ARIS SUMMARY SHEET

District Geologist, Prince George — Off Confidential: 92.09.06

ASSESSMENT REPORT 21971 — MINING DIVISION: Omineca

PROPERTY: Boot-Steele
LOCATION: LAT 55 54 00 LONG 125 25 00
UTM 10 6197375 348899
NTS 093N14W
CLAIM(S): Steele 1-4,Boot 6
OPERATOR(S): BP Res. Canada
AUTHOR(S): Humphreys, N.
REPORT YEAR: 1991, 65 Pages
COMMODITIES
SEARCHED FOR: Copper,Gold
KEYWORDS: Jurassic-Cretaceous,Hogem Batholith,Duckling Creek Syenite
Syenites,Diorites,Monzonites,Porphyry copper
WORK
DONE: Geophysical,Geological
EMAB 425.0 km
Map(s) - 6; Scale(s) - 1:10 000
FOTO 2375.0 ha
Map(s) - 1; Scale(s) - 1:10 000
MAGA 425.0 km
Map(s) - 8; Scale(s) - 1:10 000
RADA 425.0 km
Map(s) - 5; Scale(s) - 1:10 000

ASSESSMENT REPORT

ON THE COMBINED HELICOPTER-BORNE MAGNETIC, ELECTROMAGNETIC AND VLF-EM SURVEY OVER THE STEELE 1-4 AND BOOT 6 CLAIMS IN THE DUCKLING CREEK AREA, B.C.

Omineca Mining Division
NTS: 93N/14

Latitude 55°54' / Longitude 125°25'

BPVR 91-17
December, 1991

N. Humphreys

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LIST OF APPENDICES

LIST OF FIGURES

Note: The Figures for the geophysical survey results are listed with the report in Appendix C and are located in the pockets.

1. INTRODUCTION

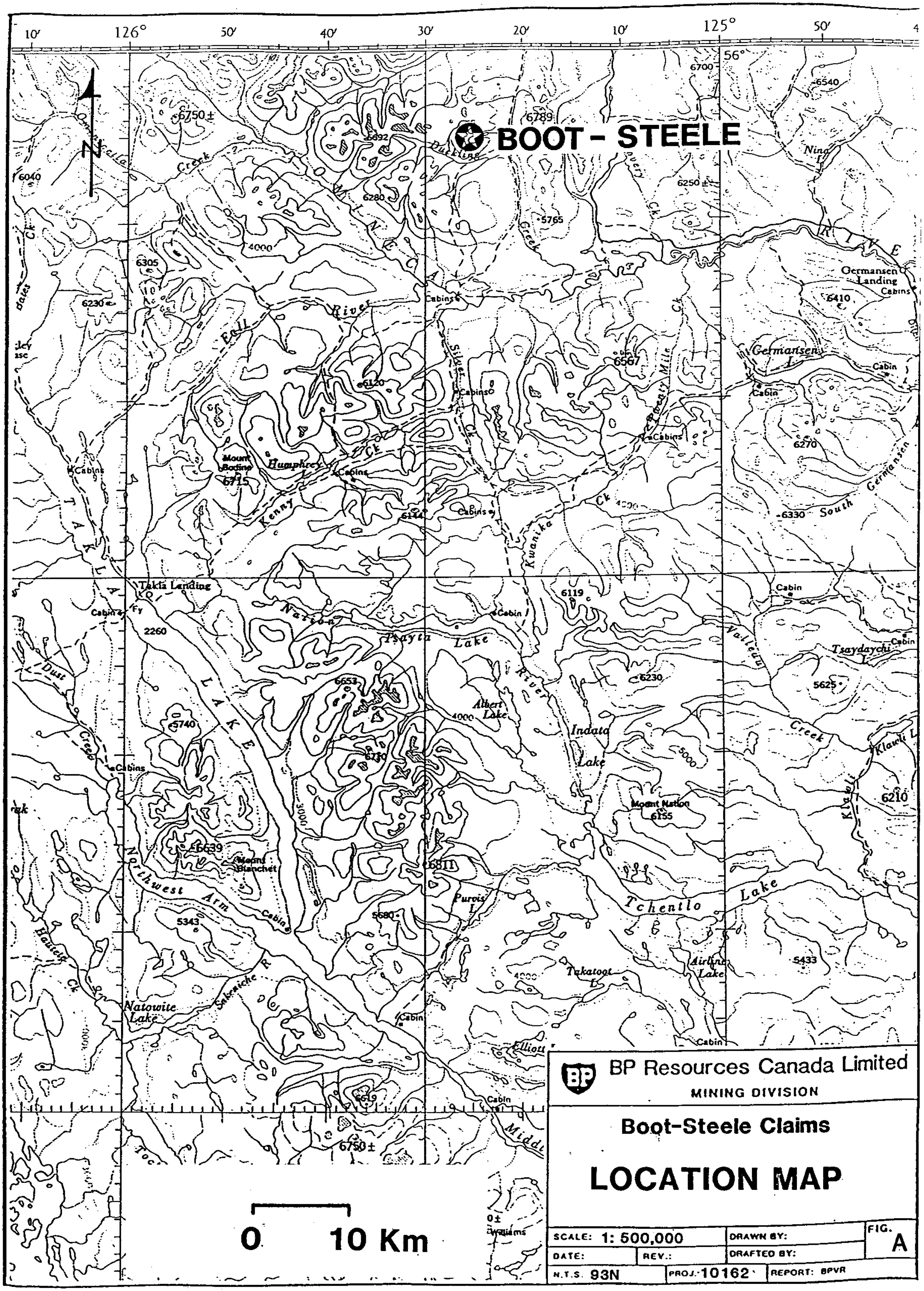
This report gives the results of an airborne EM-magnetic-radiometric survey done over the BOOT-STEELE claims located in the Duckling Creek area in north-central British Columbia. The survey was flown between 1-19 June, 1991 and covered 425 line kilometres.

The BOOT-STEELE claims surround Kennecott Canada Limited's Lorraine property that hosts an alkalic porphyry copper-gold deposit with reported reserves of 10 million tons grading 0.7% copper and 0.34 g/t gold. The purpose of the survey was to identify targets on the BOOT-STEELE claims with a similar geophysical signature as that found at the Lorraine deposit.

Prior to the survey, an orthophoto was prepared at a scale of 1:10,000. This provided ground control for the plotting of the survey results.

2. LOCATION AND ACCESS

The claims are located about 45 km west-northwest of Germansen Landing in the Duckling Creek area of north-central B.C. The Lorraine property access road crosses the southern part of the Boot-Steele property. This road, constructed many years ago, was rehabilitated by Kennecott in 1990. It leaves the Omineca Mining Road at a point approximately 45 km north of Germansen Landing. Travelling time from the property to Germansen Landing is about two hours.



BP Resources Canada Limited

MINING DIVISION

Boot-Steele Claims

LOCATION MAP

SCALE: 1: 500,000	DRAWN BY:	FIG. A
DATE: / REV.:	DRAFTED BY:	
N.T.S. 93N	PROJ. 10162	REPORT: BPVR

The central and northern sections of the claims require helicopter access. Machines are usually based at Germansen Landing during the summer months

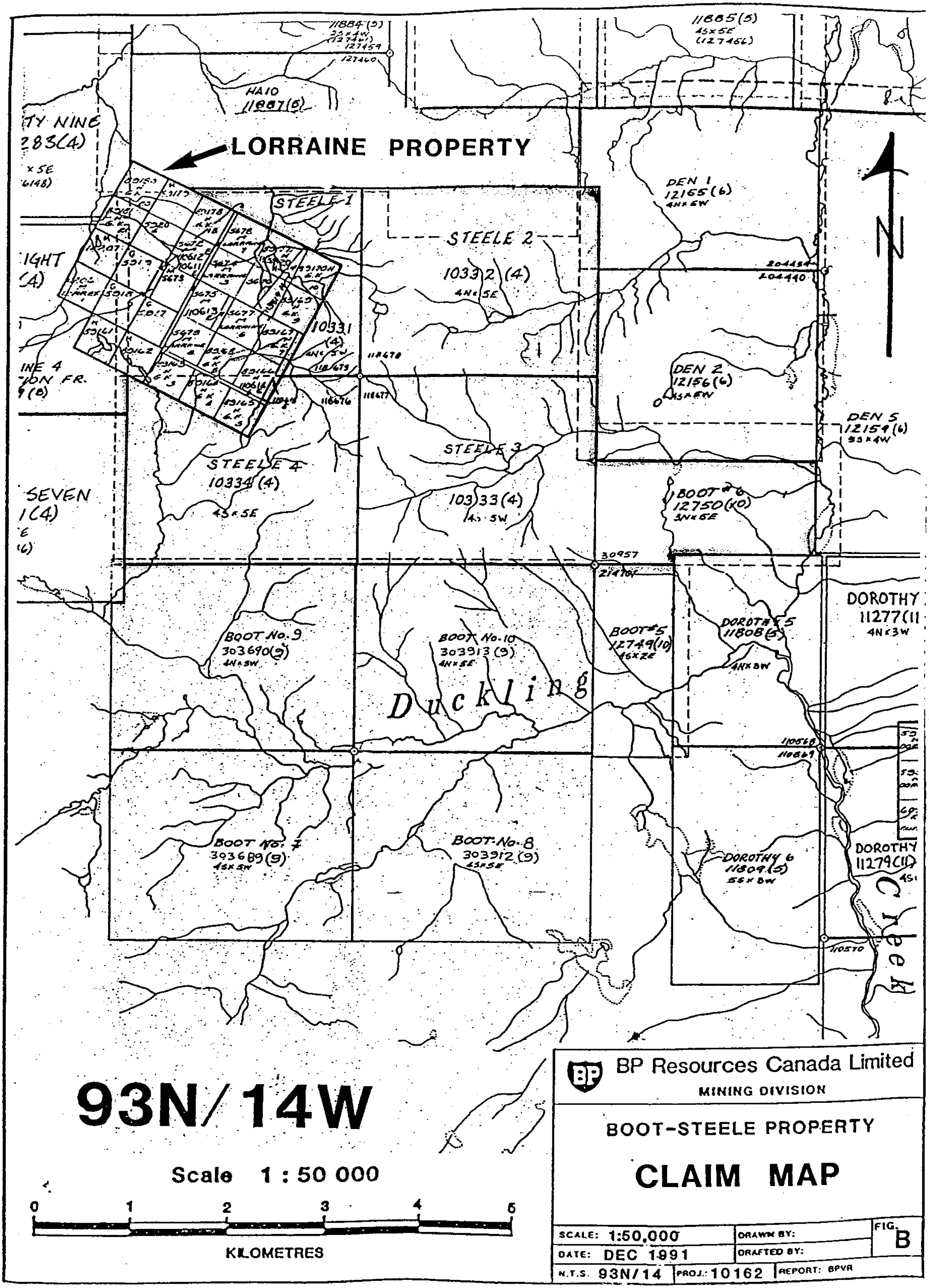
3. CLAIM STATUS

Claim Name	Units	Record Number	Staking/ Anniversary Date
STEELE 1	20	10331	April 29, 1989
STEELE 2	20	10332	April 29, 1989
STEELE 3	20	10333	April 29, 1989
STEELE 4	20	10334	April 29, 1989
BOOT 6	15	12750	October 30, 1990
Total:	**95 units**		

Note: The position of the Lorraine property as shown on the government map is not accurate. The position as shown on Figures C and on the geophysical maps is much more accurate.

4. GEOLOGICAL SETTING (Figure 3)

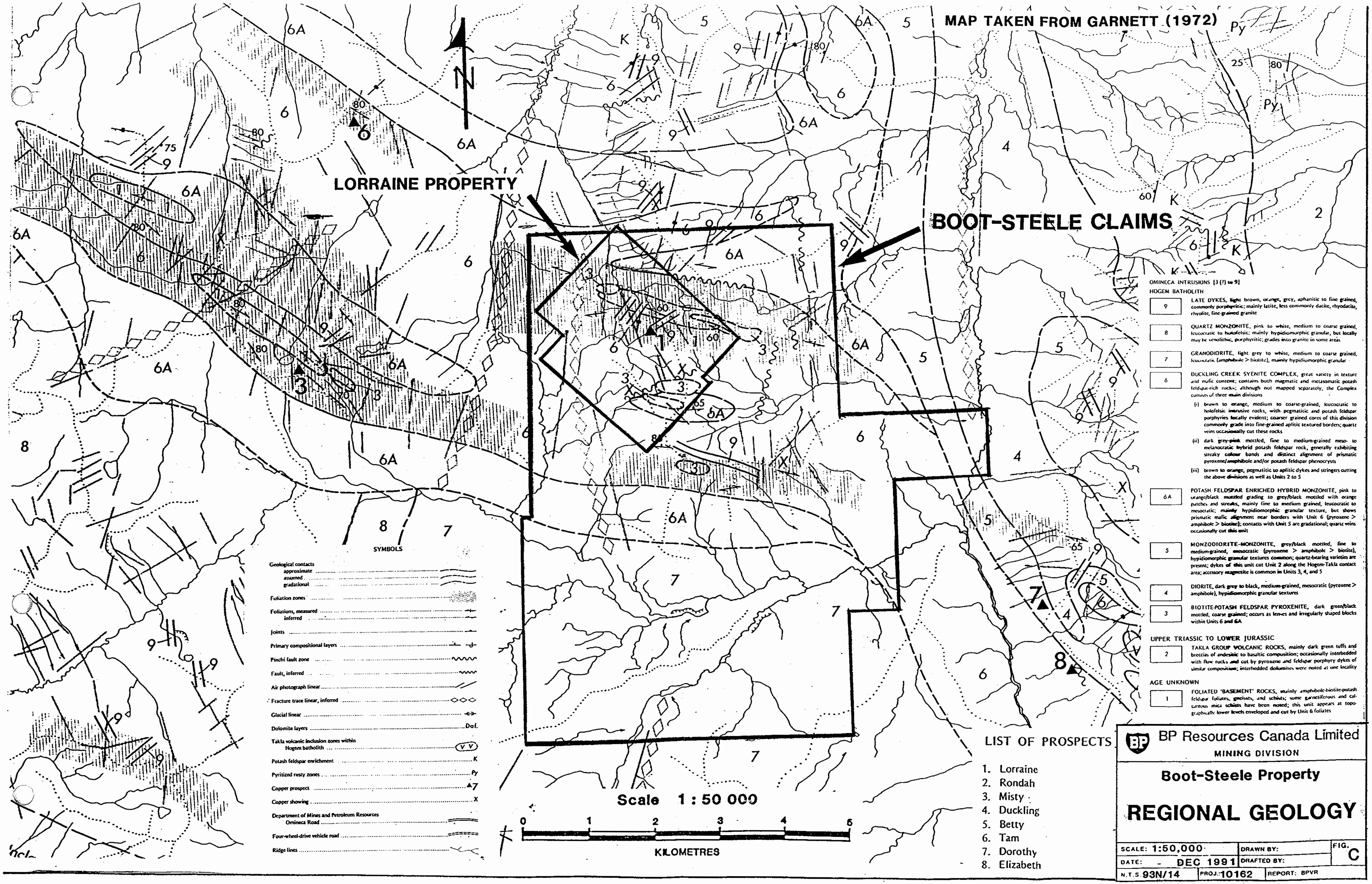
The Boot-Steele claims cover a portion of the Hogem Batholith, a northwesterly-trending, composite intrusion of Early Jurassic to Early Cretaceous age. The intrusion is 160 km long and up to 40 km wide and is bounded on the west by the Pinchi fault. To the east, the batholith intrudes volcanic rocks of the co-magmatic Takla Group of the Quesnel Trough.


LORRAINE PROPERTY
STEELE 1
STEELE 2
10332 (4)
STEELE 3
10333 (4)
STEELE 4
10334 (4)
10331 (4)
DEN 1
12165 (6)
DEN 2
12156 (6)
DEN 5
12154 (6)
BOOT #6
12750 (10)
BOOT #5
12749 (10)
BOOT No. 9
303690 (9)
BOOT No. 10
303913 (9)
BOOT No. 7
303689 (9)
BOOT No. 8
303912 (9)
DOROTHY 5
11808 (5)
DOROTHY 6
11809 (5)
DOROTHY
11277 (11
DOROTHY
11279 (11)
HA10
11887 (6)
11884 (5)
11885 (5)
Duckling
Creek
N
93N/14W
Scale 1 : 50 000
0 1 2 3 4 5
KILOMETRES
BP Resources Canada Limited
MINING DIVISION
BOOT-STEELE PROPERTY
CLAIM MAP
SCALE: 1:50,000
DATE: DEC 1991
N.T.S. 93N/14
PROJ.: 10162
DRAWN BY:
DRAFTED BY:
REPORT: BPVR
FIG. B

In the area of the claims, the Hogem batholith can be divided into three rock suites. Of principal importance is the Duckling Creek Syenite Complex (DCSC) that hosts the Lorraine deposit. Northeast of the Complex is a group of older mafic monzonites and diorites. To the south are younger phases of quartz monzonite and granodiorite. Late dykes of mainly latitic composition cut all three rock suites and mark the youngest intrusive event.

The DCSC forms a northwesterly-trending elliptical body about 5 km wide and 32 km long. The rocks within the Complex are highly variable in texture and mafic content but they have been sub-divided by Wilkinson et al (1976) into two main types: 1) syenite migmatite, interpreted to have formed by a syenite magma intruding and metasomatizing layered monzonite-diorite-pyroxenite; and 2) pink leucocratic syenite, varying in texture from aplites to pegmatites. A hybrid zone of variably potassium-metasomatized monzonite marks much of the contact of the DCSC.

Lenses up to 2500 m long of pyroxenite and schistose 'basement' rocks are enveloped by the DCSC. The pyroxenites are not generally true ultramafic rocks but are composed of variable amounts of pyroxene, biotite, potassium feldspar and magnetite. Often they display large porphyroblasts of potash feldspar. The pyroxenites are thought to have formed as sill-like cumulates within the monzonites and diorites and were subsequently potassium metasomatized by the invading syenite magma.


MAP TAKEN FROM GARNETT (1972)
LORRAINE PROPERTY
BOOT-STEELE CLAIMS
N
OMINECA INTRUSIONS [3 (?) to 9]
HOGEM BATHOLITH
9
LATE DYKES, light brown, orange, grey, aphanitic to fine grained, commonly porphyritic; mainly latite, less commonly dacite, rhyodacite, rhyolite, fine-grained granite
8
QUARTZ MONZONITE, pink to white, medium to coarse grained, leucocratic to holofelsic; mainly hypidiomorphic granular, but locally may be xenolithic, porphyritic; grades into granite in some areas
7
GRANODIORITE, light grey to white, medium to coarse grained, leucocratic (amphibole > biotite), mainly hypidiomorphic granular
6
DUCKLING CREEK SYENITE COMPLEX, great variety in texture and mafic content; contains both magmatic and metasomatic potash feldspar-rich rocks; although not mapped separately, the Complex consists of three main divisions
(i) brown to orange, medium to coarse-grained, leucocratic to holofelsic intrusive rocks, with pegmatitic and potash feldspar porphyries locally evident; coarser grained cores of this division commonly grade into fine-grained aplitic textured borders; quartz veins occasionally cut these rocks
(ii) dark grey-pink mottled, fine to medium-grained meso- to melanocratic hybrid potash feldspar rock, generally exhibiting streaky colour bands and distinct alignment of prismatic pyroxene/amphibole and/or potash feldspar phenocrysts
(iii) brown to orange, pegmatitic to aplitic dykes and stringers cutting the above divisions as well as Units 2 to 5
6A
POTASH FELDSPAR ENRICHED HYBRID MONZONITE, pink to orange/black mottled grading to grey/black mottled with orange patches and streaks, mainly fine to medium grained, leucocratic to mesocratic; mainly hypidiomorphic granular texture, but shows prismatic mafic alignment near borders with Unit 6 (pyroxene > amphibole > biotite); contacts with Unit 5 are gradational; quartz veins occasionally cut this unit
5
MONZODIORITE-MONZONITE, grey/black mottled, fine to medium-grained, mesocratic (pyroxene > amphibole > biotite), hypidiomorphic granular textures common; quartz-bearing varieties are present; dykes of this unit cut Unit 2 along the Hogem-Takla contact area; accessory magnetite is common in Units 3, 4, and 5
4
DIORITE, dark grey to black, medium-grained, mesocratic (pyroxene > amphibole), hypidiomorphic granular textures
3
BIOTITE-POTASH FELDSPAR PYROXENITE, dark green/black mottled, coarse grained; occurs as lenses and irregularly shaped blocks within Units 6 and 6A
UPPER TRIASSIC TO LOWER JURASSIC
2
TAKLA GROUP VOLCANIC ROCKS, mainly dark green tuffs and breccias of andesitic to basaltic composition; occasionally interbedded with flow rocks and cut by pyroxene and feldspar porphyry dykes of similar composition; interbedded dolomites were noted at one locality
AGE UNKNOWN
1
FOLIATED 'BASEMENT' ROCKS, mainly amphibole-biotite-potash feldspar foliates, gneisses, and schists; some garnetiferous and calcareous mica schists have been noted; this unit appears at topographically lower levels enveloped and cut by Unit 6 foliates
SYMBOLS
Geological contacts
approximate
assumed
gradational
Foliation zones
Foliations, measured
inferred
Joints
Primary compositional layers
Pinchi fault zone
Fault, inferred
Air photograph linear
Fracture trace linear, inferred
Glacial linear
Dolomite layers ... Dol.
Takla volcanic inclusion zones within Hogem batholith ... V V
Potash feldspar enrichment ... K
Pyritized rusty zones ... Py
Copper prospect ... ▲7
Copper showing ... X
Department of Mines and Petroleum Resources Omineca Road
Four-wheel-drive vehicle road
Ridge lines
Scale 1 : 50 000
0 1 2 3 4 5
KILOMETRES
LIST OF PROSPECTS
1. Lorraine
2. Rondah
3. Misty
4. Duckling
5. Betty
6. Tam
7. Dorothy
8. Elizabeth
BP Resources Canada Limited
MINING DIVISION
Boot-Steele Property
REGIONAL GEOLOGY
SCALE: 1:50,000
DRAWN BY:
FIG. C
DATE: DEC 1991
DRAFTED BY:
N.T.S 93N/14
PROJ. 10162
REPORT: BPVR

The dominant regional structures are west to northwest foliation zones within the DCSC that parallel the general trend of the Complex. These zones contain the lenses of pyroxenite and basement schists and display structures ranging from the alignment of phenocrysts to gneissic layering and migmatitic banding.

Garnett (1973) recognized three steeply dipping fracture patterns. The youngest and strongest pattern is at 105° and cross-cuts northeasterly-trending dykes and fractures and a northerly-trending fracture set.

5. EXPLORATION HISTORY

Copper showings at Lorraine have been known for many years and have been investigated by a number of individuals and companies since the early 1930's.

Drilling by Kennco in 1949 and 1961-1963 and by Granby Mining Corp in 1970-71 outlined two zones of disseminated chalcopyrite and bornite in syenite migmatite. The two zones have reported reserves of 10 million tons grading 0.7% copper and 0.34 g/t gold. A detailed review of the Lorraine geology is provided by Wilkinson et. al., (1976).

Compared to the extensive exploration carried out on the Lorraine property, little work appears to have been done on what is now the Boot-Steele claims. The earliest work was probably done on the Jeno showing. The exact location of the showing is not known but according to a map in the 1949 BCDM Annual Report it is located on the east-southeasterly trending ridge crossed by the southeastern Lorraine property claim line.

According to the BCDM Minfile description of the Jeno Showing, copper mineralization occurs over a 150 by 550 m area in specks and stringers parallel to a north-striking gneissosity.

In 1966 Belcarra Explorations Ltd. did a reconnaissance soil survey southeast of "Jeno Ridge" (BCDM assessment report 1012). An area with enhanced copper values (to 280 ppm) was outlined over what is now the northeastern corners of BOOT 10. This area is 700 m long, up to 250 m wide and open to the east and west.

In 1972, Noranda explored the PIK claim group immediately west of the Lorraine property (assessment report 4522). They found a northwesterly-trending copper soil anomaly (values greater than 357 ppm) that is 1280 m long, open to the northwest and southeast and up to 500 m wide. The highest copper value is 3300 ppm while a weak Mo soil anomaly occurs within the copper zone. The anomaly is located in the northwestern corner of the STEELE claims, northwest of the present Lorraine property boundary.

The Ted claims, explored by Tupco Mines Ltd., in 1972 (assessment reports 4151,4152), covered what is now the eastern edge the STEELE 2 and 3 claims. Numerous small copper showings and areas of potassium feldspar alteration were found and spotty copper soil anomalies (values to 790 ppm) outlined. An IP survey over the same area showed zones of weak to moderate IP responses that were recommended for drilling.

The Col claim group, explored in 1972 by the LUC syndicate, (assessment reports, 3610, 3995), straddled what is now the northern boundary of the STEELE claims. Bornite and chalcopyrite showings were mapped on the ridges within and adjacent to the STEELE claims. Extensive copper and molybdenum soil anomalies extend into the valley northeast of the Lorraine property. According to assessment report 3610, the molybdenum anomaly covers an area 360 m wide by 700 m long and averages 17 ppm Mo.

6. SURVEY RESULTS

Detailed results of the airborne survey are given in Appendix C. Aerodat has chosen five areas that have a similar geophysical setting as that found over the Lorraine deposit. All the selected targets are in rocks of the Duckling Creek Syenite Complex - the host rocks for the Lorrraine deposit. Of particular interest are Aerodat's targets A-2, A-3 and A-4 which lie within the same east-west foliation zone as the Lorraine deposit.

7. CONCLUSIONS AND RECOMMENDATIONS

The airborne geophysical survey has been very successful in outlining areas of interest on the BOOT-STEELE claims. These areas are located close to the Lorraine deposit and are underlain by the same rock units that host the deposit. A follow-up programme of IP surveys, geological mapping and soil/rock geochemistry is recommended to test these targets.

8. REFERENCES

BCDM Assessment Reports 1012, 4522, 4151, 4152, 3610, 3995.

1949 DCDM Annual Report, Duckling Creek Area; p. A98.

Garnett, J.A. (1972): Preliminary geological map of Duckling Creek area, BCDM Prel. Map No. 9

Garnett, J.A. (1973): Lorraine, Lorrex; from the BCDM GEM Report, 1973 pp. 370-378.

Wilkinson, W.T. et al (1976): Lorraine, from CIM Special Volume No. 15, Porphyry Deposits of the Canadian Cordillera.

APPENDIX A

Statement of Qualifications

Statement of Qualifications

I, Neil Humphreys of 3028 W. 14th Avenue, in Vancouver in the Province of British Columbia, do hereby state:

1. That I have received a B.Sc degree in geology from the University of Saskatchewan in 1976 and an M.Sc degree in Mineral Exploration from Queen's University in 1982.

2. That I have been active in mineral exploration since 1975 in Canada and the U.S.A.

3. That I have been employed by major mining companies until 1988. From 1988 until the present I have been a consulting geologist directing exploration projects in British Columbia.

Neil Humphreys

Vancouver
March, 1991

APPENDIX B

Statement of Costs

Statement of Costs

Airborne Geophysical Survey	$38,250
Orthophoto Preparation	5,700
Total:	**$43,950**

APPENDIX C

Report on a Combined Helicopter-borne Magnetic, Electromagnetic and VLF-EM Survey, Duckling Creek/Boot Option Omineca River Area, British Columbia

REPORT ON A
COMBINED HELICOPTER-BORNE
MAGNETIC, ELECTROMAGNETIC AND VLF-EM SURVEY
DUCKLING CREEK/BOOT OPTION,
OMINECA RIVER AREA, BRITISH COLUMBIA

FOR

BP RESOURCES CANADA LIMITED
- MINING DIVISION
890 WEST PENDER STREET
SUITE 700
VANCOUVER, B.C.
V6C 1K5

BY

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

August 7, 1991

J9137

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

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LIST OF MAPS

BLACK LINE MAPS: (Scale 1:10,000)

Map Type	Description
1.	**BASE MAP;** screened orthophoto base map with survey area boundary and UTM grid.
2.	**FLIGHT PATH MAP;** photocombination of the base map with flight lines, and EM anomaly symbols.
3.	**COMPILATION/INTERPRETATION MAP;** with base map and flight lines.
4.	**TOTAL FIELD MAGNETIC CONTOURS;** with base map and flight lines.
5.	**VERTICAL MAGNETIC GRADIENT CONTOURS;** with base map and flight lines.
6.	**APPARENT RESISTIVITY CONTOURS;** apparent resistivity calculated for the 4600 Hz data, with base map and flight lines.
7.	**VLF-EM TOTAL FIELD CONTOURS;** with base map and flight lines.

COLOUR MAPS: (Scale 1:10,000)

1. **TOTAL FIELD MAGNETICS;** with superimposed contours, flight lines and EM anomaly symbols.
2. **VERTICAL GRADIENT MAGNETICS;** with superimposed contours, flight lines and EM anomaly symbols.
3. **APPARENT RESISTIVITY;** calculated for the 4600 Hz data with superimposed contours, flight lines and EM anomaly symbols.
4. **VLF-EM TOTAL FIELD;** with superimposed contours, flight lines and EM anomaly symbols.

5A. **HEM OFFSET PROFILES;** 935 and 33000 Hz data with flight lines and EM anomaly symbols.

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

6. **APPARENT WEIGHT PERCENT MAGNETITE;** with superimposed contours, flight lines and EM anomaly symbols.

7A. **TOTAL COUNT RADIOMETRICS;** with superimposed contours, flight lines and EM anomaly symbols.

7B. **POTASSIUM RADIOMETRICS;** with superimposed contours, flight lines and EM anomaly symbols.

7C. **URANIUM RADIOMETRICS;** with superimposed contours, flight lines and EM anomaly symbols.

7D. **THORIUM RADIOMETRICS;** with superimposed contours, flight lines and EM anomaly symbols.

<u>DERIVATIVE COLOUR MAP</u>: (Scale 1:20,000)

1-A. **TOTAL FIELD MAGNETICS SHADOW MAP;** at an illumination direction given by angle A.

**REPORT ON A
COMBINED HELICOPTER-BORNE
MAGNETIC, ELECTROMAGNETIC AND VLF-EM
SURVEY, DUCKLING CREEK/BOOT OPTION,
OMINECA RIVER AREA,
BRITISH COLUMBIA**

1. INTRODUCTION

This report describes an airborne geophysical survey carried out on behalf of BP Resources Canada Limited - Mining Division (BP) by Aerodat Limited under a contract dated May 24, 1991. Principal geophysical sensors included a four frequency electromagnetic system, a high sensitivity cesium vapour magnetometer, a two frequency VLF-EM system and a four channel radiometric system. Ancillary equipment included radar ranging and GPS navigation systems, a colour video tracking camera, radar and barometric altimeters, a power line monitor and a base station magnetometer.

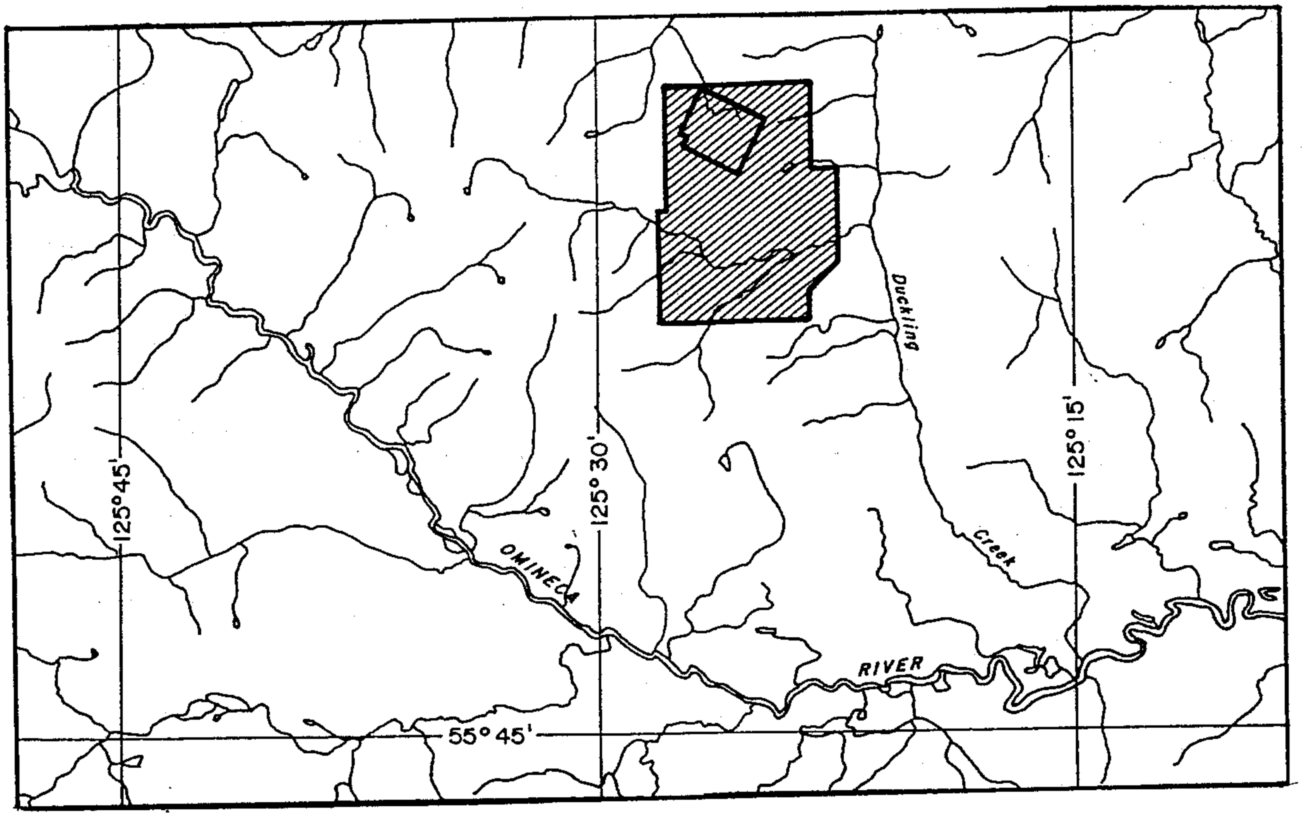
The survey was flown over an area of about 40 square kilometres just north of the Omineca River and about 175 km northwest of Fort St. James in central British Columbia. The flight line spacing was 100 m. Total coverage was approximately 425 line kilometres. The Aerodat Job Number is J9137.

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 straddles Duckling Creek in central British Columbia. The area is roughly 175 km northwest of Fort St. James. Area topography is shown on the 1:50,000 scale NTS map - 93N/14 (Discovery Creek).

Local relief is moderate to extreme. A mountain range - part of the Swannell Range - runs down the middle of the north half of the survey area. Subsidiary ranges run east of the central mountain range. Mountain peaks reach elevations of 1950 m. Elevations at the base are 1250 to 1300 m. The southern third of the area is relatively flat. The area is free of major roads, railroads, powerlines, etc.



HELICOPTERBORNE GEOPHYSICAL SURVEY
DUCKLING CREEK/BOOT OPTION, B.C.

on behalf of
BP RESOURCES CANADA LIMITED

BY

AERODAT LIMITED
J9137

The Lorraine porphyry copper deposit is located in the northwest part of the survey area. The exploration history of this deposit goes back to the early 1940's.

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

The local magnetic field has an inclination of 75° and a declination of 30° east of north.

3. SURVEY PROCEDURES

The survey was flown in the period June 1 to June 19, 1991. Principal personnel are listed in Appendix IV. Twenty-two (22) survey flights were required to complete the project.

The flight line spacing was 100 m. The flight line direction was ne/sw. 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 or more 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.

Two electronic navigation systems were installed. GPS and the radar ranging systems were operational and the navigation was based on which system performed best.

The UTM coordinates of survey area corners were taken from maps provided by BP. 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 systems. The operator entered manual fiducials over prominent topographic features as seen on a 1:10,000 scale topographic map (a 5 times enlargement of the 1:50,000 scale NTS map sheet). Survey lines which showed excessive deviation were re-flown.

Maintaining a uniform terrain clearance was difficult in the north-central and northeast parts of the survey area. Most of the survey lines 42 to 63 were flown in two segments - the survey lines were broken on the mountain ridge.

The magnetic tie line was flown using visual navigation. Under ideal conditions, it is flown in areas of low topographic and magnetic relief. Aircraft position was taken from the navigation system.

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

Pre-flight radiometric system checks involved placing potassium, uranium and thorium sources at standard locations on the crystal package.

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 black line maps are bound with the report.

The colour and shadow maps are delivered in four copies. The colour and shadow 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 - 4600 Hz (Black line)
7	VLF-EM Total Field Contours (Black line)
1	Total Magnetic Field Contours (Colour)
2	Vertical Magnetic Gradient Contours (Colour
3	Apparent Resistivity Contours - 4600 Hz - (Colour)
4	VLF-EM Total Field Contours (Colour)
5A	HEM Offset Profiles 935 & 33000 Hz (Colour)
5B	HEM Offset Profiles 4175 & 4600 Hz (Colour)
6	Apparent Weight % Magnetite (Colour)
7A	Total Count Contours (Colour)
7B	Potassium Contours (Colour)
7C	Uranium Contours (Colour)
7D	Thorium Contours (Colour)
1A	Total Field Magnetic Shadow Map (Colour)

All maps are presented at a scale of 1:10,000. The total field magnetic shadow map is presented at a scale of 1:20,000.

A small block over the Lorraine deposit has been windowed out and results presented at a scale of 1:5,000. This block is some 2 x 2.5 km - 5 square km - and is located in the northwest corner of the survey area. Black line map types 1, 2, 4, 5, 6 and 7 and colour map types 1, 2, 3, 4, 6 and 7 are presented for this block.

All black line maps show a screened orthophoto base, the survey area boundary, major rivers/creeks and a UTM reference grid. All colour maps show the survey area boundary, major rivers/creeks and a UTM grid or reference corners.

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.

5. AIRCRAFT AND EQUIPMENT

5.1 Aircraft

An Aerospatiale Lama helicopter (C-GXYM), owned and operated by Peace Helicopters, was 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 4175 Hz and 33000 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, NLK, Jim Creek, Washington broadcasting at 24.8 kHz and NSS, Annapolis, Maryland broadcasting at 21.4 kHz. In general, NAA Cutler was used as the line station. The only exceptions were flight 1 and flight 15. For flight 1, NAA data is recorded in the ortho channel. For flight 15 - survey lines 10440 to 10502 - NSS, Annapolis was the line station and NLK, Jim Creek was 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 Gamma-Ray Spectrometer

An Exploranium GR-256 spectrometer coupled to 512 cubic inches of crystal sensor was used to record 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 were as follows:

Channel	Window
Total Count (TC)	0.83 to 3.00 MeV
Potassium (K)	1.38 to 1.56 MeV
Uranium (U)	1.67 to 1.90 MeV
Thorium (Th)	2.51 to 2.78 MeV

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

5.6 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 on a 3 1/2" diskette. 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.

Barometric Altimeter

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

Tracking Camera

A 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.

GPS Navigation System

A Trimble TANS GPS receiver was installed as well. The receiver was interfaced to the PNAV 2001 to provide guidance over the survey grid. The sample rate is 1 sec. Resolution is 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
CXI1	935 Hz, Coaxial, Inphase	2.5 ppm/mm
CXQ1	935 Hz, Coaxial, Quadrature	2.5 ppm/mm
CXI2	4600 Hz, Coaxial, Inphase	2.5 ppm/mm
CXQ2	4600 Hz, Coaxial, Quadrature	2.5 ppm/mm
CPI1	4175 Hz, Coplanar, Inphase	10 ppm/mm
CPQ1	4175 Hz, Coplanar, Quadrature	10 ppm/mm
CPI2	33000 Hz, Coplanar, Inphase	20 ppm/mm
CPQ2	33000 Hz, Coplanar, Quadrature	20 ppm/mm
TC	Total Count Radiometrics	50 cps/mm
K	Potassium	5 cps/mm
UR	Uranium	5 cps/mm
TH	Thorium	5 cps/mm
	ANCILLARY DATA	
RALT	Radar Altimeter	10 ft/mm
BALT	Barometric Altimeter	20 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.

Most of the analog channels are shown as positive up. The VLF data are reversed - normally positive anomalies are seen as negative 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	SAMPLING	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 (4 Channels)	0.2 s	0.1 m
Altimeters (2 Channels)	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 1:10,000 scale base map was prepared from an orthophoto. Orthophotos were not available for about 15% of the survey area and topographic detail has been substituted. This was prepared from a five times enlargement of the 1:50,000 scale NTS map sheet. A 2 km UTM reference grid was added. The survey boundary was taken from maps provided by BP. The outline of prominent creeks and rivers were digitized from the 1:50,000 scale topographic maps. The outline of the small block over the Lorraine deposit is shown on all 1:10,000 scale maps.

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 3 mm at a scale of 1:10,000). These positions are expressed as UTM eastings (x) and UTM northings (y).

Electronic navigation may be temporarily lost. The resulting gaps in the flight path are filled in by interpolation. Larger gaps may require the use of line segments from the navigators map/flight path recovery. These segments are recognizable by the straight line character of the flight path.

Lines 35 to 62 crossed over the most rugged parts of the survey area. All of these lines were flown in at least two segments because of difficulties in maintaining terrain clearance over the tops of the mountains. The flight path is therefore interrupted in this area.

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 10680 13 for example indicates line number 68, flight 13.

The flight path map is registered to the base map by matching UTM coordinates from the base map 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.

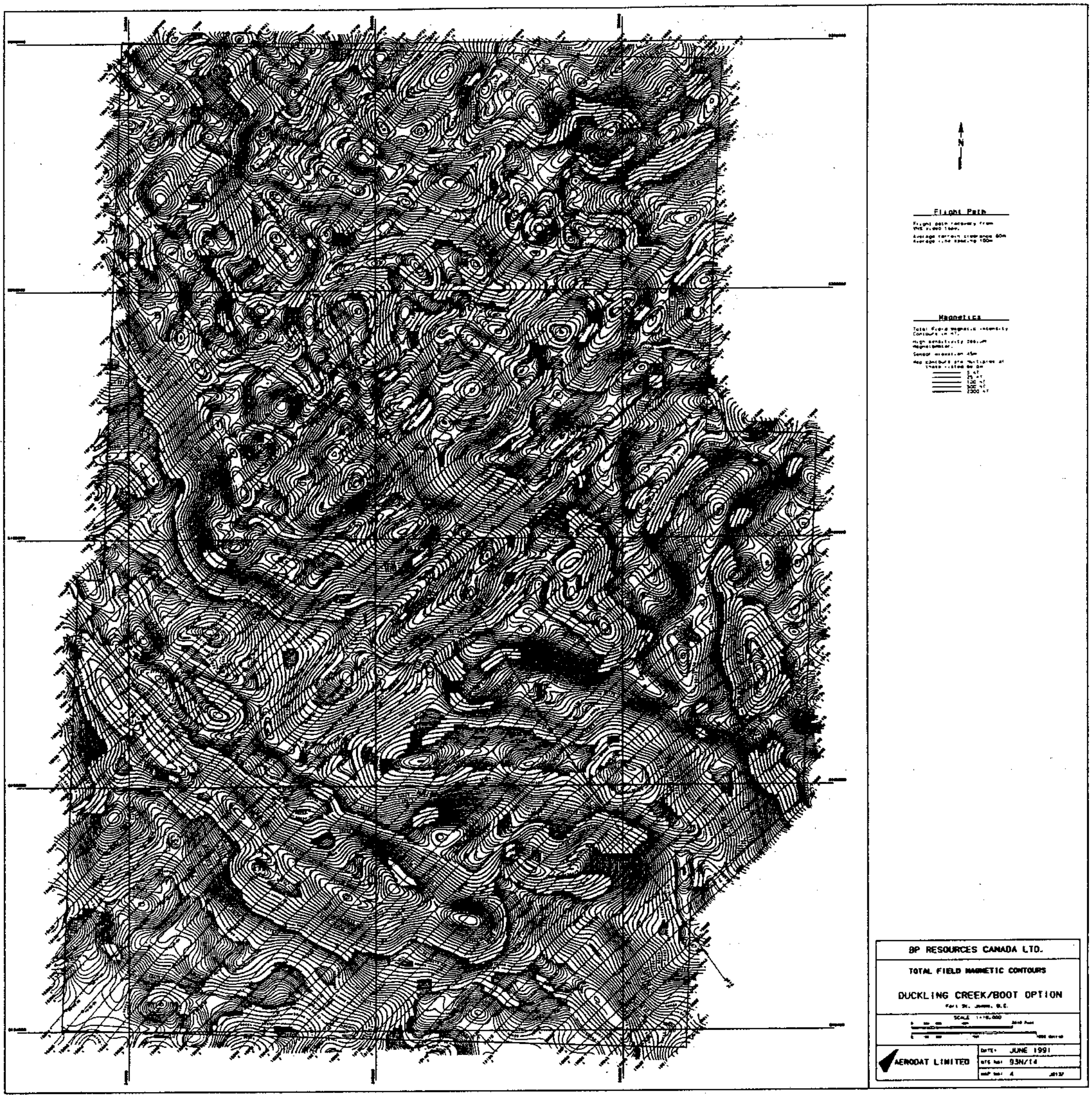
6.3 Electromagnetic Survey Data

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).


N
Flight Path
Magnetics
BP RESOURCES CANADA LTD.
TOTAL FIELD MAGNETIC CONTOURS
DUCKLING CREEK/BOOT OPTION
AERODAT LIMITED
JUNE 1991
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The offset profiles are drawn at vertical scales of 2 ppm/mm (935 and 4600 Hz), 8 ppm/mm (4175 Hz) and 16 ppm/mm (33000 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 5 nT. A grid cell size of 25 m was used for the 1:10,000 scale maps. A 10 m grid was used for the 1:5,000 scale maps.

A page size copy of the 1:10,000 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 0.5 nT/m. The 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 m) 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.

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 1 %. Grid cell size is 25 m.

The VLF profile data is subjected to a high pass filter before gridding to remove the effects of variations in transmitter power. The filter removes signals with periods of about 150 seconds or more - 450 m at a ground speed of 30 m/s. In areas of extreme topographic relief, the VLF total field channel mimics the terrain - broad VLF highs over mountain tops and lows in the valleys. Peak amplitudes are large - ±25 %. The removal of terrain effects using simple filters is not always totally effective and broad VLF anomalies in mountainous areas should be viewed with suspicion.

6.8 Apparent Weight Percent Magnetite

The apparent weight percent magnetite has been calculated from the 935 Hz inphase EM response. The algorithm is based on the HEM response to a non-conducting, magnetically polarizable half-space. The calculation involves a correction to a sensor elevation of 30 m followed by a conversion to weight percent. The elevation correction is based on the exponential fall-off of response amplitude with height. Data collected with a sensor terrain clearance less than 20 m is ignored. As a rule of thumb, a negative inphase response of 1 ppm in either coaxial channel will work out to a percent magnetite by weight of about 0.2%.

The results will be misleading if the source is a near-vertical dyke or intrusion. In such cases, the calculated weight percent magnetite may be too little by a factor of 10 or more.

The calculated apparent percent magnetite data were interpolated on a square grid (25 m grid cell size). The grid provided the basis for threading the presented contours. The minimum contour interval is 1%.

6.9 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 used were

alpha	- 0.55 (Th into U)
beta	- 0.30 (Th into K)
gamma	- 0.73 (U into K)
a	- 0.09 (U into Th)
b	- 0.00 (K into Th)
g	- 0.03 (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 used were 0.0072 (TC), 0.0085 (K), 0.0082 (U) and 0.0067 (Th). The units are m^{-1}. These coefficients are taken from GSC publications for similar radiometric systems. Radiometric data were corrected to a mean terrain clearance of 60 m.

The corrected data were interpolated on a square grid (grid cell size 25m) using an Akima spline technique. The grids provided the basis for threading the presented contours. The minimum contour intervals are 20 cps(TC), 5 cps (K) and 2 cps(U, Th).

7. INTERPRETATION

7.1 Area Geology

The following comments on the area geology have been taken from the British Columbia Department of Mines and Petroleum Resources, GEM, 1973, pages 370 to 378. A copy of this material has been provided by Mr. Chris Bates of BP.

* The malachite-strained cliffs of the Lorraine deposit are the most visible indication of copper mineralization in the Duckling Creek area. Its presence was known for many years by local Indians and was shown to prospectors during World War I.

* The Lorraine deposit lies mainly within the Duckling Creek Syenite complex, a K-feldspar rich phase of the Hogem batholith maintaining magmatic, migmatitic and metasomatic rocks. The complex is an elongated body, approximately 5 by 30 km which trends nw/se through the survey area. Numerous copper occurrences have been investigated within this complex and the mineralization appears to be genetically related to the syenite intrusion.

* The major intrusive units were emplaced as a differentiated mass during Late Triassic to Early Jurassic time. The syenite phase intruded these units during the early Middle Jurassic, and a granite phase cross cuts all previous units, possibly during the early Cretaceous period.

* Some of the foliated rocks within the Duckling Creek Syenite body are schistose and paragneissic in appearance and suggest that some remnants of pre-existing metasedimentary or volcaniclastic material may be included within the migmatitic complex.

* Three steeply dipping fracture patterns are seen. In order of strength, they are approximately east/west, ene/wsw and north/south.

7.2 Exploration Target

The Lorraine porphyry copper deposit has been the subject of exploration efforts which go back almost 50 years. Current reserve estimates are 10 million tonnes at 0.6 % copper.

The purpose of the airborne survey is to define the geophysical signature of the Lorraine deposit and to suggest extensions or other similar geophysical settings in the survey area.

The following notes on the Lorraine deposit have been taken from the reference cited above:

* The best mineralized sections occur within mafic-rich foliated syenitic migmatite. Mineralization is predominantly disseminated chalcopyrite and bornite. The significant mineralization is associated with pervasive potash feldspathization and the presence of accessory magnetite.

* The mineralized sections appear as lenses erratically distributed through otherwise identically appearing, poorly mineralized syenitic migmatites. Although some mineral zoning is present, the predominance of magnetite over pyrite indicates a sulphur-poor mineralizing environment.

* The largest mineralized zone has dimensions in plan of some 250 m (ne/sw) by 1100 m (nw/se). A 50 x 600 m zone lies 500 m south of the main zone. Scattered small zones are seen further south and west. All zones trend northwest/southeast.

* The predominance of disseminated sulphides over fracture-filling primary mineralization and the strong spatial correlation of foliated syenite with copper sulphides suggest the copper bearing solutions were genetically associated with the syenites which intruded basic rocks of the Hogem batholith in lower Middle Jurassic time - 170 my.

The direct geophysical response of the deposit may therefore be relatively high potassium and magnetite. Local concentrations of metallic sulphides with associated fracture or fault zones may be seen as linear resistivity lows with coincident weak EM and/or VLF anomalies.

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 most anomalies picked is a positive anomaly in the 4600 Hz inphase or quadrature channel with a coincident low in the 4175 Hz inphase or quadrature channel.

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. The comparable figures for a conductor under 50 m of overburden is 220 m.

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.

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.

B. Analysis

The EM anomaly response amplitudes at 4600 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 anomaly listings are given for each of the four survey blocks separately.

The inphase anomaly amplitude and the thin sheet conductance range as determined from the 4600 Hz response amplitudes are shown with the plotted anomaly symbols. Each anomaly is identified by flight line number and letter label.

EM anomalies which show a negative inphase response are plotted as an open circle with an "M" printed inside.

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

The airborne geophysical results suggest the survey area may be divided into two distinct regions. The dividing line runs wnw/ese in the area of Duckling Creek. To the south of Duckling Creek, the aeromagnetic results show a band of relatively uniform linear anomalies trending nw/se to wnw/ese. Parallel low magnetic field gradient and amplitude bands are to the north and south.

To the north of Duckling Creek, aeromagnetic patterns are more confused although a general nw/se trend is preserved. This pattern persists to the southwest where Duckling Creek leaves the survey area.

This rough division into two regions is also seen in the EM (resistivity, bedrock conductors and magnetite) data and to some extent in the topography. A fundamental change in geology would explain the division. Region I in the north and east is one of intrusive rocks. Region II in the southwest may be is one of metavolcanics and/or metasediments.

The Lorraine deposit in the northwest corner of the survey area is centered over a mountain peak and ridge coming off the peak to the northwest. The immediate area is one of the most rugged parts of the survey area as the number of broken survey lines attests.

A helicopter survey in which the flight path is all from an electronic navigation system and in which the sensors are maintained at a uniform terrain clearance is the ideal. In mountainous areas, this is not always possible and the interpretation of the geophysical results should allow for deviations from the ideal. This is particularly true for those quantities which are often most valued - EM conductors and the vertical magnetic gradient. These measurements are most sensitive to terrain clearance and/or flight path integrity. The apparent resistivity, apparent weight percent magnetite, contoured VLF and radiometric data are less effected if only because of the lateral extent of most sources. The total field magnetic is the quantity least affected by variations in terrain clearance.

EM

The offset profiles show three response types. In order of decreasing amplitudes, they are

- negative inphase responses due to magnetite
- long period quadrature responses due to variations in apparent resistivity
- short period anomalies from bedrock conductors

Large amplitude negative EM anomalies - 20 to 40 ppm in the 935 Hz inphase channel - are common in the northern half of the survey area. In most cases the 4600/4175 Hz quadrature channels show no coincident bedrock conductor. Large variations in the negative peak amplitudes are due in part to variations in sensor terrain clearance. Near the northeast end of line 56 for example, the 935 Hz inphase channel shows anomalies of -40 to -80 ppm. The radar altimeter indicates a helicopter clearance of only 100 to 150 feet - the EM sensor is very close to ground level. Neighbouring lines in this area, flown at a helicopter terrain clearance of more than 200 feet, show no negative inphase responses.

The calculation of apparent weight percent magnetite includes a correction for terrain clearance. The correction is only valid for sensor elevations of 20 m or more - this will remove the effects of the more extreme terrain clearance variations before presentation.

The map of apparent resistivity shows background values of 2000 to 5000 ohm-m with extremes to 250 ohm-m. The lowest values are on or near Duckling Creek. The highest resistivity values are generally over topographic highs. The apparent resistivity map shows no correlation with the Lorraine deposit. A band of resistivities less than 1000 ohm-m follows the topographic low near the northwest end of the deposit.

A number of EM anomalies thought to be due to bedrock conductors have been identified. In the southwest parts of the survey area, these anomalies show low conductance estimates - less than 1 mho - and are connected as conductor axes parallel to magnetic strike. In the northern part of the survey area, the only evidence of a possible bedrock conductor is a 4600 Hz quadrature peak and coincident 4175 Hz quadrature low. The inphase channels are often negative and of no help in picking EM anomalies. Conductance estimates are therefore completely unreliable.

Magnetics

Information on the distribution of magnetite is taken from three sources - the total magnetic field, the vertical magnetic gradient and the apparent weight percent magnetite. Each measurement responds best to sources at different depths and hence maps of these three quantities may disagree.

For tabular sources, the total field, vertical gradient and EM fields fall off roughly as r^{-2}, r^{-3} and r^{-4}. The map of weight percent magnetite reflects variations in magnetite in the top 50 m. The total magnetic field responds to variations at much greater depths. The vertical gradient provides information at intermediate depths.

The total field magnetics show the broad zoning commented on earlier. The north east half of the survey area shows overall amplitudes greater than 59,000 nT with peaks to 61,500 nT. Anomaly shapes are elliptical and arcuate with a variety of strike directions often seen with intrusives. The southwest part of the survey area shows three nw/se trending bands of alternating low (58,500 nT), high (over 59,000 nT) and low (less than 58,000 nT) background values. The middle band describes a nearly continuous linear trend which crosses the whole survey area.

The calculated vertical gradient contour map shows the often confused patterns over the intrusives expected from a high pass filter of the total field results. In some cases, the confusion is considered an artifact of uncertainties in the flight path and/or variations in terrain clearance. Much of the flight path has been taken from the navigators fiducial marks and the positional accuracy of electronic navigation, which is the basis for the most reliable vertical gradient maps, is lacking.

VLF

Relatively sharp VLF anomalies of reasonable amplitude (i.e. peak values greater than 5%) are considered possible reflections of a confined resistivity low and not just a topographic high. Such anomalies are relatively few in number. They show the wnw/ese bias expected from a transmitter which is just south of east from the survey area.

One of the clearest VLF anomalies sits right over the main zone of the Lorraine deposit. The strongest parts of the VLF anomaly are at the northwest end of the zone - an area of moderate topographic relief. If VLF terrain effects were a problem, they would be more likely to show up at the southeast end of the main zone - an area of extreme relief.

Radiometrics

The contoured potassium radiometric map shows scattered highs of over 75 cps in the central and northern parts of the survey area. These anomalies typically cover areas of 300 x 500 m or larger. The same anomaly patterns are seen in the total count map. The Uranium and Thorium map show relatively low count rates.

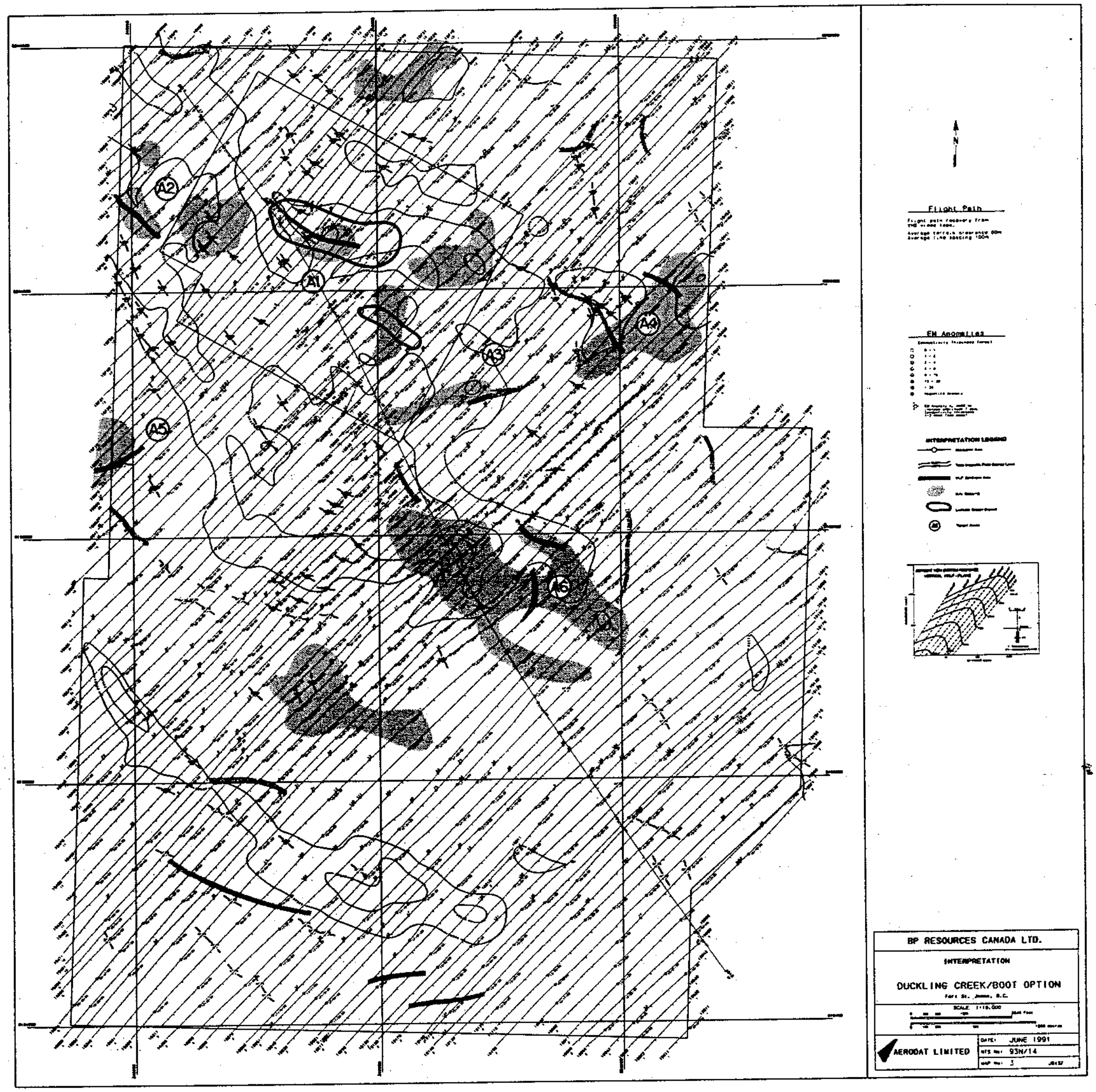
The main zone of the Lorraine deposit is an area of high potassium counts - peak count rates are over 100 cps.

7.5 Compilation/Interpretation Map

The compilation map shows the following

- EM conductor axes
- the 59,500 and 60,500 nT contour lines
- areas of high potassium to uranium ratio
- VLF conductor axes
- outline of the two largest zones of the Lorraine copper deposit
- favourable area labels

A page size copy of the 1:10,000 scale compilation/interpretation map is enclosed.



N
Flight Path
Average line spacing 100m
EM Anomalies
A1
A2
A3
A4
A5
A6
BP RESOURCES CANADA LTD.
INTERPRETATION
DUCKLING CREEK/BOOT OPTION
AERODAT LIMITED
JUNE 1991
93N/14

EM conductor axes are drawn through EM anomaly centers which are similar in character. Consistency with local magnetic strike is a factor.

The 59,500 and 60,500 nT contour lines are used to indicate broad magnetic zoning by amplitude.

Areas of high potassium to uranium ratio are assigned where the K/U ratio exceeds 6. Background values for this ratio are about 3. The ratio, rather than the raw potassium count rate, is used in an attempt to remove the effects of variations in masking - i.e. overburden, etc.

The outline of the two largest zones of the Lorraine copper deposit are taken from Figure 28 of the GEM article cited above - see section 7.1. Favourable area labels are shown as a letter followed by a counter.

7.6 Favourable Areas

Favourable areas are shown on the compilation/interpretation map as a letter A followed by a counter. Label A1 is reserved for the Lorraine copper deposit. Counter numbers 2 to 6 increase from north to south.

Favourable areas are selected because of a similar geophysical setting as that over the Lorraine deposit. The Lorraine deposit is seen to have the following airborne geophysical characteristics.

- moderate to high (59,500 to 60,500) total magnetic field values and an anomalous trend which coincides with that of the deposit.

- a coincident VLF conductor axis over most of the axis of the largest zone of the deposit.

- high radioactive potassium count rates and a high potassium/uranium ratio over all or part of the deposit.

The apparent resistivity, EM conductors (with or without magnetite) and the apparent weight percent magnetite seem to bear no special relationship to the Lorraine deposit and therefore have not been included in the selection criteria for promising exploration targets.

The center of the Lorraine deposit is given by the peaks of the total field magnetic response and the K/U ratio. The peak of the VLF response is 200 m northwest of this position. Targets A2 to A6 are therefore defined by the position of the peak value of the K/U ratio, local total field magnetic response and/or VLF conductor axis. It is understood that the position given is only the center point of what is potentially a large area of interest.

A2: Line 10800 (11:03:45)

A nw/se trending VLF axis with coincident high K/U ratio - over 8 and high magnetic values - over 60,800 nT. This target is 1500 m west of the center of the Lorraine deposit.

A3: Line 10501 (8:17:11)

A small circular magnetic high (over 60,500) with coincident high K/U ratio (over 8). A VLF conductor axis is just south and east of this position.

A4: Line 10441 (07:27:34)
Line 10441 (07:28:23)

Two locations within the same high K/U region near the eastern survey boundary. Both positions are at the southeast ends of VLF conductor axes.

The first position is on the 59,500 nT contour line. Exploration might focus on the isolated magnetic high (60,300 nT) some 300 m north. The apparently low K/U ratio northwest of line 45 may be due to excessive terrain clearance.

The second position should be shared with the isolated 60,500 nT high 200 m west.

A5: Line 10680 (11:36:00)

This is at the extreme western edge of the survey area. Near coincident magnetic (59,000 nT), K/U (8) and VLF anomalies suggest this target.

A6: Line 10377 (5:43:16)

A strong VLF anomaly (9%) with a reasonable K/U ratio (over 6) and coincident high magnetic values (59,800 nT). There is no localized magnetic anomaly as has been seen with targets A1 (Lorraine deposit - main zone), A3 to A5.

No targets have been selected from the southern part of the survey area. This is because of the absence of a Lorraine-type geophysical setting - moderate to high magnetics with local anomaly, high K/U ratio and VLF conductor axis. A relaxing of these criteria might result in the identification of promising targets in this part of the survey area.

8. CONCLUSIONS

High resolution helicopterborne geophysical surveys have been completed over an area of about 40 square kilometres centered over Duckling Creek and about 175 km northwest of Fort St. James, B.C. Total coverage is approximately 425 line kilometres. Results are presented on black line and colour maps at a scale of 1:10,000. Map types include EM anomaly centres, apparent resistivity, contoured magnetic field, contoured vertical magnetic gradient, contoured VLF-EM Total Field, contoured apparent weight percent magnetite and contoured radiometric data - total count, potassium, uranium and thorium. Black line and colour maps are also presented at a scale of 1:5,000 for a small block - 5 sq. km - centered over the Lorraine porphyry copper deposit.

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,

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Consulting Geophysicist
for
AERODAT LIMITED
August 7, 1991

J9137

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.

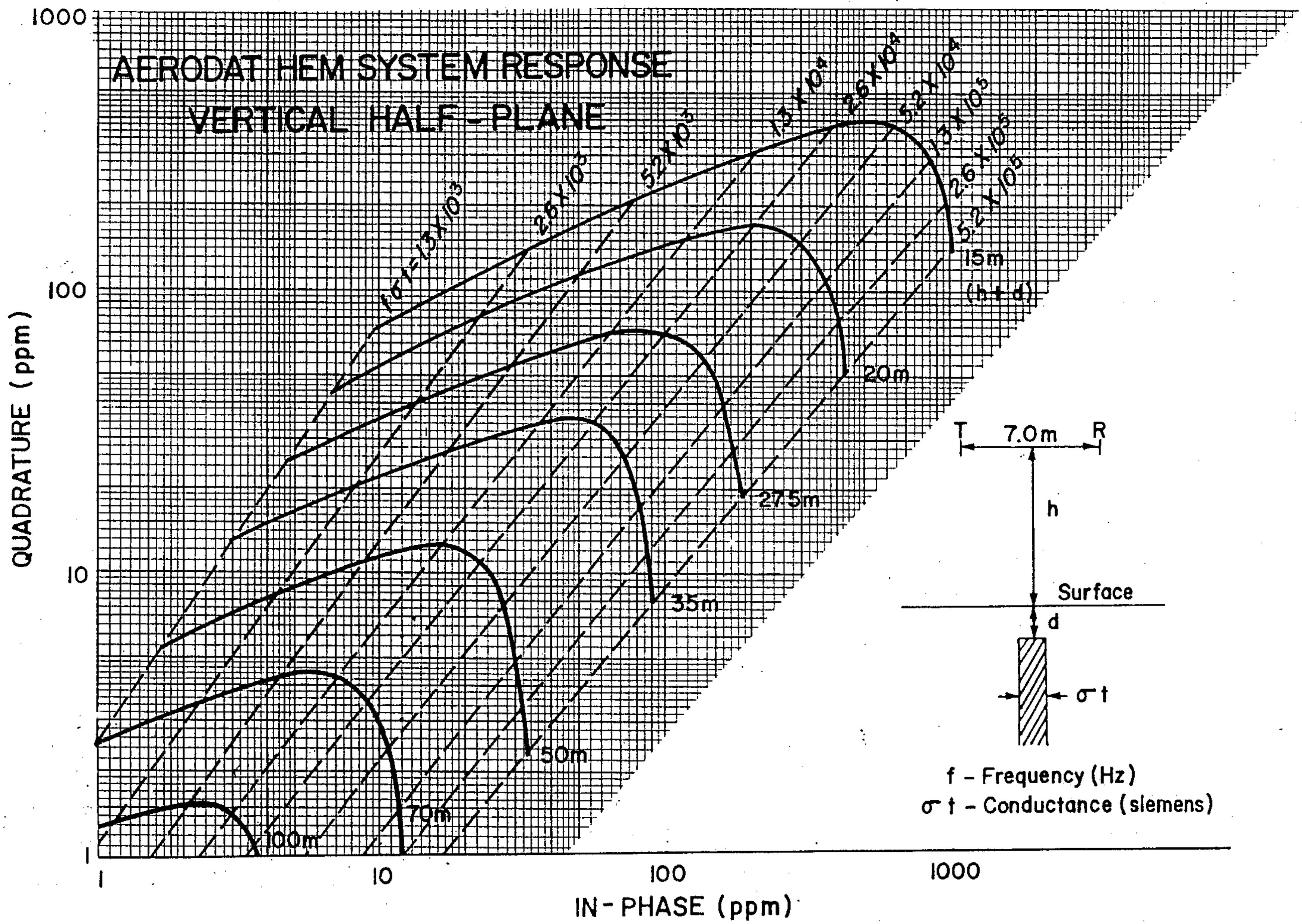
Electrical Considerations

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.

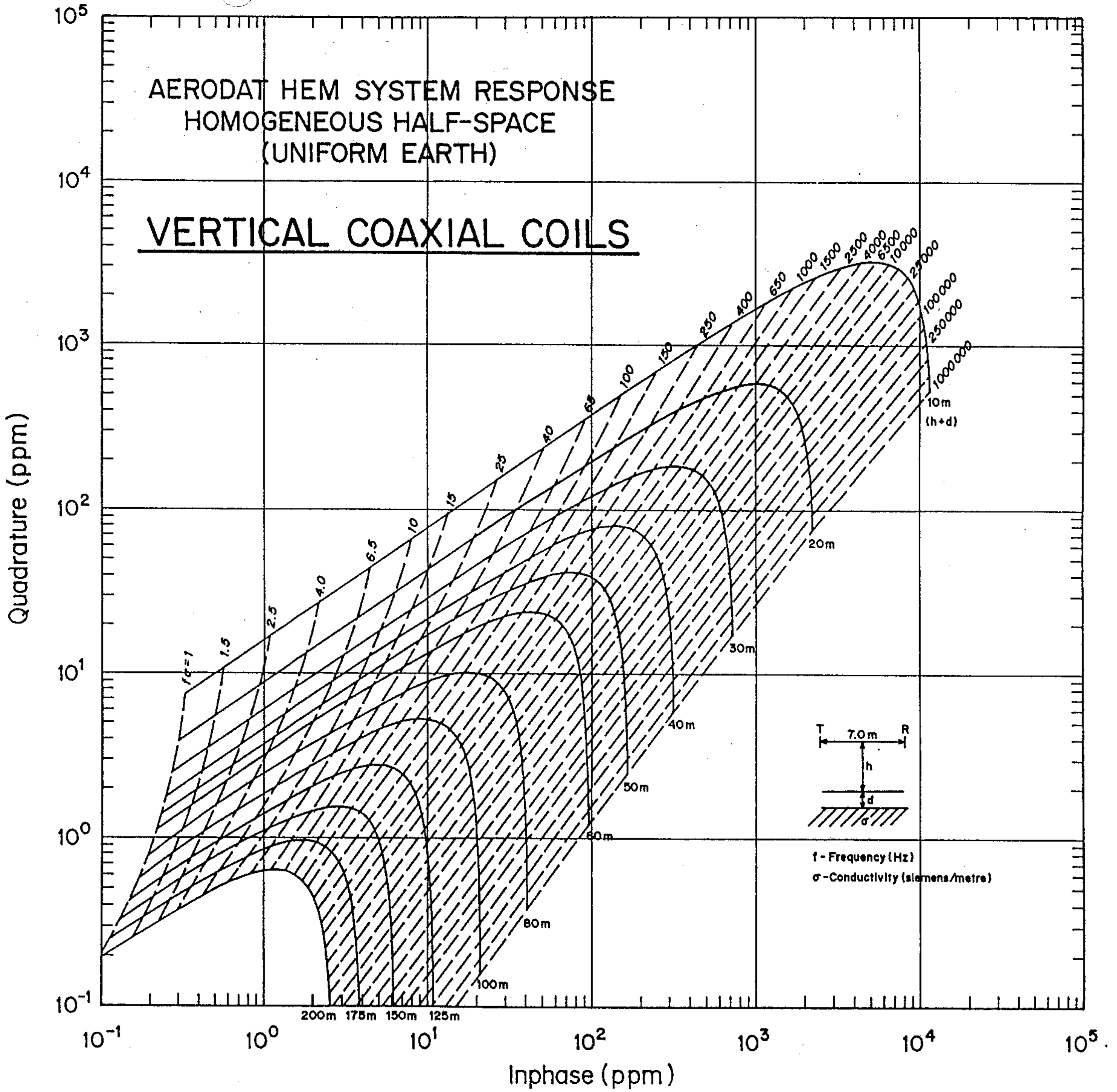
The phasor diagram for the vertical half-plane model, as presented, is for the coaxial coil configuration with the amplitudes in parts per million (ppm) of the primary field as measured at the response peak over the conductor. To assist the interpretation of the survey results the computer is used to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

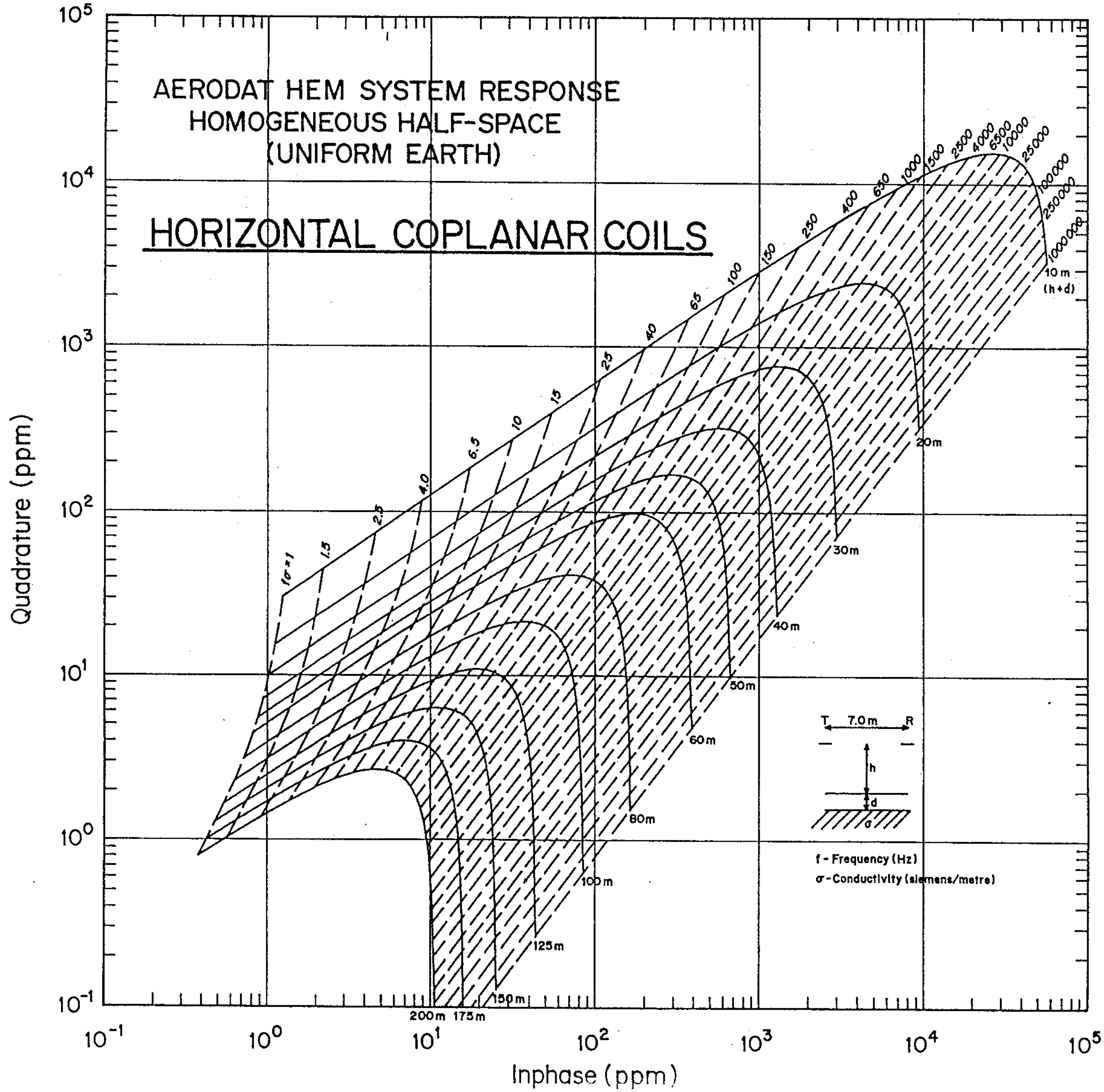
The conductance estimate is most reliable when anomaly amplitudes are large and background resistivities are high. Where the EM anomaly is of low amplitude and background resistivities are low, the conductance estimates are much less reliable. In such situations, the conductance estimate is often quite 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
QUADRATURE (ppm)
IN - PHASE (ppm)
1000
100
10
1
1
10
100
1000
f σ t = 1.3 X 10³
2.6 X 10³
5.2 X 10³
1.3 X 10⁴
2.6 X 10⁴
5.2 X 10⁴
1.3 X 10⁵
2.6 X 10⁵
5.2 X 10⁵
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 - Frequency (Hz)
σ - Conductivity (siemens/metre)
T
7.0m
R
h
d
σ
10m
(h+d)
20m
30m
40m
50m
60m
80m
100m
200m
175m
150m
125m


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

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

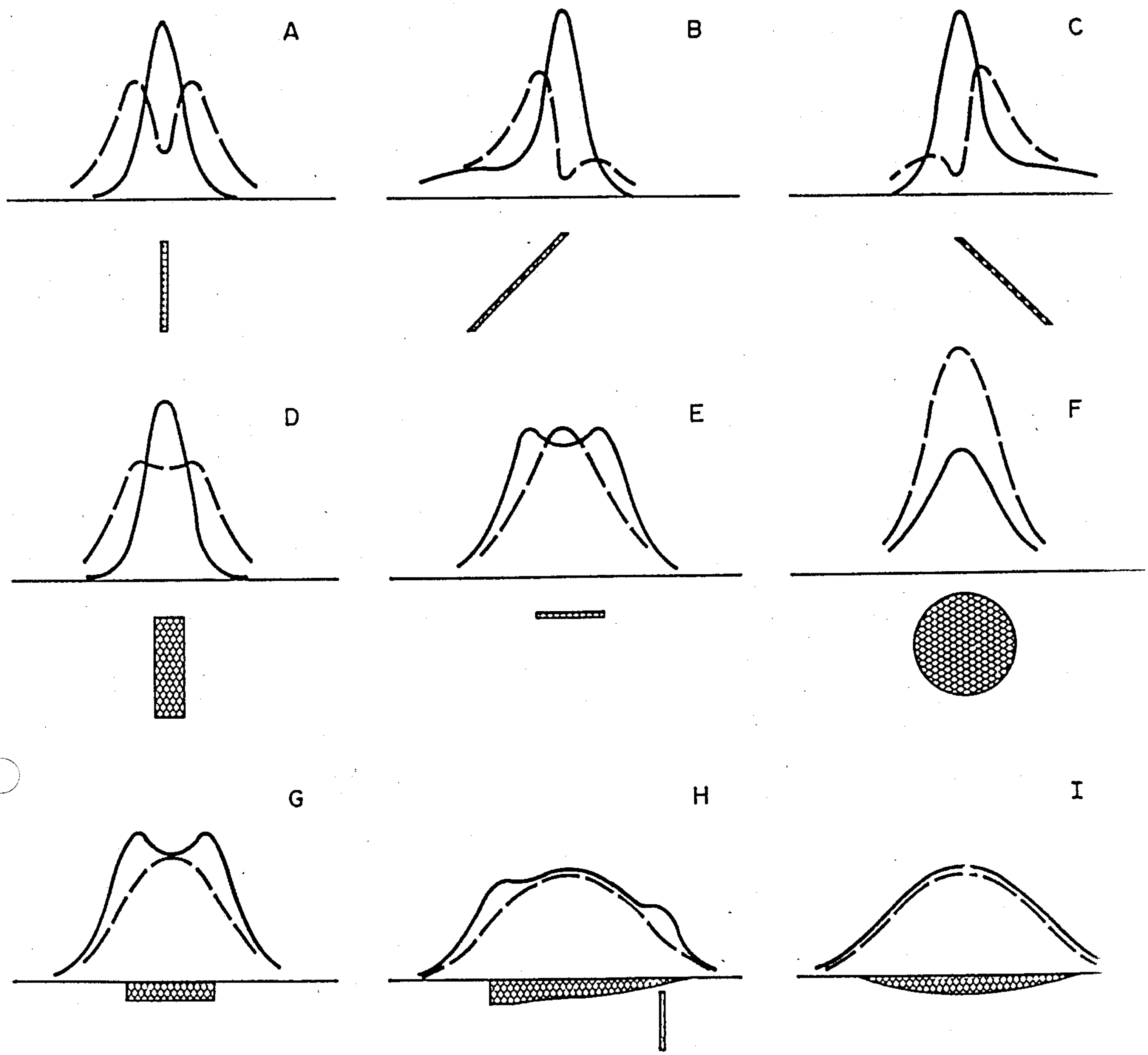
Geometrical information about the geologic conductor can often be interpreted from the profile shape of the anomaly. The change in shape is primarily related to the change in inductive coupling among the transmitter, the target, and the receiver. The accompanying figure shows a selection of HEM response 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

——— COAXIAL vertical scale 1 ppm/unit
— — — COPLANAR vertical scale 4 ppm/unit



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.

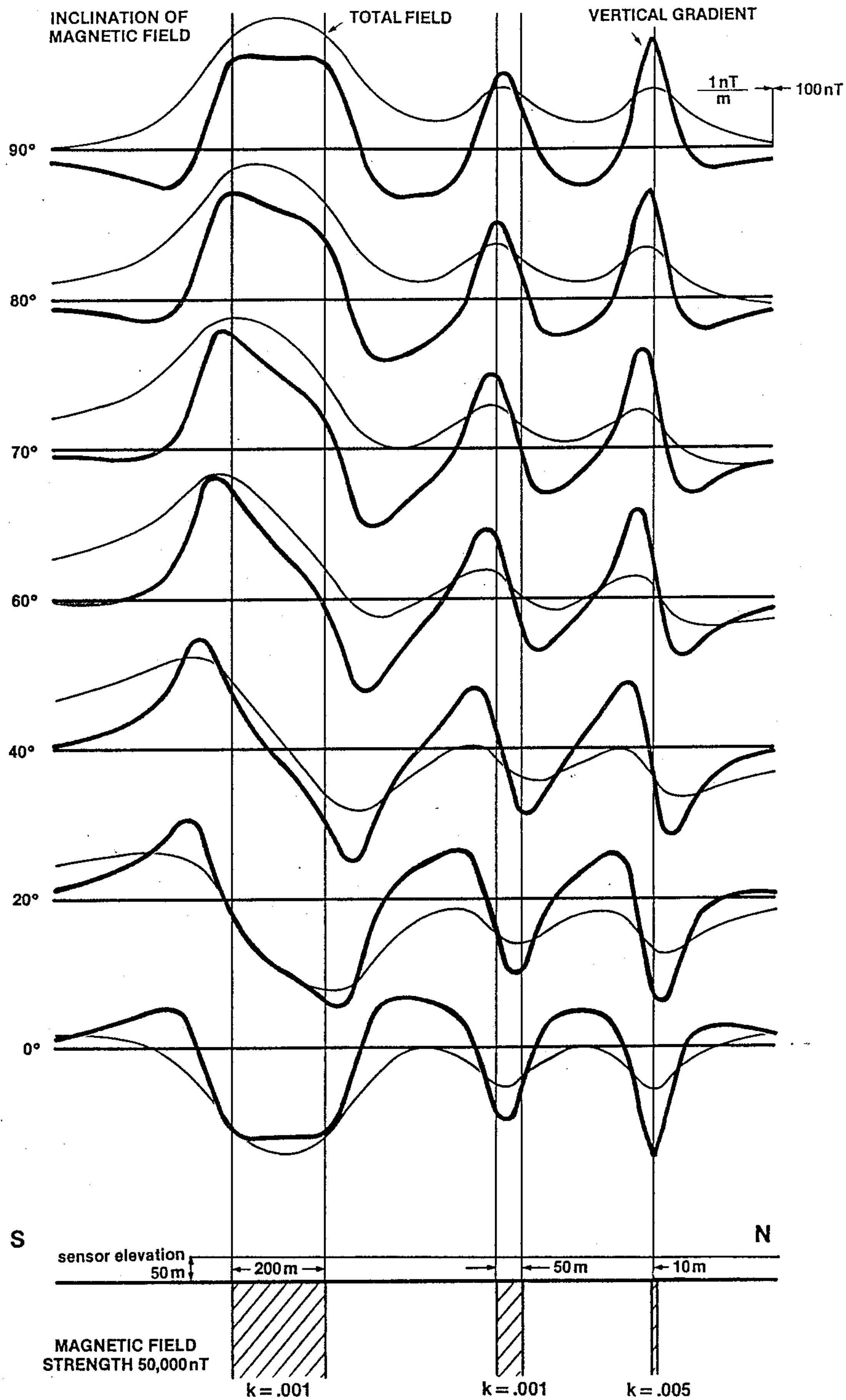
Theoretical profiles of total field and vertical gradient anomalies from tabular sources at a variety of magnetic inclinations are shown in the attached figure. Sources are 10, 50 and 200 m wide. The source-sensor separation is 50 m. The thin line is the total field profile. The thick line is the vertical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

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

J9137

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
2	10090	A MAGN	0	4.1	12.9	0.1	0	40
2	10090	B MAGN	0	2.6	11.4	0.0	0	36
2	10100	A MAGN	0	2.5	9.8	0.0	0	43
2	10100	B MAGN	0	3.8	12.6	0.1	0	34
2	10110	A MAGN	0	6.4	15.2	0.2	1	34
2	10110	B MAGN	0	4.0	17.0	0.0	2	26
2	10120	A MAGN	0	4.4	16.8	0.1	0	29
2	10130	A MAGN	0	3.5	13.6	0.0	0	32
2	10140	A MAGN	0	6.0	17.2	0.1	0	34
2	10190	A MAGN	0	4.6	14.2	0.1	7	26
2	10200	A MAGN	0	6.6	10.8	0.4	5	37
2	10210	A MAGN	0	4.3	9.8	0.2	0	42
2	10210	B MAGN	0	6.4	13.1	0.3	0	41
3	10221	A MAGN	0	3.8	5.7	0.3	9	46
3	10230	A MAGN	0	2.0	9.2	0.0	4	30
3	10240	A MAGN	0	3.3	8.2	0.1	16	27
5	10251	A MAGN	0	4.4	11.6	0.1	0	45
3	10270	A MAGN	0	2.0	4.9	0.1	10	41
3	10270	B MAGN	0	4.1	6.3	0.3	26	27
3	10270	C MAGN	0	2.6	5.7	0.1	15	35
3	10280	A MAGN	0	1.3	4.7	0.0	10	36
3	10280	B MAGN	0	4.8	9.1	0.3	13	31
3	10290	A MAGN	0	2.1	9.6	0.0	2	31
3	10290	B MAGN	0	4.3	6.7	0.3	16	36
3	10300	A MAGN	0	2.6	10.5	0.0	20	14
3	10320	A MAGN	0	1.0	11.9	0.0	0	34
4	10331	A	0	-4.9	1.9	0.0	0	28

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.

J9137

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
4	10331	B MAGN	0	8.0	19.9	0.2	0	31
4	10331	C MAGN	0	-0.9	13.2	0.0	0	28
4	10340	A	1	1.2	1.8	1.0	59	23
4	10360	D	0	-5.6	2.5	0.0	0	26
9	10380	C MAGN	0	-0.5	7.1	0.0	0	30
9	10380	D MAGN	0	0.0	7.1	0.0	0	33
9	10390	A MAGN	0	0.0	5.0	0.0	0	46
10	10401	A MAGN	0	2.1	10.5	0.0	0	41
10	10401	B	0	-6.2	4.4	0.0	0	23
10	10401	C	0	-10.8	2.8	0.0	0	22
10	10401	D	0	-11.0	1.8	0.0	0	26
10	10401	E	0	-2.9	2.6	0.0	0	28
10	10401	G	0	-2.3	1.8	0.0	0	30
10	10411	A	0	-2.2	2.2	0.0	0	17
10	10411	B	0	-2.0	1.5	0.0	0	21
10	10411	E	0	-3.5	2.4	0.0	0	32
10	10422	A	0	-2.8	2.0	0.0	0	41
11	10440	A MAGN	0	2.6	13.2	0.0	0	35
11	10440	B	0	-0.1	2.1	0.0	0	28
11	10440	C	0	-13.4	2.7	0.0	0	25
11	10440	D	0	-7.7	1.7	0.0	0	18
15	10441	A	0	-4.1	0.5	0.0	0	41
15	10441	C	0	-5.2	5.0	0.0	0	36
15	10441	E	0	-49.2	6.8	0.0	0	18
11	10460	D	0	-5.0	3.6	0.0	0	30
11	10460	E MAGN	0	1.4	10.7	0.0	0	29
11	10470	B	0	-3.8	4.0	0.0	0	25
11	10470	C	0	-12.9	2.5	0.0	0	21
11	10470	D	0	-18.1	1.9	0.0	0	22
15	10461	C	0	-8.2	4.0	0.0	0	34
15	10461	D	0	-40.5	2.6	0.0	0	16
15	10461	E	0	-28.9	2.4	0.0	0	13
15	10461	F MAGN	0	0.2	7.9	0.0	0	44

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.

J9137

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
15	10471	E	0	-9.5	3.8	0.0	0	23
15	10471	F	0	-21.8	1.6	0.0	0	22
15	10471	G MAGN	0	-0.9	10.5	0.0	0	50
15	10471	H MAGN	0	-2.7	13.4	0.0	0	37
15	10481	B	0	-15.9	1.7	0.0	0	27
15	10481	C	0	-7.7	0.9	0.0	0	30
11	10480	C	0	-9.8	4.0	0.0	0	24
11	10480	D	0	-1.7	3.8	0.0	0	19
11	10500	C MAGN	0	2.4	11.9	0.0	0	32
15	10501	F	0	-3.0	1.9	0.0	0	36
17	10511	G	0	-11.4	1.9	0.0	0	36
11	10520	A	0	-18.8	0.7	0.0	0	37
11	10520	B	0	-18.1	1.5	0.0	0	30
11	10520	C	0	-18.4	1.1	0.0	0	28
11	10520	E MAGN	0	5.1	12.1	0.2	11	26
17	10524	A	0	-7.0	0.8	0.0	0	38
11	10530	B MAGN	0	5.2	11.3	0.2	1	38
21	10543	B MAGN	0	4.1	8.8	0.2	0	49
21	10543	C MAGN	0	4.4	8.2	0.3	0	49
21	10551	B MAGN	0	2.7	9.4	0.0	0	43
17	10531	J	0	-11.0	3.9	0.0	0	36
17	10542	A	0	-3.5	3.0	0.0	0	43
17	10542	C	0	-507.2	-5.5	0.0	0	9
17	10571	F	0	-12.3	3.8	0.0	0	31
18	10580	G	0	-33.3	4.1	0.0	0	20
18	10580	H	0	-32.8	3.8	0.0	0	22
21	10582	B MAGN	0	3.2	11.9	0.0	0	40
21	10595	D	0	-11.3	3.0	0.0	0	23

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.

J9137

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
6	10610	B	0	-19.9	4.6	0.0	0	22
6	10610	C	0	-28.8	6.8	0.0	0	16
18	10620	D MAGN	0	1.7	9.9	0.0	0	44
18	10630	C	0	-12.4	7.7	0.0	0	24
19	10621	A MAGN	0	3.4	9.5	0.1	8	30
19	10631	A MAGN	0	4.4	14.2	0.1	6	27
20	10642	A MAGN	0	3.3	10.5	0.1	7	29
20	10652	A MAGN	0	3.1	7.4	0.1	9	36
13	10670	A MAGN	0	3.5	10.2	0.1	0	51
13	10670	C	0	-8.9	2.9	0.0	0	28
13	10670	J	0	-4.1	3.7	0.0	0	42
13	10680	A	0	-29.2	6.5	0.0	0	47
13	10680	C	0	-64.5	2.0	0.0	0	26
13	10680	M	0	-8.9	3.6	0.0	0	59
13	10690	C	0	-6.2	3.6	0.0	0	34
13	10690	D	0	-6.0	3.5	0.0	0	34
13	10690	E	0	-3.0	1.2	0.0	0	46
13	10700	M	0	-11.7	5.4	0.0	0	29
13	10710	F	0	-33.9	2.2	0.0	0	25
13	10720	K	0	-8.0	4.9	0.0	0	28
13	10731	A	0	-15.7	5.2	0.0	0	32
13	10731	C	0	-4.3	4.5	0.0	0	28
13	10731	D	0	-4.1	3.7	0.0	0	31
13	10731	F	0	-7.7	3.6	0.0	0	28
13	10731	G	0	-14.9	2.7	0.0	0	30
13	10731	J	0	-249.3	1.0	0.0	0	42
13	10731	K	0	-74.2	2.6	0.0	0	37
13	10740	G	0	-6.1	4.0	0.0	0	27
13	10750	A	0	-6.8	2.7	0.0	0	39

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.

J9137

FLIGHT	LINE	ANOMALY	CATEGORY	AMPLITUDE (PPM) INPHASE	QUAD.	CONDUCTOR CTP MHOS	CONDUCTOR DEPTH MTRS	BIRD HEIGHT MTRS
13	10750	B	0	-8.5	2.9	0.0	0	45
13	10750	D	0	-26.1	2.8	0.0	0	29
13	10750	E	0	-14.2	3.7	0.0	0	23
13	10750	K	0	-4.2	3.9	0.0	0	40
13	10760	A	0	-10.5	1.2	0.0	0	36
13	10760	C	0	-15.4	6.4	0.0	0	98
13	10760	G	0	-10.5	2.6	0.0	0	39
13	10760	H	0	-8.2	4.4	0.0	0	26
13	10770	A	0	0.6	3.3	0.0	4	41
13	10770	B	0	-24.0	2.7	0.0	0	25
13	10780	A	0	1.8	1.8	2.4	44	43
22	10794	A	0	-0.9	3.7	0.0	0	29
22	10794	E	0	-5.3	2.3	0.0	0	34
22	10800	A	0	-0.1	3.9	0.0	0	29
8	10831	A	0	-35.0	3.3	0.0	0	16

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 BP Resources Canada Limited 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 BP Resources Canada Limited.

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

J9137
Thornhill, Ontario
August 7, 1991

APPENDIX IV

PERSONNEL

FIELD

Flown	June 1 to June 19, 1991
Pilots	Ron Mitchinson
Operators	Scott Wessler Mark Peltier Bert Simon

OFFICE

Processing	Doug Oneschuk George McDonald
Report	Ian Johnson