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HELICOPTER-BORNE MAGNETIC AND

DIGHEM II ELECTRO-MAGNETIC SURVEY

of the

Whitney Township Properties

of

ROSARIO RESOURCES CANADA LTD.

(Allerston and Alamo Blocks)

by

R.S. Middleton

Rosario Resources Canada Ltd.

310 - 55 Yonge St.

TORONTO, Ontario

(With Interpretation and maps by Dighem Ltd.)

September, 1978

Copies:	Rosario Resources - TORONTO	(1)
	Rosario Resources - TUSCON	(1)
	Ontario Division of Mines	(2)
	R. Allerston	(1)

CONTENTS

Appendix

Report by D.C. Fraser "Dighem Survey of South Porcupine Area, Ontario, September 26, 1977. D. 78.

MAPS

Electromagnetics	1" = ¼ mile
Magnetics	1" = ¼ mile
Enhanced Magnetics	1" = ¼ mile
Resistivity	1" = ¼ mile

INTRODUCTION

A helicopter-borne survey by Dighem Ltd. was carried out in southern Whitney Township in August 1977 over the ROSARIO RESOURCES CANADA LTD. holdings. This survey was contracted by COMINCO Ltd. who at the time were working on the ROSARIO holdings. A portion of this airborne survey (magnetics only) was submitted in October 1977 by COMINCO for assessment credit on the Alamo * portion of the claims. The complete survey is now submitted herein giving the Dighem II results over part of the [illegible] group and all of the Alamo claim group as well as the enhanced (filtered) magnetic results and resistivity map derived from the electromagnetic information.

The original report ([illegible]) by Dr. D.C. Fraser giving a description of the helicopter installation, data processing procedures, and interpretation is included with this introductory report.

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* Alamo Petroleum Ltd., wholly owned subsidiary of Rosario Resources Corporation.

Property

The claim holdings by SARIO are broken into two groups - the Allerston option and the Alamo group. Only the eastern portion of the Allerston option has been covered by the survey while all of the Alamo claims received full coverage. Only those claims in the Allerston option that received coverage and were elligible at this time for further geophysical assessment credits are shown on the maps at the back of this report. All of the Alamo group is shown on the maps although some claims may no longer be elligible for further geophysical credits. Measurements of the line miles over each block give 15.69 miles over the Allerston claims and 47.45 miles over the Alamo claims.

Allerston Option Claims

15.69 miles x 40/21 clms = 29.9 days per clm per parameter

Claim No.	Magnetic Survey Credits	Dighem EM Survey Credits	Allowable Credits Remaining
P. 420076	29.9	29.9	15.5
P. 420077	29.9	29.9	15.5
P. 420078	29.9	29.9	15.5
P. 420079	29.9	29.9	15.5
P. 420080	29.9	29.9	15.5
P. 420081	29.9	29.9	15.5
P. 420082	29.9	29.9	15.5
P. 420083	29.9	29.9	15.5
P. 420084	29.9	29.9	15.5
P. 420085	29.9	29.9	15.5
P. 420086	29.9	29.9	40
P. 420087	29.9	29.9	40
P. 443580	29.9	29.9	15.5
P. 443581	29.9	29.9	15.5

P. 494153	31	DIGHEM EM
P. 494154	"	"
P. 494155	"	"
P. 494156	"	"
P. 494157	"	"
P. 494158	"	"
P. 479905	"	"
P. 479906	"	"
P. 479907	"	"
P. 479908	"	"
P. 493358	"	"
P. 493359	"	"
P. 493360	"	"
P. 493361	"	"
P. 493362	"	"
P. 493363	"	"
P. 493364	"	"
P. 493365	"	"
P. 493682	"	"
P. 493683	"	"
P. 493375	"	"
P. 493376	"	"
P. 493377	"	"
P. 493378	"	"
P. 493379	"	"
P. 493380	"	"
P. 493381	"	"
P. 493382	"	"
P. 493564	"	"
P. 493565	"	"
P. 493566	"	"
P. 493567	"	"
P. 493568	"	"
P. 493569	"	"
P. 493570	"	"
P. 493571	"	"

Total: 61 claims
47.45 line mi

SURVEY PROCEDURE, INSTRUMENTATION AND INTERPRETATIONS

Details on the Dighem II system and interpretation are given in the following report by D.C. Fraser (1977).

Conclusions

The airborne EM survey has outlined various sulphide-oxide iron formations which may serve as a guide to base metal or precious metal deposits within or parallel to the iron formation horizons. Major folds within south central Whitney can also be traced from the airborne data.

Respectfully submitted,

R.S. Middleton
Exploration Manager, Canada.

RM/lj

REPORT NO. D78

DIGHEM SURVEY

OF

SOUTH PORCUPINE AREA, ONTARIO

FOR

COMINCO LIMITED

BY

DIGHEM LIMITED

TORONTO, ONTARIO
SEPTEMBER 26, 1977

D. C. FRASER
PRESIDENT

S U M M A R Y

A DIGHEM^{II} airborne electromagnetic/resistivity/magnetic survey of 254 line-miles was flown for Cominco Limited in August 1977, in the South Porcupine area of Ontario. A considerable number of conductors were detected, some of which were recognizable only on those channels which have geological noise stripped off. Several discrete targets were identified.

LOCATION MAP

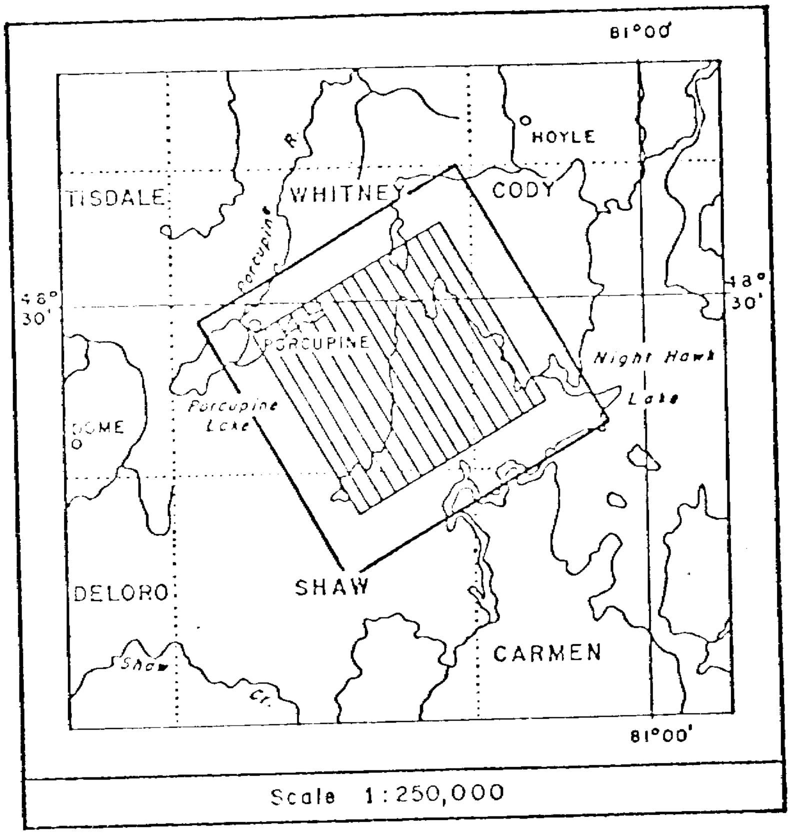

Figure 1. The survey area.

INTRODUCTION

A DIGHEM survey of 254 line-miles was flown with a 400-foot line-spacing for Cominco Limited on August 9th, 1977, in the South Porcupine area of Ontario (Figure 1). The Alouette II jet helicopter C-GNQX flew with an average airspeed of 60 mph and EM bird height of 110 feet. Ancillary equipment consisted of a Geometrics 803 magnetometer with its bird at an average height of 160 feet, a Sperry radio altimeter, Geocam sequence camera, 60 hz monitor, Barringer 8-channel hot pen analog recorder, and a Geometrics G-704 digital data acquisition system with a Cipher 70 7-track 200-bpi magnetic tape recorder. The analog equipment recorded six channels of EM data at approximately 900 hz and one of magnetics and radio altitude. The digital equipment recorded the EM data with a sensitivity of 0.2 ppm/bit and the magnetic field to an accuracy of one gamma.

The Appendix provides details on the data channels, their respective noise levels, and the data reduction procedure. The quoted noise levels are generally valid for wind speeds up to 20 mph. Higher winds may cause the system to be grounded because excessive bird swinging produces control difficulties in piloting the helicopter. The swinging results from the 50 square feet of area which is presented by the bird to broadside gusts. The DIGHEM system nevertheless can be flown under wind conditions that seriously degrade other AEM systems.

DATA PRESENTATION

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

The vertical sheet (half plane) model 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 the most suitable model for broad conductors. Resistivity contour maps result from the use of this model. Resistivity contour maps should be prepared when the EM responses predominantly are of the broad class. 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	≥ 100
5	50 - 99
4	20 - 49
3	10 - 19
2	5 - 9
1	≤ 4

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.* 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.

* 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.

Conductive overburden generally produces broad EM responses which are not plotted on the EM maps. However, patchy conductive overburden can yield discrete-like anomalies with a conductance grade (cf. Table I) of 1, or even of 2 for highly conducting clays. The anomaly shapes from the multiple coils often allow surface conductors to be recognized, and these are indicated by the letter S on the map. The remaining grade 1 and 2 anomalies could be weak bedrock conductors. The higher grades indicate increasingly higher conductances. Examples: DIGHEM's New Insco copper discovery (Noranda, Quebec) yielded a grade 4 anomaly, as did the neighbouring copper-zinc Magusi River ore body; Mattabi (copper-zinc, Sturgeon Lake, Ontario) and Whistle (nickel, Sudbury, Ontario) gave grade 5; and DIGHEM's Montcalm nickel-copper discovery (Timmins, Ontario) 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, 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.

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 of 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 standard (coaxial maximum-coupled) coil 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 best fits the recorded data. The depth estimate, however, can be erroneous. The anomaly from a near-surface conductor, which exists only to one side of a flight line, will yield a large depth estimate because the computer assumes that the conductor occurs directly beneath the flight line.

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 further interpretation is presented on the EM map by means of the line-to-line correlation of anomalies. This provides conductor axes which may define the geological structure over portions of the survey area.

The majority of massive sulfide ore deposits have strike lengths of a few hundred to a few thousand feet. Consequently, it is important to recognize short conductors which may exist in close proximity to long conductive bands. The high resolution of the DIGHEM system, and the line-to-line correlation given on the EM map, are especially important for a proper strike length evaluation.

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 followup 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 and depth. 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 anomalies are listed from top to bottom of the map for each line.

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 50 feet. 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 anomaly amplitudes rather than true zero levels. The use of local base levels may distort the horizontal sheet and conductive earth parameters. True zero levels, however, are used for resistivity mapping, discussed below.

Resistivity mapping

Areas of widespread conductivity have been encountered while surveying for base metals. In such areas, anomalies can be generated by decreases of only 20 feet 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 contour maps can aid the interpretation of the airborne data. The advantage of the contour maps is that anomalies caused by altitude changes are considerably reduced, and the contours reflect mainly those anomalies caused by conductivity changes. In areas of widespread conductivity, many anomalies on the EM map may be caused by altitude variations. The majority of these "anomalies" are flagged by S or S? (see map legend). A more quantitative approach is to prepare a resistivity contour map. Such a map improves the interpreter's ability to differentiate between conductive trends in the bedrock and those patterns typical of conductive overburden. Discrete conductors will appear as narrow lows on the contour map and broad conductors will appear as wide lows.

Conductive overburden diminishes the ability of an EM system to effectively explore the bedrock. For example, the lower the resistivity of the cover, the more active the EM channels, and the less the likelihood of recognizing that a particular anomaly might be caused by a bedrock conductor. As a general rule of thumb, the effectiveness of the DIGHEM system for base metal exploration is given in Table II.

Table II. Influence of Conductive Cover On Base Metal Surveys.

Resistivity	Exploration effectiveness at 900 hz
$>$ 300 ohm-m	excellent
100 to 300	good
30 to 100	moderate
$<$ 30	poor

Apparent resistivity maps should be constructed when the exploration effectivenss (Table II) is moderate to poor, because the contour patterns can be helpful in differentiating between bedrock and overburden conductors. Wide resistivity lows may be caused by broad (e.g., flatly dipping) bedrock conductors or by conductive overburden. The two can only be differentiated on the basis of the resistivity contour patterns coupled with knowledge of the geology. For example, a wide east-west resistivity low might suggest the existence of a bedrock conductor in an area of flatly dipping stratigraphy which strikes east-west, whereas it would be suspect if the geological strike was north-south.

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., 300 to 400 feet below surface), or 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 3 m, and thick when in excess of 15 m. 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, or when the anomaly amplitudes are small.

Reduction of conductive overburden response

The DIGHEM^{II} system yields four channels which generally are free of the response of conductive overburden. These are the inphase differences channel 33, the quadrature differences channel 34, and the two anomaly recognition functions of channels 35 and 36. Channels 35 and 36 are used to trigger the conductance channel 37 which identifies discrete conductors.

Discrete conductors usually occur in the bedrock, such as sulfides or graphite, rather than in the overburden, such as conductive clay. Only discrete conductors are plotted on the EM map. Broad (i.e., non-discrete) conductors are not plotted on this map, but are identified by lows on the resistivity contour map.

Reduction of magnetite response

Magnetite produces a form of geological noise on the inphase channels of all EM systems. Rocks containing as little as 1% magnetite can yield negative inphase anomalies. 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 magnetite generally vanishes on the inphase differences 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 photomosaic. 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., Kidd Creek near Timmins, Ontario) as well as magnetic (e.g., Mattabi).

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 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 enhanced magnetic map bears a resemblance to a ground magnetic map. It therefore simplifies the recognition of trends in the rock strata and the interpretation of geological structure. The contour

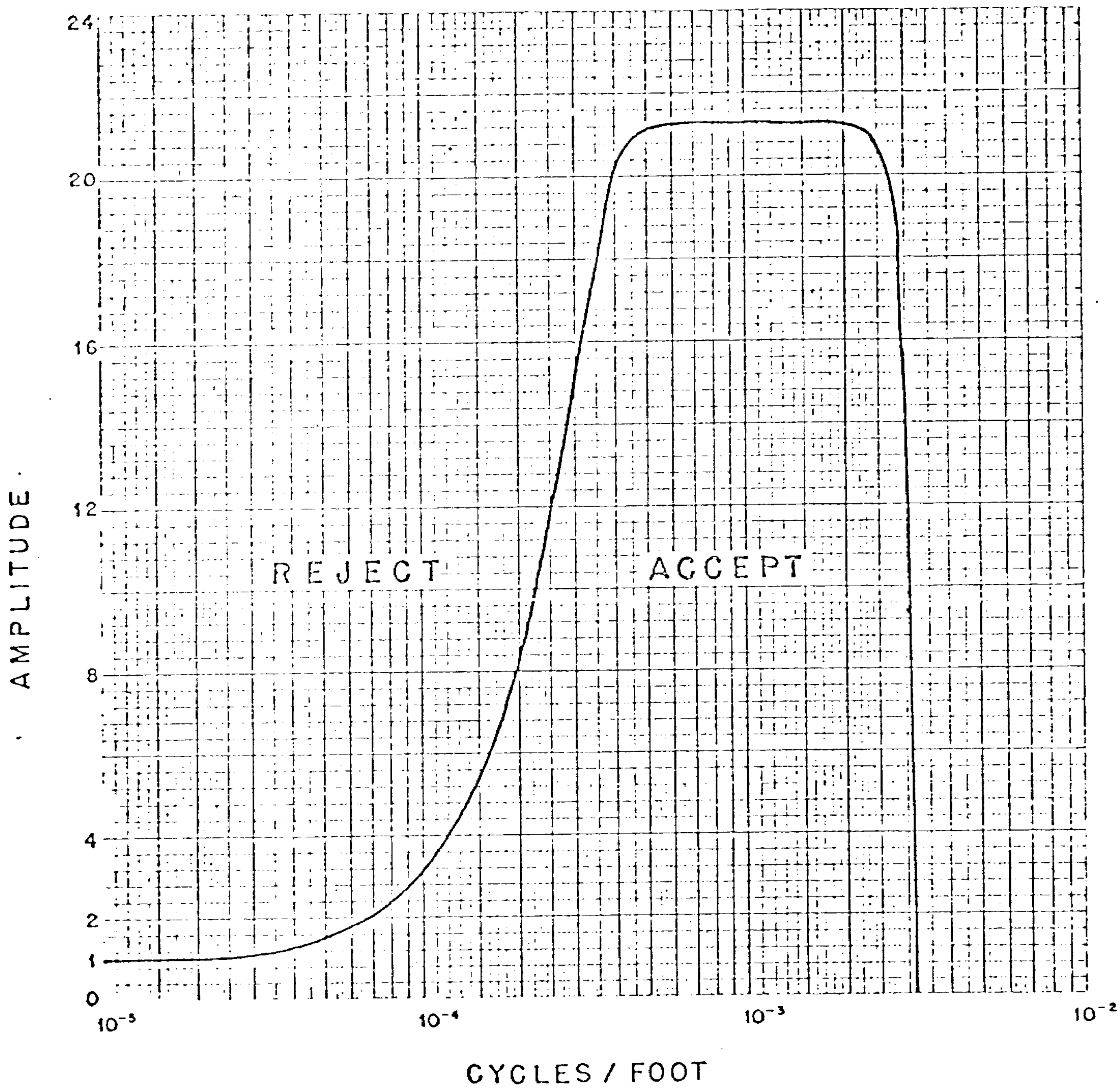

Figure 2 Frequency response of magnetic operator

interval of 100 gammas is suitable for defining the near-surface local geology while de-emphasizing deep-seated regional features.

Apart from the difference in the contour interval, the enhanced magnetic map and the standard magnetic map are identical when magnetic basement rocks underlie several thousand feet of non-magnetic cover. The difference between the two maps increases with the amount of magnetization of the near-surface geology.

The presence of a magnetic coincidence with an EM anomaly can result because the conductor is magnetic or because a magnetic body occurs in juxtaposition with the conductor. The majority of magnetic conductors represent sulfides containing pyrrhotite or magnetite. However, graphite and magnetite in close association can provide coinciding EM-magnetic anomalies. The truly magnetic conductors tend to follow closely the contoured magnetic highs. Such coincidence may be more evident on the enhanced magnetic map than on the standard magnetic map because of less disturbance from regional magnetic features. The enhancement, therefore, provides data maps which contribute to the evaluation of EM anomalies.

CONDUCTORS IN THE SURVEY AREA

The DIGHEM map provides an interpretation of conductors, as to their length, strike direction, depth, and conductance quality or conductivity-thickness product in mhos. There remains only to correlate these conductors with the known geology to provide the next step in the exploration program.

When studying the EM map for followup planning, consult the anomaly listings appended to this report to ensure that none of the conductors are overlooked. Conversely, the original map may be printed with topography burned out, leaving only the anomalies which then will be clearly visible.

The survey area was fairly active due to cultural features and to the abundance of bedrock conductors and conductive overburden. The resistivity over bedrock conductors was as low as 1 ohm-m, sharply contrasting with the overburden resistivity of 300 ohm-m.

The EM map indicates which anomalies are believed to be caused by cultural and surficial sources. Generally, such anomalies are not commented on below, as the discussions are directed to identifying bedrock conductors.

The field followup should not completely ignore anomalies interpreted to be of a possible cultural source. If the followup shows that culture does not exist near such an anomaly, then the conductor probably occurs in the bedrock.

Anomaly 19D — A single-line grade 2 bedrock conductor, with a 20 gamma magnetic correlation, occurs on strike with group 5.

Groups 6,7 — These groups reflect huge conductive zones with widths up to 700 feet. The zones are better defined by the resistivity map than the EM map because of the considerable thicknesses involved. The enhanced magnetic map clearly defines the associated magnetic properties of these zones, and suggests that group 8 is an extension of group 6.

Anomalies 28C, 36D — These single-line grade 1 conductors may have their computed mho values degraded by conductive overburden. They may reflect a widening of the huge conductive zone of group 7. There is a possibility, however, that they are isolated from this zone. They appear to have a weak magnetic correlation.

Group 8 — A short strong conductor exists with a 150 gamma magnetic correlation. The EM responses on the south end (lines 11 and 12) are subtle. Both conductance and thickness increase to the north.

Group 9 — Lines 9, 13 and 14 converge on a conductor having a grade 2 conductance. It occurs in an area of intense electromagnetic activity and is largely masked by neighbouring strong conductive and magnetitic EM responses. Its apparently isolated nature suggests that it may be an interesting target.

Group 10 — One or more conductors strike parallel to the flight lines, making resolution impossible. The conductors are only visible on the whaletail inphase channel 24 and on the resistivity channel 40. The resistivity map shows the general conductive trend.

Group 11 — A 700-foot long non-magnetic grade 1 conductor is isolated from other conductive responses, and so could be an interesting target.

Anomaly 15F — A single-line near-surface non-magnetic conductor is indicated by a sharp quadrature response on the standard coil-pair. There is a possibility that it could reflect an unusual sferic pulse or a discarded geophysical wire.

Group 12 — A 350 gamma correlation exists with a grade 1 conductor which has a length of 1200 feet. The conductor is poorly defined because of geological noise, and its conductance may be larger than the computed value.

Group 13 — Two short conductors on lines 22 and 24 may exist, hidden in geologic noise. Magnetic correlations of 100 to 450 gammas occur with these questionable conductors.

Group 14 — The single-line grade 6 anomaly 24E exists only on the whaletail coil-pair. It correlates with a 10 gamma magnetic high. There is a suggestion that it extends northeastward to the x-type response on line 25. This x-type response also exists only on the whaletail coil-pair, and is only 1 ppm in amplitude. The followup of the conductor may prove difficult, as it could represent a blind body at a depth in excess of 300 feet.

Group 15 This group consists of three x-type responses which strike parallel to the magnetics. They could reflect a conductor at a depth in excess of 300 feet.

Group 16 A grade 2 conductor with a 20 gamma correlation (which is visible only on the enhanced map) has a length of 700 feet. It appears to be an attractive target as it is isolated from long conductive zones.

Group 17 The anomalies of group 17 are complicated by cultural features. The conductor usually appears to be thin over most of its 1.5-mile length. The zone may widen to include anomaly 43B. The conductor is generally magnetic, which can best be seen on the enhanced magnetic map.

Group 18 This grade 3 conductor lies outside of the survey area. The anomalies may be somewhat mislocated because the aircraft was in process of turning towards the next survey line.

Group 19 A moderately wide conductive zone extends for over one mile before it runs off the map sheet. It occurs on the southeast flank of a magnetic high.

Anomaly 48C — This single-line grade 2 conductor might be caused by conductive overburden. It has a magnetic correlation of 150 gammas, with a somewhat thumb-print-shaped pattern on the enhanced magnetic map.

Group 20 — Two x-type responses could reflect a moderately strong non-magnetic conductor at a depth greater than 300 feet.

Anomaly 55D — A short non-magnetic grade 3 conductor yielded a strong anomaly on the whaletail coil-pair and a weak response on the standard coil-pair. This implies that the system flew subparallel to the strike of the conductor. The magnetic map shows a diabase dike-like feature with such a strike within 1000 feet of the EM anomaly. The anomaly certainly should be followed up if previous work has not explained its source.

Anomaly 58C — An x-type response on an adjacent line correlates with this non-magnetic grade 1 anomaly. The conductor may have a stronger conductance than indicated on the map.

Respectfully submitted,

D. C. Fraser
President

Toronto, Ontario
September 30th, 1977
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Four maps accompany this report:

Electromagnetics	1 map sheet
Resistivity	1 map sheet
Magnetics	1 map sheet
Enhanced magnetics	1 map sheet

The following anomalies may be of interest.

Group 1 — A conductive magnetic band, with a length of 3 miles, runs off the southwest boundary of the survey area. Conductance grades vary from 1 to 6. The zone appears to reflect iron formation.

Group 2 — A cluster of high conductance EM anomalies coincides with a 900 gamma elliptical magnetic anomaly in an area of culture. Some of the EM anomalies may reflect bedrock conductors, but most appear to be cultural.

Group 3 — A non-magnetic grade 1 conductor extends over a length of 1/2 mile. It is believed to reflect mainly a bedrock source although some of the anomalies may be caused by conductive overburden.

Anomaly 14EF — A non-magnetic single-line grade 1 anomaly reflects a weak near-surface conductor. There is a possibility that the anomaly is caused by a local pocket of conductive overburden, although the resistivity does not support this. The resistivity gradient shows that the EM anomaly occurs at a point where overburden thickness increases rapidly.

Groups 4,5 — Group 4 outlines a non-magnetic conductor, with conductance grades of 2 to 4, which has a length of one mile. It runs along the northwest flank of a magnetic high. Group 5 runs along the southeast flank of the same magnetic high, reflecting a generally non-magnetic conductor of grades 1 to 6.

APPENDIX

THE FLIGHT RECORD AND PATH RECOVERY

The flight record is a roll of chart paper containing the geophysical profiles. The profiles were generated by computer at a scale identical to the geophysical maps. The flight record contains up to 16 channels of information, as follows:

Channel Number	Parameter	Scale units/mm	Noise
20	magnetics	10 gamma	2 gamma
21	altitude	10 feet	5 feet
22	standard* coil-pair inphase	1 ppm	1-2 ppm
23	standard coil-pair quadrature	1 ppm	1-2 ppm
24	whaletail** coil-pair inphase	1 ppm	1-2 ppm
25	whaletail coil-pair quadrature	1 ppm	1-2 ppm
28	ambient noise monitor (standard receiver)	1 ppm	0 ppm
29	ambient noise monitor (whaletail receiver)	1 ppm	0 ppm
31	sums function inphase***	1 ppm	1-2 ppm
32	sums function quadrature***	1 ppm	1-2 ppm
33	differences function inphase	1 ppm	1-2 ppm
34	differences function quadrature	1 ppm	1-2 ppm
35	first anomaly recognition function	1 ppm	1-2 ppm
36	second anomaly recognition function	1 ppm	1-2 ppm
37	conductance	1 mho	
40	log resistivity	.03 decade	

* coaxial
** horizontal coplanar
*** generally not plotted

The log resistivity scale of 0.03 decade/mm means that the resistivity changes by an order of magnetude 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 record 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 often 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.

The DIGHEM^{II} system has two transmitter coils which are mounted at right angles to each other. Both coils transmit at approximately 900 hz. Thus, the system provides two completely independent surveys at one pass. In addition, the 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 15 m). Further, the EM channels include a channel of resistivity and another of conductance. A minimum of 10 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 3 shows a DIGHEM^{II} flight profile over the massive pyrrhotite ore body in Montcalm Township, Ontario. It will serve to identify the various channels.

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 standard 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 whaletail coil-pair.

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

Channels 33 and 34 are inphase and quadrature differences functions of the standard and whaletail channels. The differences 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

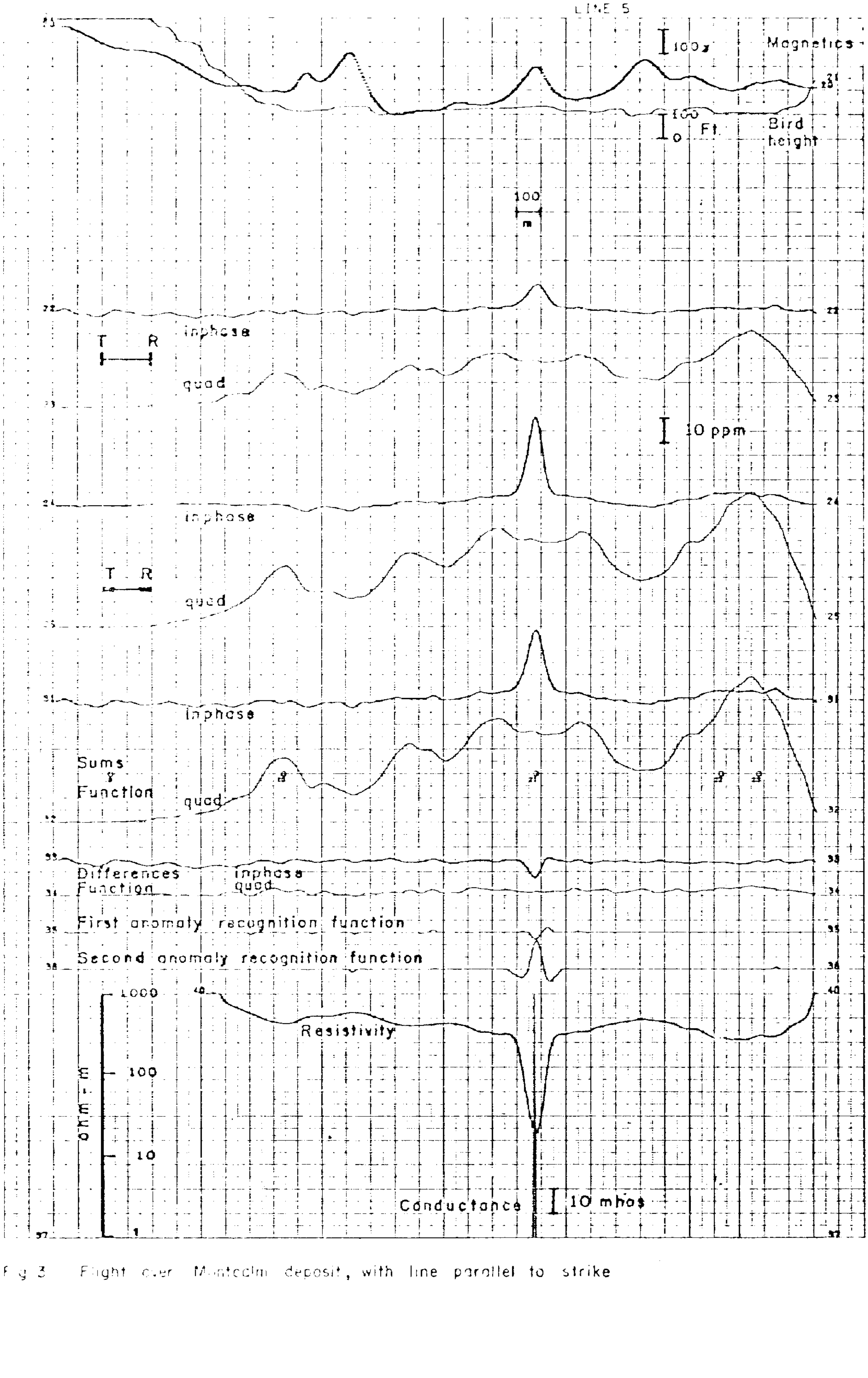

Fig. 3 Flight over Montcalm deposit, with line parallel to strike

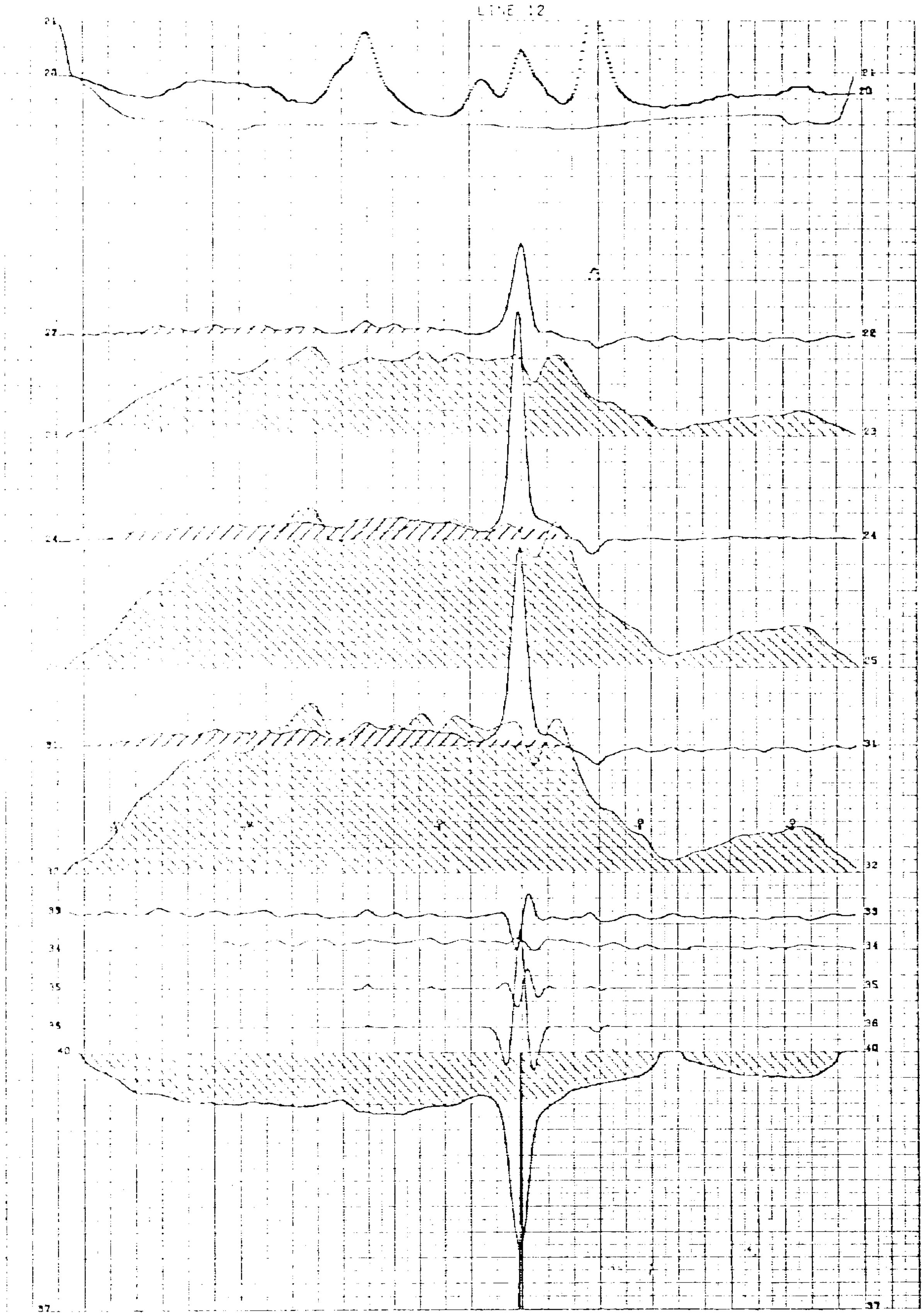

Fig 4   Flight over Montcalm deposit, with line perpendicular to strike.

enhanced magnetic contour map is similar to the filtered magnetic map discussed by Fraser.*

Figure 4 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 differences 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

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

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 3 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).

LINE & ANOMALY	STANDARD COIL REAL PPM	STANDARD 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
1A	56	30	41	15	37	30	10	142	2	106
1B	1	7	1	5	1	33	1	146	403	2
1C	4	4	5	7	6	134	2	331	44	215
1D	6	4	14	8	14	137	4	328	11	252
1E	14	7	30	15	26	80	7	235	4	185
1F	48	12	164	28	156	43	33	139	1	121
2A	1	8	0	14	1	2	1	76	733	0
2B	0	2	4	14	1	52	1	191	243	45
2C	7	4	16	8	18	116	5	306	7	241
2D	3	0	0	2	29	300	7	619	5	537
2E	2	0	2	0	23	317	5	652	8	557
2F	62	15	160	28	156	12	33	105	1	87
2G	1	2	15	3	22	35	5	268	6	195
3A	8	1	19	6	72	0	15	141	1	103
3B	3	3	0	0	5	255	2	527	63	388
3C	8	2	36	3	158	85	30	245	1	223
3D	49	10	134	17	197	11	40	110	1	95
4A	5	1	12	2	123	157	24	371	1	343
4B	0	8	0	14	1	0	1	41	735	0
4C	5	6	22	15	11	97	3	261	15	186
4D	9	3	22	0	99	113	20	293	1	264
4E	7	3	5	4	17	161	4	382	9	308
5A	17	2	10	4	97	0	20	160	1	131
5B	3	3	2	0	8	190	2	465	33	345
5C	12	12	14	33	6	41	2	162	28	77
5D	4	12	2	15	2	0	1	97	149	0
5E	8	9	17	16	9	73	3	224	21	144
5F	6	3	12	0	53	132	12	350	2	299
5G	13	7	24	11	25	92	6	255	4	203
6A	7	2	6	8	14	64	4	278	11	197
6B	6	15	7	19	3	66	1	178	76	78
6C	25	16	55	32	23	63	6	185	4	138
6D	21	21	40	48	11	47	4	156	12	95
6E	9	2	18	1	173	183	32	363	1	343

* 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	STANDARD COIL REAL PPM	STANDARD 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
8A	25	7	33	16	47	0	11	107	1	65
8B	36	19	64	30	33	0	9	86	2	48
8D	7	20	10	40	2	0	1	84	80	0
8E	3	8	7	17	3	37	1	169	87	54
8F	3	9	1	13	1	37	1	153	195	28
8G	57	40	154	73	36	22	10	113	1	80
8H	16	3	36	0	297	116	53	260	1	247
8I	22	10	43	13	44	114	11	253	1	211
9A	10	2	8	8	23	9	6	210	5	146
9B	22	10	27	11	33	0	8	146	2	100
9C	5	7	3	8	4	93	1	253	70	129
9D	12	18	23	34	7	66	2	180	23	101
9E	10	4	23	8	33	78	8	254	3	200
9F	14	4	28	5	70	80	15	243	1	205
9G	5	2	15	5	28	150	7	358	4	294
9H	5	4	14	9	13	146	4	339	12	260
10A	46	20	70	11	68	0	16	102	1	70
10B	6	8	8	13	5	61	2	215	40	110
10C	18	7	38	12	45	71	11	217	1	174
10D	12	6	31	18	22	105	6	261	5	206
11A	109	102	140	113	23	0	7	0	3	0
11B	77	31	84	35	53	0	13	97	1	67
11C	67	28	119	53	51	0	13	94	1	63
11D	2	12	3	25	1	28	1	114	208	7
11E	4	5	8	8	7	110	2	298	32	197
11F	20	8	48	12	55	75	13	214	1	175
11G	3	6	5	5	4	69	1	249	73	116
12A	109	145	137	145	16	0	5	0	5	0
12B	61	38	30	48	19	0	6	87	5	42
12C	34	28	42	32	18	0	5	0	6	0
12D	9	7	18	14	12	76	4	241	12	168
12E	18	6	45	8	79	90	17	234	1	200
12F	2	5	0	6	1	40	1	181	313	27
13A	88	124	85	107	13	0	4	0	7	0

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LINE & ANOMALY	STANDARD COIL REAL PPM	STANDARD 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
13B	47	20	27	26	29	10	8	130	3	88
13C	5	9	5	19	3	38	1	163	86	52
13D	0	12	0	22	1	0	1	62	865	0
13E	6	3	23	14	18	52	5	227	7	162
13F	7	4	15	10	16	134	4	324	9	253
13G	0	0	5	0	14	367	3	731	17	616
13H	12	3	33	9	63	126	14	286	1	248
13I	17	3	43	1	277	142	50	281	1	267
14A	144	127	122	109	24	0	7	0	3	0
14B	147	119	115	97	27	0	8	0	2	0
14C	5	10	2	13	3	20	1	147	97	33
14D	2	12	1	17	1	1	1	71	312	0
14E	1	1	1	17	1	47	1	137	518	0
14F	0	13	2	30	1	5	1	29	808	0
14G	2	2	13	8	11	126	3	339	18	248
14H	10	5	18	9	23	103	6	283	5	226
14I	2	0	7	1	56	271	12	550	2	501
14J	0	1	1	1	2	240	1	603	203	374
14K	7	4	23	7	28	111	7	295	4	237
15A	121	91	117	101	26	0	8	0	2	0
15B	6	14	2	22	2	13	1	117	106	13
15C	2	11	2	17	1	10	1	93	270	0
15D	93	57	181	93	41	7	11	89	1	60
15E	17	26	19	92	4	15	2	92	40	21
15F	0	8	1	2	1	5	1	116	598	0
16A	53	34	34	43	19	0	6	0	5	0
16B	0	6	0	11	1	0	1	88	658	0
16C	1	2	2	8	2	133	1	310	188	151
16D	4	0	10	2	70	216	15	446	1	407
16E	7	7	19	6	17	78	5	260	8	192
17A	121	96	137	164	22	0	7	0	3	0
17B	0	9	0	16	1	0	1	54	777	0
17C	21	18	59	44	17	36	5	151	6	100
17D	3	30	0	63	1	0	1	0	355	0
18A	125	118	139	166	20	0	6	0	4	0

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	STANDARD 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
18B	0	3	0	6	1	2	1	182	528	16
18C	10	5	25	9	29	80	7	251	3	197
18D	10	15	45	44	10	48	3	163	14	96
19A	73	38	143	39	59	0	15	85	1	57
19B	11	16	16	40	5	22	2	127	38	41
19D	3	3	6	8	6	142	2	346	46	227
19E	27	12	60	26	38	67	10	192	2	152
19F	5	8	6	7	4	89	2	250	56	132
20A	46	29	26	23	22	0	6	55	4	8
20B	7	10	10	13	6	40	2	184	36	85
20D	37	14	100	24	76	46	18	157	1	127
20E	4	10	8	10	4	36	1	181	62	66
21A	104	105	92	107	18	0	6	0	4	0
21B	8	13	12	20	5	78	2	207	36	112
21C	10	1	16	4	98	172	20	355	1	326
22A	18	8	11	12	19	50	5	210	6	150
22B	5	5	4	12	4	104	2	266	56	148
22C	18	14	32	21	17	55	5	191	7	133
23A	22	10	9	10	23	0	6	110	5	56
23B	17	15	21	21	11	20	4	152	13	88
23C	0	6	7	16	2	29	1	150	183	23
23D	3	5	6	10	4	116	1	285	60	162
23E	3	9	8	13	3	100	1	234	80	119
24A	2	7	6	32	2	0	1	58	146	0
24B	19	9	9	2	29	86	7	254	3	201
24C	7	16	17	23	5	29	2	148	38	56
24D	6	16	6	22	3	21	1	126	85	28
24E	8	2	21	0	162	131	31	311	1	289
24F	3	4	2	5	3	154	1	345	95	198
24G	3	4	6	6	5	142	2	336	56	209

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LINE & ANOMALY	STANDARD COIL REAL PPM	STANDARD 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
25A	14	8	2	7	12	65	4	240	14	163
25B	22	18	35	27	16	19	5	143	7	87
25C	14	18	32	31	10	62	3	181	15	113
26B	13	7	3	0	23	109	6	305	5	243
26C	19	19	26	25	11	2	4	125	12	63
26D	30	25	97	56	24	11	7	115	3	72
27A	14	6	20	3	47	66	11	235	1	188
27B	1	1	0	2	2	215	1	509	190	293
27C	7	11	22	26	7	16	2	147	26	60
27D	1	3	5	6	3	104	1	304	95	154
27E	10	8	42	17	24	37	6	186	4	135
28A	12	11	5	3	11	60	3	230	15	153
28B	5	12	10	24	3	0	1	102	61	2
28C	4	16	6	20	2	10	1	112	115	8
28D	15	3	44	0	430	67	72	205	1	196
29A	82	87	88	101	16	0	5	0	5	0
29B	38	21	116	35	51	15	13	121	1	88
29C	16	14	32	50	9	21	3	134	15	65
29D	28	7	82	11	146	44	30	162	1	142
30A	14	14	23	55	6	0	2	0	24	0
30B	32	14	77	34	40	2	10	119	1	82
30C	40	15	114	16	106	39	23	146	1	121
31A	15	14	12	12	10	48	3	192	16	123
31B	128	124	126	163	19	0	6	0	4	0
31C	34	26	98	48	29	7	8	112	2	72
31D	31	25	56	64	14	45	5	146	8	97
31E	11	14	13	37	5	38	2	149	37	61
31F	58	16	147	28	126	43	27	139	1	118
32A	5	3	3	9	5	2	2	199	46	80

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LINE & ANOMALY	STANDARD COIL REAL PPM	STANDARD 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
32B	96	85	95	97	20	0	6	0	4	0
32C	44	14	111	23	100	0	22	97	1	73
32D	16	14	30	28	13	58	4	187	11	126
32E	18	13	34	25	16	72	5	204	7	147
33A	67	45	15	10	24	0	7	0	3	0
33B	22	12	66	34	30	40	8	164	2	123
33C	18	11	34	31	16	72	5	203	7	145
33D	11	13	39	25	14	12	4	145	10	84
33E	13	14	42	19	18	23	5	160	6	103
34A	27	15	20	30	15	0	4	43	8	0
34B	27	12	19	14	25	91	7	233	4	184
34C	18	13	32	21	18	14	5	151	6	95
34D	7	12	22	26	6	57	2	184	27	98
34E	35	25	119	50	35	18	9	121	2	86
35A	29	17	5	4	21	59	6	204	5	149
35B	26	8	21	7	53	80	12	228	1	187
35C	29	13	51	25	35	61	9	188	2	147
35D	15	13	62	16	33	55	9	190	2	147
35E	6	16	7	35	2	20	1	113	94	18
35F	8	12	28	24	9	60	3	193	18	118
36A	27	33	65	80	11	0	4	0	10	0
36B	30	11	25	10	42	86	10	226	2	183
36C	30	9	41	11	62	13	14	145	1	110
36D	1	2	1	8	1	116	1	282	285	114
36E	3	6	36	44	7	9	2	132	23	51
36F	50	24	135	50	52	42	13	141	1	110
37A	7	5	13	0	32	83	8	287	3	226
37B	11	2	14	6	48	111	11	299	2	250
37C	3	3	0	5	3	102	1	308	102	153
37D	21	18	35	53	10	48	3	156	13	93
37E	97	20	259	18	359	24	68	102	1	92
38A	132	132	150	154	21	0	7	0	3	0

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LINE & ANOMALY	STANDARD COIL REAL PPM	STANDARD 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
38B	16	6	19	5	40	88	10	254	2	205
38C	17	11	41	20	24	52	6	191	4	142
38D	2	0	0	0	13	319	3	687	19	570
39A	120	136	144	166	18	0	6	0	4	0
39B	23	4	46	15	72	85	16	221	1	188
40A	7	7	26	17	13	44	4	201	11	132
40B	11	8	24	7	22	88	6	254	5	198
40C	2	12	7	22	2	15	1	121	126	12
41A	105	114	139	153	18	0	6	0	4	0
41B	17	7	26	35	14	86	4	222	9	161
41C	4	6	11	10	7	89	2	265	32	165
42A	20	10	48	19	36	49	9	186	2	142
42B	16	11	11	16	11	37	3	183	14	114
43A	125	131	133	148	19	0	6	0	4	0
43B	4	3	4	0	18	193	4	459	10	374
43C	16	8	23	16	21	71	6	225	5	169
43D	11	11	9	8	9	65	3	223	19	146
44A	0	0	63	70	10	0	3	0	14	0
44B	4	6	4	9	3	53	1	212	82	84
44C	15	7	21	22	16	47	5	195	8	133
44D	14	7	3	0	24	110	6	304	5	242
44E	5	15	8	25	2	19	1	122	94	22
45A	0	0	13	10	9	88	3	317	24	216
45B	8	10	11	22	5	32	2	164	38	67
45C	19	21	21	39	8	15	3	123	19	50
46B	6	8	18	6	12	94	4	268	13	192

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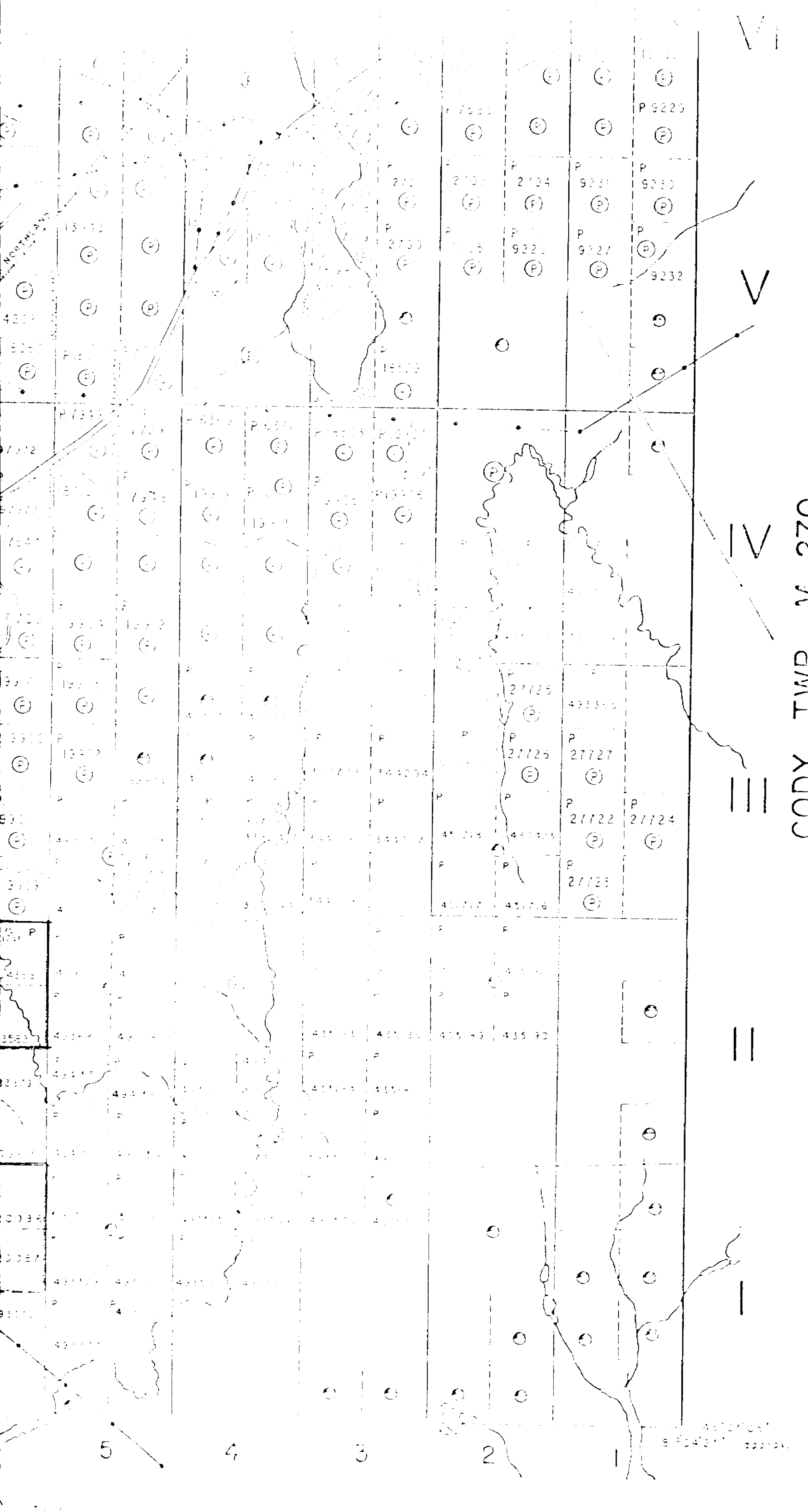
LINE & ANOMALY	STANDARD COIL REAL PPM	STANDARD COIL QUAD PPM	COPLANAR COIL REAL PPM	COPLANAR COIL QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* FEET	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH FEET	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH FEET
46C	3	5	2	7	3	82	1	255	107	112
46D	8	9	10	16	6	29	2	175	31	79
46E	6	7	3	0	8	129	2	339	29	240
47A	7	5	8	3	15	136	4	344	10	268
47B	5	8	8	23	3	58	1	182	72	75
47C	5	10	1	15	2	54	1	174	123	59
47D	14	17	8	9	7	47	2	183	24	99
48A	9	3	13	0	78	111	16	304	1	268
48B	6	6	7	4	9	108	3	303	22	213
48C	2	5	2	6	2	72	1	233	172	87
49A	5	6	8	0	13	120	4	337	13	254
49B	8	8	2	2	8	92	2	281	27	190
50A	4	6	4	5	5	63	2	252	49	132
51A	5	6	6	4	7	88	2	283	33	181
51B	5	5	4	6	6	99	2	295	39	185
51C	8	6	6	6	9	60	3	247	21	161
52A	6	3	7	0	25	167	6	402	5	330
52B	8	5	5	6	10	57	3	251	19	164
53A	9	7	11	9	12	103	3	278	14	201
53B	9	7	9	9	11	82	3	256	16	177
54A	9	7	2	3	8	115	3	307	25	217
55A	8	6	7	8	9	63	3	241	23	156
55C	15	7	4	3	22	60	6	245	5	185
55D	4	3	22	17	12	106	4	280	13	205

* 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.

	STANDARD 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
56A	9	11	8	13	6	40	2	184	33	87
56B	9	9	6	4	9	36	3	211	22	128
57A	5	8	9	14	5	55	2	203	45	96
57B	10	15	6	11	5	18	2	151	36	55
58A	6	10	6	19	3	39	1	164	70	57
58B	8	6	4	1	12	97	3	306	14	221
58C	4	6	1	9	2	42	1	190	115	60

* 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.



PORCUPINE
MINING DIVISION

SCALE: 1-INCH = 40 CHAINS

LEGEND

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

NOTES

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

This township lies within the Municipality of CITY of TIMMINS.

Any restakings within stippled area in Con. 4 and 5 subject to rights and privileges granted to Pamour Porcupine Mines Ltd. for tailings ...

Location Map

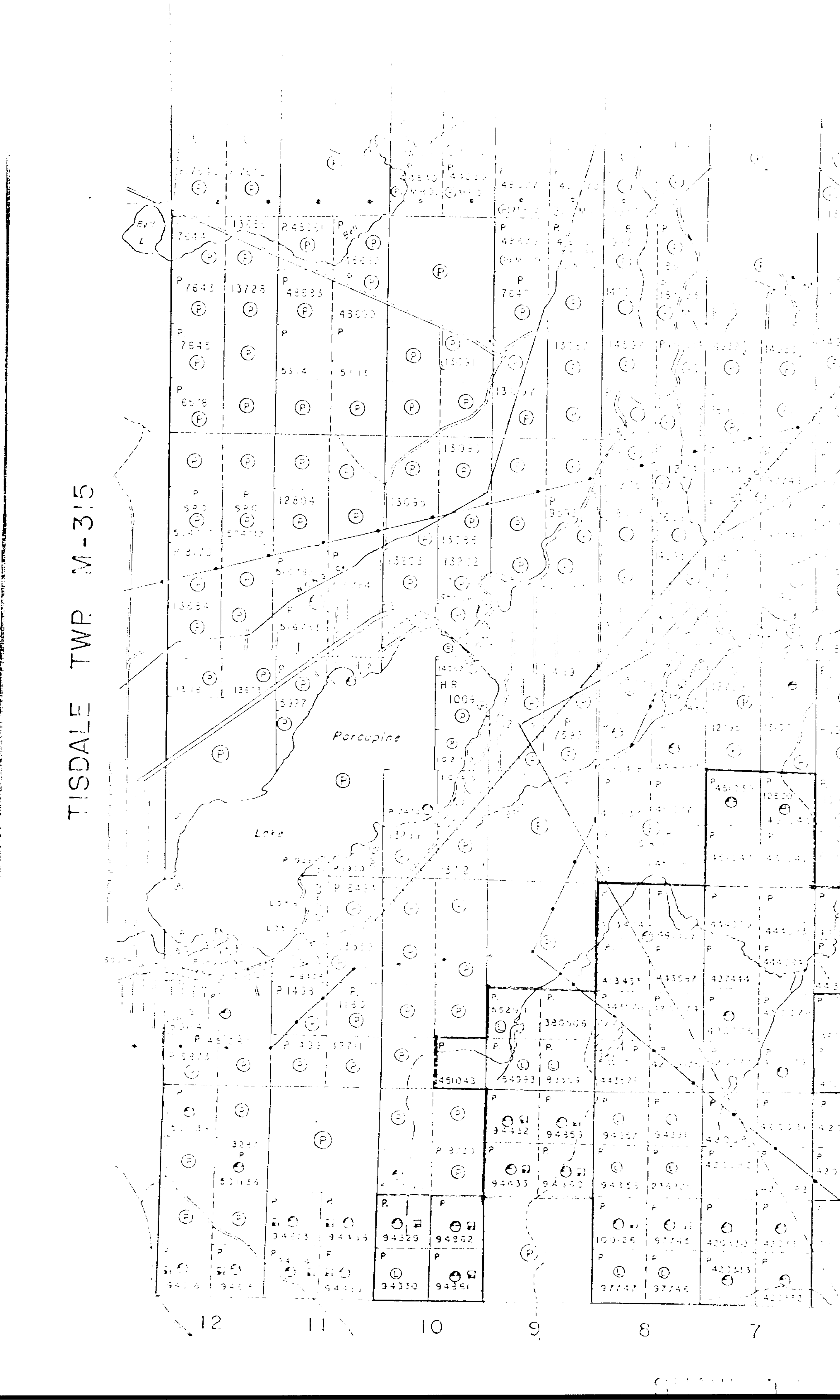
Alteration Blocks

Alamo Blocks

Dighem Survey

Scale 1" = ½ Mile

MINISTRY OF NATURAL RESOURCES



TISDALE TWP. M-315
Porcupine
Lake
12
11
10
9
8
7

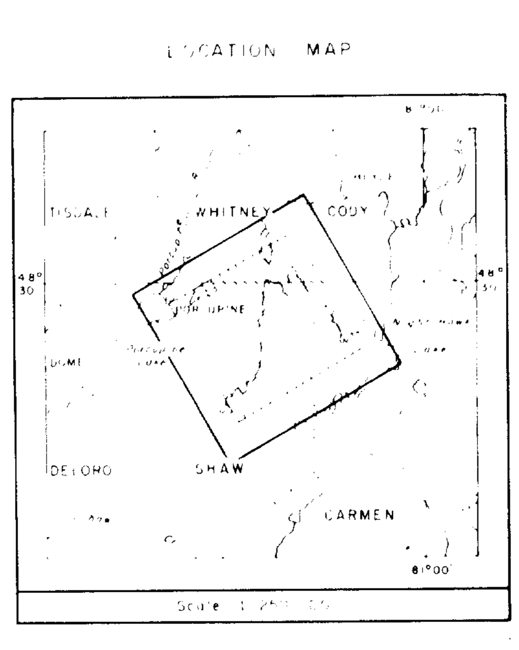
DIGHEM SURVEY

SOUTH PORCUPINE, ONTARIO

ELECTROMAGNETICS

FOR

COMINCO LIMITED



ANOMALY GRADE	EM GRADE SYMBOL	MHO RANGE
6	●	> 100
5	●	50 – 99
4	●	20 – 49
3	◉	10 – 19
2	O	5 – 9
1	○	< 4
	X	Possible conductor

DIGHEM anomalies are divided into six grades of conductivity-thickness product. This product in mhos is the reciprocal of resistance in ohms. The mho is a measure of conductance, and is a geologic parameter. Most swamps yield Grade 1 anomalies but highly conducting clays can give Grade 2 anomalies. The 3 dimensional anomaly shapes often allow surface conductors to be recognized, and these are indicated by the letter S on this map. The remaining Grade 1 and 2 anomalies could be weak bedrock conductors. The higher grades indicate increasingly higher conductances. Examples: The ore bodies of the Magusi River camp yield Grade 4 anomalies, while Mattabi and Whistle give Grade 5. Graphite and sulphides can span all grades but in this survey area field work may show that the different grades indicate different types of conductors.

identifier — 38 — mho value

Depth is greater than: 50 feet, 100 feet, 150 feet, 200 feet

Inphase and Quadrature of max coupled coil is greater than: 5 ppm, 10 ppm, 15 ppm, 20 ppm

Refer to list of anomalies in survey report for the actual ppm values for all coils, and for conductor depths.

The actual mho value is plotted beside the EM grade symbol. The letter is the anomaly identifier. The horizontal rows of dots indicate anomaly amplitude on the flight record, and the vertical column gives the estimated depth. This 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 conductive overburden effects.

- Conductor axis
- S — Probable surface response
- S? — Possible surface response
- L — Probable line (power, telephone, pipe, or fence)
- L? — Possible line
- ? — Questionable anomaly
- 100γ — Direct magnetic correlation of 100 gammas
- 100γN — Conductor is on the flank of a 100 gamma magnetic anomaly located to the north

DIGHEM 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 followup 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 all conductors in terms of length, strike direction, conductance and depth. The accuracy is comparable to an interpretation from a ground EM survey having the same line spacing.

Flight line

Fiducials and numbers

MILES

REGISTERED PROFESSIONAL ENGINEER
D. C. FRASER
PROVINCE OF ONTARIO

EASTERN DISTRICT

Drawn by: | Traced by:

Revised by | Date | Revised by | Date

ALAMO PROPERTY
DIGHEM SURVEY
ELECTROMAGNETICS

ONTARIO | N.T.S 42-A-6

Scale: 1in = 1/4 mi | Date: Jan 1978 | Plate: AEM-1

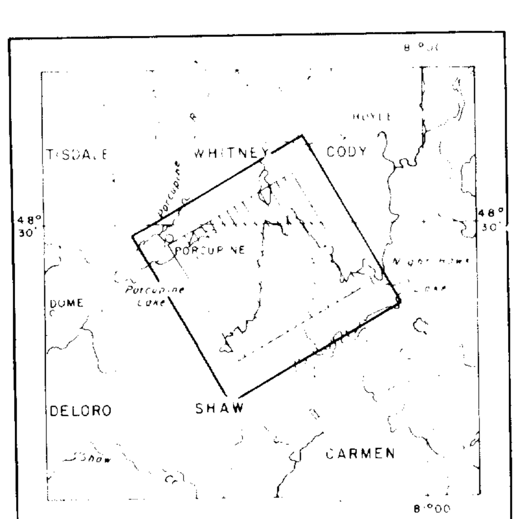
FORM 210-0670

2.2833

42A06NE0046 2.2833 WHITNEY

200

LOCATION MAP



Scale 1:250,000

DIGHEM SURVEY

SOUTH PORCUPINE, ONTARIO

ENHANCED MAGNETICS

FOR

COMINCO LIMITED

Flight line

Fiducials and numbers

ISOMAGNETIC LINES

(enhanced field)

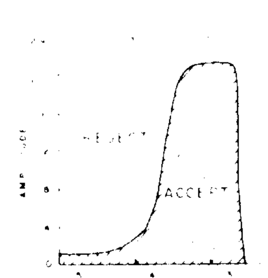
5000 gammas

1000 gammas

200 gammas

100 gammas

magnetic depression



Frequency response of magnetic operator

MILES

EASTERN DISTRICT

Drawn by:	Traced by:
Revised by / Date	Revised by / Date

ALAMO PROPERTY
DIGHEM SURVEY
ENHANCED MAGNETICS

ONTARIO — N.T.S 42-A-6

Scale: 1 in = 1/4 mi — Date: Jan 1978 — Plate: AEM-4

FORM 210-0670

210

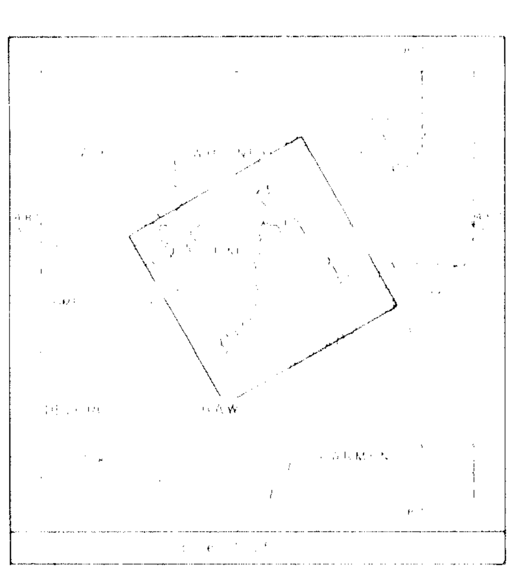
DIGHEM SURVEY

SOUTH PORCUPINE, ONTARIO

RESISTIVITY

FOR

COMINCO LIMITED



LEGEND

Contours in ohms meters at eight intervals per decade

100
75
56
42
31
23
17
13
10

Note

The numbers face in the direction of increasing value

EASTERN DISTRICT

Drawn by:	Traced by:	ALAMO PROPERTY DIGHEM SURVEY RESISTIVITY
Revised by / Date	Revised by / Date	
ONTARIO Scale: 1 in = 1/4 m.	Date: Jan 1978	N.T.S 42-A-6 Plate: AEM-2

FORM 210-0670

2 2833

220

DIGHEM SURVEY

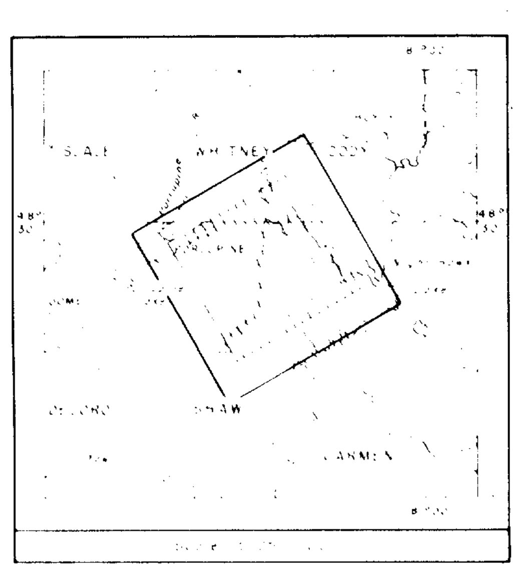
SOUTH PORCUPINE, ONTARIO

MAGNETICS

FOR

COMINCO LIMITED

LOCATION MAP



ISOMAGNETIC LINES
(total field)
1000 gammas
200 gammas
50 gammas
25 gammas
magnetic depression

EASTERN DISTRICT
ALAMO PROPERTY
DIGHEM SURVEY
MAGNETICS
ONTARIO
N.T.S. 42-A-6

230