1981 Geophysical Assessment Report

TITLE	Airborne Electromagnetic and Magnetic Survey, Midway Property, Tootsee River Area, British Columbia and Yukon
CLAIMS	Mid (1-160) - Yukon Way (1-23), Bull (1-3), Bull 4 Fr., Macc Climax 1-11, Post 1 - British Columbia
COMMODITY	Pb/Zn/Ag
LOCATED	90 kilometres west of Watson Lake, Y.T. Latitude 60°00'N Longitude 130°10'W NTS 105B/1 and 104 O/16 Watson Lake Mining District, Yukon Liard Mining Division, British Columbia
BY	J.L. LeBel, AMAX Minerals Exploration Dighem Limited, Toronto, Ontario
FOR	Regional Resources Ltd.
WORK PERIOD	May 9, 1981 to May 21, 1981

MINERAL RESOURCES BRANCH
ASSESSMENT REPORT
9912
NO.

Part 5 of 7

AMAX VANCOUVER OFFICE

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SUMMARY

A 782 line kilometre airborne electromagnetic/magnetic survey was conducted on the Midway property which straddles the B.C./Yukon border approximately 90 kilometres west of Watson Lake, Y.T. At the time of the survey, the property consisted of 160 claims (Mid 1-160) in the Yukon and 39 claims (Way 1-25, Bull 1-3, Macc, Climax 1-11, Post 1) and one fractional claim (Bull 4 Fr.) in British Columbia.

The property is underlain by a sequence of clastic sedimentary rocks the lowest unit of which, a graphitic shale, hosts barite beds and exhalative chert horizons. A bedded massive sulphide horizon is located on the Bull 3 claim in a similar stratigraphic position.

Of numerous electromagnetic anomalies recorded by the survey the majority are caused by wide (or multiple), probably flat lying conductors and none can be readily attributed to a massive sulphide response.

A resistivity map prepared from the electromagnetic data shows that the area is moderately to highly conductive and that zones of very high conductivity correlate with the observed shale units.

Several small magnetic closures associated with conductors on the east side of the property suggest the presence of sulphides although known mineralization elsewhere is devoid of magnetic minerals.

INTRODUCTION

Results of a 782 line kilometre airborne electromagnetic and magnetic survey (Figure 1) flown on the Midway property are documented in this report. The survey was done by Dighem Limited, Suite 7010, 1 First Canadian Place, Toronto, Ontario between May 9th and May 21st, 1981. Base of operations for the survey was at Rancheria, Y.T.

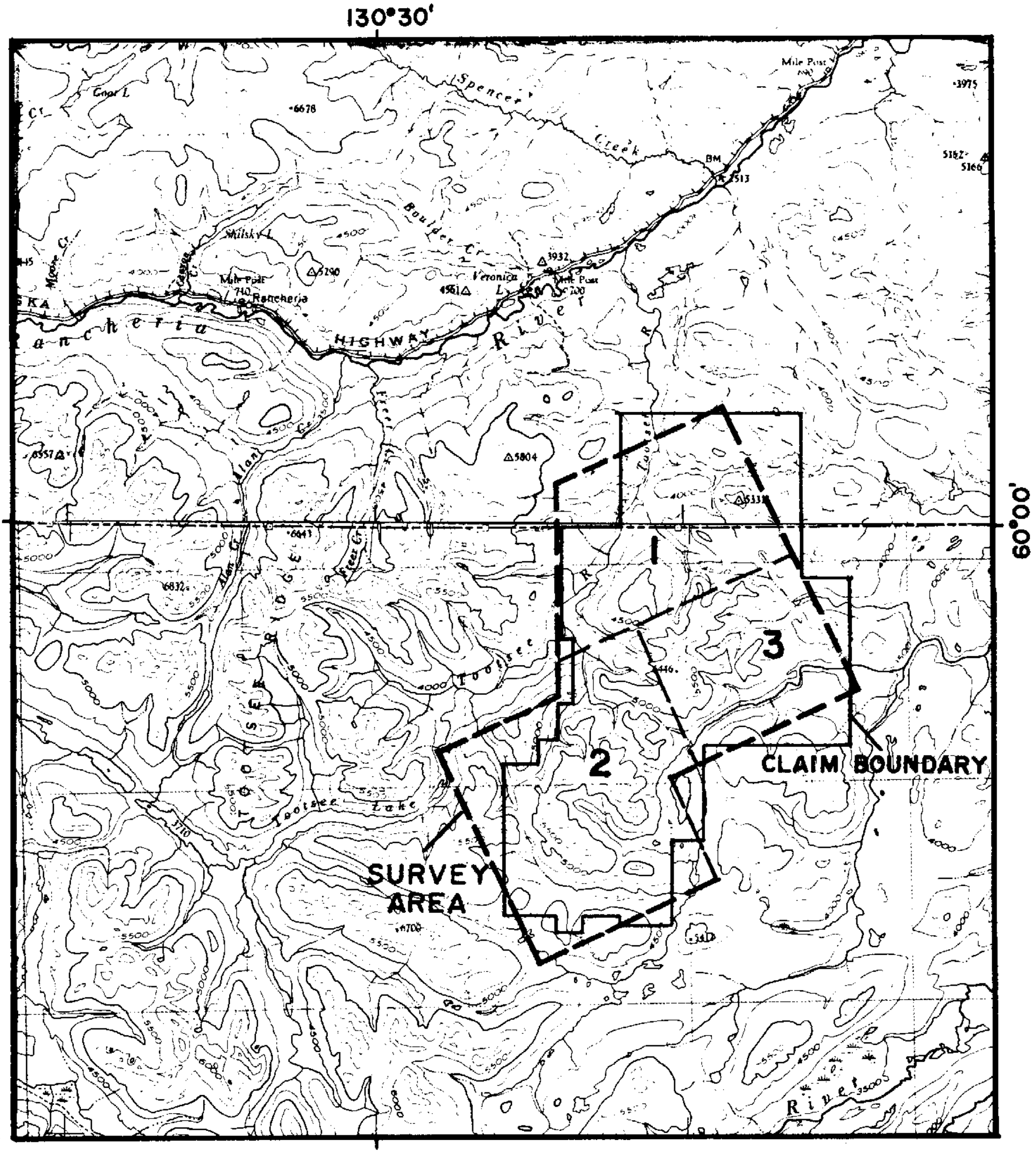
The Midway property straddles the B.C./Yukon border approximately 90 kilometres west of Watson Lake, Y.T. at latitude 60°00'N and longitude 130°10'W (NTS 105B and NTS 104O).

The property consists of 240 claims in the Watson Lake Mining District, Y.T. and 39 claims and one fractional claim in the Liard Mining Division, British Columbia. A summary of the claim status is shown below.

MIDWAY PROPERTY - CLAIM STATUS

CLAIM	GRANT NO.	EXPIRY DATE
Mid 1-128	YA 56975-57102	October 6, 1981
Mid 129-160	YA 57155-57186	October 22, 1981
Mid 161-225	YA 58936-59000	June 10, 1981
Mid 226-240	YA 65801-65815	June 10, 1981

CLAIM	RECORD NO.	EXPIRY DATE
Way 1-5	1684-1688	October 20, 1981
Way 6-23	1726-1743	November 26, 1981
Bull 1-3	1705-1707	November 12, 1981
Bull 4 Fr.	1725	November 26, 1981
Bull 5	1959	July 21, 1982
Climax 1	1716	November 26, 1981
Climax 2 & 3	1709, 1710	November 12, 1981



MIDWAY PROPERTY
LOCATION MAP
1:250,000

FIGURE 1

(cont'd)

CLAIM	RECORD NO.	EXPIRY DATE
Climax 4-11	1717-1724	November 26, 1981
Post 1	1708	November 12, 1981

OWNER: AMAX of Canada Limited

Access to the property is gained via a four-wheel drive road which departs from the Alaska Highway at milepost 701.6. The road extends approximately 13 kilometres south of the B.C./Yukon border to about the midpoint of the west side of the property. From there, a bulldozer track continues south to the south end of the claim group.

The property is underlain by Mississippian argillites, sandstones and coarse clastics of the Lower Sylvester Formation, which lie stratigraphically between McDame Formation carbonates and Upper Sylvester Formation volcanic rocks. Siliceous, pyritic and baritic exhalites, thought to be distal equivalents to Pb-Zn-Ag-Ba mineralization occur within the argillite. A stratiform sphalerite-galena-pyrite showing has been identified on the Bull 3 claim (B.C.).

The Lower Sylvester Formation rocks strike northwest and occupy the central part of a broad northwesterly trending syncline. Stratigraphy dips at 10 to 30° northeast and southwest toward the center of the structure. Numerous high angle faults cut stratigraphy, with vertical displacements of up to several hundred metres. A detailed account of property geology appears in a separate 1981 property geological and geochemical assessment report.

The objectives of the electromagnetic/magnetic survey were to; 1) investigate for the presence of massive sulphides, 2) identify and trace the favourable shale horizons and, 3) map regional geology and structure in a general way to assist in orienting more detailed surface evaluation work.

The property is under option to AMAX of Canada from Regional Resources Ltd. Work on the property was managed by Cordilleran Engineering on Regional Resource Ltd's behalf with assistance given by AMAX personnel.

EQUIPMENT AND PROCEDURE

The survey was carried out with the Dighem II electromagnetic system. The Dighem system consists of two pairs of transmitter/receiver coils oriented in coaxial (standard) and coplanar (whale tail) configurations operating at approximately 900 hertz. The coils are mounted in a ten metre long bird towed approximately 30 metres below a helicopter. The helicopter used for the survey was an Aerospatiale Lama registration number C-GDEM. Ancilliary equipment consisted of a Sonotek PMH-5010 magnetometer with its sensor approximately 15 metres below the helicopter, a Sperry radio altimeter, Geocam sequence camera, Barringer 8-channel hot-pen analog recorder, and a Sonotek SDS 1200 digital data acquisition system with a Digi-Data D1130 9-track 800-bpi magnetic tape recorder. The analog equipment recorded four channels of EM data, two ambient EM noise channels (for the coaxial and coplanar receivers), and one channel each of magnetics and radio altitude. The digital equipment recorded the EM data with a sensitivity of 0.20 ppm/bit and the magnetic field to one gamma/bit.

Line spacing for the survey was 300 metres flown at an average bird height of 38 metres at an average airspeed of 103 kilometres per hour. Navigation was achieved visually using a 1:20,000 scale airphoto mosaic.

DATA PROCESSING

The data recorded by the survey was subjected to several computer processing steps to improve recognition of bedrock anomalies.

The processing steps include digital band pass filtering of the magnetic data and calculation of electromagnetic difference channels to subdue the effects of conductive overburden. The outputs of the coaxial coils are used to calculate the conductance and depth to the cause of each anomaly using two models, a vertical thin sheet and a horizontal thin sheet and the apparent resistivity and depth to a conductive earth.

The outputs of the coplanar coils are used to calculate the apparent resistivity of the ground in a continuous manner. The model used is a 'pseudo half-space' that is, a conductive half-space overlain by a resistive layer. The details of this and the other processing steps and the significance of the various calculated parameters are discussed in Appendix A.

Recorded data and calculated parameters are plotted in stacked profiles adjusted for variations in speed of the helicopter, at a scale compatible with the airphoto mosaic compilation map.

The computer generated profiles, rather than the original analog records, are used in the evaluation and interpretation of the results in this report.

PRESENTATION OF RESULTS

The results of the survey, electromagnetics, resistivity, magnetics and enhanced (filtered) magnetics, are presented in plan superimposed on a 1:15,000 scale airphoto mosaic. For convenience in handling the map is divided into three sheets.

Anomalies are located on the electromagnetic by various symbols which depict the quality and additional essential characteristics. The symbols are labelled with an alphabetic indentifier and conductance and depth for the vertical thin sheet model. Amplitude of each anomaly, conductance and estimated depth for the vertical thin sheet models and apparent resistivity and estimated depth for the conductive earth model are listed in Appendix B. Details of the grading and labelling system used by Dighem are described in Appendix C.

The magnetic and enhanced magnetic data are presented in contoured form using 25 and 100 gamma intervals respectively. The larger contour interval for the enhanced magnetics results from a 20 lines amplification imparted to the data by the filter operator (see discussion of magnetics in Appendix C).

The resistivity results are contoured at logarithmic intervals of 1, 1.3, 1.7, 2.3, 3.1, 4.2, 5.6, 7.5, 10.0 etc to accommodate the large resistivity range. The data are cut-off at one ohm-m and 1,000 ohm-m, the low and high sensitivity limits of the system. Numerical labels on the contours 'point' in the direction of increasing resistivity.

RESULTS

An abundance of anomalies were detected by the survey. Line to line correlation of the anomalies to show strike length and direction of the conductors was hampered by the variable character and numbers of the anomalies and the lack of guidance provided by the bland magnetic activity in the area. The trends of the conductors shown on the electromagnetic map were largely determined by use of the resistivity contour patterns. Most of the conductors are long, wide and gently dipping and a majority of them are located at some depth below the surface. There is no evidence that conductive overburden contributes to the electromagnetic response of the area.

There is minimal magnetic activity in the area and only a few anomalies have direct magnetic correlation.

Resistivities range from one ohm-m to 1,000 ohm-m. Most of the area is moderately to highly conductive, resistive areas greater than 1,000 ohm-m are restricted to the east and west edges of the area and occasional small closures elsewhere.

In selecting anomalies for ground follow-up an EM conductor and a coincident resistivity low were considered favourable criteria. A resistivity low alone was not considered a worthwhile target because it could be caused by high background EM response lacking a discrete peak. An example of this type of response occurs at the west end of line 32 on sheet two. Short strike length was also considered a favourable criterion.

Anomalies judged as worthwhile targets are listed below.

Anomaly 43E - A wide conductor which correlates with an interesting 50 gamma magnetic anomaly. The conductor extends to 44E and 42B but magnetic correlation degrades to flanking.

Anomaly 45B-46A - A wide conductor associated with a discrete two line magnetic closure. The resistivity map suggests that the conductor extends south through anomaly 41B.

Anomaly 46E-48E - A wide variable conductor on a steep magnetic gradient. The anomaly probably extends to 44C where it correlates with a distinctive magnetic anomaly.

Anomaly 54C-56D - A good conductor which correlates with an intense resistivity low. Several conductors immediately to the east have similar characteristics.

Anomaly 54H-56H - A conductor situated on the east edge of a resistivity low. The asymmetry of the resistivity low suggests a westward dipping feature.

Other Anomalies - Anomalies 44U, 57Q, 61X, 65N and others associated with resistivity lows immediately east of the 1,000 ohm-m resistivity contour.

Sheet 2

Anomaly 1400G-157 - A short good conductor which correlates with a 10 gamma magnetic anomaly not displayed by the magnetic contour map because of the coarse contour interval used.

Anomaly 25I - A highly resolved EM response on the edge of a large resistivity low. Anomaly 3000D has similar characteristics.

Anomaly 18F - A broad but strong conductor with essentially no out-of-phase response. The anomaly is part of a long conductor which extends for several kilometres to Anomaly 2C on the west side of the area.

Anomaly 12A-14A - Modest anomalies which reflect a 'compact' conductor on a well defined resistivity low.

Other Anomalies - Other anomalies which reflect discrete conductors are 23A-25C, 28F-29C and 32D-34D.

Sheet 3

Anomaly 21I-25E - An isolated conductor with a distinct resistivity low with a westerly dip.

Anomaly 35J-35K - A pair of single weak anomalies which have generated a small resistivity low.

Anomaly 28A-29B, C - Modest anomalies associated with a small magnetic closure. The anomalies reflect a wide source.

DISCUSSION OF RESULTS

The variations in the resistivity reflect the variable carbon content in the sedimentary lithologies. The zones of lowest resistivity (say less than 10 ohm-m), in general, correlate with the known graphitic shales which host the barite and exhalite horizons and the known massive sulphide horizon. The low resistivity zones are concentrated along the west and east sides of the area, in particular at the southwest end of the area where a broad resistivity low suggests the favourable shale horizon is several hundred metres thick.

The zones of high resistivity (greater than 1,000 ohm-m) at the margins of the area reflect carbonate rocks. Isolated closures elsewhere in the area reflect either faulted blocks of carbonates or in some cases volcanic rocks, the youngest member of the Sylvester Group. In many cases, especially at the margins of the area, the juxtaposition of high and low resistivity serves to identify the location of faults.

Most of the electromagnetic anomalies reflect long, wide (or multiple) conductors characteristic of conductive lithologies. None of the anomalies detected by the survey can be readily attributed to a massive sulphide conductor. The combination of conductors and resistivity lows outline the most graphitic shale units and therefore may assist in focussing ground examination.

The bland magnetic response of the area is consistent with the low magnetic susceptibility of sedimentary rocks. Several small magnetic closures, emphasized by the enhanced magnetics, associated with the conductive trends along the east side of the area are unique because of the general absence of magnetic activity elsewhere on the property. If these anomalies are caused by pyrrhotite, they may indirectly indicate the presence of more desirable sulphide minerals, although the known mineralization is devoid of magnetic minerals.

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Date J.L. LeBel

APPENDIX A

THE FLIGHT RECORD AND PATH RECOVERY

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THE FLIGHT RECORD AND PATH RECOVERY

Both analog and digital flight records are produced. The analog profiles are recorded on green chart paper in the aircraft during the survey. The digital profiles are generated later by computer and plotted on grey chart paper at a scale usually identical to the geophysical maps. The digital profiles, which may be displayed, are as follows:

Channel			Scale	
Number/	Label	Parameter	units/mm	Noise
20	MAG	magnetometer	10 gamma	2 gamma
21	ALT	bird height	10 feet	5 feet
22	CXI	coaxial coil-pair inphase	1 ppm	1-2 ppm
23	CXQ	coaxial coil-pair quadrature	1 ppm	1-2 ppm
24	CPI	coplanar coil-pair inphase	1 ppm	1-2 ppm
25	CPQ	coplanar coil-pair quadrature	1 ppm	1-2 ppm
26	VLFT	VLF-EM total field	1 %	1-2 %
27	VLFQ	VLF-EM vertical quadrature	1 %	1-2 %
28	CXS	ambient noise monitor (coaxial coil)	1 ppm	1 ppm
29	CPS	ambient noise monitor (coplanar coil)	1 ppm	1 ppm
33	DIFI	difference function inphase	1 ppm	1-2 ppm
34	DIFQ	difference function quadrature	1 ppm	1-2 ppm
35	REC1	first anomaly recognition function	1 ppm	1-2 ppm
36	REC2	second anomaly recognition function	1 ppm	1-2 ppm
37	SIGT	conductance	1 mho	
40	RES	log resistivity at main frequency	.03 decade	
41	DP	apparent depth at main frequency	3 m	
45	RES2	log resistivity at secondary frequency	.03 decade	
46	DP2	apparent depth at secondary frequency	3 m	

Note: Channels 42 to 44 are experimental.

The log resistivity scale of 0.03 decade/mm means that the resistivity changes by an order of magnitude in 33 mm. The resistivities at 0, 33, 67 and 100 mm up from the bottom of the chart are respectively 1, 10, 100 and 1000 ohm-m.

The fiducial marks on the flight records represent points on the ground which were recognized by the aircraft navigator. Continuous photographic coverage allowed accurate photo-path recovery locations for the fiducials, which were then plotted on the geophysical maps to provide the track of the aircraft.

The fiducial locations on both the flight records and flight path maps were examined by a computer for unusual helicopter speed changes. Such changes may denote an error in flight path recovery. The resulting flight path locations therefore reflect a more stringent checking than is provided by standard flight path recovery techniques.

The following brief description of DIGHEM^{II} illustrates the information content of the various profiles*.

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*For a detailed description, see D.C. Fraser, Geophysics, v.44, p.1367-1394.

Single-frequency surveying

The DIGHEM^{II} system has two transmitter coils which are mounted at right angles to each other. Both coils transmit at approximately the same frequency. (This frequency is given in the Introduction.) Thus, the system provides two completely independent surveys at one pass. In addition, the digital flight chart profiles (generated by computer) include an inphase channel and a quadrature channel which essentially are free of the response of conductive overburden. Also, the EM channels may indicate whether the conductor is thin (e.g., less than 3 m), or has a substantial width (e.g., greater than 10 m). Further, the EM channels include channels of resistivity, apparent depth and conductance. A minimum of 11 EM channels are provided. The DIGHEM^{II} system therefore gives information in one pass which cannot be obtained by any other airborne or ground EM technique.

Figure A1 shows a DIGHEM^{II} flight profile over the massive pyrrhotite ore body in Montcalm Township, Ontario. It will serve to identify the majority of the available channels.

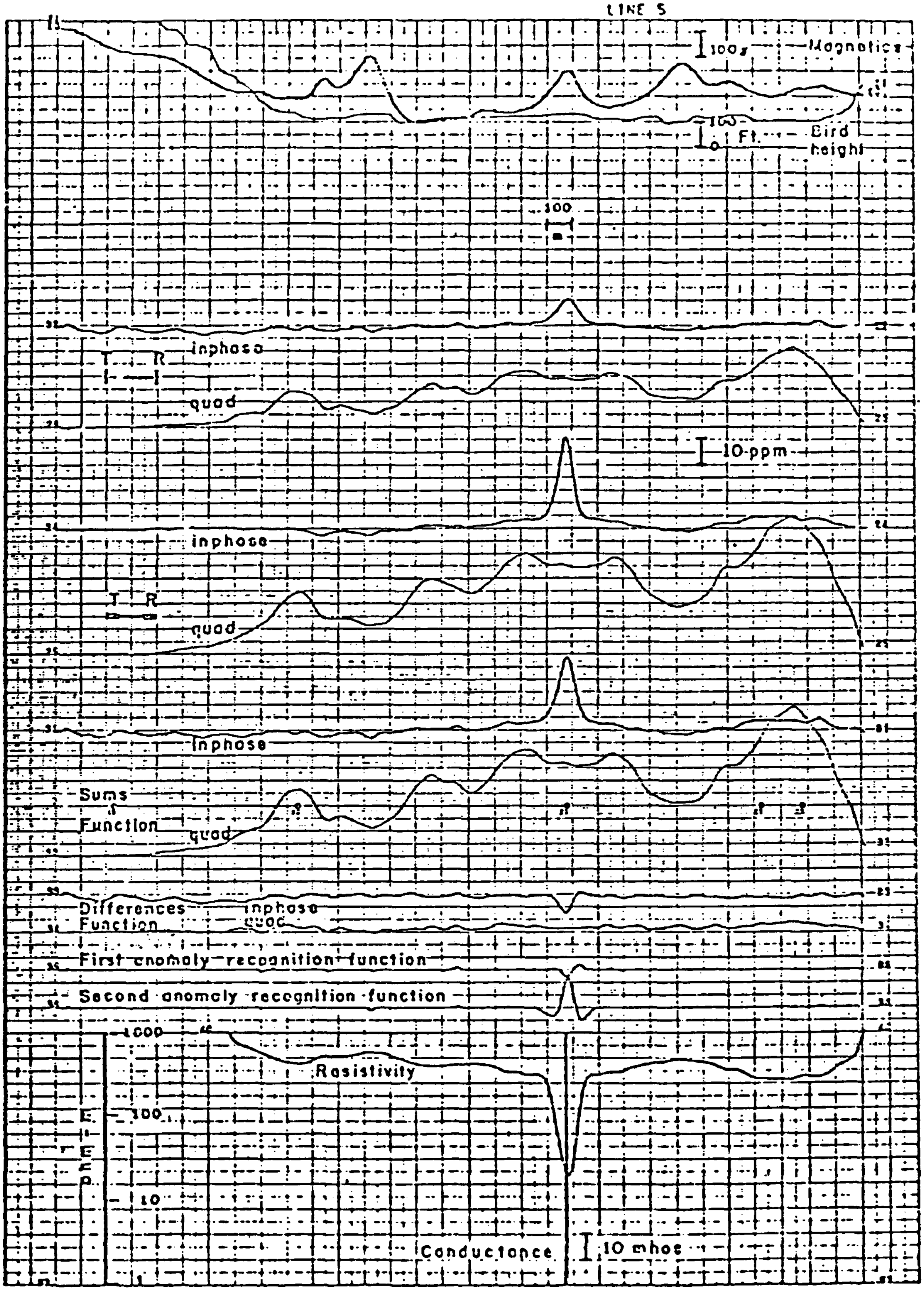

Fig. A1. Flight over Montcalm deposit, with line parallel to strike

The two upper channels (numbered 20 and 21) are respectively the magnetics and the radio altitude. Channels 22 and 23 are respectively the inphase and quadrature of the coaxial coil-pair, which is termed the <u>standard</u> coil-pair. This coil-pair is equivalent to the standard coil-pair of all inphase-quadrature airborne EM systems. Channels 24 and 25 are the inphase and quadrature of the additional coplanar coil-pair which is termed the <u>whaletail</u> coil-pair.

Channels 31 and 32 are inphase and quadrature sum functions of the standard and whaletail channels; they provide a condensed view of the four basic channels 22 to 25. The sum channels normally are not plotted.

Channels 33 and 34 are inphase and quadrature difference functions of the standard and whaletail channels. The difference channels are almost free from the response of conductive overburden. Channel 37 is the conductance. The conductance channel essentially is an automatic anomaly picker calibrated in conductance units of mhos; it is triggered by the anomaly recognition functions shown as channels 35 and 36.

Channel 40 is the resistivity, which is derived from the whaletail channels 24 and 25. The resistivity channel 40 yields data which can be contoured, and so the DIGHEM^{II} system yields a resistivity contour map in addition to an electromagnetic map, a magnetic contour map, and an enhanced magnetic contour map. The enhanced magnetic contour map is similar to the filtered magnetic map discussed by Fraser.*

Figure A2 presents the DIGHEM^{II} results for a line flown perpendicularly to the Montcalm ore body. Channel 20 shows the 175 gamma magnetic anomaly caused by the massive pyrrhotite deposit. For the EM channels, the following points are of interest:

1. On channels 22-25 and 31-34, the ore body essentially yields only an inphase response. The quadrature response is almost completely caused by conductive overburden (which also gives a small inphase response). The hachures show the EM response from the overburden. The overburden response vanishes on the

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*Cdn. Inst. Mng., Bull., April 1974.

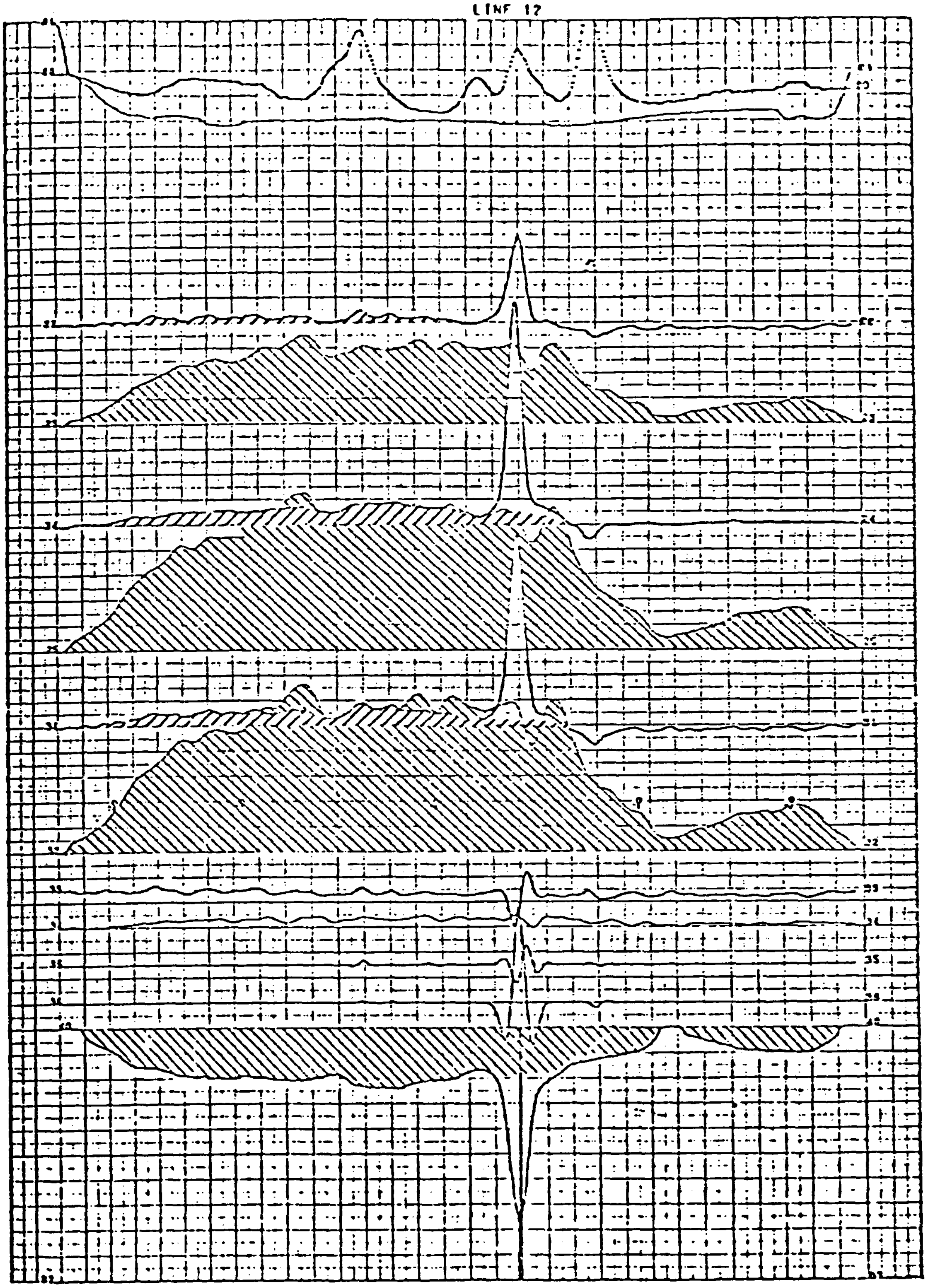

Fig. A2. Flight over Montcalm deposit, with line perpendicular to strike.

difference EM channels, as can be seen by comparing the quadrature channels 25 and 34. This is an important point to note because DIGHEM^{II} is the only EM system which provides an inphase channel and a quadrature channel which are essentially free of conductive overburden response.

2. The whaletail anomaly of channel 24 has a single peak. This shows that the conductor has a substantial width. If the width had been under 3 m, the conductor would have produced a weak m-shaped anomaly on channel 24.

3. The ore body yields a resistivity of 5 ohm-m in a background of about 200 ohm-m (cf. channel 40). A dipole-dipole ground resistivity survey with an a-spacing of 50 m showed a similar background, but the ore body gave a low of only 53 ohm-m because of the averaging effect inherent in the ground technique.

4. The ore body has a conductance of 330 mhos according to its EM response on this particular flight line. The conductance channel 37 saturates at 100 mhos, and so the deposit is indicated by a 100-mho spike.

Figure A1 illustrates the DIGHEM^{II} results for a line flown subparallel to the ore body. The ore body anomaly is small on the standard coil-pair (channel 22) but shows up strongly on the whaletail coil-pair (channel 24).

Dual-frequency surveying

For surveys flown primarily for resistivity mapping, as opposed to EM surveying, the two transmitter coils may be energized at two well-separated frequencies (e.g., 900 and 3600 Hz). Apparent resistivity and apparent depth maps can be made independently for each frequency. The interpretation procedure involves comparing the apparent resistivities and apparent depths at the two frequencies.

The use of two different coil-pair orientations (i.e., standard and whaletail) for dual-frequency resistivity mapping is an unorthodox procedure. However, as long as the current flow patterns are primarily horizontal, the different coil orientations do not influence the results, according to superposed dipole theory. Wire fences and other cultural features will produce local deviations, because they usually respond preferentially to one or the other of the coil-pairs.

The difference channels 33 and 34 are not produced because the divergent frequencies of the two coil-pairs renders them meaningless. In addition, channels 35 to 37 also are not produced.

APPENDIX B

EM ANOMALY LIST

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[illegible]

            COAXIAL       COPLANAR    .   VERTICAL    .    HORIZONTAL      CONDUCTIVE
             COIL           COIL      .     DIKE      .      SHEET            EARTH
                                      .               .
 LINE &   REAL   QUAD   REAL   QUAD   .  COND  DEPTH#.   COND  DEPTH     RESIS  DEPTH
 ANOMALY   PPM    PPM    PPM    PPM   .  MHOS   FEET .   MHOS   FEET     OHM-M   FEET
                                      .               .
                                      .               .
 [illegible]  1      2      0      0   .     4    213 .      1    752      1035      0
 [illegible]  2      0      5      1   .     4    122 .      2    338        28    243
 [illegible]  1      1      9      3   .    17    205 .      3    343        16    253
 [illegible] 23     11    145     13   .    47      0 .      3    137         3    136
 [illegible]  2      3      1      3   .     3     65 .      1    138       480     14
 [illegible]  2      7      0      4   .     1     43 .      1    211       184     69
 [illegible]  1      0      2      0   .    49    241 .      2    194        59     71
 [illegible]  5     19      7     37   .     2      0 .      1    102       139      0
 [illegible]  5     15      6     25   .     2     14 .      1    130       123     22
 [illegible]  0      9      8      0   .    22    156 .     14    149         1    114
 [illegible] 61     24    105     37   .    59     23 .     15     87         1     61
                                      .               .
 43A         5      2     11     13   .     6     63       2    298        30    202
 43C         3      0      3      0   .    51      0 .     14    154         1    123
 43E         5      2      5      1   .    30      0 .      3    226         3    166
 43F        10      0     15      0   .    33     88 .      5    146         7     89
 43G         2      3      0      5   .     2     53 .      3    165        21     83
 43H         0      4      0      0   .     3    100 .      2    266        36    160
 43K         5      1      3      5   .     4     22 .      1    307       139    135
 43O         7     17     12     34   .     2      0 .      1    115        65     15
 43P         3     10     10     23   .     2     12 .      2    152        46     53
 43R         4     12      0     12   .     1     15 .      1    133       154     56
 43T         4     14      2     30   .     1      0 .      1    126        33     25
 43U         1      0      9      0   .    49    231 .      2    173        30     80
 43V         3      2     12      3   .    11     92 .      3    205        21    123
 43W         1      1      0      3   .     5    129 .      2    157        54     39
 43X         4      3      5      5   .     7     69 .      2    220        54     97
 43Z        12     10     25     21   .    12     34 .      4    216        12    144
                                      .               .
                                      .               .
 .                                                                       .
 .# 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.     .
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[illegible] [illegible], [illegible] 10-JUN-1981

LINE & ANOMALY	COAXIAL COIL REAL PPM	COAXIAL COIL QUAD PPM	COPLANAR COIL REAL PPM	COPLANAR COIL QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* FEET	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH FEET	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH FEET
41B	7	9	17	14	9	63	4	227	12	157
41C	12	5	33	9	72	0	3	125	3	79
41D	22	6	47	14	35	3	10	116	1	76
41E	3	5	13	17	5	42	2	139	24	102
41G	4	2	1	0	11	52	1	552	130	352
41I	1	0	2	11	1	0	1	172	440	0
41J	5	5	7	7	8	2	2	157	52	46
41K	2	2	0	0	5	134	2	223	55	97
41M	3	15	7	21	4	0	1	128	97	13
41N	2	1	0	0	5	193	1	211	91	81
41O	5	10	9	13	4	15	2	136	41	39
41Q	4	1	1	0	39	240	1	241	80	107
41R	7	10	4	11	4	40	1	162	144	35
41T	15	1	14	5	49	76	2	337	31	234
42A	33	21	61	35	29	10	7	137	3	94
42B	22	22	34	35	12	13	4	128	9	74
42C	10	15	17	14	10	76	3	192	16	121
42D	2	5	1	6	2	18	1	151	457	0
42E	11	17	15	31	5	0	2	122	48	24
42F	3	3	1	3	4	129	2	236	59	111
42G	2	0	1	0	15	195	2	134	58	55
42H	4	2	3	1	10	84	2	174	47	59
43C	4	5	2	4	8	32	4	305	11	224
43D	5	0	1	0	11	149	4	194	9	113
43E	25	35	39	55	9	0	3	107	13	44
43F	4	12	0	15	2	0	2	228	29	133
43G	13	10	21	22	15	12	3	175	14	105
43H	4	3	3	6	7	75	2	245	34	142
43I	2	5	0	4	2	50	1	291	197	114
43K	5	4	9	5	13	63	4	265	13	182

* 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.

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[illegible] RIVER  10-JUN-1981

            COAXIAL       COPLANAR     .  VERTICAL     .    HORIZONTAL      CONDUCTIVE
              COIL          COIL       .    DIKE       .      SHEET            EARTH
                                       .               .
LINE .    REAL   QUAD   REAL   QUAD    . COND   DEPTH*.   COND   DEPTH     RESIS   DEPTH
ANOMALY    PPM    PPM    PPM    PPM    . MHOS    FEET .   MHOS    FEET    OHM-M    FEET
                                       .               .
                                       .               .
  43M        4     10      5     10    .    3       0 .      1     204       91      67
  43N        4      5      6      9    .    4      34 .      1     217       62      92
  43P        3      3      7     10    .    4      37 .      1     135       72      64
  43Q        3      1      3      1    .   21     203 .      1     334       83     181
  43R        4      2      2      1    .   17     217 .      1     482      112     303
                                       .               .
                                       .               .
  44A        3      0      3      1    .   49      54 .      4     159       13      86
  44B        4      3      2      6    .    4      64 .      3     251       27     160
  44C       14     13     22     20    .   12      54 .      3     180       14     115
  44D        1      3      3     15    .    2      28 .      2     201       24     115
  44E        9      2      7      0    .   31      79 .      5     200        6     138
  44F       10      6      4      7    .   10     133 .      1     233       71     115
  44H        1      4      4      1    .    7     159 .      1     238       69     118
  44I        3      9     12     13    .    8      39 .      2     233       30     136
  44M        5     11      7     20    .    3       9 .      1     137       93      25
  44N        6      5      3      5    .    5      12 .      1     172       59      49
  44P        4      6      2      5    .    4      92 .      1     314       69     177
  44T        2      3      0      2    .    2     159 .      1     279       86     142
  44U        3      1      9      0    .   49      30 .     13     322        1     277
                                       .               .
                                       .               .
  45B       13     16     29     29    .   10      44 .      3     172       14     106
  45C        5      7      9     12    .    5      82 .      3     193       19     116
  45D        2      1      2      1    .    5     164 .      3     194       21     114
  45E        4      5      1     10    .    3      47 .      2     216       33     117
  45G       10     16      7     12    .    5      19 .      2     215       56      97
  45I        3      4      3      5    .    4      89 .      2     238       54     117
  45J        4      5      0      5    .    3       5 .      1     200      201      36
   .                                                                          .
   .* 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.                .
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[illegible] AREA, TOOTSEE RIVER 10-JUN-1981

	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE & ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
45N	2	2	3	4	5	103	2	222	44	103
45O	3	3	11	15	5	49	2	198	34	99
45P	4	7	0	5	3	51	1	217	74	93
45Q	5	4	2	3	6	101	1	222	117	78
45R	10	7	13	3	16	54	2	215	44	103
46A	1	0	5	1	40	233	3	206	17	126
46B	1	1	0	2	4	130	3	191	22	103
46C	4	3	3	11	2	12	2	174	27	84
46E	2	0	0	0	10	229	3	313	17	227
46F	2	2	5	3	9	157	3	278	16	193
46G	11	7	20	15	15	41	3	139	18	113
46I	5	5	4	12	5	53	2	243	41	132
46J	1	4	0	4	3	120	1	176	344	18
46M	3	17	11	25	4	3	1	143	65	33
46N	6	14	5	13	3	9	1	151	132	31
46P	5	10	5	15	3	8	1	159	91	41
46T	3	4	0	4	2	105	1	137	374	0
47A	4	2	0	0	9	73	1	579	1035	0
47B	5	9	3	3	3	43	3	177	22	94
47C	6	4	8	6	12	105	3	163	17	90
47D	4	7	5	3	4	70	2	155	27	68
47E	35	27	50	43	18	0	4	127	10	70
47F	2	4	1	0	3	85	1	263	145	104
47G	1	7	3	3	2	4	1	162	94	42
47H	12	8	14	13	13	73	3	196	21	115
47I	3	15	5	27	3	0	1	143	63	40
47K	5	7	7	9	5	0	2	187	51	67
47M	4	4	5	5	8	119	1	220	85	89

* 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.

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[illegible] AREA, [illegible] RIVER  10-JUN-1981

            COAXIAL       COPLANAR      .  VERTICAL    .    HORIZONTAL      CONDUCTIVE
             COIL           COIL        .    DIKE      .      SHEET           EARTH
                                        .              .
 LINE &   REAL    QUAD    REAL    QUAD  . COND  DEPTH*.  COND   DEPTH     RESIS   DEPTH
 ANOMALY   PPM     PPM     PPM     PPM  . MHOS   FEET .  MHOS    FEET     OHM-M    FEET
                                        .              .
                                        .              .
   48B       6       2      13       3  .   40    122 .     7     364         4     293
   48C       9       4       5       3  .    5     77 .     2     275        30     179
   48D      17      14      35      27  .   15      2 .     5     131         7      74
   48E       1       0       2       1  .   35    376 .     4     246         9     180
   48F       3       3       3      12  .    2     42 .     1     191        57      81
   48G       4       7       2       0  .    4    127 .     2     237        49     126
   48H       2       7       0      10  .    1      0 .     1     217        68      94
   48I       2       0       3       0  .   96    254 .     2     255        29     161
   48J       6      12       5      12  .    3     20 .     1     175       137      47
   48M       2       3       1       1  .    5    121 .     1     150       700       0
                                        .              .
                                        .              .
   49A       4       3       0       0  .    7    149 .     1     684        96     501
   49B       8       5      27       3  .   27      0 .    10     166         2     115
   49C      52      24      92      42  .   42      0 .     8     137         2      96
   49E       4       5       3       1  .    6     27 .     1     256        84     107
   49F       2      13       4      23  .    1     34 .     1     215       111      99
   49G      10       7       4       3  .    9     70 .     2     204        44      95
   49I       3       7       8      17  .    2     35 .     2     170        53      64
   49J       5       4       5       7  .    6    105 .     1     209        58      93
   49K       5      12       5      21  .    2      0 .     1     151       133      30
   49M       3       3       0       0  .    7    144 .     1     230       133      74
   49N       4       2       1       1  .   10    211 .     1     281       431      83
                                        .              .
                                        .              .
   50A      22       9      34      15  .   34      0 .     9     118         2      72
   50B       2       3      17       6  .   15     19 .    10     131         2      84
   50C       3       4       2       1  .    5    148 .     1     446       271     229
   50D       9      12      16      22  .    7      0 .     4     155        13      87
   50E       4       2       1       0  .    8    179 .     2     340        35     237
   50F       4       7       8       7  .    5     85 .     2     285        31     187
   50G       5       5       7      10  .    7     65 .     1     210        67      67
   50H       4       4       4       6  .    5     97 .     1     146        63      40
   50J       3       0       4       1  .   49    247 .     1     301        93     151
                                        .              .
                                        .              .
   51A       1       0      17       0  .   49    114 .     8     194         3     142
  .                                                                       .
  .* 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.     .
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E-842 A -K, TOOTSEE RIVER 19-JUN-1981

	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE & ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
51B	12	12	8	13	8	45	4	217	9	151
51D	7	5	8	7	9	113	2	382	34	275
51F	14	0	24	0	49	57	9	184	2	135
51G	0	5	0	0	2	0	4	132	13	110
51H	10	10	15	13	9	19	3	179	15	109
51I	3	2	6	3	14	65	3	252	19	157
51J	3	5	2	7	3	16	1	204	106	61
51M	3	12	0	13	1	0	1	112	226	0
51N	5	1	4	4	12	149	1	286	65	151
52A	33	40	65	69	14	0	4	132	10	74
52B	8	6	9	3	11	70	2	368	60	232
52D	4	3	5	15	3	19	1	144	77	32
52E	3	0	8	1	49	220	2	179	47	78
52F	4	6	7	9	5	95	1	151	63	50
53A	0	15	0	33	3	0	3	113	14	47
53B	32	0	77	0	49	27	15	92	1	62
53C	75	46	123	91	30	0	10	99	1	67
53D	13	15	8	13	6	50	1	191	59	82
53E	3	0	6	0	49	201	3	174	14	99
53F	5	0	4	0	17	162	2	161	28	72
53G	5	10	1	15	2	25	2	137	43	45
53H	4	2	8	5	14	31	3	151	22	74
53I	31	39	58	71	11	0	3	99	13	25
54A	55	31	156	56	70	0	15	70	1	40
54B	7	0	7	0	49	46	3	169	17	85
54C	4	4	7	7	7	84	2	336	59	203
54D	8	3	16	5	33	99	4	193	10	126
54E	5	0	11	1	49	153	7	258	3	203
54F	8	6	7	10	9	72	3	211	21	130
54G	3	5	4	11	3	50	1	157	64	50

* 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.

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[illegible] TOOTSEE RIVER  10-JUN-1981

             COAXIAL       COPLANAR    .   VERTICAL    .   HORIZONTAL      CONDUCTIVE
              COIL           COIL      .     DIKE      .     SHEET            EARTH
                                       .               .
LINE &   REAL   QUAD    REAL    QUAD   . COND  DEPTH*. COND  DEPTH     RESIS   DEPTH
ANOMALY  PPM    PPM     PPM     PPM    . MHOS  FEET  . MHOS  FEET      OHM-M   FEET
                                       .               .
                                       .               .
  54H      4      0       5       3    .   7     83  .   2    214        30     118
  54J      6     10      11      20    .   5     48  .   2    178        44      77
                                       .               .
                                       .               .
  55B     53     25     114      72    .  31      0  .   7     91         3      49
  55C     15      5      23      12    .  42     27  .   6    197         4     143
  55E     15      6      23      12    .  33      0  .   6    198         5     137
  55F      6      5       0       5    .   3     54  .   1    278       168     107
  55G      2      3       5      13    .   2     39  .   2    219        41     115
  55I      5      0       7       0    .  35    187  .   3    294        14     212
  55J      1      0       1       0    .  54    390  .   3    298        22     205
  55K      5      5       7       3    .   7     63  .   2    229        29     134
  55M      5      0       7       1    .  49    120  .   2    164        30      63
  55N      4      5       6      10    .   4     62  .   2    194        48      83
                                       .               .
                                       .               .
  56A      4      0       5       1    .  49    146  .   5    245         7     179
  56B      6      5      15       3    .  17     64  .   5    239         6     177
  56C     26     19      95      43    .  37      0  .   9    133         2      92
  56E      3      5       4 [illegible].   5     87  .   2    301        53     176
  56F      5      5       4       3    .   5     64  .   2    270        45     154
  56G      5      1       9       2    .  30    139  .   5    344         9     269
  56H      6      3       7       4    .  17     93  .   2    219        51      99
  56I      6      1       6       1    .  47    137  .   1    148        61      35
  56J      6      2       6       7    .  16     56  .   1    201       123      49
                                       .               .
                                       .               .
  57B      5      2       3       3    .   9     23  .   1    392       119     205
  57C      0      0       7       7    .   5    149  .   2    218        47     106
  57D      2      3       7       7    .   5     97  .   2    233        38     127
  57E      3      5       3      15    .   3     55  .   1    203        83      81
  57F      4      9      10      22    .   4     15  .   2    157        41      66
  57G      5      0       6       1    .  22    130  .   2    199        39      92
   .                                                                           .
   .* 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.                 .
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[illegible] AREA, [illegible] RIVER 10-JUN-198[illegible]

	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE & ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
57J	1	5	0	10	1	9	1	233	117	96
57M	8	17	13	22	4	0	1	127	62	25
57N	3	6	1	7	2	45	1	130	178	43
57O	1	5	0	2	1	0	1	213	135	74
57Q	4	0	3	0	48	102	2	411	51	273
58A	2	3	0	4	2	74	1	491	74	340
58B	6	8	8	11	5	53	3	294	23	204
58C	3	7	8	12	3	32	2	208	34	107
58D	3	1	0	1	6	144	1	218	64	94
58E	3	3	0	7	4	94	2	253	35	149
58F	3	7	15	17	8	19	2	171	26	81
58G	2	6	1	6	2	22	1	171	168	35
58H	0	1	0	0	5	184	1	175	73	57
58I	4	7	10	17	4	43	2	143	50	43
58J	3	12	20	20	6	0	2	143	32	50
59A	3	1	5	1	34	5	3	408	22	293
59C	3	5	1	3	2	50	2	296	57	165
59D	2	1	4	3	12	191	3	333	17	241
59E	4	1	3	0	20	180	3	360	23	258
59F	3	3	5	13	2	6	1	173	69	56
59G	3	3	6	8	6	84	1	200	59	82
59I	5	10	7	22	3	20	1	156	67	50
59J	4	2	9	9	9	79	2	197	31	99
59K	3	3	8	8	8	96	2	258	35	153
59M	5	2	8	6	14	11	2	190	39	79
60A	4	2	7	4	19	159	3	384	16	291
60B	1	0	2	0	49	223	7	223	4	158
60C	0	1	4	1	16	207	5	204	7	137
60E	5	9	3	11	4	30	1	229	85	93

* 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.

[illegible], TOOTSEE RIVER 10-JUN-1981

	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE & ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
60F	2	5	0	9	2	17	1	203	83	72
60G	3	2	10	21	6	3	2	156	42	52
60I	5	7	7	2	8	30	2	194	31	96
60J	5	3	11	5	16	83	3	238	25	149
60M	5	5	5	14	5	57	2	178	47	72
60O	5	3	9	17	4	38	2	187	33	90
60Q	3	6	5	9	3	47	1	169	84	48
60T	5	2	0	3	8	163	1	272	197	108
61A	2	2	0	0	3	165	1	304	64	173
61B	2	11	0	33	1	10	2	151	43	62
61C	4	5	9	0	14	157	3	151	19	76
61E	5	6	11	10	8	20	3	168	14	94
61F	2	5	4	7	3	56	2	251	34	148
61H	2	3	0	7	1	12	2	288	29	193
61I	6	2	13	6	27	115	5	212	7	149
61J	3	0	0	0	14	264	7	254	4	204
61K	4	6	0	6	3	73	1	176	59	65
61M	13	4	21	15	24	28	3	138	15	113
61N	1	1	0	3	2	162	1	207	125	69
61O	1	0	0	0	4	204	1	160	66	50
61Q	2	8	5	17	2	0	1	128	69	25
61R	2	5	0	0	4	126	1	139	105	63
61T	5	4	12	7	14	112	2	208	43	102
61U	2	4	0	7	2	69	1	189	143	58
61V	3	12	4	21	3	11	1	140	60	38
61X	50	21	87	47	41	4	6	136	4	89
62L	5	4	10	3	15	100	3	345	18	250

* 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.

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[illegible], TOOTSEE RIVER  10-JUN-1991

            COAXIAL      COPLANAR    .  VERTICAL    .   HORIZONTAL     CONDUCTIVE
             COIL          COIL      .    DIKE      .     SHEET           EARTH
                                     .              .
LINE &   REAL   QUAD   REAL   QUAD   . COND  DEPTH*.  COND   DEPTH    RESIS   DEPTH
ANOMALY  PPM    PPM    PPM    PPM    . MHOS   FEET .  MHOS   FEET     OHM-M   FEET
                                     .              .
                                     .              .
  62C      3      3      9      3    .    8     40 .     2    222        32    122
  62E     13      3     24      7    .   32     64 .     3    202        19    125
  62F     11      3     10     16    .    9     11 .     3    144        22     62
  62G      1      1      5      2    .   10    225 .     2    200        41     94
  62H      7      7     20     11    .   13    103 .     3    235        21    154
                                     .              .
                                     .              .
  63A      5      3     12      3    .   29    147 .     4    279         9    209
  63B     10     11     15     23    .    7      0 .     2    122        28     34
  63D      4      4     10      9    .    8     37 .     3    192        25     95
  63E      0      2      0      0    .    4    182 .     1    269        72    133
  63F      5      3      5     12    .    4     44 .     1    209        67     85
  63G      7      4      7      3    .   10     88 .     2    269        33    167
  63I     15      3     31      3    .   49     82 .    15    240         1    202
  63J      4      2      2      3    .    9    147 .     1    226        66    100
  63N      1      3      9      7    .    6    110 .     2    222        39    115
                                     .              .
                                     .              .
  64A      5      2      7      1    .   30    153 .     2    292        30    196
  64B      2      4      0      7    .    2     55 .     1    178        55     70
  64C      4      5     11     17    .    5     65 .     2    168        30     79
  64D      1      1      5      1    .   25    207 .     3    172        21     92
  64E      3      1      0      0    .    5    167 .     2    209        42    102
  64F      6      0     13      0    .   49    128 .     5    306         7    241
  64G      1      0      7      2    .   46    246 .     2    211        29    113
  64H      0      0      4      0    .   59    354 .    11    338         2    289
  64I      0      5      0      2    .    1     63 .     1    276        72    145
  64J      4      5      0      8    .    2     69 .     1    194        73     79
  64K      5      3     14     10    .   15    126 .     2    224        26    134
                                     .              .
                                     .              .
  65A      3      5      0      5    .    2     65 .     1    220      1035      0
  65B     19      7     32     12    .   42     64 .     5    219         8    155
  65C      2      0      0      2    .    5    184 .     2    192        48     81
  65D      5      2      4      4    .   12     83 .     2    171        26     80
  65F      3      0      0      0    .   72    242 .     3    234        17    192
 .                                                                         .
 .* 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.               .
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[illegible] TOOTSEE RIVER  10-JUN-1981

            COAXIAL       COPLANAR      .  VERTICAL     .    HORIZONTAL     CONDUCTIVE
             COIL           COIL        .    DIKE       .      SHEET          EARTH
                                        .               .
LINE &     REAL   QUAD   REAL   QUAD   . COND  DEPTH*. COND   DEPTH    RESIS   DEPTH
ANOMALY    PPM    PPM    PPM    PPM    . MHOS   FEET . MHOS   FEET    OHM-M   FEET
                                        .               .
                                        .               .
 63H        3      5     12      3     .  21     41  .   4     200      11     124
 63I        5      1      6      1     .  91    152  .   6     314       5     243
 65H        1      0      2      3     .   2    103  .   3     186      23     103
 65H        5      2      6      3     .  26    139  .   2     306      37     199

  .                                                                       .
  .* 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.    .

TERMINATION OF JOB
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[illegible] TOOTSIE RIVER 10-JUN-19[illegible]

          COAXIAL       COPLANAR     .  VERTICAL   .  HORIZONTAL      CONDUCTIVE
            COIL          COIL       .    DIKE     .    SHEET            EARTH
                                     .             .
LINE &  REAL   QUAD   REAL   QUAD   . COND  DEPTH*. COND   DEPTH    RESIS   DEPTH
ANOMALY  PPM    PPM    PPM    PPM   . MHOS   FEET . MHOS    FEET    OHM-M    FEET
                                     .             .
                                     .             .
  1A       2      5      6     10   .    3    45  .    1    250      114     102
  1B      24     23     45     50   .   13     0  .    3    105       15      37
  1C      12      4     37     12   .   42    53  .    4    158        9     105
  1D      13     13     16     28   .    8     0  .    2    117       28      32
  1F       4      5      3      5   .    5   104  .    3    328       19     237
  1G       3      3      8      5   .    9   178  .    5    349        7     262
  1H       5      3      5     12   .    4    33  .    2    272       35     169
  1J       2      1      5      2   .   21     0  .    4    293       11     197
  1K      10      7     13     16   .   12     4  .    3    190       15     112
  1N      15      4     33      2   .   78     0  .   11    121        1      75
  1P       4      2      9      3   .   22   120  .    9    326        3     262
                                     .             .
                                     .             .
  2A      31     57     51     95   .    7     0  .    3     98       16      25
  2B      22     13     49     53   .   18    31  .    4    154        9      98
  2C       1      0      0      0   .   32   328  .   25    325        1     293
  2D       1      0      1      0   .   30   409  .   29    335        1     362
  2E      22     12     32     21   .   23     3  .    5    137        4     133
  2F       2      2      0      0   .    7   123  .    2    190       36      91
  2H     114     39    223     80   .   34     0  .   15     92        1      54
                                     .             .
                                     .             .
  3D      15     27     42     54   .    8    22  .    3    101       19      34
  3E       3      3     13     20   .    7    62  .    2    120       30      39
  3F      62     51    102     97   .   21     1  .    5    102        7      54
  3H       3      3      6      5   .    6   118  .    2    204       34     104
  3J       4      0      7      0   .   49   185  .   31    350        1     323
  3K       9      4     14      9   .   19     0  .    6    172        4     115
  3M       7      0     10      1   .   49    32  .    7    170        4     110
  3N       2     .5      5      1   .    6   115  .    2    182       36      81
  3P      15     16     44     35   .   13     8  .    6    105        5      57
  .                                                               .
  .* 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.     .
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 DD-SRC  ..X, TOOTUET RIVER  10-JUN-193

         COAXIAL       COPLANAR    .   VERTICAL    .   HORIZONTAL       CONDUCTIVE
          COIL           COIL      .     DIKE      .     SHEET            EARTH
                                   .               .
LINE 1   REAL   QUAD   REAL   QUAD  .  COND   DEPTH*.   COND   DEPTH    RESIS   DEPTH
ANOMALY  PPM    PPM    PPM    PPM   .  MHOS   FEET .    MHOS   FEET     OHM-M   FEET
                                   .               .
                                   .               .
                                   .               .
                                   .               .
   4A     22     45    149     77   .     6       5 .      2      91       20      19
   4C     44     26     69     63   .    19       7 .      4     112        9      57
   4D      3     15      4     20   .     3      43 .      4     179       12     113
   4E     57     15    110     35   .    36       0 .     12     116        1      73
   4F     12      1     32      5   .   271       0 .     10     129        2      63
   4G     32     14    150     31   .    30      13 .      9     130        2      83
                                   .               .
                                   .               .
   5C     13     31     35     55   .     7       7 .      3     119       19      47
   5D     12     15     16     13   .     8      37 .      3     128       20      53
   5F     85     24    161     45   .   104       0 .     15      90        1      63
   5G     21     11     26     14   .    26      72 .      6     149        5     101
   5I     17      0     42      0   .    49      33 .     10     149        2     107
   5J     25     11     29     23   .    24       0 .      5     152        8      90
   5K      8      1      8      9   .    16     111 .      3     240       20     159
   5N      1      1      0      0   .     5     259 .      6     359        4     295
   5O      1      2      6      3   .     4     149 .      5     355        8     283
                                   .               .
                                   .               .
   6A      7     14     14     24   .     4      10 .      2     158       33      65
   6B     15     10     21     15   .    17      23 .      3     167       21      87
   6C      1     14      0      1   .     1      29 .      3      96       15      33
   6D     73      0    128      0   .    49      27 .     19      96        1      70
   6F     15      0     37      0   .   123      69 .      6     113       -4      70
   6G     25     44     34     72   .     6       5 .      5     109        5      65
   6H     10      3     22     13   .    13     175 .      4     340       13     260
                                   .               .
                                   .               .
   7A     11     27     19     45   .     4       0 .      2     112       39      26
   7C     15      3     41     15   .    32      24 .     10      98        2      53
   .                                                                    .
   .* 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.    .
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[illegible]  ANOM. TOOTSEE RIVER  10-JUN-193

             COAXIAL       COPLANAR     .  VERTICAL     .   HORIZONTAL      CONDUCTIVE
               COIL          COIL       .    DIKE       .     SHEET            EARTH
                                        .               .
 LINE &    REAL   QUAD   REAL   QUAD   . COND  DEPTH*. COND  DEPTH     RESIS  DEPTH
 ANOMALY    PPM    PPM    PPM    PPM   . MHOS   FEET . MHOS   FEET     OHM-M   FEET
                                        .               .
                                        .               .
    7C     133     15    147     34    .   49      0 .   15     38         1     61
    7E      13      3     24      5    .   32     61 .    7     98         3     55
    7F       3     15      0     23    .    3      0 .    4    110        11     52
    7G      31      5     55     13    .  131      0 .   11    117         1     76
    7H      41     13     57     32    .   50      0 .   10    138         1     98
    7J       4      5      7     11    .    4     39 .    3    203        25    114
    7K       2      1      4      1    .   21      0 .    5    227         7    145
                                        .               .
                                        .               .
    8B       8     12     15     25    .    5     29 .    2    149        24     67
    8C       1      0      0      0    .   10    212 .    3    281        15    187
    8D       5      8     11     21    .    4     37 .    2    193        44     79
    8E      64     13    134     35    .   96      3 .   12     56         1     57
    8H      82      0     74     24    .  420     21 .   17     86         1     60
    8J       5      0      8      0    .   49    165 .   16    115         1     84
    8K      23      5     65     14    .  111     33 .   16    114         1     84
    8N       0      0      4      3    .    8    187 .    1    232        82    133
    8P       5      3      0      0    .   24    132 .    2    231        37    175
    8Q      27     10     32     20    .   33      2 .    4    187         9    120
                                        .               .
                                        .               .
    9A       3      6      7     12    .    4     14 .    2    194        49     79
    9B      25      0     41      0    .   49     45 .   19    105         1     78
    9C       2     16      0     25    .    1      0 .    9    104         2     67
    9D      55      0    126      0    .   49      0 .   24     77         1     53
    9E      10     12     14     20    .   13     41 .    3    213        24    127
                                        .               .
                                        .               .
   10B       5      5     10     11    .    8    111 .    3    231        24    144
   10C       7     15     13     29    .    4     10 .    2    134        31     48
   10D       4      2      3      3    .   10    102 .    2    231        38    182
   10E      13     13     33     33    .   12     10 .    4    126        12     63
     .                                                               .
     .* 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.     .
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[illegible] ANOM., [illegible] RIVER [illegible]

	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
10C	119	31	200	64	109	0	15	77	1	49
10I	1	0	2	0	3	240	5	212	4	161
10J	32	15	64	22	42	28	8	157	2	115
10K	6	7	15	14	8	0	3	205	20	120
11B	3	5	9	14	5	75	2	190	36	93
11C	30	1	54	3	399	18	10	132	1	92
11E	4	23	21	49	3	0	4	98	12	36
11F	30	13	69	30	40	0	11	144	1	103
11H	1	3	0	1	2	151	1	307	954	6
12A	3	3	6	3	10	109	1	243	73	107
12B	57	31	105	53	36	0	8	97	3	56
12C	0	0	9	3	17	107	7	188	4	128
12D	6	1	13	1	49	85	13	136	1	146
12E	24	3	45	10	49	10	9	112	2	72
12F	36	14	69	30	44	8	9	131	3	89
13B	7	8	9	6	8	10	2	202	41	91
13D	5	16	4	26	2	0	2	139	35	48
13E	2	0	7	0	19	155	3	146	22	63
13F	2	0	3	0	34	179	6	220	5	156
13G	3	3	5	5	5	102	3	279	15	195
13H	2	9	1	3	1	0	2	132	41	78
13I	7	3	0	4	9	125	3	215	24	128
13J	0	3	0	0	6	123	5	207	6	146
13K	33	17	53	33	26	0	7	151	3	106
13M	13	2	34	1	49	50	25	174	1	151
13N	3	9	0	10	4	17	2	261	41	149
13O	10	3	15	14	11	46	2	325	57	193
14A	6	8	9	15	5	0	1	177	76	45

* 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.

30-S-2 AREA, TOOTSEE RIVER 10-JUN-197

LINE &	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
14F	5	2	11	3	35	109	3	274	14	191
1400B	63	14	124	25	49	0	13	116	1	87
1400C	12	0	14	2	49	129	8	262	3	209
1400D	5	3	3	1	12	152	3	240	22	156
1400E	3	0	5	3	20	136	5	256	7	197
1400G	4	1	12	1	52	106	20	222	1	194
1400H	23	15	54	24	27	16	9	158	2	116
1400J	0	0	0	0	6	123	2	365	37	255
15A	4	9	9	14	4	0	2	150	38	56
15B	10	4	19	11	25	19	3	142	19	66
15C	36	13	60	41	27	0	7	119	3	74
15E	3	6	2	6	2	38	2	236	52	117
15F	19	10	23	21	20	22	4	212	10	143
15H	4	5	13	4	14	78	7	309	5	242
15I	7	5	0	3	6	86	1	403	74	253
15J	11	4	13	9	24	0	3	187	22	95
16A	2	5	3	9	2	0	1	96	398	0
16B	11	22	19	40	5	4	2	121	48	31
16C	10	9	9	13	8	6	2	150	33	53
16E	5	3	7	21	3	0	2	149	52	39
16F	2	10	4	19	2	0	1	126	85	14
16G	3	10	25	21	10	23	4	145	13	81
16H	24	6	46	13	72	23	5	140	8	82
16I	15	5	29	9	55	57	4	157	10	95
16J	2	10	3	15	4	33	4	151	13	98
16K	0	0	0	2	4	92	3	249	19	165

* 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.

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[illegible] [illegible], TOOTSIE RIVER  10-JUN-193

            COAXIAL       COPLANAR     .  VERTICAL     .   HORIZONTAL      CONDUCTIVE
             COIL           COIL       .    DIKE       .     SHEET            EARTH
                                       .               .
 LINE &   REAL   QUAD   REAL   QUAD   . COND  DEPTH*. COND   DEPTH    RESIS   DEPTH
 ANOMALY  PPM    PPM    PPM    PPM    . MHOS   FEET . MHOS    FEET    OHM-M    FEET
                                       .               .
                                       .               .
   16E      4     12      9     22    .   3      0  .    1     150       60      50
   16F      3      1      6      2    .  19    119  .    5     478        9     384
                                       .               .
                                       .               .
   17A     12     20     15     33    .   5      0  .    1      85       55       0
   17B      3      5     11      3    .  15     44  .    3     205       17     125
   17C      8     11     20     26    .   7      3  .    3     147       22      65
   17E      9      6     21     15    .  14     69  .    4     171       11     103
   17G      5      0      9      4    .  59    146  .    3     137       16     115
   17H     20     14     36     24    .  19     20  .    7     139        4     140
   17I      0      5      0      3    .   7     85  .    6     176        4     123
   17K     13      1      1     11    .  21     95  .   20      96        1      70
   17M     35      4     92     21    .  49     19  .   20     102        1      75
   17N     30     13     54     25    .  36    145  .   10     265        2     225
   17O     24      3     37     14    .  46     22  .    5     234        7     163
                                       .               .
                                       .               .
   18A      4      4      4      4    .   7     43  .    2     274       40     164
   18B      4      0      7      0    .  49    159  .    5     209        6     149
   18C      6      1      3      0    .  51     83  .    7     198        4     141
   18D     13      3     11      9    .  14     52  .    5     229        7     165
   18E      2      1      3      1    .  15    241  .    5     338        6     269
   18F      3      0      6      0    . 102     33  .   31     159        1     137
                                       .               .
                                       .               .
   19A     12      6     21     16    .  17     31  .    4     174       12     105
   19B      2      2      4      2    .  10    157  .    2     400       40     279
   19C      1      3      0      0    .   4    147  .    1     290      196     124
   19D      5     14      3     14    .   2     34  .    1     172       96      64
   19E     12     13     15     27    .   6      0  .    2     144       40      45
   19F     33     24     44     42    .  17      0  .    3     141       14      75
   19H      4      5      0      4    .   4     55  .    3     126       18      51
   19I      9      9     14     15    .   9     46  .    3     153       15      94
   19J      6      3      9      3    .  25     92  .    4     288       10     210
   19K      7      6      2      9    .   5      3  .    2     178       26      87
   19N      6      2     12      2    .  60     82  .   11     158        1     114
 .                                                                           .
 .* 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.    .
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  150-340 [illegible], TOOTSIE RIVER  10-JUN-198[illegible]

              COAXIAL     COPLANAR     .  VERTICAL     .   HORIZONTAL      CONDUCTIVE
               COIL         COIL       .    DIKE       .     SHEET            EARTH
                                       .               .
  LINE &   REAL   QUAD   REAL   QUAD   . COND  DEPTH*. COND   DEPTH     RESIS   DEPTH
  ANOMALY  PPM    PPM    PPM    PPM    . MHOS   FEET . MHOS   FEET      OHM-M   FEET
                                       .               .
                                       .               .
    19G      3      1      0      2    .    8     23 .    2    351        41     217
    19F      7      5     17      5    .   20     46 .    3    255         3     206
                                       .               .
                                       .               .
    20A     12     21     22     39    .    6      0 .    2    111        33      22
    20C      4      5      0      2    .    4     26 .    1    156        79      30
    20D      5      5      4      3    .    5     22 .    1    178        61      54
    20E      5      3      8      5    .   12     85 .    2    205        49      89
    20G      3      5      5      3    .    8     20 .    2    192        33      92
    20H      2      2      5      2    .   12    152 .    4    351        11     269
    20I      5      5      3      2    .    8      0 .    2    395        50     251
    20J      7      2      5      2    .   31      0 .    6    264         5     185
    20K      2      5      1      7    .    2      0 .    3    250        20     171
    20L      0      2      0      0    .    2    123 .   12    494         2     439
                                       .               .
                                       .               .
    21B      2     20      5     37    .    1      0 .    1     76       120       0
    21C      4      2      4      2    .   24     90 .    4    335        13     243
    21D      7      2      9      7    .   24    101 .    3    158        15      90
    21E      2      0      0      0    .   11    128 .    5    237         7     162
    21F      4      5      2      0    .    4     73 .    3    235        25     192
    21G      4     10      3     10    .    3      7 .    2    210        28     117
    21H      5      1     12      1    .   85    149 .    5    264         6     203
    21I     20      9     13     13    .   18     51 .    3    231        16     154
    21J     15      5     26     11    .   39      0 .    3    211         3     153
    21K      4      1      3      0    .   92     90 .    5    307         7     226
    21M      6      4     15     10    .   15     16 .    4    228         9     155
                                       .               .
                                       .               .
    22A      2      5      0      7    .    1      3 .    1    109       244       0
    22B      4      5      4      3    .    4     62 .    1    175       123      46
    22D      5      5      3      4    .    4      0 .    1    280        84     124
    22F      4      2      4      0    .   21     95 .    4    180        12     103
    22H      0      5      0      5    .    1      0 .    3    215        23     124
   .                                                                           .
   .* 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.                 .
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[illegible] AMAX, TOOTSEE RIVER 10-JUN-1983

	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE & ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
22J	7	2	11	3	22	3	3	131	20	93
22K	20	5	29	9	56	0	10	147	2	97
22L	5	1	1	0	37	86	5	259	9	184
22N	3	4	5	4	6	19	4	230	11	198
23A	5	3	8	3	9	0	3	144	16	63
23B	2	3	4	3	5	21	2	301	59	167
23C	2	0	5	3	33	111	5	226	7	157
23D	1	2	2	2	5	167	4	291	9	213
23E	6	0	1	2	32	115	3	225	21	133
23F	5	5	14	14	10	7	3	136	15	108
23G	1	2	0	7	6	23	2	227	41	114
23H	14	2	21	8	51	0	8	125	3	71
23I	2	5	9	5	6	13	6	187	5	127
23J	15	3	19	3	25	0	6	174	5	116
23K	34	12	29	32	24	20	5	155	7	93
23N	0	0	5	0	3	191	8	274	3	222
24A	2	1	6	1	44	131	5	363	7	282
24B	2	5	11	13	5	52	2	222	32	123
24C	14	13	5	12	8	14	5	146	6	83
24D	0	0	5	0	6	104	6	153	4	102
24E	1	0	2	0	4	126	8	120	-2	73
24F	52	26	115	50	45	30	9	110	2	75
25A	4	4	4	5	6	95	2	192	45	83
25C	2	2	9	2	26	134	4	264	9	192
25D	3	1	0	0	31	178	3	302	26	196
25E	3	2	7	0	44	106	5	285	6	213
25F	23	22	92	57	29	0	7	76	3	34
25G	0	0	1	0	6	107	3	232	16	153
25H	3	5	13	5	18	20	4	230	8	159
25I	21	13	75	23	37	0	9	111	2	67
26A	3	4	2	4	3	30	1	193	178	31

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

DEC-SHD DMAX, TOOTSEE RIVER 10-JUN-195

LINE & ANOMALY	COAXIAL COIL REAL PPM	COAXIAL COIL QUAD PPM	COPLANAR COIL REAL PPM	COPLANAR COIL QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* FEET	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH FEET	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH FEET
26C	2	3	11	7	10	104	3	232	16	197
26D	3	0	3	0	25	109	4	246	9	171
26E	4	4	4	11	4	101	2	257	38	152
26F	13	3	6	1	70	0	4	205	13	122
26G	1	0	0	0	7	243	4	251	11	172
26H	9	9	16	19	8	27	3	183	14	113
26I	41	27	103	55	31	21	7	137	3	95
26J	27	15	42	23	27	58	5	171	6	113
27A	2	3	5	5	4	116	1	216	77	91
27B	7	7	6	9	6	26	2	170	54	55
27C	1	0	1	0	49	365	3	342	19	242
27D	3	4	4	6	5	97	2	269	35	164
27E	2	2	5	6	5	129	2	273	46	156
27G	8	6	34	13	20	70	4	207	11	141
27H	37	16	76	26	50	13	7	138	3	92
27I	9	4	4	3	17	123	3	177	14	111
27J	11	0	13	0	49	119	9	203	2	157
27K	4	16	11	32	2	0	1	148	70	41
27M	1	12	6	21	1	0	1	209	136	67
28A	3	4	7	9	5	50	2	172	46	63
28B	8	10	13	17	6	53	3	212	16	141
28C	1	0	2	0	61	356	4	234	-8	213
28D	4	4	3	7	5	136	1	316	63	186
28E	6	4	6	9	9	74	2	251	39	151
28F	9	11	20	20	9	0	3	194	15	119
28G	1	0	0	2	4	259	3	238	19	148
28H	9	21	14	24	4	36	3	189	21	111
28I	13	2	17	2	90	90	6	213	4	160
28J	9	2	23	5	66	118	15	263	1	225
29A	2	6	0	3	1	8	1	217	193	59
29B	7	4	7	7	10	67	3	233	21	148

* 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.

([illegible] AMAX, TOOTSEE RIVER 10-JUN-198

	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE & ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
29C	9	[illegible]	20	17	11	0	3	152	21	70
3000A	13	9	18	15	13	45	3	205	18	130
3000B	1	2	1	2	2	193	1	322	1035	0
3000C	1	4	0	2	1	47	1	220	1035	0
3000D	53	12	62	20	57	26	7	218	4	165
3000E	4	6	9	10	6	102	2	335	34	232
31A	1	8	0	11	1	22	1	134	346	1
31C	3	9	2	10	2	28	1	180	172	47
31D	6	5	1	1	8	79	3	190	25	100
32A	7	7	6	11	6	60	2	230	42	120
32B	4	5	5	8	5	58	2	252	44	137
32C	0	2	0	3	2	101	2	266	36	160
32D	4	3	16	9	15	55	3	210	15	131
32E	2	1	0	0	5	130	1	378	74	228
33A	3	2	6	5	9	107	2	232	36	176
33B	3	7	15	6	15	62	5	238	7	173
33C	2	0	7	1	32	121	4	181	12	103
33G	41	21	84	40	37	12	9	174	2	131
33H	0	1	0	0	4	181	7	492	4	421
33I	33	25	100	45	34	9	11	121	1	87
33J	33	6	71	11	49	0	13	131	1	93
33K	5	6	0	13	6	24	4	172	10	104
34A	3	4	6	10	4	109	2	261	45	149
34B	11	8	25	16	16	82	3	141	14	76
34C	9	15	17	34	5	35	3	125	19	53
34D	23	43	72	76	12	0	4	118	11	59
34E	43	17	82	32	53	11	16	123	1	92

* 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.

150-SM2 AMAX, TOOTSEE RIVER 10-JUN-193

	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE & ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
34F	44	14	83	35	50	6	16	109	1	73
34G	36	13	65	24	52	42	14	151	1	117
34H	64	27	129	53	50	23	12	136	1	103
34I	2	19	9	47	2	0	5	133	6	82
35A	5	5	4	3	5	1	1	144	70	19
35B	5	4	5	9	8	54	2	196	56	67
35C	3	4	12	5	21	75	3	235	23	149
35I	14	6	45	1	49	4	20	93	1	63
35J	5	3	19	0	88	91	13	105	1	69
35M	4	6	29	15	13	23	11	106	1	67
36A	5	10	5	12	4	44	1	191	167	54
36B	9	6	11	10	13	52	1	188	122	50
37B	13	8	9	12	12	29	1	211	66	84
3800A	14	23	23	43	6	12	2	147	26	64
3800B	7	5	6	9	7	66	2	223	58	102
3800C	12	6	22	10	25	89	9	273	2	222
3800D	2	0	3	1	54	23	8	240	4	171

* 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.

LINE & ANOMALY	COAXIAL COIL REAL PPM	COAXIAL COIL QUAD PPM	COPLANAR COIL REAL PPM	COPLANAR COIL QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* FEET	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH FEET	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH FEET
19B	5	9	3	21	2	0	2	149	45	49
19C	7	1	10	5	20	103	2	176	34	79
19D	21	45	35	30	7	0	3	108	15	43
19E	5	0	7	0	49	163	5	168	5	116
19F	4	0	3	3	49	198	2	196	35	95
19G	6	9	3	21	4	26	1	145	54	42
19H	3	5	9	5	11	86	2	201	54	83
19I	3	7	5	3	3	33	1	170	160	35
19J	2	2	0	0	4	197	1	328	1035	0
19K	10	13	15	20	6	0	2	152	45	47
19N	3	13	1	20	1	0	1	112	161	0
20A	2	1	8	4	18	162	2	248	45	133
20B	10	13	0	11	6	43	1	145	87	37
20C	33	30	79	67	19	0	5	100	8	49
20D	41	22	86	49	32	0	5	96	4	51
20E	11	13	26	37	7	3	2	136	28	50
20F	5	9	4	9	4	63	1	145	135	25
20G	2	6	7	14	3	20	1	126	60	24
21B	2	0	2	0	44	161	6	323	5	245
21C	5	7	16	16	8	83	2	261	30	165
21E	4	0	5	1	49	193	2	206	41	99
21F	15	9	35	24	20	51	5	177	6	121
21G	15	0	32	1	49	76	5	207	4	156
21H	11	19	21	23	6	14	2	119	50	23
21I	2	0	5	1	49	262	1	268	94	131
21K	2	11	3	13	1	0	1	75	202	0
21M	1	2	0	0	3	183	1	89	239	0
21N	2	0	0	0	10	295	1	245	88	104
22A	13	7	16	13	17	20	5	226	6	163
22B	0	0	2	0	49	460	3	292	18	204

* 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.

[illegible], TOOTSIE RIVER 10-JUN-[illegible]

	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE & ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
22C	0	4	3	7	1	44	1	258	68	128
22E	5	5	12	14	8	63	2	219	31	121
22F	4	0	7	5	29	163	1	236	38	99
22G	3	3	5	5	6	81	1	174	36	44
23A	5	2	7	2	24	0	8	247	4	180
23B	4	3	1	4	6	83	3	322	17	229
23C	2	2	5	4	9	131	5	301	7	232
23D	1	0	2	0	25	262	6	316	5	243
23E	0	1	3	3	2	149	2	293	42	179
23F	3	2	4	6	5	80	1	205	90	70
23G	1	5	4	9	3	39	1	176	98	49
23H	12	13	22	27	9	20	2	180	31	85
23I	2	5	0	10	1	25	1	152	111	40
23J	0	0	2	0	14	429	2	261	42	149
23K	3	4	4	8	4	69	2	224	58	101
24A	37	17	69	30	41	0	9	149	3	102
24B	7	4	19	8	25	1	6	132	4	124
24C	10	3	25	5	64	0	11	142	2	95
24D	3	0	12	0	49	96	3	193	14	114
24E	5	2	0	3	4	143	2	230	51	114
24F	4	1	3	0	36	205	2	227	51	109
24G	19	5	35	17	38	49	5	175	6	122
25A	5	2	9	3	30	0	12	204	1	155
25B	21	10	36	15	31	24	10	164	2	120
25C	21	9	22	20	12	0	6	140	4	83
25E	5	2	3	0	40	159	2	369	32	260
25F	4	8	5	16	3	31	1	143	110	32
26A	17	9	37	13	30	12	9	212	3	159
26B	7	3	12	5	23	43	2	281	27	181
26C	4	0	7	0	31	153	7	191	4	136
26D	20	11	40	26	33	0	7	140	3	93

* 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.

[illegible] [illegible]X, TOOTSEE RIVER 10-JUN-[illegible]

	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
LINE & ANOMALY	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
26F	2	0	0	0	45	311	5	264	6	203
26G	11	9	5	3	9	80	3	210	20	130
26H	13	7	13	7	32	62	4	206	13	135
26I	15	12	21	21	12	0	3	149	18	73
26J	4	0	0	0	49	240	2	335	28	233
27A	9	5	11	10	12	71	2	269	41	157
27B	11	2	20	4	98	71	9	244	3	189
27C	0	3	0	0	5	132	4	293	9	210
27E	7	5	11	12	10	35	3	211	23	127
27F	4	3	4	4	7	111	1	352	119	182
27H	4	2	4	2	17	140	1	352	81	199
27I	2	1	4	4	8	120	1	147	62	25
28A	11	4	23	5	45	47	6	201	5	145
28C	14	10	20	17	13	0	4	160	13	84
28F	1	1	3	7	6	116	3	321	16	230
28G	16	7	32	15	29	37	4	190	9	115
28H	3	4	0	3	4	149	1	210	73	93
28J	2	3	5	5	5	159	1	297	77	162
28K	2	3	6	8	5	116	2	236	56	160
29A	2	2	0	1	6	225	4	448	14	356
29B	8	5	9	8	12	75	4	400	72	100
29C	4	6	3	3	3	76	3	253	16	175
29D	1	2	3	4	8	151	3	274	20	187
29E	3	5	15	5	22	46	4	234	9	163
29F	6	5	7	9	7	59	2	259	34	156
30A	15	9	30	15	22	14	8	192	3	141

* 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.

[illegible] 10-JUN-80

LINE & ANOMALY	COAXIAL COIL		COPLANAR COIL		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* FEET	COND MHOS	DEPTH FEET	RESIS OHM-M	DEPTH FEET
30B	0	0	0	0	1	51	6	241	5	182
30C	11	11	23	25	9	19	4	150	11	95
30D	17	26	29	41	7	21	3	163	14	95
30E	3	1	1	0	30	203	3	296	23	197
30F	2	2	3	1	10	206	3	355	22	256
30G	29	33	5	16	3	37	1	199	64	89
30I	4	7	3	9	3	74	1	234	65	114
31A	11	3	27	14	20	35	8	206	2	155
31B	5	0	7	0	21	136	6	278	5	216
31C	0	9	16	17	6	0	3	168	14	94
31D	3	5	6	5	8	92	3	286	21	192
31E	3	3	6	4	8	140	3	362	14	273
31F	6	5	4	5	7	32	2	304	45	186
32A	11	4	26	9	36	33	5	226	6	164
32B	3	1	6	0	49	191	5	330	7	260
32C	4	5	6	10	6	117	3	319	17	234
32D	5	4	13	7	14	20	4	256	10	180
32F	6	3	9	7	13	57	2	231	35	127
32G	2	0	2	1	40	245	3	218	15	138
32H	3	7	12	13	8	81	3	221	24	135
32I	4	4	0	3	5	113	2	221	38	114
32J	3	6	4	12	3	56	1	243	118	104
32K	2	15	4	13	1	0	1	174	172	43
33B	4	7	2	5	2	69	3	344	22	248
33D	6	1	7	5	37	159	3	208	20	128
33E	7	3	6	7	13	126	3	205	19	129
33F	5	2	6	3	17	160	2	217	30	122
33H	1	2	4	0	6	210	2	251	44	139
33I	5	6	5	7	5	0	2	209	44	92

* 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.

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[illegible] MAX, [illegible] RIVER 10-JUN-1[illegible]

            COAXIAL      COPLANAR     .  VERTICAL    .  HORIZONTAL    CONDUCTIVE
             COIL          COIL       .    DIKE      .    SHEET         EARTH
                                      .              .
LINE &   REAL   QUAD   REAL   QUAD    . COND  DEPTH*.  COND  DEPTH   RESIS  DEPTH
ANOMALY  PPM    PPM    PPM    PPM     . MHOS   FEET .  MHOS   FEET   OHM-M   FEET
                                      .              .
                                      .              .
  34A      3      2     13      2     .   48    142 .     5    299      7    234
  34B      6      1     13      0     .   49    160 .     9    224      3    176
  34C     11      5      6     10     .   12    100 .     1    250      8    180
  34D     14      2     30      1     .   49     77 .    17    164      1    132
  34E     10     11     14     22     .    7     60 .     5    186      7    130
  34F      1      0      1      0     .   49    455 .     6    236      5    180
  34G      4      7      4     10     .    3     83 .     1    212     88     91
  34H      4      4      4      3     .    6     85 .     1    136    115     11
  34I      7     10      4      3     .    4     15 .     1    156    114     35
                                      .              .
                                      .              .
  35A      2      2      9      2     .   20    148 .     5    341      7    267
  35B      1      0      6      0     .   37    205 .    19    168      1    137
  35C     29     10     52     15     .   60     34 .    14    164      1    123
  35D     14      6     13     14     .   19      4 .     8    164      3    113
  35E      4      3      0      9     .    4     47 .     3    215     14    141
  35F      7      5     29     13     .   21     73 .     6    187      5    132
  35H     11      2     15      3     .   37     77 .     4    215     13    142
  35J      7     11      7      9     .    5      0 .     2    158     50     42
  35K      4      5      7      6     .    6     10 .     2    131     48     63
                                      .              .
                                      .              .
  36A      0      0      0      4     .    4    245 .     1    305     93    159
  36B     20     17     36     25     .   18     13 .     6    169      5    115
  36C     10      5     22      7     .   30     58 .     6    237      4    180
  36D      3      3      9      6     .    8    150 .     3    400      5    180
  36E     12     14     10     26     .    6     20 .     3    165     17     91
  36G     25     14     42     26     .   24     29 .     4    198     10    124
  36H      5      7      3     12     .    5     85 .     1    213     88     90
                                      .              .
                                      .              .
  37A      1      1      0      1     .    4    271 .     2    344     53    217
  37B     16     14     25     22     .   14     36 .     5    194      7    133
  37C      9     17     29     25     .    6     20 .     3    160     17     83
  37D      2      5     10     14     .    5     71 .     3    196     23    112
  37E      3      3     14     12     .    8    102 .     3    206     17    134
  .                                                                  .
  .* 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.     .
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 -S-2 ( ), TOOTSIE RIVER 10-JUN-79

                COAXIAL      COPLANAR     .   VERTICAL    .    HORIZONTAL      CONDUCTIVE
                 COIL          COIL       .     DIKE      .      SHEET            EARTH
                                          .               .
 /LINE &    REAL   QUAD   REAL   QUAD     . COND  DEPTH*. COND   DEPTH     RESIS   DEPTH
  ANOMALY   PPM    PPM    PPM    PPM      . MHOS   FEET . MHOS   FEET     OHM-M    FEET
                                          .               .
                                          .               .               376       0      1

    37F       4      5      7      3      .    6     73 .    2     257        28     163
    37H       1      0      0      0      .    4    131 .    2     253        36     150
    37I       5      5      7      9      .    7     67 .    2     175        48      66
                                          .               .
                                          .               .
    38A       5      2      9      5      .   17    119 .    4     352         9     277
    38B       9      3      6      3      .    8    104 .    2     390        55     260
    38C       1      1      2      0      .    6    181 .    2     476        30     362
    38D       8      8     13      9      .   10     48 .    2     276        27     183
    38E       2      3      4      5      .    4    107 .    2     324        53     197
    38F       4      1      3      0      .   38    137 .    2     353        28     240
                                          .               .
                                          .               .
  3800A       1      3      0      7      .    1      0 .    1     108       629       0
    00B       1      0      1      0      .   31    302 .    2     249        51     124

   .                                                                        .
   .* 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.    .

TERMINATION OF JOB
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APPENDIX C

ELECTROMAGNETICS AND MAGNETICS

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 100 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 interpreted 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.

Discrete conductor analysis

The EM anomalies appearing on the electromagnetic map are interpreted by computer to give the conductance (i.e., conductivity-thickness product) in mhos of a vertical sheet model. DIGHEM anomalies are divided into six grades of conductance, as shown in Table I. The conductance in mhos is the reciprocal of resistance in ohms.

Table I. EM Anomaly Grades

Anomaly Grade	Mho Range
6	greater than 99
5	50 - 99
4	20 - 49
3	10 - 19
2	5 - 9
1	less than 5

The mho value is a geological parameter because it is a characteristic of the conductor alone; it generally is independent of frequency, and of flying height or depth of burial apart from the averaging over a greater portion of the conductor as height increases.[1] Small anomalies from deeply buried strong conductors are not confused with small anomalies from shallow weak conductors because the former will have larger mho values.

Conductive overburden generally produces broad EM responses which are not plotted on the EM maps. However, patchy conductive overburden in otherwise resistive areas can yield discrete-like anomalies with a conductance grade (cf. Table I) of 1, or even of 2 for conducting clays which have resistivities as low as 50 ohm-m. In areas where ground resistivities can be as low as 1 ohm-m, anomalies caused by weathering variations and similar causes can have conductance grades as high as 4. The anomaly shapes from the multiple coils often allow such surface conductors to be recognized, and these are indicated by the letter S on the map. The remaining anomalies in such areas could be

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[1] This statement is an approximation. DIGHEM, with its short coil separation, tends to yield larger and more accurate mho values than airborne systems having a larger coil separation.

bedrock conductors. The higher grades indicate increasingly higher conductances. Examples: DIGHEM's New Insco copper discovery (Noranda, Quebec, Canada) yielded a grade 4 anomaly, as did the neighbouring copper-zinc Magusi River ore body; Mattabi (copper-zinc, Sturgeon Lake, Ontario, Canada) and Whistle (nickel, Sudbury, Ontario, Canada) gave grade 5; and DIGHEM's Montcalm nickel-copper discovery (Timmins, Ontario, Canada) yielded a grade 6 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 5 and 6) are characteristic of massive sulfides or graphite. Moderate conductors (grades 3 and 4) typically reflect sulfides of a less massive character or graphite, while weak bedrock conductors (grades 1 and 2) can signify poorly connected graphite or heavily disseminated sulfides. Grade 1 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, New Brunswick, Canada, yielded a well defined grade 1 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., grade 1 and 2). 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 electromagnetic map, the actual mho value and a letter are plotted beside the EM grade symbol. The letter is the anomaly identifier. The horizontal rows of dots, beside each anomaly symbol, indicate the anomaly amplitude on the flight record. The vertical column of dots gives the estimated depth. In areas where anomalies are crowded, the identifiers, dots and mho values 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 be accurate whereas one obtained from a small ppm anomaly (no dots) could be 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 mho value and depth estimate will illustrate which of these possibilities fits the recorded data best.

Flight line deviations occasionally yield cases where two anomalies, having similar mho 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 on 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 mho values are plotted 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 direction, conductance, depth, thickness (see below), and dip. The accuracy is comparable to an interpretation from a ground EM survey having the same line spacing.

An EM anomaly list attached to each survey report provides a tabulation of anomalies in ppm, and in mhos and estimated depth for the vertical sheet model. The EM anomaly list also shows the conductance in mhos and the 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 15 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.

X-type electromagnetic responses

DIGHEM^{II} maps contain x-type EM responses in addition to EM anomalies. An x-type response is below the noise threshold of 2 ppm, and reflects 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 a flight line, or aerodynamic noise. Those responses that have the appearance of valid bedrock anomalies on the flight profiles are mentioned in the report. The others should not be followed up unless their locations are of considerable geological interest.

The thickness parameter

DIGHEM^{II} can provide an indication of the thickness of a steeply dipping conductor. The ratio of the anomaly amplitude of channel 24/channel 22 generally increases as the apparent thickness increases, i.e., the thickness in the horizontal plane. This 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 3m, and thick when in excess of 10 m. In base metal exploration applications, thick conductors can be high priority targets because most massive sulfide ore bodies are thick, whereas non-economic bedrock conductors are usually thin. An estimate of thickness cannot be obtained 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 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 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. This helps the interpreter to differentiate between conductive trends in the bedrock and those patterns typical of conductive overburden. Discrete conductors will generally appear as narrow lows on the contour map and broad conductors will appear as wide lows.

Channel 40 (see Appendix) and the resistivity contour map present the apparent resistivity using the so-called pseudo-layer (or buried) half space model defined in Fraser (1978)[2]. This model consists of a resistive layer overlying a conductive half space. Channel 41 gives the apparent depth below surface of the conductive material.

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

The apparent depth therefore 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^{II} system has been flown for the purpose 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 41 can be of significant help in distinguishing between overburden and bedrock conductors.

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 bedrock conductors. The processing of DIGHEM^{II} data, however, produces four channels which contribute significantly to the recognition of bedrock conductors. These are the inphase and quadrature difference channels (number 33 and 34), and the resistivity and depth channels (40 and 41). The EM difference channels eliminate up to 99% of the response of conductive ground, leaving responses from bedrock conductors, cultural features (e.g., telephone lines, fences, etc.) and edge effects. An edge effect arises when the conductivity of the ground suddenly changes, and this is 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 highly conductive environment therefore is based on the anomalous responses of the two difference channels (33 and 34) and the resistivity channel (40). The most favourable situation is where anomalies coincide on all three channels.

Channel 41, which is the apparent depth to the conductive material, also helps determine whether a conductive response arises from surficial material or from a conductive zone in the bedrock. When this channel rides above the zero level on the grey profile paper (i.e., it is negative), it implies that the EM and resistivity profiles are responding primarily to a conductive upper layer, i.e., conductive overburden. If channel 41 is below the zero level, it indicates that a resistive upper layer exists, and this usually implies the existence of a bedrock conductor.

Channels 35 and 36 are the anomaly recognition functions. They are used to trigger the conductance channel 37 which identifies discrete conductors. In highly conducting environments, channel 36 may not be generated because it is subject to some corruption by highly conductive earth signals. Some of the automatically selected anomalies (channel 37) are discarded by the human interpreter. 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 rising from geologic or aerodynamic noise.

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.

(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[3]. 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.

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

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[3] The gradient analogy is only valid with regard to the identification of anomalous locations. The calculation of conductance is based on EM amplitudes relative to a local base level, rather than to an absolute zero level as for the resistivity calculation.

and magnetic polarization. It was mentioned above that the EM difference channels (i.e., channel 33 for inphase and 34 for quadrature) tend to eliminate the response of conductive overburden. This marked a unique development in airborne EM technology, as DIGHEM^{II} 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 polarization. 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 33. This feature can be a significant aid in the recognition of conductors which occur in rocks containing accessory magnetite.

MAGNETICS

The existence of a magnetic correlation with an EM anomaly is indicated directly on the EM map. 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, Ontario, Canada) as well as magnetic (e.g., the Mattabi deposit near Sturgeon Lake, Ontario).

The magnetometer data are digitally recorded in the aircraft to an accuracy of one gamma. The digital tape is processed by computer to yield a standard total field magnetic map which is usually contoured at 25 gamma intervals. The magnetic data also are treated mathematically to enhance the magnetic response of the near-surface geology, and an enhanced magnetic map is produced with a 100 gamma contour interval. The response of the enhancement operator in the frequency domain is shown in Figure 2. The 100 gamma contour interval is equivalent to a 5 gamma interval for the passband components of the airborne data. This is because these components are amplified 20 times by the operator of Figure 2.

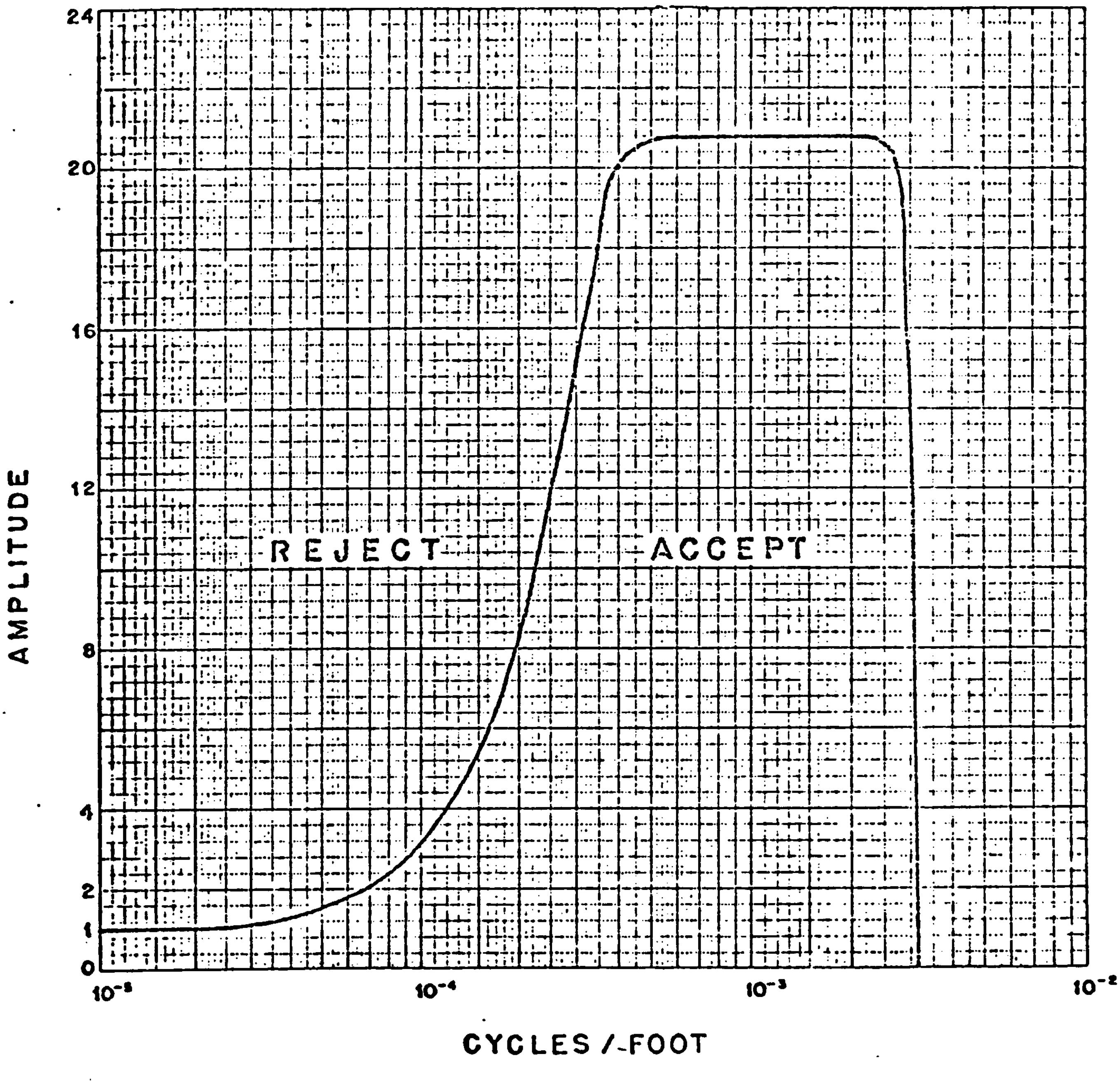

Figure 2 Frequency response of magnetic operator

The enhanced map, which bears a resemblance to a downward continuation map, is produced by digital bandpass filtering 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. The contour interval of 100 gammas is suitable for defining the near-surface local geology while de-emphasizing deep-seated regional features.

APPENDIX D

STATEMENT OF COSTS

STATEMENT OF COSTS

Midway Property - Geophysical Assessment Report

Work Period: May 9 - May 21, 1981

Airborne Electromagnetic Survey - Dighem Limited, Toronto

Ferry/mobilization	$10,000.00
Survey 778 km @ 53/km	41,234.00
Total	$51,234.00

Contractor's invoices and disposition of costs are contained in: 1981 Geological and Geochemical Report on the Midway Property.

APPENDIX E

STATEMENT OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

NAME: J. LAURENCE LEBEL

EDUCATION: B.Sc. (1971) Queen's University - Geological Engineering - Geophysics Option

M.Sc (1973) University of Manitoba - Geophysics

EXPERIENCE:

5/70-9/70 - Amax Exploration, Inc. Vancouver, B.C.
- conducting and compiling magnetometer surveys

5/71-9/71 - Amax Exploration, Inc. Toronto, Ont.
- conducting and reporting on IP/resistivity surveys

5/72-12/72- Gulf Minerals, Toronto, Ont.
- senior geophysical operator
- conducting and reporting on magnetometer electromagnetic and scintillometer surveys

3/73-12/73- Scintrex Surveys, Concord, Ont.
- Junior Geophysicist
- conducting, supervising of and reporting on airborne magnetometer and electromagnetic surveys, ground electromagnetic and IP/resistivity surveys

4/74 - - AMAX of Canada Limited - Toronto & Vancouver
- Staff Geophysicist