM sensor height above ground		6 m
CXI900	vertical coaxial coil-pair inphase	900 Hz	2 ppm
CXQ900	vertical coaxial coil-pair quadrature	900 Hz	2 ppm
CPI900	horizontal coplanar coil-pair inphase	900 Hz	2 ppm
CPQ900	horizontal coplanar coil-pair quadrature	900 Hz	2 ppm
CXI5500	vertical coaxial coil-pair inphase	5500 Hz	4 ppm
CXQ5500	vertical coaxial coil-pair quadrature	5500 Hz	4 ppm
CPI7200	horizontal coplanar coil-pair inphase	7200 Hz	4 ppm
CPQ7200	horizontal coplanar coil-pair quadrature	7200 Hz	4 ppm
CPI56K	horizontal coplanar coil-pair inphase	56,000 Hz	10 ppm
CPQ56K	horizontal coplanar coil-pair quadrature	56,000 Hz	10 ppm
4XSP	coaxial spherics monitor		
4XPL	coaxial powerline monitor		
CPSP	coplanar spherics monitor		
	Computed Parameters		
DIFI	difference function inphase	from CXI and CPI	2 ppm
DIFQ	difference function quadrature	from CXQ and CPQ	2 ppm
RP900	log resistivity		.06 decade
RP7200	log resistivity		.06 decade
RP56K	log resistivity		.06 decade
DP900	apparent depth		6 m
DP7200	apparent depth		6 m
DP56K	apparent depth		6 m
CDT	conductance		1 grade

Contour, Colour and Shadow Map Displays

The geophysical data are interpolated onto a regular grid using a modified Akima spline technique. The resulting grid is suitable for generating contour maps of excellent quality. The grid cell size is usually 25% of the line interval.

Colour maps are produced by interpolating the grid down to the pixel size. The parameter is then incremented with respect to specific amplitude ranges to provide colour "contour" maps. Colour maps of the total magnetic field are particularly useful in defining the lithology of the survey area.

Monochromatic shadow maps or images are generated by employing an artificial sun to cast shadows on a surface defined by the geophysical grid. There are many variations in the shadowing technique. These techniques can be applied to total field or enhanced magnetic data, magnetic derivatives, VLF, resistivity, etc. The shadow of the enhanced magnetic parameter is particularly suited for defining geological structures with crisper images and improved resolution.

SURVEY RESULTS

GENERAL DISCUSSION

The survey results are presented on one separate map sheets for each parameter at a scale of 1:20,000. Table 4-1 summarizes the EM responses in the survey area, with respect to conductance grade and interpretation.

The anomalies shown on the electromagnetic anomaly maps are based on a near-vertical, half plane model. This model best reflects "discrete" bedrock conductors. Wide bedrock conductors or flat-lying conductive units, whether from surficial or bedrock sources, may give rise to very broad anomalous responses on the EM profiles. These may not appear on the electromagnetic anomaly map if they have a regional character rather than a locally anomalous character. These broad conductors, which more closely approximate a half space model, will be maximum coupled to the horizontal (coplanar) coil-pair and should be more evident on the resistivity parameter. Resistivity maps, therefore, may be more valuable than the electromagnetic anomaly maps, in areas where broad or flat-lying conductors are considered to be of importance. Contoured resistivity maps, based on the 900 Hz coplanar data are included with this report.

TABLE 4-1

EM ANOMALY STATISTICS

BARB PROPERTY

CONDUCTOR GRADE	CONDUCTANCE RANGE SIEMENS (MHOS)	NUMBER OF RESPONSES
7	>100	0
6	50 - 100	0
5	20 - 50	0
4	10 - 20	0
3	5 - 10	5
2	1 - 5	45
1	<1	4
*	INDETERMINATE	118
TOTAL		172

CONDUCTOR MODEL	MOST LIKELY SOURCE	NUMBER OF RESPONSES
D	DISCRETE BEDROCK CONDUCTOR	11
B	DISCRETE BEDROCK CONDUCTOR	8
S	CONDUCTIVE COVER	94
H	ROCK UNIT OR THICK COVER	53
E	EDGE OF WIDE CONDUCTOR	6
TOTAL		172

(SEE EM MAP LEGEND FOR EXPLANATIONS)

Excellent resolution and discrimination of conductors was accomplished by using a fast sampling rate of 0.1 sec and by employing a common frequency (900 Hz) on two orthogonal coil-pairs (coaxial and coplanar). The resulting "difference channel" parameters often permit differentiation of bedrock and surficial conductors, even though they may exhibit similar conductance values.

Anomalies which occur near the ends of the survey lines (i.e., outside the survey area), should be viewed with caution. Some of the weaker anomalies could be due to aerodynamic noise, i.e., bird bending, which is created by abnormal stresses to which the bird is subjected during the climb and turn of the aircraft between lines. Such aerodynamic noise is usually manifested by an anomaly on the coaxial inphase channel only, although severe stresses can affect the coplanar inphase channels as well.

Magnetics

A Scintrex MEP-710 cesium vapour magnetometer was operated at the survey base to record diurnal variations of the earth's magnetic field. The clock of the base station was synchronized with that of the airborne system to permit subsequent removal of diurnal drift. A GEM Systems GSM-19T proton precession magnetometer was also operated as a backup unit.

The total magnetic field data have been presented as contours on the base map using a contour interval of 5 nT where gradients permit. The map shows the magnetic properties of the rock units underlying the survey area.

There is some evidence on the magnetic map which suggests that the survey area has been subjected to deformation and/or alteration. These structural complexities are evident on the contour maps as variations in magnetic intensity, irregular patterns, and as offsets or changes in strike direction. Some of the more prominent linear features are also evident on the topographic base map.

If a specific magnetic intensity can be assigned to the rock type which is believed to host the target mineralization, it may be possible to select areas of higher priority on the basis of the total field magnetic data. This is based on the assumption that the magnetite content of the host rocks will give rise to a limited range of contour values which will permit differentiation of various lithological units.

The magnetic results, in conjunction with the other geophysical parameters, have provided valuable information which can be used to effectively map the geology and structure in the survey area.

Apparent Resistivity

An apparent resistivity map, which displays the conductive properties of the survey area, was produced from the 900 Hz coplanar data. The maximum resistivity values which are calculated are 1,000 ohm-m. This cutoff eliminates the erratic higher resistivities which would result from unstable ratios of very small EM amplitudes.

In general, the resistivity patterns show good agreement with the magnetic trends. This suggests that many of the resistivity lows are probably related to bedrock features or bedrock control of conductive overburden. There are some areas, however, where contour patterns appear to be strongly influenced by conductive surficial material. The East Arm of Frances Lake is associated with resistivities of less than 50 ohm-m due to conductive lake-bottom sediments.

Northwest to west-northwest (290°-270°) structural breaks are evident on both the resistivity and magnetics. Possible structural breaks which can be identified from the resistivity and magnetics are located at: line 10170 fiducial 3020 through line 10230 fiducial 2180, line 10240 fiducial 2050 through line 10310 fiducial 1040, line 10290 fiducial 1440 through line 10310 fiducial 1080. A well-defined, curved contact is obvious from the west end of line 10390 to the east end of 10540.

The apparent resistivity maps indicate that the East Arm plateau area is covered by a thin layer of conductive surficial overburden which thins as the topography steepens to the northeast and becomes thicker and/or more moisture laden near East Arm. The interpreted bedrock conductors identified by this survey are within the area covered by the thin surficial cover on the plateau. As the inferred bedrock conductors yield low conductances, it should be taken into consideration that some of the anomalies may reflect sharp bedrock/overburden interfaces.

Electromagnetic Anomalies

The EM anomalies resulting from this survey appear to fall within one of two general categories. The first type consists of discrete, well-defined anomalies which yield marked inflections on the difference channels. These anomalies are usually attributed to conductive sulphides or graphite and are generally given a "B", "T" or "D" interpretive symbol, denoting a bedrock source.

The second class of anomalies comprises moderately broad responses which exhibit the characteristics of a half space and do not yield well-defined inflections on the difference channels. Anomalies in this category are usually given an "S" or "H" interpretive symbol. The lack of a difference channel response usually implies a broad or flat-lying conductive source such as overburden. Some of these anomalies may reflect conductive rock units, zones of deep weathering, or the weathered tops of kimberlite pipes which can often yield "non-discrete" signatures.

The effects of conductive overburden are evident over portions of the survey area. Although the difference channels (DFI and DFQ) are extremely valuable in detecting bedrock conductors which are partially masked by conductive overburden, sharp undulations in the bedrock/overburden interface can yield anomalies in the difference channels which may be interpreted as possible bedrock conductors. Such anomalies usually fall into the "S?" or "B?" classification but may also be given an "E" interpretive symbol, denoting a resistivity contrast at the edge of a conductive unit.

The "?" symbol does not question the validity of an anomaly, but instead indicates some degree of uncertainty as to which is the most appropriate EM source model. This ambiguity results from the combination of effects from two or more conductive sources, such as overburden and bedrock, gradational changes, or moderately shallow dips. The presence of a conductive upper layer has a tendency to mask or alter the characteristics of bedrock conductors, making interpretation difficult. This problem is further exacerbated in the presence of magnetite.

In areas where EM responses are evident primarily on the quadrature components, zones of poor conductivity are indicated. Where these responses are coincident with magnetic anomalies, it is possible that the inphase component amplitudes have been suppressed by the effects of magnetite. Most of these poorly-conductive magnetic features give rise to resistivity anomalies which are only slightly below background. If it is expected that poorly-conductive economic mineralization may be associated with magnetite-rich units, most of these weakly anomalous features will be of interest. In areas where magnetite causes the inphase components to become negative, the apparent conductance and depth of EM anomalies may be unreliable. Magnetite effects usually give rise to overstated (higher) resistivity values and understated (shallow) depth calculations.

As economic mineralization within the area may be associated with massive to weakly disseminated sulphides, which may or may not be hosted by magnetite-rich rocks, it is impractical to assess the relative merits of EM anomalies on the basis of conductance. It is recommended that an attempt be made to compile a suite of geophysical "signatures" over any known areas of interest. Anomaly characteristics are clearly defined on the computer-processed geophysical data profiles which are supplied as one of the survey products.

A complete assessment and evaluation of the survey data should be carried out by one or more qualified professionals who have access to, and can provide a meaningful compilation of, all available geophysical, geological and geochemical data.

CONDUCTORS IN THE SURVEY AREA

The electromagnetic anomaly map shows the anomaly locations with the interpreted conductor type, dip, conductance and depth being indicated by symbols. Direct magnetic correlation is also shown if it exists. The strike direction and length of the conductors are indicated where anomalies can be correlated from line to line with a reasonable degree of confidence.

In areas where several conductors or conductive trends appear to be related to a common geological unit, these have been outlined as "zones" on the EM anomaly maps. The zone outlines usually approximate the limits of conductive units defined by the resistivity contours, but may also be related to distinct rock units which can be inferred from the magnetic data.

There are several known sulphide occurrences in the area including a deposit located near anomalies 10270B-10280A and a disseminated Cu, Zn, Ag body near anomalies 10440B-10450C. The EM anomalies in these locations are weakly conductive and poorly defined. If these anomalies reflect the known sulphide mineralization, then the stronger, better defined interpreted bedrock conductors identified by this survey will definitely be worthy of further investigation.

Conductor 10030C-10040B

Anomalies 10030C and 10040B reflect narrow, dike-like, weakly conductive sources. Such responses would normally be attributed to bedrock sources. These anomalies correlate with a stream which indicates that another possible source would be a resistivity contrast associated with fluvial sediments. Anomaly 10030C yields a magnetic correlation and is located near a sulphide showing (near anomaly 10030B) which elevates the significance of this conductor for sulphide exploration.

Conductor 10082D-10082E

This conductor is associated with an isolated resistivity low and is situated in a local magnetic low. Two narrow edges from a "cup-shaped" body, or a conductor parallel to the flight line are possible geometries for the source. The EM profile shapes also closely resemble a cylinder or disk-shaped source such as a weathered cap on an intrusive pipe or plug, similar to kimberlite targets in the NWT.

Conductor 10082C-10110A

This conductor reflects a narrow, northeast-dipping bedrock source. For the most part, the conductor flanks a northwest-trending magnetic unit and may be associated with a contact or faulted contact which is common to the sulphide showing near anomaly 10030B. Anomaly 10110A yields a magnetic correlation which possibly increases its importance as a target for massive sulphides.

Conductor 10190B-10210B

This is a possible narrow, dike-like bedrock source. Given the weak responses from the known sulphide occurrences, even this weakly conductive, poorly-defined response may warrant further investigation.

Conductors 10340B, 10340C-10380A

Anomalies 10340B, 10340C and 10350B are relatively well-defined. These probable bedrock sources generally flank magnetic units and may be related to a contact or faulted contact. They appear to be on strike with the sulphide zone in the vicinity of anomalies 10270B and 10280A which elevates their importance.

A northeast dip can be inferred in the vicinity of anomaly 10350B. These conductors probably warrant further investigation to determine the sources.

Zone A (indicated on the ELECTROMAGNETIC ANOMALIES map, Anomalies 10510B to 10540B)

This broad circular resistivity low becomes more conductive with depth. This is normally attributed to bedrock sources such as sulphides. Clay alteration, beneath a more resistive overburden, such as that associated with economic mineralization from hydrothermal alteration, is another possible source. Another option is lacustrine clays from an area previously part of East Arm.

CONCLUSIONS AND RECOMMENDATIONS

This report provides a very brief description of the survey results and describes the equipment, procedures and logistics of the survey.

There are several anomalies in the survey block which are typical of bedrock conductors. Conductors 10082C-10110A and 10340C-10380A have similar, but stronger and better defined responses than those of known sulphide occurrences in the area and warrant further investigation. The other interpreted bedrock conductors defined by the survey should also be subjected to further investigation, using appropriate surface exploration techniques. Anomalies which are currently considered to be of moderately low priority may require upgrading if follow-up results are favourable.

Most anomalies in the area are moderately weak and poorly-defined. Many have been attributed to conductive overburden or deep weathering. Others coincide with magnetic gradients which may reflect contacts, faults or shears. Such structural breaks are considered to be of particular interest as they may have influenced mineral deposition within the survey area. Given the weak response from known sulphide occurrences in the area, even those weak "S" or "S?" anomalies may warrant follow-up based on corresponding geological, geophysical or geochemical information.

Respectfully submitted,

GEOTERREX-DIGHEM

Doug McConnell

Douglas L. McConnell, P.Eng.
Geophysicist

DLM/sdp

R1318SEP.98

APPENDIX A

LIST OF PERSONNEL

The following personnel were involved in the acquisition, processing, interpretation and presentation of data, relating to a DIGHEM^{V} airborne geophysical survey carried out for Inaternational Barytex Resources Ltd., near Frances Lake, Yukon.

Greg Paleolog	Manager, Helicopter Operations
Doug McConnell	Manager, Data Processing and Interpretation
Darcy Blouin	Senior Geophysical Operator
Pat Henriquez	Field Geophysicist
Terry Thompson	Pilot (Questral Helicopters Ltd.)
Gordon Smith	Data Processing Supervisor
Graham Konieczny	Computer Processor
Doug McConnell	Interpretation Geophysicist
Lyn Vanderstarren	Drafting Supervisor
Mike Armstrong	Draftsperson (CAD)
Susan Pothiah	Word Processing Operator
Albina Tonello	Secretary/Expeditor

The survey consisted of 172 km of coverage, flown from September 5 to September 6, 1998.

All personnel are employees of Geoterrex-Dighem, except for the pilot who is an employee of Questral Helicopters Ltd.

APPENDIX B

STATEMENT OF COST

Date: September 30, 1998

IN ACCOUNT WITH GEOTERREX-DIGHEM

To: Dighem flying of Agreement dated August 21, 1998, pertaining to an Airborne Geophysical Survey in the Frances Lake area, Yukon.

Survey Charges

172 km of flying	$20,000.00

Allocation of Costs

- Data Acquisition	(80%)
- Data Processing	(10%)
- Interpretation, Report and Maps	(10%)

REVISED STATEMENT OF COSTS

FRANCES LAKE PROPERTY
FRAN, BARB, BINTI, BETH AND PAT CLAIMS

Dighem Airborne Geophysical Survey	$ 20,000
Office Costs:	
Interpretation of airborne date	
H.L. King 2.5 days @ $400/day	1,000
	$ 21,000

H. L. King
General Manager

November 2, 1998

BACKGROUND INFORMATION

Electromagnetics

DIGHEM electromagnetic responses fall into two general classes, discrete and broad. The discrete class consists of sharp, well-defined anomalies from discrete conductors such as sulphide lenses and steeply dipping sheets of graphite and sulphides. The broad class consists of wide anomalies from conductors having a large horizontal surface such as flatly dipping graphite or sulphide sheets, saline water-saturated sedimentary formations, conductive overburden and rock, and geothermal zones. A vertical conductive slab with a width of 200 m would straddle these two classes.

The vertical sheet (half plane) is the most common model used for the analysis of discrete conductors. All anomalies plotted on the geophysical maps are analyzed according to this model. The following section entitled **Discrete Conductor Analysis** describes this model in detail, including the effect of using it on anomalies caused by broad conductors such as conductive overburden.

The conductive earth (half space) model is suitable for broad conductors. Resistivity contour maps result from the use of this model. A later section entitled

Resistivity Mapping describes the method further, including the effect of using it on anomalies caused by discrete conductors such as sulphide bodies.

Geometric Interpretation

The geophysical interpreter attempts to determine the geometric shape and dip of the conductor. Figure C-1 shows typical DIGHEM anomaly shapes which are used to guide the geometric interpretation.

Discrete Conductor Analysis

The EM anomalies appearing on the electromagnetic map are analyzed by computer to give the conductance (i.e., conductivity-thickness product) in siemens (mhos) of a vertical sheet model. This is done regardless of the interpreted geometric shape of the conductor. This is not an unreasonable procedure, because the computed conductance increases as the electrical quality of the conductor increases, regardless of its true shape. DIGHEM anomalies are divided into seven grades of conductance, as shown in Table C-1. The conductance in siemens (mhos) is the reciprocal of resistance in ohms.

The conductance value is a geological parameter because it is a characteristic of the conductor alone. It generally is independent of frequency, flying height or depth of burial, apart from the averaging over a greater portion of the conductor as height increases. Small anomalies from deeply buried strong conductors are not confused with small anomalies from shallow weak conductors because the former will have larger conductance values.

Table C-1. EM Anomaly Grades

Anomaly Grade	Siemens
7	> 100
6	50 - 100
5	20 - 50
4	10 - 20
3	5 - 10
2	1 - 5
1	< 1

Conductive overburden generally produces broad EM responses which may not be shown as anomalies on the geophysical. However, patchy conductive overburden in otherwise resistive areas can yield discrete anomalies with a conductance grade (cf. Table C-1) of 1, 2 or even 3 for conducting clays which have resistivities as low as 50 ohm-m. In areas where ground resistivities are below 10 ohm-m, anomalies caused by weathering variations and similar causes can have any conductance grade. The anomaly shapes from the multiple coils often allow such conductors to be recognized, and these are indicated by the letters S, H, and sometimes E on the geophysical maps (see EM legend on maps).

For bedrock conductors, the higher anomaly grades indicate increasingly higher conductances. Examples: DIGHEM's New Insco copper discovery (Noranda, Canada) yielded a grade 5 anomaly, as did the neighbouring copper-zinc Magusi River ore body; Mattabi (copper-zinc, Sturgeon Lake, Canada) and Whistle (nickel, Sudbury, Canada) gave grade 6; and DIGHEM's Montcalm nickel-copper discovery (Timmins, Canada) yielded a grade 7 anomaly. Graphite and sulphides can span all grades but, in any particular survey area, field work may show that the different grades indicate different types of conductors.

Strong conductors (i.e., grades 6 and 7) are characteristic of massive sulphides or graphite. Moderate conductors (grades 4 and 5) typically reflect graphite or sulphides of a less massive character, while weak bedrock conductors (grades 1 to 3) can signify poorly connected graphite or heavily disseminated sulphides. Grades 1 and 2 conductors may not respond to ground EM equipment using frequencies less than 2000 Hz.

The presence of sphalerite or gangue can result in ore deposits having weak to moderate conductances. As an example, the three million ton lead-zinc deposit of Restigouche Mining Corporation near Bathurst, Canada, yielded a well-defined grade 2 conductor. The 10 percent by volume of sphalerite occurs as a coating around the fine grained massive pyrite, thereby inhibiting electrical conduction. Faults, fractures and shear zones may produce anomalies which typically have low conductances (e.g., grades

1 to 3). Conductive rock formations can yield anomalies of any conductance grade. The conductive materials in such rock formations can be salt water, weathered products such as clays, original depositional clays, and carbonaceous material.

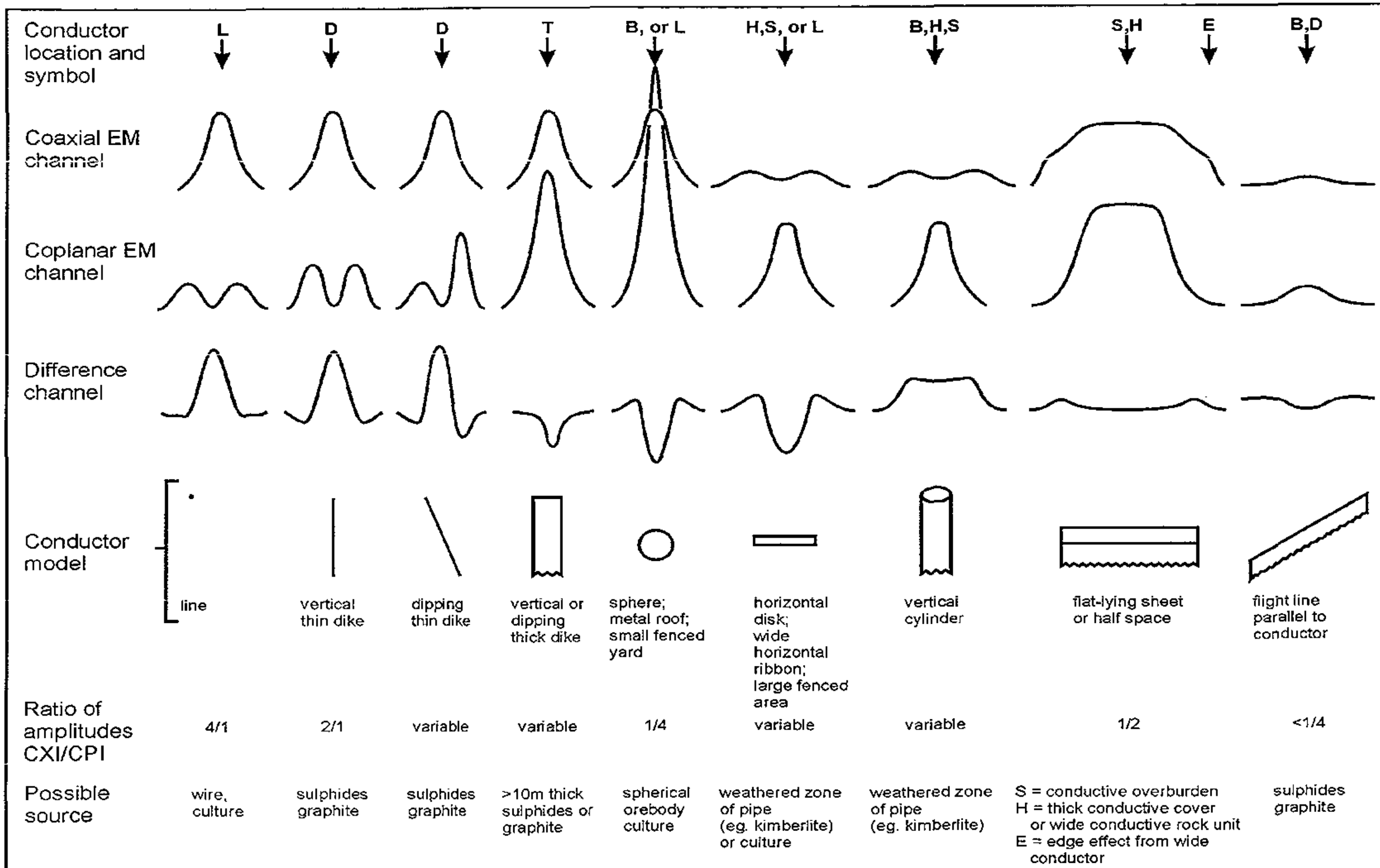
For each interpreted electromagnetic anomaly on the geophysical maps, a letter identifier and an interpretive symbol are plotted beside the EM grade symbol. The horizontal rows of dots, under the interpretive symbol, indicate the anomaly amplitude on the flight record. The vertical column of dots, under the anomaly letter, gives the estimated depth. In areas where anomalies are crowded, the letter identifiers, interpretive symbols and dots may be obliterated. The EM grade symbols, however, will always be discernible, and the obliterated information can be obtained from the anomaly listing appended to this report.

The purpose of indicating the anomaly amplitude by dots is to provide an estimate of the reliability of the conductance calculation. Thus, a conductance value obtained from a large ppm anomaly (3 or 4 dots) will tend to be accurate whereas one obtained from a small ppm anomaly (no dots) could be quite inaccurate. The absence of amplitude dots indicates that the anomaly from the coaxial coil-pair is 5 ppm or less on both the inphase and quadrature channels. Such small anomalies could reflect a weak conductor at the surface or a stronger conductor at depth. The conductance grade and depth estimate illustrates which of these possibilities fits the recorded data best.

The conductance measurement is considered more reliable than the depth estimate. There are a number of factors which can produce an error in the depth estimate, including the averaging of topographic variations by the altimeter, overlying conductive overburden, and the location and attitude of the conductor relative to the flight line. Conductor location and attitude can provide an erroneous depth estimate because the stronger part of the conductor may be deeper or to one side of the flight line, or because it has a shallow dip. A heavy tree cover can also produce errors in depth estimates. This is because the depth estimate is computed as the distance of bird from conductor, minus the altimeter reading. The altimeter can lock onto the top of a dense forest canopy. This situation yields an erroneously large depth estimate but does not affect the conductance estimate.

Dip symbols are used to indicate the direction of dip of conductors. These symbols are used only when the anomaly shapes are unambiguous, which usually requires a fairly resistive environment.

A further interpretation is presented on the EM map by means of the line-to-line correlation of bedrock anomalies, which is based on a comparison of anomaly shapes on adjacent lines. This provides conductor axes which may define the geological structure over portions of the survey area. The absence of conductor axes in an area implies that anomalies could not be correlated from line to line with reasonable confidence.



Typical DIGHEM anomaly shapes
Figure C-1

DIGHEM electromagnetic anomalies are designed to provide a correct impression of conductor quality by means of the conductance grade symbols. The symbols can stand alone with geology when planning a follow-up program. The actual conductance values are printed in the attached anomaly list for those who wish quantitative data. The anomaly ppm and depth are indicated by inconspicuous dots which should not distract from the conductor patterns, while being helpful to those who wish this information. The map provides an interpretation of conductors in terms of length, strike and dip, geometric shape, conductance, depth, and thickness. The accuracy is comparable to an interpretation from a high quality ground EM survey having the same line spacing.

The attached EM anomaly list provides a tabulation of anomalies in ppm, conductance, and depth for the vertical sheet model. The EM anomaly list also shows the conductance and depth for a thin horizontal sheet (whole plane) model, but only the vertical sheet parameters appear on the EM map. The horizontal sheet model is suitable for a flatly dipping thin bedrock conductor such as a sulphide sheet having a thickness less than 10 m. The list also shows the resistivity and depth for a conductive earth (half space) model, which is suitable for thicker slabs such as thick conductive overburden. In the EM anomaly list, a depth value of zero for the conductive earth model, in an area of thick cover, warns that the anomaly may be caused by conductive overburden.

Since discrete bodies normally are the targets of EM surveys, local base (or zero) levels are used to compute local anomaly amplitudes. This contrasts with the use of true zero levels which are used to compute true EM amplitudes. Local anomaly amplitudes are shown in the EM anomaly list and these are used to compute the vertical sheet parameters of conductance and depth. Not shown in the EM anomaly list are the true amplitudes which are used to compute the horizontal sheet and conductive earth parameters.

Questionable Anomalies

DIGHEM maps may contain EM responses which are displayed as asterisks (*). These responses denote weak anomalies of indeterminate conductance, which may reflect one of the following: a weak conductor near the surface, a strong conductor at depth (e.g., 100 to 120 m below surface) or to one side of the flight line, or aerodynamic noise. Those responses that have the appearance of valid bedrock anomalies on the flight profiles are indicated by appropriate interpretive symbols (see EM legend on maps). The others probably do not warrant further investigation unless their locations are of considerable geological interest.

The Thickness Parameter

DIGHEM can provide an indication of the thickness of a steeply dipping conductor. The amplitude of the coplanar anomaly (e.g., CPI channel on the digital profile) increases relative to the coaxial anomaly (e.g., CXI) as the apparent thickness increases, i.e., the thickness in the horizontal plane. (The thickness is equal to the conductor width if the conductor dips at 90 degrees and strikes at right angles to the flight line.) This report refers to a conductor as thin when the thickness is likely to be less than 3 m, and thick when in excess of 10 m. Thick conductors are indicated on the EM map by parentheses "( )". For base metal exploration in steeply dipping geology, thick conductors can be high priority targets because many massive sulphide ore bodies are thick, whereas non-economic bedrock conductors are often thin. The system cannot sense the thickness when the strike of the conductor is subparallel to the flight line, when the conductor has a shallow dip, when the anomaly amplitudes are small, or when the resistivity of the environment is below 100 ohm-m.

Resistivity Mapping

Resistivity mapping is useful in areas where broad or flat lying conductive units are of interest. One example of this is the clay alteration that is associated with Carlin-type deposits in the south west United States. The Dighem system was able to identify the clay alteration zone over the Cove deposit. The alteration zone appeared as a strong resistivity low on the 900 Hz resistivity parameter. The 7,200 Hz and 56,000 Hz resistivities show more of the detail in the covering sediments, and delineate a range front fault. This is typical in many areas of the south west United States, where conductive near surface sediments, which may sometimes be alkalic, attenuate the higher frequencies.

Resistivity mapping has proven successful for locating diatremes in diamond exploration. Weathering products from relatively soft kimberlite pipes produce a resistivity contrast with the unaltered host rock. In many cases weathered kimberlite pipes were associated with thick conductive layers which contrasted with overlying or adjacent relatively thin layers of lake bottom sediments or overburden.

Areas of widespread conductivity are commonly encountered during surveys. These conductive zones may reflect alteration zones, shallow-dipping sulphide or graphite-rich units or conductive overburden. In such areas, anomalies can be generated by decreases of only 5 m in survey altitude as well as by increases in conductivity. The typical flight record in conductive areas is characterized by inphase and quadrature channels which are continuously active. Local EM peaks reflect either increases in conductivity of the earth or decreases in survey altitude. For such conductive areas, apparent resistivity profiles and contour maps are necessary for the correct interpretation of the airborne data. The advantage of the resistivity parameter is that anomalies caused by altitude changes are virtually eliminated, so the resistivity data reflect only those anomalies caused by conductivity changes. The resistivity analysis also helps the interpreter to differentiate between conductive bedrock and conductive overburden. For example, discrete conductors will generally appear as narrow lows on the contour map and broad conductors (e.g., overburden) will appear as wide lows.

The apparent resistivity is calculated using the pseudo-layer (or buried) half space model defined by Fraser (1978)[2]. This model consists of a resistive layer overlying a conductive half space. The depth channels give the apparent depth below surface of the conductive material. The apparent depth is simply the apparent thickness of the overlying resistive layer. The apparent depth (or thickness) parameter will be positive when the upper layer is more resistive than the underlying material, in which case the apparent depth may be quite close to the true depth.

The apparent depth will be negative when the upper layer is more conductive than the underlying material, and will be zero when a homogeneous half space exists. The apparent depth parameter must be interpreted cautiously because it will contain any errors

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[2] Resistivity mapping with an airborne multicoil electromagnetic system: Geophysics, v. 43, p.144-172

which may exist in the measured altitude of the EM bird (e.g., as caused by a dense tree cover). The inputs to the resistivity algorithm are the inphase and quadrature components of the coplanar coil-pair. The outputs are the apparent resistivity of the conductive half space (the source) and the sensor-source distance. The flying height is not an input variable, and the output resistivity and sensor-source distance are independent of the flying height when the conductivity of the measured material is sufficient to yield significant inphase as well as quadrature responses. The apparent depth, discussed above, is simply the sensor-source distance minus the measured altitude or flying height. Consequently, errors in the measured altitude will affect the apparent depth parameter but not the apparent resistivity parameter.

The apparent depth parameter is a useful indicator of simple layering in areas lacking a heavy tree cover. The DIGHEM system has been flown for purposes of permafrost mapping, where positive apparent depths were used as a measure of permafrost thickness. However, little quantitative use has been made of negative apparent depths because the absolute value of the negative depth is not a measure of the thickness of the conductive upper layer and, therefore, is not meaningful physically. Qualitatively, a negative apparent depth estimate usually shows that the EM anomaly is caused by conductive overburden. Consequently, the apparent depth channel can be of significant help in distinguishing between overburden and bedrock conductors.

Interpretation in Conductive Environments

Environments having low background resistivities (e.g., below 30 ohm-m for a 900 Hz system) yield very large responses from the conductive ground. This usually prohibits the recognition of discrete bedrock conductors. However, DIGHEM data processing techniques produce three parameters which contribute significantly to the recognition of bedrock conductors in conductive environments. These are the inphase and quadrature difference channels (DFI and DFQ, which are available only on systems with common frequencies on orthogonal coil pairs), and the resistivity and depth channels (RES and DP) for each coplanar frequency.

The EM difference channels (DFI and DFQ) eliminate most of the responses from conductive ground, leaving responses from bedrock conductors, cultural features (e.g., telephone lines, fences, etc.) and edge effects. Edge effects often occur near the perimeter of broad conductive zones. This can be a source of geologic noise. While edge effects yield anomalies on the EM difference channels, they do not produce resistivity anomalies. Consequently, the resistivity channel aids in eliminating anomalies due to edge effects. On the other hand, resistivity anomalies will coincide with the most highly conductive sections of conductive ground, and this is another source of geologic noise. The recognition of a bedrock conductor in a conductive environment therefore is based on the anomalous responses of the two difference channels (DFI and DFQ) and the resistivity channels (RES). The most favourable situation is where anomalies coincide on all channels.

The DP channels, which give the apparent depth to the conductive material, also help to determine whether a conductive response arises from surficial material or from a conductive zone in the bedrock. When these channels ride above the zero level on the digital profiles (i.e., depth is negative), it implies that the EM and resistivity profiles are responding primarily to a conductive upper layer, i.e., conductive overburden. If the DP channels are below the zero level, it indicates that a resistive upper layer exists, and this usually implies the existence of a bedrock conductor. If the low frequency DP channel is below the zero level and the high frequency DP is above, this suggests that a bedrock conductor occurs beneath conductive cover.

The conductance channel CDT identifies discrete conductors which have been selected by computer for appraisal by the geophysicist. Some of these automatically selected anomalies on channel CDT are discarded by the geophysicist. The automatic selection algorithm is intentionally oversensitive to assure that no meaningful responses are missed. The interpreter then classifies the anomalies according to their source and eliminates those that are not substantiated by the data, such as those arising from geologic or aerodynamic noise.

Reduction of Geologic Noise

Geologic noise refers to unwanted geophysical responses. For purposes of airborne EM surveying, geologic noise refers to EM responses caused by conductive overburden and magnetic permeability. It was mentioned previously that the EM difference channels (i.e., channel DFI for inphase and DFQ for quadrature) tend to eliminate the response of conductive overburden.

Magnetite produces a form of geological noise on the inphase channels of all EM systems. Rocks containing less than 1% magnetite can yield negative inphase anomalies caused by magnetic permeability. When magnetite is widely distributed throughout a survey area, the inphase EM channels may continuously rise and fall, reflecting variations in the magnetite percentage, flying height, and overburden thickness. This can lead to difficulties in recognizing deeply buried bedrock conductors, particularly if conductive overburden also exists. However, the response of broadly distributed magnetite generally vanishes on the inphase difference channel DFI. This feature can be a significant aid in the recognition of conductors which occur in rocks containing accessory magnetite.

EM Magnetite Mapping

The information content of DIGHEM data consists of a combination of conductive eddy current responses and magnetic permeability responses. The secondary field resulting from conductive eddy current flow is frequency-dependent and consists of both inphase and quadrature components, which are positive in sign. On the other hand, the secondary field resulting from magnetic permeability is independent of frequency and consists of only an inphase component which is negative in sign. When magnetic permeability manifests itself by decreasing the measured amount of positive inphase, its presence may be difficult to recognize. However, when it manifests itself by yielding a negative inphase anomaly (e.g., in the absence of eddy current flow), its presence is assured. In this latter case, the negative component can be used to estimate the percent magnetite content.

A magnetite mapping technique was developed for the coplanar coil-pair of DIGHEM. The method can be complementary to magnetometer mapping in certain cases. Compared to magnetometry, it is far less sensitive but is more able to resolve closely spaced magnetite zones, as well as providing an estimate of the amount of magnetite in the rock. The method is sensitive to 1/4% magnetite by weight when the EM sensor is at a height of 30 m above a magnetitic half space. It can individually resolve steep dipping narrow magnetite-rich bands which are separated by 60 m. Unlike magnetometry, the EM magnetite method is unaffected by remanent magnetism or magnetic latitude.

The EM magnetite mapping technique provides estimates of magnetite content which are usually correct within a factor of 2 when the magnetite is fairly uniformly distributed. EM magnetite maps can be generated when magnetic permeability is evident as negative inphase responses on the data profiles.

Like magnetometry, the EM magnetite method maps only bedrock features, provided that the overburden is characterized by a general lack of magnetite. This contrasts with resistivity mapping which portrays the combined effect of bedrock and overburden.

Recognition of Culture

Cultural responses include all EM anomalies caused by man-made metallic objects. Such anomalies may be caused by inductive coupling or current gathering. The concern of the interpreter is to recognize when an EM response is due to culture. Points of consideration used by the interpreter, when coaxial and coplanar coil-pairs are operated at a common frequency, are as follows:

1. Channels CXP and CPP monitor 60 Hz radiation. An anomaly on these channels shows that the conductor is radiating power. Such an indication is normally a guarantee that the conductor is cultural. However, care must be taken to ensure that the conductor is not a geologic body which strikes across a power line, carrying leakage currents.

2. A flight which crosses a "line" (e.g., fence, telephone line, etc.) yields a centre-peaked coaxial anomaly and an m-shaped coplanar anomaly.[3] When the flight crosses the cultural line at a high angle of intersection, the amplitude ratio of coaxial/coplanar response is 4. Such an EM anomaly can only be caused by a line. The geologic body which yields anomalies most closely resembling a line is the vertically dipping thin dike. Such a body, however, yields an amplitude ratio of 2 rather than 4. Consequently, an m-shaped coplanar anomaly with a CXI/CPI amplitude ratio of 4 is virtually a guarantee that the source is a cultural line.

3. A flight which crosses a sphere or horizontal disk yields centre-peaked coaxial and coplanar anomalies with a CXI/CPI amplitude ratio (i.e., coaxial/coplanar) of 1/4. In the absence of geologic bodies of this geometry, the most likely conductor

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[3] See Figure C-1 presented earlier.

is a metal roof or small fenced yard.[4] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

4. A flight which crosses a horizontal rectangular body or wide ribbon yields an m-shaped coaxial anomaly and a centre-peaked coplanar anomaly. In the absence of geologic bodies of this geometry, the most likely conductor is a large fenced area.[5] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

5. EM anomalies which coincide with culture, as seen on the camera film or video display, are usually caused by culture. However, care is taken with such coincidences because a geologic conductor could occur beneath a fence, for example. In this example, the fence would be expected to yield an m-shaped coplanar anomaly as in case #2 above. If, instead, a centre-peaked coplanar anomaly occurred, there would be concern that a thick geologic conductor coincided with the cultural line.

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[4] It is a characteristic of EM that geometrically similar anomalies are obtained from: (1) a planar conductor, and (2) a wire which forms a loop having dimensions identical to the perimeter of the equivalent planar conductor.

6. The above description of anomaly shapes is valid when the culture is not conductively coupled to the environment. In this case, the anomalies arise from inductive coupling to the EM transmitter. However, when the environment is quite conductive (e.g., less than 100 ohm-m at 900 Hz), the cultural conductor may be conductively coupled to the environment. In this latter case, the anomaly shapes tend to be governed by current gathering. Current gathering can completely distort the anomaly shapes, thereby complicating the identification of cultural anomalies. In such circumstances, the interpreter can only rely on the radiation channels and on the camera film or video records.

Magnetics

Total field magnetics provides information on the magnetic properties of the earth materials in the survey area. The information can be used to locate magnetic bodies of direct interest for exploration, and for structural and lithological mapping.

The total field magnetic response reflects the abundance of magnetic material, in the source. Magnetite is the most common magnetic mineral. Other minerals such as ilmenite, pyrrhotite, franklinite, chromite, hematite, arsenopyrite, limonite and pyrite are also magnetic, but to a lesser extent than magnetite on average.

In some geological environments, an EM anomaly with magnetic correlation has a greater likelihood of being produced by sulphides than one that is non-magnetic. However, sulphide ore bodies may be non-magnetic (e.g., the Kidd Creek deposit near Timmins, Canada) as well as magnetic (e.g., the Mattabi deposit near Sturgeon Lake, Canada).

Iron ore deposits will be anomalously magnetic in comparison to surrounding rock due to the concentration of iron minerals such as magnetite, ilmenite and hematite.

Changes in magnetic susceptibility often allow rock units to be differentiated based on the total field magnetic response. Geophysical classifications may differ from geological classifications if various magnetite levels exist within one general geological classification. Geometric considerations of the source such as shape, dip and depth, inclination of the earth's field and remanent magnetization will complicate such an analysis.

In general, mafic lithologies contain more magnetite and are therefore more magnetic than many sediments which tend to be weakly magnetic. Metamorphism and alteration can also increase or decrease the magnetization of a rock unit.

Textural differences on a total field magnetic contour, colour or shadow map due to the frequency of activity of the magnetic parameter resulting from inhomogeneities in the distribution of magnetite within the rock, may define certain lithologies. For example, near surface volcanics may display highly complex contour patterns with little line-to-line correlation.

Rock units may be differentiated based on the plan shapes of their total field magnetic responses. Mafic intrusive plugs can appear as isolated "bulls-eye" anomalies. Granitic intrusives appear as sub-circular zones, and may have contrasting rings due to contact metamorphism. Generally, granitic terrain will lack a pronounced strike direction, although granite gneiss may display strike.

Linear north-south units are theoretically not well-defined on total field magnetic maps in equatorial regions due to the low inclination of the earth's magnetic field. However, most stratigraphic units will have variations in composition along strike which will cause the units to appear as a series of alternating magnetic highs and lows.

Faults and shear zones may be characterized by alteration that causes destruction of magnetite (e.g., weathering) which produces a contrast with surrounding rock. Structural breaks may be filled by magnetite-rich, fracture filling material as is the case with diabase dikes, or by non-magnetic felsic material.

Faulting can also be identified by patterns in the magnetic total field contours or colours. Faults and dikes tend to appear as lineaments and often have strike lengths of several kilometres. Offsets in narrow, magnetic, stratigraphic trends also delineate structure. Sharp contrasts in magnetic lithologies may arise due to large displacements along strike-slip or dip-slip faults.

APPENDIX D

EM ANOMALY LIST

Label	Fid	Interp	XUTM m	YUTM m	CX 1052 HZ Real ppm	CX 1052 HZ Quad ppm	CP 881 HZ Real ppm	CP 881 HZ Quad ppm	CX 5487 HZ Real ppm	CX 5487 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE 10010													
A	4897.2	E	475874	6820610	5.2	8.9	4.5	15.3	13.4	29.9	3.4	6	0
B	4905.0	H	476151	6820762	2.0	2.7	2.7	5.3	7.8	10.9	---	---	0
LINE 10020													
A	4841.1	E	475953	6820414	3.1	9.6	1.7	9.7	12.9	36.4	1.8	2	0
B	4834.4	H	476154	6820533	1.4	1.7	2.4	5.9	5.3	6.0	---	---	0
LINE 10030													
A	4708.6	H	475911	6820166	3.8	11.2	6.3	22.0	19.3	42.6	2.5	0	0
B	4717.0	H	476208	6820322	3.5	0.7	1.8	0.9	4.9	3.4	---	---	0
C	4725.0	D?	476491	6820489	0.9	3.0	0.9	5.7	6.6	9.7	---	---	65
LINE 10040													
A	4657.4	E	476123	6820056	3.8	13.3	6.3	24.4	26.0	43.7	2.2	0	0
B	4638.8	D?	476642	6820348	1.0	5.4	2.6	5.8	9.8	17.8	---	---	9
C	4628.6	S?	476990	6820528	2.3	4.4	1.3	4.2	5.8	15.1	---	---	8
LINE 10050													
A	4500.8	H	476113	6819798	4.6	7.2	8.2	18.0	16.2	21.3	---	---	0
B	4505.5	E	476276	6819889	3.6	8.7	7.7	18.1	19.8	22.4	---	---	0
C	4516.2	S	476573	6820080	3.1	5.8	1.3	7.4	8.6	22.1	---	---	0
D	4529.1	S	477003	6820315	1.0	4.0	1.1	6.0	6.6	14.8	1.1	8	33
LINE 10060													
A	4447.4	H	476272	6819667	3.2	14.6	6.5	20.6	27.0	44.2	2.1	0	0
B	4441.6	H	476433	6819756	5.2	2.8	2.0	3.4	7.5	3.0	---	---	0
C	4432.3	S	476674	6819902	3.7	3.7	0.7	5.1	8.8	13.2	---	---	13
D	4419.4	S	477105	6820155	2.9	3.2	1.0	3.7	5.8	7.5	---	---	0
LINE 10070													
A	4302.7	H	476435	6819520	3.4	0.6	1.2	3.2	4.4	0.0	---	---	0
B	4315.2	S	476787	6819722	2.2	4.0	0.6	4.6	6.3	10.8	---	---	0
LINE 10082													
A	168.6	H	476193	6819106	2.3	11.9	6.1	23.2	16.8	42.5	---	---	7
B	182.0	H	476591	6819367	2.8	5.2	1.5	7.6	9.7	14.8	2.3	20	0
C	190.0	S	476838	6819492	2.7	0.6	1.3	0.5	2.9	1.3	---	---	0
D	199.8	D	477153	6819680	4.0	3.3	3.4	5.9	6.7	19.1	6.0	27	7
E	202.7	D	477244	6819738	3.3	2.5	5.5	8.9	5.6	6.8	---	---	7
LINE 10090													
A	3962.5	H	476348	6819023	3.8	21.4	6.7	35.8	34.1	79.6	1.6	0	0
B	3950.0	H	476687	6819217	1.1	2.8	2.2	4.8	6.5	5.1	---	---	0
C	3940.8	S?	476953	6819372	2.9	2.8	1.5	1.4	7.2	7.7	---	---	0

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LINE 10100													
A	3784.0	H	476388	6818808	0.3	9.5	4.4	17.0	16.8	30.4	---	---	0
B	3805.6	D	477021	6819180	2.3	7.4	2.1	5.8	16.2	19.9	1.9	6	0
C	3822.7	S	477645	6819545	1.6	2.4	0.8	3.6	3.4	9.2	---	---	0
LINE 10110													
A	3716.0	B?	477222	6819067	4.1	1.6	2.2	6.2	5.1	20.0	8.1	38	103
B	3700.0	S	477741	6819382	0.4	3.8	1.2	5.9	3.9	18.5	---	---	3
LINE 10122													
A	375.4	S	476763	6818504	2.1	0.0	1.5	3.7	1.8	6.5	---	---	0
B	405.1	S	477660	6819050	2.9	0.9	0.6	3.1	1.7	5.3	---	---	0
LINE 10130													
A	3488.0	S	477510	6818775	2.4	2.8	1.8	0.7	4.7	3.6	---	---	0
LINE 10140													
A	3366.3	S	477306	6818421	0.3	10.5	0.9	14.7	6.9	49.6	---	---	0
B	3377.0	S	477668	6818637	0.3	3.3	1.1	6.5	5.1	13.2	---	---	145
LINE 10150													
A	3237.8	S	476974	6818002	2.5	4.5	1.1	4.3	8.5	12.0	---	---	5
B	3210.7	S	477775	6818471	2.7	0.9	2.4	0.9	3.5	0.1	---	---	5
LINE 10160													
A	3087.8	H	477118	6817848	3.8	0.5	0.0	0.2	2.6	4.8	---	---	0
B	3111.0	S	477951	6818332	1.2	2.6	0.9	4.9	3.9	9.9	---	---	1
LINE 10170													
A	3033.8	S	476793	6817447	5.8	1.1	2.6	0.7	3.1	3.9	---	---	7
B	3027.3	H	476973	6817553	1.6	11.6	2.5	20.0	21.5	46.2	1.0	0	7
LINE 10182													
A	610.2	H	476953	6817250	2.4	11.0	7.9	25.0	23.9	40.3	2.1	0	0
B	630.5	S	477566	6817608	2.2	4.3	1.8	6.8	5.4	14.0	---	---	49
C	649.7	S	478231	6817988	2.5	1.9	0.9	2.4	2.2	4.7	---	---	92
LINE 10190													
A	2802.8	H	477054	6817157	4.2	12.7	4.1	22.4	26.4	46.8	2.1	0	0
B	2777.2	D	477643	6817464	1.6	4.5	1.3	7.5	8.7	18.7	---	---	79
C	2761.8	S	478129	6817739	2.0	3.1	1.8	3.9	4.1	11.2	---	---	0
D	2750.1	S	478507	6817962	2.6	1.1	1.0	4.6	2.9	11.8	---	---	0
LINE 10200													
A	2581.1	H	477123	6816903	5.8	10.0	7.9	23.4	25.7	37.7	---	---	2
B	2605.8	B?	477803	6817315	2.4	1.7	0.6	1.7	5.5	6.9	---	---	75

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LINE 10200													
C	2618.1	S	478248	6817569	2.1	1.0	0.8	2.3	4.1	2.4	---	---	7
D	2627.3	S	478569	6817768	1.8	1.5	1.0	3.6	4.7	10.7	---	---	0
LINE 10210													
A	2536.5	S	477245	6816762	5.0	18.2	5.1	30.3	30.9	68.6	---	---	0
B	2506.4	S?	477987	6817202	2.0	1.7	0.5	3.1	3.6	7.5	---	---	0
C	2493.2	S	478419	6817442	0.7	3.3	0.4	3.8	5.5	9.5	---	---	0
LINE 10220													
A	2319.9	S	477351	6816579	2.1	6.9	5.6	15.9	19.9	17.2	---	---	24
B	2356.0	S	478510	6817288	1.2	4.0	1.1	5.4	6.1	13.7	---	---	11
LINE 10230													
A	2217.1	S	477404	6816408	3.1	16.8	6.0	26.2	36.1	47.5	1.7	0	27
B	2195.1	S	478043	6816770	1.8	3.6	0.8	5.4	3.9	16.9	---	---	179
C	2186.5	S	478319	6816928	2.1	1.8	0.6	2.1	4.4	4.9	---	---	0
D	2178.8	S	478576	6817067	2.6	2.3	1.5	4.5	4.8	10.1	---	---	0
LINE 10240													
A	2022.0	H	477492	6816203	3.7	10.4	6.9	19.2	24.3	32.4	2.7	0	0
B	2050.7	S	478334	6816706	3.7	1.2	1.2	2.8	2.3	9.1	---	---	52
LINE 10250													
A	1979.2	H	477570	6816032	3.1	12.2	4.9	20.9	25.4	37.3	1.9	0	0
B	1951.1	S	478405	6816515	2.2	0.8	1.1	1.5	1.4	3.2	---	---	8
C	1928.2	E	479202	6816994	3.5	0.6	0.4	0.2	2.6	1.2	---	---	1
D	1914.7	S	479487	6817197	2.1	0.2	0.9	0.1	1.1	0.5	---	---	0
LINE 10260													
A	1732.7	H	477652	6815846	5.5	9.1	5.5	21.6	24.0	32.7	---	---	0
B	1760.8	B?	478459	6816312	2.0	2.1	0.4	1.6	3.3	7.0	---	---	37
C	1769.7	S	478777	6816497	2.9	3.2	0.3	4.0	5.2	11.7	2.4	40	0
LINE 10270													
A	1690.7	H	477694	6815674	3.1	13.8	5.7	22.5	24.2	45.2	---	---	0
B	1667.6	S	478346	6816020	2.1	1.6	1.6	4.0	2.1	5.5	---	---	8
C	1649.6	S	478953	6816393	4.4	1.2	1.8	3.5	6.3	4.1	---	---	8
LINE 10280													
A	1513.5	S	478431	6815846	2.5	2.8	0.1	3.4	5.1	13.9	---	---	30
B	1535.0	S	479156	6816260	0.1	3.5	1.3	6.1	3.9	15.7	---	---	0
LINE 10290													
A	1454.1	H	477982	6815358	3.6	14.5	4.8	23.8	26.3	49.8	1.8	0	0
B	1408.0	S	479415	6816207	2.6	2.6	1.2	1.5	3.5	3.1	---	---	10

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LINE 10300													
A	1249.4	H	478098	6815176	0.8	11.0	7.0	22.5	26.3	31.0	1.4	0	0
B	1300.8	S	479794	6816161	2.1	0.5	0.7	1.0	2.2	6.1	---	---	0
LINE 10310													
A	1108.4	S	478265	6815032	2.5	19.2	5.2	32.5	33.7	69.5	1.3	0	13
B	1078.2	S	479034	6815476	1.5	1.5	0.5	2.5	2.7	5.5	---	---	0
C	1058.7	S	479627	6815861	1.7	1.2	1.0	0.8	0.4	0.4	---	---	0
D	1040.9	S	480179	6816159	1.8	5.3	1.1	7.6	7.3	20.2	---	---	13
LINE 10320													
A	891.4	H	478236	6814782	4.7	10.6	7.0	23.7	22.0	32.4	2.9	0	0
B	945.0	S	479922	6815751	1.3	2.8	0.8	2.0	4.4	5.5	---	---	0
LINE 10330													
A	848.8	H	478456	6814687	5.7	17.1	7.1	30.0	32.6	55.6	2.5	0	0
B	836.0	B	478767	6814864	1.4	2.5	2.2	1.3	6.5	4.9	---	---	0
C	796.6	S	479960	6815550	3.2	2.4	0.9	1.2	2.5	6.9	7.9	40	18
D	786.4	S	480280	6815728	1.8	2.8	1.9	3.6	3.6	10.6	---	---	0
LINE 10340													
A	585.9	H	478457	6814441	2.7	9.2	5.5	17.2	20.5	22.9	2.2	0	0
B	601.4	D	478949	6814734	2.5	4.9	1.2	5.2	14.4	16.7	2.7	11	0
C	605.6	D	479077	6814804	3.6	2.3	0.0	7.7	13.1	6.6	2.7	35	0
D	619.0	S?	479479	6815040	0.1	2.9	0.6	3.5	2.2	11.5	---	---	12
E	630.0	S?	479814	6815247	3.4	1.8	0.6	3.1	0.5	7.0	6.9	44	3
F	648.0	S	480330	6815553	0.3	0.7	0.5	1.4	1.3	5.7	---	---	0
LINE 10350													
A	539.6	H	478627	6814334	4.1	15.1	5.8	25.9	28.7	47.7	---	---	0
B	519.2	D	479203	6814644	2.6	6.5	1.8	8.8	12.1	21.1	2.0	6	70
C	484.1	S	480254	6815259	2.5	2.0	0.7	2.7	2.4	10.9	---	---	0
LINE 10360													
A	232.8	H	478707	6814125	4.8	11.1	6.7	20.0	26.8	32.6	---	---	0
B	252.1	D	479354	6814488	2.0	4.6	0.8	3.5	6.9	12.0	---	---	11
LINE 10370													
A	842.0	D	479478	6814335	0.8	3.3	0.8	3.8	5.7	11.1	0.4	0	13
LINE 10380													
A	639.3	S?	479607	6814180	1.6	1.3	0.3	4.2	3.0	5.6	---	---	1
LINE 10390													
A	570.0	S?	479639	6813981	0.9	2.3	0.9	2.9	2.9	9.2	---	---	11
B	540.0	S	480510	6814483	0.6	2.4	0.8	4.7	2.7	10.5	---	---	132

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LINE 10400													
A	373.0	S?	479815	6813840	0.1	0.4	1.0	1.5	1.0	2.7	---	---	14
B	403.0	S?	480673	6814352	1.0	2.5	1.1	4.2	2.7	11.8	---	---	0
LINE 10410													
A	269.6	S	480903	6814245	2.5	2.6	1.1	3.5	4.8	11.3	---	---	0
LINE 10421													
A	130.0	S?	479965	6813476	1.2	0.6	0.5	2.3	2.9	4.5	---	---	0
B	168.5	S	481050	6814106	2.6	0.2	0.5	1.5	0.8	0.7	---	---	0
LINE 10431													
A	191.3	S	481035	6813869	2.5	0.1	1.5	0.7	1.7	7.0	---	---	22
LINE 10440													
A	433.8	H	479982	6813026	2.7	1.7	2.1	6.6	4.6	1.5	3.9	36	0
B	480.0	S	481259	6813764	1.0	1.0	0.9	1.1	2.6	3.7	---	---	0
LINE 10450													
A	385.7	H	479911	6812766	3.0	4.0	2.8	7.9	10.0	14.9	---	---	0
B	374.9	E	480258	6812962	3.2	1.7	2.3	3.3	4.8	3.2	---	---	0
C	343.0	S	481290	6813559	0.4	2.3	0.7	3.3	2.8	10.3	---	---	58
LINE 10460													
A	145.8	H	480016	6812587	1.7	6.1	2.5	10.8	9.1	22.1	---	---	0
B	156.5	S?	480377	6812790	3.0	3.9	2.8	5.3	10.6	6.8	---	---	0
LINE 10472													
A	964.7	H	480154	6812407	1.0	10.0	2.5	13.7	15.3	33.2	0.9	0	0
B	978.1	S?	480533	6812626	4.5	7.7	4.2	11.6	21.1	18.1	3.4	11	0
C	1023.1	S	481477	6813173	1.7	0.1	0.6	1.5	1.1	3.8	---	---	0
D	1058.0	S	482104	6813534	1.3	1.5	0.7	2.0	1.3	4.6	---	---	10
LINE 10480													
A	1659.2	H	480231	6812233	0.4	6.1	1.6	11.1	12.4	18.9	1.6	0	8
B	1674.0	B	480679	6812504	5.3	8.6	3.9	9.4	20.5	8.5	3.0	30	0
C	1694.0	S	481247	6812833	2.1	2.4	0.6	4.3	2.8	9.6	---	---	0
D	1734.7	S	482210	6813384	2.6	1.1	1.0	2.5	2.8	2.4	---	---	0
LINE 10492													
A	1340.6	H	480324	6812057	3.2	14.1	5.9	20.9	25.7	39.7	---	---	0
B	1325.5	B	480876	6812345	7.8	9.5	8.6	21.1	20.7	26.7	4.1	20	0
C	1314.3	S	481276	6812604	3.8	5.7	2.0	8.2	6.2	19.0	---	---	0
D	1282.7	S	482389	6813218	3.1	1.0	0.9	1.3	3.7	2.5	---	---	0

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LINE 10500													
A	1397.4	H	480515	6811942	2.7	2.5	4.7	4.7	7.3	7.2	---	---	5
B	1407.7	H	480784	6812116	0.6	7.0	4.2	12.7	13.8	21.4	1.3	0	0
C	1415.2	H	480992	6812240	3.4	9.0	5.0	15.2	19.2	18.7	2.7	2	0
D	1450.4	S	481930	6812772	2.5	2.1	0.0	1.9	3.4	7.5	4.3	55	0
E	1478.5	S	482715	6813218	2.0	1.6	0.4	1.6	2.1	6.0	---	---	5
LINE 10510													
A	1346.1	H	480662	6811796	5.4	9.2	10.2	16.1	17.2	16.1	3.9	22	2
B	1323.4	H?	481437	6812240	3.7	6.7	2.4	9.5	12.8	12.8	2.8	7	0
LINE 10520													
A	1159.0	H	480744	6811624	5.2	4.9	7.1	9.2	11.4	3.0	---	---	0
B	1188.1	B?	481689	6812160	2.2	3.2	6.2	5.0	4.7	2.6	---	---	0
LINE 10530													
A	1044.1	H	480846	6811448	5.4	5.6	9.6	11.1	13.7	7.1	---	---	1
B	1019.8	B?	481742	6811963	5.2	3.3	5.6	9.1	7.4	9.6	7.9	22	2
C	1002.0	S	482411	6812345	2.4	3.6	2.0	7.6	8.4	12.6	---	---	0
LINE 10540													
A	866.6	H	480794	6811189	5.7	9.9	10.2	17.6	21.6	17.5	3.7	14	0
B	897.2	H?	481864	6811806	4.0	4.4	4.0	8.9	9.0	10.2	3.9	28	0
LINE 10550													
A	800.9	H	481986	6811643	4.6	4.7	4.6	9.5	11.8	5.2	---	---	0
B	771.9	S	483124	6812286	0.6	3.1	1.1	5.2	5.9	7.6	0.9	0	0
LINE 10560													
A	667.3	S	481698	6811233	0.6	4.2	0.8	6.3	7.0	15.9	1.0	6	0
B	712.6	S	483296	6812163	1.1	2.7	1.1	3.8	5.5	8.3	---	---	0
LINE 10570													
A	606.0	H	481215	6810730	6.4	20.1	13.7	35.0	39.4	47.0	3.4	0	0
B	587.4	S	481943	6811150	1.0	4.6	1.0	5.3	8.0	14.4	---	---	0
C	566.0	S	482785	6811641	3.0	4.4	1.3	4.1	12.6	9.6	2.6	36	0
D	546.6	S	483542	6812072	0.9	3.1	1.1	4.2	5.5	8.9	---	---	0
LINE 10581													
A	190.1	H	481275	6810552	5.1	10.8	8.9	17.2	20.2	23.1	3.4	17	0
B	214.4	S	482144	6811030	0.0	5.8	2.3	10.4	6.7	20.9	---	---	0
C	231.0	S	482722	6811369	2.2	3.3	1.8	6.2	9.1	8.8	---	---	0
LINE 10590													
A	381.6	H	481428	6810404	6.4	7.3	6.4	13.7	18.3	13.5	---	---	0
B	365.0	S	482042	6810759	0.2	3.7	0.8	6.3	4.8	17.2	---	---	0

CX = COAXIAL
CP = COPLANAR

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

Label	Fid	Interp	XUTM m	YUTM m	CX 1052 HZ Real ppm	CX 1052 HZ Quad ppm	CP 881 HZ Real ppm	CP 881 HZ Quad ppm	CX 5487 HZ Real ppm	CX 5487 HZ Quad ppm	Vertical Dike COND siemens	Vertical Dike DEPTH* m	Mag. Corr NT
LINE 10590													
C	339.3	S	483033	6811323	2.3	2.9	0.3	3.6	6.6	8.0	---	---	2
D	328.5	S	483450	6811573	1.7	4.0	1.7	7.8	6.6	14.1	---	---	0
LINE 10600													
A	197.0	H	481345	6810142	1.9	3.5	4.1	6.3	7.6	10.2	---	---	2
B	229.8	S	482482	6810795	1.3	4.3	2.4	7.5	9.0	11.6	1.7	8	0
C	249.3	S	483163	6811190	1.4	2.6	1.8	4.1	5.9	7.5	---	---	0
LINE 19010													
A	5353.9	H	482844	6811310	2.5	8.9	2.0	12.4	18.5	28.9	1.5	0	7
B	5328.9	H	482285	6812317	5.1	2.6	3.4	2.3	6.5	2.1	---	---	0
C	5228.0	S	480110	6816058	0.8	3.2	1.5	6.8	4.6	16.3	---	---	0
D	5157.4	S	478613	6818647	3.3	1.5	0.7	1.5	2.4	4.1	---	---	0
LINE 19020													
A	5436.7	H	481170	6810659	5.5	16.5	10.5	27.9	32.6	39.0	3.2	0	0
B	5470.9	H	480322	6812113	6.1	8.6	8.0	13.9	16.9	31.8	4.3	20	0
C	5513.0	S	479268	6813893	2.9	9.8	3.2	15.8	16.5	30.4	1.8	0	0
D	5537.8	S?	478743	6814828	2.0	2.4	0.9	5.1	4.8	7.9	---	---	0

CX = COAXIAL
CP = COPLANAR

Note: EM values shown above are local amplitudes

EM Anomaly List

* 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 magnetite/overburden effects.

093989

Data Compilation
and
Interpretation of Airborne EM Anomalies

Barb Property
Watson Lake Mining Division
Yukon Territory

N.T.S. 105H/6/11

for

INTERNATIONAL BARYTEX RESOURCES LTD.

by

H. L. King, P. Geo.

April 9, 1999

2 of 2

SUMMARY

The 100% owned Barb property is strategically located in an area of southeast Yukon that has recently been the focus of considerable exploration interest following Cominco's 1994 discovery of a large zinc-copper-lead-silver-gold deposit and recent Atna/Westmin base metal discoveries.

Previous work on the property has outlined a massive sulphide deposit estimated to contain 588,000 tons grading 6.5% lead, 4.6% zinc and 3.0 oz/ton silver. Several airborne EM conductors identified in a 1998 survey and numerous untested copper, lead and zinc geochemical soil anomalies offer excellent exploration targets within a favourable geological setting that has the potential to host large massive sulphide deposits.

INTRODUCTION

A compilation of geological, geochemical, ground geophysical data and recently aquired airborne geophysical data was undertaken in October, 1998. Several of the airborne geophysical anomalies are interpreted to represent bedrock conductors favorably located with respect to known mineralization. Please see the compilation map accompanying this report.

LOCATION

The property comprises 134 mineral claims located on the east shore of the east arm of Frances Lake, approximately 160 kilometres north of Watson Lake and 15 kilometres east of the Robert Campbell Highway.

Present access to the property is by either float plane from Watson Lake or by paved highway to the forestry campground on Frances Lake and then by boat or helicopter to the claims.

GEOLOGICAL SETTING

The property is underlain by Devonian/Mississippian phyllitic rocks that form the western limb of a north-northwest trending syncline. The phyllitic rocks form two conformable units; a dark green to black phyllite overlies a light grey, fine-grained unit. Cherty tuffaceous beds occur within the dark phyllites and host thin-bedded, massive sulphides at the Matt Berry Zone. An extensive quartz-sericite schist unit, locally sulphide-bearing and of possible volcanic origin, occurs within the phyllitic rocks southeast of the Matt Berry deposit.

The Matt Berry deposit is in phyllites similar in age to the sedimentary hosts rocks at the Tom and Jason deposits at McMillan Pass and the Red Dog deposit in Alaska. Drill results indicate the deposit is stratiform and stratabound like other shale hosted base metal deposits of the Selwyn Basin.

ECONOMIC GEOLOGY

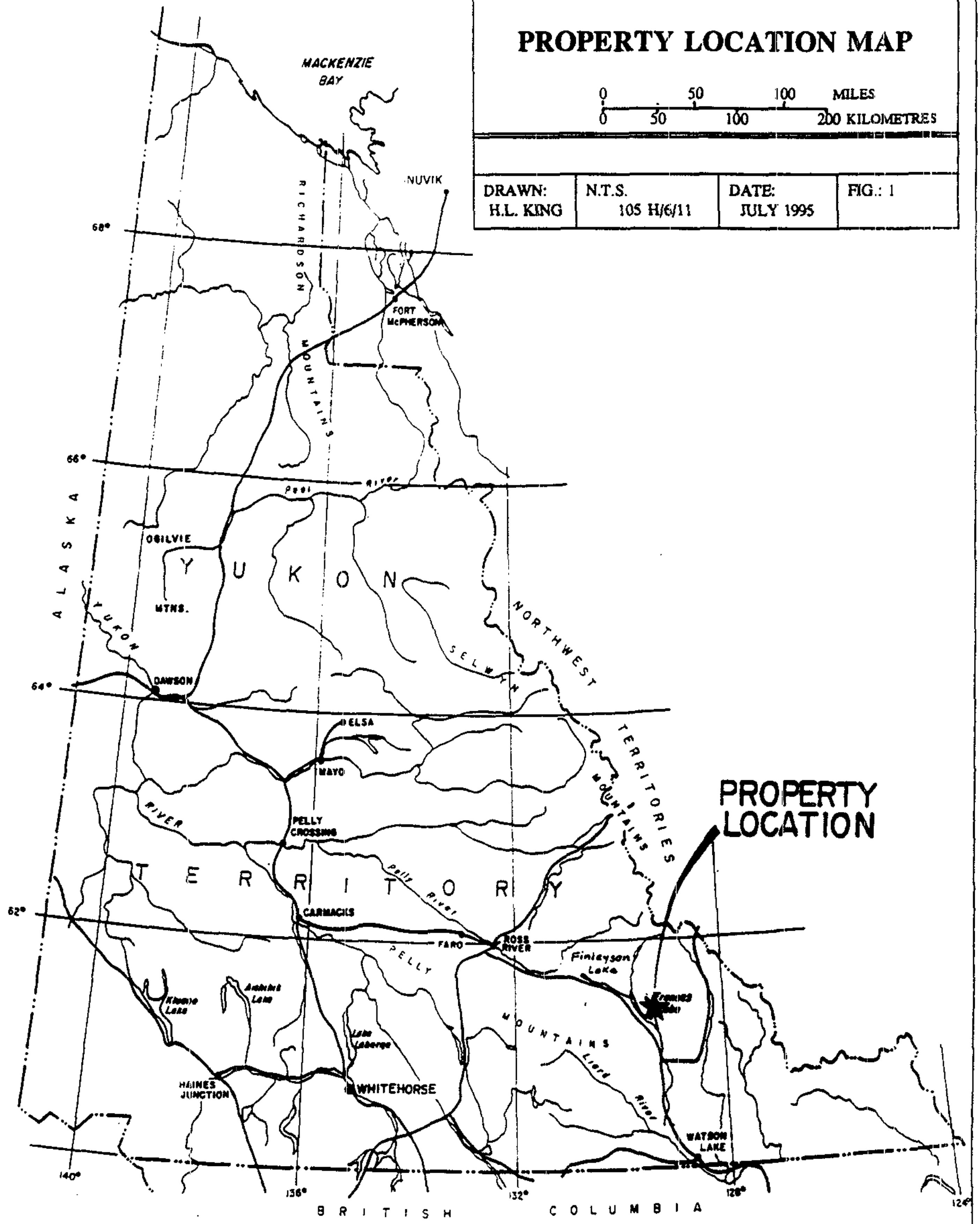
The Matt Berry zone consisting of stratabound, massive sulphide mineralization has been outlined by surface trenching and diamond drilling. Mineralization includes argentiferous galena, sphalerite,

Barb Property

PROPERTY LOCATION MAP

0 50 100 MILES
0 50 100 200 KILOMETRES

DRAWN:	N.T.S.	DATE:	FIG.: 1
H.L. KING	105 H/6/11	JULY 1995	



pyrite, pyrrhotite, boulangerite, arsenopyrite and manganiferous siderite.

The mineralization is made up of a number of thin-bedded, massive sulphide zones within a cherty, tuffaceous interval that averages about 12 meters in thickness. Drill-indicated and inferred reserves have been estimated at 588,000 tons grading 6.1% Pb, 4.6% Zn and 3.0 oz/ton Ag.

Soil sampling programs have resulted in the delineation of numerous copper, lead and zinc geochemical soil anomalies. Some of the anomalies are closely associated with a quartz-sericite schist unit that has been traced over a distance of about 5 kilometres. One of the geochemical anomalies called the Money Zone, with a similar geochemical signature to the Matt Berry Zone, was detailed by geophysical surveys in 1988.

HISTORICAL WORK

The area comprising the present Barb, Beth, Binti, Pat and Fran claims has been prospected and explored intermittently since the discovery of lead-zinc-silver mineralization in the 1930s. Historical exploration work has been carried out by various major and junior mining companies between 1966 and 1988. Work has included geochemistry, geophysics, geological mapping, bulldozer trenching and approximately 3900 metres of diamond drilling centered over the original Matt Berry showing on Thompson Creek.

RECENT EXPLORATION

In July 1991, a 303 metre/4 hole diamond drill program by Pulse Resources Ltd tested 450 metres of strike length on the Money Zone, located 1.0 km southeast of the Matt Berry deposit. This area is underlain by a 600 metre long, coincident lead-zinc soil geochemical anomaly, favourable stratigraphy equated with the Matt Berry deposit and moderate to strong IP chargeability features. Results of the drill program included 1.0 to 3.0 metre long intercepts of semi-massive to massive sulphides in 3 of 4 holes. A 0.5 metre intercept of base metal mineralization intersected in hole PUL 91-1 assayed 5.87% Zn and 1.82% Pb.

In June 1995, International Barytex Ltd carried out geological mapping and prospecting on the claim group. Outcrop on the claim group is sparse due to extensive overburden cover. An airborne geophysical survey to identify potential massive sulphide deposits was recommended.

In September 1998, a Digem airborne EM and magnetic survey was flown over the claim group. Several anomalous features considered to be moderate to high priority exploration targets were outlined by the survey.

INTERPRETATION OF AIRBORNE EM ANOMALIES

Two high priority airborne EM anomalies to the west and parallel to the Money Zone, are coincident with an IP anomaly that has not been drill tested. One of the conductors is at least 600 metre long. Both conductors appear to be on strike with the Matt Berry lead-zinc-silver zone located one kilometre to the north. Four weak conductors located within the northern portion of the property also warrant detailed ground geophysical coverage. The northernmost conductor is coincident with a weakly mineralized quartz vein which could represent an occurrence peripheral to more massive sulphide concentration.

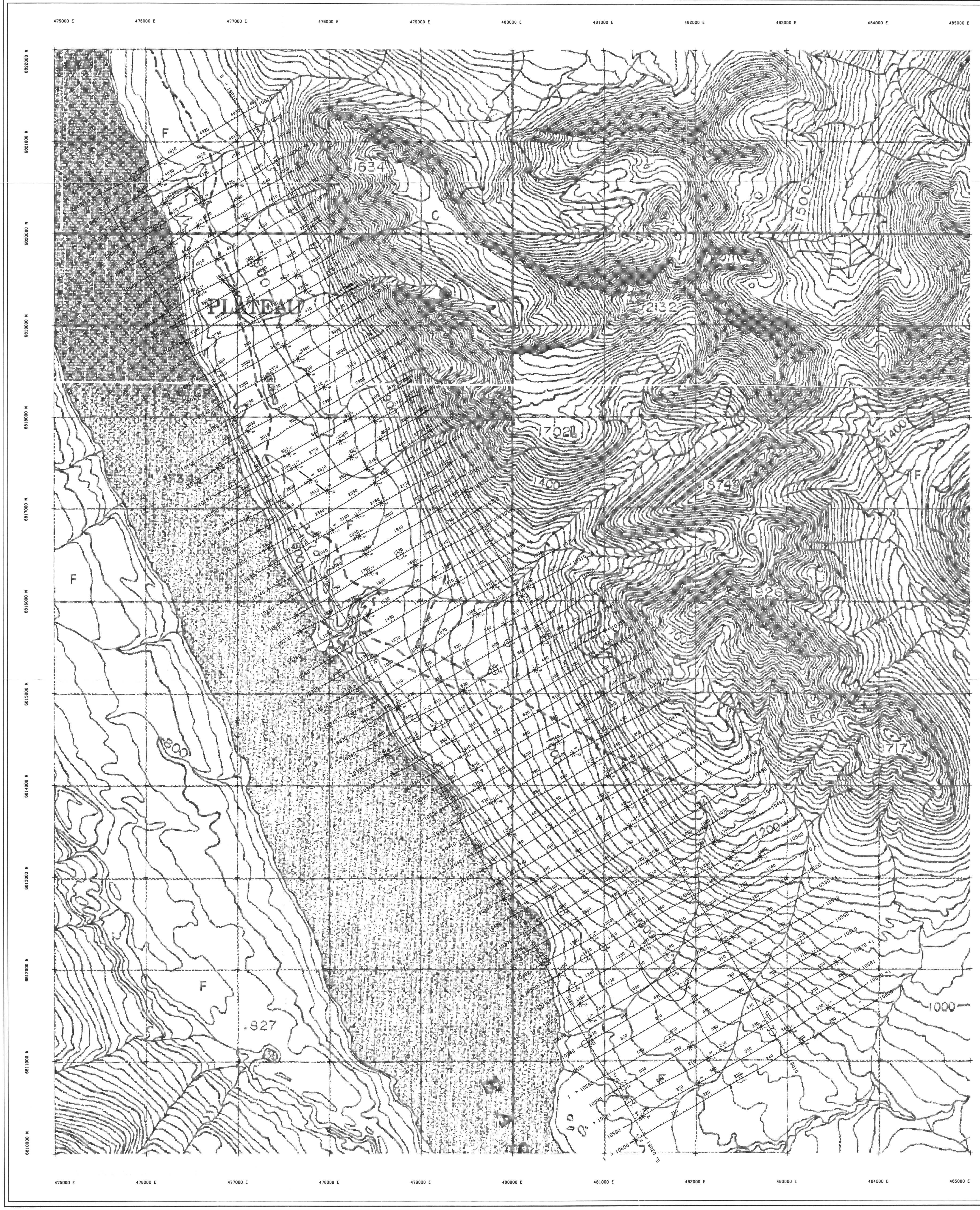
CONCLUSIONS AND RECOMMENDATIONS

The two airborne EM anomalies to the west and parallel to the Money Zone are considered high priority targets and the four northermost anomalies second priority. However, all warrant ground geophysical follow-up in order to define drill targets.

The geological setting within this immediate area is highly prospective for hosting large massive sulphide deposits. Well mineralized boulders point to additional base metal-bearing volcanic units. The potential of this setting remains to be fully tested.

H. L. King
General Manager

April 9, 1999



TECHNICAL SUMMARY

Navigation . . . . Ashtech/Racal GPS positioning
Data reduction grid interval . . . . 50 metres
Terrain clearance . . . . Helicopter 57 m
Electromagnetic sensor 30 m
Magnetometer 30 m
Data sampling interval . . . . 0.1 second
Magnetometer / sensitivity . . . . . Cesium / 0.01 nT
Electromagnetic system . . . . . . DIGHEM[V]

Frequency	Sensitivity	Coil Orientation
900 Hz	0.1 ppm	Vertical coaxial
5500 Hz	0.2 ppm	Vertical coaxial
900 Hz	0.1 ppm	Horizontal coplanar
7200 Hz	0.2 ppm	Horizontal coplanar
56000 Hz	0.5 ppm	Horizontal coplanar

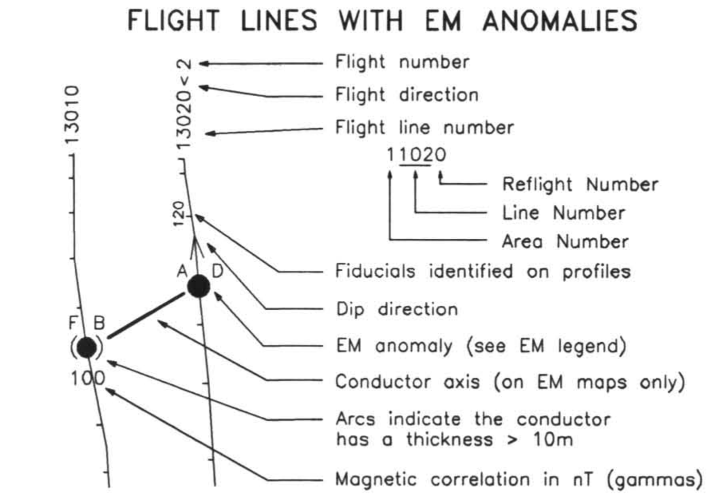
ELECTROMAGNETIC ANOMALIES

Grade	Anomaly	Conductance
7	●	>100 siemens
6	◕	50–100 siemens
5	◒	20–50 siemens
4	⊕ (quarter filled)	10–20 siemens
3	⊕	5–10 siemens
2	○	1–5 siemens
1	◌	< 1 siemens
–	✳	Questionable anomaly

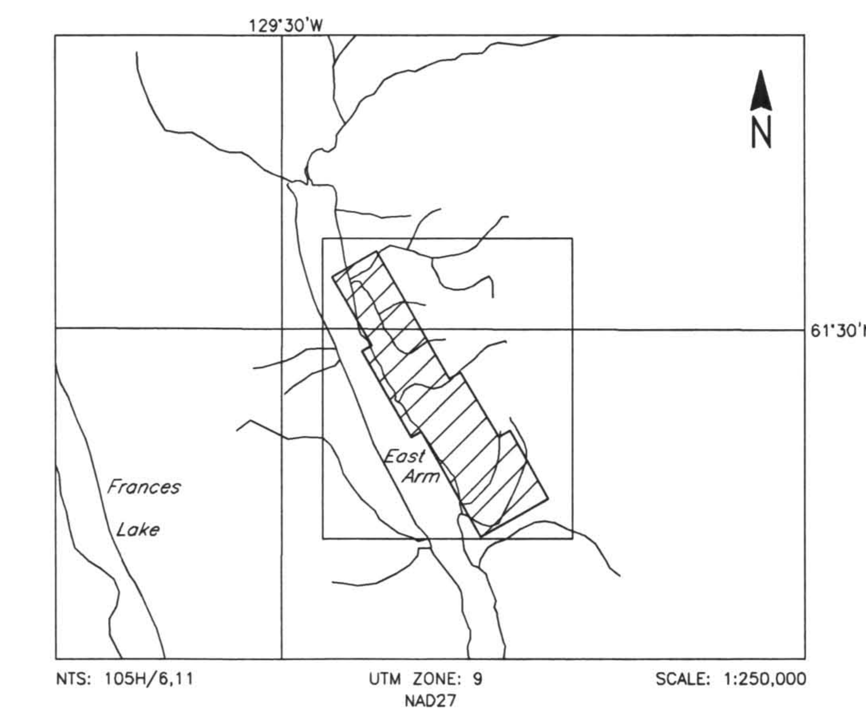
Anomaly identifier — C
Interpretive symbol — H
Depth is greater than
· 15 m
: 30 m
⁝ 45 m
⁞ 60 m
Inphase and Quadrature of coaxial coil is greater than
. 5 ppm
.. 10 ppm
... 15 ppm
.... 20 ppm

Interpretive symbol	Conductor ("model")
B	Bedrock conductor
D	Narrow bedrock conductor ("thin dike")
S	Conductive cover ("horizontal thin sheet")
H	Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half space")
E	Edge of broad conductor ("edge of half space")
L	Culture, e.g. power line, metal building or fence

FLIGHT LINES WITH EM ANOMALIES



LOCATION MAP



NTS: 105H/6,11 — UTM ZONE: 9 NAD27 — SCALE: 1:250,000

INTERNATIONAL BARYTEX RESOURCES LTD.
BARB PROPERTY–FRANCES LAKE, YUKON

ELECTROMAGNETIC ANOMALIES

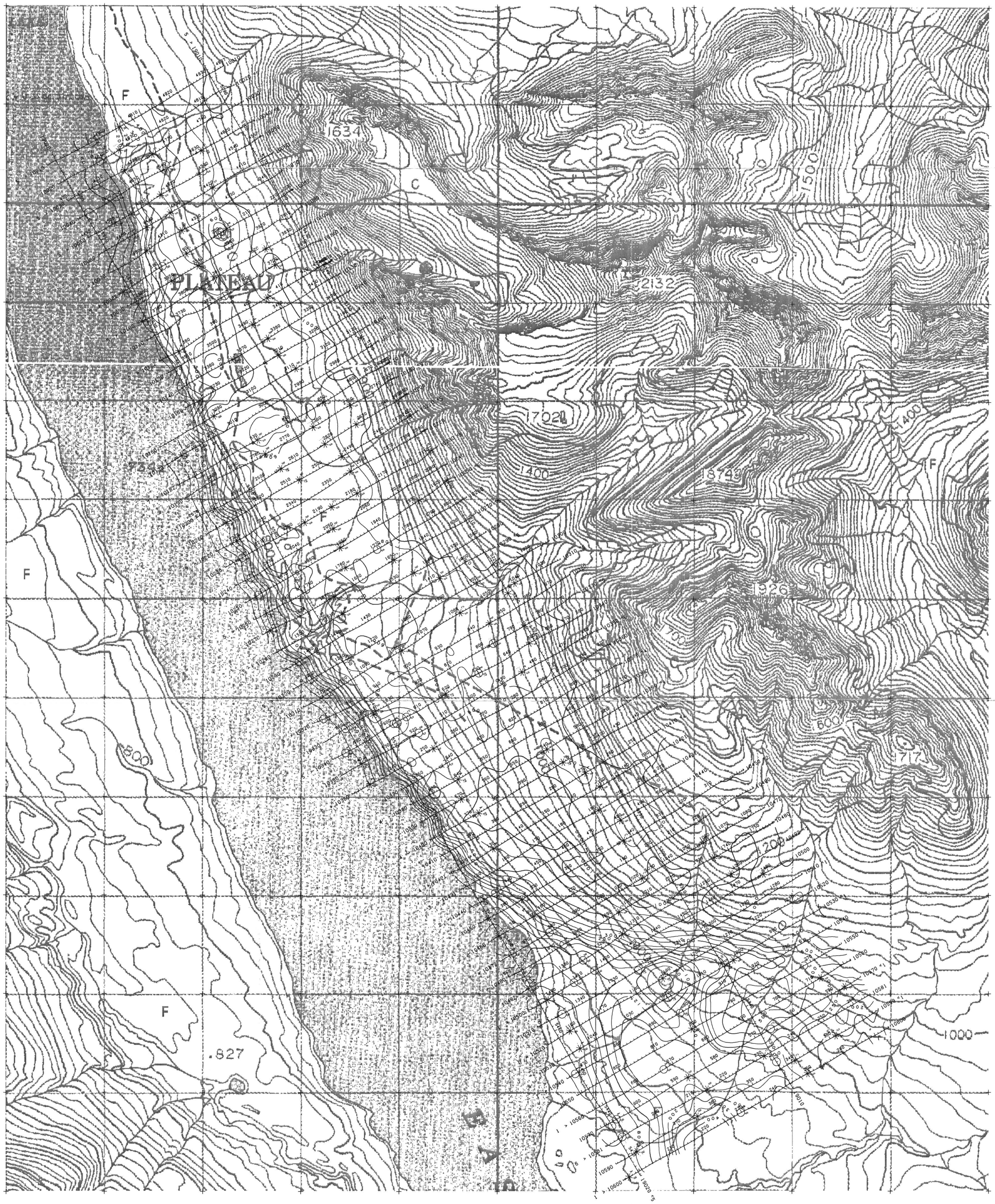
DIGHEM[V] SURVEY	NTS: 105H/6,11	GEOPHYSICIST: D.M.
DATE: SEPTEMBER, 1998	JOB: 1318	SHEET: 1

Geoterrex–Dighem, A division of CGG Canada Ltd.

0 1 2 Km
Scale 1:20 000

093989 2/2
DWG ①

geoterrex-dighem
Airborne & Ground *Geophysics*



TECHNICAL SUMMARY

Navigation .... Ashtech/Racal GPS positioning
Data reduction grid interval .... 50 metres
Terrain clearance .... Helicopter 57 m
Electromagnetic sensor 30 m
Magnetometer 30 m
Data sampling interval .... 0.1 second
Magnetometer / sensitivity ..... Cesium / 0.01 nT
Electromagnetic system .... DIGHEM[v]

Frequency	Sensitivity	Coil Orientation
900 Hz	0.1 ppm	Vertical coaxial
5500 Hz	0.2 ppm	Vertical coaxial
900 Hz	0.1 ppm	Horizontal coplanar
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Anomaly identifier
Interpretive symbol
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· 15 m
: 30 m
⁝ 45 m
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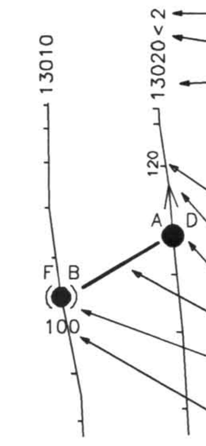
FLIGHT LINES WITH EM ANOMALIES

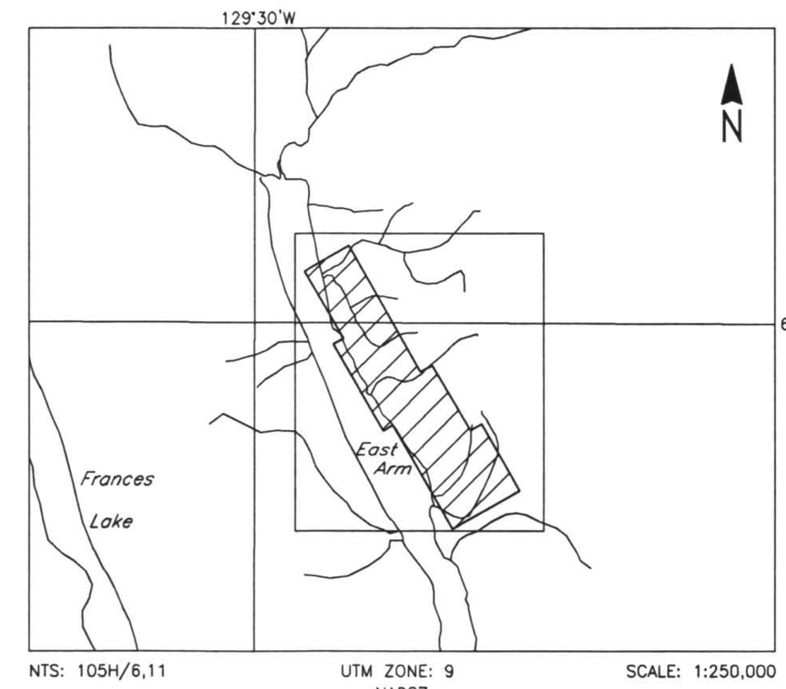


RESISTIVITY CONTOURS

1000
800
600
500
400
300
250
200
150
125
100

Contours in ohm–m at 10 intervals per decade

LOCATION MAP



INTERNATIONAL BARYTEX RESOURCES LTD.
BARB PROPERTY–FRANCES LAKE, YUKON

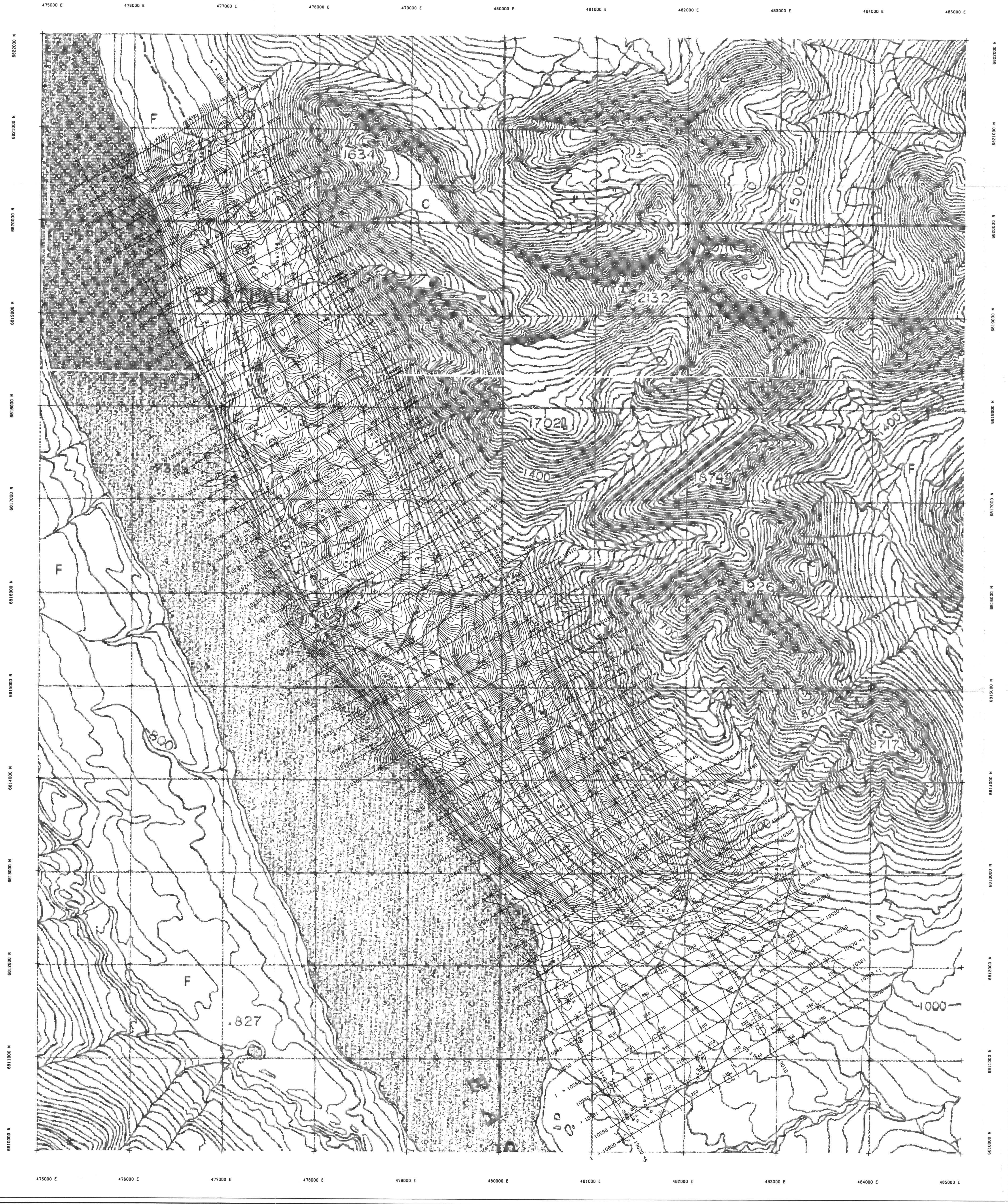
APPARENT RESISTIVITY
900 Hz COPLANAR

DIGHEM[v] SURVEY	NTS: 105H/6,11	GEOPHYSICIST: Dm.
DATE: SEPTEMBER, 1998	JOB: 1318	SHEET: 1

Geoterrex–Dighem, A division of CGG Canada Ltd.

0 1 2 Km
Scale 1:20 000

geoterrex-dighem
Airborne & Ground Geophysics



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Magnetometer 30 m
Data sampling interval . . . . 0.1 second
Magnetometer / sensitivity . . . . . Cesium / 0.01 nT
Electromagnetic system . . . . . . DIGHEM[V]

Frequency	Sensitivity	Coil Orientation
900 Hz	0.1 ppm	Vertical coaxial
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1	◌	< 1 siemens
–	✳	Questionable anomaly

Anomaly identifier
Interpretive symbol
Depth is greater than
· 15 m
: 30 m
⋮ 45 m
⁞ 60 m
Inphase and Quadrature of coaxial coil is greater than
. 5 ppm
.. 10 ppm
... 15 ppm
.... 20 ppm

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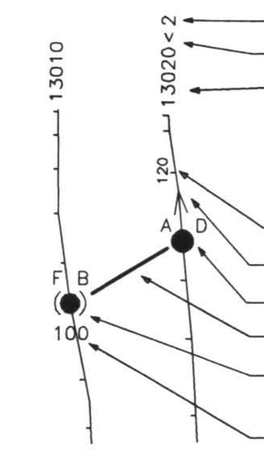
FLIGHT LINES WITH EM ANOMALIES



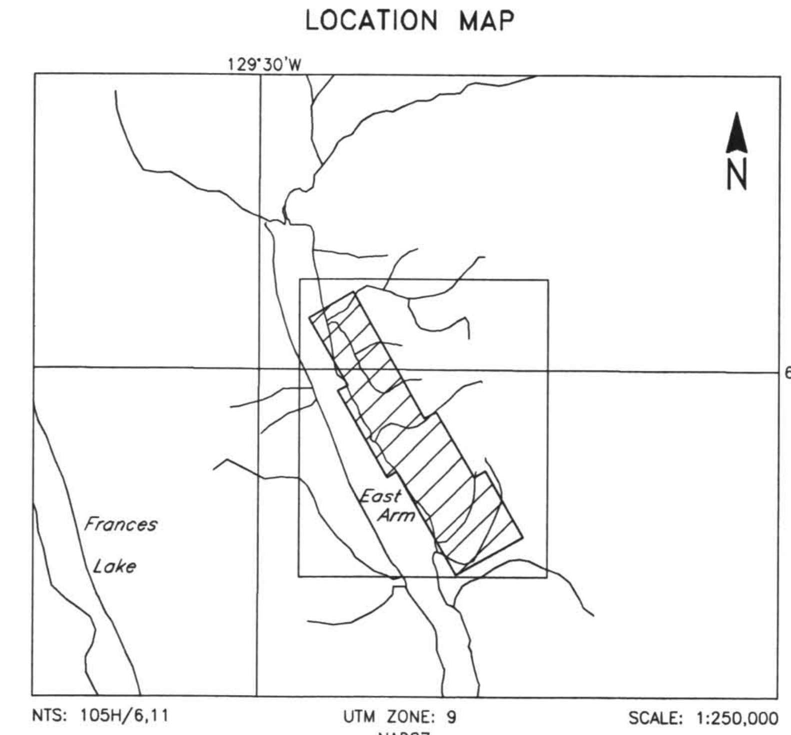
Flight number
Flight direction
Flight line number
11020
Reflight Number
Line Number
Area Number
Fiducials identified on profiles
Dip direction
EM anomaly (see EM legend)
Conductor axis (on EM maps only)
Arcs indicate the conductor has a thickness > 10m
Magnetic correlation in nT (gammas)

TOTAL FIELD MAGNETIC CONTOURS

. . . . 250 nT
. . . . 50 nT
. . . . 10 nT
. . . . 5 nT
. . . . magnetic low

Magnetic inclination within the survey area: 78 degrees N
Magnetic declination within the survey area: 29 degrees E

LOCATION MAP



NTS: 105H/6,11 UTM ZONE: 9 NAD27 SCALE: 1:250,000

INTERNATIONAL BARYTEX RESOURCES LTD.
BARB PROPERTY–FRANCES LAKE, YUKON

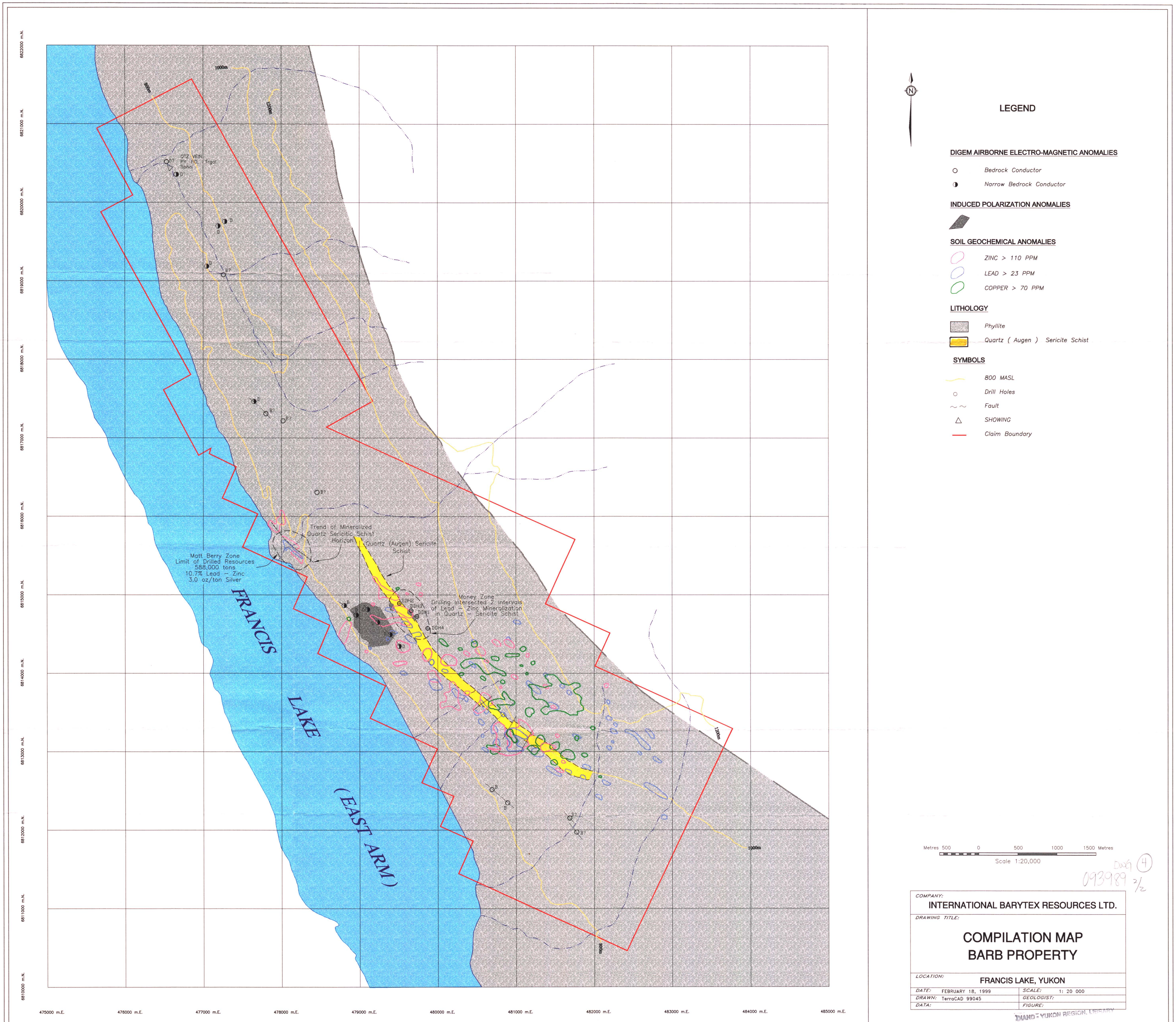
TOTAL FIELD MAGNETICS

DIGHEM[V] SURVEY	NTS: 105H/6,11	GEOPHYSICIST: DM
DATE: SEPTEMBER, 1998	JOB: 1318	SHEET: 1

Geoterrex–Dighem, A division of CGG Canada Ltd.

0 1 2 Km
Scale 1:20 000

geoterrex-dighem
Airborne & Ground Geophysics



LEGEND
DIGEM AIRBORNE ELECTRO-MAGNETIC ANOMALIES
Bedrock Conductor
Narrow Bedrock Conductor
INDUCED POLARIZATION ANOMALIES
SOIL GEOCHEMICAL ANOMALIES
ZINC > 110 PPM
LEAD > 23 PPM
COPPER > 70 PPM
LITHOLOGY
Phyllite
Quartz (Augen) Sericite Schist
SYMBOLS
800 MASL
Drill Holes
Fault
SHOWING
Claim Boundary
N
FRANCIS LAKE (EAST ARM)
Matt Berry Zone
Limit of Drilled Resources
588,000 tons
10.7% Lead - Zinc
3.0 oz/ton Silver
Trend of Mineralized
Quartz Sericitic Schist
Horizon
Quartz (Augen) Sericite
Schist
Money Zone
Drilling Intersected 2 Intervals
of Lead - Zinc Mineralization
in Quartz - Sericite Schist
QTZ VEIN
DDH2
DDH3
DDH1
DDH4
1000m
475000 m.E.
476000 m.E.
477000 m.E.
478000 m.E.
479000 m.E.
480000 m.E.
481000 m.E.
482000 m.E.
483000 m.E.
484000 m.E.
485000 m.E.
6810000 m.N.
6811000 m.N.
6812000 m.N.
6813000 m.N.
6814000 m.N.
6815000 m.N.
6816000 m.N.
6817000 m.N.
6818000 m.N.
6819000 m.N.
6820000 m.N.
6821000 m.N.
6822000 m.N.
Metres 500 0 500 1000 1500 Metres
Scale 1:20,000
DWG 4
093989 2/2
COMPANY:
INTERNATIONAL BARYTEX RESOURCES LTD.
DRAWING TITLE:
COMPILATION MAP
BARB PROPERTY
LOCATION:
FRANCIS LAKE, YUKON
DATE: FEBRUARY 18, 1999
SCALE: 1: 20 000
DRAWN: TerraCAD 99045
GEOLOGIST:
DATA:
FIGURE: