Report #1097-A

DIGHEM^{IV} SURVEY

FOR

BUL RIVER MINERAL CORPORATION LTD.

(R.H. STANFIELD)

STEEPLES CLAIM BLOCK

&

PORTIONS OF THE ASPEN CLAIM BLOCK

BRITISH COLUMBIA

NTS 82G/6,11,12

GEOLOGICAL BRANCH
ASSESSMENT REPORT

21,155

DIGHEM SURVEYS & PROCESSING INC.
MISSISSAUGA, ONTARIO
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SUMMARY

This report describes the logistics and results of a DIGHEM^{IV} airborne geophysical survey carried out for Bul River Mineral Corporation Ltd. over a property located at or adjacent to the Steeples Range in southeastern British Columbia. Total coverage of the survey block amounted to 1206 km. The survey was flown in two phases from December 5 to December 16, 1990, and from January 5 to January 21, 1991.

The purpose of the survey was to detect zones of conductive mineralization and to provide information that could be used to map the geology and structure of the survey area. This was accomplished by using a DIGHEM^{IV} multi-coil, multi-frequency electromagnetic system, supplemented by a high sensitivity Cesium magnetometer and a two-channel VLF receiver. The information from these sensors was processed to produce maps which display the magnetic and conductive properties of the survey area. An electronic navigation system, operating in the UHF band, ensured accurate positioning of the geophysical data with respect to the base map. Visual flight path recovery techniques were used in areas where transponder signals were blocked by topographic features.

The survey property contains anomalous features which are to be assigned priority as exploration targets. The

inferred bedrock conductors appear to warrant further investigation using appropriate surface exploration techniques. Areas of interest may be assigned priorities on the basis of supporting geophysical (e.g., resistivity), geochemical and/or geological information. After initial investigations have been carried out, it may be necessary to re-evaluate the remaining anomalies based on information acquired from the follow-up program.

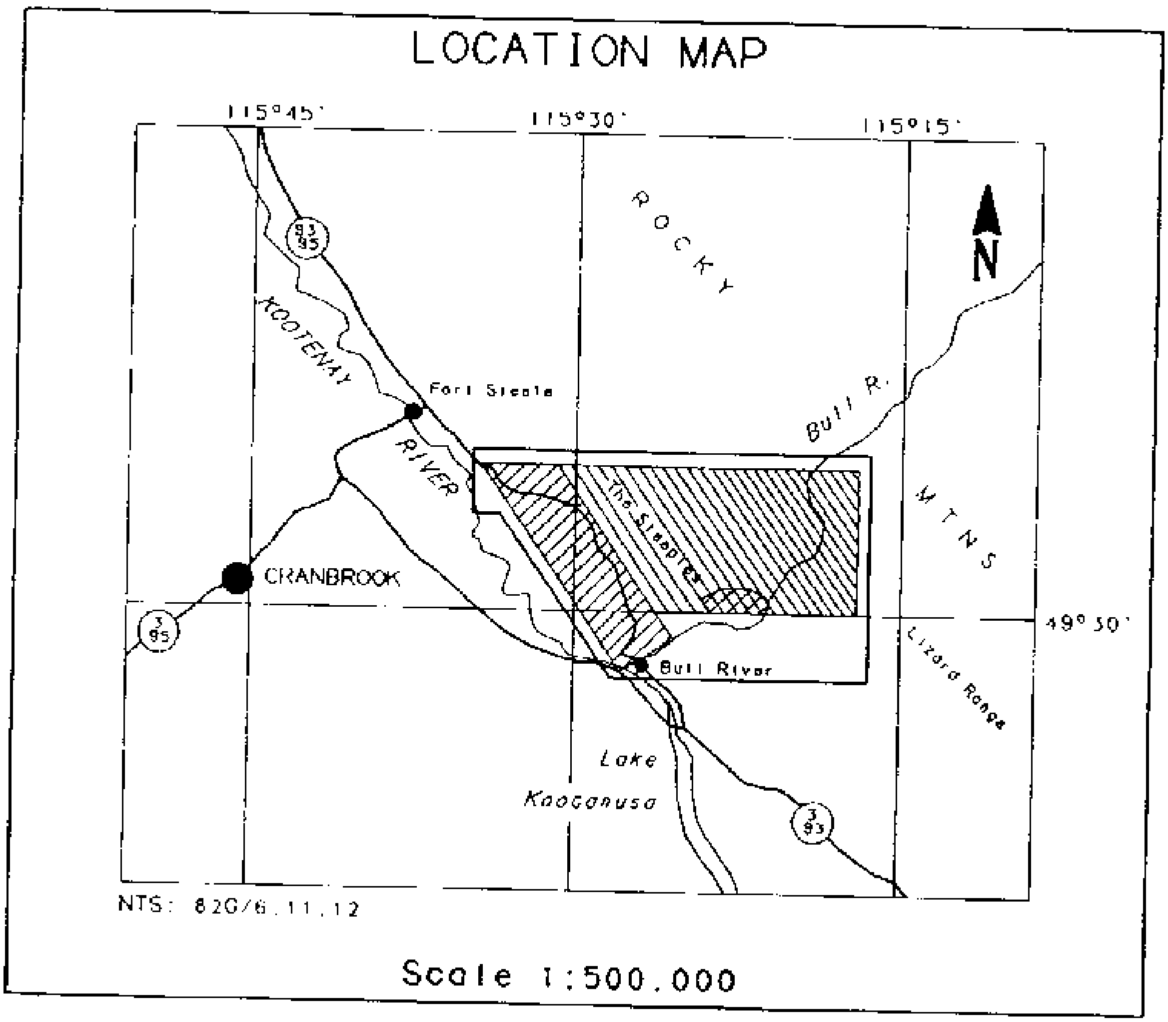

FIGURE 1

THE SURVEY AREA

CONTENTS

INTRODUCTION

A DIGHEM^{IV} electromagnetic/resistivity/magnetic/VLF survey was flown for Bul River Mineral Corporation Ltd. in two phases from December 5 to December 16, 1990, and from January 5 to January 21, 1991, over a survey block located at or adjacent to the Steeples Range in southeastern British Columbia. The survey area can be located on NTS map sheet 82G/6,11,12. (See Figure 1).

Survey coverage consisted of approximately 1206 line-km, including tie lines. Flight lines were flown in an azimuthal direction of 150°/330° for the 10000 series lines, and 60°/240° for the 30000 series lines. Both sets of lines were flown with a line separation of 200 metres.

The survey employed the DIGHEM^{IV} electromagnetic system. Ancillary equipment consisted of a magnetometer, radar altimeter, video camera, analog and digital recorders, a VLF receiver and an electronic navigation system. Details on the survey equipment are given in Section 2.

The instrumentation was installed in an Aerospatiale AS350B1 turbine helicopter (Registration PHR) which was provided by Peace Helicopters Ltd. The helicopter flew with an average EM bird height of approximately 30 m.

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

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

Due to the numerous cultural features in the survey area, any interpreted conductors which occur in close proximity to cultural sources, should be confirmed as bedrock conductors prior to drilling.

SURVEY EQUIPMENT

This section provides a brief description of the geophysical instruments used to acquire the survey data:

Electromagnetic System

Model:	DIGHEM IV
Type:	Towed bird, symmetric dipole configuration operated at a nominal survey altitude of 30 metres. Coil separation is 8 metres for 900 Hz and 7200 Hz, and 6.3 metres for the 56,000 Hz coil-pair.
Coil orientations/frequencies:	coaxial / 900 Hz coplanar/ 900 Hz coplanar/ 7,200 Hz coplanar/56,000 Hz
Channels recorded:	4 inphase channels 4 quadrature channels 3 monitor channels
Sensitivity:	0.2 ppm at 900 Hz 0.4 ppm at 7,200 Hz 1.0 ppm at 56,000 Hz
Sample rate:	10 per second

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

Magnetometer

Model: Picodas 3340

Type: Optically pumped Cesium vapour

Sensitivity: 0.01 nT

Sample rate: 10 per second

The magnetometer sensor is towed in a bird 15 m below the helicopter.

Magnetic Base Station

Model: Scintrex MP-3

Type: Digital recording proton precession

Sensitivity: 0.10 nT

Sample rate: 0.2 per second

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

VLF System

Manufacturer:	Herz Industries Ltd.
Type:	Totem-2A
Sensitivity:	0.1%
Stations:	Seattle, Washington; NLK, 24.8 kHz Annapolis, Maryland; NSS, 21.4 kHz Lualualei, Hawaii; NPM, 23.4 kHz

The VLF receiver measures the total field and vertical quadrature components of the secondary VLF field. Signals from two separate transmitters can be measured simultaneously. The VLF sensor is towed in a bird 10 m below the helicopter.

Radar Altimeter

Manufacturer:	Honeywell/Sperry
Type:	AA 220
Sensitivity:	1 ft

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

Analog Recorder

Manufacturer: RMS Instruments

Type: DGR33 dot-matrix graphics recorder

Resolution: 4x4 dots/mm

Speed: 1.5 mm/sec

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

Digital Data Acquisition System

Manufacturer: RMS Instruments

Type: DGR 33

Tape Deck: RMS TCR-12, 6400 bpi, tape cartridge recorder

The digital data were used to generate several computed parameters. Both measured and computed parameters were plotted as "multi-channel stacked profiles" during data processing. These parameters are shown in Table 2-2.

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

Table 2-1. The Analog Profiles

Channel Name	Parameter	Scale units/mm	Designation on digital profile
1X9I	coaxial inphase (900 Hz)	2.5 ppm	CXI (900 Hz)
1X9Q	coaxial quad (900 Hz)	2.5 ppm	CXQ (900 Hz)
2P9I	coplanar inphase (900 Hz)	2.5 ppm	CPI (900 Hz)
2P9Q	coplanar quad (900 Hz)	2.5 ppm	CPQ (900 Hz)
3P7I	coplanar inphase (7200 Hz)	5 ppm	CPI (7200 Hz)
3P7Q	coplanar quad (7200 Hz)	5 ppm	CPQ (7200 Hz)
4P5I	coplanar inphase(56000 Hz)	10 ppm	CPI (56 kHz)
4P5Q	coplanar quad (56000 Hz)	10 ppm	CPQ (56 kHz)
ALTR	altimeter	3 m	ALT
CMGC	magnetics, coarse	20 nT	MAG
CMGF	magnetics, fine	2.0 nT	
VF1T	VLF-total: primary stn.	2%	
VF1Q	VLF-quad: primary stn.	2%	
VF2T	VLF-total: secondary stn.	2%	
VF2Q	VLF-quad: secondary stn.	2%	
CXSP	coaxial spherics monitor		CXS
CXPL	coaxial powerline monitor		CXP
CPPL	coplanar powerline monitor		CPP

Table 2-2. The Digital Profiles

Channel Name	(Freq)	Observed parameters	Scale units/mm
MAG		magnetics	10 nT
ALT		bird height	6 m
CXI	(900 Hz)	vertical coaxial coil-pair inphase	2 ppm
CXQ	(900 Hz)	vertical coaxial coil-pair quadrature	2 ppm
CPI	(900 Hz)	horizontal coplanar coil-pair inphase	2 ppm
CPQ	(900 Hz)	horizontal coplanar coil-pair quadrature	2 ppm
CPI	(7200 Hz)	horizontal coplanar coil-pair inphase	4 ppm
CPQ	(7200 Hz)	horizontal coplanar coil-pair quadrature	4 ppm
CPI	(56 kHz)	horizontal coplanar coil-pair inphase	10 ppm
CPQ	(56 kHz)	horizontal coplanar coil-pair quadrature	10 ppm
CXS		coaxial spherics monitor	
CXP		coaxial powerline monitor	
CPS		coplanar spherics monitor	
CPP		coplanar powerline monitor	
		Computed Parameters	
DFI	(900 Hz)	difference function inphase from CXI and CPI	2 ppm
DFQ	(900 Hz)	difference function quadrature from CXQ and CPQ	2 ppm
RES	(900 Hz)	log resistivity	.06 decade
RES	(7200 Hz)	log resistivity	.06 decade
RES	(56 kHz)	log resistivity	.06 decade
DP	(900 Hz)	apparent depth	6 m
DP	(7200 Hz)	apparent depth	6 m
DP	(56 kHz)	apparent depth	6 m
CDT		conductance	1 grade

Tracking Camera

Type: Panasonic Video

Model: AG 2400/WVCD132

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

Navigation System

Model: Del Norte 547

Type: UHF electronic positioning system

Sensitivity: 1 m

Sample rate: 2 per second

The navigation system uses ground based transponder stations which transmit distance information back to the helicopter. The ground stations are set up well away from the survey area and are positioned such that the signals cross the survey block at an angle between 30° and 150°. The onboard Central Processing Unit takes any two transponder distances and determines the helicopter position relative to these two ground stations in cartesian coordinates.

The cartesian coordinates are transformed to UTM coordinates during data processing. This is accomplished by correlating a number of prominent topographical locations with the navigational data points. The use of numerous visual tie points serves two purposes: to accurately relate the navigation data to the map sheet and to minimize location errors which might result from distortions in uncontrolled photomosaic base maps.

PRODUCTS AND PROCESSING TECHNIQUES

The following products are available from the survey data. Those which are not part of the survey contract may be acquired later. Refer to Table 3-1 for a summary of the maps which accompany this report, some of which may be sent under separate cover. Most parameters can be displayed as contours, profiles, or in colour.

Base Maps

A base map of the survey area has been produced from published topographic maps. This provides a relatively accurate, distortion-free base which facilitates correlation of the navigation data to the UTM grid. Photomosaics are useful for visual reference and for subsequent flight path recovery, but usually contain scale distortions. Orthophotos are ideal, but their cost and the time required to produce them, usually precludes their use as base maps.

Electromagnetic Anomalies

Anomalous electromagnetic responses are selected and analysed by computer to provide a preliminary electromagnetic anomaly map. This preliminary map is used, by the

Table 3-1 Plots Available from the Survey

MAP PRODUCT	NO. OF SHEETS	ANOMALY MAP	PROFILES ON MAP	CONTOURS		SHADOW MAP
				INK	COLOUR	
Electromagnetic Anomalies	1	20,000	N/A	N/A	N/A	N/A
Resistivity (900 Hz)	1	N/A	-	20,000	20,000	-
Resistivity (7,200 Hz)	1	N/A	-	20,000	20,000	-
Resistivity (56,000 Hz)	1	N/A	-	20,000	20,000	-
Total Field Magnetics	1	N/A	-	20,000	20,000	20,000
Filtered Total Field VLF	1	N/A	-	20,000	-	-
Multi-channel stacked profiles		Worksheet profiles				20,000
		Interpreted profiles				-

N/A Not available
- Not required under terms of the survey contract
* Recommended
20,000 Scale of delivered map, i.e, 1:20,000

Notes:

- Inked contour maps are provided on transparent media and show flight lines, EM anomalies and suitable registration.

geophysicist, in conjunction with the computer-generated digital profiles, to produce the final interpreted EM anomaly map. This map includes bedrock, surficial and cultural conductors. A map containing only bedrock conductors can be generated, if desired.

Resistivity

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

Total Field Magnetics

The aeromagnetic data are corrected for diurnal variation using the magnetic base station data. The regional IGRF can be removed from the data, if requested.

VLF

The VLF data are digitally filtered to remove long wavelengths such as those caused by variations in the transmitted field strength.

Multi-channel Stacked Profiles

Distance-based profiles of the digitally recorded geophysical data are generated and plotted by computer. These profiles also contain the calculated parameters which are used in the interpretation process. These are produced as worksheets prior to interpretation. The profiles display electromagnetic anomalies with their respective interpretive symbols.

Contour, Colour and Shadow Map Displays

The geophysical data are interpolated onto a regular grid using a modified Akima spline technique. The resulting grid is suitable for generating contour maps of excellent quality.

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

SURVEY RESULTS

GENERAL DISCUSSION

The survey results are presented on one map sheet for each parameter at a scale of 1:20,000. Tables 4-1 and 4-2 summarize the EM responses in the survey area, with respect to conductance grade and interpretation.

The anomalies shown on the electromagnetic anomaly map are based on a near-vertical, half plane model. This model best reflects "discrete" bedrock conductors. Wide bedrock conductors or flat-lying conductive units, whether from surficial or bedrock sources, may give rise to very broad anomalous responses on the EM profiles. These may not appear on the electromagnetic anomaly map if they have a regional character rather than a locally anomalous character. These broad conductors, which more closely approximate a half space model, will be maximum coupled to the horizontal (coplanar) coil-pair and should be more evident on the resistivity parameter. Resistivity maps, therefore, may be more valuable than the electromagnetic anomaly map, in areas where broad or flat-lying conductors are considered to be of importance. Contoured resistivity maps, based on the 900 Hz, 7200 Hz and 56,000 Hz coplanar data are included with this report.

TABLE 4-1

EM ANOMALY STATISTICS

STEEPLES BLOCK

CONDUCTOR GRADE	CONDUCTANCE RANGE SIEMENS (MHOS)	NUMBER OF RESPONSES
7	> 100	0
6	50 - 100	2
5	20 - 50	5
4	10 - 20	9
3	5 - 10	16
2	1 - 5	31
1	< 1	19
*	INDETERMINATE	54
TOTAL		136

CONDUCTOR MODEL	MOST LIKELY SOURCE	NUMBER OF RESPONSES
B	DISCRETE BEDROCK CONDUCTOR	18
S	CONDUCTIVE COVER	47
H	ROCK UNIT OR THICK COVER	5
L	CULTURE	66
TOTAL		136

(SEE EM MAP LEGEND FOR EXPLANATIONS)

TABLE 4-2

EM ANOMALY STATISTICS

VALLEY BLOCK

CONDUCTOR GRADE	CONDUCTANCE RANGE SIEMENS (MHOS)	NUMBER OF RESPONSES
7	> 100	0
6	50 - 100	0
5	20 - 50	11
4	10 - 20	15
3	5 - 10	31
2	1 - 5	113
1	< 1	21
*	INDETERMINATE	95
TOTAL		286

CONDUCTOR MODEL	MOST LIKELY SOURCE	NUMBER OF RESPONSES
D	DISCRETE BEDROCK CONDUCTOR	1
B	DISCRETE BEDROCK CONDUCTOR	8
S	CONDUCTIVE COVER	98
H	ROCK UNIT OR THICK COVER	63
L	CULTURE	116
TOTAL		286

(SEE EM MAP LEGEND FOR EXPLANATIONS)

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

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

Magnetics

A Scintrex proton precession magnetometer was operated at the survey base to record diurnal variations of the earth's magnetic field. The clock of the base station was synchronized with that of the airborne system to permit subsequent removal of diurnal drift.

The background magnetic level has been adjusted to match the International Geomagnetic Reference Field (IGRF) for the survey area. The IGRF gradient across the survey block is left intact.

The total field magnetic data have been presented as contours on the base map using a contour interval of 2 nT where gradients permit. The map shows the magnetic properties of the rock units underlying the survey area.

The total field magnetic data have been subjected to a processing algorithm to produce a vertical gradient magnetic map. This procedure enhances near-surface magnetic units and suppresses regional gradients. It also provides better definition and resolution of magnetic units and displays weak magnetic features which may not be clearly evident on the total field map. A map of the second vertical magnetic derivative can also be prepared from existing survey data, if requested.

The magnetic contour map of the survey area displays generally low gradient magnetics. Magnetic values gradually increase from west to east, from less than 57,760 nT in the northwest corner of the survey block to over 57,880 nT in the northeast corner. There are several magnetic features within the survey area which are 50 to 100 nT above background. Many of these trends appear to be quite complex. These structural complexities are evident as variations in magnetic intensity, irregular patterns, and as offsets or changes in strike direction.

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

VLF

VLF results were obtained from the transmitting stations at Lualualei, Hawaii (NPM, 23.4 kHz), Seattle, Washington (NLK - 24.8 kHz) and Annapolis, Maryland (NSS - 21.4 kHz). The VLF map shows the contoured results of the filtered total field from Annapolis for most of the area. When Annapolis was not transmitting, signals from Seattle were used to fill in the gaps from line 10150 to line 10380, and line 30280 to line 30500, and from Lualualei between lines 10390 and 10420.

The VLF method is quite sensitive to the angle of coupling between the conductor and the propogated EM field. Consequently, conductors which strike towards the VLF station will usually yield a stronger response than conductors which are nearly orthogonal to it. In general, the VLF trends are weak and poorly defined.

The VLF parameter does not normally provide the same degree of resolution available from the EM data. Closely-spaced conductors, conductors of short strike length or conductors which are poorly coupled to the VLF field, may escape detection with this method. Erratic signals from the VLF transmitters can also give rise to strong, isolated anomalies which should be viewed with caution. The filtered total field VLF contours are presented on the base map with a contour interval of one percent.

Resistivity

Resistivity maps, which display the conductive properties of the survey area, were produced from the 900 Hz, 7200 Hz and 56,000 Hz coplanar data. In general, the resistivity patterns show good agreement with topographic features. Some topographic features, however, may be structurally controlled. The 1000 ohm-metre contour defines the limit of a conductive zone in the western portion of the survey area. This conductive zone is associated with an area of low topography. The resistivity contrast, approximately defined by the 1000 ohm-metre contour, is coincident with the change from relatively low topography west of the contrast, to the mountainous topography of the Steeples area to the east. This resistivity contrast may also be coincident with the contact between conductive material associated with the Rocky Mountain Trench and more resistive rock units to the east. Within this conductive zone associated with the Rocky Mountain Trench, a resistive zone is situated over the western ends of lines 30080 through 30200. This resistive zone is associated with a topographic high.

A complex, highly conductive zone is situated where the two sets of flight lines overlap, over the east ends of lines 30010 through 30120 and the south ends of lines 10200 through 10340. Several probable bedrock anomalies are associated with this zone.

The central portion of the survey block is relatively resistive, and exhibits resistivities of over 6000 ohm-metres on the 7200 Hz resistivity map. To the east of line 10380, in the eastern portion of the survey block, several moderately conductive zones are evident.

One resistivity low extends over lines 10490 through 10700. Its approximate limit is defined by the 1000 ohm-metre contour on the 7200 Hz resistivity map. It shows good correlation with the Bull River and Dibble Creek systems. Lower resistivities are exhibited by the resistivity maps calculated from the higher frequencies, which suggests that this resistivity low has a surficial source.

A possible linear structural feature is evident on the 7200 Hz resistivity map. It extends east-southeast from the north end of lines 10321 to fiducial 5580 on line 10570. This may be part of the Dibble fault. This possible structural break is also visible on the total field magnetic map.

Electromagnetics

The EM anomalies resulting from this survey appear to fall within one of three general categories. The first type consists of possible bedrock anomalies which yield inflections on the difference channels. These anomalies are generally given a "B", or "B?" interpretive symbol, denoting a bedrock source.

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

The third class consists of cultural anomalies which are usually given the symbol "L" or "L?"

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

It is recommended that an attempt be made to compile a suite of geophysical "signatures" over areas of interest. Anomaly characteristics are clearly defined on the computer-processed geophysical data profiles which are supplied as one of the survey products.

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

CONDUCTORS IN THE SURVEY AREA

The electromagnetic anomaly map shows the anomaly locations with the interpreted conductor type, dip, conductance and depth being indicated by symbols. Direct magnetic correlation is also shown if it exists. The strike direction and length of the conductors are indicated when anomalies can be correlated from line to line. When studying the map sheets, consult the anomaly listings appended to this report.

The possible bedrock anomalies interpreted from the survey data are all located south of the Bull Canyon Fault in the Aldridge Formation[1].

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1 General Geology of the Gallowai Property, A Tecteno-Stratigraphic Classification. Pilsum Master, October, 1990.

Anomalies 10290B, 10300B, 10300C, 10300D, 10311B, 10311C and 10311D

These anomalous features are situated in the vicinity of the Copper King deposit. Most reflect weak, possible bedrock sources, except 10300B and 10300C which are indicative of strong possible bedrock sources. Anomalies 10300D and 10311C are situated in close proximity to a road. Further work will have to be done to determine their causative sources.

There is no direct magnetic correlation with these anomalies. They give rise to a well-defined resistivity low.

Anomalies 10230B, 10240C, 10240D and 10260B

These anomalies are located immediately southeast of the previous group. All reflect weak, possible bedrock sources. Anomaly 10240D should be viewed with caution as it is coincident with a road, and may be a cultural response.

Anomalies 10200A, 10200B, 10200C, 10210A, 10210B, 10220A, 30040G, 30040H, 30050G, 30050H, 30050I, 30050J, 30050K and 30060J

These anomalies are situated in the vicinity of an abandoned open pit mine. They give rise to a well-defined resistivity low. Most responses are weak but moderately well-defined. Anomaly 30050I reflects a moderately weak, thin bedrock source. There is no direct correlation of this group of anomalies with the total field magnetic data.

BACKGROUND INFORMATION

This section provides background information on parameters which are available from the survey data. Those which have not been supplied as survey products may be generated later from raw data on the digital archive tape.

ELECTROMAGNETICS

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

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

The conductive earth (half space) model is suitable for broad conductors. Resistivity contour maps result from the use of this model. A later section entitled **Resistivity Mapping** describes the method further, including the effect of using it on anomalies caused by discrete conductors such as sulfide bodies.

Geometric interpretation

The geophysical interpreter attempts to determine the geometric shape and dip of the conductor. Figure 5-1 shows typical DIGHEM anomaly shapes which are used to guide the geometric interpretation.

Discrete conductor analysis

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

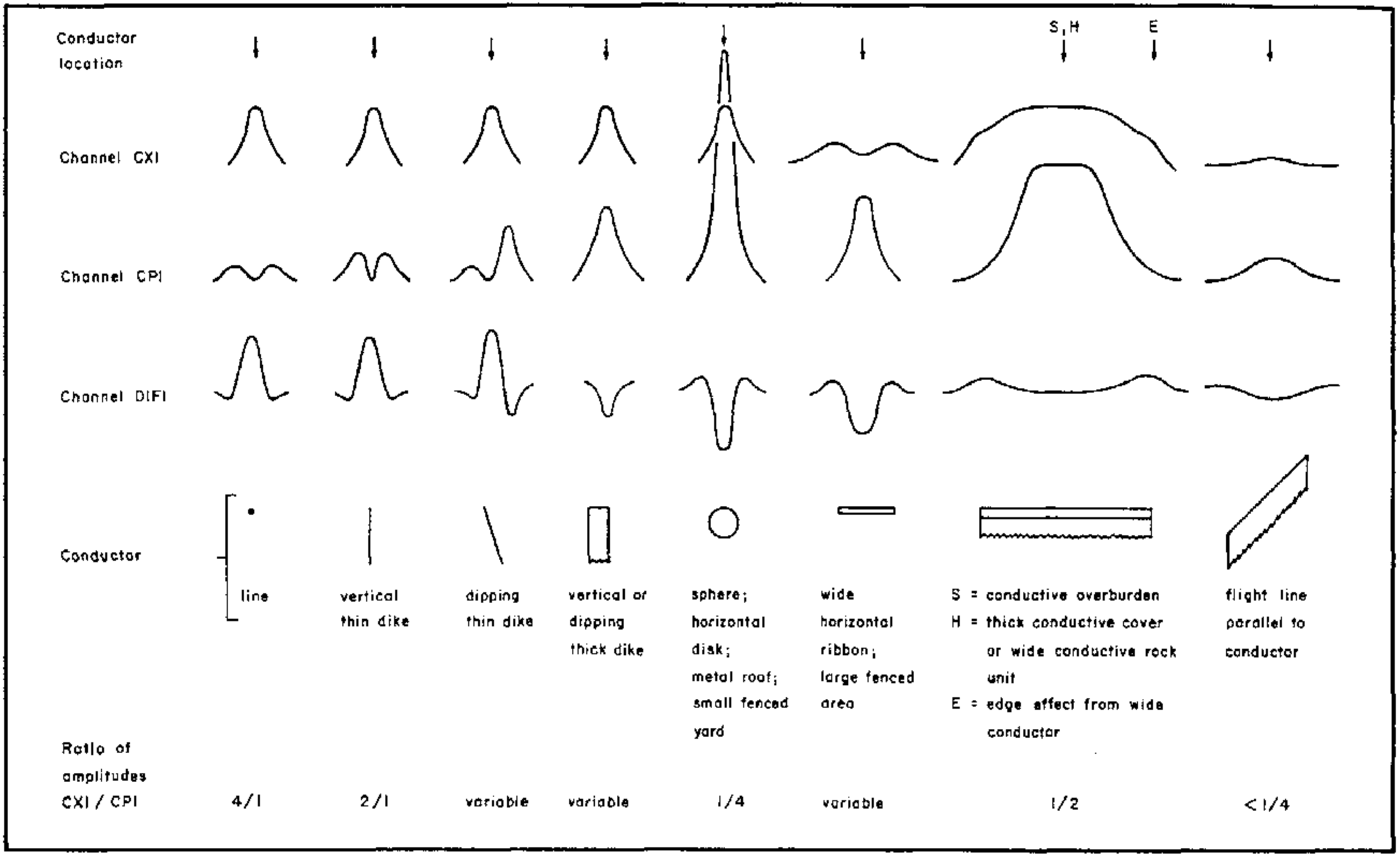

Fig. 5-1 Typical DIGHEM anomaly shapes

are divided into seven grades of conductance, as shown in Table 5-1 below. The conductance in siemens (mhos) is the reciprocal of resistance in ohms.

Table 5-1. EM Anomaly Grades

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

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

Conductive overburden generally produces broad EM responses which may not be shown as anomalies on the EM maps. However, patchy conductive overburden in otherwise resistive areas can yield discrete anomalies with a conductance grade (cf. Table 5-1) of 1, 2 or even 3 for conducting clays which have resistivities as low as 50 ohm-m. In areas where ground resistivities are below 10 ohm-m, anomalies caused by weathering variations and similar causes can have any conductance grade. The anomaly shapes from the multiple coils often allow such conductors to be recognized, and these are indicated by the letters S, H, and sometimes E on the electromagnetic anomaly map (see EM map legend).

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

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

The presence of sphalerite or gangue can result in ore deposits having weak to moderate conductances. As an example, the three million ton lead-zinc deposit of Restigouche Mining Corporation near Bathurst, Canada, yielded a well-defined grade 2 conductor. The 10 percent by volume of sphalerite occurs as a coating around the fine grained massive pyrite, thereby inhibiting electrical conduction.

Faults, fractures and shear zones may produce anomalies which typically have low conductances (e.g., grades 1 to 3). Conductive rock formations can yield anomalies of any conductance grade. The conductive materials in such rock formations can be salt water, weathered products such as clays, original depositional clays, and carbonaceous material.

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

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

Flight line deviations occasionally yield cases where two anomalies, having similar conductance values but dramatically different depth estimates, occur close together on the same conductor. Such examples illustrate the reliability of the conductance measurement while showing that the depth estimate can be unreliable. There are a number of factors which can produce an error in the depth estimate, including the averaging of topographic variations by the altimeter, overlying conductive overburden, and the location and attitude of the conductor relative to the flight line. Conductor location and attitude can provide an erroneous depth estimate because the stronger part of the conductor may be deeper or to one side of the flight line, or because it has a shallow dip. A heavy tree cover can also produce errors in depth estimates. This is because the depth estimate is computed as the distance of bird from conductor, minus the altimeter reading. The altimeter can lock onto the top of a dense forest canopy. This situation yields an erroneously large depth estimate but does not affect the conductance estimate.

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

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

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

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

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

Questionable Anomalies

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

The thickness parameter

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

Resistivity mapping

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

The resistivity profiles and the resistivity contour maps present the apparent resistivity using the so-called pseudo-layer (or buried) half space model defined by Fraser (1978)[1]. This model consists of a resistive layer overlying

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

a conductive half space. The depth channels give the apparent depth below surface of the conductive material. The apparent depth is simply the apparent thickness of the overlying resistive layer. The apparent depth (or thickness) parameter will be positive when the upper layer is more resistive than the underlying material, in which case the apparent depth may be quite close to the true depth.

The apparent depth will be negative when the upper layer is more conductive than the underlying material, and will be zero when a homogeneous half space exists. The apparent depth parameter must be interpreted cautiously because it will contain any errors which may exist in the measured altitude of the EM bird (e.g., as caused by a dense tree cover). The inputs to the resistivity algorithm are the inphase and quadrature components of the coplanar coil-pair. The outputs are the apparent resistivity of the conductive half space (the source) and the sensor-source distance. The flying height is not an input variable, and the output resistivity and sensor-source distance are independent of the flying height. The apparent depth, discussed above, is simply the sensor-source distance minus the measured altitude or flying height. Consequently, errors in the measured altitude will affect the apparent depth parameter but not the apparent resistivity parameter.

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

The resistivity map often yields more useful information on conductivity distributions than the EM map. In comparing the EM and resistivity maps, keep in mind the following:

(a) The resistivity map portrays the absolute value of the earth's resistivity, where resistivity = 1/conductivity.

(b) The EM map portrays anomalies in the earth's resistivity. An anomaly by definition is a change from the norm and so the EM map displays anomalies, (i) over narrow, conductive bodies and (ii) over the boundary zone between two wide formations of differing conductivity.

The resistivity map might be likened to a total field map and the EM map to a horizontal gradient in the direction of flight[2]. Because gradient maps are usually more sensitive than total field maps, the EM map therefore is to be preferred in resistive areas. However, in conductive areas, the absolute character of the resistivity map usually causes it to be more useful than the EM map.

Interpretation in conductive environments

Environments having background resistivities below 30 ohm-m cause all airborne EM systems to yield very large responses from the conductive ground. This usually prohibits the recognition of discrete bedrock conductors. However, DIGHEM data processing techniques produce three parameters which contribute significantly to the recognition of bedrock conductors. These are the inphase and quadrature difference channels (DIFI and DIFQ), and the resistivity and depth channels (RES and DP) for each coplanar frequency.

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2 The gradient analogy is only valid with regard to the identification of anomalous locations.

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

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

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

Reduction of geologic noise

Geologic noise refers to unwanted geophysical responses. For purposes of airborne EM surveying, geologic noise refers to EM responses caused by conductive overburden and magnetic permeability. It was mentioned previously that the EM difference channels (i.e., channel DIFI for inphase and DIFQ for quadrature) tend to eliminate the response of conductive overburden. This marked a unique development in airborne EM technology, as DIGHEM is the only EM system which yields channels having an exceptionally high degree of immunity to conductive overburden.

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

EM magnetite mapping

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

A magnetite mapping technique was developed for the coplanar coil-pair of DIGHEM. The technique yields a channel (designated FEO) which displays apparent weight percent magnetite according to a homogeneous half space model.[3] The method can be complementary to magnetometer mapping in certain cases. Compared to magnetometry, it is far less sensitive but is more able to resolve closely spaced magnetite zones, as well as providing an estimate of the amount of magnetite in the rock. The method is sensitive to 1/4% magnetite by weight when the EM sensor is at a height of 30 m above a magnetitic half space. It can individually resolve steep dipping narrow magnetite-rich bands which are

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[3] Refer to Fraser, 1981, Magnetite mapping with a multi-coil airborne electromagnetic system: Geophysics, v. 46, p. 1579-1594.

separated by 60 m. Unlike magnetometry, the EM magnetite method is unaffected by remanent magnetism or magnetic latitude.

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

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

Recognition of culture

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

1. Channel CPS monitors 60 Hz radiation. An anomaly on this channel shows that the conductor is radiating power. Such an indication is normally a guarantee that the conductor is cultural. However, care must be taken to ensure that the conductor is not a geologic body which strikes across a power line, carrying leakage currents.

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

3. A flight which crosses a sphere or horizontal disk yields center-peaked coaxial and coplanar anomalies with a CXI/CPI amplitude ratio (i.e., coaxial/coplanar) of

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[4] See Figure 5-1 presented earlier.

1/4. In the absence of geologic bodies of this geometry, the most likely conductor is a metal roof or small fenced yard.[5] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

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

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

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

geologic conductor coincided with the cultural line.

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

MAGNETICS

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

The magnetometer data are digitally recorded in the aircraft to an accuracy of one nT (i.e., one gamma) for proton magnetometers, and 0.01 nT for cesium magnetometers. The digital tape is processed by computer to yield a total field magnetic contour map. When warranted, the magnetic data may also be treated mathematically to enhance the magnetic response of the near-surface geology, and an enhanced magnetic contour map is then produced. The response of the enhancement operator in the frequency domain is illustrated in Figure 5-2. This figure shows that the passband components of the airborne data are amplified 20 times by the enhancement operator. This means, for example, that a 100 nT anomaly on the enhanced map reflects a 5 nT anomaly for the passband components of the airborne data.

The enhanced map, which bears a resemblance to a downward continuation map, is produced by the digital bandpass filtering of the total field data. The enhancement is equivalent to continuing the field downward to a level (above the source) which is 1/20th of the actual sensor-source distance.

Because the enhanced magnetic map bears a resemblance to a ground magnetic map, it simplifies the recognition of trends in the rock strata and the interpretation of geological structure. It defines the near-surface local

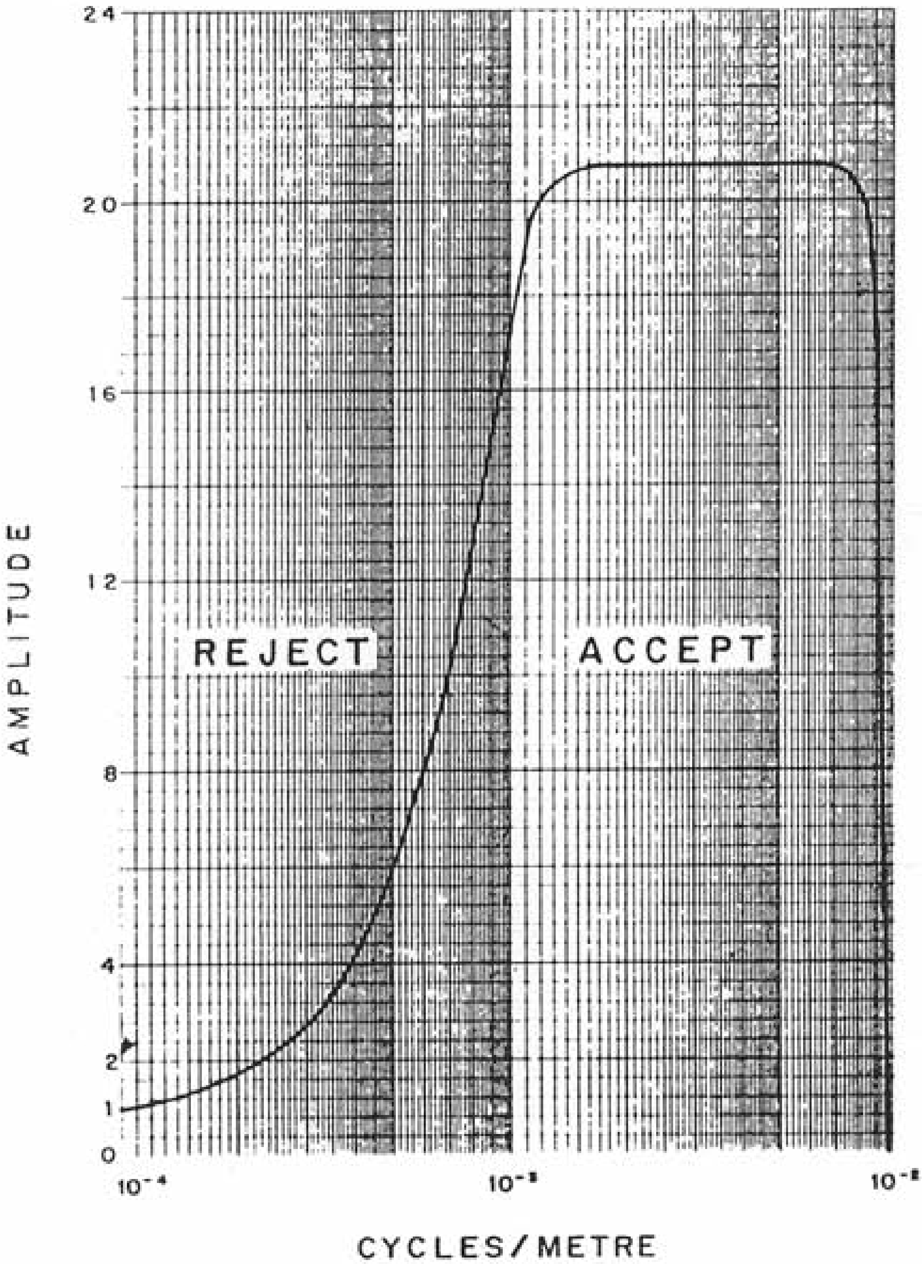

Fig. 5-2 Frequency response of magnetic enhancement operator.

geology while de-emphasizing deep-seated regional features. It primarily has application when the magnetic rock units are steeply dipping and the earth's field dips in excess of 60 degrees.

Any of a number of filter operators may be applied to the magnetic data, to yield vertical derivatives, continuations, magnetic susceptibility, etc. These may be displayed in contour, colour or shadow.

VLF

VLF transmitters produce high frequency uniform electromagnetic fields. However, VLF anomalies are not EM anomalies in the conventional sense. EM anomalies primarily reflect eddy currents flowing in conductors which have been energized inductively by the primary field. In contrast, VLF anomalies primarily reflect current gathering, which is a non-inductive phenomenon. The primary field sets up currents which flow weakly in rock and overburden, and these tend to collect in low resistivity zones. Such zones may be due to massive sulfides, shears, river valleys and even unconformities.

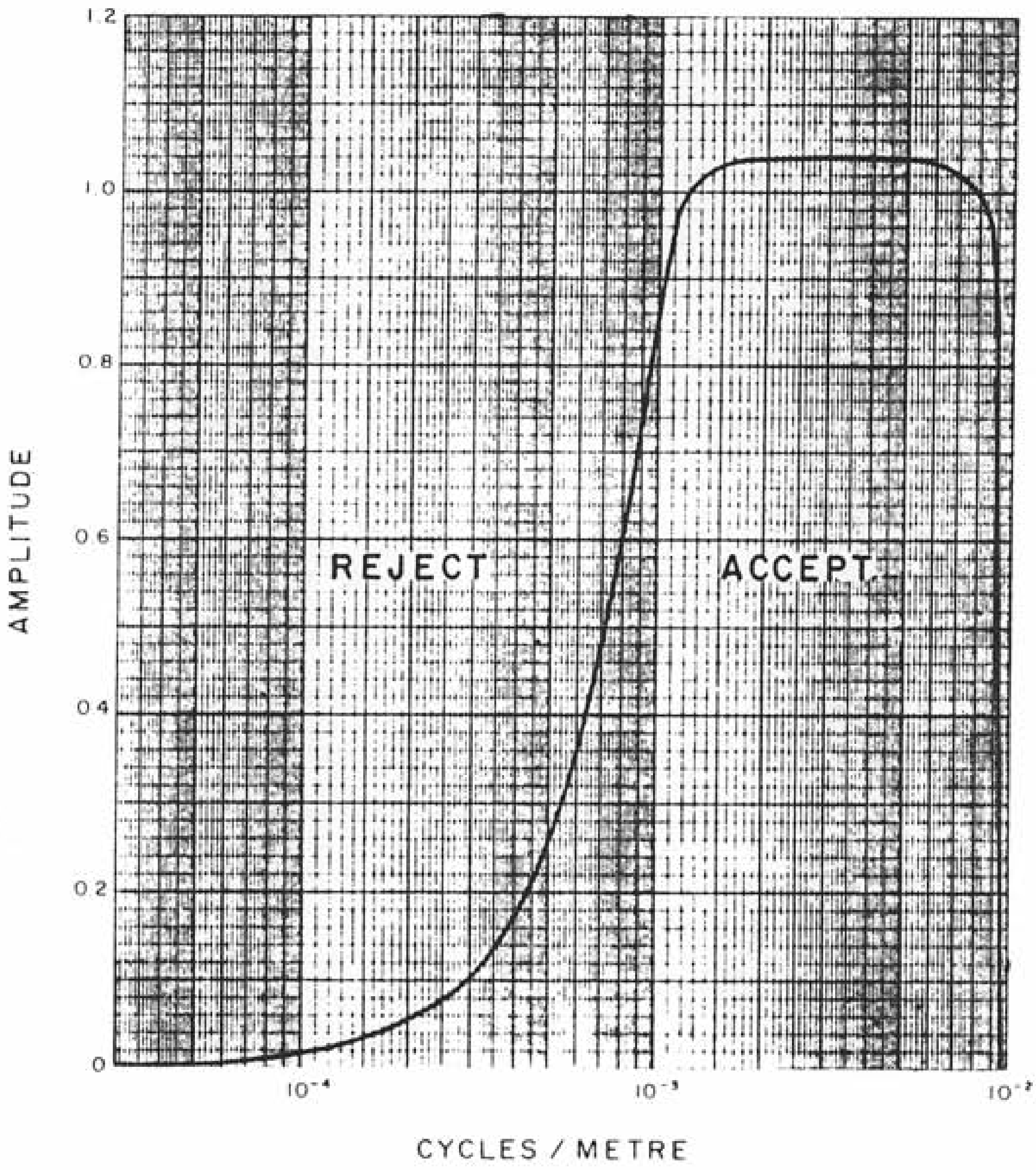

Fig. 5-3 Frequency response of VLF operator.

The VLF field is horizontal. Because of this, the method is quite sensitive to the angle of coupling between the conductor and the transmitted VLF field. Conductors which strike towards the VLF station will usually yield a stronger response than conductors which are nearly orthogonal to it.

The Herz Industries Ltd. Totem VLF-electromagnetometer measures the total field and vertical quadrature components. Both of these components are digitally recorded in the aircraft with a sensitivity of 0.1 percent. The total field yields peaks over VLF current concentrations whereas the quadrature component tends to yield crossovers. Both appear as traces on the profile records. The total field data are filtered digitally and displayed as contours to facilitate the recognition of trends in the rock strata and the interpretation of geologic structure.

The response of the VLF total field filter operator in the frequency domain (Figure 5-3) is basically similar to that used to produce the enhanced magnetic map (Figure 5-2). The two filters are identical along the abscissa but different along the ordinant. The VLF filter removes long wavelengths such as those which reflect regional and wave transmission variations. The filter sharpens short wavelength responses such as those which reflect local geological variations.

CONCLUSIONS AND RECOMMENDATIONS

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

The survey was successful in locating a few moderately weak or broad conductors which may warrant additional work. The various maps included with this report display the magnetic and conductive properties of the survey area. It is recommended that the survey results be reviewed in detail, in conjunction with all available geophysical, geological and geochemical information. Particular reference should be made to the computer generated data profiles which clearly define the characteristics of the individual anomalies.

The interpreted bedrock conductors defined by the survey should be subjected to further investigation, using appropriate surface exploration techniques. Anomalies which are currently considered to be of moderately low priority may require upgrading if follow-up results are favourable.

It is also recommended that image processing of existing geophysical data be considered, in order to extract the maximum amount of information from the survey results. Current software and imaging techniques often provide valuable information on structure and lithology, which may not be clearly evident on the contour and colour maps. These techniques can yield images which define subtle, but significant, structural details.

Respectfully submitted,

DIGHEM SURVEYS & PROCESSING INC.

R. Pritchard

Ruth A. Pritchard
Geophysicist

RAP/sdp

A1097FEB.92R

APPENDIX A

LIST OF PERSONNEL

The following personnel were involved in the acquisition, processing, interpretation and presentation of data, relating to a DIGHEM^{IV} airborne geophysical survey carried out for Bul River Mineral Corporation Ltd., in the Steeples area, British Columbia.

Steve Kilty	Vice President, Operations
Robert Gordon	Survey Operations Supervisor
Steve Haney	Senior Geophysical Operator
Del Rokosh	Pilot (Peace Helicopters Ltd.)
Gordon Smith	Data Processing Supervisor
Ruth A. Pritchard	Interpretation Geophysicist
Reinhard Zimmermann	Drafting Supervisor
Lyn Vanderstarren	Draftsperson (CAD)
Susan Pothiah	Word Processing Operator
Albina Tonello	Secretary/Expeditor

The survey consisted of 1206 km of coverage, flown from December 5 to December 16, 1990, and from January 5 to January 21, 1991. The survey data were processed and interpreted from December 12, 1990 to March 12, 1991.

All personnel are employees of Dighem Surveys & Processing Inc., except for the pilot who is an employee of Peace Helicopters Ltd.

DIGHEM SURVEYS & PROCESSING INC.

R. Pritchard

Ruth A. Pritchard
Geophysicist

RAP/sdp

Ref: Report #1097

A1097FEB.92R

APPENDIX B

STATEMENT OF COST

Date: February 25, 1991

IN ACCOUNT WITH
DIGHEM SURVEYS & PROCESSING INC.

To: Dighem flying of Agreement dated November 9, 1990, pertaining to an Airborne Geophysical Survey in the Steeples area, British Columbia.

Survey Charges

Mobilization/demobilization	$ 6,000.00
Navigation setup	$ 3,000.00
1206 km of flying @ $126.00/km	$151,956.00
Helicopter charges for weather check flights	$ 960.50
	$161,916.50

Allocation of Costs

- Data Acquisition (60%)
- Data Processing (20%)
- Interpretation, Report and Maps (20%)

DIGHEM SURVEYS & PROCESSING INC.

R. Pritchard

Ruth A. Pritchard
Geophysicist

RAP/sdp

A1097FEB.92R

APPENDIX C

LIST OF CLAIMS

Work covers the following claims:

Steeples: 8, 10, 17, 18, 19, 2, 4, 6, 15, 16, 23, 24, 25, 26, 27, 28, 29, 30, 1, 3, 5, 7, 9, 21, 22, 31, 33, 35, 36, 37, 38, 39, 40, 11, 12, 13, and 14

37 claims, 20 units each.

Aspen: 11, 12, 13, 14, and 15

5 claims, 20 units each

A1097FEB.92R

APPENDIX D

STATEMENT OF QUALIFICATIONS

I, Ruth A. Pritchard of the City of Brampton, Province of Ontario, do hereby certify that:

1. I am a geophysicist, residing at 31 Barrington Crescent, Brampton, Ontario, L6Z 1N2.

2. I am a graduate of York University, Downsview, Ontario, with a Specialized Honours B.Sc. Earth Sciences - Geophysics (1986).

3. I have been actively engaged in geophysical exploration since 1986.

4. The statements made in this report represent my best opinion and judgement.

R. Pritchard

Ruth A. Pritchard
Geophysicist

A1097FEB.92R

A P P E N D I X   E

EM ANOMALY LIST

ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10010	(FLIGHT		1)										
A 896 L?	1	2	1	2	2	4	-	-	-	-	-	-	0
B 761 S	2	6	2	13	37	160	1.1	9	1	15	457	0	0
C 744 S	0	5	1	9	30	76	0.7	4	1	16	479	0	0
D 731 S?	0	2	1	2	2	4	-	-	-	-	-	-	0
E 705 S	0	2	0	2	2	4	-	-	-	-	-	-	0
F 609 S?	4	3	1	6	23	50	4.7	35	1	32	382	0	4
G 584 L	1	2	1	2	2	4	-	-	-	-	-	-	0
H 543 S?	1	3	0	3	20	22	1.0	0	1	36	157	15	0
I 512 L	32	22	0	27	4	9	8.0	0	1	0	319	0	7
LINE 10020	(FLIGHT		1)										
A 1012 L?	7	4	3	4	13	13	10.8	23	1	93	196	40	40
B 1114 L	1	12	2	8	14	19	0.9	0	1	49	234	8	4
C 1301 H	5	9	4	15	59	50	3.2	9	1	44	137	9	0
D 1304 B?	1	2	1	2	2	4	-	-	-	-	-	-	0
E 1335 L	8	10	13	28	41	12	5.3	6	1	28	106	0	5
LINE 10030	(FLIGHT		1)										
A 1778 L?	1	2	0	2	2	4	-	-	-	-	-	-	0
B 1769 L?	3	3	1	3	4	17	5.0	9	1	25	738	0	0
C 1718 S?	6	4	3	7	19	22	9.0	23	1	38	197	0	0
D 1689 L	0	2	1	2	2	4	-	-	-	-	-	-	0
E 1506 H	3	8	8	14	62	53	3.0	4	1	46	83	13	0
F 1470 L	0	6	4	5	12	10	1.5	0	1	36	107	0	0
LINE 10040	(FLIGHT		1)										
A 1846 L	7	8	1	2	10	14	6.0	14	1	137	1035	0	0
B 1907 S	0	2	1	2	2	4	-	-	-	-	-	-	8
C 1933 L	1	2	1	2	2	4	-	-	-	-	-	-	0
D 1987 S	1	2	1	2	2	4	-	-	-	-	-	-	0
E 2039 S?	1	2	0	2	2	4	-	-	-	-	-	-	4
F 2137 H	0	6	3	10	39	66	0.7	0	1	57	187	15	0
G 2161 H	0	2	1	2	2	4	-	-	-	-	-	-	0
H 2171 L	0	2	1	2	2	4	-	-	-	-	-	-	0
I 2211 S?	1	9	1	11	33	79	0.5	0	1	43	663	0	4
LINE 10050	(FLIGHT		1)										
A 2277 L	0	2	1	2	2	4	-	-	-	-	-	-	0
B 2230 S	0	6	1	12	39	101	0.5	10	1	57	731	2	0
LINE 10060	(FLIGHT		1)										
A 3234 S	1	2	1	2	2	4	-	-	-	-	-	-	4

* 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.

ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10060	(FLIGHT		1)										
B 3431 L	5	10	9	25	14	37	3.4	0	1	32	122	0	0
LINE 10070	(FLIGHT		1)										
A 3919 H	1	2	0	2	2	4	-	-	-	-	-	-	0
B 3614 L	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10080	(FLIGHT		1)										
A 4684 L	1	2	1	2	2	2	-	-	-	-	-	-	0
B 4695 S	0	2	1	2	2	4	-	-	-	-	-	-	4
C 4706 S?	2	4	1	11	28	85	1.2	7	1	52	673	0	0
LINE 10090	(FLIGHT		1)										
A 4756 L	2	6	8	16	11	19	3.0	0	1	40	100	4	0
B 4731 S?	3	6	4	10	38	77	2.7	0	1	38	293	0	6
LINE 10100	(FLIGHT		2)										
A 441 L	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10110	(FLIGHT		2)										
A 1755 L	2	3	8	12	3	11	4.3	0	1	65	139	20	0
LINE 10120	(FLIGHT		2)										
A 2075 L	1	2	1	2	2	3	-	-	-	-	-	-	0
LINE 10130	(FLIGHT		2)										
A 3474 L	2	4	7	9	5	11	4.5	0	1	59	158	12	9
LINE 10160	(FLIGHT		9)										
A 498 L	1	1	1	2	2	4	-	-	-	-	-	-	0
LINE 10180	(FLIGHT		9)										
A 2200 S?	1	2	1	2	2	4	-	-	-	-	-	-	0
B 2187 S?	1	2	1	2	2	4	-	-	-	-	-	-	9
LINE 10190	(FLIGHT		9)										
A 3911 S?	3	11	4	13	33	88	1.9	0	1	48	143	11	0
LINE 10200	(FLIGHT		9)										
A 4559 B?	3	4	7	11	28	22	5.1	23	2	63	52	31	0
B 4550 B?	3	4	23	25	54	6	7.9	5	2	82	56	46	7
C 4545 B?	1	2	1	2	2	4	-	-	-	-	-	-	0

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	COAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10210	(FLIGHT	8)											
A 3204 B?	1	10	6	18	51	58	1.6	0	1	40	145	3	5
B 3214 B?	6	13	16	23	58	41	4.9	0	1	43	91	9	0
C 3236 L	15	7	2	11	11	8	12.7	0	5	90	3	81	0
LINE 10220	(FLIGHT	8)											
A 2470 B?	1	2	1	2	2	4	-	-	-	-	-	-	5
B 2441 L	28	17	11	8	3	22	21.2	0	2	141	32	104	0
C 2426 S?	4	5	9	5	45	33	9.1	38	3	73	13	52	4
D 2403 S?	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10230	(FLIGHT	8)											
A 2340 L	27	25	6	40	7	7	7.7	0	4	127	15	97	0
B 2353 B?	1	2	1	2	2	4	-	-	-	-	-	-	0
C 2374 S?	5	5	16	17	41	20	8.7	4	3	62	15	39	3060
LINE 10240	(FLIGHT	8)											
A 1386 L	16	15	10	5	28	21	12.7	0	6	94	6	74	0
B 1379 L	17	2	4	5	5	32	78.9	0	2	109	31	74	0
C 1356 B?	4	9	11	16	38	13	4.2	2	2	94	33	63	0
D 1344 B?	3	7	5	14	33	37	3.0	1	2	104	30	72	0
E 1327 L?	31	33	42	46	104	83	12.8	9	3	64	13	44	20
LINE 10250	(FLIGHT	8)											
A 1248 L	1	1	1	2	1	1	-	-	-	-	-	-	0
B 1303 L?	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10260	(FLIGHT	8)											
A 443 L	16	19	15	3	11	1	12.7	0	1	158	35	151	0
B 409 B?	7	11	5	11	32	25	4.5	12	1	71	64	37	0
LINE 10270	(FLIGHT	7)											
A 8791 L	40	5	9	22	11	2	50.3	0	2	91	45	56	0
LINE 10280	(FLIGHT	7)											
A 7739 L	9	4	12	6	5	4	23.8	0	12	101	1	95	0
B 7669 S?	4	5	6	10	24	36	5.3	8	1	57	136	15	8
LINE 10290	(FLIGHT	7)											
A 7492 L	23	13	14	21	7	4	15.0	0	1	155	1035	0	0
B 7536 B?	8	13	19	25	51	30	6.7	0	2	29	35	2	0
LINE 10300	(FLIGHT	7)											
A 6687 L	8	25	22	24	5	2	4.9	0	10	53	1	46	0

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ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10300	(FLIGHT		7)										
B 6632 B?	10	5	22	11	41	16	23.8	12	3	84	23	56	0
C 6625 B	12	7	35	16	53	16	27.0	0	5	36	6	19	0
D 6615 B?	9	9	13	13	33	22	9.6	0	2	62	34	32	9
LINE 10311	(FLIGHT		7)										
A 6402 L	12	3	5	4	0	7	31.5	0	1	117	1035	0	0
B 6445 B?	1	2	1	2	2	4	-	-	-	-	-	-	5
C 6456 B?	1	2	1	2	2	4	-	-	-	-	-	-	6
D 6466 B?	2	10	4	11	37	62	1.6	4	1	57	699	0	0
LINE 10320	(FLIGHT		7)										
A 5515 L	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10330	(FLIGHT		7)										
A 5181 L	4	42	10	10	5	5	1.8	0	1	44	89	0	5
B 5188 L	32	38	4	4	2	1	10.1	0	1	82	1035	0	0
LINE 10340	(FLIGHT		7)										
A 4044 L	7	17	17	17	6	10	5.6	3	1	201	1035	0	4
LINE 10350	(FLIGHT		7)										
A 3415 L	1	2	1	2	1	2	-	-	-	-	-	-	0
B 3423 L	1	2	1	2	0	0	-	-	-	-	-	-	10
LINE 10370	(FLIGHT		7)										
A 1869 L	15	19	3	3	1	1	8.9	0	2	148	14	138	0
LINE 10380	(FLIGHT		7)										
A 618 L	6	18	3	18	4	4	2.4	0	1	28	1003	0	6
LINE 10390	(FLIGHT		6)										
A 4215 L	38	29	6	31	5	5	11.9	0	1	164	743	0	0
LINE 10400	(FLIGHT		6)										
A 3046 L	14	29	5	7	3	6	4.7	0	1	158	1035	0	0
LINE 10410	(FLIGHT		6)										
A 2430 L	14	6	4	10	6	7	16.0	0	1	90	99	43	0
LINE 10420	(FLIGHT		6)										
A 1424 L	5	22	16	19	23	25	3.6	0	13	97	1	91	5

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	COAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10430	(FLIGHT		5)										
A 4865 L	9	15	3	3	7	6	4.9	0	1	148	622	0	0
LINE 10450	(FLIGHT		5)										
A 3535 L	5	5	4	2	15	24	0.6	0	1	19	65	0	0
LINE 10460	(FLIGHT		5)										
A 2356 L	1	2	1	2	2	4	-	-	-	-	-	-	5
LINE 10470	(FLIGHT		5)										
A 1980 L	3	12	14	4	8	7	5.4	0	9	114	1	106	6
LINE 10480	(FLIGHT		5)										
A 1104 L	5	3	2	4	22	28	1.0	0	1	30	154	5	0
LINE 10490	(FLIGHT		4)										
A 2304 L	0	3	15	64	4	2	1.7	0	1	0	68	0	0
LINE 10500	(FLIGHT		4)										
A 990 L	1	16	19	43	8	14	2.6	0	1	0	259	0	16
LINE 10510	(FLIGHT		3)										
A 7968 L	5	9	16	61	3	12	4.0	0	1	0	248	0	0
LINE 10520	(FLIGHT		3)										
A 7410 S	1	4	1	8	24	41	0.9	0	1	14	661	0	0
B 7386 L	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10530	(FLIGHT		3)										
A 6934 S?	0	5	0	7	22	47	0.5	0	1	32	785	0	7
B 7067 S	0	6	1	10	34	61	0.5	0	1	24	629	0	0
C 7096 L	0	2	1	2	1	2	-	-	-	-	-	-	0
LINE 10540	(FLIGHT		3)										
A 6779 S?	1	2	0	2	2	4	-	-	-	-	-	-	0
B 6758 S	0	5	0	10	17	75	0.5	0	1	35	704	0	0
C 6747 S?	2	8	0	12	28	87	0.7	0	1	24	694	0	0
D 6639 S	1	4	0	9	23	47	0.5	0	1	25	722	0	0
E 6605 L	1	2	1	2	0	1	-	-	-	-	-	-	0
LINE 10550	(FLIGHT		3)										
A 6334 L	0	2	1	2	2	4	-	-	-	-	-	-	0

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LINE 10560	(FLIGHT		3)										
A 6116 S	1	4	0	7	19	44	0.5	0	1	52	850	0	0
B 6040 S	1	7	0	11	32	87	0.5	0	1	21	630	0	0
C 6004 S	0	3	1	5	18	35	0.6	0	1	17	305	0	0
D 5942 L	0	2	1	2	0	0	-	-	-	-	-	-	0
LINE 10570	(FLIGHT		3)										
A 5547 S	0	2	0	2	2	4	-	-	-	-	-	-	0
B 5594 S	0	2	0	2	2	4	-	-	-	-	-	-	4
C 5671 L	3	11	9	69	2	4	1.4	0	1	0	130	0	0
LINE 10590	(FLIGHT		3)										
A 5015 L	0	2	1	2	2	3	-	-	-	-	-	-	6
LINE 10600	(FLIGHT		3)										
A 4413 S	0	2	0	2	2	4	-	-	-	-	-	-	0
B 4401 S	1	2	1	2	2	4	-	-	-	-	-	-	0
C 4298 L	0	2	9	42	4	4	0.5	0	1	0	132	0	0
LINE 10610	(FLIGHT		3)										
A 4007 S	0	2	0	2	2	4	-	-	-	-	-	-	0
B 4076 S	0	2	0	2	2	4	-	-	-	-	-	-	30
C 4192 L	0	2	1	2	1	2	-	-	-	-	-	-	0
LINE 10630	(FLIGHT		3)										
A 2180 S	0	2	0	2	2	4	-	-	-	-	-	-	0
B 2033 S?	1	7	1	11	32	69	0.6	0	1	36	623	0	0
LINE 10640	(FLIGHT		3)										
A 1876 S	0	2	0	2	2	4	-	-	-	-	-	-	0
LINE 10660	(FLIGHT		3)										
A 1405 S	0	4	0	7	26	31	0.5	0	1	28	799	0	0
LINE 10670	(FLIGHT		3)										
A 1094 S	0	4	0	7	28	44	1.0	0	1	42	840	0	0
LINE 10680	(FLIGHT		3)										
A 947 S	0	2	1	2	2	4	-	-	-	-	-	-	4
B 1025 S?	0	4	0	7	22	45	0.5	0	1	29	552	0	0
LINE 10690	(FLIGHT		3)										
A 798 S	1	2	0	2	2	4	-	-	-	-	-	-	0

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ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 30010 (FLIGHT 4)													
A 1313 L	1	2	0	2	2	4	-	-	-	-	-	-	0
B 1354 L	1	2	1	2	2	1	-	-	-	-	-	-	0
C 1483 L	12	23	11	59	1	2	3.4	0	1	0	244	0	0
D 1496 L	9	15	12	57	5	26	3.3	0	1	9	209	0	0
E 1552 S	0	2	1	2	2	4	-	-	-	-	-	-	8
F 1587 L	0	2	9	9	15	4	4.0	0	1	30	58	0	0
G 1595 L	1	2	1	2	2	2	-	-	-	-	-	-	0
H 1609 L	8	13	16	27	4	4	5.4	0	2	0	36	0	0
I 1613 L	8	10	17	39	2	5	6.2	0	1	0	117	0	0
J 1620 L	13	6	16	15	5	5	17.7	0	1	0	376	0	0
K 1629 L	7	6	13	47	4	6	4.2	0	1	0	79	0	8
L 1636 L	7	2	17	7	19	3	30.1	0	1	10	146	0	0
LINE 30020 (FLIGHT 4)													
A 1292 L	1	2	1	2	2	4	-	-	-	-	-	-	0
B 1254 L	3	6	9	9	10	14	5.2	0	1	109	92	60	0
C 1222 S	2	3	2	5	16	19	2.4	0	1	41	589	0	0
D 1150 L	3	50	12	61	3	4	1.2	0	1	0	116	0	0
E 1143 L	6	55	0	61	2	3	4.3	0	1	0	269	0	0
F 1062 L	2	3	6	12	11	17	3.0	0	1	89	91	45	0
G 993 L	0	1	12	25	2	2	2.3	0	1	0	84	0	0
LINE 30030 (FLIGHT 4)													
A 526 L?	6	4	10	12	12	10	10.2	15	1	59	125	19	20
B 536 L	7	6	15	18	14	9	9.3	0	1	30	69	0	0
C 606 S	2	3	1	7	18	53	1.6	6	1	38	293	0	0
D 650 L	14	8	15	60	2	5	5.7	0	1	0	356	0	0
E 660 L	5	4	7	51	1	2	7.5	0	1	0	203	0	0
F 744 L	3	2	9	9	11	22	7.8	6	1	53	94	14	0
G 754 S?	1	2	1	2	2	4	-	-	-	-	-	-	80
H 811 L	1	2	1	2	2	4	-	-	-	-	-	-	0
I 824 L	8	4	12	30	3	5	6.3	0	1	26	64	0	0
J 828 L	6	10	6	31	4	7	3.0	0	1	0	77	0	4
LINE 30040 (FLIGHT 3)													
A 6486 S	0	2	0	4	13	25	0.5	0	1	13	333	0	0
B 6458 L	6	6	11	13	13	7	8.1	0	1	28	309	0	0
C 6360 L	5	6	11	60	2	3	2.7	0	1	0	243	0	0
D 6350 L	1	2	15	38	2	1	3.4	0	1	0	166	0	0
E 6272 L	1	2	1	2	2	4	-	-	-	-	-	-	5
F 6257 S?	1	2	1	2	2	4	-	-	-	-	-	-	0

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LINE 30040	(FLIGHT		3)										
G 6225 B?	1	2	1	2	2	4	-	-	-	-	-	-	0
H 6217 B	1	2	1	2	1	4	-	-	-	-	-	-	0
I 6181 L	2	3	8	30	3	8	2.5	0	1	75	95	35	0
LINE 30050	(FLIGHT		3)										
A 5818 S	3	6	2	11	41	66	1.7	0	1	15	586	0	5
B 5824 L?	4	4	4	8	13	44	4.4	0	1	31	683	0	0
C 5858 L	1	2	1	2	2	4	-	-	-	-	-	-	0
D 5936 L	7	2	13	68	0	1	5.4	0	1	0	234	0	10
E 6016 S?	3	4	2	8	22	17	2.6	0	1	17	531	0	0
F 6043 L	1	2	1	2	2	4	-	-	-	-	-	-	0
G 6093 B?	1	2	1	2	2	4	-	-	-	-	-	-	0
H 6099 B	3	10	3	17	56	55	1.8	0	1	42	71	11	4
I 6107 D	8	17	8	26	84	81	3.6	0	1	39	86	8	0
J 6110 B?	6	17	8	22	84	56	3.2	1	2	52	50	23	8
K 6117 B?	5	6	6	11	29	19	5.1	11	1	68	73	32	0
LINE 30060	(FLIGHT		3)										
A 5795 S?	1	5	1	14	41	51	0.7	0	1	4	637	0	6
B 5782 L	1	2	1	2	2	4	-	-	-	-	-	-	0
C 5772 L	5	5	10	13	8	7	7.1	0	1	30	165	0	0
D 5755 L	1	2	1	1	2	4	-	-	-	-	-	-	0
E 5689 L	1	2	1	2	2	4	-	-	-	-	-	-	0
F 5664 S	1	3	2	9	21	27	1.7	0	1	35	151	0	0
G 5630 S	1	2	1	2	2	4	-	-	-	-	-	-	0
H 5600 L	5	2	5	8	3	23	9.3	5	1	58	134	14	0
I 5525 S?	1	2	1	2	2	1	-	-	-	-	-	-	0
J 5517 B?	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30070	(FLIGHT		3)										
A 5128 B?	1	2	1	2	2	4	-	-	-	-	-	-	0
B 5159 L	13	10	11	11	14	12	12.1	11	1	83	133	39	0
C 5189 S?	1	6	3	15	32	33	1.2	0	1	34	156	0	0
D 5219 L	8	12	13	55	1	1	3.4	0	1	0	247	0	0
E 5316 L	1	2	1	2	2	4	-	-	-	-	-	-	0
F 5355 S?	1	4	1	9	28	42	0.9	0	1	35	275	0	0
G 5387 S?	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30080	(FLIGHT		3)										
A 5074 S	2	7	1	11	46	56	1.1	0	1	0	562	0	0
B 5045 L	7	5	6	8	3	6	10.4	3	1	61	527	0	7

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	COAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 30080	(FLIGHT	3)											
C 5002 L	6	11	0	63	3	7	0.6	0	1	0	239	0	0
D 4922 L	2	5	7	10	5	7	3.8	0	1	51	139	8	0
E 4845 S	1	1	1	2	2	4	-	-	-	-	-	-	0
LINE 30090	(FLIGHT	3)											
A 4474 S	1	3	1	7	25	22	1.4	0	1	22	266	0	0
B 4507 L	5	4	13	21	9	5	7.1	16	1	65	98	27	0
C 4547 L	18	17	4	66	5	8	4.1	0	1	0	252	0	0
D 4619 S	1	2	1	2	2	4	-	-	-	-	-	-	6
E 4642 L	1	2	1	2	2	4	-	-	-	-	-	-	0
F 4733 S	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30100	(FLIGHT	3)											
A 4380 L	1	2	1	2	2	3	-	-	-	-	-	-	0
B 4360 L	1	2	1	2	2	2	-	-	-	-	-	-	0
C 4284 L	0	2	5	1	6	7	3.7	6	1	15	311	0	0
LINE 30110	(FLIGHT	3)											
A 3859 S	1	2	1	2	2	4	-	-	-	-	-	-	0
B 3885 L	27	18	43	54	16	7	15.5	0	3	0	13	0	0
C 3988 L	1	2	1	2	2	4	-	-	-	-	-	-	0
D 4084 S?	1	2	1	2	2	4	-	-	-	-	-	-	4
LINE 30120	(FLIGHT	3)											
A 3712 L	6	9	12	61	7	5	4.3	0	1	0	227	0	0
B 3627 L	0	3	2	9	3	8	0.6	0	1	65	179	13	0
LINE 30130	(FLIGHT	3)											
A 3257 L	11	9	0	58	3	2	4.7	0	1	0	234	0	0
B 3284 S	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30140	(FLIGHT	3)											
A 3107 L	25	18	10	56	3	3	8.5	0	1	0	243	0	0
B 3075 L	1	2	1	2	2	4	-	-	-	-	-	-	0
C 3070 S	3	4	6	10	11	4	4.5	0	1	23	93	0	0
LINE 30150	(FLIGHT	3)											
A 2901 L	7	19	0	50	3	4	0.7	0	1	0	282	0	0
B 2936 L	2	2	1	4	13	13	2.8	0	1	0	150	0	0
C 2951 S?	2	5	3	10	30	33	2.0	0	1	23	193	0	0
LINE 30160	(FLIGHT	3)											
A 2776 L	6	6	5	60	3	3	2.4	0	1	0	257	0	0

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ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 30160	(FLIGHT	3)											
B 2727 L	9	7	10	5	24	13	14.0	0	1	30	286	0	0
C 2712 S	2	6	4	4	34	47	1.0	0	1	19	113	2	0
D 2689 S	1	4	2	10	21	39	1.5	0	1	26	258	0	0
LINE 30170	(FLIGHT	3)											
A 2534 L	7	8	9	55	4	4	2.9	0	1	0	177	0	0
B 2582 L	1	2	1	2	2	4	-	-	-	-	-	-	0
C 2600 S	2	3	3	13	18	34	2.2	19	1	20	265	0	0
D 2639 L	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30180	(FLIGHT	3)											
A 2192 L	1	2	1	2	1	1	-	-	-	-	-	-	0
B 2136 L	6	5	10	4	21	22	15.6	0	1	29	122	0	8
C 2109 L	6	8	8	11	6	16	5.6	0	1	34	146	0	0
LINE 30190	(FLIGHT	3)											
A 1940 L	13	17	12	58	1	4	4.2	0	1	0	242	0	0
B 2003 L	1	3	5	5	7	5	3.8	0	1	42	158	0	0
C 2025 L	6	6	13	21	18	37	6.3	5	1	43	64	12	0
LINE 30200	(FLIGHT	3)											
A 1873 L	14	11	11	48	2	4	6.2	0	1	0	247	0	0
B 1846 S?	2	4	2	5	14	44	2.3	26	1	24	470	0	0
C 1810 L?	1	2	1	2	2	4	-	-	-	-	-	-	0
D 1799 L	17	14	5	17	5	28	8.5	0	1	33	90	0	0
E 1791 L	2	6	8	20	8	10	2.9	0	1	29	152	0	0
LINE 30210	(FLIGHT	3)											
A 1604 L	11	12	11	64	5	16	3.8	0	1	0	201	0	0
B 1661 S?	3	6	4	16	33	57	2.2	0	1	29	146	0	0
C 1673 L	2	5	6	13	9	20	2.9	0	1	29	138	0	0
D 1680 L	11	9	17	8	17	14	16.3	6	1	42	91	8	0
E 1698 S	0	6	3	12	30	61	0.9	0	1	31	181	0	0
LINE 30220	(FLIGHT	3)											
A 1560 L	22	9	9	67	1	13	7.0	0	1	0	237	0	0
B 1501 L	1	2	1	2	2	4	-	-	-	-	-	-	0
C 1481 L	11	6	10	11	7	8	14.3	4	1	25	201	0	0
LINE 30230	(FLIGHT	3)											
A 1275 L	19	17	8	66	15	19	6.1	0	1	0	372	0	0

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. LINE, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS. .

ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 30230	(FLIGHT		3)										
B 1296 S?	3	4	5	11	36	12	3.5	14	1	28	223	0	0
C 1342 S	1	2	1	2	2	4	-	-	-	-	-	-	0
D 1368 L	21	11	15	11	17	30	22.4	9	1	32	247	0	0
E 1390 S	1	3	2	4	13	30	0.4	0	1	22	149	4	0
LINE 30240	(FLIGHT		3)										
A 1252 L	14	15	16	73	8	9	4.6	0	1	0	91	0	0
B 1181 S	3	3	4	15	23	7	3.0	21	1	36	254	0	0
C 1161 L	8	2	4	5	4	18	20.9	0	1	59	222	6	0
LINE 30250	(FLIGHT		3)										
A 1008 L	1	2	1	2	2	4	-	-	-	-	-	-	0
B 1033 H	2	5	2	11	6	22	1.4	0	1	38	218	0	0
C 1059 L	6	3	6	8	3	5	9.8	0	1	82	215	25	0
D 1078 H	2	6	1	16	15	84	1.2	0	1	30	246	0	0
LINE 30260	(FLIGHT		3)										
A 909 L	1	2	1	2	2	4	-	-	-	-	-	-	0
B 846 L	8	5	11	7	10	1	13.6	2	1	64	151	19	0
C 840 L	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30270	(FLIGHT		3)										
A 718 S	1	2	1	2	2	4	-	-	-	-	-	-	0
B 742 L	11	4	10	6	20	8	30.0	7	1	64	142	19	0
C 747 L	7	3	10	4	20	17	29.7	11	1	59	108	18	0
LINE 30280	(FLIGHT		1)										
A 1660 L	2	5	9	7	46	29	5.3	0	1	5	123	0	0
B 1697 S	1	2	1	2	2	4	-	-	-	-	-	-	0
C 1743 L	6	2	8	2	4	7	33.7	0	1	75	124	27	0
D 1748 L	3	2	8	3	5	7	18.0	0	1	53	116	8	0
LINE 30290	(FLIGHT		1)										
A 1840 L	7	3	5	5	6	5	18.5	10	1	81	77	40	0
LINE 30300	(FLIGHT		1)										
A 2030 S	1	4	2	7	22	22	1.0	0	1	32	363	0	0
B 2046 S	1	2	1	2	2	4	-	-	-	-	-	-	0
C 2053 L	7	1	3	1	5	12	47.1	14	1	114	160	59	0
D 2066 S	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30310	(FLIGHT		1)										
A 2251 S	1	4	0	4	20	35	0.7	0	1	18	224	0	0

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ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 30310	(FLIGHT		1)										
B 2227 S	0	2	1	2	2	4	-	-	-	-	-	-	0
C 2158 L	9	4	6	4	6	7	21.6	3	1	52	68	16	0
LINE 30320	(FLIGHT		1)										
A 2313 S	1	3	1	10	19	37	0.9	0	1	30	654	0	0
B 2330 S	3	4	3	8	24	26	3.3	2	1	28	195	0	0
C 2376 L	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30330	(FLIGHT		1)										
A 2518 S	2	4	5	9	18	44	3.4	16	1	47	155	8	0
B 2451 L	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30340	(FLIGHT		1)										
A 2613 S	2	3	1	2	18	20	1.0	0	1	23	163	2	0
B 2660 H	1	2	1	2	2	4	-	-	-	-	-	-	0
C 2685 L	1	2	1	2	2	3	-	-	-	-	-	-	0
LINE 30350	(FLIGHT		1)										
A 2822 S	1	2	1	2	2	4	-	-	-	-	-	-	0
B 2771 L	1	1	1	0	2	0	-	-	-	-	-	-	0
LINE 30360	(FLIGHT		1)										
A 3188 S	2	5	2	8	22	65	1.6	12	1	74	174	29	0
B 3209 S?	4	4	1	7	17	36	4.1	24	1	75	139	31	0
C 3254 L	1	2	1	2	2	3	-	-	-	-	-	-	0
D 3263 H	2	4	3	7	23	36	2.2	0	1	43	296	0	0
LINE 30370	(FLIGHT		1)										
A 3441 S	1	2	1	2	2	4	-	-	-	-	-	-	0
B 3349 L	10	5	12	4	4	4	23.4	0	2	90	51	52	0
LINE 30380	(FLIGHT		1)										
A 3565 H	2	3	3	5	17	16	1.0	0	1	28	93	9	0
B 3594 L	6	4	3	6	7	15	8.2	29	2	78	54	45	4
LINE 30390	(FLIGHT		1)										
A 3921 S	1	2	1	2	2	4	-	-	-	-	-	-	0
B 3819 L	6	4	5	3	2	8	13.7	19	1	58	81	21	0
LINE 30400	(FLIGHT		1)										
A 4002 H	1	2	1	2	2	4	-	-	-	-	-	-	0

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ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 30400	(FLIGHT	1)											
B 4025 S	2	4	2	6	23	24	2.6	2	1	39	87	4	0
C 4050 L	1	2	1	1	2	4	-	-	-	-	-	-	0
LINE 30410	(FLIGHT	1)											
A 4224 S	2	4	2	6	20	40	2.0	21	1	44	222	5	0
B 4207 H	2	4	3	6	7	30	2.5	27	1	58	97	24	0
C 4185 S	3	3	5	8	19	26	5.3	14	1	42	108	6	0
D 4126 L	3	3	4	5	7	6	5.6	23	1	49	92	12	0
LINE 30420	(FLIGHT	1)											
A 4324 S	0	2	1	2	2	4	-	-	-	-	-	-	0
B 4333 S	2	4	4	9	19	27	2.7	19	1	59	123	21	0
C 4343 S	3	3	6	8	26	35	5.0	28	1	63	107	25	0
D 4371 L	2	4	3	6	13	15	2.8	14	1	39	153	1	0
LINE 30430	(FLIGHT	1)											
A 4527 S?	4	8	2	15	48	74	2.1	7	1	34	172	1	0
B 4509 H	1	3	4	3	20	15	1.0	0	1	37	70	20	0
C 4470 S	1	3	2	8	21	21	1.8	12	1	47	103	12	0
D 4456 S	2	4	3	8	17	39	2.2	14	1	44	144	7	0
E 4439 S	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30440	(FLIGHT	1)											
A 4589 H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 4622 H	2	4	0	10	31	42	0.9	0	1	34	99	2	0
C 4660 S	2	5	4	11	40	29	2.2	0	1	35	146	0	0
D 4693 S	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30450	(FLIGHT	1)											
A 4843 H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 4779 H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30460	(FLIGHT	1)											
A 4931 S	1	5	1	10	29	51	0.6	0	1	42	130	5	0
B 4969 S	2	3	3	7	13	30	2.6	25	1	43	407	0	0
C 4992 S	1	2	1	2	2	4	-	-	-	-	-	-	0
D 5010 S	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30470	(FLIGHT	1)											
A 5170 H	0	2	2	6	17	35	0.7	0	1	53	196	9	0
B 5148 H	0	2	1	2	2	4	-	-	-	-	-	-	0

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ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 30470	(FLIGHT		1)										
C 5116 H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30480	(FLIGHT		1)										
A 5272 H	1	4	3	8	15	39	1.7	8	1	37	189	0	0
B 5310 H	1	3	1	6	12	26	1.3	7	1	41	185	1	0
C 5346 H	1	4	3	4	16	24	0.7	0	1	29	94	10	0
LINE 30490	(FLIGHT		1)										
A 5529 S	3	5	3	9	27	46	3.0	11	1	38	175	0	0
B 5504 S	0	4	0	7	20	36	0.5	0	1	32	214	0	4
C 5469 H	1	2	1	2	2	4	-	-	-	-	-	-	0
D 5450 H	1	4	2	8	24	36	1.6	0	1	34	143	0	0
E 5439 H	3	5	5	6	26	26	4.4	20	1	40	136	4	0
LINE 30500	(FLIGHT		1)										
A 5598 S	1	4	2	7	16	43	1.5	7	1	46	225	4	0
B 5637 S?	4	6	4	10	35	33	3.4	2	1	46	115	9	0
C 5652 S	1	4	2	7	26	28	1.7	6	1	52	133	13	4
LINE 30510	(FLIGHT		2)										
A 912 S	1	4	2	6	20	21	1.2	0	1	38	122	0	0
LINE 30520	(FLIGHT		2)										
A 1010 S	1	2	1	2	2	4	-	-	-	-	-	-	0
B 1054 H	3	5	3	10	24	48	2.6	9	1	43	122	7	0
C 1069 H	4	13	4	5	14	32	2.5	0	1	35	153	0	0
LINE 30530	(FLIGHT		2)										
A 1251 S	1	2	1	2	2	4	-	-	-	-	-	-	0
B 1220 H	1	2	1	2	2	4	-	-	-	-	-	-	0
C 1196 H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30540	(FLIGHT		2)										
A 1376 H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 1414 H	3	14	4	16	56	80	1.8	4	1	52	101	19	0
LINE 30550	(FLIGHT		2)										
A 1549 H	3	5	2	8	17	17	2.2	11	1	47	120	11	0
LINE 30560	(FLIGHT		2)										
A 1745 H	1	2	1	2	2	4	-	-	-	-	-	-	0

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	COAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 30560	(FLIGHT		2)										
B 1761 H	3	3	2	5	15	12	1.0	0	1	36	75	19	5
LINE 30570	(FLIGHT		2)										
A 2485 H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 2457 H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30580	(FLIGHT		2)										
A 2698 H	0	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30590	(FLIGHT		2)										
A 2868 H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 2809 H	4	12	2	9	26	28	1.9	0	1	59	125	20	4
C 2800 H	2	4	2	8	19	59	1.9	23	1	58	164	20	0
LINE 30600	(FLIGHT		2)										
A 3028 H	7	10	2	4	5	2	5.4	14	2	136	37	100	0
LINE 30620	(FLIGHT		2)										
A 3296 H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30630	(FLIGHT		2)										
A 3506 H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 3483 H	2	5	2	10	32	33	1.6	0	1	53	86	17	0
C 3458 H	1	2	1	2	2	4	-	-	-	-	-	-	0
D 3442 S	3	16	3	18	55	108	1.3	0	1	35	144	0	0
LINE 30640	(FLIGHT		2)										
A 3621 S	2	7	1	14	39	82	1.3	4	1	49	119	14	0
B 3633 H	1	10	2	7	18	33	1.0	1	1	59	121	22	0
C 3648 S	1	26	3	18	43	108	0.6	0	1	43	138	8	0
LINE 30650	(FLIGHT		2)										
A 3821 S	1	30	2	8	26	31	0.6	0	1	52	80	16	0
B 3805 H	2	8	2	8	22	23	1.2	0	1	51	85	16	0
C 3787 S	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30660	(FLIGHT		2)										
A 3910 H	3	6	5	14	38	55	2.9	8	1	48	81	15	0
B 3938 H	1	2	0	2	2	4	-	-	-	-	-	-	0
LINE 30670	(FLIGHT		4)										
A 2322 S	2	3	2	6	17	23	1.9	9	1	36	82	4	0

* ESTIMATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART OF THE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT LINE, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 30680	(FLIGHT		4)										
A 2369 S	2	5	2	10	31	45	1.9	0	1	37	94	2	0
B 2394 S	2	5	3	10	27	32	2.3	4	1	43	129	6	0
LINE 30690	(FLIGHT		4)										
A 2611 S	3	10	3	13	53	80	2.0	2	1	46	97	13	0
B 2595 H	1	2	1	2	2	4	-	-	-	-	-	-	0
C 2574 S	1	2	1	2	2	4	-	-	-	-	-	-	0
D 2555 S	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30700	(FLIGHT		4)										
A 2642 H	3	7	3	11	37	54	2.0	4	1	57	87	22	0
B 2656 H	1	2	1	2	2	4	-	-	-	-	-	-	0
C 2680 S	1	2	1	2	2	4	-	-	-	-	-	-	0
D 2705 S	2	3	2	5	16	27	3.0	31	1	65	163	22	0
LINE 30710	(FLIGHT		4)										
A 2906 H	2	6	3	6	14	26	2.4	14	1	55	111	18	0
B 2885 H	1	6	4	12	30	54	1.7	11	1	53	96	19	0
C 2875 S?	3	6	3	7	20	56	2.6	18	1	47	163	10	0
D 2861 S	1	3	0	8	19	52	0.6	2	1	45	263	5	4
LINE 30720	(FLIGHT		4)										
A 2961 H	1	2	3	8	19	22	1.8	7	1	45	95	10	5
B 3010 S	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30730	(FLIGHT		4)										
A 3172 H	1	3	5	9	24	24	2.1	4	1	39	100	4	0
LINE 30740	(FLIGHT		4)										
A 3248 H	2	6	5	14	35	10	2.4	11	1	54	77	22	0
B 3292 S	1	3	1	6	16	19	1.0	5	1	33	405	0	0
LINE 30750	(FLIGHT		4)										
A 3436 H	3	6	6	10	33	28	3.9	10	1	54	91	19	0
B 3417 S	1	3	1	7	20	48	0.6	0	1	59	239	14	0
LINE 30760	(FLIGHT		4)										
A 3507 L	9	4	7	2	10	41	32.9	22	1	71	88	32	0
B 3521 H	2	4	3	8	26	19	2.6	26	1	65	82	30	0
C 3548 S?	2	4	5	7	20	45	3.2	34	1	46	424	4	0
LINE 30770	(FLIGHT		4)										
A 3691 L	7	2	4	4	6	5	20.5	15	1	89	82	46	5

* ESTIMATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART OF THE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT LINE, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 30770	(FLIGHT	4)											
B 3682 H	3	3	2	5	16	14	1.0	0	1	21	126	1	0
C 3655 S	1	4	2	7	12	47	1.1	17	1	56	311	13	5
LINE 30780	(FLIGHT	4)											
A 3736 L	9	5	4	9	3	25	9.4	10	1	101	81	59	0
LINE 30790	(FLIGHT	4)											
A 3877 L	7	8	10	15	23	31	6.3	0	1	67	93	27	5
B 3870 L	7	3	8	5	12	8	17.5	25	1	108	67	68	0
C 3851 S	2	4	1	8	25	44	1.7	16	1	60	292	15	0
LINE 30800	(FLIGHT	4)											
A 3912 H	1	2	1	2	2	4	-	-	-	-	-	-	0
B 3943 S	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 30810	(FLIGHT	4)											
A 3993 H	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 39010	(FLIGHT	4)											
A 4222 H	1	4	1	7	19	30	0.8	4	1	59	106	23	0
B 4247 H	1	2	1	2	2	4	-	-	-	-	-	-	0
C 4277 H	2	4	2	8	19	11	2.0	0	1	51	86	14	0
D 4370 H	2	4	2	7	21	34	2.4	27	1	75	67	41	0
E 4383 H	1	3	1	6	15	33	1.3	21	1	73	92	37	0
F 4459 S	3	1	2	2	6	77	0.1	0	1	17	162	0	0
G 4535 L	7	5	15	61	3	4	12.4	0	1	0	229	0	0
H 4565 L	5	4	8	7	17	13	9.1	14	1	93	107	48	0

* ESTIMATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART OF THE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT LINE, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

DIGHEM AIRBORNE SURVEY
ON
THE STEEPLES CLAIM BLOCK
AND
PORTION OF THE ASPEN CLAIM BLOCK

FORT STEELE MINING DIVISION
BRITISH COLUMBIA
49°22'N, 115°22'W
N.T.S. 82 G/6,11,12

FOR
R. H. STANFIELD
380 - 4723 1ST STREET S.W.,
CALGARY, ALBERTA

SURVEY BY: DIGHEM SURVEYS & PROCESSING INC.,
MISSISSAUGA, ONTARIO
COVERING REPORT BY: MASTER MINERAL RESOURCE SERVICES LTD.
CALGARY, ALBERTA

MARCH 1991

CONTENTS:

FIGURES:

INTRODUCTION:

A helicopter borne DIGHEM geophysical survey was carried out for R. H. Stanfield (Bul River Mineral Corporation Ltd.) over the Steeples and Aspen claims detailed in the PROPERTY section of this report.

Dighem Surveys & Processing Inc. of 228 Matheson Blvd. East, Mississauga, Ontario, conducted the survey from December 5 to 16, 1990 and January 5 to 21, excluding mobilisation and demobilisation. The writer of this report was retained as consultant. Copies of Dighem's report are enclosed for assessment credit on the claims described in PROPERTY.

Preparatory work for the project commenced in August 1990, and the current phase of evaluation of the data was completed in March 1991. The object of this report is to provide the background information on the tectonics, stratigraphy and mineralisation of the area. This information was used to pick the geophysical survey methods and arrays, and for the interpretation of the results.

LOCATION, ACCESSIBILITY, & TOPOGRAPHY:

The PROPERTY is located in southeastern British Columbia, approximately 30 kilometres by Highway 3 from Cranbrook. Access from the highway to the western portion of the property is by logging and private roads. The remainder of the property, except the Bull River canyon, is only accessible by helicopter. The survey grid and the property are in the Fort Steele Mining Division, in N.T.S. 82 G/6,11,12, centred approximately at 49°22'N, 115°22'E.

In essence, the survey area straddles the relatively modest relief of the Rocky Mountain Trench, including the Kootenay River and portions of its drainage basin, and the rugged western edge of the Rocky Mountains. The Steeples Range and portions of the Lizard Range are included in this area.

Topography in the Trench portion ranges from 750 metres to approximately 900 metres, with relatively moderate relief. Elevations in the Rocky Mountain portions range from 900 metres to 2400 metres, with extremely steep gradients on the western and southern boundaries of the main ranges.

PROPERTY:

Notice to Group #	CLAIM	Record #
2324	Steeples 8,10,17,18,19	1205,1207,1210,1211,1212
2323	Steeples 2,4,6,15	352,1201,1203,1208
2325	Steeples 16,23,24,25,26	1209,1216,1217,1218,1219
2322	Steeples 1,3,5,7,9	351,1200,1202,1204,1206
2326	Steeples 27,28,29,30	1220,1221,1222,1223
2327	Steeples 21,22,31,33,35	1214,1215,2343,2344,2345
2328	Steeples 36,37,38,39,40	2394,2392,2395,2393,2580
2362	Aspen 13,14,15	2569,2570,2571

The enclosed INDEX MAP shows the claim group outlines and the approximate limit of the DIGHEM survey.

GEOLOGY

The deciphering and understanding of the structure and structural evolution of the Rocky Mountain Trench and the western edge of the Rocky Mountains of southeastern British Columbia are necessary to determine the economic potential of the property. In addition, the mode of occurrence of the different types of mineral deposits in the area, including the ones on the property, provide clues to the location and identification of target exploration areas.

LITHOLOGY AND STRATIGRAPHY :

The following Table (from McMechan, 1978) summarises the lithology and stratigraphy of the area, including the property. In addition, Cretaceous-Tertiary intrusives near the margins of the Trench are worth noting. The Trench itself is filled with Pleistocene and Recent sediments of gravel, sand, silt, till, colluvium and alluvium.

UPPER DEVONIAN TO PERMIAN
Undifferentiated Fairholme Group, Palliser Formation, Exshaw Formation, Banff Formation, Rundle Group, Rocky Mountain Group: Limestone, Shale Limestone, Shale, Quartzite, and Dolomitic Quartzite.

MIDDLE DEVONIAN AND(?) EARLIER
Upper unit (Burnais and Harrogate Formations): Shaly Limestone, Shaly Dolomite, Limestone Breccia, and Gypsum; Basal Unit: Dolomitic sandstone, Sandy Dolomite, Breccia, Conglomerate, and Shale

CAMBRIAN
'Tanglefoot Unit': Shaly Limestone, Limestone, Sandy Shale, and Dolomite

Eager Formation: Shale, Limestone, Siltstone, and Quartzite; Cranbrook Formation: Quartzite and Granule Conglomerate

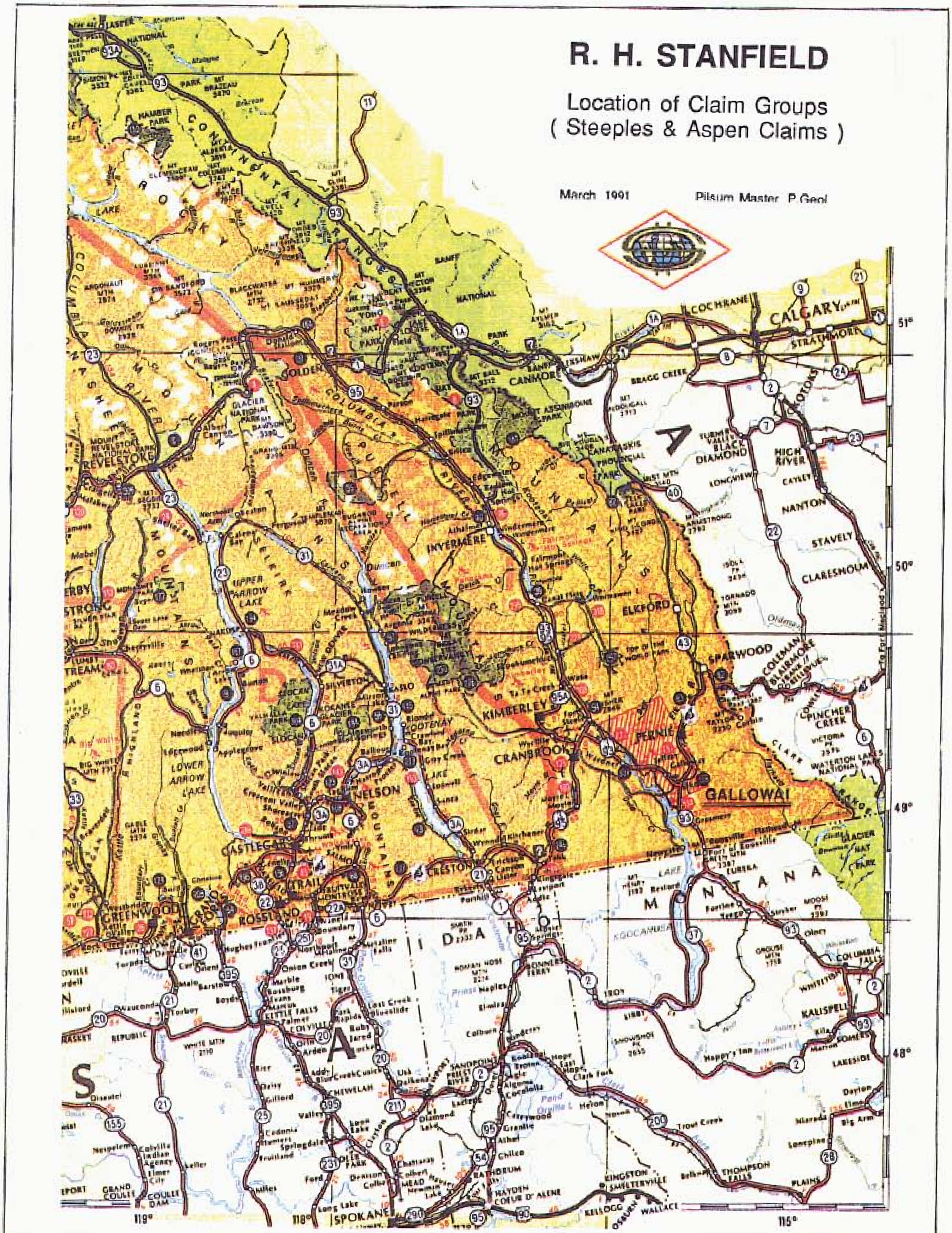
MIDDLE PROTEROZOIC
Moyie Sill: Hornblende Metadiorite to Metagabbro

PURCELL SUPERGROUP
Phillips Formation: Red Micaceous Quartzite and Siltite
Gateway Formation: Green, Purple Siltite, Minor Quartzite, and Dolomitic Siltite near top.
Sheppard Formation: Stromatolitic Dolomite, Green, Purple Siltite, Quartzite, and Silty Dolomite
'Lava and Sediment' Unit: Massive to Amygdaloidal 'Andesitic' Lava, Volcanic and Feldspathic Sandstone, Siltite, and Minor Dolomitic Siltite
'Non-Dolomitic Siltite' Unit: Green, Locally purple siltite

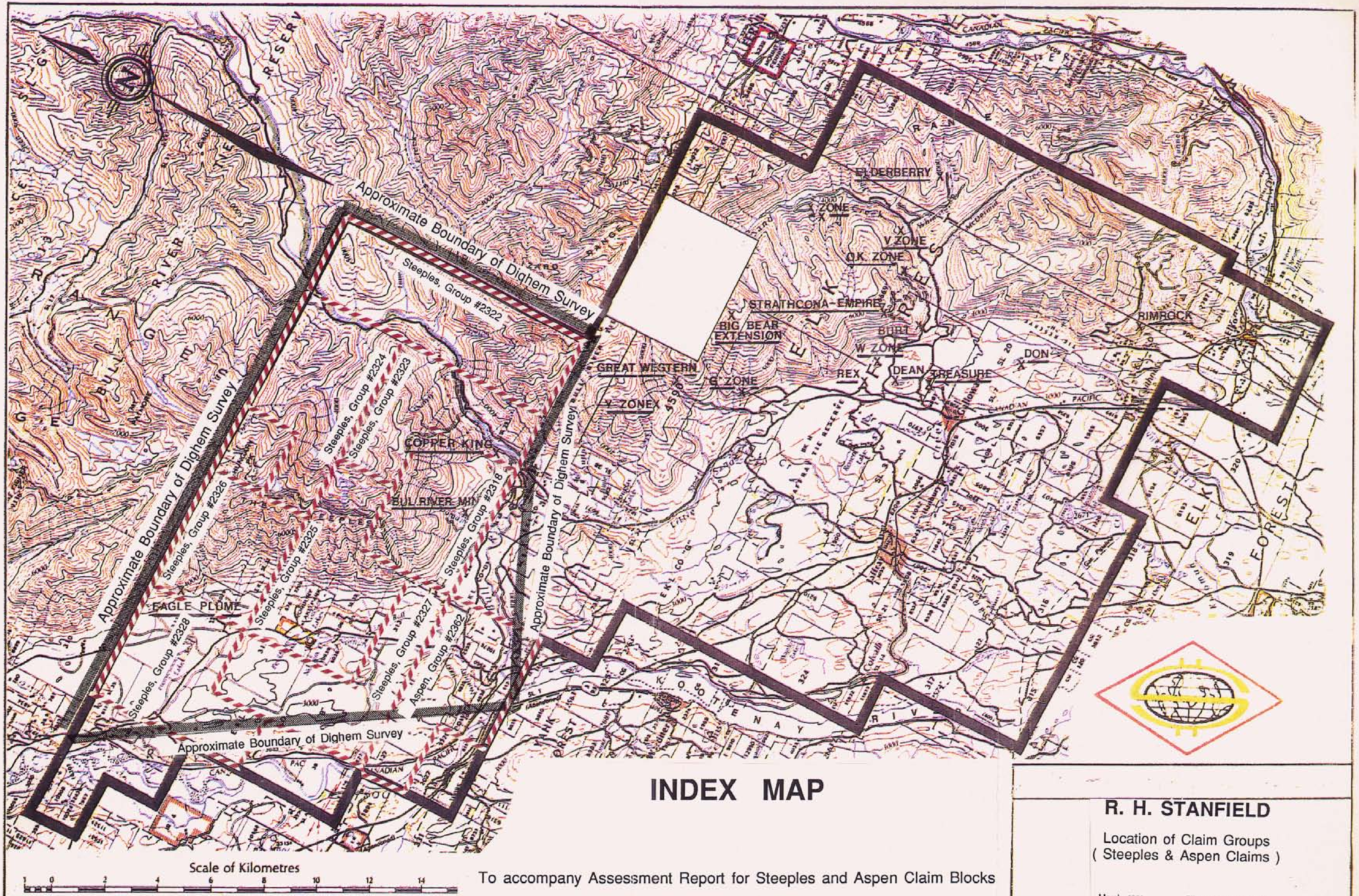
KITCHENER FORMATION
Upper Unit (North of *Dibble Creek Fault*): *Silty Dolomite, Grey Dolomitic* Siltite, Grey Siltite, Sandy Dolomite, and Stromatolitic Dolomite

Lower Unit (North of Dibble Creek Fault): Green or Grey Dolomitic Siltite, Green Siltite, and minor Dolomitic Quartzite

To accompany Assessment Report for Steeples and Aspen Claim Blocks



SITE LOCATION



INDEX MAP

To accompany Assessment Report for Steeples and Aspen Claim Blocks

R. H. STANFIELD

Location of Claim Groups
(Steeples & Aspen Claims)

March, 1991 Pilsum Master, P.Geol.

CRESTON FORMATION
Upper Subunit: Green, Lesser purple siltite, Dolomitic siltite near top, white quartzite

Lower Subunit: Purple, grey or green, very coarse-grained siltite to fine-grained quartzite, white quartzite, and green, purple siltite

Upper Subunit: Purple siltite with white quartzite

Middle Subunit: Green siltite

Lower Subunit: Grey siltite (north of Bull Canyon Fault), green, fine-grained quartzite, with grey siltite (south of Bull Canyon Fault-Unit)

ALDRIDGE FORMATION
Grey Siltite and Argillite, with two Dolomitic Siltite Horizons near top, South of Bull Canyon Fault

Quartzite, Grey Siltite and Argillite: Quartzite predominant, Siltite and Argillite predominant

TYPES OF MINERALISATION:

The following is a brief description of the types of mineralisation known on the property and in the surrounding area with similar to identical geology.

Quartz-Carbonate-Sulphide VEIN SYSTEMS in SHEAR ZONE envelopes:

Vein systems can be massive, tens of feet wide to a few inches width in stockworks and horsetails. Sulphides are chalcopyrite, pyrite, pyrrhotite mainly, with minor galena and arsenopyrite. Quartz is the major gangue mineral followed by carbonates (dolomite and siderite). Gold is associated with the sulphides and/or occurs as free gold in the quartz gangue and within silicified zones in the shear envelopes.

Host rocks are either partly silicified and chloritised argillites, argillaceous quartzites, and quartzites mainly of the Aldridge formation. Other host rocks include the argillites of the Creston and Gateway formations. The meta diorite dykes and sills of the Moyie Sill group have some degree of spatial relationship to the vein systems, but their role in the mode of origin of mineralisation is not clear.

The Bull River Mine on the property is an excellent example of this type of mineralisation. Other related examples of this type, on the property and in the immediate proximity, include the Strathcona-Empire, the Rex Zone, the Dean Zone, the Treasure Zone, the Don and Rimrock Zones.

Conformable (Syngenetic?) Massive Sulphide Deposit:

These are characterised by mainly conformable (to bedding) massive sulphides within the Aldridge formation. Sulphides are galena, sphalerite, pyrrhotite, with zones of massive pyrite. Zoning of sulphides is common, so is alteration, such as chloritisation and tourmaline. The host rock lithology is very similar to the Bull River Mine. The Sullivan Mine is a prime example of this type, and is located west-northwest of the property, on the other side of the Trench. Location of a Sullivan Type of ore body east of the Trench, has been a long term exploration goal in this part of British Columbia.

Quartz Lode Type with Sulphides and/or Free Gold:

The Cretaceous-Tertiary quartz-monzonite and granodiorite intrusives in the area have potential for this type of mineralisation, and may be source areas for some of the placer gold deposits.

Vein Type Galena-Sphalerite Mineralisation associated with Major Structures:

This type of mineralisation has been found to date in the Aldridge, Creston, and the Lower Cambrian formations. Mineralisation occurs as fillings and replacement within faults and associated fissure systems. Examples of this type in the immediate vicinity of the property are the Burt, O.K. Zones, and possibly the Great Western Zone. The Estella Mine and the Kootenay King Mine north of the property are also of this type, and so is the St.Eugene Mine across the Trench to the west.

Pb-Zn Mineralisation in the Palaeozoic Carbonate Rocks:

No significant discoveries of these types have been made. Recognition of reef structures and geometry would be the key. Haloes of zinc mineralisation detected by geochemical surveys may provide clues also.

Iron Formations:

The Bull River Iron showing on the property is probably not a classical iron formation type, and consists of hematite concentrations associated with fissures. Sandstones within the Palaeozoic and possibly Triassic formations on the property may include concentrations of Iron (magnetite), and may be associated with economic deposits of other heavy minerals.

STRUCTURE AND STRUCTURAL EVOLUTION

The property, and the remainder of R.H. Stanfield claims in the immediate vicinity are divided into a number of tecteno–stratigraphic domains. The primary divisions include the ROCKY MOUNTAIN TRENCH on the west half of the property, and the WESTERN ROCKY MOUNTAINS on the east half of the property.

The Western Rocky Mountains:

The Western Rocky Mountains form the eastern edge of the Purcell anticlinorium, against the Rocky Mountain thrust belt. The geology is fairly complex, with structural evolution mainly tied to the Hosmer Thrust.

The Western Rocky Mountains within the property and immediate vicinity are further subdivided into three major tecteno–stratigraphic terrains by EAST trending REVERSE FAULT SYSTEMS. The northernmost segment (on the property) is the STEEPLES RANGE DOMAIN, whose northern boundary is marked by the DIBBLE FAULT SYSTEM, and the southern boundary by the BULL CANYON FAULT SYSTEM. The next segment, mostly immediately south of the property, is the relatively complex SAND CREEK – LIZARD RANGE DOMAIN, that includes the Lizard Range. It is bounded in the north partly by the BULL CANYON FAULT, and to the south by the SAND CREEK FAULT. Both the Steeples and the Sand Creek – Lizard Range Domains are part of the LIZARD SEGMENT of the HOSMER THRUST, and is part of the structurally highest portion of the southern Rocky Mountains.

The southern most domain, further to the south of the property, is the BROADWOOD ANTICLINE bounded in the north by the Sand Creek Fault (different than the Upper Sand Creek Fault), and has a southern boundary off the property near Mt. Broadwood

The Steeples Range Domain:

The Dibble Fault is a right lateral reverse fault dipping northward at 55 degrees. The compressional forces were NW–SE across the fault, with the East trending fault line a result of the combination of vertical component of displacement (equivalent to 10Km of stratigraphic separation across the fault – along east wall of Trench), and a horizontal component that moved the northern hangingwall E–NE.

The Dibble Fault coincides partly with a more ancient feature — the Dibble Creek Monocline that marked the northern edge of "Montania", a structural high. This High was the site of intermittent, basement–controlled block faulting that controlled Purcell sedimentation and caused drape folding in the early Palaeozoic. This monocline and an overlying gypsum deposit controlled the configuration and evolution of the Dibble Fault (and the Lizard Fault further southeast). The gypsum bed is partly preserved in the footwall of the fault and exhibits little evidence of stress, but the more competent hanging wall formations are truncated by the fault.

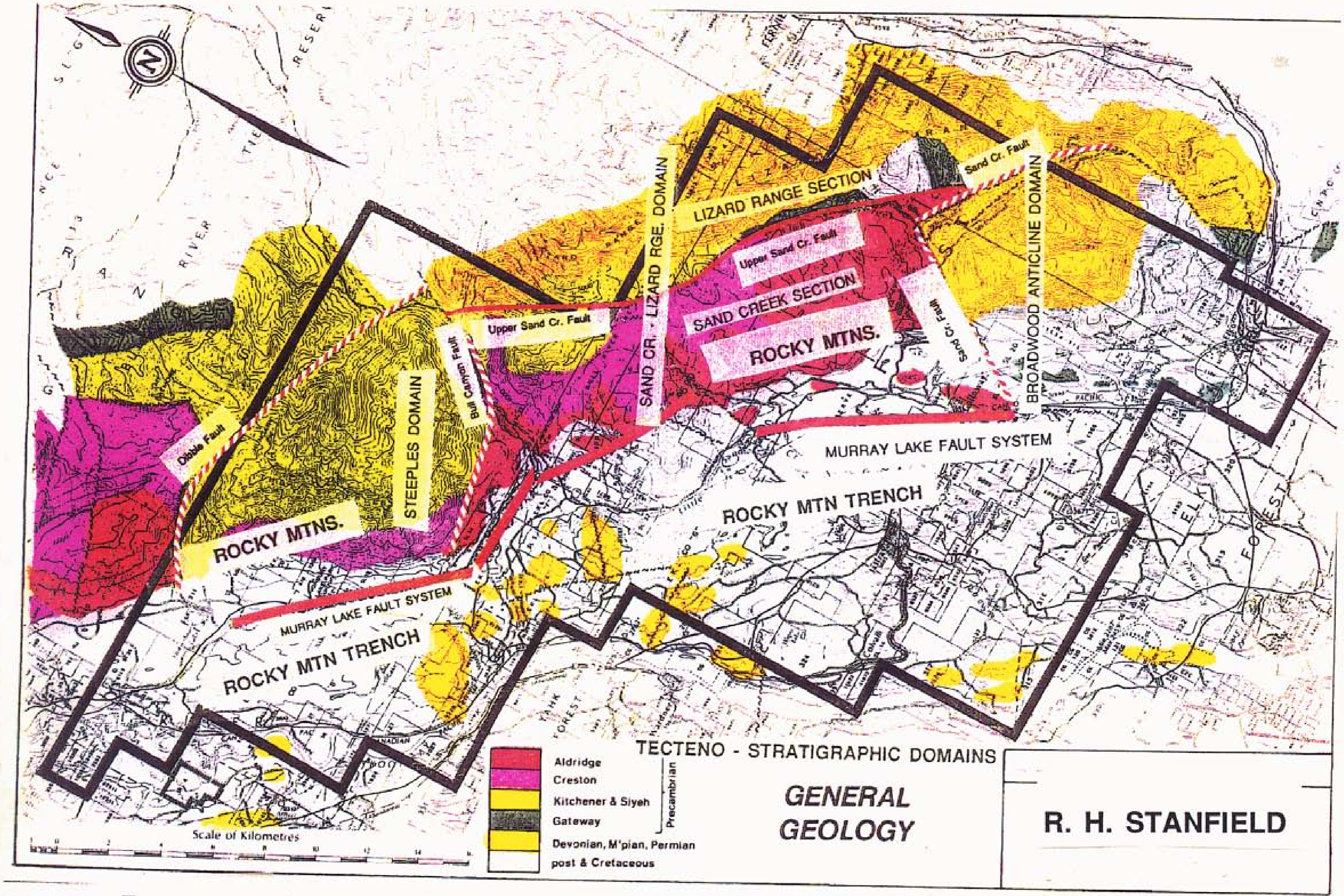
In essence, the Dibble Creek fault placed rocks formed north of the monocline over rocks deposited on top of the monocline. However, the current stratigraphy is also a result of the fact that *prior* to the fault, *deposition in the Palaeozoic was restricted* on the Steeples side of the monocline (structural high), and the pre–Devonian unconformity cut deeper into the Purcell formations on this high. As a result, in the Steeples Domain there is only a thin veneer of Devonian rocks, while north of the Dibble Fault the Palaeozoic section includes a more complete section from Cambrian to the Ordovician, that intervenes between the Precambrian Purcell and the Devonian formations.

In addition, as the rock mass overrode the monocline, there was gravitational resistance to upward displacement, causing NE TRENDING THRUST faults, folds and cleavage in the rocks. As the mass went over the crest of the monocline it was subjected to lateral gravitational spreading (southeastward extension) causing new NE TRENDING NORMAL FAULTS or converting older NE trending thrust faults to extension (normal) faults.

The Sand Creek - Lizard Range Domain:

This domain is divided into two longitudinal sections by the NW trending UPPER SAND CREEK thrust fault. The western segment is designated by us as the SAND CREEK SECTION, and the eastern segment is the LIZARD RANGE SECTION.

The BULL CANYON FAULT marks the northern boundary of the Sand Creek Section. It is a left–lateral reverse fault with about 2–3 Km of stratigraphic separation, and dips southward. The locus of the fault suggests that its origin is tied into the stress associated with the Dibble monocline. Also, the contrasts in the Purcell succession across the fault suggest that it may follow the locus of an older structure that controlled Purcell deposition. Although the Lower Purcell group of rocks are found on both sides of the fault, the NE trending structures in the Steeples Domain, north of the fault do not extend on to the hangingwall side of this fault. In addition, the large anticline north of the fault (in the Steeples Domain) is not one of the NE trending structures caused by compression during movement on the Dibble fault, but is formed during the Bull Canyon Fault displacement, and does not have a counterpart on the hangingwall (south) side of the fault.



To accompany Assessment Report for Steeples and Aspen Claim Blocks

March, 1991 Pilsum ter, P.Geol.

THE ROCKY MOUNTAIN TRENCH

The Rocky Mountain Trench underlies the western half of the property. Topographically it is very distinct from the Rocky Mountains, and forms the valley of the Kootenay River system in this area. However, its true structural eastern margin is variable, partly because of thrust faulting northeastward over the tecteno-stratigraphic elements of the Rocky Mountains, and partly due to the cut back eastward of the fault-line scarp that marks the normal-faulted edge of the Trench. The longitudinal Murray Lake Fault system probably represents the pre-erosional position of the fault scarp.

According to the literature, the portion of the Trench on the property is synclinal with major west dipping faults on its east side. Details of the nature of faulting are not discussed here, but features significant to the location of economic mineral deposits are referred to.

The flexuring of the Murray Lake fault system at Bull River and the NE trend of portion of the Bull Canyon Fault system may be due to back-sliding (reversal of the older displacement to the NW), that also caused hinge faults transverse to the Trench, i.e. N and NE trends. Similar NE trends are the Sand Mountain and Supply Creek Faults in the Sand Creek Section of the Sand Creek – Lizard Range Domain of the Rocky Mountains.

Another evidence that block faulting rather than strike slip faulting resulted in the formation of the Trench in this area, is the continuation of major Palaeozoic-Mesozoic structures across the trench, e.g. the Moyie-Dibble Fault system. These cross features are also probably responsible for the formation of structural lows within the Trench, which are detectable by gravity surveys. One such structural low is located south of the property near Jaffray. Gravity surveys (REFERENCES) indicate that these cross features form the divides (structural highs) between these lows.

The Trench is probably located above a break in the Earth's crust formed in Precambrian time. During the deposition of the Purcell sediments the Trench marked the boundary between an ancient geosyncline to the west and an ancient shelf to the east. The uplifted terrain in the west supplied detritus intermittently through Mesozoic time. In late Cretaceous-Tertiary time this supply of detritus was cut off, perhaps due to the initial formation of the Rocky Mountain Trench. It essentially became a depositional basin in the Cenozoic.

RELATIONSHIP OF MINERAL DEPOSITS, TECTONICS & STRATIGRAPHY

The Lower Purcell group of strata, particularly the Aldridge Formation, has been historically of major economic interest in the area. The Proterozoic Moyie sills and dykes are also good exploration targets, even though they are rarely host rocks for economic mineralisation. The other members of the Purcell Group have lithologic units similar or identical to the Aldridge, e.g. the Creston and Gateway Formations, and are host rocks to mineral deposits in the area.

In essence favourable target areas for syngenetic type of base metal mineralisation are the formations of the Purcell Group, particularly the Aldridge Formation. These types of deposits are probably localised near ancient crustal features, e.g. the Dibble Monocline, that controlled deposition and volcanism during Purcell time.

Cavity filling and replacement types of deposits require plumbing systems for the ore bearing fluids and significant permeability of the host rocks. Therefore, targets are in proximity to major structural features and the structures themselves. Certain faults, such as extension or normal faults may be more permeable than those caused by shear resulting in thrust faulting. Known mineral deposits on faults or proximity to faults provide clues to mode of occurance of other deposits in the area.

Within the topographic portions of the Trench, the area between the eastern structural limit (Murray Lake Fault) and the present location of the Rocky Mountain scarp are as economically significant as the western edges of the Rocky Mountain domains, because they are underlain by the same stratigraphic sequence, e.g. Lower Purcell Aldridge Formation.

Just north of the property quartz-monzonite porphyries intrude the Trench Area. The Reade Lake stock seals the St. Mary's Fault that is a cross-trench feature similar to the Moyie-Dibble Structure on the Property. These stocks are favourable locations for a host of mineral deposits, and although no known exposures occur on the property they may be within 300 metres of the surface and located by geophysical methods.

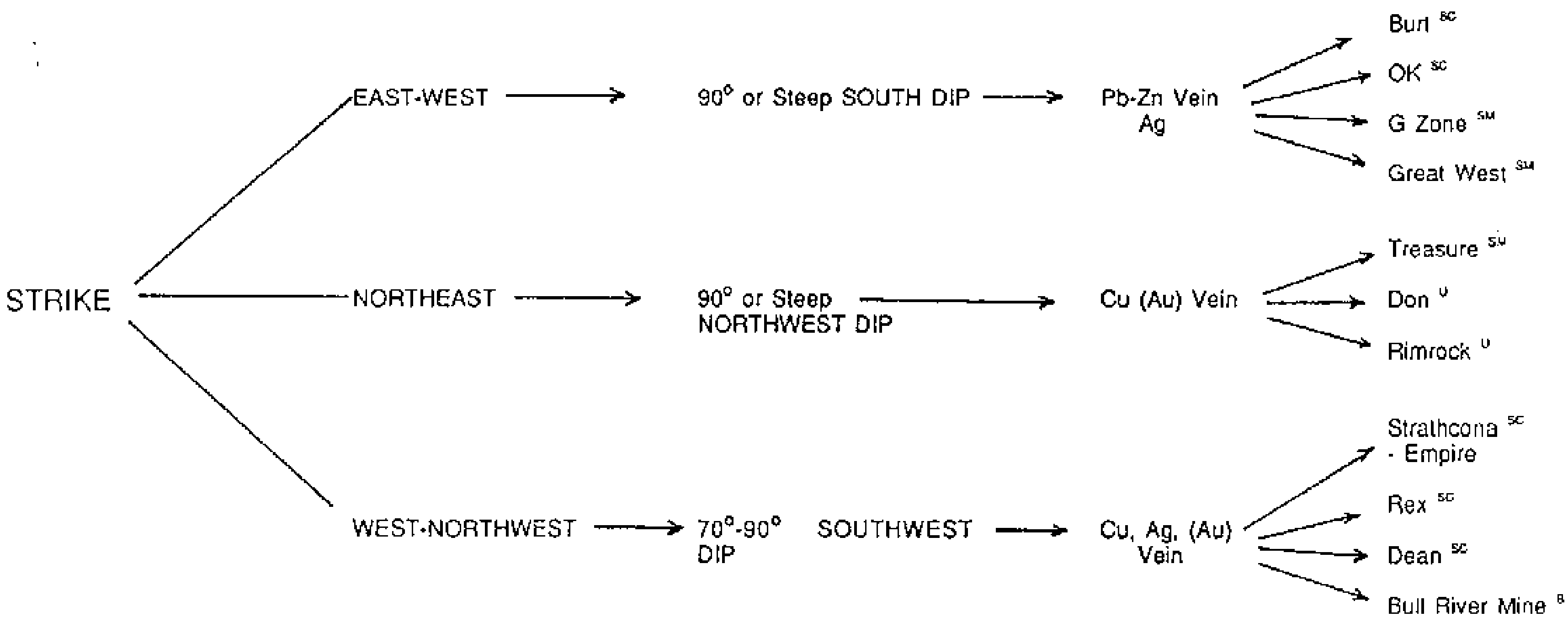
A classification of known mineral deposits on the property and in the immediate vicinity has been completed based on the strike-dip of the mineralisation, the metal types and locations with respect to the major faults discussed in the report.

It is obvious that all the Lead-Zinc type have distinct strikes and dips, while the Copper-Silver veins have attitudes that fall into another distinct category. Both types have a relatively East-West trend with a southerly dip. The exact correlation between the structural elements of the known mineralisations and the major tectonic elements of the property are worth investigating on a regional and local basis.

CLASSIFICATION OF MINERAL DEPOSITS

BASED ON

<u>Attitude, Metal Type, Location w.r.t. Faults</u>



B	BULL CANYON FAULT
SM	SAND MTN FAULT
SC	SAND CR. FAULT
U	UNKNOWN - PROBABLY RELATED TO NW TRENDING BROADWOOD FAULT

AIRBORNE GEOPHYSICS:

Due to the size of the area, the rugged terrain and relative lack of accessibility in the Rocky Mountain portion, and the unknown extent and depth of overburden and cover rocks in the Trench portion of the property, an airborne survey offered the best means of providing the evidence for the tectonic and stratigraphic criteria described above.

The geophysical method had to have the capacity for differentiating geological terrain, and the combination of airborne magnetics and resistivity measurements in detail offered the best potential. Dighem's method and equipment met most of these requirements at relatively reasonable costs. The size of the known mineral deposits in the area, and their high resistivity (quartz ?), indicated that electrical conductivity alone would not provide distinct "anomalies". Dighem offered multi-channel measurements with production of resistivity maps at three frequencies. The resistivity mapping was designed to outline the extent, shape, form and depth of "linears". In addition, resistivity and magnetics would distinguish different tecteno-stratigraphic terrains.

The instrumentation of the EM/resistivity/magnetic/VLF survey is described in some detail in the enclosed report by Dighem. The helicopter survey was flown with an average EM bird height of approximately thirty metres over the Trench and the Rocky Mountain sections of the property. Survey coverage consisted of approximately one thousand and six line kilometres, including tie lines. Flight lines over the Rocky Mountains were flown in an azimuthal direction of 150° true for the 10000 series lines (Dighem maps), and 60° true for the Trench area (30000 series lines on Dighem maps). both set of lines were flown with a line separation of two hundred metres. Overlap of the two grids over the Bul River Mine area was designed to increase coverage and data points (reduce line spacing) in an area of known mineralisation.

SUMMARY & CONCLUSIONS:

The resistivity map for the 7200 Hz frequency provides excellent opportunity for mapping the major linears (known and unknown) on the property. The linear from line 10360, fiducial 2840 to line 10560, fiducial 6000 coincides with the location of the Dibble Fault. In addition, the location of the Bull Canyon Fault coincides with linears from line 10020, fiducial 1280 to line 10340 fiducial 6680, and again from line 10420, fiducial 1440 to line 10560, fiducial 6000, where it intersects the Dibble Fault trace.

In addition, the structural, rather than the topographic eastern edge of the Trench is identifiable by the arcuate edge of the central more resistive terrain of the Rocky Mountains, and the lower resistivity of the Trench (overburden). This feature extends from line 10030, fiducial 1740, through line 10110, fiducial 1380 to line 10020, fiducial 1280.

The Bul River Mine Area from line 10210, fiducials 3180 to 3240, is shown to be part of a distinct (more irregular) resistivity terrain that extends east towards the Bull Canyon Fault trace linear on line 10320, and also westward to a distinct resisistivity plateau north of the town of Bull River (SW corner of map).

Most of the anomalies on the electromagnetic conductivity map are interpreted as linear due to culture response, mainly power lines. A significant portion of them are indeed along known power lines, but there are several bedrock conductors identified in the area of the Bul River Mine. The lack of conductors in the Rocky Mountain portion of the property, may be due to the nature of sulphide mineralisation (galena, sphalerite) and disseminated and stringer sulphides, rather than massive sulphides, associated with high resistivity gangue minerals, such as quartz. It should be noted that the background resistivity (7200 Hz) of the Rocky Mountain terrain between the Dibble and Bull Canyon Fault traces is quite high.

The total field magnetic contours indicate a rough coincidence with major linears outlined by the resistivity mapping. In addition the magnetic map indicates a regional arcuate feature extending from the Rocky Mountains from line 10180, fiducial 1520 southwest across the physiographic and structural Trench boundary to the vicinity of line 30230, fiducial 1270, then southeast to line 30010, and then northeastward through Bul River Mine area to end near the trace of the Dibble Fault.

In addition the broad magnetic highs centred at line 30720, fiducial 3020, and line 30230, fiducial 1270 may be intrusive stocks, similar to the Reade Lake stock north of the property.

RECOMMENDATIONS:

Image processing of the geophysical data is recommended to pinpoint and trace smaller resistivity and magnetic linears. These may be the fault systems that are associated with the known sulphide systems in the area, and new ones may also be identified.

The area south of the Bul River Mine should be flown, and the results would shed some more light on the distinct resistivity and magnetic terrain that parallels the southern boundary of the current survey area. The computer generated data profiles on the EM bedrock conductor anomalies in this area should be reviewed in relation to the known geology of the Bul River Mine. Follow up ground survey over these screened anomalies is also recommended.

All the resistivity linears and related magnetic linears and anomalies should be checked out by ground reconnaissance if image processing provides further data to pinpoint more specific targets in these large areas of interest.

The claim areas in the north east section, and the claims covering the Bull Canyon fault should not be dropped at this time, even though no distinct bedrock conductors were located. In addition, the magnetic anomalies in the Trench should be retained because of the potential for the location of deposits related to Mesozoic intrusives.

Respectfully submitted
MASTER MINERAL RESOURCE SERVICES LTD.

Pilsum Master, M.Sc.,P.Geol.

March 13, 1991
Calgary, Alberta

COSTS STATEMENT:

Dighem Survey Charges:		
Mobilisation/demobilisation....................	$ 6,000	
Navigation setup......................................	$ 3,000	
1206 Km flying @ $126/km....................	$151,956	
Helicopter charges for weather check flights..............................	$ 960.50	
Sub-Total......................................		$161,916.50
Rooms & Meals,Dighem crew @ Stanfield camp,107 man days @ $65/man day..............................		$ 6,955
Pilsum Master, Consultant:		
Planning & scheduling,Aug 24–Nov.28,90,Oct 1–10,90, Jan 4, 17,91, 15 days @$300/day..........................	$ 4,500	
Field supervision, Dec 1–21,90 16 days @ $350/day..................................	$ 5,600	
Mob./demob. to site, and to Dighem,Toronto..	$ 2,045	
Report Preparation, 7 days @ $300/day,3 days @ $350/day....................	$ 3,150	
Room and meals, Stanfield camp 16 days @ $65/day..................................	$ 1,040	
Truck, 16 days @ $50/day........................	$ 800	
Sub-Total...		$ 17,135
Ross Stanfield Jr., Coordinator:		
42 days @ $200/day..................................	$ 8,400	
Truck, 42 days @ $65/day........................	$ 2,730	
Room and meals, Stanfield camp 42 days @ $65/day..................................	$ 2,730	
Tim Hewison, Helper:		
42 days at $75/day..................................	$ 3,150	
Room and meals, Stanfield camp 42 days @ $65/day..................................	$ 2,730	
Sub-Total......................................		$ 19,740

Drafting and secretarial	$ 2,000
Phone, fax, shop facilities, snow removal (helicopter pad and access—including supplies grader,timber jack)	$ 3,420
Helicopter fuel	$ 6,000
TOTAL	**$217,166.50**

STATEMENT OF WORK, DECEMBER 21, 1990, STEEPLES CLAIM BLOCK:
$115,356 + PAC

STATEMENT OF WORK, MARCH 21, 1991, STEEPLES CLAIM BLOCK:
$ 86,540 + PAC

STATEMENT OF WORK, DECEMBER 21, 1990, ASPEN CLAIMS:
$ 15,270 + PAC

TOTAL $217,166

REFERENCES:

HOY, T.; VAN DER HEYDEN, P.; 1988; Geochemistry, Geochronology, and Tectonic Implications of two Quartz Monsonite Intrusions, Purcell Mountains, Southeastern British Columbia; Canadian Journal of Earth Science, *vol.25*, pp. 106–115.

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LEECH, G.B., 1960; Map 11 – 1960; Geology, Fernie (West Half), British Columbia; Geological Survey of Canada.

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McMECHAN, M.E.; 1978; Geology of the Mount Fisher–Sand Creek Area, Southeastern B.C.; Notes and Preliminary Map 34; Ministry of Energy, Mines and Petroleum Resources, B.C.

McMECHAN, M.E., PRICE, R.A.; 1982; Transverse Folding and Superimposed Deformation, Mount Fisher Area, Southern Canadian Rocky Mountain Thrust and Fold Belt; Canadian Journal of Earth Sciences; *vol.19, no.5*; pp.1011–1024.

THOMPSON, T.L.; 1962; Origin of the Rocky Mountain Trench in Southeastern British Columbia by Cenozoic Block Faulting; Journal of the Alberta Society of Petroleum Geologists; *vol.10, no.7*, pp.408–427.

STATEMENT OF QUALIFICATION:

I Pilsum Master of 32 Midpark Gardens S.E., Calgary, Alberta certify that:

I am a graduate of the University of Bombay, India, and a graduate of the University of New Mexico, U.S.A., and hold the following degrees therefrom:

B.Sc., 1963, Geology/Chemistry
M.Sc., 1965, Geology
M.Sc., 1968, Geology/Mineralogy

I am a registered Professional Geologist (Association of Professional Engineers, Geologists and Geophysicists of Alberta), and a member of the American Institute of Mining, Metallurgical and Processing Engineers.

I have practised my profession for the past twenty three years.

I hold no interest in the properties or securities of R. H. Stanfield, or affiliates thereof, nor do I expect to receive any directly or indirectly.

The covering report on the Dighem survey is based on my direct involvement in the planning, preparation and choice of survey methods, site supervision, and subsequent input into the geological interpretation of the results of the survey.

March 13, 1991

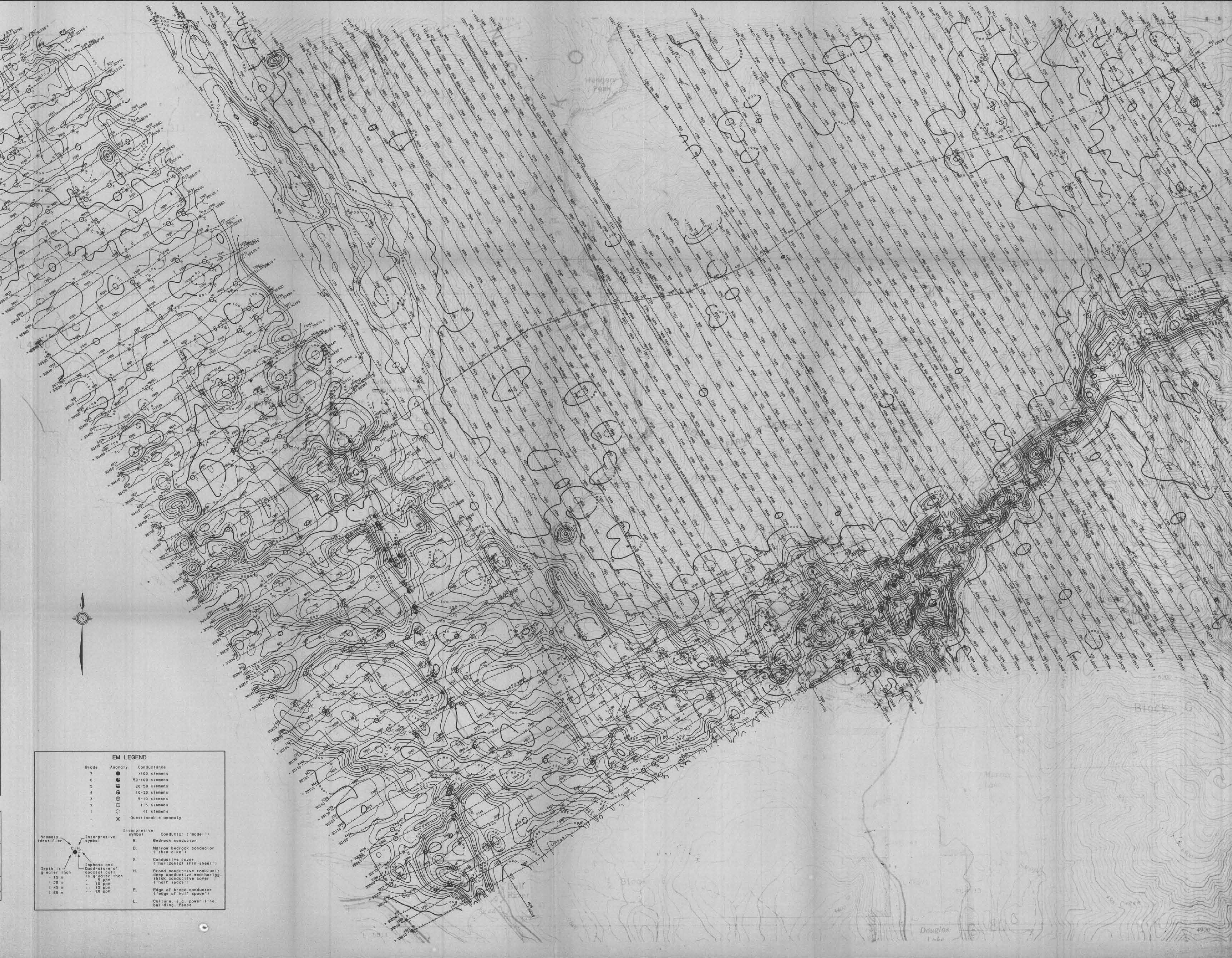
Pilsum Master M.Sc.,P.Geol.


GEOLOGICAL BRANCH
ASSESSMENT REPORT
21,155
CONTOUR INTERVALS
100 nT
20 nT
4 nT
2 nT
magnetic low
Magnetic inclination within the survey area: 72 degrees
FLIGHT LINES WITH EM ANOMALIES
Flight direction
Flight line number
11020
Reflight Number
Line Number
Area Number
Fiducials identified on profiles
Dip direction
EM anomaly (see EM legend)
Conductor axis (on EM maps only)
Arcs indicate the conductor has a thickness > 10m
Magnetic correlation in nT (gammas)
LOCATION MAP
115°45'
115°30'
115°15'
ROCKY
MTNS
KOOTENAY
RIVER
Fort Steele
Bull R.
CRANBROOK
The Steeples
49°30'
Lizard Range
Bull River
Lake Koocanusa
NTS: 82G/6,11,12
Scale 1:500,000
BUL RIVER MINERAL CORPORATION LTD.
STEEPLES CLAIM BLOCK
TOTAL FIELD MAGNETICS
DIGHEM SURVEY
NTS: 82G/6,11,12
GEOPHYSICIST:
DATE: JANUARY 1991
JOB: 1097
SHEET: 1
DIGHEM SURVEYS & PROCESSING INC.
0
1
2 Km
Scale 1:20000
Dighem
EM LEGEND
Grade
Anomaly
Conductance
7 ≥100 siemens
6 50-100 siemens
5 20-50 siemens
4 10-20 siemens
3 5-10 siemens
2 1-5 siemens
1 <1 siemens
- Questionable anomaly
Anomaly identifier
Interpretive symbol
Depth is greater than
15 m
30 m
45 m
60 m
Inphase and Quadrature of coaxial coil is greater than
5 ppm
10 ppm
15 ppm
20 ppm
Interpretive symbol
Conductor ("model")
B. Bedrock conductor
D. Narrow bedrock conductor ("thin dike")
S. Conductive cover ("horizontal thin sheet")
H. Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half space")
E. Edge of broad conductor ("edge of half space")
L. Culture, e.g. power line, building, fence
Hungary Peak
Block G
Block E
Bull River
Murray Lake
Douglas Lake


GEOLOGICAL BRANCH
ASSESSMENT REPORT
21,155
FLIGHT LINES WITH EM ANOMALIES
Flight direction
Flight line number
11020
Reflight Number
Line Number
Area Number
Fiducials identified on profiles
Dip direction
EM anomaly (see EM legend)
Conductor axis (on EM maps only)
Arcs indicate the conductor has a thickness > 10m
Magnetic correlation in nT (gammas)
LOCATION MAP
115°45'
115°30'
115°15'
ROCKY
MTNS
KOOTENAY
RIVER
Fort Steele
CRANBROOK
Bull R.
The Steeples
Bull River
Lizard Range
Lake Koocanusa
49°30'
NTS: 82G/6,11,12
Scale 1:500,000
BUL RIVER MINERAL CORPORATION LTD.
STEEPLES CLAIM BLOCK
ELECTROMAGNETIC ANOMALIES
DIGHEM™ SURVEY
NTS: 82G/6,11,12
GEOPHYSICIST: RP
DATE: JANUARY 1991
JOB: 1097
SHEET: 1
DIGHEM SURVEYS & PROCESSING INC.
Scale 1:20000
2 Km
Dighem
EM LEGEND
Grade
Anomaly
Conductance
7 ≥100 siemens
6 50-100 siemens
5 20-50 siemens
4 10-20 siemens
3 5-10 siemens
2 1-5 siemens
1 <1 siemens
- Questionable anomaly
Anomaly identifier
Interpretive symbol
Depth is greater than
15 m
30 m
45 m
60 m
Inphase and Quadrature of coaxial coil is greater than
5 ppm
10 ppm
15 ppm
20 ppm
Interpretive symbol
Conductor ("model")
B. Bedrock conductor
D. Narrow bedrock conductor ("thin dike")
S. Conductive cover ("horizontal thin sheet")
H. Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half space")
E. Edge of broad conductor ("edge of half space")
L. Culture, e.g. power line, building, fence
Hungary Park
Block G
Douglas Lake
Bull River


GEOLOGICAL BRANCH
ASSESSMENT REPORT
21,155
CONTOURS
2.5 nT/metre
0.5 nT/metre
0.1 nT/metre
0.05 nT/metre
FLIGHT LINES WITH EM ANOMALIES
Flight direction
Flight line number
11020
Reflight Number
Line Number
Area Number
Fiducials identified on profiles
Dip direction
EM anomaly (see EM legend)
Conductor axis (on EM maps only)
Arcs indicate the conductor has a thickness > 10m
Magnetic correlation in nT (gammas)
LOCATION MAP
115°45'
115°30'
115°15'
ROCKY
MTNS
KOOTENAY
RIVER
Fort Steele
CRANBROOK
Bull R.
Bull River
Lizard Range
Lake Koocanusa
49°30'
NTS: 82G/6,11,12
Scale 1:500.000
BUL RIVER MINERAL CORPORATION LTD.
STEEPLES CLAIM BLOCK
CALCULATED VERTICAL GRADIENT MAGNETICS
DIGHEM™ SURVEY
NTS: 82G/6,11,12
GEOPHYSICIST: RP
DATE: JANUARY 1991
JOB: 1097
SHEET: 1
DIGHEM SURVEYS & PROCESSING INC.
Scale 1:20000
0
1
2 Km
Dighem
EM LEGEND
Grade
Anomaly
Conductance
7 ≥100 siemens
6 50-100 siemens
5 20-50 siemens
4 10-20 siemens
3 5-10 siemens
2 1-5 siemens
1 <1 siemens
- Questionable anomaly
Anomaly identifier
Interpretive symbol
Depth is greater than
15 m
30 m
45 m
60 m
Inphase and Quadrature of coaxial coil is greater than
5 ppm
10 ppm
15 ppm
20 ppm
Interpretive symbol
Conductor ("model")
B. Bedrock conductor
D. Narrow bedrock conductor ("thin dike")
S. Conductive cover ("horizontal thin sheet")
H. Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half space")
E. Edge of broad conductor ("edge of half space")
L. Culture, e.g. power line, building, fence
Hungary Peak
Block D
Bull River
Douglas Lake


GEOLOGICAL BRANCH
ASSESSMENT REPORT
21,155
CONTOURS
Contours in percent
10
2
1
Frequency response of VLF-EM filter
Amplitude
REJECT
ACCEPT
Cycles/metre
VLF STATION
TRANSMITTER
LINE
NSS (Annapolis,Md.) 21.4 kHz
all
FLIGHT LINES WITH EM ANOMALIES
Flight direction
Flight line number
11020
Reflight Number
Line Number
Area Number
Fiducials identified on profiles
Dip direction
EM anomaly (see EM legend)
Conductor axis (on EM maps only)
Arcs indicate the conductor has a thickness > 10m
Magnetic correlation in nT (gammas)
LOCATION MAP
115°45'
115°30'
115°15'
ROCKY
MTNS
KOOTENAY
RIVER
Fort Steele
Bull R.
CRANBROOK
Bull River
Lizard Range
Lake Koocanusa
49°30'
NTS: 82G/6,11,12
Scale 1:500,000
BUL RIVER MINERAL CORPORATION LTD.
STEEPLES CLAIM BLOCK
FILTERED VLF
DIGHEM™ SURVEY
NTS: 82G/6,11,12
GEOPHYSICIST: RP
DATE: JANUARY 1991
JOB: 1097
SHEET: 1
DIGHEM SURVEYS & PROCESSING INC.
Scale 1:20000
2 Km
Dighem
EM LEGEND
Grade
Anomaly
Conductance
7 ≥100 siemens
6 50-100 siemens
5 20-50 siemens
4 10-20 siemens
3 5-10 siemens
2 1-5 siemens
1 <1 siemens
- Questionable anomaly
Anomaly identifier
Interpretive symbol
Depth is greater than
15 m
30 m
45 m
60 m
Inphase and Quadrature of coaxial coil is greater than
5 ppm
10 ppm
15 ppm
20 ppm
Interpretive symbol
Conductor ("model")
B. Bedrock conductor
D. Narrow bedrock conductor ("thin dike")
S. Conductive cover ("horizontal thin sheet")
H. Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half space")
E. Edge of broad conductor ("edge of half space")
L. Culture, e.g. power line, building, fence
Hungary Peak
Block G



GEOLOGICAL BRANCH
ASSESSMENT REPORT

21,155

CONTOUR LEVELS

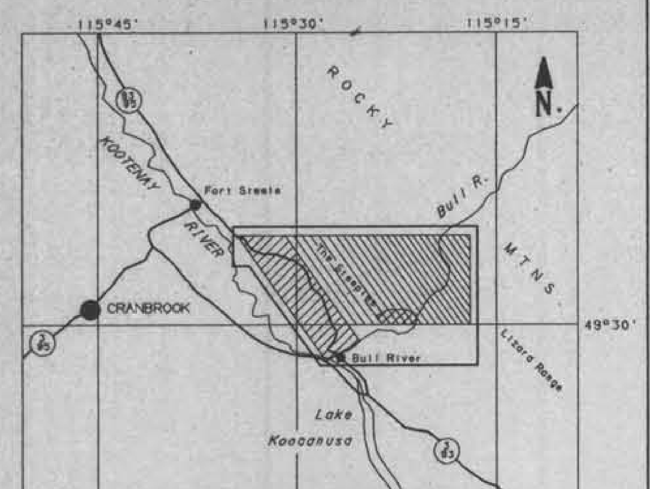
1000
800
600
500
400
300
250
200
150
125
100

Contours in ohm-m
at 10 intervals per decade

FLIGHT LINES WITH EM ANOMALIES

13010
13020
Flight direction
Flight line number
11020
Reflight Number
Line Number
Area Number
Fiducials identified on profiles
Dip direction
EM anomaly (see EM legend)
Conductor axis (on EM maps only)
Arcs indicate the conductor has a thickness > 10m
Magnetic correlation in nT (gammas)

LOCATION MAP



NTS: 82G/6,11,12

Scale 1:500,000

BUL RIVER MINERAL CORPORATION LTD.
STEEPLES CLAIM BLOCK

RESISTIVITY (900 Hz)

DIGHEM™ SURVEY	NTS: 82G/6,11,12	GEOPHYSICIST: RP
DATE: JANUARY 1991	JOB: 1097	SHEET: 1

DIGHEM SURVEYS & PROCESSING INC.

0 1 2 Km
Scale 1:20000

+ Dighem

EM LEGEND

Grade	Anomaly	Conductance
7	●	≥100 siemens
6	◕	50-100 siemens
5	◒	20-50 siemens
4	◔	10-20 siemens
3	⊕	5-10 siemens
2	○	1-5 siemens
1	◌	<1 siemens
-	✳	Questionable anomaly

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

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

GEOLOGICAL BRANCH
ASSESSMENT REPORT

21,155


GEOLOGICAL BRANCH
ASSESSMENT REPORT
21,155
CONTOUR LEVELS
1000
800
600
500
400
300
250
200
150
125
100
Contours in ohm-m
at 10 intervals per decade
FLIGHT LINES WITH EM ANOMALIES
13010
13020
Flight direction
Flight line number
11020
Reflight Number
Line Number
Area Number
Fiducials identified on profiles
Dip direction
EM anomaly (see EM legend)
Conductor axis (on EM maps only)
Arcs indicate the conductor has a thickness > 10m
Magnetic correlation in nT (gammas)
LOCATION MAP
115°45'
115°30'
115°15'
Port Steele
CRANBROOK
Bull River
Lake
Koocanusa
49°30'
NTS: 82G/6,11,12
Scale 1:500,000
BUL RIVER MINERAL CORPORATION LTD.
STEEPLES CLAIM BLOCK
RESISTIVITY (56,000 Hz)
DIGHEM SURVEY
NTS: 82G/6,11,12
GEOPHYSICIST:
DATE: JANUARY 1991
JOB: 1097
SHEET: 1
DIGHEM SURVEYS & PROCESSING INC.
0
1
2 Km
Scale 1:20000
Dighem
EM LEGEND
Grade
Anomaly
Conductance
7 ≥100 siemens
6 50-100 siemens
5 20-50 siemens
4 10-20 siemens
3 5-10 siemens
2 1-5 siemens
1 <1 siemens
- Questionable anomaly
Anomaly identifier
Interpretive symbol
C H.
Depth is greater than
15 m
30 m
45 m
60 m
Inphase and Quadrature of coaxial coil is greater than
5 ppm
10 ppm
15 ppm
20 ppm
Interpretive symbol
Conductor ("model")
B. Bedrock conductor
D. Narrow bedrock conductor ("thin dike")
S. Conductive cover ("horizontal thin sheet")
H. Broad conductive rock unit, deep conductive weathering, thick conductive cover ("half space")
E. Edge of broad conductor ("edge of half space")
L. Culture, e.g. power line, building, fence
Hungry Park
Bull River
Block E
Block F
Block G
Douglas Lake
Murray Lake