REPORT ON A
COMBINED HELICOPTER-BORNE
MAGNETIC, ELECTROMAGNETIC AND VLF-EM SURVEY
FRIPP TOWNSHIP, ONTARIO

FOR

FALCONBRIDGE LTD. - EXPLORATION
571 MONETA AVENUE, BOX 1140
TIMMINS, ONTARIO
P4N 7H9

BY

AERODAT LIMITED
3883 NASHUA DRIVE
MISSISSAUGA, ONTARIO
L4V 1R3
PHONE: 416 - 671-2446

August 1, 1991

J9101F

2.3844 (qual).

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

42A06SW0502 2.14526 FRIPP

010C

TABLE OF CONTENTS

LIST OF MAPS

Maps are labelled according to scale, map type and sheet number. Map scales are 1:5,000 and 1:20,000. All map types are not necessarily presented at both scales. Details on map types, scales and map sheet layout are given in Section 4.

BLACK LINE MAPS:

Map Type	Description
1.	**BASE MAP**; screened photomosaic base map with township boundaries and UTM reference corners or grid.
2.	**FLIGHT PATH MAP**; photocombination of the base map with flight lines, and EM anomaly symbols.
3.	**COMPILATION/INTERPRETATION MAP**; with base map.
4.	**TOTAL FIELD MAGNETIC CONTOURS**; with base map.
5.	**VERTICAL MAGNETIC GRADIENT CONTOURS**; with base map.
6.	**APPARENT RESISTIVITY CONTOURS**; apparent resistivity calculated for the 935 Hz data, with base map.
7.	**VLF-EM TOTAL FIELD CONTOURS**; with base map.
8.	**HEM OFFSET PROFILES (935 Hz)**; with base map and flight lines.

COLOUR MAPS:

1. **TOTAL FIELD MAGNETICS**; with superimposed contours and EM anomaly symbols.

2. **VERTICAL GRADIENT MAGNETICS**; with superimposed contours and EM anomaly symbols.

3. **APPARENT RESISTIVITY**; calculated for the 935 Hz data with superimposed contours and EM anomaly symbols.

4. **VLF-EM TOTAL FIELD**; with superimposed contours, fiducials and EM anomaly symbols.

5A. **HEM OFFSET PROFILES;** 935 Hz and 850 Hz data with flight lines and EM anomaly symbols.

5B. **HEM OFFSET PROFILES;** 4175 Hz and 4600 Hz data with flight lines and EM anomaly symbols.

DERIVATIVE COLOUR MAPS:

1-A. **TOTAL FIELD MAGNETICS SHADOW MAPS;** at illumination directions given by angle A.

REPORT ON A
COMBINED HELICOPTER-BORNE
MAGNETIC, ELECTROMAGNETIC AND VLF-EM
SURVEY, FRIPP TOWNSHIP, ONTARIO

1. INTRODUCTION

This report describes an airborne geophysical survey carried out on behalf of Falconbridge Limited - Exploration (Falconbridge) by Aerodat Limited under a contract dated January 4, 1991. Principal geophysical sensors included a four frequency electromagnetic system, a high sensitivity cesium vapour magnetometer and a two frequency VLF-EM system. Ancillary equipment included a radar ranging navigation system, a colour video tracking camera, a radar altimeter, a power line monitor and a base station magnetometer.

The survey was carried out over an area of some 20 square kilometres centered in the south east part of Fripp Township and about 30 km south of Timmins. Total survey coverage was approximately 200 line kilometres (plus 18 km magnetic tie lines). The flight line spacing was 100 m. The Aerodat job number is J9101F.

This report describes the survey, the data processing and the data presentation. Electromagnetic anomalies which are thought to be the response to bedrock conductors have been identified and appear on selected map products as EM anomaly symbols with interpreted source characteristics. Where EM and Magnetic results supported it, anomaly centers are joined to form conductor axes. Recommendations concerning areas with favourable geophysical characteristics are made with reference to a compilation/interpretation map.

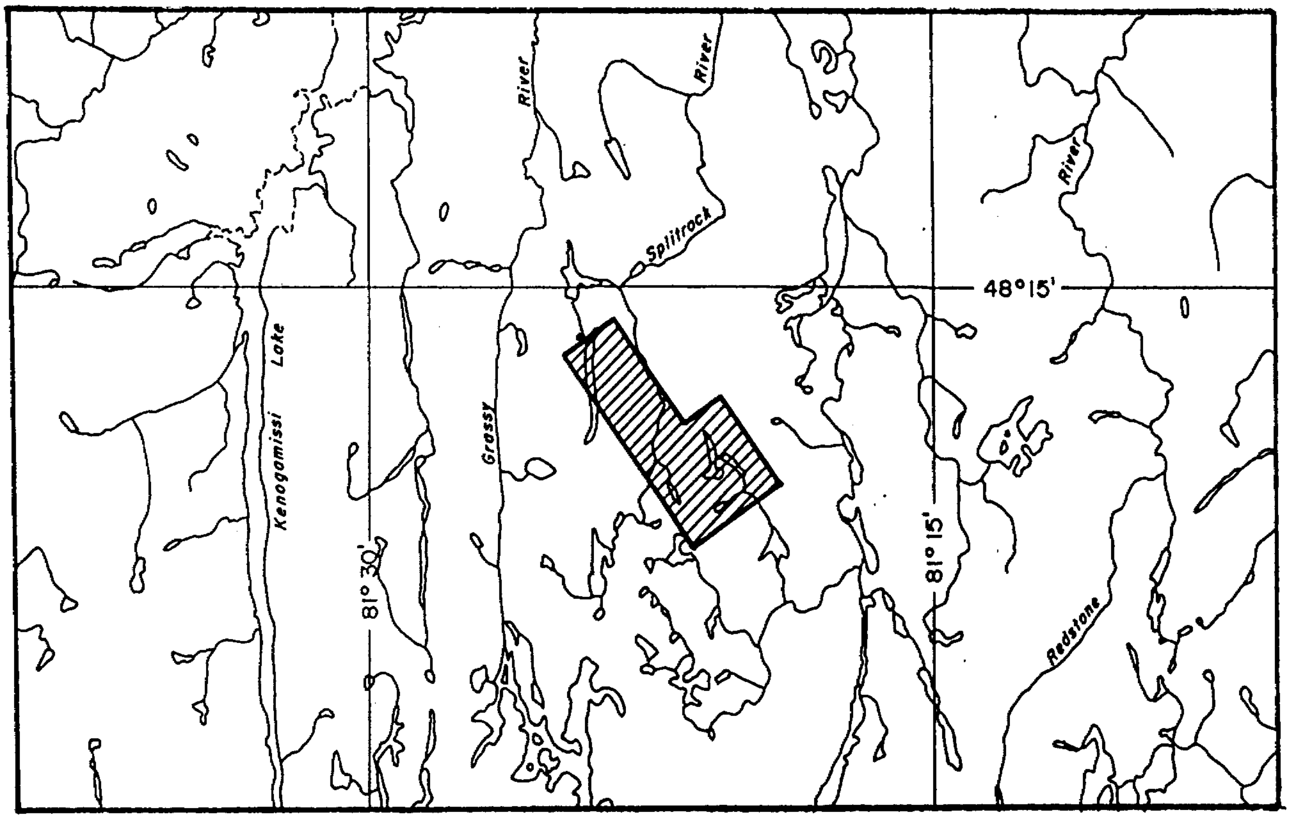
2. SURVEY AREA

The survey area is centred some 30 km south of Timmins, Ontario. Area topography is shown on the 1:50,000 scale NTS map sheet - 42A/3 (Peterlong Lake).

Local relief is minimal - elevations range from 1100 to 1200 feet. The area is free of major roads, powerlines, railroads, etc.

The survey area is shown in the attached index map which includes local topography and latitude - longitude coordinates.

The local magnetic field has an inclination of 77° and a declination of 8° west of north.



HELICOPTERBORNE GEOPHYSICAL SURVEY
FRIPP TOWNSHIP AREA

on behalf of
FALCONBRIDGE LIMITED - EXPLORATION

BY

AERODAT LIMITED
J9101F

3. SURVEY PROCEDURES

The survey was flown in the period February 26 and 27, 1991. Principal personnel are listed in Appendix IV. Four (4) survey flights were required to complete the project.

The flight line spacing was 100 m. The aircraft ground speed was maintained at approximately 60 knots (30 metres per second). The nominal EM sensor height was 30 metres, consistent with the safety of the aircraft and crew.

Following equipment installation and testing, the ground based transponders of the radar ranging navigation system were installed at two or more sites near the survey area. The UTM coordinates of each site were taken from published 1:50,000 NTS maps. The base line (or line between transponders) was flown to determine their separation. The result is used to check the UTM coordinates assigned to each transponder.

The UTM coordinates of survey area corners were taken from maps provided by Falconbridge. These coordinates are used to program the navigation system. A test flight was used to confirm that area coverage would be as required.

Thereafter the traverse lines are flown under the guidance of the navigation system. The operator entered manual fiducials over prominent topographic features as seen on a 1:10,000 scale photomosaic map. Survey lines which showed excessive deviation were re-flown.

The magnetic tie lines were flown using visual navigation in areas of low topographic and magnetic relief. Aircraft position was taken from the navigation system. Two magnetic tie lines were flown.

Calibration lines are flown at the start, middle (if required) and end of every survey flight. These lines are flown outside of ground effects to record electromagnetic zero levels.

4. DELIVERABLES

The results of the survey are presented in a report plus maps. The report is presented in four copies. Folded white print copies of the 1:20,000 scale compilation/interpretation map are bound with the report.

The black line maps are delivered as cronaflex (or clear acetate) originals. The colour maps are delivered in four copies. The shadow maps are delivered in two copies. All maps are rolled and delivered in map tube(s).

A full list of all map types is given at the beginning of this report. A summary is given here.

MAP TYPE	DESCRIPTION
1	Base Map (Black line)
2	Flight Path Map (Black line)
3	Compilation/Interpretation Map (Black line)
4	Total Magnetic Field Contours (Black line)
5	Vertical Magnetic Gradient Contours (Black line)
6	Apparent Resistivity - 935 Hz (Black line)
7	VLF-EM Total Field Contours (Black line)
8	HEM Offset Profiles - 935 Hz (Black line)
1	Total Magnetic Field Contours (Colour)
2	Vertical Magnetic Gradient Contours (Colour
3	Apparent Resistivity Contours - 935 Hz - (Colour)
4	VLF-EM Total Field Contours (Colour)
5A	HEM Offset Profiles - (935 & 850 Hz) (Colour)
5B	HEM Offset Profiles - (4175 & 4600 Hz) (Colour)
1A	Total Field Magnetic Shadow Maps (Colour)

Black line map scales are as follows:

MAP TYPE	1:5,000	1:20,000
1	X	X
2	X	X
3	X	X
4	X	X
5	X	X
6		X
7		X
8		X

All maps, except type 2 (flight path map with anomaly centers), are presented on cronaflex. Type 2 maps are presented on clear acetate.

The colour and shadow maps are presented at the following scales:

MAP TYPE	1:5,000	1:20,000
1	X	X
2	X	X
3		X
4		X
5(A&B)	X	
1-A		X

The 1:20,000 scale maps are presented on one map sheet. These maps show township boundaries and a screened photomosaic base. The 1:5,000 scale maps are presented on seven map sheets. The map sheet layout for the 1:5,000 scale map is shown in the attached figure.

Each 1:5,000 scale map sheet covers an area of 5000 m (east-west) by 3000 m (north-south). Map sheet boundaries are lines of equal UTM grid eastings and northings. Map sheets are labelled using a 7 number code. The first three numbers indicate the UTM easting (in kilometres) of the western boundary of the sheet. The last four numbers indicate the UTM northing (in kilometres) of the southern boundary of the sheet. The 1:5,000 scale map sheet number 4705338 for example covers the area given by

UTM Eastings from 470000 to 475000
UTM Northings from 5338000 to 5341000

The 5,000 scale maps show local topography and a 1 km square UTM grid. A total of seven 1:5,000 scale maps were needed to cover the survey area.

The processed digital data is organized on 9 track archive tape. Both the profile and the gridded data are saved on tape. A full description of the archive tape(s) is delivered with the tape(s).

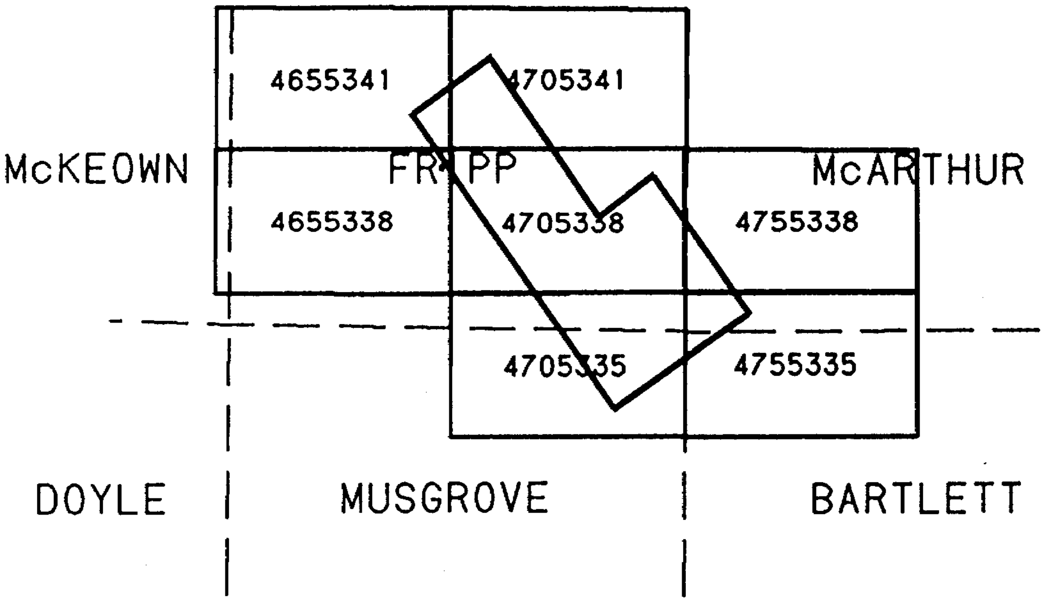
All gridded data are also provided on diskettes suitable for displaying on IBM compatible 286 or 386 microcomputers using the Aerodat RTI software package.

The Aerodat RTI (Real Time Imaging) program for displaying the gridded data sets from the survey is delivered to Falconbridge.

5. AIRCRAFT AND EQUIPMENT

5.1 Aircraft

An Astar 350B helicopter, (C-GJIX), owned and operated by Questral Helicopters, was



MAP SHEET LAYOUT
1:5,000 SCALE MAPS
AIRBORNE GEOPHYSICAL SURVEY
FRIPP TOWNSHIP AREA

on behalf of
FALCONBRIDGE LIMITED - EXPLORATION

BY

AERODAT LIMITED
J9101F

used for the survey. Installation of the geophysical and ancillary equipment was carried out by Aerodat. The survey aircraft was flown at a mean terrain clearance of 60 metres.

5.2 Electromagnetic System

The electromagnetic system was an Aerodat 4-frequency system. Two vertical coaxial coil pairs were operated at 935 Hz and 4,600 Hz and two horizontal coplanar coil pairs at 850 Hz and 4,175 Hz. The transmitter-receiver separation was 7 metres. Inphase and quadrature signals were measured simultaneously for the 4 frequencies with a time constant of 0.1 seconds. The HEM bird was towed 30 metres below the helicopter.

5.3 VLF-EM System

The VLF-EM System was a Herz Totem 2A. This instrument measures the total field and vertical quadrature components of two selected frequencies. The sensor was towed in a bird 15 metres below the helicopter.

VLF transmitters are designated "Line" and "Ortho". The line station is that which is in a direction from the survey area which is ideally normal to the flight line direction. This is the VLF station most often used because of optimal coupling with near vertical conductors running perpendicular to the flight line direction. The ortho station is ideally 90 degrees in azimuth away from the line station.

The transmitters used were NAA, Cutler, Maine broadcasting at 24.0 kHz, NSS, Annapolis, Maryland broadcasting at 21.4 kHz, and NLK, Jim Creek, Washington broadcasting at 24.8 kHz. NAA (24.0 kHz) was used as the line station and NSS (21.4 kHz) and nlk (24.8 kHz) were used as the ortho station.

5.4 Magnetometer

The magnetometer employed was a Scintrex H8 cesium, optically pumped magnetometer sensor. The sensitivity of this instrument is 0.001 nanoTeslas at a 0.2 second sampling rate. The sensor was towed in a bird 15 metres below the helicopter.

5.5 Ancillary Systems

Base Station Magnetometer

An IFG-2 proton precession magnetometer was operated at the base of operations 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 facilitate later correlation. Recording resolution was 1 nT. The update rate was 4 seconds.

External magnetic field variations were recorded on a 3" wide paper chart and in digital form. The analog record shows the magnetic field trace plotted on a grid. Each division of the grid (0.25") is equivalent to 1 minute (chart speed) or 5 nT (vertical sensitivity). The date, time and current total field magnetic value are printed every 10 minutes.

Radar Altimeter

A King KRA-10 radar altimeter was used to record terrain clearance. The output from the instrument is a linear function of altitude.

Tracking Camera

A Panasonic colour video camera was used to record flight path on VHS video tape. The camera was operated in continuous mode. The flight number, 24 hour clock time (to .01 second), and manual fiducial number are encoded on the video tape.

Radar Ranging Navigation System

A Motorola Miniranger III positioning system was used to guide the pilot over a programmed grid. The ranges to at least two ground stations were digitally recorded. The output sampling rate is 1 second. Ranges are recorded with a resolution of 0.1 m.

Analog Recorder

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

Label	Contents	Scale
GEOPHYSICAL SENSOR DATA		
MAGF	Total Field Magnetics, Fine	2.5 nT/mm
MAGC	Total Field Magnetics, Course	25 nT/mm
VLT	VLF-EM, Total Field, Line Station	2.5 %/mm
VLQ	VLF-EM, Vertical Quadrature, Line Station	2.5 %/mm
VOT	VLF-EM, Total Field, Ortho Station	2.5 %/mm
VOQ	VLF-EM, Vertical Quadrature, Ortho Station	2.5 %/mm
X09I	935 Hz, Coaxial, Inphase	2.5 ppm/mm
X09Q	935 Hz, Coaxial, Quadrature	2.5 ppm/mm
X4KI	4600 Hz, Coaxial, Inphase	2.5 ppm/mm
X4KQ	4600 Hz, Coaxial, Quadrature	2.5 ppm/mm
P09I	850 Hz, Coplanar, Inphase	5 ppm/mm
P09Q	850 Hz, Coplanar, Quadrature	5 ppm/mm
P4KI	4175 Hz, Coplanar, Inphase	10 ppm/mm
P4KQ	4175 Hz, Coplanar, Quadrature	10 ppm/mm

ANCILLARY DATA

RALT	Radar Altimeter	10 ft/mm
PWRL	60 Hz Power Line Monitor	-

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

All but the VLF data are shown on the analog records as positive up. The VLF channels are reversed - positive anomalies are seen as downward excursion, negative anomalies are seen as upward excursions.

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

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

Digital Recorder

A DGR-33 data system recorded the digital survey data on magnetic media. Contents and update rates were 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	0.03 ppm (coaxial), 0.06 ppm (coplanar)
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 1:20,000 scale base maps were prepared from 1:20,000 scale maps of township boundaries provided by Falconbridge. A photomosaic base was added. The 1:5,000 scale base maps were made as a four times photographic enlargement of the 1:20,000 scale topographic maps from the Ministry of Natural Resources of Ontario. A UTM reference grid was added.

6.2 Flight Path Map

The flight path is drawn using linear interpolation between x,y positions from the navigation system. These positions are updated every second (or about 6mm at a scale of 1:5,000). These positions are expressed as UTM eastings (x) and UTM northings (y).

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 2 seconds. Larger tick marks are plotted every 10 seconds. The block, line and flight numbers are given at the start and end of each survey line. The number 60380 30 for example indicates block 6, line 38, flight 30. The high block and flight numbers are due to the fact that this survey followed a larger project for Falconbridge which was done under the same Aerodat job number.

The flight path map is registered to 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 were recorded digitally at a sample rate of 10 per second with a time constant of 0.1 seconds. A two stage digital filtering process was carried out to reject major sferic events and the reduce 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 was further enhanced by the application of a low pass digital filter. This filter has zero phase shift which 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 was made using EM zero levels determined during high altitude calibration sequences. The correction applied is a linear function of time that ensures the corrected amplitude of the various inphase and quadrature components is zero when no conductive or permeable source is present. The filtered and levelled data were used in the determination of apparent resistivity (see below).

The offset profiles are plotted at vertical scales of a 2 ppm/mm (935 and 4600 Hz) and 8 ppm/mm (850 and 4175 Hz).

6.4 Total Field Magnetics

The aeromagnetic data were corrected for diurnal variations by adjustment with the recorded base station magnetic values. Where needed, the magnetic tie line results were used to further level the magnetic data. No corrections for regional variations were applied. The corrected profile data were 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. Grid cell sizes of 25 m (1:20,000 scale maps) and 10 m (1:5,000 scale maps) were used.

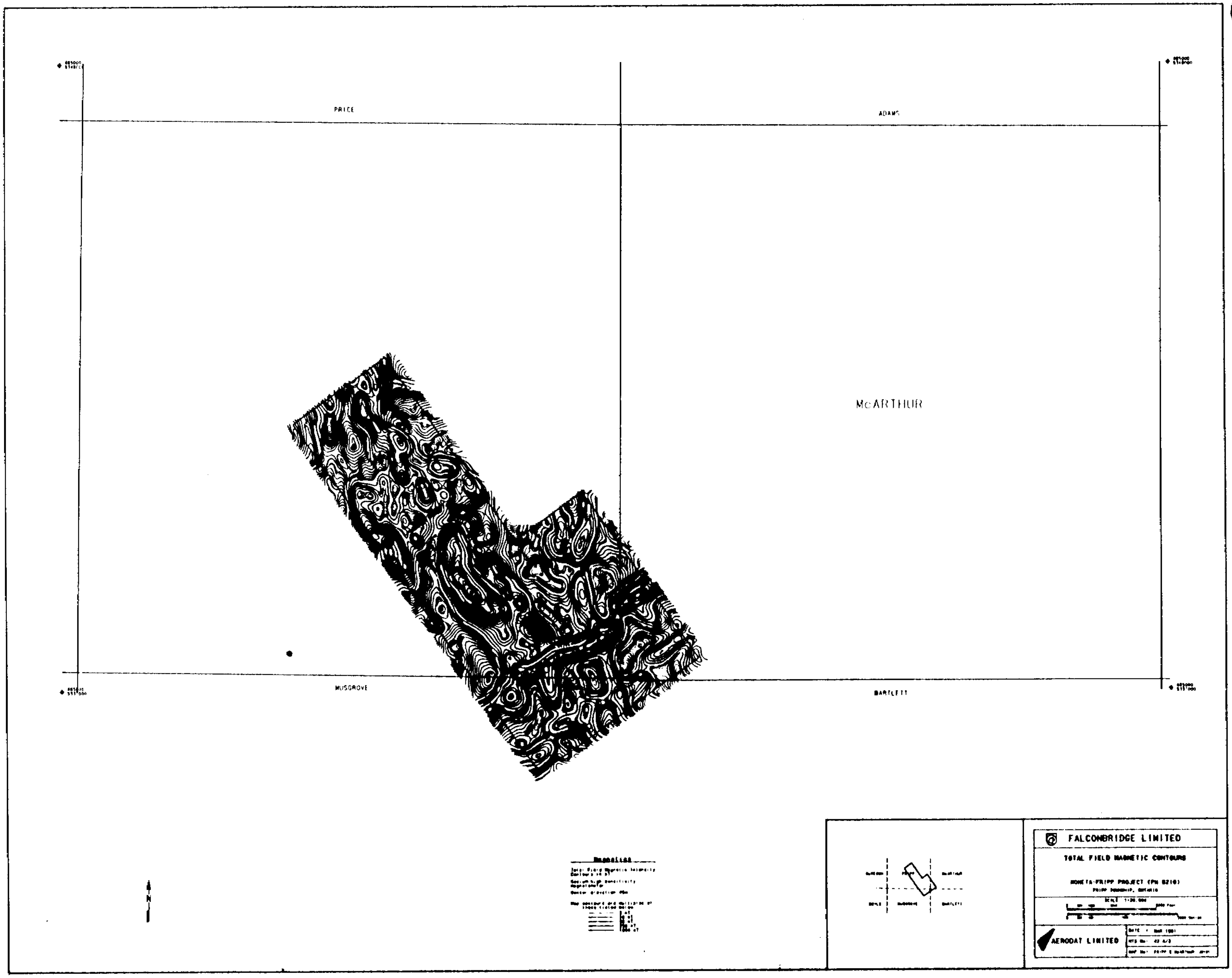
A page size copy of the 1:20,000 scale black line contoured total magnetic field map is attached.

6.5 Vertical Magnetic Gradient

The vertical magnetic gradient was calculated from the gridded total field magnetic data. The calculation is based on a 17 x 17 point convolution in the space domain. The results are contoured using a minimum contour interval of 0.2 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 were interpolated onto a regular grid at a 25 metres (or 10 metres) true scale interval using an Akima spline technique and contoured using logarithmically arranged contour intervals. The contour interval is 0.1 log(ohm.m). This translates to contour lines at 100, 126, 158, 200, 251, 316, 398, 501, 631 and 794 ohm.m and multiples of 10. Thicker contour lines are used for 100 and 316 ohm.m and multiples of 10.



PRICE
ADAMS
McARTHUR
MUSGROVE
BARTLETT
FALCONBRIDGE LIMITED
TOTAL FIELD MAGNETIC CONTOURS
AERODAT LIMITED

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

6.7 VLF-EM

The VLF Total Field data from the Line Station is levelled such that a response of 0% is seen in non-anomalous regions. The corrected profile data are interpolated onto a regular grid using an Akima spline technique. The grid provided the basis for threading the presented contours. The minimum contour interval is 0.5 %. Grid cell size is 25 m (or 10 m).

7. INTERPRETATION

7.1 Area Geology

The following notes have been taken from OGS Report 171, Geology of the Peterlong Lake Area, Districts of Timiskaming and Sudbury, D.R. Pyke, 1978. This report is accompanied by a 1:50,000 scale map of the precambrian geology - OGS map number 2345.

* Two cycles of volcanism have been recognized, each consisting of a lower unit of ultramafic metavolcanics, an overlying unit of mafic metavolcanics and an upper unit of intermediate to felsic metavolcanics. The composite thickness of the two volcanic cycles is on the order of 12 to 16 km.

* Late stocks of granodiorite and monzonite were emplaced within the metavolcanic - metasedimentary succession. The margin of a large complex granitic batholith, composed of at least three intrusive phases, intrudes the lower sequence of mafic and ultramafic volcanics in the survey area. This batholith has been named the Peterlong Lake Complex.

* The ultramafic metavolcanics, engulfed by the granitic batholith in Fripp Township, are largely altered to talc-carbonate or tremolite and probably reflect retrograde metamorphism associated with numerous nw trending faults. Some ultramafics flows, unaffected by retrograde effects, are recrystallized to an aggregate of cummingtonite with minor magnetite.

* The flows at Donut Lake form the southern end of a narrow band of ultramafic rocks that extend northwest toward Bruce Lake. Elsewhere, within this band, in addition to ultramafic lenses extending southwest from Bruce Lake, is a structure characteristic of many of the ultramafic flows in Langmuir Township. A volcanic origin is considered likely for all rocks southeast of Bruce Lake in Fripp Township.

The 1:50,000 scale geology map which accompanied this OGS report shows the following features in the survey area

- north/south trending diabase dykes on both sides of Bruce Lake
- a ne/sw trending quartz diabase dyke which crosses the survey area just southeast of Bartlett and Jules Lakes.
- nw/se trending iron formation northeast of Donut and Jules Lakes.
- nw/se and n/s trending regional faults
- sulphide mineralization near Donut Lake and a Nickel-Copper occurrence on the east side of Bruce Lake.

7.2 Exploration Target

From OGS Report 177, Geology of the Peterlong Lake Area, by D.R. Pyke, 1978

* gold, copper, nickel, lead, zinc, silver, molybdenum, iron and asbestos have been reported from the map area.

* gold mineralization is generally associated with quartz veins and feldspar porphyry dykes occupying shear zones or factors within the metavolcanics or epizonal intrusions. Associated minor pyrite and traces of chalcopyrite are common.

* nickel occurs with metallic sulphides near the base of a serpentinized ultramafic unit which is largely composed of ultramafic volcanic flows. The nickel bearing mineral is mainly pentlandite. The mineralization may be disseminated or massive.

* minor amounts of copper are associated with siliceous sulphide bearing iron formations. Minor chalcopyrite is present in some of the subsidiary shear zones associated with the northerly trending volcanics, particularly in the mafic volcanics. Sulphide minerals consist of chalcopyrite, pyrite, pyrrhotite and bornite and occur as massive sulphide stringers or as disseminations in quartz and quartz-carbonate veins.

* lead-zinc mineralization is associated with quartz-carbonate veining in felsic pyroclastic rocks.

* a vein of massive pyrrhotite up to 0.9 m thick occurs in a trench at the contact of the ultramafic volcanics and sheared granitic rocks on the western shore of Donut Lake.

Falconbridge has an interest in any of the above - not just the ultramafics which might host nickel deposits. All interesting geophysical responses and settings are considered of possible importance.

7.3 EM Anomaly Selection and Analysis

A. Anomaly Selection

The purpose of EM anomaly selection is to identify possible bedrock conductors. The principal characteristic for some anomalies picked is a positive anomaly in the 935 Hz inphase channel with a coincident low in the 850 Hz inphase channel. The same behaviour in 4600/4175 Hz inphase and/or quadrature channels has been used in some cases as selection criteria on their own.

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

The width of an anomaly from a thin sheet conductor will depend principally on depth of burial, dip and orientation with respect to flight line direction. A near vertical conductor running normal to the flight lines will yield a coaxial EM anomaly whose width is about 2.5 times the source-sensor separation (measured from 20% of the anomaly peak). The anomaly from such conductors at surface is about 80 m (4 mm at 1:20,000 or 1.6 cm at 1:5,000). The comparable figures for a conductor under 50 m of overburden is 220 m (1.1 cm at 1:20,000 or 4.4 cm at 1:5,000).

Special care is taken in areas of negative inphase response (due to magnetite). The quadrature channels may be the only indicators of a coincident conductor. In many instances in this survey, a bedrock conductor is indicated where the 935 and 850 Hz inphase traces are negative but the 935 Hz inphase shows a slight positive superimposed on a broader more powerful low. These responses are unusual.

EM anomalies due to cultural sources are so judged if there is a coincident response in the power line monitor as seen on the analog records. If present, they are shown on maps as open squares. Conductance range estimates and inphase response amplitudes are not plotted with the anomaly symbol.

Where EM anomalies of a similar nature consistently line up over an obvious cultural feature such as a road or railroad but where there is no 60 Hz response, the anomalies are also shown as due to cultural sources.

B. Analysis

The EM anomaly response amplitudes at 935 Hz are used to determine the conductance and depth of burial of a vertical thin sheet conductor model. These data appear in Appendix II. The inphase anomaly amplitude and the thin sheet conductance range as determined from the 935 Hz response amplitudes are shown with the plotted anomaly symbols. Each anomaly is identified by flight line number and letter label.

EM anomalies with negative inphase responses in either the 935 or 850 Hz inphase channels are shown with an "M" printed inside the anomaly symbol.

Conductance estimates are only valid when working with sufficient anomaly amplitudes. Where the anomaly has been picked from the 4600 and 4175 Hz responses and there is no clear 935 Hz inphase anomaly, the conductance estimates derived from the 935 Hz responses are unreliable. The true conductance is probably quite low however (i.e. less than 1 mho) and in a range where conductance differences are not distinguishable.

Conductive overburden will generally reduce thin sheet conductance estimates because of elevated background levels in the quadrature channels. Depth of burial estimates will in general be too small.

7.4 General Comments

EM

The apparent resistivity map shows background values of more than about 3000 ohm-m over most of the survey area. Resistivity lows of less than 1500 ohm-m follow Bruce Lake, Splitrock River, Bartlett Lake and a branch of Bartlett Creek. Isolated values of extremely low apparent resistivities over these features are considered artifacts of inverting very low signal amplitudes.

A strong isolated resistivity low near the intersection of lines 12 and 803 - the westernmost magnetic tie line - is real. Low frequency inphase anomalies at this position are well above background levels. A bedrock conductor is the probable cause of this resistivity low.

A number of EM anomalies have been picked. They fall into three classes. The first type is the traditional 935/850 Hz complimentary inphase and quadrature responses. Vertical thin sheet conductance estimates are high. The second type is seen as a small positive anomaly in the 935 Hz inphase channel in an area where the 935 and/or 850 Hz inphase channels show a negative response. The source is interpreted to be a near vertical thin sheet source which is conductive and magnetic - or in a narrow sandwich which is magnetic. The conductance estimates for these anomalies are totally unreliable because of negative inphase - the anomaly symbols show an "M" printed inside.

The third type of anomaly picked may be lake edge effects. They are seen on the edge of resistivity lows as a separation of the 4600 and 4175 Hz quadrature channels. Conductance estimates are uniformly low - less than 1 mho.

Magnetics

The total field contour map shows background values of around 58,500 nT and strong nw/se trending anomalies with peak amplitudes over 60,000 nT. A ne/sw magnetic high crosses the southern part of the survey area where the geology map shows a diabase dyke. North/south trending magnetic anomalies of 50 to 150 nT are the responses to another set of dykes.

The contour map of the calculated vertical gradient shows the patterns seen in the total field data but with more resolution. Breaks in the magnetic dyke crossing the southern part of the survey area are particularly clear. These breaks are the main evidence for nw/se trending faults.

There are a number of EM anomalies which show an apparent bedrock conductor and coincident high weight percent magnetite. These are shown with an "M" printed inside the anomaly symbol. These EM anomalies are found under strong magnetic anomalies with wavelengths suggesting a relatively shallow source depth.

Many strong magnetic features show no coincident negative inphase response. This may be due to the different depths of exploration of magnetic and EM methods. The total magnetic field anomaly from a tabular source falls off as $1/r^2$. The EM response falls off as $1/r^4$. Negative inphase responses indicate concentrations of magnetite near surface. A total field anomaly may reflect a source at a depth which is beyond the range of the EM system.

VLF

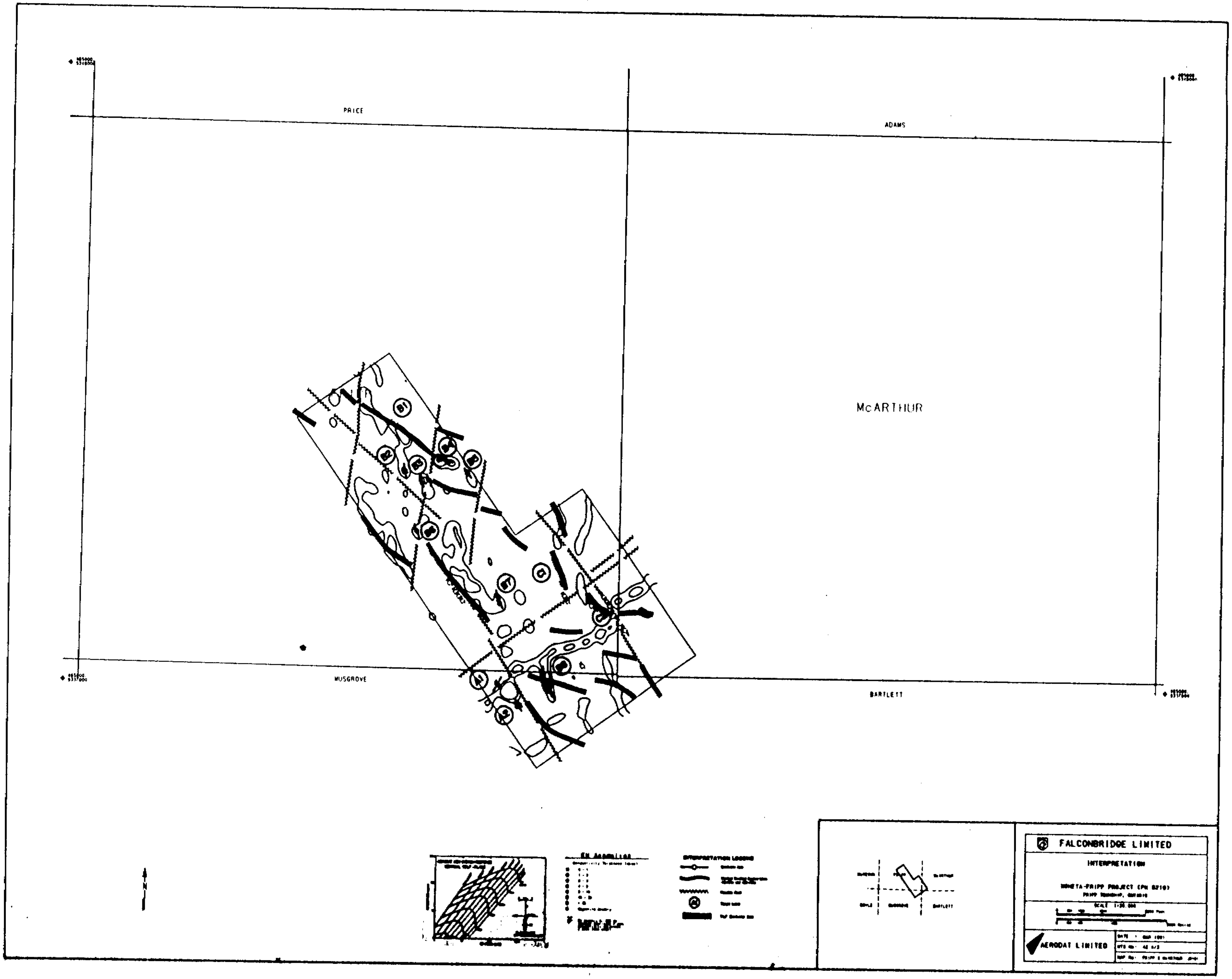
The contour map of the VLF total field shows many strong linear anomalies with the nw/se trend expected when using Cutler which is south of east from the survey area. Peak amplitudes commonly exceed 10%. Two and possibly three n/s trending breaks are seen in the nw/se trending VLF anomalies in the northern half of the survey area. A ne/sw trending break parallels line 23 in the southern part of the survey area.

7.5 Compilation/Interpretation Map

The compilation/interpretation map shows the following
- EM conductor axes
- the +5 and +25 nT/m vertical gradient contour lines
- possible faults
- VLF conductor axes
- favourable area labels

A page size copy of the 1:20,000 scale compilation/interpretation map is attached.

EM conductor axes have been drawn through anomaly centers which represent EM


PRICE
ADAMS
McARTHUR
MUSGROVE
BARTLETT
FALCONBRIDGE LIMITED
INTERPRETATION
AERODAT LIMITED

anomalies of a consistent character and parallel local magnetic strike directions. Low conductance EM anomalies which are thought to be edge effects of a resistivity low due to overburden effects have not been joined into conductor axes.

The +5 nT/m vertical gradient contour line is used as a possible outline of moderate magnetic sources. Strong sources show both the +5 and the +25 nT/m contours.

Possible faults are taken from the vertical gradient and VLF data. The nw/se faults have been taken from the vertical gradient map. The n/s and ne/sw faults have been taken from the VLF data.

Labels of targets or favourable areas are shown as a letter (A, B or C) followed by a number or counter. These favourable areas are discussed below.

7.6 Favourable Areas

Favourable targets are indicated on the compilation map by letter/number labels. The letter - A, B or C - indicates target type. The number is a counter which advances from north to south.

The three target types are described as follows;

A: An EM conductor which shows moderate to high conductance estimates and clear 935/850 Hz inphase responses.

B: An EM conductor which has negative inphase responses in the 935 and/or 850 Hz channels.

C: An EM conductor which shows very low conductance estimates but a promising coincident VLF or magnetic expression.

A total of twelve targets have been highlighted. They are numbered A1, A2, B1 to B8 and C1, C2. In the discussion which follows, each target is identified by the survey line and 24 hour clock time of the most promising EM response in the group which defines the conductor.

A1: Line 60170 (16:59:59)

A one line EM anomaly just south of Jules Lake and north of the ne/sw trending diabase dyke which crosses the southern part of the survey area. Peak EM amplitudes are 2 and 4 ppm in the 935 and 4600 Hz inphase channels. The conductance estimate is high - 8 to 15 mhos.

The EM response suggests a dip to the northeast. The complete lack of EM anomalies on the neighbouring survey lines makes any strike assignment difficult - local magnetic strike is ne/sw but this may be no more than the overbearing effect of the magnetic dyke.

A2: Line 60120 (16:55:09)

This is a one line EM anomaly 500 m southeast of A1. The position given is the positive peak (80 ppm) of the 850 Hz inphase anomaly. Complimentary peaks of 8 to 12 ppm in the 935 Hz inphase channel are on either side of this position.

These unusual responses suggest a tabular or spherical source. The conductance estimates of 4 to 15 mhos are probably too low - the vertical thin sheet conductor model does not apply.

There are no detectable EM responses on neighbouring lines. This anomaly is shown just south of the diabase dyke and has no clear magnetic expression of its own. It is in the area of an occurrence of massive pyrrhotite on the western shore of Donut Lake. This occurrence is shown on the 1:50,000 scale geology map (OGS Map 2345).

B1: Line 60660 (9:58:31)
B3: Line 60550 (9:30:36)
B4: Line 60560 (9:33:14)
B8: Line 60120 (16:55:28)

These are the four most prominent of the eight type B targets. Prominence is due to EM response patterns and/or multiple responses which define a conductor axis. The remaining four type B targets are discussed below. All type B targets are shown as anomaly symbols with an "M" indicating negative inphase responses due to magnetite. The evidence of a bedrock conductor is in the behaviour of the 935 Hz inphase response - it is less negative than the 850 Hz inphase response.

In all cases, there is little or no quadrature response. The targets are therefore very conductive and near surface. All have strong coincident magnetic anomalies.

Target B1 has a coincident VLF anomaly with peak amplitudes over 12%. The VLF response is much longer with a strike length over 1500 m. The vertical gradient anomaly is broken just north of B1 - a n/s fault may be the cause.

Target B3 is shown on the compilation map as two parallel conductors - from two EM anomalies. This is due to local magnetic trends. This could well be one conductor which strikes east/west. The position given has a very slight negative response in the 850 Hz inphase channel and a positive response in the 935 Hz inphase channel - hence a measurable conductance estimate of 4 to 8 mhos.

B4 is 500 m northeast of B3 and shows relatively striking anomaly shapes. The coincident 935 and 850 Hz inphase peaks are +1 and -24 ppm respectively. This is the clearest type B anomaly seen. Relatively high conductance estimate and weight percent magnetite should apply.

B8 is a three or four line conductor trending nw/se just south of the diabase dyke in the southern part of the survey area. EM responses are very weak. The conductor is interrupted by an east/west trending VLF conductor axis.

B2: Line 60580 (9:37:26)
B5: Line 60510 (9:21:28)
B6: Line 60480 (9:15:02)
B7: Line 60290 (8:26:37)

These are similar EM anomalies with coincident magnetic responses. EM peak responses are typically -2 and -20 ppm in the 935 and 850 Hz inphase channels. They are similar in character and geophysical setting.

C1: Line 60280 (17:55:04)

A weak two line conductor with very strong coincident VLF anomaly. Peak amplitudes exceed 25%! A small magnetic anomaly - 5 nT and 1.2 nT/m may be associated.

The conductor is on the southwest side of a resistivity low which sits over the northern end of Bartlett Lake. The EM responses are in the 4600/4175 Hz quadrature channels and edge effects are possible.

C2: Line 60180 (17:17:48)

A three line conductor on a possible nw/se trending fault and near the northwest shore of a small lake.

EM responses are as with C1 - 4600/4175 Hz quadrature anomalies only and on the edge of a resistivity low. These is some evidence that this target extends further northwest and separates itself form the lake edge.

8. CONCLUSIONS

High resolution helicopterborne geophysical surveys have been completed over an area of about 20 square kilometres centered in the southwest part of Fripp Township and 30 km south of Timmins. Total coverage is approximately 200 line kilometres (plus magnetic tie lines). Results are presented on black line and colour maps at scales of

1:5,000 and 1:20,000. Map types include EM anomaly centres, apparent resistivity, contoured magnetic field, contoured vertical magnetic gradient and contoured VLF-EM Total Field data.

Preferred geophysical characteristics have been built up from a model geological target. These characteristics have been extracted from various map products and transferred to a compilation/interpretation map. Favourable areas are discussed with reference to this compilation map.

Respectfully submitted,

Ian Johnson, Ph.D., P.Eng.
Consulting Geophysicist
for
AERODAT LIMITED
August 1, 1991

J9101F

REGISTERED PROFESSIONAL ENGINEER
I. M. JOHNSON
PROVINCE OF ONTARIO

APPENDIX I

GENERAL INTERPRETIVE CONSIDERATIONS

Electromagnetic

The Aerodat four frequency system utilizes two different transmitter-receiver coil geometries. The traditional coaxial coil configuration is operated at two widely separated frequencies. The horizontal coplanar coil configuration is similarly operated at two 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.

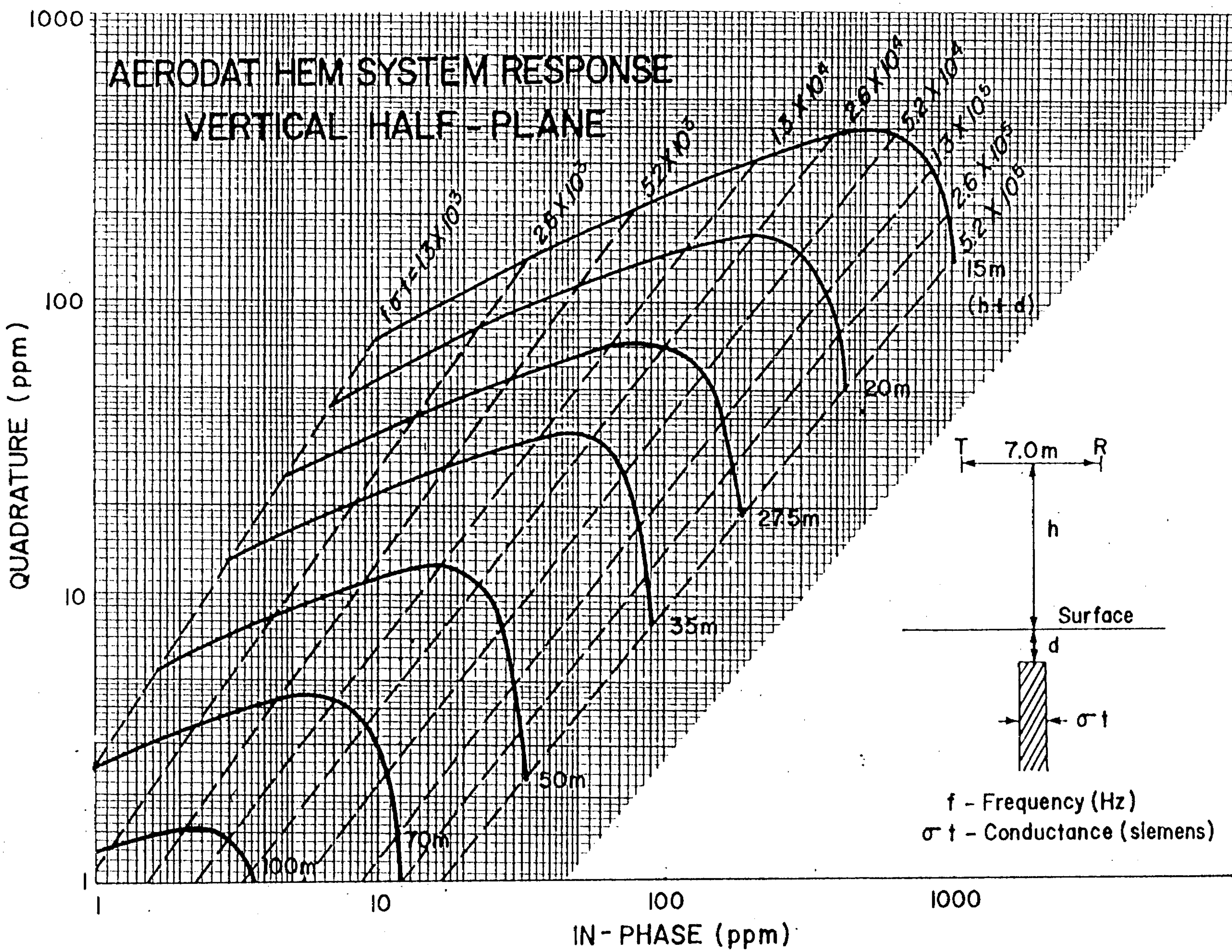
Electrical Considerations

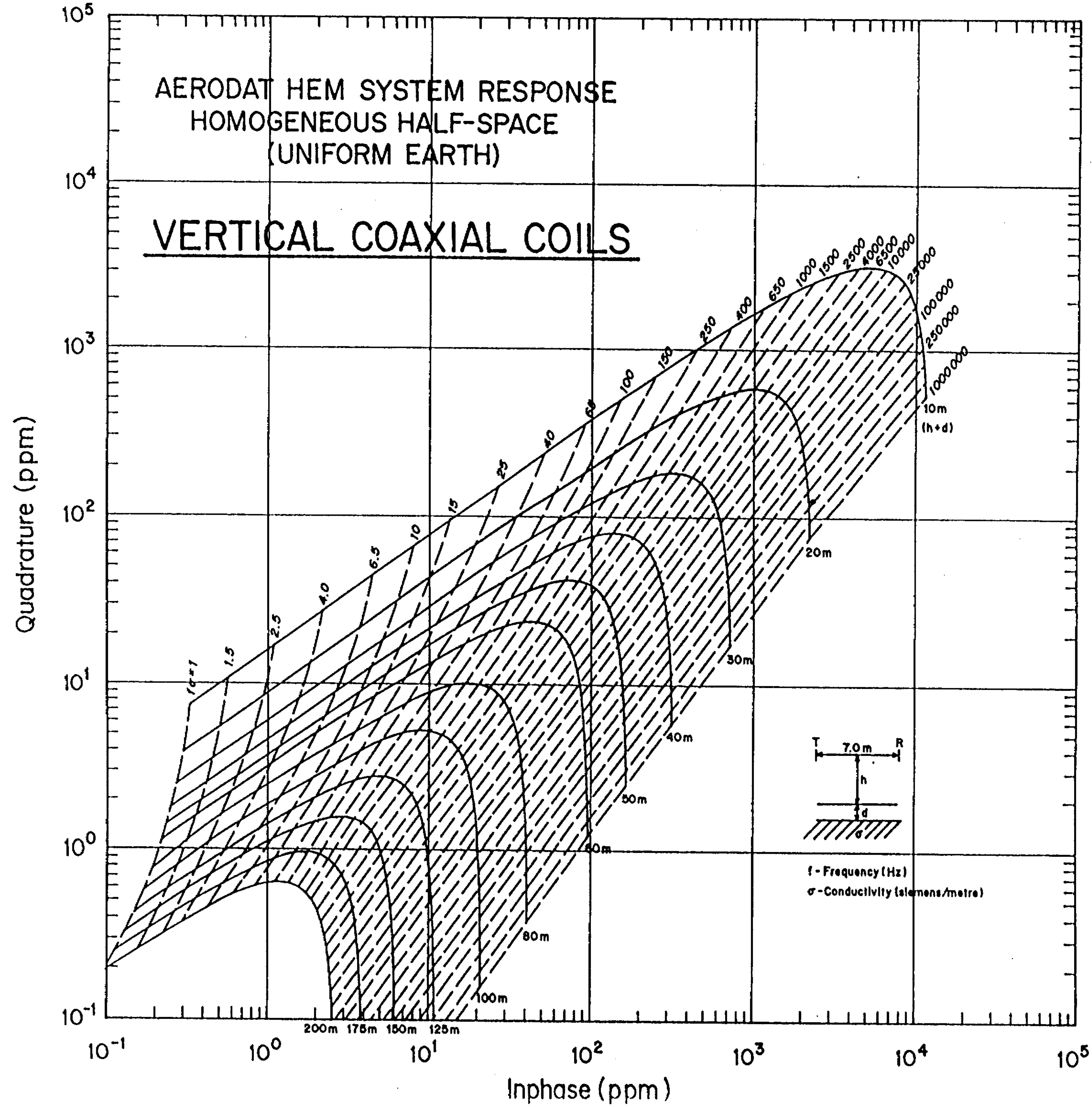
For a given conductive body the measure of its conductivity or conductance is closely related to the measured phase shift between the received and transmitted electromagnetic field. A small phase shift indicates a relatively high conductance, a large phase shift lower conductance. A small phase shift results in a large inphase to quadrature ratio and a large phase shift a low ratio. This relationship is shown quantitatively for 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.

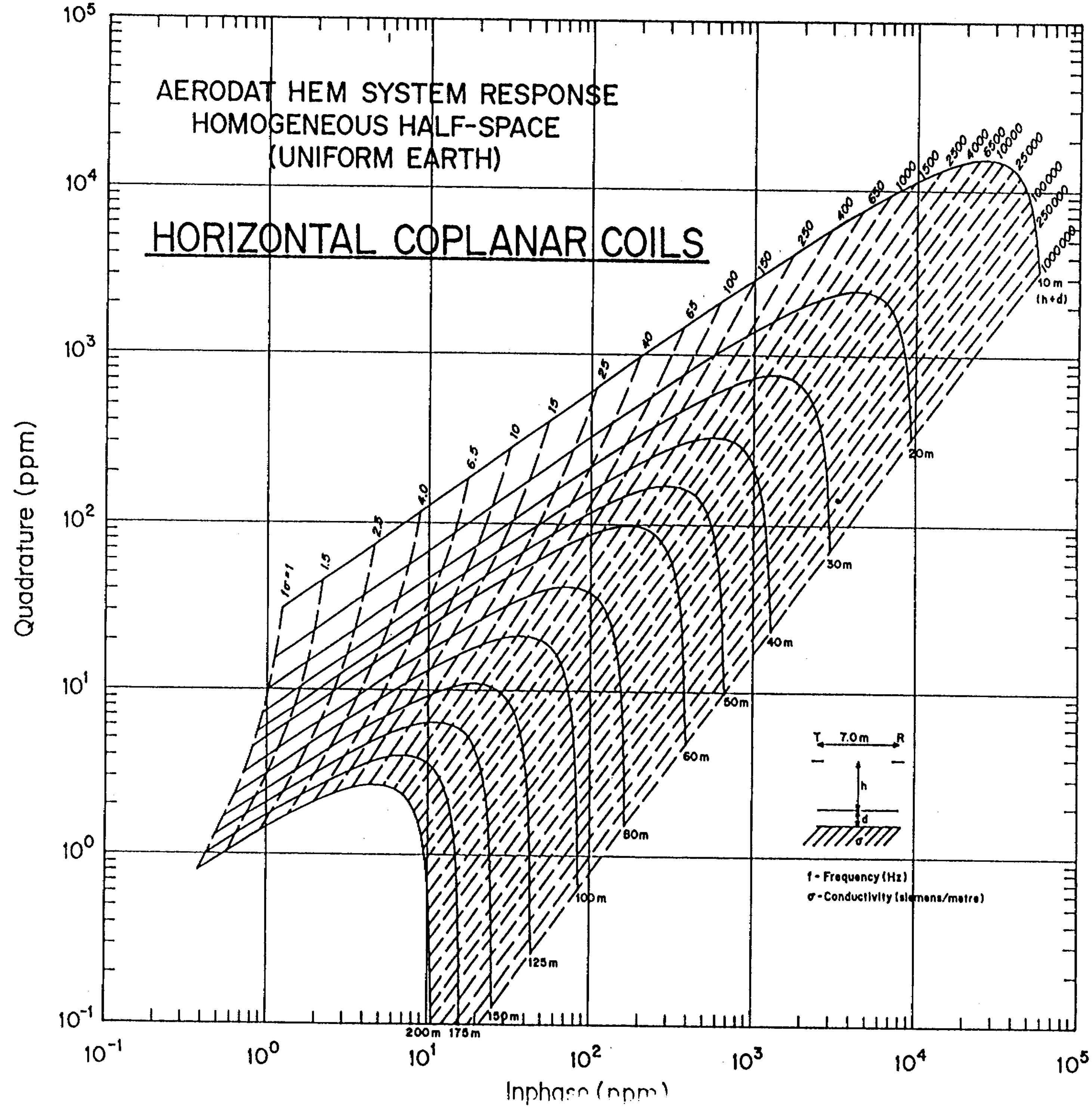
The phasor diagram for the vertical half-plane model, as presented, is for the coaxial coil configuration with the amplitudes in parts per million (ppm) of the primary field as measured at the response peak over the conductor. To assist the interpretation of the survey results the computer is used to identify the apparent conductance and depth of 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 EM 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.

The conductance and depth values 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, or may be strongly magnetic. Its conductivity and thickness may vary with depth


AERODAT HEM SYSTEM RESPONSE
VERTICAL HALF-PLANE
1000
100
10
1
QUADRATURE (ppm)
1
10
100
1000
IN-PHASE (ppm)
|f| = 1.3 X 10^3
2.6 X 10^3
5.2 X 10^3
1.3 X 10^4
2.6 X 10^4
5.2 X 10^4
1.3 X 10^5
2.6 X 10^5
5.2 X 10^5
15m
(h + d)
20m
27.5m
35m
50m
70m
100m
T
7.0m
R
h
Surface
d
σ t
f - Frequency (Hz)
σ t - Conductance (siemens)


AERODAT HEM SYSTEM RESPONSE
HOMOGENEOUS HALF-SPACE
(UNIFORM EARTH)
VERTICAL COAXIAL COILS
Quadrature (ppm)
Inphase (ppm)
f·σ=1
1.5
2.5
4.0
6.5
10
15
25
40
65
100
150
250
400
650
1000
1500
2500
4000
6500
10000
25000
100000
250000
1000000
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
HOMOGENEOUS HALF-SPACE
(UNIFORM EARTH)
HORIZONTAL COPLANAR COILS
Quadrature (ppm)
Inphase (ppm)
fσ=1
1.5
2.5
4.0
6.5
10
15
25
40
65
100
150
250
400
650
1000
1500
2500
4000
6500
10000
25000
100000
250000
1000000
10m (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)

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.

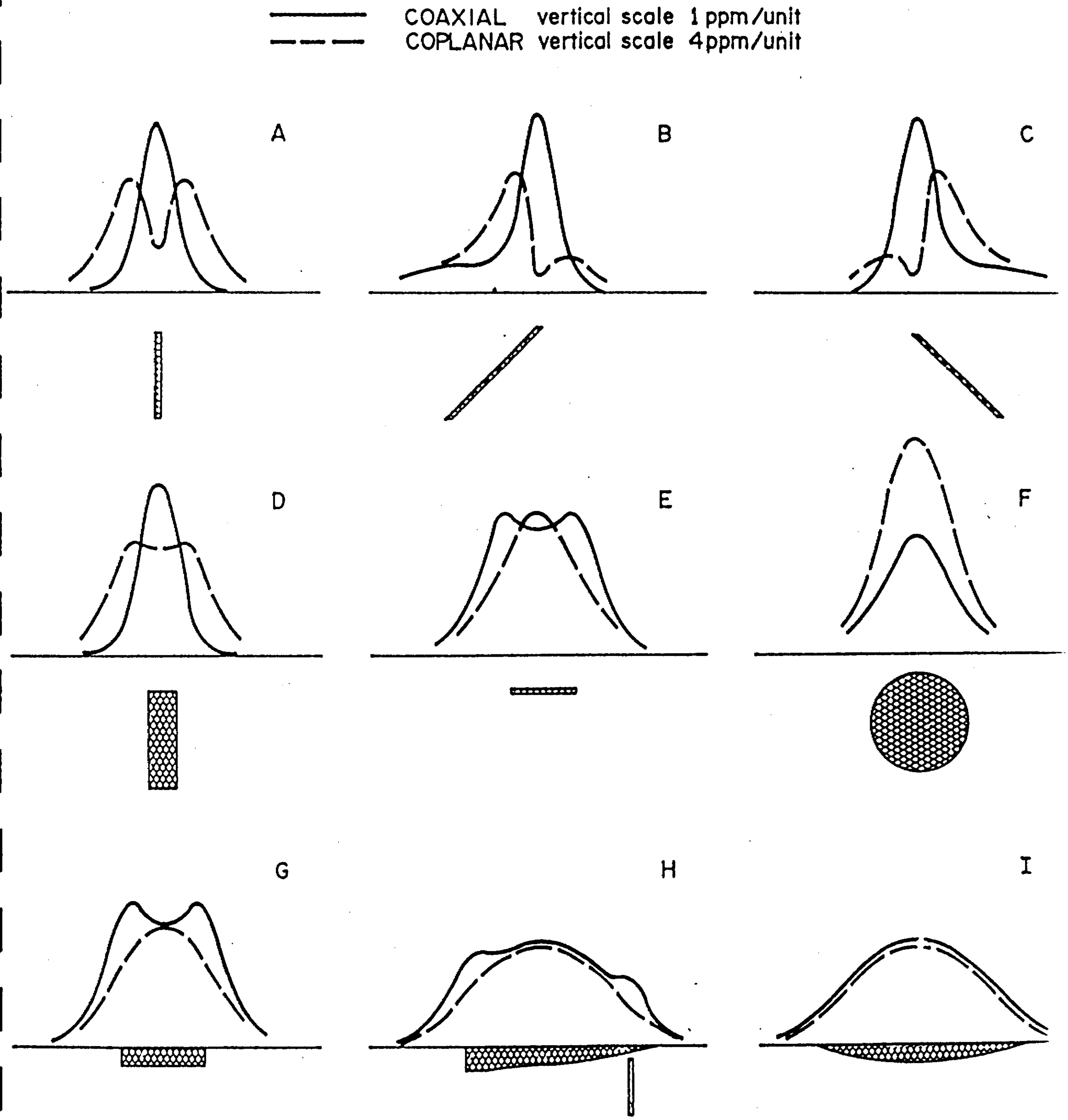
Geometrical Considerations

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.

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

HEM RESPONSE PROFILE SHAPE AS AN INDICATOR OF CONDUCTOR GEOMETRY



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 ratio 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.

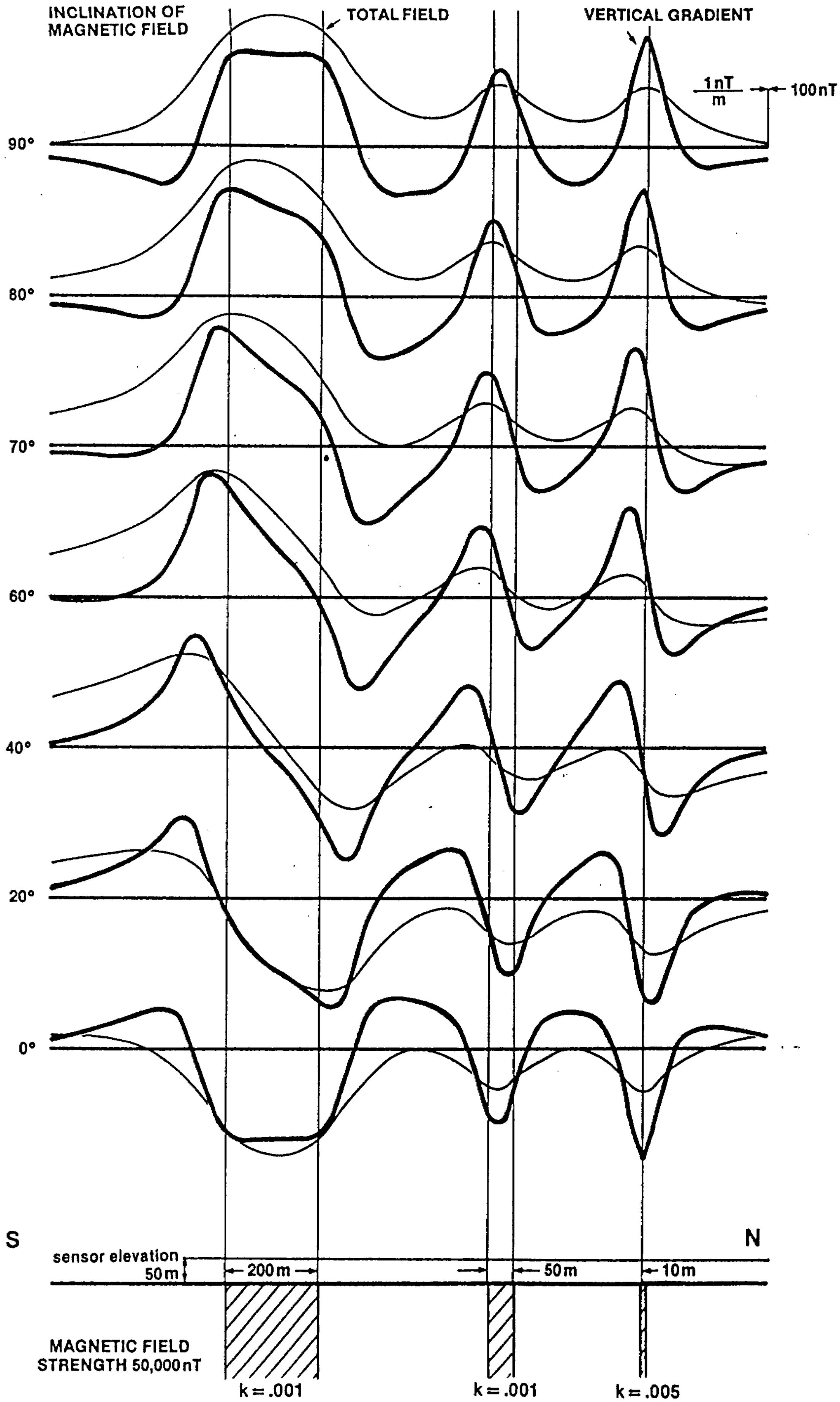
Theoretical profiles of total field and vertical gradient anomalies from tabular sources at a variety of magnetic inclinations are shown in the attached figure. Sources are 10, 50 and 200 m wide. The source-sensor separation is 50 m. The thin line is the total field profile. The thick line is the vertical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



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

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.

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 the 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 or 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.

AERODAT LIMITED
June, 1991.

APPENDIX II

ANOMALY LISTINGS

J9101 - FALCONBRIDGE LIMITED ANOMALY LIST - FRIPP TOWNSHIP AREA

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	AMPLITUDE (PPM) QUAD.	CONDUCTOR CTP MHOS	CONDUCTOR DEPTH MTRS	BIRD HEIGHT MTRS
29	60100	A MAGN	0	0.4	0.6	0.4	98	34
29	60110	A	0	0.7	1.0	0.7	79	32
29	60110	B MAGN	0	0.6	0.8	0.7	95	27
29	60120	A	3	3.7	2.3	6.5	61	26
29	60120	B	4	5.6	2.2	14.6	49	33
29	60120	C MAGN	0	-0.8	0.3	0.0	0	29
29	60120	D	0	0.0	1.0	0.0	0	32
29	60130	A	0	0.1	1.2	0.0	0	31
29	60140	A MAGN	0	-0.9	-0.1	0.0	0	34
29	60170	A	0	0.3	1.2	0.0	49	30
29	60170	B	4	2.0	0.7	11.9	85	34
29	60180	A	0	-0.3	0.6	0.0	0	28
29	60180	B	0	-0.1	1.6	0.0	0	34
29	60191	A	0	0.0	0.7	0.0	0	28
29	60191	B	0	0.5	1.5	0.1	49	31
29	60200	A	0	0.2	0.6	0.0	77	34
29	60220	A	0	0.9	1.5	0.7	60	33
29	60230	A	0	0.1	1.4	0.0	0	32
29	60250	A	0	-1.0	0.3	0.0	0	30
29	60280	A	0	0.1	1.7	0.0	0	31
30	60290	A	0	-0.1	1.4	0.0	0	33
30	60290	B MAGN	0	-0.6	0.5	0.0	0	34
30	60300	A MAGN	0	-0.6	0.1	0.0	0	30
30	60330	A	0	-0.1	1.0	0.0	0	30
30	60330	B	0	-0.5	1.5	0.0	0	32
30	60340	A	0	0.1	0.8	0.0	0	34
30	60350	A	0	-0.1	1.0	0.0	0	32

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.

J9101 - FALCONBRIDGE LIMITED ANOMALY LIST - FRIPP TOWNSHIP AREA

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
30	60370	A	0	0.2	0.5	0.0	95	29
30	60390	A	0	-0.5	1.2	0.0	0	29
30	60410	A	0	-1.1	0.0	0.0	0	28
30	60420	A	0	-0.5	0.3	0.0	0	31
30	60430	A	0	0.3	0.9	0.0	65	30
30	60480	A MAGN	0	-0.9	0.0	0.0	0	26
30	60510	A MAGN	0	0.0	0.2	0.0	0	26
30	60540	A MAGN	0	-1.2	0.1	0.0	0	23
30	60550	A MAGN	0	-0.1	0.3	0.0	0	31
30	60550	B	3	1.5	1.0	4.0	83	35
30	60560	A MAGN	0	0.7	1.0	0.7	80	31
30	60580	A MAGN	0	-1.6	0.4	0.0	0	29
30	60640	A MAGN	0	-1.3	1.6	0.0	0	33
30	60650	A MAGN	0	-1.7	0.4	0.0	0	29
30	60660	A MAGN	0	-2.3	0.0	0.0	0	31

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

CERTIFICATE OF QUALIFICATIONS

I, IAN JOHNSON, certify that:

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

2. I reside at 38 Tinti Place in the town of Thornhill, Ontario.

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

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

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

7. I have no interest, direct or indirect, in the property described nor in Falconbridge Limited - Exploration.

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

Signed,

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

REGISTERED PROFESSIONAL ENGINEER
I. M. JOHNSON
PROVINCE OF ONTARIO

J9101F
Thornhill, Ontario
August 1, 1991

APPENDIX IV

PERSONNEL

FIELD

Flown	February 26 and February 27, 1991
Pilots	Luke Kukovica
Operators	Peter Moore

OFFICE

Processing	Mary Chong-Foo George McDonald Ed Hamilton
Report	Ian Johnson

Ontario

42A06SW0502 2.14526 FRIPP

900

Ministry of Northern Development and Mines

Ministère du Développement du Nord et des Mines

Geoscience Approvals Section
Mining Lands Branch
159 Cedar Street, 4th Floor
Sudbury, Ontario
P3E 6A5

Telephone: (705) 670-7264
Fax: (705) 670-7262

Our File: 2.14526
Transaction #: W9260.00019

June 9, 1992

Mining Recorder
Ministry of Northern Development
and Mines
60 Wilson Avenue
Timmins, Ontario
P4N 2S7

Dear Sir:

RE: Approval of Assessment Work on mining claims P 1170917 et al. in Fripp and Musgrove Townships.

The Assessment Credits for an Airborne Geophysical Survey, section 15 of the Mining Act, as listed on the attached Assessment Work Credit form, have been approved as of June 8, 1992. This Assessment Work Credit form replaces the one filed as part of the original submission.

Please indicate this approval on the claim record sheets.

If you require further information please contact Clive Stephenson at (705) 670-7251.

Yours sincerely,

Ron C Gashinski

Ron C. Gashinski
Senior Manager, Mining Lands Branch
Mines and Minerals Division

CDM
CDS/jl
Enclosures:

cc: Assessment Files Office
Toronto, Ontario

Resident Geologist
Timmins, Ontario

ASSESSMENT WORK CREDIT FORM

FILE NUMBER: 2.14526
CLIENT NUMBER: 130679
DATE: June 9, 1992

RECORDED HOLDER: Falconbridge Limited
TOWNSHIP: Fripp and Musgrove
TRANSACTION NUMBER: W9260.00019

CLAIM NUMBER	VALUE OF ASSESSMENT DONE ON THIS CLAIM	VALUE APPLIED TO THIS CLAIM
P 1170917	$ 101.00	$ 101.00
P 1170918	$ 101.00	$ 101.00
P 1172108	$ 101.00	$ 101.00
P 1172109	$ 101.00	$ 101.00
P 1172110	$ 101.00	$ 101.00
P 1172111	$ 101.00	$ 101.00
P 1172112	$ 101.00	$ 101.00
P 1175376	$ 101.00	$ 101.00
P 1175377	$ 101.00	$ 101.00
P 1175378	$ 101.00	$ 101.00
P 1175379	$ 101.00	$ 101.00
P 1175380	$ 101.00	$ 101.00
P 1175381	$ 101.00	$ 101.00
P 1175397	$ 101.00	$ 101.00
P 1175398	$ 101.00	$ 101.00
P 1175399	$ 101.00	$ 101.00
P 1175400	$ 101.00	$ 101.00
P 1175401	$ 101.00	$ 101.00
P 1175402	$ 101.00	$ 101.00
P 1175403	$ 101.00	$ 101.00
P 1175409	$ 101.00	$ 101.00
P 1175410	$ 101.00	$ 101.00
P 1175411	$ 101.00	$ 101.00
P 1175412	$ 101.00	$ 101.00
P 1175413	$ 101.00	$ 101.00
P 1175546	$ 101.00	$ 101.00
P 1175547	$ 101.00	$ 101.00
P 1175548	$ 101.00	$ 101.00
P 1175549	$ 101.00	$ 101.00
P 1175550	$ 101.00	$ 101.00
P 1175551	$ 101.00	$ 101.00
P 1175552	$ 101.00	$ 101.00
P 1175566	$ 101.00	$ 101.00
P 1175567	$ 101.00	$ 101.00
P 1175568	$ 101.00	$ 101.00
P 1175569	$ 101.00	$ 101.00
P 1175570	$ 101.00	$ 101.00
P 1175571	$ 101.00	$ 101.00
P 1175572	$ 110.00	$ 110.00
TOTALS:	$ 3,948.00	$ 3,948.00

Ministry of Northern Development and Mines
Ontario

Report of Work Conducted After Recording Claim

Mining Act

Transaction Number: W9260.00019

Personal information collected on this form is obtained under the authority of the Mining Act. This information will be used for correspondence. Questions about this collection should be directed to the Provincial Manager, Mining Lands, Ministry of Northern Development and Mines, Fourth Floor, 159 Cedar Street, Sudbury, Ontario, P3E 6A5, telephone (705) 670-7264.

2.14526

Instructions:
- Please type or print and submit in duplicate.
- Refer to the Mining Act and Regulations for requirements of filing assessment work or consult the Mining Recorder.
- A separate copy of this form must be completed for each Work Group.
- Technical reports and maps must accompany this form in duplicate.
- A sketch, showing the claims the work is assigned to, must accompany this form.

Recorded Holder(s): FALCONBRIDGE LIMITED ~~LTD~~ (J.V. MONETA PORCUPINE MINES LTD.)		Client No.: 130679
Address: P.O. BOX 1140, 571 MONETA AVE TIMMINS ONT		Telephone No.: 705-267-1188
Mining Division: PORCUPINE	Township/Area: FRIPP - MUSGROVE	M or G Plan No.:
Dates Work Performed From: FEBRUARY 26, 1991	To: FEBRUARY 27, 1991	

Work Performed (Check One Work Group Only)

	Work Group	Type
	Geotechnical Survey	AIRBORNE GEOPHYSICAL SURVEY (REGIONAL SURVEY)
	Physical Work, Including Drilling	
	Rehabilitation	RECEIVED
	Other Authorized Work	APR 15 1992
	Assays	
	Assignment from Reserve	MINING LANDS BRANCH

RECORDED
JAN 24 1992
Receipt ________

Total Assessment Work Claimed on the Attached Statement of Costs $ 5961.00

Note: The Minister may reject for assessment work credit all or part of the assessment work submitted if the recorded holder cannot verify expenditures claimed in the statement of costs within 30 days of a request for verification.

Persons and Survey Company Who Performed the Work (Give Name and Address of Author of Report)

Name	Address
IAN JOHNSON	AERODAT LTD. 3883 NASHUA DRIVE MISSISSAUGA ONT L4V 1R3

(attach a schedule if necessary)

Certification of Beneficial Interest * See Note No. 1 on reverse side

I certify that at the time the work was performed, the claims covered in this work report were recorded in the current holder's name or held under a beneficial interest by the current recorded holder.	Date: Jan. 24/92	Recorded Holder or Agent (Signature): B. Jeffery

Certification of Work Report

I certify that I have a personal knowledge of the facts set forth in this Work report, having performed the work or witnessed same during and/or after its completion and annexed report is true.

Name and Address of Person Certifying: Bruce D. Jeffery, 571 Moneta Ave. P.O. Box 1140 Timmins Ont. P4N 7H9		
Telephone No.: 267-1188	Date: Jan. 24/92	Certified By (Signature): B. Jeffery

For Office Use Only

Total Value Cr. Recorded	Date Recorded	Mining Recorder	Received Stamp
$5,961.00	JAN 24/92.	[signature]	PORCUPINE MINING DIVISION RECEIVED JAN 24 1992
	Deemed Approval Date: APRIL 23/92	Date Approved	400 C
	Date Notice for Amendments Sent		

0241 (03/91)

0241 (03/91)

Work Report Number for Applying Reserve	Claim Number (see Note 2)	Number of Claim Units	Value of Assessment Work Done on this Claim	Value Applied to this Claim	Value Assigned from this Claim	Reserve: Work to be Claimed at a Future Date
	Total Number of Claims		Total Value Work Done	Total Value Work Applied	Total Assigned From	Total Reserve

SEE ATTACHED LIST.

RECEIVED
APR 15 1992
MINING LANDS BRANCH

Credits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate from which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☑ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

In the event that you have not specified your choice of priority, option one will be implemented.

2.14526

Note 1: Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.

Note 2: If work has been performed on patented or leased land, please complete the following:

I certify that the recorded holder had a beneficial interest in the patented or leased land at the time the work was performed.	Signature	Date Jan. 24/92

FAX # 4-6080

Fripp/Musgrove Township Property Assessment Credit Distribution
1991 Aerodat Ltd. Airborne Geophysical Survey

Claim Number	Type of Claim	Expiry Date	Registered Owner	Township	Assessment Dollars
51061	Leased	08/01/94	Noneta Porc. Mines	Fripp	~~$ 135.47~~
51070	Leased	08/01/94	Noneta Porc. Mines	Fripp	~~$ 135.47~~
51071	Leased	08/01/94	Noneta Porc. Mines	Fripp	~~$ 135.47~~
51072	Leased	08/01/94	Noneta Porc. Mines	Fripp	~~$ 135.47~~
55174	Leased	08/01/94	Noneta Porc. Mines	Fripp	~~$ 135.47~~
1170917	Unpatented	01/24/93	Falconbridge Ltd.	Fripp	$ 135.47
1170918	Unpatented	01/24/93	Falconbridge Ltd.	Fripp	$ 135.47
1172108	Unpatented	01/25/93	Falconbridge Ltd.	Fripp	$ 135.47
1172109	Unpatented	01/25/93	Falconbridge Ltd.	Fripp	$ 135.47
1172110	Unpatented	01/26/93	Falconbridge Ltd.	Fripp	$ 135.47
1172111	Unpatented	01/25/93	Falconbridge Ltd.	Fripp	$ 135.47
1172112	Unpatented	01/26/93	Falconbridge Ltd.	Fripp	$ 135.47
1175376	Unpatented	01/26/93	Falconbridge Ltd.	Fripp	$ 135.47
1175377	Unpatented	01/28/93	Falconbridge Ltd.	Fripp	$ 135.47
1175378	Unpatented	01/25/93	Falconbridge Ltd.	Fripp	$ 135.47
1175379	Unpatented	01/27/93	Falconbridge Ltd.	Fripp	$ 135.47
1175380	Unpatented	01/27/93	Falconbridge Ltd.	Fripp	$ 135.47
1175381	Unpatented	01/27/93	Falconbridge Ltd.	Fripp	$ 135.47
1175397	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175398	Unpatented	01/29/93	Falconbridge Ltd.	Musgrove	$ 135.47
1175399	Unpatented	01/29/93	Falconbridge Ltd.	Musgrove	$ 135.47
1175400	Unpatented	01/29/93	Falconbridge Ltd.	Musgrove	$ 135.47
1175401	Unpatented	01/29/93	Falconbridge Ltd.	Musgrove	$ 135.47
1175402	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175403	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175409	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175410	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175411	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175412	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175413	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175545	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175547	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175548	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175549	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175550	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175551	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175552	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175565	Unpatented	01/29/93	Falconbridge Ltd.	Musgrove	$ 135.47
1175567	Unpatented	01/29/93	Falconbridge Ltd.	Musgrove	$ 135.47
1175568	Unpatented	01/29/93	Falconbridge Ltd.	Musgrove	$ 135.47
1175569	Unpatented	01/29/93	Falconbridge Ltd.	Musgrove	$ 135.47
1175570	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	$ 135.47
1175571	Unpatented	01/29/93	Falconbridge Ltd.	Fripp	~~$ 135.47~~ 153.00
1175572	Unpatented	01/29/93	Falconbridge Ltd.	Musgrove	$ 135.47 147.00

153.00

Total Assessment Credits ~~[illegible]~~ 5961 = 39 CLAIMS

TOTAL 0

$5,961.00

153.00 x 38 = 5814
147.00 x 1 = 147
5961

RECEIVED
JAN 24 1992
400 c

Approved

RECEIVED
APR 15 1992
MINING LANDS BRANCH

2.14526

Ministry of Northern Development and Mines
Ontario

Ministère du Développement du Nord et des mines

Statement of Costs for Assessment Credit

État des coûts aux fins du crédit d'évaluation

Mining Act/Loi sur les mines

Transaction No./N° de transaction: W9260.00019

2.14586

Personal information collected on this form is obtained under the authority of the Mining Act. This information will be used to maintain a record and ongoing status of the mining claim(s). Questions about this collection should be directed to the Provincial Manager, Minings Lands, Ministry of Northern Development and Mines, 4th Floor, 159 Cedar Street, Sudbury, Ontario P3E 6A5, telephone (705) 670-7264.

Les renseignements personnels contenus dans la présente formule sont recueillis en vertu de la Loi sur les mines et serviront à tenir à jour un registre des concessions minières. Adresser toute question sur la collecte de ces renseignements au chef provincial des terrains miniers, ministère du Développement du Nord et des Mines, 159, rue Cedar, 4e étage, Sudbury (Ontario) P3E 6A5, téléphone (705) 670-7264.

1. Direct Costs/Coûts directs

Type	Description	Amount Montant	Totals Total global
Wages Salaires	Labour Main-d'oeuvre		
	Field Supervision Supervision sur le terrain		
Contractor's and Consultant's Fees Droits de l'entrepreneur et de l'expert-conseil	Type AIRBORNE GEOPHYSICAL		
	(SEE ATTACHED MEMO)		
			5464
Supplies Used Fournitures utilisées	Type		
Equipment Rental Location de matériel	Type		
		Total Direct Costs Total des coûts directs	5464

2. Indirect Costs/Coûts indirects

** Note: When claiming Rehabilitation work Indirect costs are not allowable as assessment work.
Pour le remboursement des travaux de réhabilitation, les coûts indirects ne sont pas admissibles en tant que travaux d'évaluation.

Type	Description	Amount Montant	Totals Total global
Transportation Transport	Type		
Food and Lodging Nourriture et hébergement			
Mobilization and Demobilization Mobilisation et démobilisation	[illegible] MOBILIZATION	[illegible]	497
		Sub Total of Indirect Costs Total partiel des coûts indirects	497
		Amount Allowable (not greater than 20% of Direct Costs) Montant admissible (n'excédant pas 20 % des coûts directs)	497
		Total Value of Assessment Credit (Total of Direct and Allowable Indirect costs) Valeur totale du crédit d'évaluation (Total des coûts directs et indirects admissibles	5961

RECORDED
JAN 24 1992
Receipt

Note: The recorded holder will be required to verify expenditures claimed in this statement of costs within 30 days of a request for verification. If verification is not made, the Minister may reject for assessment work all or part of the assessment work submitted.

Note : Le titulaire enregistré sera tenu de vérifier les dépenses demandées dans le présent état des coûts dans les 30 jours suivant une demande à cet effet. Si la vérification n'est pas effectuée, le ministre peut rejeter tout ou une partie des travaux d'évaluation présentés.

Filing Discounts

1. Work filed within two years of completion is claimed at 100% of the above Total Value of Assessment Credit.
2. Work filed three, four or five years after completion is claimed at 50% of the above Total Value of Assessment Credit. See calculations below:

Total Value of Assessment Credit		Total Assessment Claimed
	× 0.50 =	

Remises pour dépôt

1. Les travaux déposés dans les deux ans suivant leur achèvement sont remboursés à 100 % de la valeur totale susmentionnée du crédit d'évaluation.
2. Les travaux déposés trois, quatre ou cinq ans après leur achèvement sont remboursés à 50 % de la valeur totale du crédit d'évaluation susmentionné. Voir les calculs ci-dessous.

Valeur totale du crédit d'évaluation		Évaluation totale demandée
	× 0,50 =	

Certification Verifying Statement of Costs

I hereby certify:
that the amounts shown are as accurate as possible and these costs were incurred while conducting assessment work on the lands shown on the accompanying Report of Work form.

that as Senior Geologist (Recorded Holder, Agent, Position in Company) I am authorized

to make this certification

Attestation de l'état des coûts

J'atteste par la présente :
que les montants indiqués sont le plus exact possible et que ces dépenses ont été engagées pour effectuer les travaux d'évaluation sur les terrains indiqués dans la formule de rapport de travail ci-joint.

Et qu'à titre de ______________ (titulaire enregistré, représentant, poste occupé dans la compagnie) je suis autorisé

à faire cette attestation.

Signature	Date
B. L. Jeffery	Jan. 24/92

PORCUPINE MINING DIVISION
RECEIVED
JAN 24 1992
400 C

0212 (03/91)

Nota : Dans cette formule, lorsqu'il désigne des personnes, le masculin est utilisé au sens neutre.

Ministry of Northern Development and Mines
Ontario
Ministère du Développement du Nord et des mines

Statement of Costs for Assessment Credit
État des coûts aux fins du crédit d'évaluation

Mining Act/Loi sur les mines

Transaction No./N° de transaction: W9260.00019

2

Personal information collected on this form is obtained under the authority of the Mining Act. This information will be used to maintain a record and ongoing status of the mining claim(s). Questions about this collection should be directed to the Provincial Manager, Mining Lands, Ministry of Northern Development and Mines, 4th Floor, 159 Cedar Street, Sudbury, Ontario P3E 6A5, telephone (705) 670-7264.

Les renseignements personnels contenus dans la présente formule sont recueillis en vertu de la Loi sur les mines et serviront à tenir à jour un registre des concessions minières. Adresser toute question sur la collecte de ces renseignements au chef provincial des terrains miniers, ministère du Développement du Nord et des Mines, 159, rue Cedar, 4e étage, Sudbury (Ontario) P3E 6A5, téléphone (705) 670-7264.

1. Direct Costs/Coûts directs

Type	Description	Amount Montant	Totals Total global
Wages Salaires	Labour Main-d'oeuvre		
	Field Supervision Supervision sur le terrain		
Contractor's and Consultant's Fees Droits de l'entrepreneur et de l'expert-conseil	Type AIRBORNE GEOPHYSICS		
	(SEE ATTACHED MEMO)		
Supplies Used Fournitures utilisées	Type		
Equipment Rental Location de matériel	Type		
		Total Direct Costs Total des coûts directs	

2. Indirect Costs/Coûts indirects

** Note: When claiming Rehabilitation work Indirect costs are not allowable as assessment work.
Pour le remboursement des travaux de réhabilitation, les coûts indirects ne sont pas admissibles en tant que travaux d'évaluation.

Type	Description	Amount Montant	Totals Total global
Transportation Transport	Type		
Food and Lodging Nourriture et hébergement			
Mobilization and Demobilization Mobilisation et démobilisation	LOCAL MOBILIZATION	$1000	497
		Sub Total of Indirect Costs Total partiel des coûts indirects	497
		Amount Allowable (not greater than 20% of Direct Costs) Montant admissible (n'excédant pas 20 % des coûts directs)	497
		Total Value of Assessment Credit (Total of Direct and Allowable Indirect costs) Valeur totale du crédit d'évaluation (Total des coûts directs et indirects admissibles)	5961

RECORDED
JAN 24 1992
Receipt ______

Note: The recorded holder will be required to verify expenditures claimed in this statement of costs within 30 days of a request for verification. If verification is not made, the Minister may reject for assessment work all or part of the assessment work submitted.

Note : Le titulaire enregistré sera tenu de vérifier les dépenses demandées dans le présent état des coûts dans les 30 jours suivant une demande à cet effet. Si la vérification n'est pas effectuée, le ministre peut rejeter tout ou une partie des travaux d'évaluation présentés.

Filing Discounts

1. Work filed within two years of completion is claimed at 100% of the above Total Value of Assessment Credit.
2. Work filed three, four or five years after completion is claimed at 50% of the above Total Value of Assessment Credit. See calculations below:

Total Value of Assessment Credit		Total Assessment Claimed
	× 0.50 =	

Remises pour dépôt

1. Les travaux déposés dans les deux ans suivant leur achèvement sont remboursés à 100 % de la valeur totale susmentionnée du crédit d'évaluation.
2. Les travaux déposés trois, quatre ou cinq ans après leur achèvement sont remboursés à 50 % de la valeur totale du crédit d'évaluation susmentionné. Voir les calculs ci-dessous.

Valeur totale du crédit d'évaluation		Évaluation totale demandée
	× 0,50 =	

Certification Verifying Statement of Costs

I hereby certify:
that the amounts shown are as accurate as possible and these costs were incurred while conducting assessment work on the lands shown on the accompanying Report of Work form.

that as Senior Geologist (Recorded Holder, Agent, Position in Company) I am authorized to make this certification.

Attestation de l'état des coûts

J'atteste par la présente :
que les montants indiqués sont le plus exact possible et que ces dépenses ont été engagées pour effectuer les travaux d'évaluation sur les terrains indiqués dans la formule de rapport de travail ci-joint.

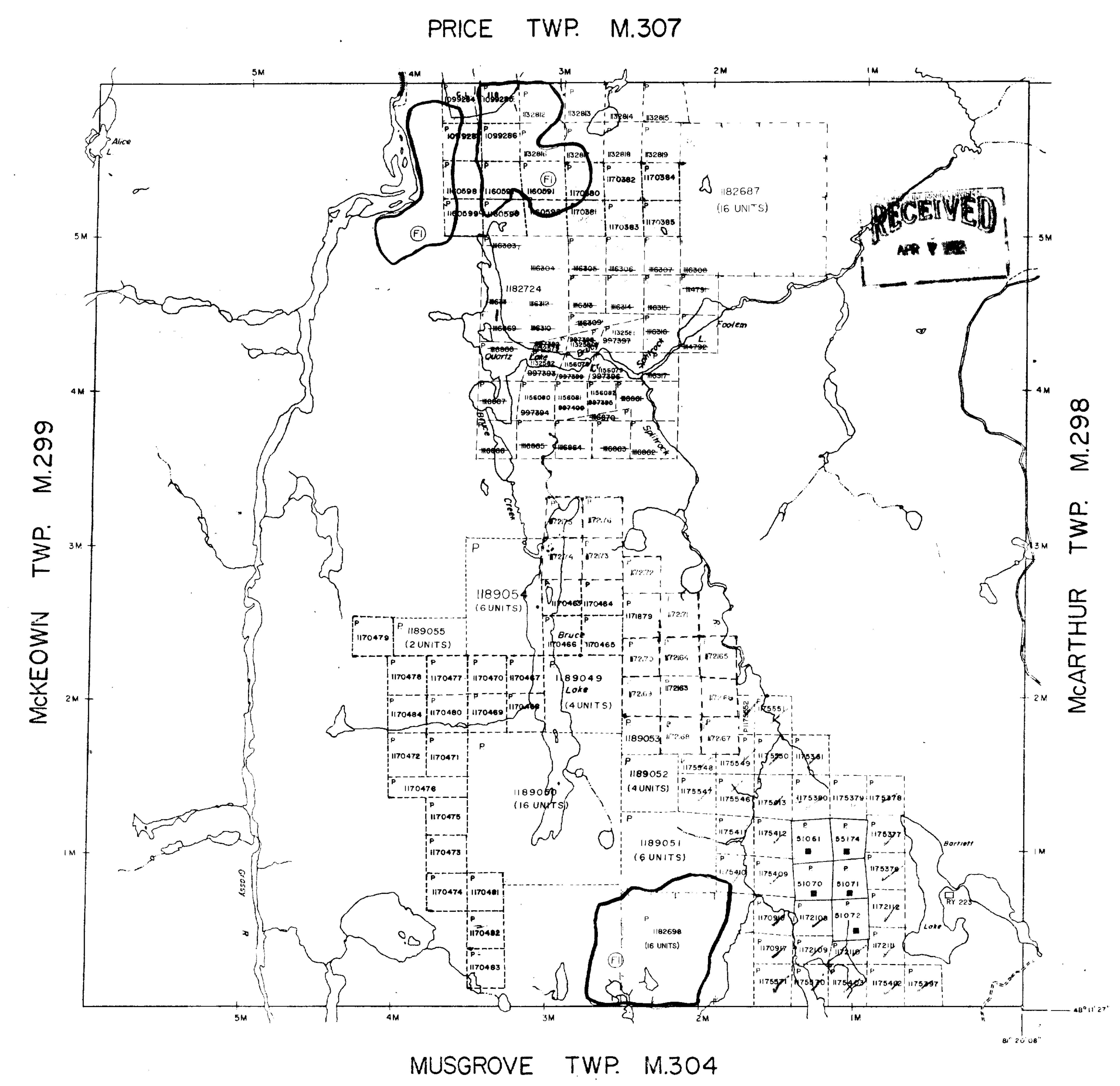
Et qu'à titre de ______ (titulaire enregistré, représentant, poste occupé dans la compagnie) je suis autorisé à faire cette attestation.

Signature	Date
[signature]	Jan. 24/92

PORCUPINE MINING DIVISION
RECEIVED
JAN 24 1992
400 C

0212 (03/91)

Nota : Dans cette formule, lorsqu'il désigne des personnes, le masculin est utilisé au sens neutre.



THE TOWNSHIP OF FRIPP

DISTRICT OF TIMISKAMING

PORCUPINE MINING DIVISION

SCALE: 1-INCH 40 CHAINS

DISPOSITION OF CROWN LANDS

PATENT, SURFACE AND MINING RIGHTS
" , SURFACE RIGHTS ONLY
" , MINING RIGHTS ONLY
LEASE, SURFACE AND MINING RIGHTS
" , SURFACE RIGHTS ONLY
" , MINING RIGHTS ONLY
LICENCE OF OCCUPATION
ROADS
IMPROVED ROADS
KING'S HIGHWAYS
RAILWAYS
POWER LINES
MARSH OR MUSKEG
MINES
CANCELLED C.

NOTES

400' surface rights reservation along the shores of all lakes and rivers.

Areas withdrawn from staking under Section 43 of the Mining Act (R.S.O. 1970.)

Order Nº	File	Date	Disposition
RY 223			

⊕ REMOTE TOURIST CAMPS

Fi - THIS TWP. SUBJECT TO FOREST ACTIVITY IN 1992/93. FURTHER INFORMATION ON FILE

IN SERVICE NOV. 22/89 CHECKED BY S. ROWAN

PLAN NO. M.281

ONTARIO
MINISTRY OF NATURAL RESOURCES
SURVEYS AND MAPPING BRANCH

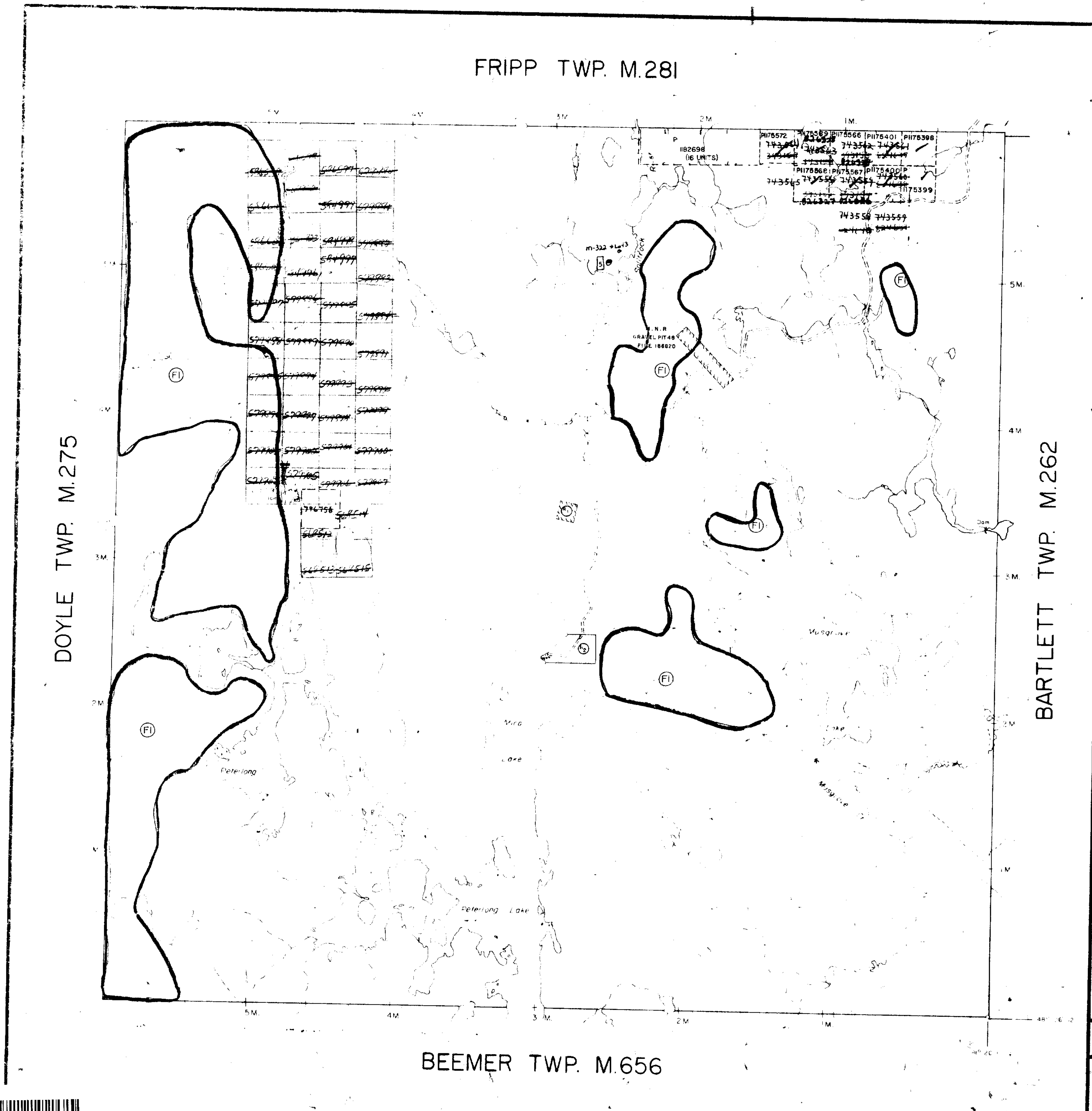
THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES, AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HERE(

42A06SW0502 2.14526 FRIPP

200

M.304

MUSGROVE TWP.



THE TOWNSHIP OF

MUSGROVE

RECEIVED APR 8 1992

DISTRICT OF TIMISKAMING

PORCUPINE MINING DIVISION

SCALE: 1-INCH 40 CHAINS

LEGEND

RECEIVED APR 15 1992 MINING LANDS BRANCH

PATENTED LAND	P
CROWN LAND SALE	C.S.
LEASES	L
LOCATED LAND	Loc.
LICENSE OF OCCUPATION	L.O.
MINING RIGHTS ONLY	
SURFACE RIGHTS ONLY	S.R.O.
ROADS	
IMPROVED ROADS	
KING'S HIGHWAYS	
RAILWAYS	
POWER LINES	
MARSH OR MUSKEG	
MINES	
CANCELLED	C

NOTES

400' Surface Rights Reservation around all lakes and rivers.

Flooding Rights in Peterlong and Mica Lakes assigned to H.E.P.C. L.O. 7190. File 1162 Vol. 4

Areas withdrawn from staking under Section 43 of the Mining Act, R.S.O. 1970

Order No.	File	Date	Disposition
W.23/77	188543	11/3/77	S.R.O.
W.19/78	188543	10/4/78	S.R.O.

PLANNED REFORESTATION May 2/83

(FI) THIS TWP. SUBJECT TO FOREST ACTIVITIES IN 1992/93. FURTHER INFORMATION AVAILABLE ON FILE.

Received May 8/80

PLAN NO. M.304

ONTARIO

MINISTRY OF NATURAL RESOURCES

SURVEYS AND MAPPING BRANCH

42A06SW0502 2.14526 FRIPP

210

M.304

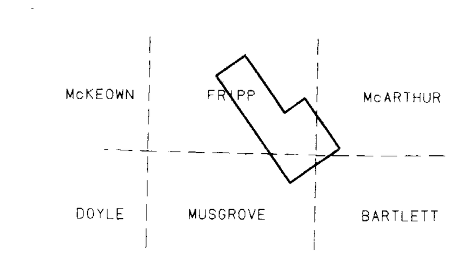
Flight Path

Navigation and recovery using Motorola Mini-Ranger (MRS III) radar navigation system.

Average terrain clearance 60m
Average line spacing 100m

EM Profiles

935 Hz Coaxial 2 ppm/mm
——— inphase component
——— quadrature component
Sensor elevation..........30m
Coil separation............7m



FALCONBRIDGE LIMITED

EM PROFILES (935 Hz)

MONETA-FRIPP PROJECT (PN 8210)
FRIPP TOWNSHIP, ONTARIO

SCALE 1:20,000

0 660 1320 2640 5280 Feet
0 200 400 1000 2000 Metres

AERODAT LIMITED

DATE : MAR 1991
NTS No: 42 A/3
MAP No: FRIPP & McARTHUR J9101

220

N

Apparent Resistivity

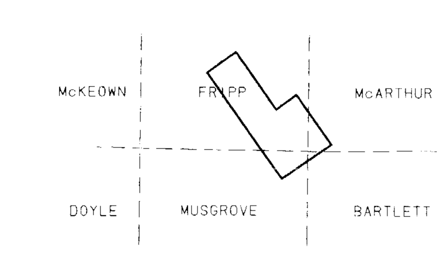
Calculated from 935 Hz coaxial EM response assuming a 200 m conductive layer.

Contouring in ohm*m at logarithmic intervals.

Sensor elevation 30m

Map contours are multiples of those listed below

- 0.1 log(ohm*m)
- 0.5 log(ohm*m)
- 1.0 log(ohm*m)
- 5.00 log(ohm*m)



FALCONBRIDGE LIMITED

APPARENT RESISTIVITY CONTOURS (935 Hz)

MONETA-FRIPP PROJECT (PN 8210)

FRIPP TOWNSHIP, ONTARIO

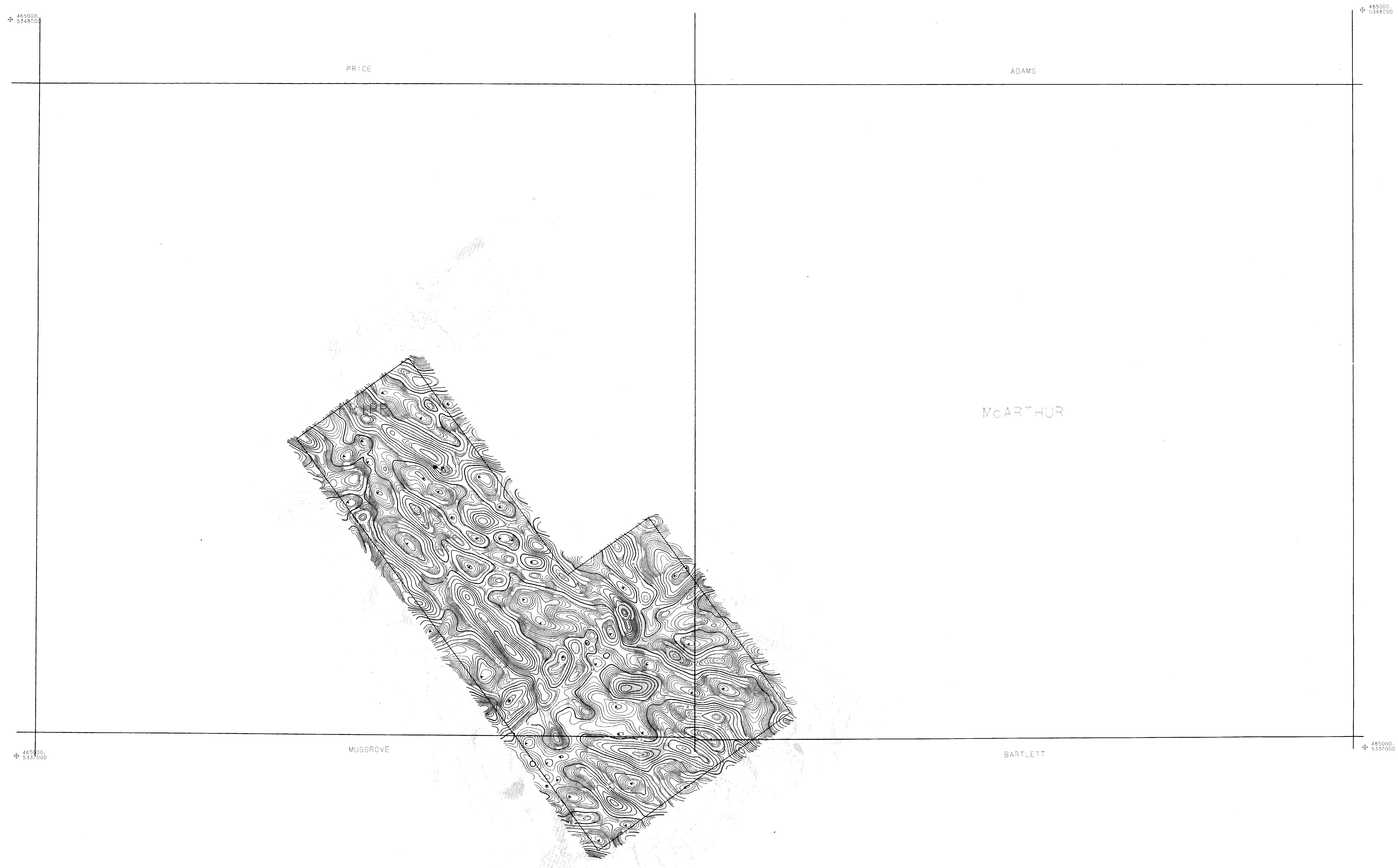
SCALE 1:20,000

0 660 1320 2640 5280 Feet

0 200 400 1000 2000 Metres

AERODAT LIMITED

DATE :	MAR 1991
NTS No:	42 A/3
MAP No:	FRIPP & McARTHUR J9101



VLF-EM

VLF-EM Total Field Intensity in percent.

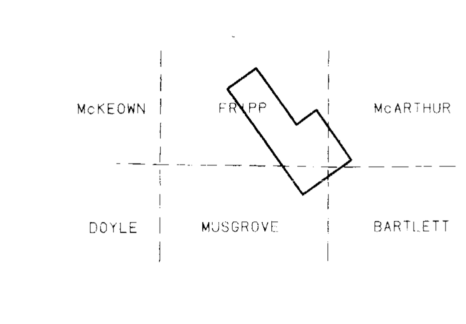
Station: NAA
Cutler, Maine
24.0 kHz

Sensor elevation 45m

Map contours are multiples of those listed below

----	0.5 %
----	2.5 %
----	10.0 %
----	50.0 %

N



FALCONBRIDGE LIMITED

VLF-EM TOTAL FIELD CONTOURS

MONETA-FRIPP PROJECT (PN 8210)
FRIPP TOWNSHIP, ONTARIO

SCALE 1:20,000

0 660 1320 2640 5280 Feet

0 200 400 1000 2000 Metres

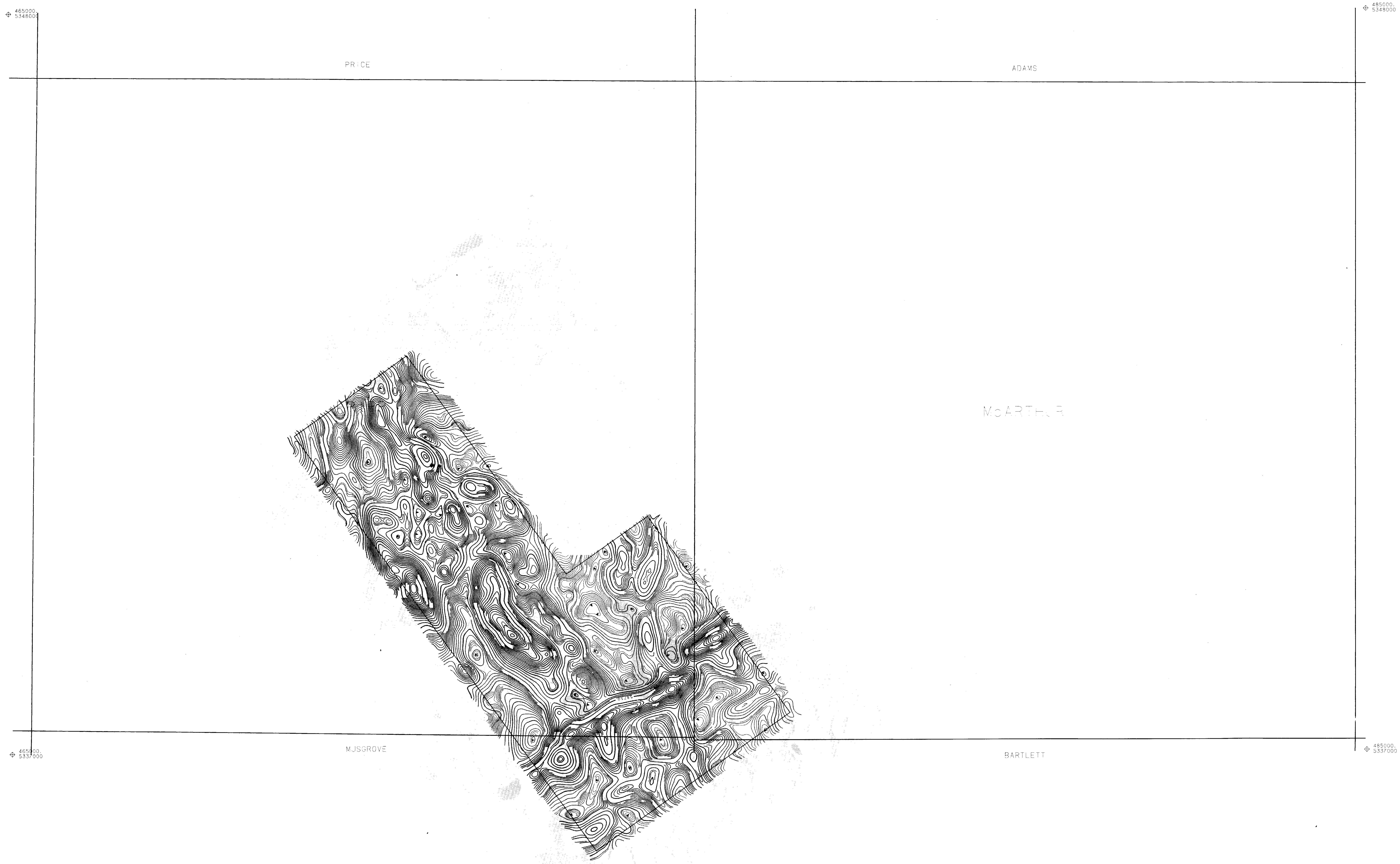
AERODAT LIMITED

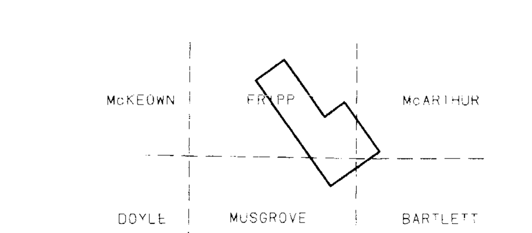
DATE : MAR 1991

NTS No: 42 A/3

MAP No: FRIPP & McARTHUR J9101

240





Magnetics

Total Field Magnetic Intensity Contours in nT.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below
- 2 nT
- 10 nT
- 50 nT
- 250 nT
- 1000 nT

N

FALCONBRIDGE LIMITED

TOTAL FIELD MAGNETIC CONTOURS

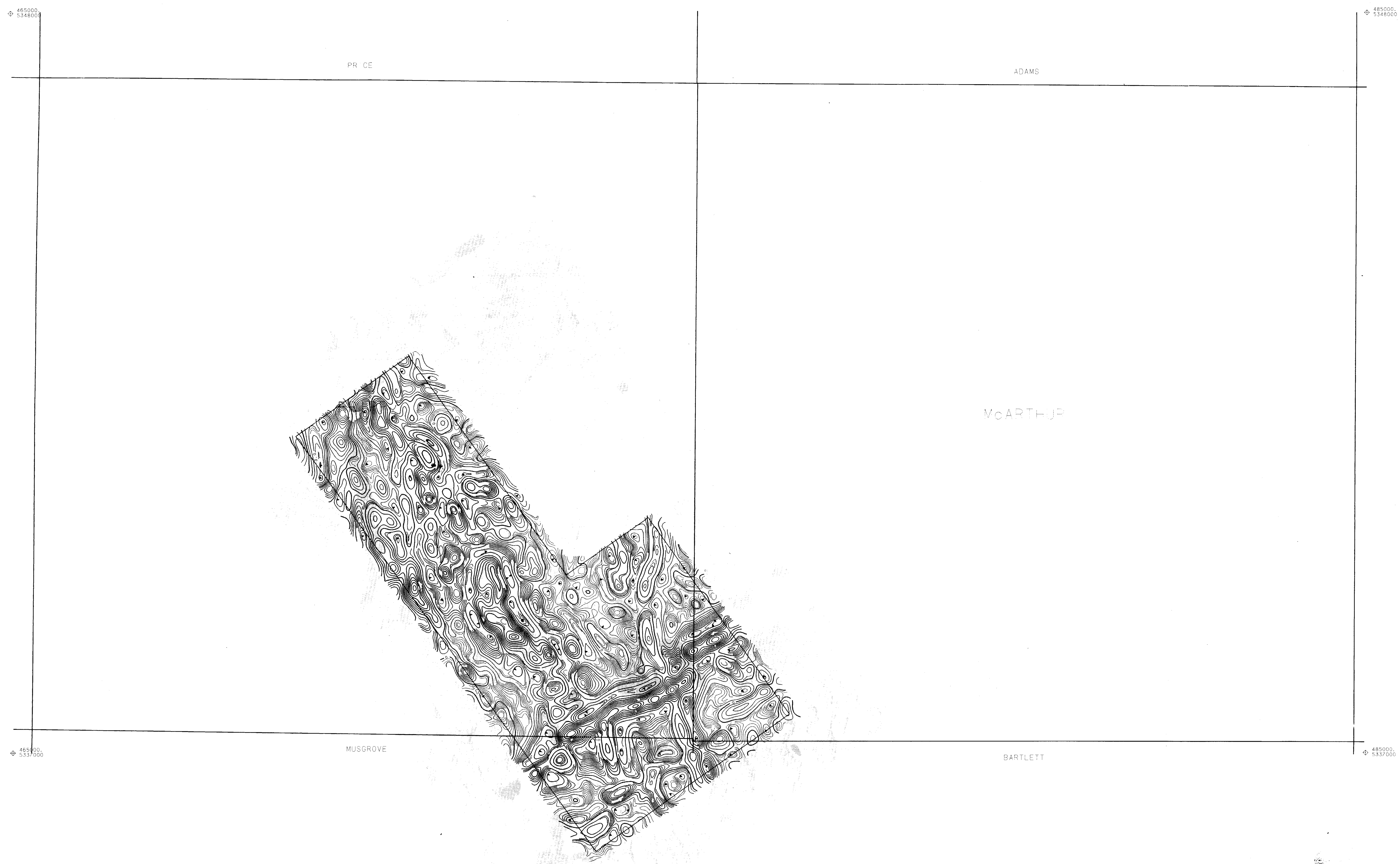
MONETA-FRIPP PROJECT (PN 8210)
FRIPP TOWNSHIP, ONTARIO

SCALE 1:20,000
0 660 1320 2640 5280 Feet
0 200 400 1000 2000 Metres

AERODAT LIMITED

DATE : MAR 1991
NTS No: 42 A/3
MAP No: FRIPP & McARTHUR J9101

250



Vertical Gradient

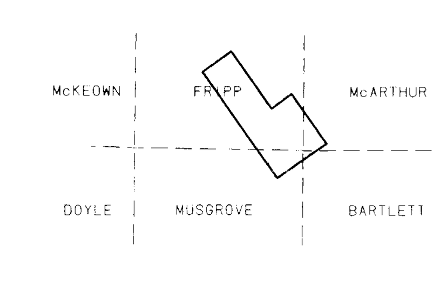
Vertical Magnetic Gradient calculated from the total field magnetic intensity in nT/m.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below

———	0.20 nT/m
———	1.00 nT/m
———	5.00 nT/m
———	25.0 nT/m
———	100 nT/m



FALCONBRIDGE LIMITED

CALCULATED VERTICAL MAGNETIC GRADIENT

MONETA-FRIPP PROJECT (PN 8210)

FRIPP TOWNSHIP, ONTARIO

SCALE 1:20,000

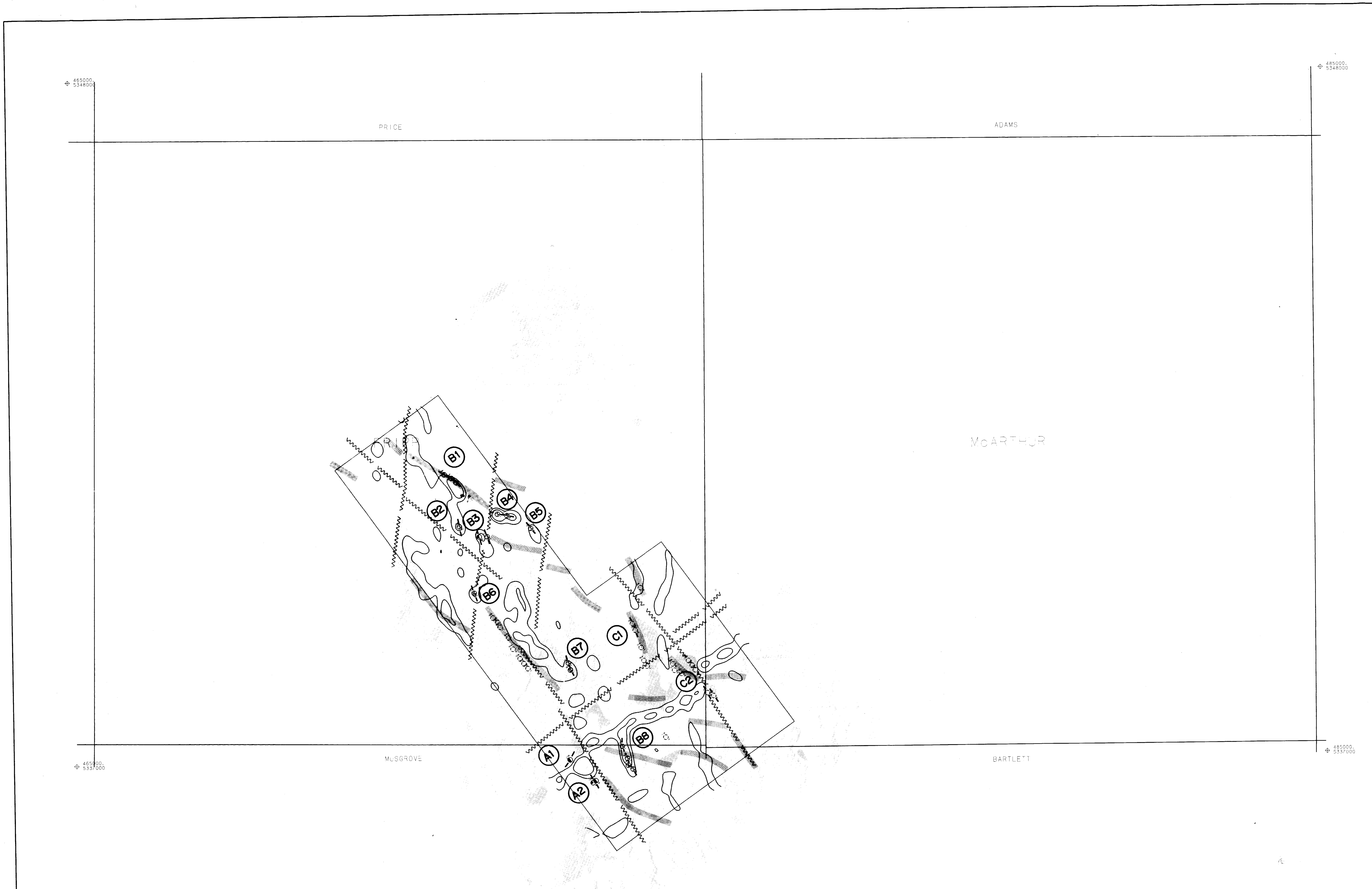
0 660 1320 2640 5280 Feet

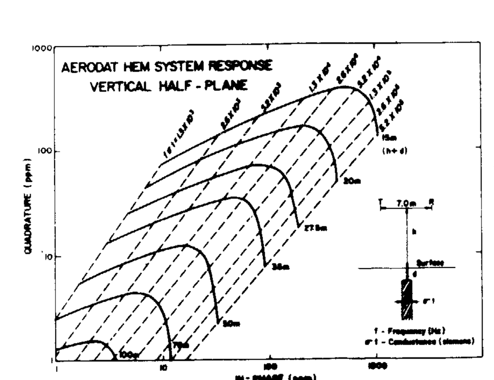
0 200 400 1000 2000 Metres

AERODAT LIMITED

DATE :	MAR 1991
NTS No:	42 A/3
MAP No:	FRIPP & McARTHUR J9101

260





EM Anomalies

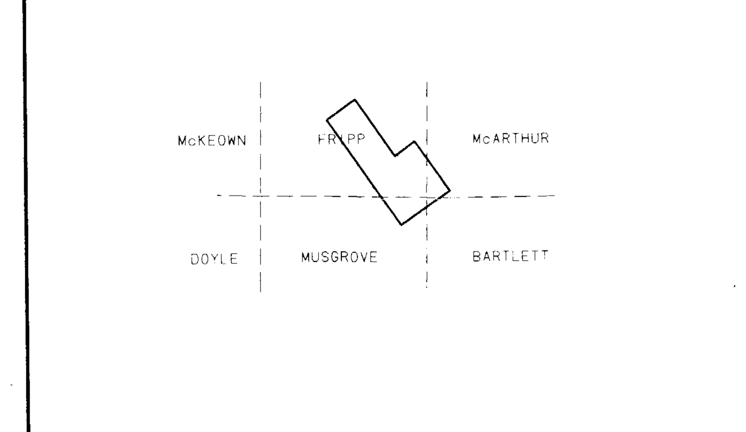
Conductivity Thickness (mhos)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 8
- 8 - 15
- 15 - 30
- > 30
- Magnetite Anomaly

EM Anomaly A, 935 Hz inphase amplitude 7 ppm. Conductivity thickness 2 mhos (see code).

INTERPRETATION LEGEND

- Conductor Axis
- Vertical Gradient Contour Lines +5 nT/m and +25 nT/m
- Possible Fault
- A1 Target Label
- VLF Conductor Axis



FALCONBRIDGE LIMITED

INTERPRETATION

MONETA-FRIPP PROJECT (PN 8210)

FRIPP TOWNSHIP, ONTARIO

SCALE 1:20,000

0 660 1320 2640 5280 Feet

0 200 400 1000 2000 Metres

AERODAT LIMITED

DATE :	MAR 1991
NTS No:	42 A/3
MAP No:	FRIPP & McARTHUR J9101

280