REPORT

ON A COMBINED HELICOPTER-BORNE MAGNETIC, ELECTROMAGNETIC AND RADIOMETRIC SURVEY

VISTA DE ORO PROPERTY
TODD CREEK AREA
BRITISH COLUMBIA
NTS 104 A/4,5

FOR

GEOFINE EXPLORATION CONSULTANTS LIMITED
49 NORMANDALE ROAD
UNIONVILLE, ONTARIO
L34 4J8

BY

GEONEX AERODAT INC.
3883 NASHUA DRIVE
MISSISSAUGA, ONTARIO
L4V 1R3
PHONE: 90[illegible]71-[illegible]

August [illegible]4, 1994

R. W. Woolham, P. Eng.
Consulting Geophysicist

J9440

TABLE OF CONTENTS

LIST OF MAPS

The survey data are presented in a set of numbered maps in the following format:

BLACK LINE MAPS: (Scale 1:20,000)

Map No. Description

1. BASE MAP; screened topographic base map plus survey area boundary, and UTM grid.

2. COMPILATION/INTERPRETATION MAP; with base map, flight path map and EM anomaly symbols with interpretation .

3. TOTAL FIELD MAGNETIC CONTOURS; with base map and flight lines.

4. VERTICAL MAGNETIC GRADIENT CONTOURS; with base map and flight lines.

5A. APPARENT RESISTIVITY CONTOURS; apparent resistivity calculated for the coaxial 4,600 Hz data, with base map and flight lines.

5B. APPARENT RESISTIVITY CONTOURS; apparent resistivity calculated for the coplanar 33,000 Hz data, with base map and flight lines.

COLOUR MAPS: (Scale 1:20,000)

1. TOTAL FIELD MAGNETICS; with superimposed contours, flight lines and EM anomaly symbols.

2. VERTICAL MAGNETIC GRADIENT; with superimposed contours, flight lines and EM anomaly symbols.

3A. HEM OFFSET PROFILES; coplanar 32,000 Hz and coaxial 935 Hz data with flight lines and EM anomaly symbols.

3B. HEM OFFSET PROFILES; coplanar 4,175 Hz and coaxial 4,600 Hz data with flight lines and EM anomaly symbols.

4A. APPARENT RESISTIVITY; calculated for the coaxial 4,600 Hz data with superimposed contours, flight lines and EM anomaly symbols.

4B. APPARENT RESISTIVITY; calculated for the coplanar 33,000 Hz data with superimposed contours, flight lines and EM anomaly symbols.

5A. TOTAL COUNT with superimposed contours, EM anomaly symbols and flight lines.

5B. THORIUM COUNT with superimposed contours, EM anomaly symbols and flight lines.

5C. POTASSIUM COUNT with superimposed contours, EM anomaly symbols and flight lines.

5D. URANIUM COUNT with superimposed contours, EM anomaly symbols and flight lines.

SHADOW DERIVATIVE: (Scale 1:50,000)

6. TOTAL FIELD MAGNETICS SHADOW MAP; with most suitable sun angle

7. TERNARY MAP; of Uranium, Thorium and Potassium

REPORT ON A
COMBINED HELICOPTER-BORNE
MAGNETIC, ELECTROMAGNETIC
AND RADIOMETRIC SURVEY
VISTA DE ORO PROPERTY
TODD CREEK AREA, BRITISH COLUMBIA

1. INTRODUCTION

This report describes an airborne geophysical survey carried out for Geofine Exploration Consultants Company Limited by Geonex Aerodat Inc. under a contract dated July 14, 1994. Principal geophysical sensors included a four frequency electromagnetic system, a high sensitivity cesium vapour magnetometer and a radiometric system. Ancillary equipment included a colour video tracking camera, Global Positioning System (GPS) navigation instrumentation, a radar altimeter, a power line monitor and a base station magnetometer.

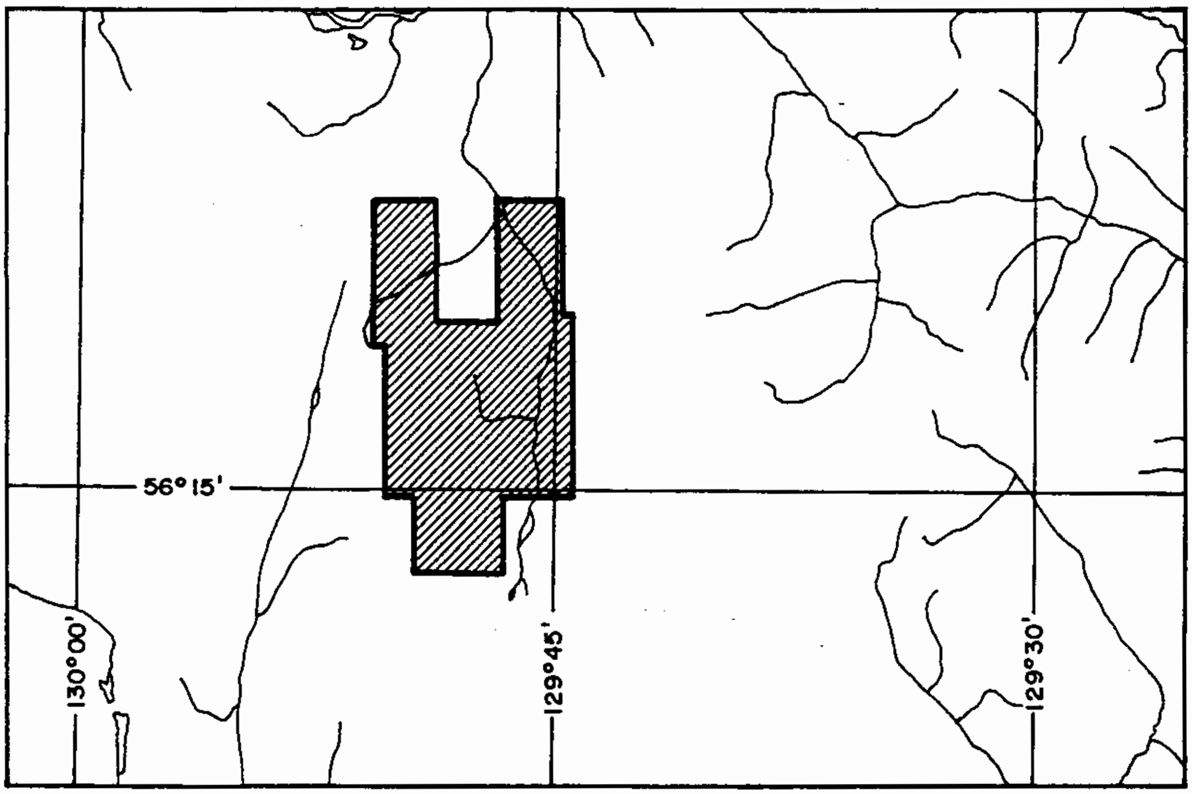
The survey covered an area of about 60 square kilometres located in the Stewart area of northern British Columbia. Total survey coverage is approximately 309 line kilometres including 21 kilometres of tie lines. The flight line spacing is 200 m and the Geonex Aerodat Job Number is J9440.

This report describes the survey, the data processing, data presentation and interpretation of the geophysical results. Identified electromagnetic anomalies appear on selected map products as EM anomaly symbols with interpreted source characteristics. The interpretation map indicates conductive areas of interest with designation number or letter. It also shows prominent structural features interpreted from the magnetic results. Significant structural and magnetic associations of the designated conductors, as well as their relative conductivity, is the basis for the selection of specific geophysical anomalies for further investigation. Recommendations are more focused if the exploration target and/or geological environment is known. The Stewart area is a well known gold camp hosting several producing and past producing gold mines.

2. SURVEY AREA

The survey block is located about 50 km. north-northeast of Stewart and south of Bowser Lake which is just west of the Cassiar highway. Topography is shown on the 1:50,000 scale NTS map sheets 104 A/4 and A/5. Local relief is very rugged. Elevations range from 700 to over 2,400 metres above mean sea level. The survey area is shown in the attached index map that includes local topography and latitude - longitude coordinates. This index map also appears on all black line map products. The flight line direction is east-west. Line spacing is 200 metres.

INDEX MAP



3. SURVEY PROCEDURES

The survey was completed in the period from July 31 to August 3, 1994. Principal personnel are listed in Appendix III. A total of eight survey flights was required to complete the project. Aircraft ground speed is maintained at approximately 60 knots (30 metres per second). The nominal EM sensor height is 30 metres (100 feet), consistent with the safety of the aircraft and crew.

A global positioning system (GPS) consisting of a Trimble TANS GPS receiver plus the Polycorder data logger provides navigation and flight line control. Differential GPS data is processed in the field on a PC using software supplied by Trimble. One system is installed in the survey helicopter. This involves mounting the receiver antenna on the tail boom. A second system acts as the base station.

The published NTS maps provide the UTM coordinates of the survey area corners. These coordinates program the navigation system. A test flight confirms if area coverage is correct. Thereafter the navigation system guides the pilot along the survey traverse lines marked on the topographic map. The operator also enters manual fiducials over prominent topographic features. Survey lines showing excessive deviation are re-flown.

The magnetic tie line navigation is visual and, where possible, traverses cover areas of low topographic and magnetic relief. Aircraft position is registered by the navigation system. The operator calibrates the geophysical systems at the start, middle (if required) and end of every survey flight. During calibration the aircraft is flown away from ground effects to record electromagnetic zero levels.

4. DELIVERABLES

The report on the results of the survey is presented in four copies. The report includes folded white print copies of all black line maps. Four copies of the colour maps and two copies of the shadow maps are in accompanying map tube(s).

The black line maps show topography, UTM grid coordinates and the survey boundary. A full list of all map types is at the beginning of this report. A summary is follows:

MAP NO.	DESCRIPTION
	BLACK LINE
1	Base Map
2	Compilation/Interpretation Map
3	Total Field Magnetic Contours
4	Vertical Magnetic Gradient Contours

5A Apparent Resistivity Contours - 4,600 Hz
5B Apparent Resistivity Contours - 33,000 Hz

COLOUR

1 Total Field Magnetics
2 Vertical Magnetic Gradient
3A HEM Offset Profiles - 935 Hz and 32,000 Hz
3B HEM Offset Profiles - 4,175 Hz and 4,600 Hz
4A Apparent Resistivity - 4,600 Hz
4B Apparent Resistivity - 33,000 Hz
5A Total Count Radiometric (TC)
5B Thorium Count Radiometric (Th)
5C Potassium Count Radiometric (K)
5D Uranium Count Radiometric (U)

SHADOW

6 Total Field Magnetic Shadow
7 Ternary Map of U,Th, K and TC

The processed digital data, including both the profile and the gridded data, is on nine track archive tape. A full description of the archive tape(s) is included with the package. All gridded data are also on diskettes suitable for displaying on IBM compatible 286 or 386 microcomputers using the Aerodat AXIS (Aerodat Extended Imaging System) or RTI (Real Time Imaging) software package. The complete data package includes all analog records, base station magnetometer records, flight path video tape and original map cronaflexes.

5. AIRCRAFT AND EQUIPMENT

5.1 Aircraft

The survey aircraft was a ASTAR 350BA helicopter, piloted by T. Thompson, owned and operated by Questral Helicopters Ltd. M. Barry of Geonex Aerodat acted as navigator and equipment operator. Geonex Aerodat performed the installation of the geophysical and ancillary equipment. The survey aircraft is flown at a mean terrain clearance of 60 metres (200 feet).

5.2 Electromagnetic System

The electromagnetic system is an Aerodat four frequency configuration. Two vertical coaxial coil pairs operate at frequency ranges of 935 Hz and 4,600 Hz and two horizontal coplanar coil pairs at frequency ranges of 4,175 Hz and 32 kHz. The actual frequencies used depend on the particular bird configuration. At the present time Aerodat has eight bird systems. This survey utilized the Falcon bird with frequencies of 918 Hz and 4,470 Hz for the coaxial coil pairs and 4,083 Hz and 32,540 Hz for the coplanar coil pairs. The transmitter-receiver separation is 7 metres. Inphase and quadrature signals are measured simultaneously for the four frequencies with a time constant of 0.1 seconds. The HEM bird is towed 30 metres (100 feet) below the helicopter.

5.3 Magnetometer

A Scintrex H8 cesium, optically pumped magnetometer sensor, measures the earth's magnetic field. The sensitivity of this instrument is 0.001 nanoTesla at a sampling rate of 0.2 second. The sensor is towed in a bird 15 metres (50 feet) below the helicopter 45 metres (150 feet) above the ground).

5.4 Gamma-Ray Spectrometer

An Exploranium GR-256 spectrometer coupled to 512 cubic inches of crystal sensor records four channels of radiometric data. Spectrum stabilization is based on the 662 KeV peak from Cesium sources planted on the crystals.

The four channels recorded and their energy windows are as follows:

Channel	Window
Total Count (TC)	0.40 to 2.81 MeV
Potassium (K)	1.37 to 1.57 MeV
Uranium (U)	1.66 to 1.86 MeV
Thorium (Th)	2.41 to 2.81 MeV

The four channels of radiometric data record at a one second update rate (counts per second - cps). Digital recording resolution is one cps.

5.5 Ancillary Systems

Base Station Magnetometer

An IFG-2 proton precession magnetometer is set up at the base of operations to record diurnal variations of the earth's magnetic field. Synchronization of the clock of the base station with that of the airborne system is checked each day to insure diurnal corrections will be accurate. Recording resolution is 1 nT with an update rate of four seconds. Magnetic field variation data are plotted on a 3" wide gridded paper chart analog recorder.

Each division of the grid (0.25") is equivalent to one minute (chart speed) or five nT (vertical sensitivity). The date, time and current total field magnetic value are automatically recorded every 10 minutes. The data is also saved to digital tape.

Radar Altimeter

A King KRA-10 radar altimeter records terrain clearance. The output from the instrument is a linear function of altitude. The radar altimeter is checked after installation using a line marked off at intervals of 50 feet. A heavy weight is tied onto one end of the line. The helicopter moves up over the weight and the operator notes the radar altimeter reading at the 100, 150, 200 and 250 foot marks.

Tracking Camera

A Panasonic colour video camera records the flight path on VHS video tape. The camera operates in continuous mode. The video tape also shows the flight number, 24 hour clock time (to .01 second), and manual fiducial number.

Global Positioning System (GPS)

The Global Positioning System is a U.S. Department of Defense program that will provide worldwide, 24 hour, all weather position determination capability. GPS consists of three segments:

- a constellation of satellites
- ground stations that control the satellites
- a receiver

The receiver takes in coded data from satellites in view and there after works out the range to each satellite. The coded data must therefore include the instantaneous position of the satellite relative to some agreed earth-fixed coordinate system. The satellite constellation consists of 24 satellites with a proportion of the satellites acting as standby spares.

Analog Recorder

An RMS dot matrix recorder displays the data during the survey. Record contents are as follows:

Label	Contents	Scale
MAGF	Total Field Magnetics, Fine	2.5 nT/mm
MAGC	Total Field Magnetics, Course	25 nT/mm
CXI1	935 Hz, Coaxial, Inphase	2.5 ppm/mm

CXQ1	935 Hz, Coaxial, Quadrature	2.5 ppm/mm
CXI2	4,600 Hz, Coaxial, Inphase	2.5 ppm/mm
CXQ2	4,600 Hz, Coaxial, Quadrature	2.5 ppm/mm
CPI1	4,175 Hz, Coplanar, Inphase	10 ppm/mm
CPQ1	4,175 Hz, Coplanar, Quadrature	10 ppm/mm
CPI2	32,000 Hz, Coplanar, Inphase	20 ppm/mm
CPQ2	32,000 Hz, Coplanar, Quadrature	20 ppm/mm
TC	Radiometric - Total Count	10 counts/mm
K	Radiometric - Potassium	5 counts/mm
U	Radiometric - Uranium	2.5 counts/mm
T	Radiometric - Thorium	2.5 counts/mm
RALT	Radar Altimeter	10 ft/mm
PWRL	60 Hz Power Line Monitor	-

Data is recorded with positive - up, negative - down. The analog zero of the radar altimeter is 5 cm from the top of the analog record. A helicopter terrain clearance of 60 m (200 feet) should therefore be seen some 3 cm from the top of the analog record.

Chart speed is 2 mm/second. The 24-hour clock time is printed every 20 seconds. The total magnetic field value is printed every 30 seconds. The ranges from the radar navigation system are printed every minute.

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

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

Digital Recorder

A DGR-33 data system records the digital survey data on magnetic media. Contents and update rates are as follows:

DATA TYPE	RECORDING INTERVAL	RECORDING RESOLUTION
Magnetometer	0.2 s	0.001 nT
VLF-EM (4 Channels)	0.2 s	0.03%
HEM (8 Channels)	0.1 s	
coaxial		0.03 ppm
coplanar- Hz/4,175 Hz		0.06 ppm

· coplanar -32 kHz		0.125 ppm
Radiometric	0.2 s	1 cps
Position (2 Channels)	0.2 s	0.1 m
Altimeter	0.2 s	0.05 m
Power Line Monitor	0.2 s	-
Manual Fiducial		
Clock Time		

6. DATA PROCESSING AND PRESENTATION

6.1 Base Map

The base map is taken from a photographic enlargement of the NTS topographic maps. A UTM reference grid (grid lines usually every kilometre) and the survey area boundaries are added. After registration of the flight path to the topographic base map, some topographic detail and the survey boundary are added digitally. This digital image forms the base for the colour, ternary and shadow maps.

6.2 Flight Path Map

Global Positioning System

The GPS receiver takes in coded data from satellites in view and there after calculates the range to each satellite. The coded data must therefore include the instantaneous position of the satellite relative to some agreed earth-fixed coordinate system.

A further calculation using ranges to several satellites gives the position of the receiver in that coordinate system (eg. UTM, lat/long.). The elevation of the receiver is given with respect to a model ellipsoidal earth.

Normally the receiver must see four satellites for a full positional determination (three space coordinates and time). If the elevation is known in advance, only three satellites are needed. These are termed 3D and 2D solutions.

The position of the receiver is updated every second. The accuracy of any one second position determination is described by the Circular Error Probability (CEP). Ninety-five percent of all position determinations will fall within a circle of a certain radius. If the horizontal position accuracy is 25 m CEP, for example, 95% of all trials will fall within a circle of 25 m radius centred on the mean. The system may be degraded for civilian use and the autonomous accuracy is then 100 m CEP. This situation is called selective availability (SA). Much of this error (due principally to satellite position/time errors and atmospheric delays) can be removed using two GPS receivers operating simultaneously.

One receiver acting as the base station, is at a known position. The second remote receiver is in the unknown position. Differential corrections determined for the base station may then be applied to the remote station. Differential positions are accurate to five m CEP (for a one second sample). Averaging will reduce this error further.

Flight Path

The flight path is drawn using linear interpolation between x,y positions from the navigation system. These positions are updated every second (or about 1.5 mm at a scale of 1:20,000). These positions are expressed as UTM eastings (x) and UTM northings (y).

Occasional dropouts occur when the optimum number of satellites are not available for the GPS to make accurate positional determinations. Interpolation is used to cover short flight path gaps. The navigator's flight path and/or the flight path recovered from the video tape may be stitched in to cover larger gaps. Such gaps may be recognized by the distinct straight line character of the flight path.

The manual fiducials are shown as a small circle and labelled by fiducial number. The 24-hour clock time is shown as a small square, plotted every 30 seconds. Small tick marks are plotted every two seconds. Larger tick marks are plotted every 10 seconds. The line and flight numbers are given at the start and end of each survey line.

The flight path map is merged with the base map by matching UTM coordinates from the base maps and the flight path record. The match is confirmed by checking the position of prominent topographic features as recorded by manual fiducial marks or as seen on the flight path video record.

6.3 Electromagnetic Survey Data

The electromagnetic data are recorded digitally at a sample rate of 10 per second with a time constant of 0.1 seconds. A two stage digital filtering process rejects major sferic events and reduces system noise.

Local sferic activity can produce sharp, large amplitude events that cannot be removed by conventional filtering procedures. Smoothing or stacking will reduce their amplitude but leave a broader residual response that can be confused with geological phenomena. To avoid this possibility, a computer algorithm searches out and rejects the major sferic events. The signal to noise ratio is further enhanced by the application of a low pass digital filter. This filter has zero phase shift that prevents any lag or peak displacement from occurring, and it suppresses only variations with a wavelength less than about 0.25 seconds. This low effective time constant gives minimal profile distortion.

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

6.4 Total Field Magnetics

The aeromagnetic data is corrected for diurnal variations by adjustment with the recorded base station magnetic values. No corrections for regional variations are applied. The corrected profile data are interpolated on to a regular grid using an Akima spline technique. The grid provided the basis for threading the presented contours. The minimum contour interval is 2 nT with a grid cell size of 25 m.

6.5 Calculated Vertical Magnetic Gradient

The vertical magnetic gradient is calculated from the gridded total field magnetic data. The calculation is based on a 17 x 17 point convolution in the space domain. The results are contoured using a minimum contour interval of 0.05 nT/m. Grid cell sizes are the same as those used in processing the total field data.

6.6 Apparent Resistivity

The apparent resistivity is calculated by assuming a 200 metre thick conductive layer over resistive bedrock. The computer determines the resistivity that would be consistent with the sensor elevation and recorded inphase and quadrature response amplitudes at the selected frequency. The apparent resistivity profile data is re-interpolated onto a regular grid at a 25 metres true scale interval using an Akima spline technique and contoured using logarithmically arranged contour intervals. The minimum contour interval is 0.1 log(ohm.m) and is logarithmic intervals of 0.1, 0.5, 1.0, 5,0 etc.

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

6.7 Radiometric Data

The four channels of radiometric data are subject to a four-stage data correction process.

The stages are:

- low pass filter (seven point Hanning)
- background removal
- terrain clearance correction
- compton stripping correction

The Compton stripping factors are:

alpha	- 0.304 (Th into U)
beta	- 0.428 (Th into K)
gamma	- 0.756 (U into K)
a	- 0.060 (U into Th)
b	- 0.003 (K into Th)
g	- 0.010 (K into U)

where alpha, beta and gamma are the forward stripping coefficients and a, b, g are the backward stripping coefficients. These coefficients are taken in part from the sample checks done at the start of each flight.

The altitude attenuation coefficients are TC: 0.003; K: 0.006; U: 0.005; and Th: 0.006. The units are metres $^{-1}$. These coefficients are taken from GSC publications for similar radiometric systems. Radiometric data are corrected to a mean terrain clearance of 60 m.

The corrected data are interpolated on a square grid (cell size 25 m) using an Akima spline technique. The grids provided the basis for threading the presented contours. The minimum contour intervals are 5 cps for TC and 1 cps for K, U and Th.

7. INTERPRETATION

7.1 Magnetic Interpretation

The total field magnetic responses reflect major changes in the magnetite content of the underlying rock units. The amplitude of the magnetic responses relative to the regional background help to assist in identifying specific magnetic and nonmagnetic units related to, for example, mafic flows or tuffs, mafic to ultramafic intrusives, felsic intrusives, felsic volcanics and/or sediments etc. Obviously, several geological sources can produce the same magnetic response. These ambiguities can be reduced considerably if basic geological information on the area is available to the geophysical interpreter.

In addition to amplitude variations, magnetic patterns related to the geometry of the particular rock unit also help in determining the probable source of the magnetic response. For instance, long narrow magnetic linears usually reflect mafic tuff/flow horizons or mafic intrusive dyke structures while semi-circular features with complex magnetic amplitudes may be produced by local plug-like intrusive sources such as pegmatites, carbonatites or kimberlites.

The calculated vertical magnetic gradient assists considerably in mapping weaker magnetic linears that are partially masked by nearby higher amplitude magnetic features.

The broad zones of higher magnetic amplitude, however, are severely attenuated in the vertical magnetic gradient results. These higher amplitude zones reflect rock units having magnetic susceptibility signatures. For this reason both the total and gradient magnetic data sets must be evaluated.

Theoretically the magnetic gradient zero contour line marks the contacts or limits of large magnetic sources. This applies to wide sources, greater than 50 metres, having simple slab geometries and shallow depth.(See discussion in Appendix I) Thus the gradient map also aids in the more accurate delineation of contacts between differing magnetic rock units.

The cross cutting structures, shown on the interpretation map as faults, are based on interruptions and discontinuities in the magnetic trends. Generally, sharp folding of magnetic units will produce a magnetic pattern indistinguishable from a fault break. Thus, if anomaly displacements are small such fault structures, where they mark an anomaly interruption, may actually represent fold axis rather than faulting.

7.2 Magnetic Survey Results and Conclusions

To facilitate the following discussion of the magnetic results it is suggested the interpretation map be compared with the total field and vertical gradient magnetic colour contour maps either as overlays or side by side.

The magnetic background is interpreted to be approximately 57,200 nanoTesla (nT). Amplitudes range from about 600 nT above background to 350 nT below background. The major magnetic feature of the area strikes north-south through the west central part of the survey block. It consists of a zone of intermittent sinuous horizons with amplitudes greater than 300 nT above background. Other less extensive linears occur to the east of this zone. These higher amplitude horizons are shown as solid lines on the interpretation map. Lower amplitude weaker linears are indicated with a dashed line. Mafic flows and/or dykes are the suspected source of these magnetic signatures.

Strike directions are generally north-south for all but the extreme northwest and northeast arms of the survey block. Here magnetic trends form an apex with a northeast striking west arm and northwest striking east arm. The overall magnetic patterns suggest a north-south fold axis may be present possibly positioned in approximately the centre of the survey block.

The magnetic trend interruptions and discontinuities are interpreted to reflect the presence of generally northwest striking fault structures. The exception is a northeast fault present in the northwest part of the area.

There are three negative or below background magnetic zones in the south which may indicate the presence of felsic or sedimentary units. The two southwesterly largest lows occur over icefields and therefore probably relate only to thick ice cover attenuating the bedrock magnetic response. The smallest zone, bounded by two northwest striking faults, may warrant further investigation, however, as it could reflect alteration effects associated with haematite.

7.3 Electromagnetic Anomaly Selection/Interpretation

Usually two sets of stacked colour coded profile maps of one coaxial and one coplanar inphase and quadrature responses are used to select conductive anomalies of interest. Selection of anomalies is based on conductivity as indicated by the inphase to quadrature ratios of the 935 Hz and/or 4,600 Hz coaxial data, anomaly shape, and anomaly profile characteristics relative to coaxial and corresponding coplanar responses.(see discussion and figure in Appendix I) It is difficult to differentiate between responses associated with the edge effects of flat lying conductors and actual poor conductivity bedrock conductors on the edge of or overlain by flat lying conductors. Poor conductivity bedrock conductors having low dips will also exhibit responses that may be interpreted as surficial overburden conductors. In such cases, where the source of the conductive response appears to be ambiguous, the anomaly is still selected for plotting. In some situations the conductive response has line to line continuity and some magnetic association thus providing possible evidence that the response is related to an actual bedrock source.

The calculation of the depth to the conductive source and its conductivity is based on the 4,600 Hz data assuming a thin vertical sheet model. The amplitude of the inphase and quadrature responses are used for the calculations which are automatically determined by computer. These data are listed in Appendix II and the depth and conductivity values are shown with each plotted anomaly. Further detailed discussion and illustration of the determination of these values is contained in Appendix I.

The selected anomalies are automatically categorized according to their conductivity and amplitude. The calculation of the conductivity of low amplitude anomalies can be very inaccurate. Therefore, anomalies having amplitudes below a certain level and/or low conductivity value are given a zero rating with the category increasing for increasing conductivity values that are statistically reliable.

7.4 Electromagnetic Survey Results and Conclusions

Conductive flat lying material is contributing to the electromagnetic responses in various degrees throughout the survey block. These areas are characterized by identically shaped coaxial and coplanar response profiles. This is a typical response shape usually seen over a flat lying conductor as illustrated in Appendix I, in the figure entitled "HEM Response Profile Shapes ....." profile I. These areas of apparent flat lying conductive sources have not been indicated on the interpretation map or anomaly map but show up on the apparent resistivity maps as broad low resistivity zones.

There are many conductive intercepts scattered haphazardly throughout the survey block. All have poor conductivity. Where line to line continuity of a particular set of conductor intercepts is evident, however, they are grouped together with line segments. Most of the more continuous conductive trends occur in the northeast arm of the survey block. They are within or flank low amplitude magnetic horizons suggesting a possible graphitic sedimentary source may be producing the responses. Weak shear or fault zones will also produce such conductive effects. Some of the conductive trends correlate with river valleys and may only be reflecting conductive surficial material.

Nonetheless, investigation of these conductive trends, especially those in the northeast sector, is recommended on a low priority basis. Some may reflect the presence of pyrite having a possible association with gold mineralization.

7.5 Radiometric Interpretation

The ability to detect natural occurring radiation, whether on the ground or from an airborne platform, depends on a number of factors listed as follows:

Count Time

Measurements or count rate statistics are more reliable the longer the detector is in position over a particular location. Therefore in airborne surveying, traverse speed is an important factor in detecting radiation sources. For this reason STOL aircraft and helicopters are a favoured platform for radiometric surveys.

Detector size

The detector crystal volume and thickness determine the sensitivity of the radiometric system to radiation. For accurate measurement and differentiation of higher energy levels of radiation, a large crystal volume is a pre-requisite.

Distance from Source (Altitude)

The attenuation or absorption of radiation in air, although not a significant factor in ground surveys, is a factor in airborne surveys. Normalization of the radiation amplitude data for altitude variations of the aircraft during the survey is necessary. The attenuation is not significant for large areal sources of radiation but is quite severe for localized point sources.

Overburden Cover

Radiation can be completely masked by one foot of rock or three feet of unconsolidated overburden.

Source Geometry

A large exposed outcrop of slightly radioactive material, such as granite which usually has a high potassium count, will be easily detectable from the air. A small outcrop of highly radioactive material, containing an appreciable amount of pitchblende for instance, may not be detectable unless the sensor passes directly over the outcrop and/or is quite close to it.

Source Characteristics

The type and percentage concentration of radioactive minerals present in the rock will determine radiation amplitudes and therefore the ability of the sensor to measure the radiation.

The above factors must be taken into consideration when evaluating and interpreting radiometric surveys. Variations in radiation amplitudes may only be a factor of overburden cover. As a result, an outcrop map of the survey area is very useful for initial evaluation of radioactive element concentrations.

Shales and felsic intrusives tend to have high potassium and thorium levels. Mafic intrusives, sandstone and especially limestone have concentrations of one half to one tenth of the highest levels. Specific intrusives types, such as pegmatites, can have levels of potassium, uranium and thorium, in the order of three to four times the amounts normally present. Uranium ore can contain concentrations of radioactive minerals one to four orders of magnitude greater than normally encountered.

Thus, interpretation of the source of radioactive anomalies, even when the uranium, thorium and potassium thresholds are separated, can be difficult and ambiguous. In some geological environments, specific rock units have higher or lower uranium/thorium, uranium/potassium, or thorium/potassium ratios. Additional diagnostic information is sometimes available when such ratio maps are generated and compared to known geological parameters.

7.6 Radiometric Survey Results and Conclusions

Only those areas having radiometric levels of about twice background or greater are indicated on the interpretation map. Background levels are taken as K channel = 40 cps, Th channel = 14 cps and U channel = 35 cps.

The only significant radiometric responses are produced by the potassium channel results. There are four large areas, numbered 1 to 4 on the interpretation map, having twice background potassium channel responses. These areas may only reflect specific rock units known for their high potassium content such as granite. Alteration processes sometimes associated with gold mineralization often produce high potassium responses and therefore these anomalies are usually considered to be prime targets for investigation. Unfortunately, anomalies 1, 2 and 4 occur over very steep topographic gradients. The automatic correction factors applied for sensor altitude assume there is a level surface below the aircraft. With a steep topographic gradient, however, the vertical distance below the aircraft will be greater than the actual distance normal to the ground. Thus the data will be over corrected for altitude producing higher than normal values in these areas. Nevertheless, the anomalies will be assessed on the assumption they are valid responses.

Anomalies 1 and 3 have a spatial association with magnetic anomalies while 2 and 4 correlate with background to slightly elevated magnetic levels. The latter are considered to have the best potential, especially anomaly 4, as it is bisected by two fault structures. Note the east end of anomaly 1 is also associated with fault structures and a conductive trend.

There remain a few isolated potassium, uranium and thorium channel anomalies of possible interest. These responses are indicated with their respective letter designations on the interpretation map. Their significance is questionable except for the cluster of responses just north of anomaly 2 in an area of steep topographic gradients. This area is recommended for investigation on a low priority basis.

As would be expected, the areas with below background responses occur over the ice covered portions of the survey area.

8. RECOMMENDATIONS

Local geological information or the ore target model for the survey area was not made available to the author. Gold mineralization is presumably the ore target in this area. As a result, selection of geophysical anomalies for further investigation is based on their possible structural, magnetic and radiometric associations. Prior to any ground follow-up, the geophysical results should be reviewed with respect to the geological target model being sought and known geology and mineralization in the area.

Potassium channel anomalies 1 to 4 are recommended for investigation with the cautionary comment that 1, 2 and 4 may be, in part, produced by correction effects related to steep topography. The more favourable anomalies appear to be numbers 1 and 4. The conductive trends in the northeast portion of the survey block require an explanation. Some of them may reflect weak pyrite mineralization and/or shear zones having the potential to host gold mineralization. Further exploration will depend on the results of these initial investigations.

It should be emphasised the extremely rugged terrain made contour or drape flying very difficult and sometimes impossible where the safety of the aircraft and crew was compromised. As a result, attenuation of radiometric and conductive responses in some areas must be expected. Therefore, areas of more subtle responses may be important if they have favourable geological or geochemical attributes.

REGISTERED PROFESSIONAL ENGINEER
R. W. WOOLHAM
PROVINCE OF ONTARIO

Respectfully submitted,

R. W. Woolham, P.Eng.
Consulting Geophysicist

for

GEONEX AERODAT INC.

J9440

August 24, 1994

APPENDIX I

GENERAL INTERPRETIVE CONSIDERATIONS

GENERAL INTERPRETIVE CONSIDERATIONS

Electromagnetic

The Aerodat electromagnetic system utilized two different transmitter-receiver coil geometries. The traditional coaxial coil configuration is operated at widely separated frequencies. The horizontal coplanar coil configuration is similarly operated at different frequencies where at least one pair is approximately aligned with one of the coaxial frequencies.

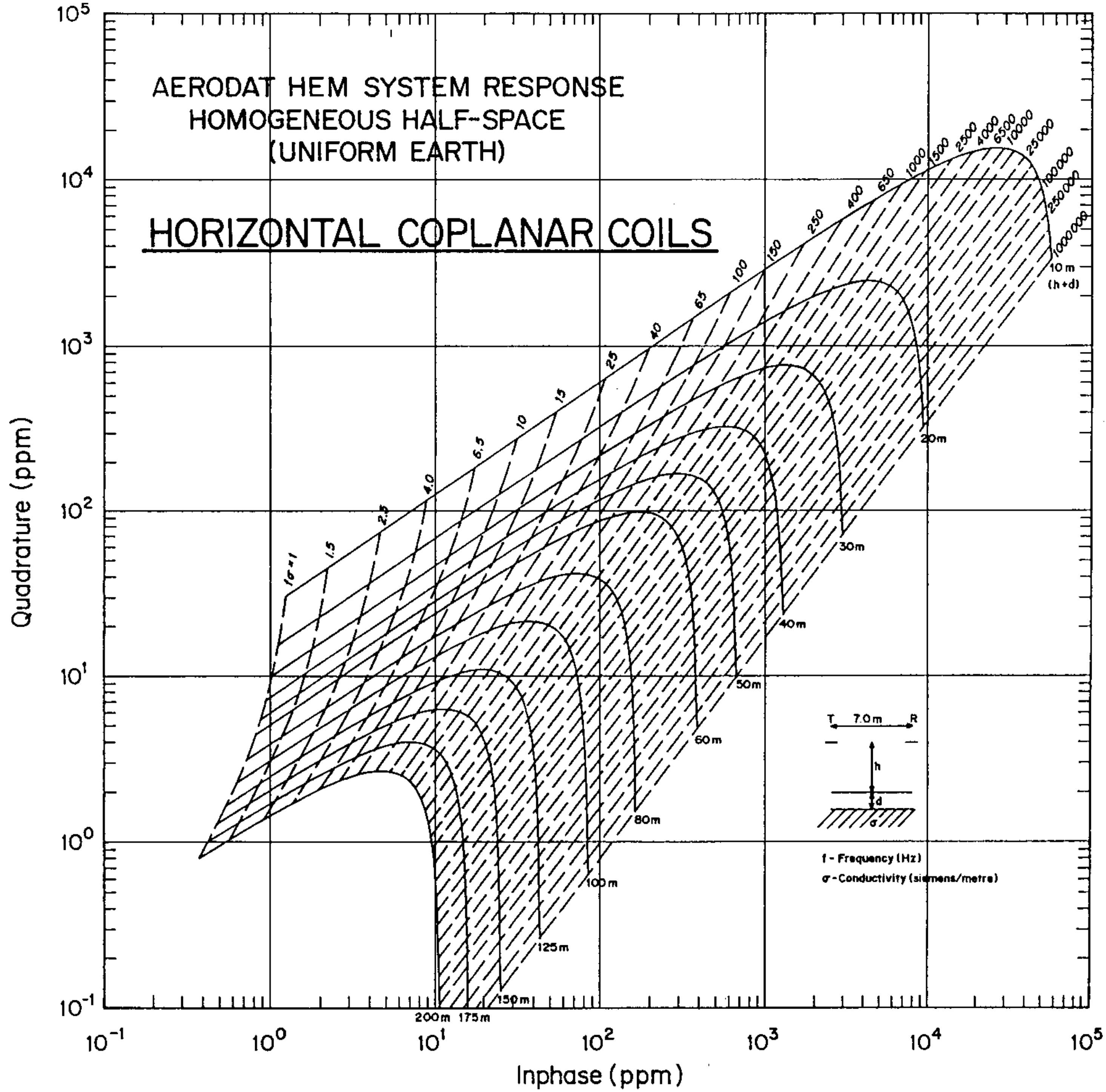
The electromagnetic response measured by the helicopter system is a function of the "electrical" and "geometrical" properties of the conductor. The "electrical" property of a conductor is determined largely by its electrical conductivity, magnetic susceptibility and its size and shape; the "geometrical" property of the response is largely a function of the conductor's shape and orientation with respect to the measuring transmitter and receiver.

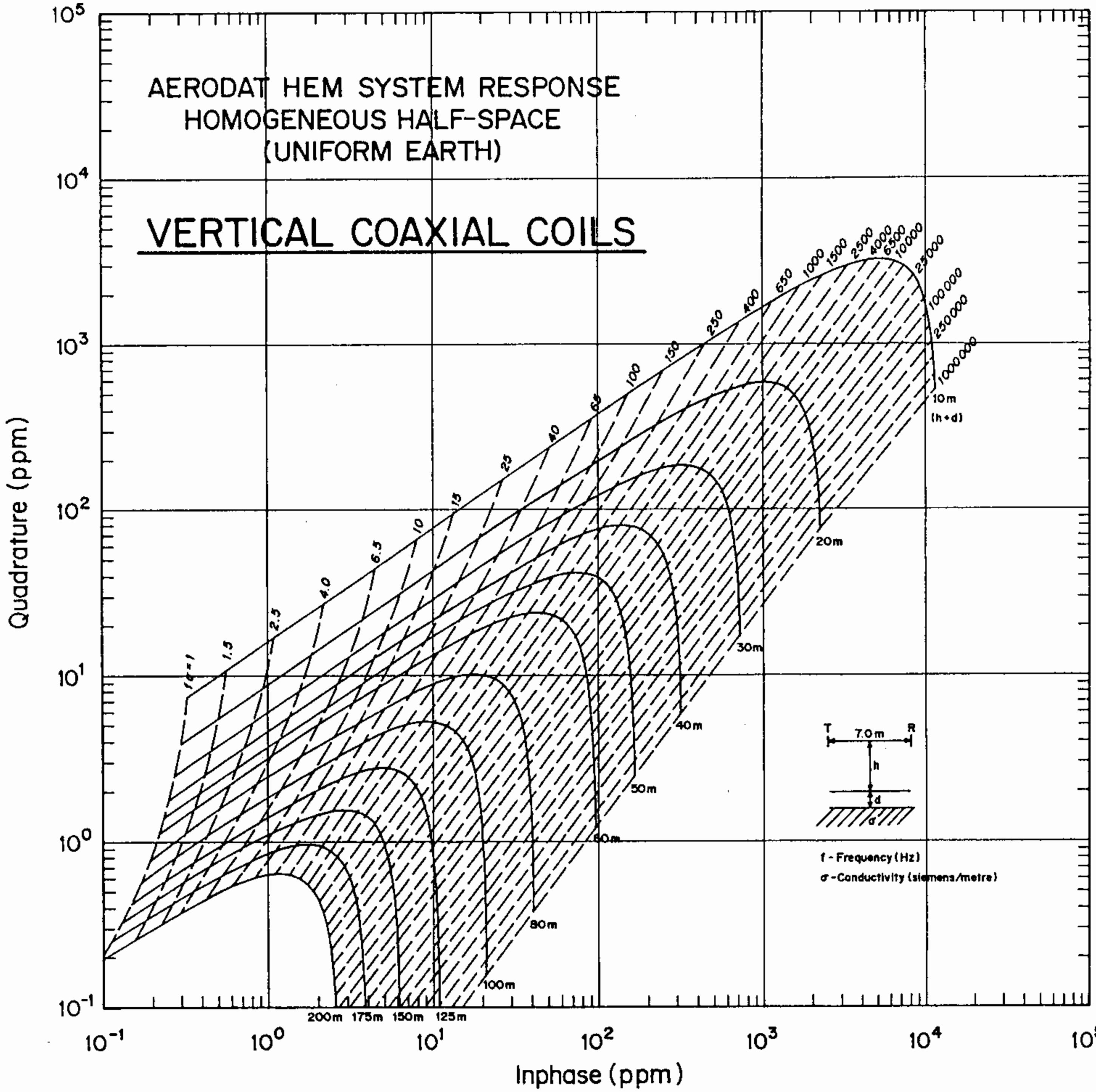
Electrical Considerations

For a given conductive body the measure of its conductivity or conductance is closely related to the measured phase shift between the received and transmitted electromagnetic field. A small phase shift indicates a relatively high conductance, a large phase shift lower conductance. A small phase shift results in a large inphase to quadrature ratio and a large phase shift a low ratio. This relationship is shown quantitatively for a non-magnetic vertical half-plane and half space models on the accompanying phasor diagrams. Other physical models will show the same trend but different quantitative relationships.

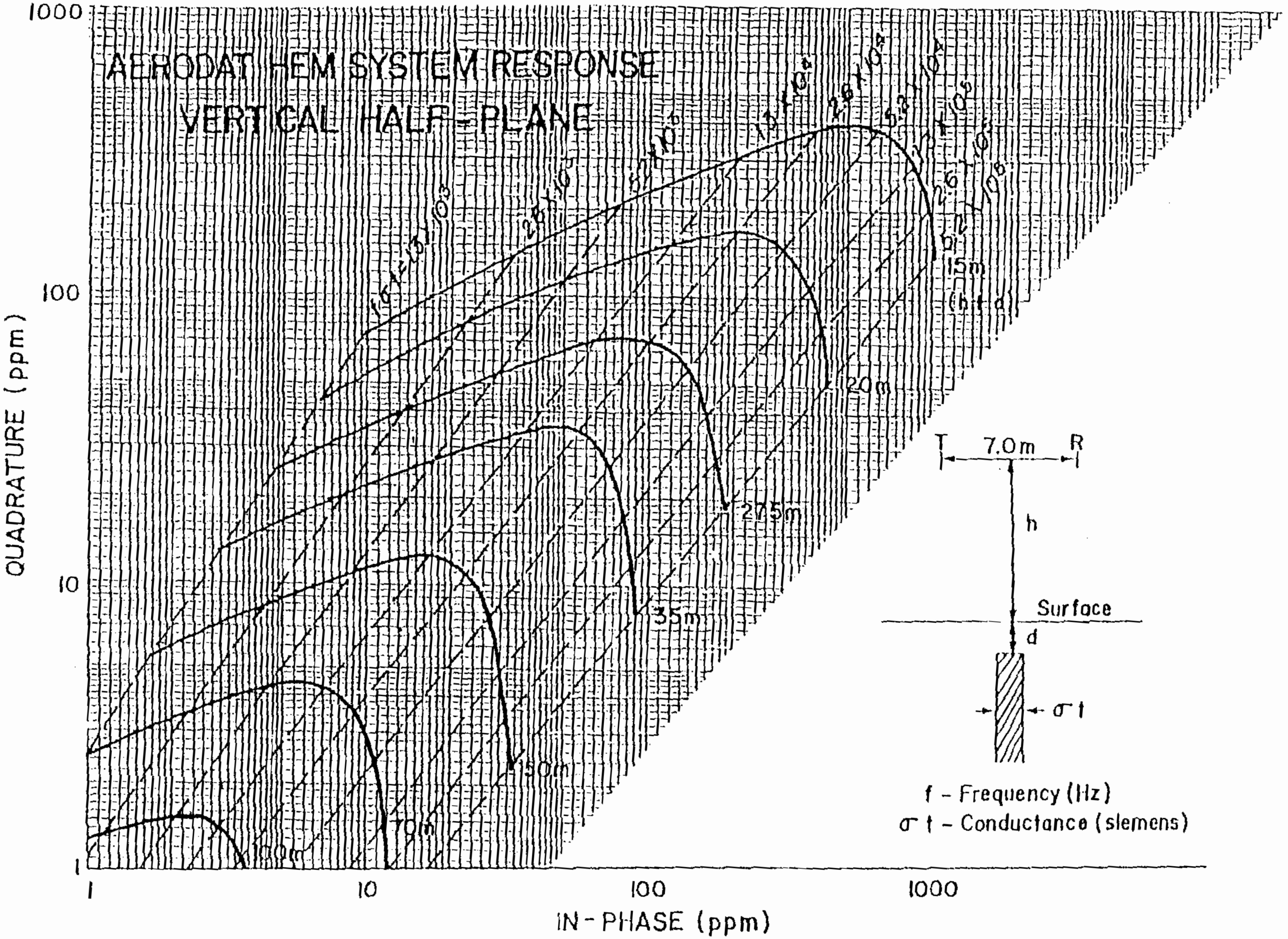
The phasor diagram for the vertical half-plane model, as presented, is for the coaxial coil configuration with the amplitudes in parts per million (ppm) of the primary field as measured at the response peak over the conductor. To assist the interpretation of the survey results the computer is used to identify the apparent conductance and depth at selected anomalies. The results of this calculation are presented in anomaly listings included in the survey report and the conductance and inphase amplitude are presented in symbolized form on the map presentation.

The conductance estimate is most reliable when anomaly amplitudes are large and background resistivities are high. Where the anomaly is of low amplitude and background resistivities are low, the conductance estimates are much less reliable. In such situations, the conductance estimate is often quite low regardless of the true nature of the conductor. This is due to the elevated background response levels in the quadrature channel. In an extreme case, the conductance estimate should be discounted and should not prejudice target selection.


AERODAT HEM SYSTEM RESPONSE
HOMOGENEOUS HALF-SPACE
(UNIFORM EARTH)
HORIZONTAL COPLANAR COILS
Quadrature (ppm)
Inphase (ppm)
10 m (h+d)
20m
30m
40m
50m
60m
80m
100m
125m
150m
200m 175m
T 7.0m R
h
d
σ
f - Frequency (Hz)
σ - Conductivity (siemens/metre)



AERODAT HEM SYSTEM RESPONSE
HOMOGENEOUS HALF-SPACE
(UNIFORM EARTH)
VERTICAL COAXIAL COILS
Quadrature (ppm)
Inphase (ppm)
10m (h+d)
20m
30m
40m
50m
60m
80m
100m
125m
150m
175m
200m
T
7.0m
R
h
d
σ
f - Frequency (Hz)
σ - Conductivity (siemens/metre)



AERODAT HEM SYSTEM RESPONSE
VERTICAL HALF-PLANE
QUADRATURE (ppm)
IN-PHASE (ppm)
1000
100
10
1
1
10
100
1000
15m
20m
27.5m
35m
50m
70m
100m
T
7.0m
R
h
Surface
d
σ t
f - Frequency (Hz)
σ t - Conductance (siemens)

The conductance and depth vales as presented are correct only as far as the model approximates the real geological situation. The actual geological source may be of limited length, have significant dip, may be strongly magnetic. Its conductivity and thickness may vary with depth and/or strike and adjacent bodies and overburden may have modified the response. In general the conductance estimate is less affected by these limitations than is the depth estimate, but both should be considered as relative rather than absolute guides to the anomaly's properties.

Conductance in mhos is the reciprocal of resistance in ohms and in the case of narrow slab-like bodies is the product of electrical conductivity and thickness.

The higher ranges of conductance, greater than 2-4 mhos, indicate that a significant fraction of the electrical conduction is electronic rather than electrolytic in nature. Materials that conduct electronically are limited to certain metallic sulphides and to graphite. High conductance anomalies, roughly 10 mhos or greater, are generally limited to massive sulphides or graphites.

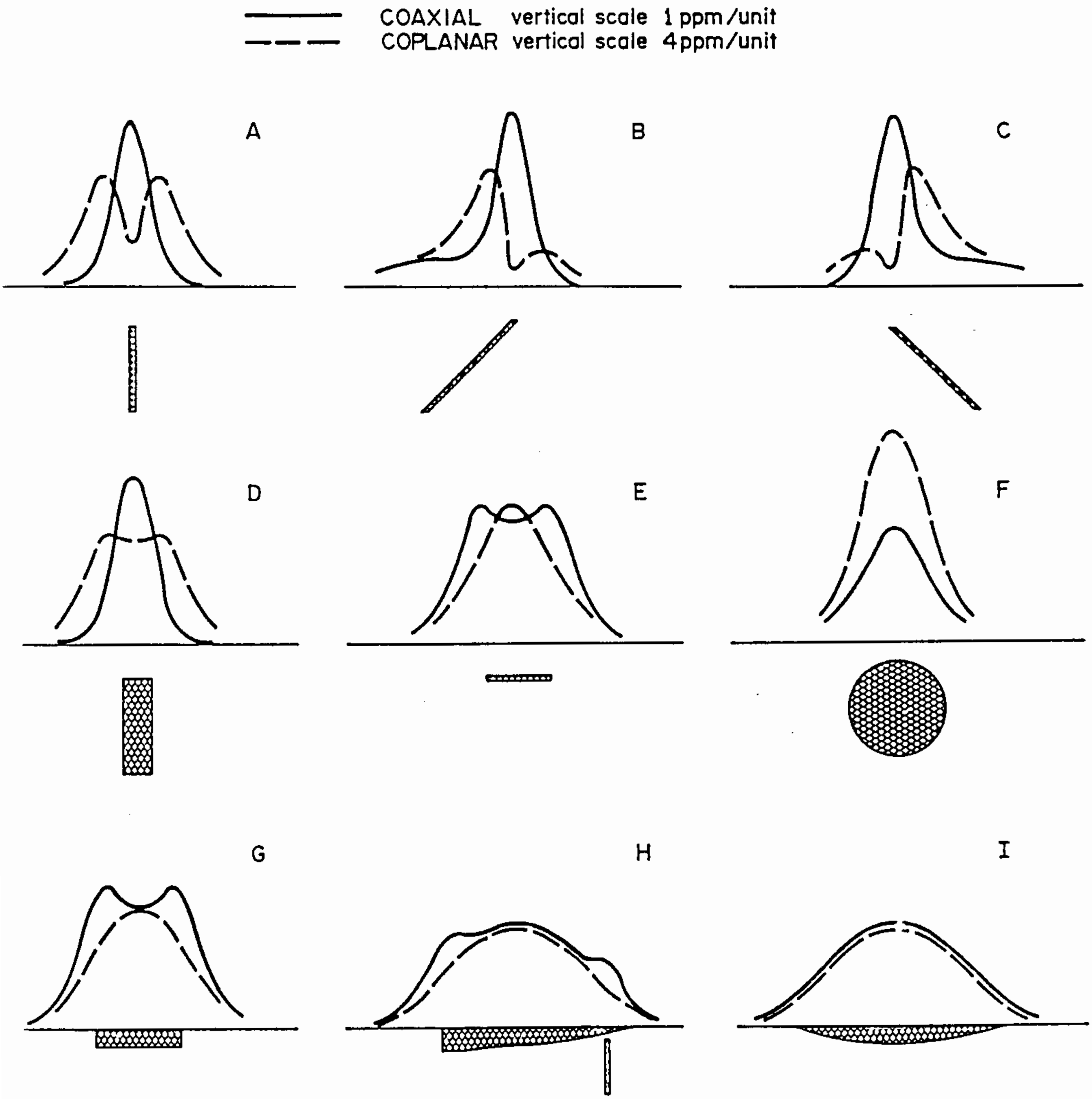
Sulphide minerals, with the exception of such ore minerals as sphalerite, cinnabar and stibnite, are good conductors. Sulphides may occur in a disseminated manner that inhibits electrical conduction through the rock mass. In this case the apparent conductance can seriously underrate the quality of the conductor in geological terms. In a similar sense the relatively non-conducting sulphide minerals noted above may be present in significant concentrations in association with minor conductive sulphides, and the electromagnetic response will only relate to the minor associated mineralization. Indicated conductance is also of little direct significance for the identification of gold mineralization. Although gold is highly conductive, it would not be expected to exist in sufficient quantity to create a recognizable anomaly. Minor accessory sulphide mineralization may however provide a useful indirect indication.

In summary, the estimated conductance of a conductor can provide a relatively positive identification of significant sulphide or graphite mineralization. A moderate to low conductance value does not rule out the possibility of significant economic mineralization.

Geometrical Considerations

Geometrical information about the geologic conductor can often be interpreted from the profile shape of the anomaly. The change in shape is primarily related to the change in inductive coupling among the transmitter, the target, and the receiver. The accompanying figure shows a selection of HEM response profile shapes from nine idealized targets. Response profiles are labelled A through I. These labels are used in the discussion which follows.

HEM RESPONSE PROFILE SHAPE AS AN INDICATOR OF CONDUCTOR GEOMETRY



In the case of a thin, steeply dipping, sheet-like conductor, the coaxial coil pair will yield a near symmetric peak over the conductor. On the other hand, the coplanar coil pair will pass through a null couple relationship and yield a minimum over the conductor, flanked by positive side lobes (Profile A). As the dip of the conductor decrease from vertical, the coaxial anomaly shape changes only slightly, but in the case of the coplanar coil pair the side lobe on the down dip side strengthens relative to that on the up dip side (Profiles B and C).

As the thickness of the conductor increases, induced current flow across the thickness of the conductor becomes relatively significant and complete null coupling with the coplanar coils is no longer possible (Profile D). As a result, the apparent minimum of the coplanar response over the conductor diminishes with increasing thickness, and in the limiting case of a fully 3 dimensional body or a horizontal layer or half-space, the minimum disappears completely.

A horizontal conducting layer such as a horizontal thin sheet or overburden will produce a response in the coaxial and coplanar coils that is a function of altitude (and conductivity if not uniform). The profile shape will be similar in both coil configurations with an amplitude ratio (coplanar:coaxial) of about 4:1* (Profiles E and G).

In the case of a spherical conductor, the induced currents are confined to the volume of the sphere, but not relatively restricted to any arbitrary plane as in the case of a sheet-like form. The response of the coplanar coil pair directly over the sphere may be up to 8* times greater than that of the coaxial pair (Profile F).

In summary, a steeply dipping, sheet-like conductor will display a decrease in the coplanar response coincident with the peak of the coaxial response. The relative strength of this coplanar null is related inversely to the thickness of the conductor. A pronounced null indicates a relatively thin conductor. The dip of such a conductor can be inferred from the relative amplitudes of the side-lobes.

Massive conductors that could be approximated by a conducting sphere will display a simple single peak profile form on both coaxial and coplanar coils, with a ratio between the coplanar to coaxial response amplitudes as high as 8*.

Overburden anomalies often produce broad poorly defined anomaly profiles (Profile I). In most cases, the response of the coplanar coils closely follows that of the coaxial coils with a relative amplitude ration of 4*.

Occasionally, if the edge of an overburden zone is sharply defined with some significant depth extent, an edge effect will occur in the coaxial coils. In the case of a horizontal conductive ring or ribbon, the coaxial response will consist of two peaks, one over each edge; whereas the coplanar coil will yield a single peak (Profile H).

* It should be noted at this point that Aerodat's definition of the measured ppm unit is related to the primary field sensed in the receiving coil without normalization to the maximum coupled (coaxial configuration). If such normalization were applied to the Aerodat units, the amplitude of the coplanar coil pair would be halved.

Magnetics

The Total Field Magnetic Map shows contours of the total magnetic field, uncorrected for regional variation. Whether an EM anomaly with a magnetic correlation is more likely to be caused by a sulphide deposit than one without depends on the type of mineralization. An apparent coincidence between an EM and a magnetic anomaly may be caused by a conductor which is also magnetic, or by a conductor which lies in close proximity to a magnetic body. The majority of conductors which are also magnetic are sulphides containing pyrrhotite and/or magnetite. Conductive and magnetic bodies in close association can be, and often are, graphite and magnetite. It is often very difficult to distinguish between these cases. If the conductor is also magnetic, it will usually produce an EM anomaly whose general pattern resembles that of the magnetics. Depending on the magnetic permeability of the conducting body, the amplitude of the inphase EM anomaly will be weakened, and if the conductivity is also weak, the inphase EM anomaly may even be reversed in sign.

The interpretation of contoured aeromagnetic data is a subject on its own involving an array of methods and attitudes. The interpretation of source characteristics for example from total field results is often based on some numerical modelling scheme. The vertical gradient data is more legible in some aspects however and useful inferences about source characteristics can often be read off the contoured VG map.

The zero contour lines in contoured VG data are often sited as a good approximation to the outline of the top of the magnetic source. This only applies to wide (relative to depth of burial) near vertical sources at high magnetic latitudes. It will give an incorrect interpretation in most other cases.

Theoretical profiles of total field and vertical gradient anomalies from tabular sources at a variety of magnetic inclinations are shown in the attached figure. Sources are 10, 50 and 200 m wide. The source-sensor separation is 50 m. The thin line is the total field profile. The thick line is the vertical gradient profile.

The following comments about source geometry apply to contoured vertical gradient data for magnetic inclinations of 70 to 80°.

Outline

Where the VG anomaly has a single sharp peak, the source may be a thin near-vertical tabular source. It may be represented as a magnetic axis or as a tabular source of measurable width - the choice is one of geological preference.

Where the VG anomaly has a broad, flat or inclined top, the source may be a thick tabular source. It may be represented as a thick body where the width is taken from the zero contour lines if the body dips to magnetic north. If the source appears to be dipping to the south (i.e. the VG anomaly is asymmetric), the zero contours are less reliable indicators of outline. The southern most zero contour line should be ignored and the outline taken from the northern zero contour line and the extent of the anomaly peak width.

Dip

A symmetrical vertical gradient response is produced by a body dipping to magnetic north. An asymmetrical response is produced by a body which is vertical or dipping to the south. For southern dips, the southern most zero contour line may be several hundred meters south of the source.

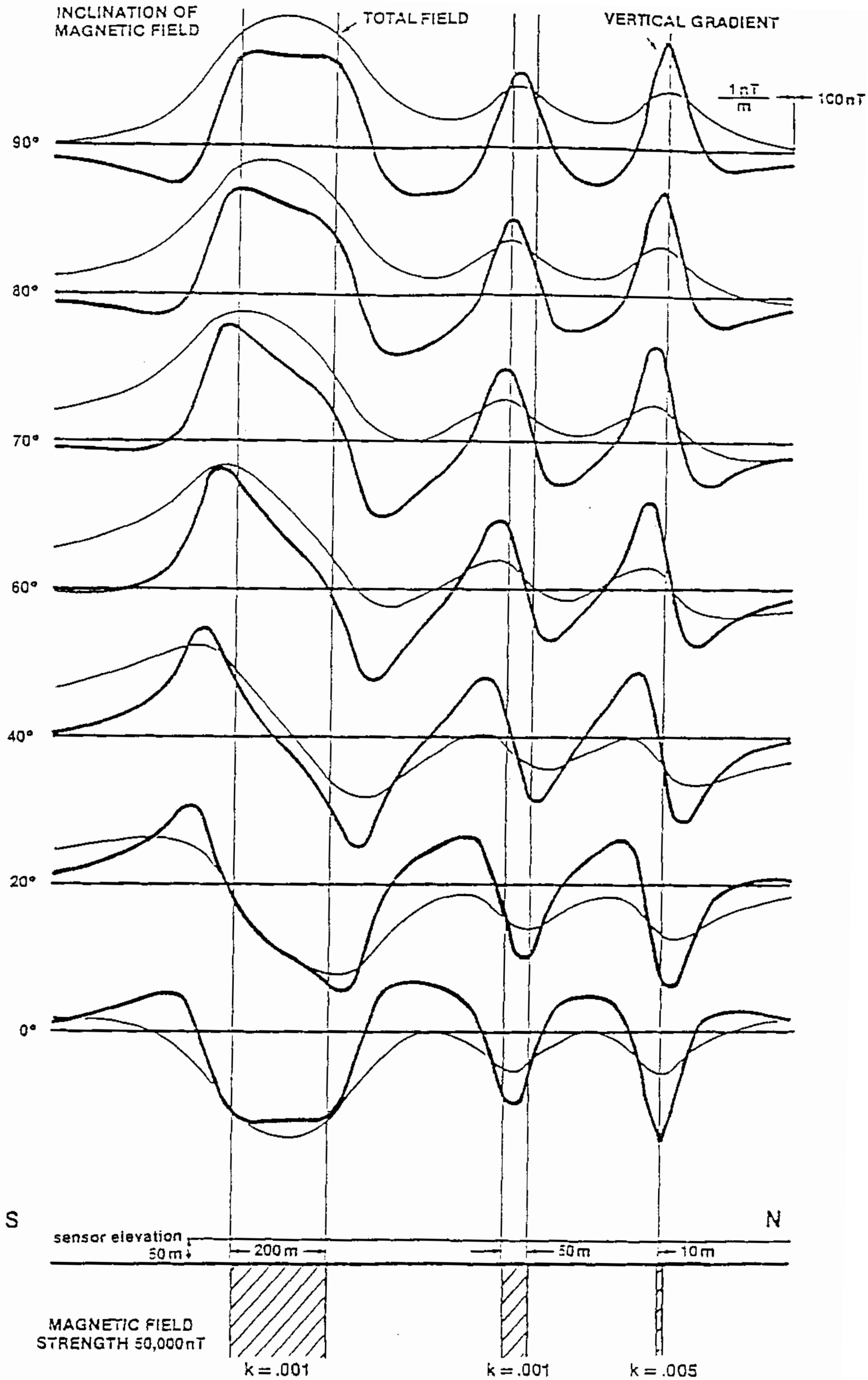
Depth of Burial

The source-sensor separation is about equal to half of the distance between the zero contour lines for thin near-vertical sources. The estimated depth of burial for such sources is this separation minus 50 m. If a variety of VG anomaly widths are seen in an area, use the narrowest width seen to estimate local depths.

VLF Electromagnetics

The VLF-EM method employs the radiation from powerful military radio transmitters as the primary signals. The magnetic field associated with the primary field is locally horizontal and normal to a line pointing at the transmitter.

The Herz Totem uses three coils in the X, Y, Z configuration to measure the total field and vertical quadrature component from two VLF stations. These stations are designated Line and Ortho. The line station is ideally in a direction from the survey area at right angles to the flight line direction. Conductors normal to the flight line direction point at the line station and are therefore optimally coupled to VLF magnetic fields and in the best situation to gather secondary VLF currents. The ortho station is ideally 90 degrees in azimuth from the line station.


INCLINATION OF MAGNETIC FIELD
TOTAL FIELD
VERTICAL GRADIENT
1 nT/m
100 nT
90°
80°
70°
60°
40°
20°
0°
S
N
sensor elevation 50 m
200 m
50 m
10 m
MAGNETIC FIELD STRENGTH 50,000 nT
k = .001
k = .001
k = .005

The relatively high frequency of VLF (15-25) kHz provides high response factors for bodies of low conductance. Relatively "disconnected" sulphide ores have been found to produce measurable VLF signals. For the same reason, poor conductors such as sheared contacts, breccia zones, narrow faults, alteration zones and porous flow tops normally produce VLF anomalies. The method can therefore be used effectively for geological mapping. The only relative disadvantage of the method lies in its sensitivity to conductive overburden. In conductive ground to depth of exploration is severely limited.

The effect of strike direction is important in the sense of the relation of the conductor axis relative to the energizing electromagnetic field. A conductor aligned along a radius drawn from a transmitting station will be in a maximum coupled orientation and thereby produce a stronger response than a similar conductor at a different strike angle. Theoretically, it would be possible for a conductor, oriented tangentially to the transmitter to produce no signal. The most obvious effect of the strike angle consideration is that conductors favourably oriented with respect to the transmitter location and also near perpendicular to the flight direction are most clearly rendered and usually dominate the map presentation.

The total field anomaly is an indicator of the existence and position of a conductor. The response will be a maximum over the conductor, without any special filtering, and strongly favour the upper edge of the conductor even in the case of a relatively shallow dip.

Conversely a negative total field anomaly is often seen over local resistivity highs. This is because the VLF field produces electrical currents which flow towards (or away from) the transmitter. These currents are gathered into a conductor and are taken from resistive bodies. The VLF system sees the currents gathered into the conductor as a total field high. It sees the relative absence of secondary currents in the resistor as a total field low.

As noted, VLF anomaly trends show a strong bias towards the VLF transmitter. Structure which is normal to this direction may have no associated VLF anomaly but may be seen as a break or interruption in VLF anomalies. If these structures are of particular interest, maps of the ortho station data may be worthwhile.

Conductive overburden will obscure VLF responses from bedrock sources and may produce low amplitude, broad anomalies which reflect variations in the resistivity of thickness of the overburden.

Extreme topographic relief will produce VLF anomalies which may bear no relationship to variations in electrical conductivity. Deep gullies which are too narrow to have been surveyed at a uniform sensor height often show up as VLF total field lows. Sharp ridges show up as total field highs.

The vertical quadrature component over steeply dipping sheet-like conductor will be a cross-over type response with the cross-over closely associated with the upper edge of the conductor.

The response is a cross-over type due to the fact that it is the vertical rather than total field quadrature component that is measured. The response shape is due largely to geometrical rather than conductivity considerations and the distance between the maximum and minimum on either side of the cross-over is related to target depth. For a given target geometry, the larger this distance the greater the depth.

The vertical quadrature component is rarely presented. Experience has shown the total field to be more sensitive to bedrock conductors and less affected by variations in conductive overburden.

Apparent Resistivity/Conductivity Maps

Overburden and different types of bedrock may be modelled as a large area horizontal conductor of fixed thickness. A phasor diagram may be constructed, in the same fashion as for the vertical sheet, to convert the measured HEM in-phase and quadrature response to a depth and conductivity value for a horizontal layer. Traditionally if the thickness is large, an infinite half-space, the associated conductivity value is referred to as "apparent conductivity". We have generalized the use of the word "apparent" to include any model where the thickness of the layer is a fixed as opposed to a variable parameter. The units of apparent resisitivity are ohm-m and those of apparent conductivity are the inverse mhos/m or siemen/m. If the chosen model layer thickness is close to the true thickness of the conductor then the apparent conductivity will closely conform to the true value; however, if the thickness is inappropriate the apparent value may be considerably different from the true value.

The benefit of the apparent conductivity mapping is that it provides a simple robust method of converting the HEM in-phase and quadrature response to apparent change in ground conductivity.

A phasor diagram for several apparent resistivity models is presented. The general forms for the various thicknesses is very similar and also closely resembles the diagram for the vertical sheet. The diagrams also show the curves for apparent depth. As with the conductivity value the depth value is meaningful if the model thickness closely resembles the true conductive layer thickness. If the HEM response from a thin conducting layer is applied to a thick layer model the apparent conductivity and depth will be less than the true conductivity and depth.

APPENDIX II

ANOMALY LISTINGS

J9440

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
6	10620	A	0	-3.4	10.5	0.0	0	52	450049.6	6231120.5
6	10620	B	0	-10.9	10.1	0.0	0	27	451517.1	6231107.5
6	10590	A	0	1.8	5.4	0.0	0	55	451721.8	6231707.5
6	10600	A	0	-0.6	12.0	0.0	0	23	451775.9	6231496.0
6	10580	A	0	-2.4	6.4	0.0	0	28	450782.6	6231937.0
6	10560	A	0	-0.9	9.5	0.0	0	36	449941.9	6232301.0
6	10560	B	0	-1.9	10.2	0.0	0	25	450624.3	6232313.0
6	10560	C	0	-1.8	5.6	0.0	0	36	451059.2	6232312.5
6	10550	A	0	-7.4	7.3	0.0	0	28	449630.5	6232457.5
6	10540	A	0	-5.6	9.2	0.0	0	30	449678.3	6232708.0
6	10540	B	0	-1.3	11.5	0.0	0	44	450957.0	6232710.5
6	10540	C	0	-2.6	18.2	0.0	0	31	451714.3	6232702.5
6	10530	A	0	2.1	10.4	0.0	0	51	451191.0	6232868.0
6	10530	B	0	0.1	7.7	0.0	0	29	450273.6	6232867.5
6	10520	A	0	1.4	8.0	0.0	8	28	450120.0	6233072.5
6	10520	B	0	0.2	10.5	0.0	0	47	451023.9	6233050.0
6	10520	C	0	-1.1	15.0	0.0	0	42	451789.0	6233102.0
5	10480	A	0	-0.2	10.2	0.0	0	33	451460.7	6233894.5
5	10470	A	0	2.8	10.2	0.0	20	18	450496.5	6234089.0
5	10470	B	0	-0.6	8.9	0.0	0	26	450934.2	6234076.0
5	10470	C	0	-5.4	10.6	0.0	0	26	454111.2	6234069.0
5	10461	A	0	1.5	11.7	0.0	0	33	450892.2	6234254.5
5	10450	A	0	-10.5	7.4	0.0	0	38	451707.5	6234451.5
5	10450	B	0	-3.3	7.4	0.0	0	34	453813.5	6234496.5
5	10440	A	0	-2.9	5.8	0.0	0	33	453723.9	6234711.5
5	10440	B	0	-4.4	10.0	0.0	0	31	452980.4	6234706.0
4	10430	A	0	1.3	4.6	0.0	11	39	453376.6	6234900.5
4	10430	B	0	-2.3	4.2	0.0	0	30	450878.7	6234911.5
4	10420	A	0	2.0	6.4	0.0	7	40	451423.3	6235100.5

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

J9440

				AMPLITUDE (PPM)		CONDUCTOR		BIRD		
						CTP	DEPTH	HEIGHT		
FLIGHT	LINE	ANOMALY	CATEGORY	INPHASE	QUAD.	MHOS	MTRS	MTRS		
------	----	-------	--------	-------	-----	----	----	----		
4	10420	B	0	0.7	7.6	0.0	0	32	451498.8	6235102.5
4	10420	C	0	-1.9	7.0	0.0	0	30	451879.9	6235093.5
4	10400	A	0	-2.3	8.3	0.0	0	37	448111.6	6235478.5
4	10400	B	0	0.2	8.6	0.0	0	27	451757.9	6235507.5
4	10400	C	0	-7.3	6.8	0.0	0	36	452651.7	6235496.0
4	10400	D	0	-5.2	8.1	0.0	0	32	452769.7	6235496.0
4	10400	E	0	-0.9	7.4	0.0	0	44	452931.4	6235494.0
4	10400	F	0	-1.9	10.8	0.0	0	32	453957.5	6235475.0
4	10390	A	0	1.5	9.1	0.0	0	39	453035.1	6235689.5
4	10390	B	0	1.9	7.1	0.0	11	32	448480.2	6235701.5
4	10380	A	0	-1.6	10.5	0.0	0	33	448250.5	6235842.5
4	10380	B	0	-1.2	8.6	0.0	0	29	448959.3	6235883.0
4	10380	C	0	2.6	8.6	0.0	6	36	451922.7	6235893.0
4	10380	D	0	2.0	5.9	0.0	10	39	452246.3	6235886.0
4	10380	E	0	1.7	11.2	0.0	0	41	452907.2	6235870.5
4	10380	F	0	2.3	15.2	0.0	0	38	453166.9	6235866.5
4	10380	G	0	3.1	9.3	0.1	2	39	453327.7	6235867.0
4	10380	H	0	0.0	8.9	0.0	0	37	453519.2	6235870.5
4	10380	J	0	-1.7	10.1	0.0	0	26	453768.4	6235879.5
4	10370	A	0	-7.0	10.7	0.0	0	40	453758.3	6236105.5
4	10370	B	0	0.9	8.8	0.0	1	28	452634.1	6236099.0
4	10370	C	0	0.8	8.3	0.0	5	24	452537.2	6236098.5
4	10360	A	0	-1.5	7.3	0.0	0	23	448838.8	6236301.5
4	10360	B	0	-5.5	4.6	0.0	0	33	448966.3	6236302.5
4	10360	C	0	-8.2	9.1	0.0	0	41	449976.3	6236292.5
4	10360	D	0	-1.4	8.2	0.0	0	32	451415.7	6236311.0
4	10360	E	0	1.0	8.3	0.0	0	34	454024.6	6236302.5
4	10350	A	0	-4.3	25.0	0.0	0	22	452926.1	6236504.0
3	10340	A	0	0.1	8.8	0.0	0	21	450399.4	6236657.5
3	10340	B	0	0.2	6.2	0.0	0	60	451004.0	6236680.5
3	10340	C	0	-0.8	6.5	0.0	0	33	452386.2	6236705.0
3	10330	A	0	0.1	9.9	0.0	0	45	452598.3	6236919.5
3	10330	B	0	0.3	10.1	0.0	0	33	451842.8	6236888.5
3	10330	C	0	-0.3	8.8	0.0	0	42	451150.5	6236901.5
3	10321	A	0	-0.9	8.5	0.0	0	50	452170.4	6237100.0
3	10310	A	0	-2.8	8.4	0.0	0	27	451734.9	6237308.0

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

J9440

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
3	10310	B	0	-1.9	8.7	0.0	0	49	451626.0	6237311.0
3	10300	A	0	2.4	9.1	0.0	0	40	450317.3	6237449.5
3	10300	B	0	0.1	16.1	0.0	0	47	451481.0	6237478.5
3	10300	C	0	1.2	13.9	0.0	0	29	451632.1	6237471.5
3	10300	D	0	-1.6	10.0	0.0	0	36	453685.9	6237495.0
3	10290	A	0	0.4	7.9	0.0	0	39	453608.8	6237709.5
3	10291	A	0	0.2	7.7	0.0	0	46	451417.5	6237667.0
3	10280	A	0	-1.7	5.0	0.0	0	50	449460.9	6237896.5
3	10280	B	0	0.7	11.6	0.0	0	65	451694.0	6237851.5
3	10280	C	0	0.5	12.2	0.0	0	40	452135.8	6237860.5
3	10280	D	0	-0.9	11.9	0.0	0	38	452328.9	6237869.0
3	10280	E	0	-1.0	7.1	0.0	0	31	452768.9	6237884.5
3	10280	F	0	-0.1	10.8	0.0	0	56	453135.7	6237891.0
3	10260	A	0	2.4	8.6	0.0	11	30	450629.8	6238318.5
3	10260	B	0	2.7	20.4	0.0	0	43	453168.0	6238292.0
3	10260	C	0	4.1	15.3	0.1	0	41	453352.5	6238291.5
3	10251	A	0	-3.9	8.2	0.0	0	35	450689.9	6238482.5
3	10250	A	0	4.5	11.9	0.1	0	66	453379.3	6238507.5
3	10250	B	0	4.8	26.0	0.0	0	35	453257.7	6238507.5
2	10240	A	0	7.4	10.5	0.5	0	71	453351.1	6238697.5
2	10240	B	0	14.7	25.4	0.5	0	41	453105.3	6238691.0
2	10240	C	0	4.5	13.6	0.1	1	35	452701.6	6238686.5
2	10240	D	0	4.9	12.5	0.1	5	34	452433.4	6238694.0
2	10230	A	0	-0.4	8.7	0.0	0	66	452160.2	6238868.0
2	10230	B	0	1.4	16.6	0.0	0	40	452321.3	6238872.0
2	10230	C	0	7.8	15.8	0.3	0	61	453288.2	6238897.0
2	10220	A	0	7.0	15.7	0.2	0	44	453395.4	6239119.5
2	10220	B	0	4.9	10.4	0.2	5	39	452685.1	6239099.0
2	10220	C	0	3.1	20.3	0.0	0	31	452505.1	6239110.0
2	10210	A	0	0.3	25.9	0.0	0	39	452543.1	6239294.5
2	10210	B	0	2.3	18.1	0.0	0	44	453315.9	6239297.0
2	10190	A	0	-2.8	19.7	0.0	0	48	451967.1	6239679.5
2	10180	A	0	2.2	10.4	0.0	0	49	453805.9	6239923.0

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

J9440

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
2	10180	B	0	-0.1	9.2	0.0	0	73	453601.0	6239926.0
2	10180	C	0	0.0	9.0	0.0	0	43	452081.3	6239902.5
2	10170	A	0	-1.1	4.6	0.0	0	58	453065.3	6240095.5
2	10160	A	0	0.6	12.0	0.0	0	46	453701.2	6240292.5
2	10130	A	0	6.4	22.0	0.1	0	34	453821.3	6240845.5
1	10110	A	0	3.6	28.4	0.0	0	37	453492.6	6241306.5
1	10110	B	0	9.0	32.8	0.1	0	27	453180.0	6241308.5
1	10100	A	0	8.5	22.1	0.2	0	37	452890.8	6241496.5
1	10090	A	0	2.7	16.0	0.0	0	55	452808.5	6241686.0
1	10090	B	0	0.4	8.6	0.0	0	37	452438.5	6241674.5
1	10090	C	0	-0.7	7.3	0.0	0	37	452349.4	6241673.5
1	10090	D	0	0.9	10.8	0.0	0	42	451620.8	6241706.5
1	10080	A	0	-1.6	10.8	0.0	0	40	452256.0	6241900.0
1	10080	B	0	8.8	38.6	0.1	0	27	452720.6	6241913.0
1	10080	C	0	2.8	28.5	0.0	0	22	452869.5	6241907.5
1	10080	D	0	5.7	27.8	0.0	0	24	453221.9	6241871.5
1	10080	E	0	9.7	41.1	0.1	0	28	453734.3	6241813.0
1	10070	A	0	8.4	36.3	0.1	0	37	453501.8	6242084.0
1	10070	B	0	6.9	47.5	0.0	0	23	453361.8	6242084.5
1	10070	C	0	8.0	31.8	0.1	0	32	452604.4	6242107.0
1	10060	A	0	8.7	20.4	0.2	0	37	452367.2	6242292.0
1	10060	B	0	10.2	30.2	0.2	11	17	452864.3	6242276.0
1	10060	C	0	9.8	28.7	0.2	0	32	453057.2	6242284.0
1	10060	D	0	19.3	60.4	0.2	0	27	453220.9	6242297.5
1	10050	A	0	10.8	46.6	0.1	0	39	453053.0	6242512.0
1	10040	A	0	12.9	63.0	0.1	0	23	452583.6	6242688.5
1	10040	B	0	23.0	108.8	0.1	0	19	452689.3	6242689.0
1	10040	C	0	15.9	55.7	0.2	0	31	452842.2	6242689.5
1	10030	A	0	2.0	9.2	0.0	0	84	453603.8	6242897.5
1	10030	B	0	-0.7	21.9	0.0	0	37	453159.0	6242934.0
1	10030	C	0	0.4	32.1	0.0	0	31	453018.8	6242925.5
1	10030	D	0	1.1	13.1	0.0	0	49	452007.6	6242913.0
1	10020	A	0	4.0	9.5	0.1	0	55	452014.7	6243082.0

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

J9440

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS		
1	10011	A	0	2.8	14.7	0.0	0	40	451875.0	6243321.0
7	20050	A	0	-1.8	10.7	0.0	0	24	448784.4	6242503.0
7	20070	A	0	-0.5	6.3	0.0	0	34	449158.6	6242061.5
7	20070	B	0	-0.5	8.3	0.0	0	26	448675.8	6242096.0
7	20080	A	0	0.0	9.7	0.0	0	32	449119.9	6241904.5
7	20090	A	0	3.6	7.7	0.2	6	43	449809.7	6241740.5
7	20090	B	0	2.7	10.0	0.0	10	28	449034.1	6241668.0
7	20110	A	0	0.8	11.7	0.0	0	39	449722.3	6241332.5
7	20120	A	0	-14.5	8.9	0.0	0	24	449148.1	6241105.0
7	20120	B	0	-12.1	8.5	0.0	0	18	449210.4	6241104.0
7	20120	C	0	1.4	10.1	0.0	6	25	449621.2	6241104.0
7	20130	A	0	-2.8	13.3	0.0	0	26	449661.3	6240911.0
7	20130	B	0	-0.1	5.5	0.0	0	35	449022.3	6240898.5
7	20130	C	0	1.5	6.3	0.0	4	39	448905.5	6240898.5
7	20150	A	0	-15.8	9.0	0.0	0	22	449435.7	6240450.5
7	20150	B	0	-1.1	14.0	0.0	0	32	448827.6	6240473.5
7	20160	A	0	0.5	8.2	0.0	0	40	448296.1	6240283.5
7	20160	B	0	0.8	7.7	0.0	0	34	448523.4	6240284.0
7	20170	A	0	-4.9	15.9	0.0	0	25	448794.8	6240112.0
7	20170	B	0	-3.3	11.5	0.0	0	34	448242.3	6240130.5
7	20180	A	0	-0.7	11.7	0.0	0	34	448573.9	6239894.0
7	20190	A	0	-3.3	9.0	0.0	0	36	448928.9	6239686.5
7	20200	A	0	-2.8	4.5	0.0	0	21	447790.2	6239486.5
7	20210	A	0	-0.3	12.5	0.0	0	18	449078.7	6239305.0
7	20210	B	0	-1.5	9.4	0.0	0	31	448869.0	6239319.5
7	20210	C	0	-1.3	8.5	0.0	0	39	448575.2	6239332.5
7	20210	D	0	-0.6	3.5	0.0	0	43	448258.8	6239318.5

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

APPENDIX III

PERSONNEL

FIELD

Flown	July 31 to August 3, 1994
Pilot(s)	T. Thompson
Operator(s)	M. Barry

OFFICE

Processing	Duncan Wilson George McDonald
Report	R. W. Woolham

APPENDIX IV

CERTIFICATE OF QUALIFICATION

I, Roderick W. Woolham of the town of Pickering, Province of Ontario, do hereby certify that:-

1. I am a geophysicist and reside at 1463 Fieldlight Blvd., Pickering, Ontario, L1V 2S3

2. I graduated from the University of Toronto in 1961 with a degree of Bachelor of Applied Science, Engineering Physics, Geophysics Option. I have been practising my profession since graduation.

3. I am a member in good standing of the following organizations: Professional Engineers Ontario (Mining Branch); Society of Exploration Geophysicists; South African Geophysical Association.

4. I have not received, nor do I expect to receive, any interest, directly or indirectly, in the properties or securities of Geofine Exploration Consultants Company Limited or any affiliate.

5. The statements contained in this report and the conclusions reached are based upon evaluation and review of maps and information supplied by Geonex Aerodat.

6. I consent to the use of this report in submissions for assessment credits or similar regulatory requirements.

REGISTERED PROFESSIONAL ENGINEER
R. W. WOOLHAM
PROVINCE OF ONTARIO

R. W. Woolham, P.Eng.

Pickering, Ontario

August 24, 1994