MAR 19780014: RICHARDSON RIVER

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AIRBORNE ELECTROMAGNETIC SURVEY

NORCEN ENERGY RESOURCES LIMITED

RICHARDSON RIVER AREA, ALBERTA

FILE NO: 20006 JUNE, 1978

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Questor Surveys Limited, 6380 Viscount Road, Mississauga, Ontario L4V 1H3

CONTENTS

INTRODUCTION

This report contains our interpretation of the results of an airborne electromagnetic survey flown in the Richardson River Area, Alberta on April 4 to 6, 1978. A brief description of the survey procedure together with recommendations for ground follow-up is included.

The survey totalled 850 line miles and was performed by Questor Surveys Limited. The survey aircraft was a Shorts Skyvan CF-QSL and the operating base was Fort McMurray, Alberta.

The area outline is shown on the map at the end of this report. This is part of the 1:250,000 N.T.S. Maps 74E and 74L.

The personnel on the aircraft were as follows:-

Pilot	M. Portalier
Navigator	C. Reid
Operator	G. Mason
Engineer	G. Nicholson

MAP COMPILATION

The base maps are uncontrolled mosaics constructed from National Air Photo Library 1:5000' photographs. The mosaics were reproduced at a scale of 1" = 2640 feet on stable transparent film from which white prints can be made.

Flight path recovery was accomplished by comparison of the prints of the 35mm film with the mosaic in order to locate the fiducial points. These points are approximately 4500 feet apart.

SURVEY PROCEDURE

Terrain clearance was maintained as close to 400 feet as possible, with the E.M. Bird at approximately 150 feet above the ground. A normal S-pattern flight path using approximately one mile turns was used. The equipment operator logged the flight details and monitored the instruments.

A line spacing of 1320 feet was used.

RESULTS

Both Blocks are characterized by conductive overburden which in some cases is observable in the first four channels. Block 2 is void of anomalies with bedrock character.

BLOCK 1

The most prominent feature on Block 1 is the long structural feature (AA) striking southeast from lines 0270W to 0120E. The absence of an anomaly on line 0180E indicates an increase in depth. Depth estimates (Vertical half plane model) resulted in values of 300 feet in the northwest to less than 100 feet in the southeast. Conductivity is probably due to clays in a fault zone. Conductor BB is of interest because of its isolation from the main conductor. This conductor may be a dip indicator (to the east) and not a valid conductor. This dip would also account for the stagger of the INPUT anomalies.

ZONE 1

This is a short conductor striking southeast on the east side of the main conductor. Depth estimates place it at 80 feet (This value may not be valid due to intersection of the conductor at an oblique angle to strike). This is a very weak target, again probably due to clay along a fault zone.

ZONE 2

This is a weak conductor with a strike length of 8,000 feet to the southeast. Depth estimates (vertical half plane) give a value of 60 feet. The accuracy of this calculation is doubtful because of the weakness of the conductor. The conductor is located on the edge of a magnetic high indicating that it may be along a contact. This zone should be given a medium priority.

QUESTOR SURVEYS LIMITED,

[redacted]

S. Kilty,
Senior Geophysicist.

APPENDIX

EQUIPMENT

The aircraft are equipped with Mark VI INPUT (R) airborne E.M. systems and Geometrics G 803 proton precession magnetometers. Radar altimeters are used for vertical control. The outputs of these instruments together with fiducial timing marks are recorded by means of galvanometer type recorders using light sensitive paper. Thirty-five millimeter continuous strip cameras are used to record the actual flight path.

(I) BARRINGER/QUESTOR MARK VI INPUT (R) SYSTEM

The Induced Pulse Transient (INPUT) system is particularly well suited to the problems of overburden penetration. Currents are induced into the ground by means of a pulsed primary electromagnetic field which is generated in a transmitting loop around the aircraft. By using half sine wave current pulses and a loop of large turns-area, the high output power needed for deep penetration is achieved.

The induced current in a conductor produces a secondary electromagnetic field which is detected and measured after the termination of each primary pulse. Detection is accomplished by means of a receiving coil towed behind the aircraft on four hundred feet of cable, and the received signal is processed and recorded by equipment in the aircraft. Since the measurements are in the time domain rather than the frequency domain common to continuous wave systems, interference effects of the primary transmitted field are eliminated. The secondary field is in the form of a decaying voltage transient originating in time at the termination of the transmitted pulse. The amplitude of the transient is, of course, proportional to the amount of current induced into the conductor and, in turn, this current is proportional to the dimensions, the conductivity and the depth beneath the aircraft.

The rate of decay of the transient is inversely proportional to conductivity. By sampling the decay curve at six different time intervals, and recording the amplitude of each sample, an estimate of the relative conductivity can be obtained. By this means, it is possible to discriminate between the effects due to conductive near-surface materials such as swamps and lake bottom silts, and those due to genuine bedrock sources. The transients due to strong conductors such as sulphides exhibit long decay curves and are therefore commonly recorded on all six channels. Sheet-like surface materials, on the other hand, have short decay curves and will normally only show a response in the first two or three channels.

The samples, or gates, are positioned at 310, 490, 760, 1120, 1570 and 2110 micro-seconds after the cessation of the pulse. The widths of the gates are 180, 180, 360, 360, 540 and 540 micro-seconds respectively.

For homogeneous conditions, the transient decay will be exponential and the time constant of decay is equal to the time difference at two successive sampling points divided by the log ratio of the amplitudes at these points.

(II) GEOMETRICS G-803 PROTON PRECESSION MAGNETOMETER

The magnetometers which measure the total magnetic field have a sensitivity of 1 gamma and a range from 20,000 gammas to 100,000 gammas.

Because of the high intensity field produced by the INPUT transmitter, the magnetometer results are recorded on a time-sharing basis. The magnetometer head is energized while the transmitter is on, but the read-out is obtained during a short period when the transmitter is off. Using this technique, the head is energized for 1.15 seconds while the precession frequency is being recorded and converted to gammas. Thus a magnetic reading is taken every 1.3 seconds.

DATA PRESENTATION

The symbols used to designate the anomalies are shown in the legend on each map sheet, and the anomalies on each line are lettered in alphabetical order in the direction of flight. Their locations are plotted with reference to the fiducial numbers on the analog record.

A sample record is included to indicate the method used for correcting the position of the E.M. Bird and to identify the parameters that are recorded.

All the anomaly locations, magnetic correlations, conductivity-thickness values and the amplitudes of channel number 2 are listed on the data sheets accompanying the final maps.

GENERAL INTERPRETATION

The INPUT system will respond to conductive overburden and near-surface horizontal conducting layers in addition to bedrock conductors. Differentiation is based on the rate of transient decay, magnetic correlation and the anomaly shape together with the conductor pattern and topography.

Power lines sometimes produce spurious anomalies but these can be identified by reference to the monitor channel.

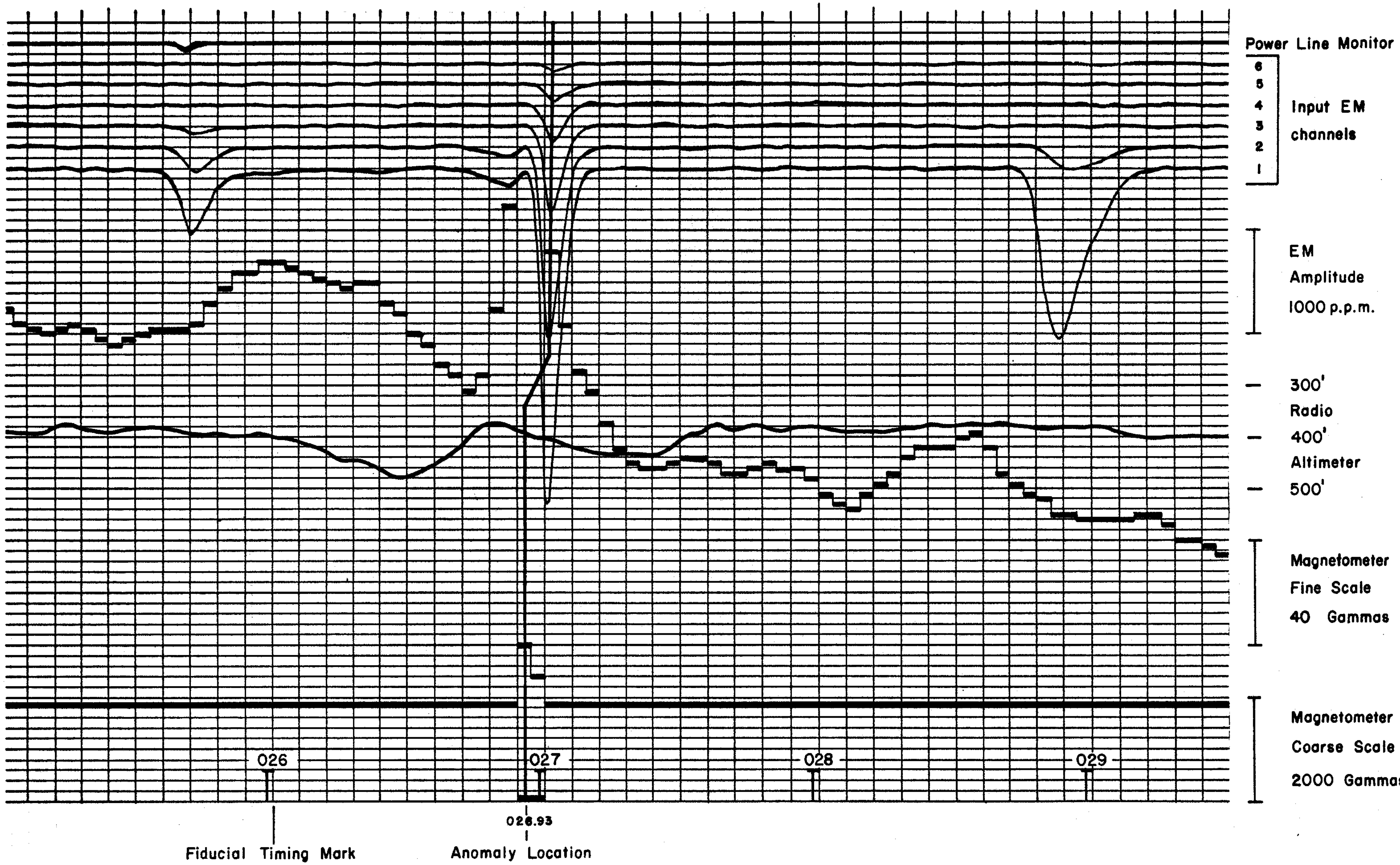
Railroad and pipeline responses are recognized by studying the film strips.

Graphite or carbonaceous material exhibits a wide range of conductivity. When long conductors without magnetic correlation are located on or parallel to known faults or photographic linears, graphite is most likely the cause.

Contact zones can often be predicted when anomaly trends coincide with the lines of maximum gradient along a flanking magnetic anomaly. It is unfortunate that graphite can also occur as relatively short conductors and produce attractive looking anomalies. With no other information than the airborne results, these must be examined on the ground.

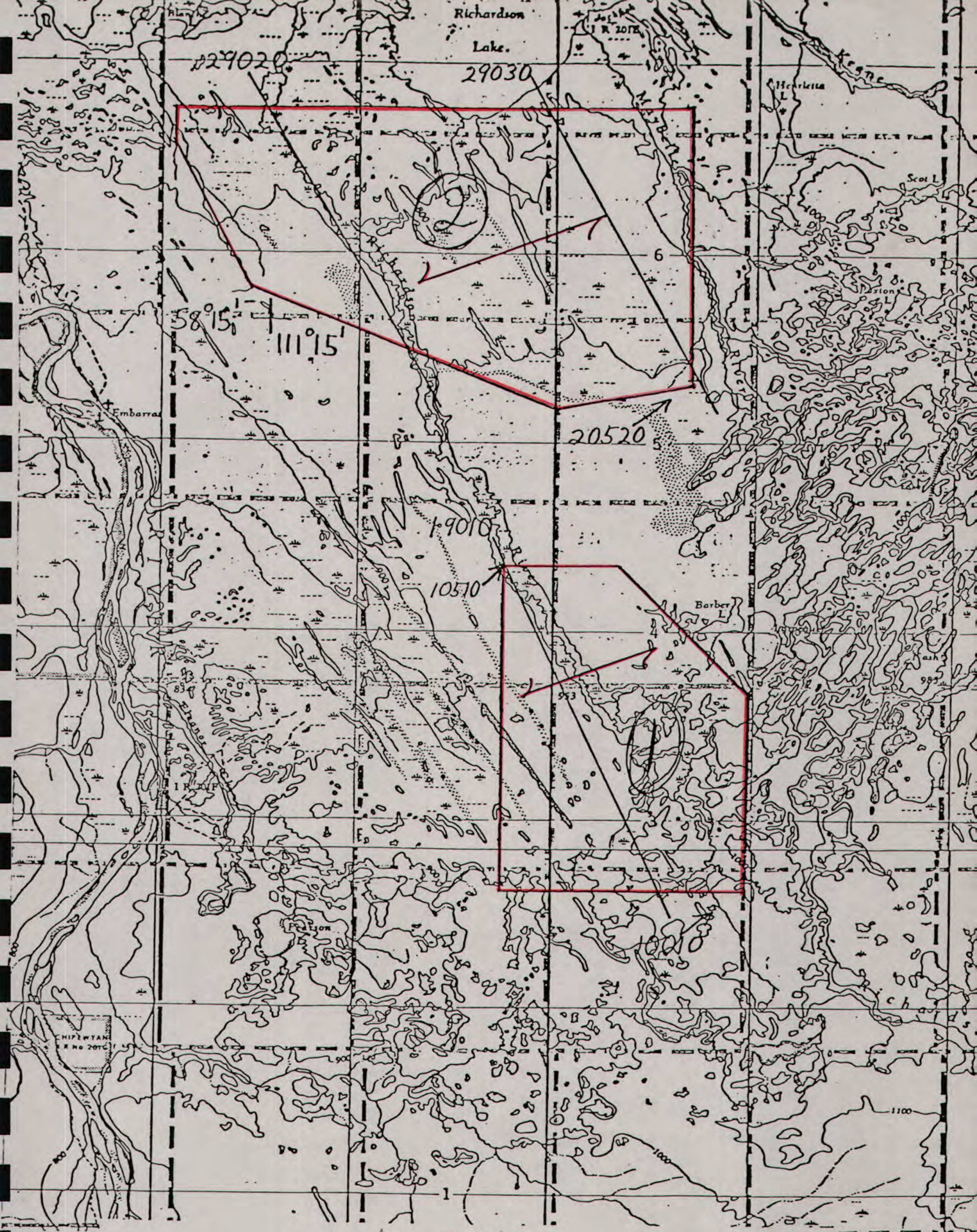
Serpentinized peridotites often produce anomalies with a character that is fairly easy to recognize. The conductivity which is probably caused in part by magnetite, is fairly low so that the anomalies often have a fairly large response on channel #1; they decay rapidly, and they have strong magnetic correlation. INPUT E. M. anomalies over massive magnetites show a relationship to the total Fe content. Below 25 - 30%, very little or no response at all is obtained, but as the percentage increases the anomalies become quite strong with a characteristic rate of decay which is usually greater than that produced by massive sulphides.

Commercial sulphide ore bodies are rare, and those that respond to airborne survey methods usually have medium to high conductivity. Limited lateral dimensions are to be expected and many have magnetic correlation caused by magnetite or pyrrhotite. Provided that the ore bodies do not occur within formational conductive zones as mentioned above, the anomalies caused by them will usually be recognized on an E.M. map as priority targets.



Sample Record

Representative INPUT, Magnetometer and Altimeter Recording



Area Outline

19780014

ANOM	FID	CHS	CH2.PPM	MHOS	MAG	VALUE
0120A	870.80	2	125	NC	0.00	0
0130A	836.03	4	400	2	836.10	30
0140A	891.20	4	275	4	891.00	30
0150A	855.20	3	250	1	855.25	30
0150B	860.13	3	350	1	0.00	0
0160A	910.94	3	200	3	910.80	30
0170A	876.20	3	200	1	876.20	20
0190A	897.20	4	400	2	897.20	8
0200A	951.22	3	200	3	951.10	4
0210A	916.50	3	250	4	0.00	0
0210B	918.08	4	600	1	0.00	0
0220A	971.00	4	300	9	970.90	12
0230A	939.50	4	700	3	939.55	10
0240A	990.60	5	650	9	990.45	6
0250A	960.00	3	450	1	0.00	0
0250B	960.30	4	750	2	960.45	10
0260A	8.30	4	700	1	0.00	0
0260B	8.64	5	450	8	8.55	20
0270A	980.74	3	450	2	0.00	0
10190AX	3895.65	3	125	4		
10200B	3952.65	3	150	2		
10220D	3972.55	3	150	2		
10120AX	3866.62	3	550	9		
10130B	3841.65	3	700	1		
10140AX	3886.40	3	150	2		
10150C	3860.80	3	150	2		
10160AX	3906.62	2	150			

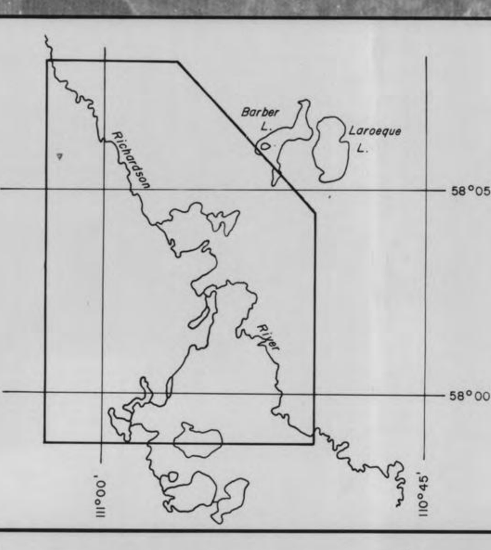
Legend

- 6 Channel Anomaly
- 5 Channel Anomaly
- 4 Channel Anomaly
- 3 Channel Anomaly
- 2 Channel Anomaly
- Magnetic Correlation

Anomaly Letter — B, 5 — Apparent Conductivity-Width

1800 — Ch. 2 Amplitude P.P.M.

200 Depth (ft)



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Airborne Mk VI Input Survey

RICHARDSON RIVER AREA

Scale – 1" : 2640 feet

Drawn By	K.C.
Dates Flown	April, 1978
Flight Path Recovery	K.C.
Data Reduction	R.D.
Completed	May, 1978
Checked	S.K.
File No. 20006	Map 1 of 2

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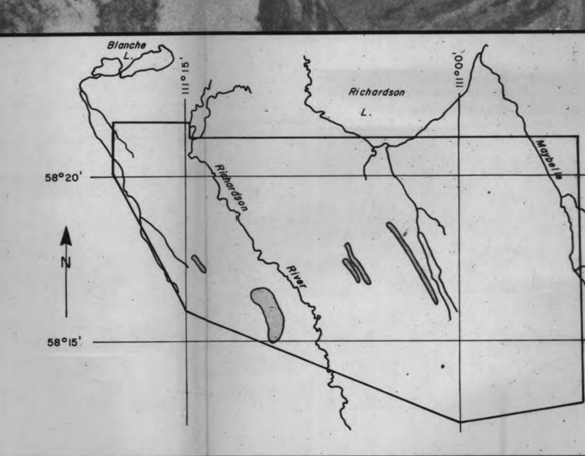
Legend

- 6 Channel Anomaly
- 5 Channel Anomaly
- 4 Channel Anomaly
- 3 Channel Anomaly
- 2 Channel Anomaly
- Magnetic Correlation

Anomaly Letter — B 5 — Apparent Conductivity-Width

1800 — Ch. 2 Amplitude P.P.M.



Scale – 1" = 2640 feet

MIN 19870014

QUESTOR SURVEYS LIMITED

Airborne Mk VI Input Survey

RICHARDSON RIVER AREA

Drawn By	M.C.
Dates Flown	April, 1978
Flight Path Recovery	M.C.
Data Reduction	P.N.
Completed	May, 1978
Checked	S.K.
File No. 20006	Map 2 of 2

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