REPORT NO. 207

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DIGHEM^{III} SURVEY

OF THE

FOUR CORNERS AREA, TIMMINS, ONTARIO

FOR

CHEVRON CANADA RESOURCES LIMITED

BY

DIGHEM SURVEYS & PROCESSING INC.

MISSISSAUGA, ONTARIO
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SUMMARY AND RECOMMENDATIONS

A total of 273 km of survey was flown with the DIGHEM^{III} system in August 1984, over a property held by Chevron Canada Resources Limited near Timmins, Ontario.

The survey outlined several discrete bedrock conductors associated with areas of low resistivity. They mostly occur on the flanks of well defined, narrow magnetic trends. Only in a few instances the bedrock conductors are also magnetic. Most of these anomalies appear to warrant further investigation using appropriate surface exploration techniques. Areas of interest may be assigned priorities for follow-up work on the basis of supporting geological, geochemical, and other goephysical information.

The area of interest contains at least six anomalous features which are considered to be of high priority as exploration targets.

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LOCATION MAP

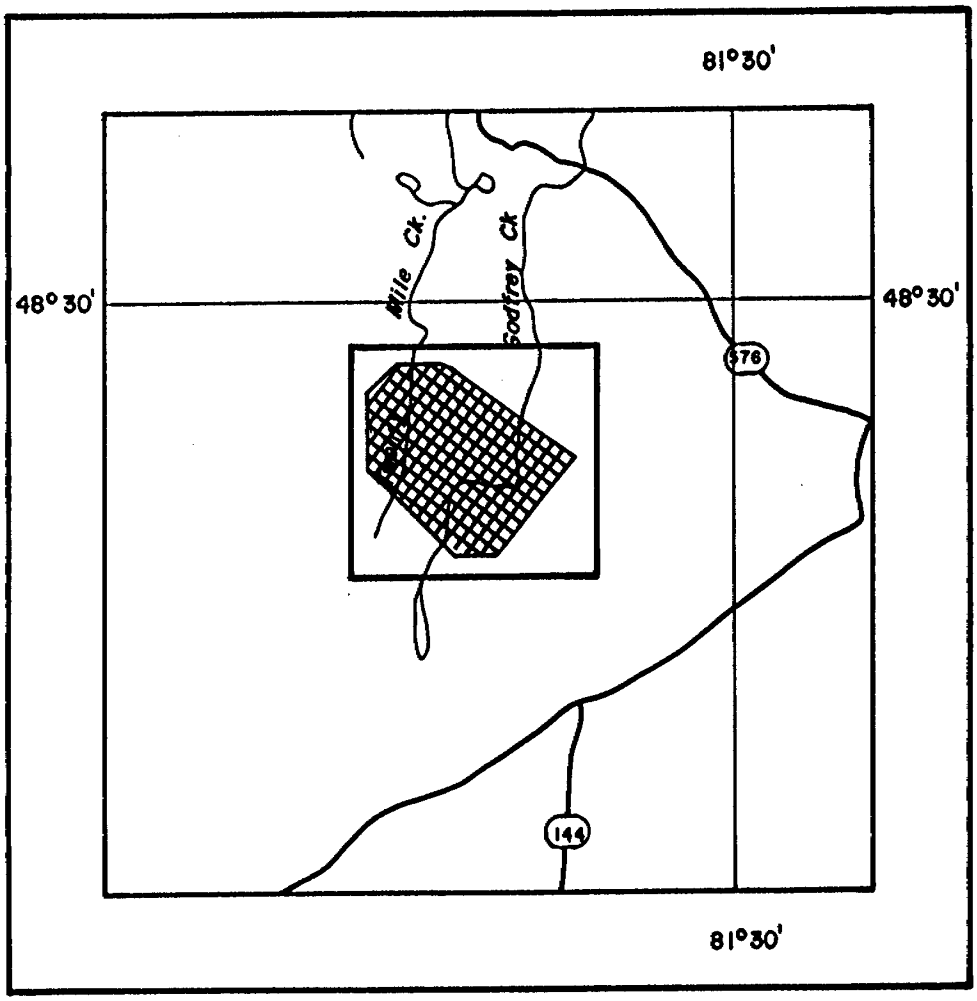

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Figure 1

The Survey Area

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INTRODUCTION

A DIGHEM^{III} electromagnetic/resistivity/magnetic survey totalling 273 line-km was flown with a 200 m line-spacing for Chevron Canada Resources Limited, on August 2 and 3, 1984, in the Four Corners area of Ontario (Figure 1).

The Astar C-GNSM turbine helicopter flew at an average airspeed of 119 km/h with an EM bird height of approximately 31 m. Ancillary equipment consisted of a Sonotek PMH 5010 magnetometer with its bird at an average height of 46 m, a Sperry radio altimeter, a Geocam sequence camera, an RMS GR33 analog recorder, a Sonotek SDS 1200 digital data acquisition system and a DigiData 1140 9-track 800-bpi magnetic tape recorder. The analog equipment recorded four channels of EM data at approximately 900 Hz, two channels of EM data at approximately 7200 Hz, two ambient EM noise channels (for the coaxial and coplanar receivers), two channels of magnetics (coarse and fine count), and a channel of radio altitude. The digital equipment recorded the above parameters, with the EM data to a sensitivity of 0.20 ppm at 900 Hz and 0.40 ppm at 7200 Hz and the magnetic field to one nT (i.e., one gamma).

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

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

In areas where magnetite causes the inphase components to become negative, the apparent conductance and depth of EM anomalies may be unreliable.

Areas, in which EM responses are evident only on the quadrature components, indicate zones of poor conductivity. Where these responses are coincident with strong magnetic anomalies, it is possible that the inphase component amplitudes have been suppressed by the effects of magnetite. Most of these poorly-conductive magnetic features give rise to resistivity anomalies which are only slightly below background. These weak features are evident on the resistivity map but may not be shown on the electromagnetic anomaly map. If it is expected that poorly-conductive sulphides may be associated with magnetite-rich units, some of these weakly anomalous features may be of interest.

SECTION I: SURVEY RESULTS

The survey covered an irregularly shaped block of land located about 20 km west of Timmins, Ontario. The survey block, covering the adjacent corners of the Turnbull, Godfrey, Bristol, and Carscallen Townships, was flown in two mutually perpendicular directions. The flight line directions, numbers, and distances flown are indicated below.

Line No.	Line Direction	km
1- 27	NW-SE	139
101-135	NE-SW	134
Total		273

Results of the survey flying are shown on a single map sheet for each parameter. Table I-1 summarizes the EM responses on the map sheet with respect to conductance grade and interpretation.

The resistivity map shows the conductive properties of the survey area. It indicates that the geologic environment

TABLE I-1

EM ANOMALY STATISTICS OF THE FOUR CORNERS AREA, TIMMINS, ONTARIO

CONDUCTOR GRADE	CONDUCTANCE RANGE	NUMBER OF RESPONSES
6	> 99 MHOS	1
5	50-99 MHOS	1
4	20-49 MHOS	5
3	10-19 MHOS	3
2	5- 9 MHOS	8
1	< 5 MHOS	280
X	INDETERMINATE	71
TOTAL		369

CONDUCTOR MODEL	MOST LIKELY SOURCE	NUMBER OF RESPONSES
D	DISCRETE BEDROCK	10
P	DISCRETE BEDROCK	2
B	DISCRETE BEDROCK	7
E	BEDROCK OR EDGE EFFECT	17
G	ROCK OR COVER	19
H	ROCK OR COVER	110
S	COVER	191
L	CULTURE	5
?	QUESTIONABLE	2
(BLANK)		6
TOTAL		369

(SEE EM MAP LEGEND FOR EXPLANATIONS)

is quite resistive, typical resistivity values being in excess of 300 ohm-m. Only a few zones of lower than 300 ohm-m resistivity occur. They reflect bedrock conductors, and near-surface conductive features, e.g., overburden. The high resistivity zones, i.e., areas with values in excess of 3,000 ohm-m, are, in general, confined to magnetic trends and, in some instances, to high ground. Conversely, low resistivity zones occur in the magnetically quiet areas or on the flanks of the magnetic trends, except when the low resistivity is due to a magnetic bedrock conductor, e.g., 113F-115B.

The magnetic field in the survey area varies from about 59,060 nT to more than 59,650 nT. The eastern half of the area displays higher magnetic activity than the western half. Several narrow trends of close to north-south direction occur here which are particularly well defined on the enhanced magnetic map. An east-west striking anomaly is distinguished on the magnetic maps that crosses the other trends and extends east of the intersection of lines 13 and 122.

The west half of the area contains two narrow magnetic anomalies. One, paralleling the north-southerly trends of the eastern half, extends from the intersection of lines 1 and 127 toward the northeast end of line 101. The other cross-cuts the area in a northwesterly direction, extending from the southeast end of line 11 toward the southwest end of line 101. The most conspicuous feature of this anomaly is its offset between lines 103 and 105.

In conclusion, the geophysical data indicates complex structures to occur in the area. It appears to contain the wealth of information the full evaluation of which is, however, beyond the scope of this report.

CONDUCTORS IN THE SURVEY AREA

The electromagnetic anomaly map shows the anomaly locations with the interpreted conductor type, dip, conductance and depth being indicated by symbols. Direct magnetic correlation is also shown if it exists. The strike direction and length of the conductors are indicated when anomalies can be correlated from line to line. When studying the map sheets for follow-up planning, consult the anomaly listings appended to this report to ensure that none of the conductors are overlooked.

Anomaly 19A-102B

These grade 1 anomalies reflect a bedrock conductor which occurs on the flank of a weak magnetic anomaly. The EM data suggests that the conductor strikes parallel or at low angle to line 19, where the anomaly appears to be of an H-type while being of dipping sheet type on line 102.

Anomaly 23A

A G? conductor is indicated by this grade 1 anomaly which occurs at the tip of a well defined enhanced magnetic anomaly.

Anomalies 108B-109C, 12D-109xB

A pair of bedrock conductors is indicated by these grade 1 to 4 anomalies and an x-type response. The main conductor 108B-109C, which is best portrayed by the 900 Hz resistivity, occurs on the flank of the major northwesterly striking magnetic anomaly. It is an attractive target which should be investigated on the ground. The conductor is believed to have been drilled in the past by Conwest Exploration Co. Limited.

The other conductor, 12D-109xB, is poorly defined and appears to be secondary in nature.

Anomaly 23B

This grade 1 anomaly, which occurs on the flank of a well developed, enhanced magnetic anomaly, reflects a weak broad conductive feature in the bedrock. It has similar characteristics as 23A.

Anomalies 111C, 112C, 113E, 17xA

All these anomalies were classified as broad, buried conductive unit responses. They fall on a very poorly defined 7200 Hz resistivity trend which also parallels the general magnetic trend in the area.

Anomalies 113F-115B, 114xA, 19C

The grade 1 and 4 anomalies 113F-115B define one of the most attractive magnetic bedrock conductors in the survey area. The conductor, which has a southwest dip, was previously drilled yielding 5 to 10% disseminated pyrite and pyrrhotite.

The grade 4 anomaly 19C reflects a separate magnetic bedrock conductor which most likely parallels 113F-115B, extending toward line 115.

The x-type response 114xA may be merely an edge effect.

Anomaly 116E-19E

A non-magnetic bedrock conductor located at the tip of a localized enhanced magnetic anomaly is indicated by these grade 1 and 4 anomalies. The conductor, which had been drilled in the past yielding 2 ft. of pyrrhotite, strikes at a low angle to line 19.

Response 116xC

This x-type response, which occurs on the flank of a weak enhanced magnetic anomaly, reflects a geologic conductor of broad conductive unit-type.

Anomaly 117B

This grade 1 anomaly may reflect a weak bedrock conductor or a flat lying, near-surface conductive material. The EM responses at this location were distorted by a spheric which made a proper evaluation of 117B difficult.

Anomalies 122B, 123xC

This poorly defined grade 1 anomaly and an x-type response, which occur on the flank of the main north-southerly magnetic trend, may have geologic origin. Alternatively, they could reflect edge effects.

Anomaly 125B

Conductor of a geologic origin, i.e., broad conductive unit-type, is indicated by this grade 1 anomaly.

Anomalies 10D, 126B, 9D, 127xA

These grade 1 and 2 anomalies and an x-type response are of mixed edge effect/broad conductive unit type. They occur along a north-southerly oriented trend that crosses a major, northwesterly striking, magnetic anomaly and lies on the flank of a high resistivity zone.

Anomaly 129B

A well defined bedrock conductor, which may strike at a low angle to the flight line, is indicated by this grade 2 anomaly.

Anomaly 132B-11J

These grade 1 to 5 anomalies reflect an attractive bedrock conductor which, according to the magnetic patterns, may consist of two parts, i.e., 132B-134B and 135B-11J. It should be investigated on the ground.

Anomaly 133B

This grade 1 anomaly could reflect a weak bedrock conductor. It is located on the flank of a weak enhanced magnetic trend and associated with a 500-600 ohm-m zone of a north-southerly strike.

Anomalies 134C, 135xA

This grade 1 anomaly and an x-type

response occur on the flank of a local magnetic trend. They may have geologic origin. However, their location in a creek valley makes them suspect for being of near-surface origin or due to aerodynamic noise.

Anomaly 135C

This grade 1 anomaly, which correlates with a small creek, may reflect a weak bedrock feature or, alternatively, near-surface (e.g., overburden) conductor.

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SECTION II: BACKGROUND INFORMATION

ELECTROMAGNETICS

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

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

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

Geometric interpretation

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

Discrete conductor analysis

The EM anomalies appearing on the electromagnetic map are analyzed by computer to give the conductance (i.e., conductivity-thickness product) in mhos of a vertical sheet model. This is done regardless of the interpreted geometric shape of the conductor. This is not an unreasonable procedure, because the computed conductance increases as the electrical quality of the conductor increases, regardless of its true shape. DIGHEM anomalies are divided into six grades of conductance, as shown in Table II-1. The conductance in mhos is the reciprocal of resistance in ohms.

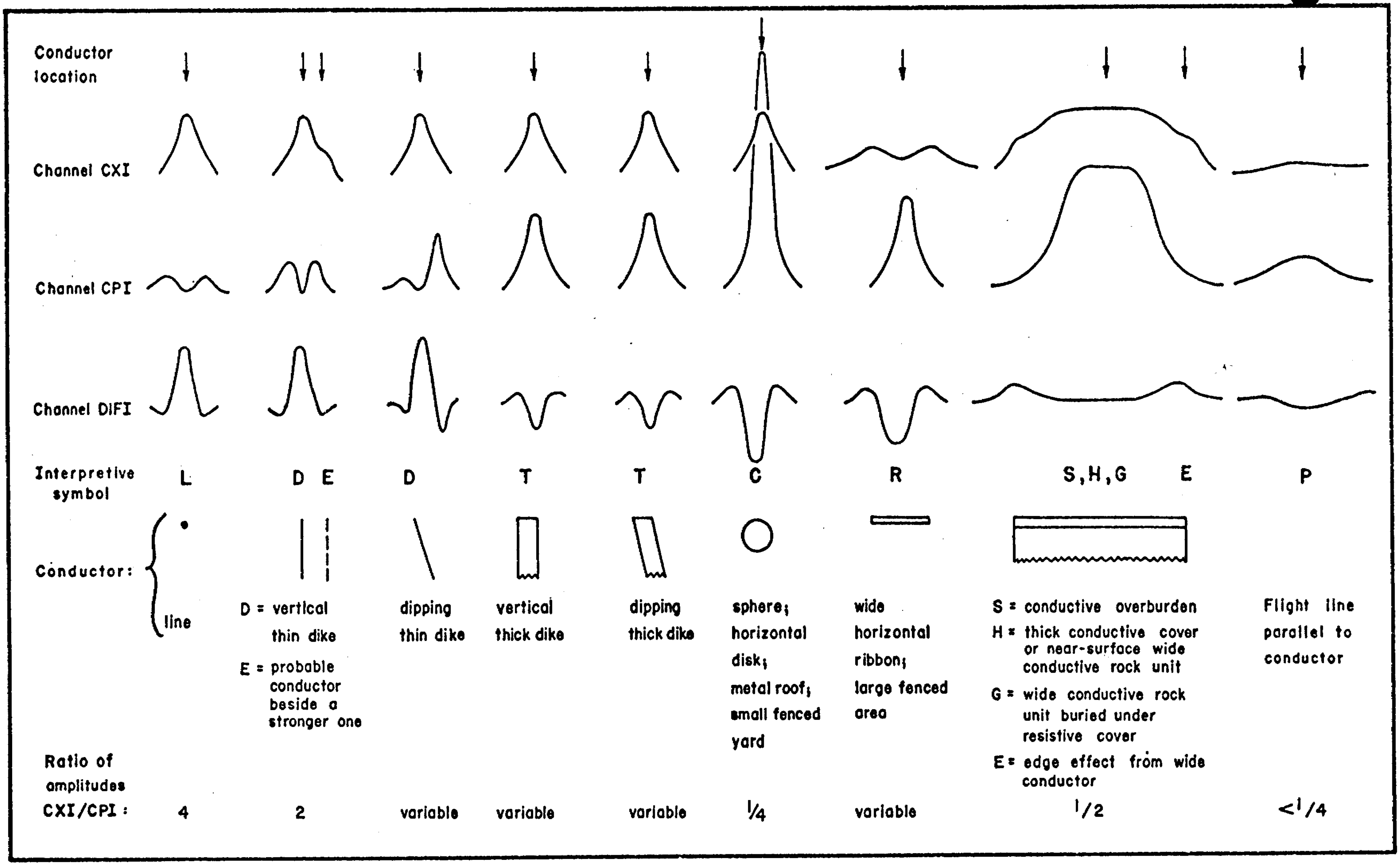

Figure II - 1 Typical DIGHEM anomaly shapes

Table II-1. EM Anomaly Grades

Anomaly Grade	Mho Range
6	> 99
5	50 - 99
4	20 - 49
3	10 - 19
2	5 - 9
1	< 5

The conductance 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 conductance values.

Conductive overburden generally produces broad EM responses which are not plotted on the EM maps. However, patchy conductive overburden in otherwise resistive areas

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

can yield discrete anomalies with a conductance grade (cf. Table II-1) 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 below 10 ohm-m, anomalies caused by weathering variations and similar causes can have any conductance grade. The anomaly shapes from the multiple coils often allow such conductors to be recognized, and these are indicated by the letters S, H, G and sometimes E on the map (see EM legend).

For bedrock conductors, the higher anomaly grades indicate increasingly higher conductances. Examples: DIGHEM's New Insco copper discovery (Noranda, Canada) yielded a grade 4 anomaly, as did the neighbouring copper-zinc Magusi River ore body; Mattabi (copper-zinc, Sturgeon Lake, Canada) and Whistle (nickel, Sudbury, Canada) gave grade 5; and DIGHEM's Montcalm nickel-copper discovery (Timmins, 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, 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., grades 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, a letter identifier and an interpretive symbol are plotted beside the EM grade symbol. The horizontal rows of dots, under the interpretive symbol, indicate the anomaly amplitude on the flight record. The vertical column of dots, under the anomaly letter, gives the estimated depth. In areas where anomalies are crowded, the letter identifiers, interpretive symbols and dots may be obliterated. The EM grade symbols, however, will always be discernible, and the obliterated information can be obtained from the anomaly listing appended to this report.

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

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

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

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

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

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

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

X-type electromagnetic responses

DIGHEM maps contain x-type EM responses in addition to EM anomalies. An x-type response is below the noise threshold of 3 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 the flight line, or aerodynamic noise. Those responses that have the appearance of valid bedrock anomalies on the flight profiles are indicated by appropriate interpretive symbols (see EM map legend). The others probably do not warrant further investigation unless their locations are of considerable geological interest.

The thickness parameter

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

Resistivity mapping

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

The resistivity profile (see table in Appendix A) 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. The depth channel (see Appendix A) gives the apparent depth below surface of the conductive material. The apparent depth is simply the apparent thickness of the overlying resistive layer. The apparent depth (or thickness) parameter will be positive when the upper layer is more resistive than the underlying material, in which case the apparent depth may be quite close to the true depth.

The apparent depth will be negative when the upper layer is more conductive than the underlying material, and will be zero when a homogeneous half space exists. The apparent depth parameter must be interpreted cautiously because it will contain any errors which may exist in the measured altitude of the EM bird (e.g., as caused by a dense tree cover). The inputs to the resistivity algorithm are the inphase and quadrature components of the coplanar coil-pair. The outputs are the apparent resistivity of the

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

conductive half space (the source) and the sensor-source distance. The flying height is not an input variable, and the output resistivity and sensor-source distance are independent of the flying height. The apparent depth, discussed above, is simply the sensor-source distance minus the measured altitude or flying height. Consequently, errors in the measured altitude will affect the apparent depth parameter but not the apparent resistivity parameter.

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

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

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

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

The resistivity map might be likened to a total field map and the EM map to a horizontal gradient in the direction of flight[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.

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[3] The gradient analogy is only valid with regard to the identification of anomalous locations.

Interpretation in conductive environments

Environments having background resistivities below 30 ohm-m cause all airborne EM systems to yield very large responses from the conductive ground. This usually prohibits the recognition of discrete bedrock conductors. The processing of DIGHEM data, however, produces six channels which contribute significantly to the recognition of bedrock conductors. These are the inphase and quadrature difference channels (DIFI and DIFQ), and the resistivity and depth channels (RES and DP) for each coplanar frequency; see table in Appendix A.

The EM difference channels (DIFI and DIFQ) 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 conductive environment therefore is based on the anomalous responses of the two difference channels (DIFI and DIFQ) and the two resistivity channels (RES). The most favourable situation is where anomalies coincide on all four channels.

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

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

Reduction of geologic noise

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

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

EM magnetite mapping

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

A magnetite mapping technique was developed for the coplanar coil-pair of DIGHEM. The technique yields channel "FEO" (see Appendix A) which displays apparent weight percent magnetite according to a homogeneous half space model.[4] The method can be complementary to magnetometer mapping in certain cases. Compared to magnetometry, it is far less sensitive but is more able to resolve closely spaced magnetite zones, as well as providing an estimate of the amount of magnetite in the rock. The method is sensitive to 1/4% magnetite by weight when the EM sensor is at a height of 30 m above a magnetitic half space. It can individually resolve steeply dipping narrow magnetite-rich bands which are separated by 60 m. Unlike magnetometry, the EM magnetite method is unaffected by remanent magnetism or magnetic latitude.

The EM magnetite mapping technique provides estimates of magnetite content which are usually correct within a

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

factor of 2 when the magnetite is fairly uniformly distributed. EM magnetite maps can be generated when magnetic permeability is evident as indicated by anomalies in the magnetite channel FEO.

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

Recognition of culture

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

1. Channels CXS and CPS (see Appendix A) measure 50 and 60 Hz radiation. An anomaly on these channels shows that the conductor is radiating cultural power. Such an indication is normally a guarantee that the conduc-

tor is cultural. However, care must be taken to ensure that the conductor is not a geologic body which strikes across a power line, carrying leakage currents.

2. A flight which crosses a "line" (e.g., fence, telephone line, etc.) yields a center-peaked coaxial anomaly and an m-shaped coplanar anomaly.[5] When the flight crosses the cultural line at a high angle of intersection, the amplitude ratio of coaxial/coplanar (e.g., CXI/CPI) is 4. Such an EM anomaly can only be caused by a line. The geologic body which yields anomalies most closely resembling a line is the vertically dipping thin dike. Such a body, however, yields an amplitude ratio of 2 rather than 4. Consequently, an m-shaped coplanar anomaly with a CXI/CPI amplitude ratio of 4 is virtually a guarantee that the source is a cultural line.

3. A flight which crosses a sphere or horizontal disk yields center-peaked coaxial and coplanar anomalies with a CXI/CPI amplitude ratio (i.e., coaxial/coplanar) of 1/4. In the absence of geologic bodies of this geometry, the most likely conductor is a metal roof or

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5 See Figure II-1 presented earlier.

small fenced yard.[6] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

4. A flight which crosses a horizontal rectangular body or wide ribbon yields an m-shaped coaxial anomaly and a center-peaked coplanar anomaly. In the absence of geologic bodies of this geometry, the most likely conductor is a large fenced area.[6] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

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

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

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

TOTAL FIELD 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, Canada) as well as magnetic (e.g., the Mattabi deposit near Sturgeon Lake, Canada).

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

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

Because the enhanced magnetic map bears a resemblance to a ground magnetic map, it simplifies the recognition of trends in the rock strata and the interpretation of

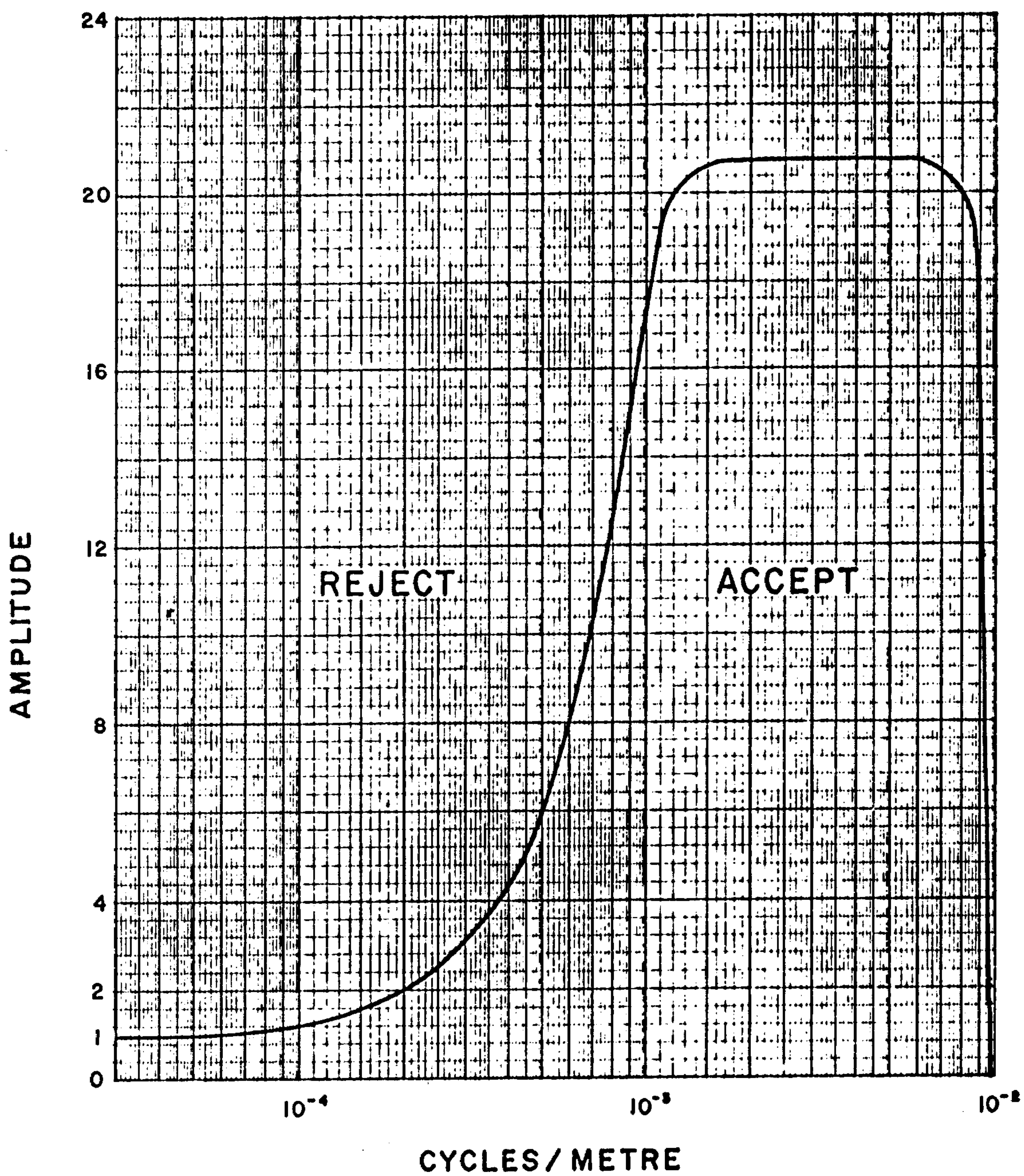

Figure II-2 Frequency response of magnetic enhancement operator.

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

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MAPS ACCOMPANYING THIS REPORT

Four map sheets accompany this report:

Electromagnetic Anomalies	1 map sheet
Resistivity	1 map sheet
Total Field Magnetics	1 map sheet
Enhanced Magnetics	1 map sheet

Respectfully submitted,
DIGHEM SURVEYS & PROCESSING INC.

Z. Dvorak

Z. Dvorak
Geophysicist

AH ZD-228

STATEMENT OF QUALIFICATIONS

I, Zbynek Dvorak, of the City of Toronto, Province of Ontario, do hereby certify that:

1. I am a geophysicist residing at 146 Three Valleys Dr., Don Mills, Ontario.

2. I am a graduate of Charles University, Prague, Czechoslovakia with a Graduate Geophysicist degree (M.Sc.) (1961), and of the Czechoslovak Academy of Science with a C.Sc. (Ph.D.) degree (1967) in Geophysics.

3. I have been practising my profession since July 1961.

4. I have been employed by Dighem Limited since March, 1978, as a geophysicist, and from March 1982 as Vice-President. In August, 1984, I became a consulting geophysicist and in October, 1984, President of Urquhart Dvorak Limited.

5. The statements made in this report represent my best opinion and judgment.

Dated at Toronto this 26th day of October, 1984.

Z. Dvořák

Zbynek Dvorak

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APPENDIX A

THE FLIGHT RECORD AND PATH RECOVERY

Both analog and digital flight records were produced. The analog profiles were recorded on chart paper in the aircraft during the survey. The digital profiles were generated later by computer and plotted on electrostatic chart paper at a scale of 1:10,000. The digital profiles are listed in Table A-1 and the analog profiles in Table A-2.

In Table A-1, 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, 100 and 133 mm up from the bottom of the digital flight record are respectively 1, 10, 100, 1,000 and 10,000 ohm-m.

Correlation of geophysical data to ground position is accomplished through the use of a fiducial system, which is an incremental counter updating every two seconds. Each fiducial number is registered on the analog record, the digital recording system, and as an individually numbered camera frame. Recognizable topographic or cultural features are then used to plot fiducials on the base maps to locate 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 speed changes may denote an error in flight path recovery. The resulting flight path locations therefore reflect a more stringent checking than is normally provided by manual flight path recovery techniques.

Table A-1. The Digital Profiles

Channel Name	(Freq)	Observed parameters	Scale units/mm
MAG		magnetics	10 nT
ALT		bird height	3 m
CXI	(900 Hz)	vertical coaxial coil-pair inphase	1 ppm
CXQ	(900 Hz)	vertical coaxial coil-pair quadrature	1 ppm
CXS	(900 Hz)	ambient noise monitor (coaxial receiver)	1 ppm
CPI	(900 Hz)	horizontal coplanar coil-pair inphase	1 ppm
CPQ	(900 Hz)	horizontal coplanar coil-pair quadrature	1 ppm
CPS	(900 Hz)	ambient noise monitor (coplanar receiver)	1 ppm
CPI	(7200 Hz)	horizontal coplanar coil-pair inphase	1 ppm
CPQ	(7200 Hz)	horizontal coplanar coil-pair quadrature	1 ppm
		Computed Parameters	
DIFI	(900 Hz)	difference function inphase from CXI and CPI	1 ppm
DIFQ	(900 Hz)	difference function quadrature from CXQ and CPQ	1 ppm
REC1		first anomaly recognition function	1 ppm
REC2		second anomaly recognition function	1 ppm
REC3		third anomaly recognition function	1 ppm
REC4		fourth anomaly recognition function	1 ppm
CDT		conductance	1 grade
RES	(900 Hz)	log resistivity	.03 decade
RES	(7200 Hz)	log resistivity	.03 decade
DP	(900 Hz)	apparent depth	3 m
DP	(7200 Hz)	apparent depth	3 m
FEO%	(900 Hz)	apparent weight percent magnetite	0.25%

Table A-2. The Analog Profiles

Channel Number	Parameter	Sensitivity per mm	Designation on computer profile
01	coaxial inphase (900 Hz)	2.5 ppm	CXI (900 Hz)
02	coaxial quad (900 Hz)	2.5 ppm	CXQ (900 Hz)
03	coplanar inphase (900 Hz)	2.5 ppm	CPI (900 Hz)
04	coplanar quad (900 Hz)	2.5 ppm	CPQ (900 Hz)
05	coplanar inphase (7200 Hz)	5.0 ppm	CPI (7200 Hz)
06	coplanar quad (7200 Hz)	5.0 ppm	CPQ (7200 Hz)
07	coaxial monitor (900 Hz)	2.5 ppm	CXS (900 Hz)
08	coplanar monitor (900 Hz)	2.5 ppm	CPS (900 Hz)
09	altimeter	3 m	ALT
10	magnetics, coarse	10 nT	MAG
11	magnetics, fine	2 nT	

A P P E N D I X   B

EM ANOMALY LIST

ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M
LINE 1 (FLIGHT 11)												
A 244 H?	1	2	1	4	10	38	1	0	1	15	562	0
B 252 H	1	4	0	8	34	68	1	1	1	18	292	0
LINE 2 (FLIGHT 11)												
A 386 H?	3	3	1	7	14	69	1	0	1	19	619	0
B 405 S	1	3	0	6	12	62	1	0	1	12	644	0
C 414 S?	1	2	0	3	9	51	1	0	1	16	1107	0
LINE 3 (FLIGHT 11)												
A 505 S	0	6	0	12	29	115	1	35	1	59	392	39
B 496 H	0	4	0	6	13	65	1	0	1	22	625	0
C 484 S	1	3	0	7	10	68	1	0	1	14	687	0
LINE 4 (FLIGHT 11)												
A 542 S	0	5	0	10	21	96	1	0	1	12	523	0
B 551 H	0	1	0	3	11	27	1	1	1	25	542	0
LINE 5 (FLIGHT 11)												
A 676 L	1	3	4	6	16	67	3	40	1	86	120	46
B 664 H	0	4	1	9	20	54	1	8	1	17	410	0
C 639 ?	5	0	2	1	5	11	138	66	1	206	342	96
LINE 6 (FLIGHT 11)												
A 730 H	1	2	0	3	12	28	1	0	1	31	300	3
B 747 S	0	3	0	9	21	65	1	0	1	24	234	5
C 760 S	1	4	0	8	20	83	1	0	1	14	419	0
D 775 H	0	1	0	2	7	21	1	0	1	23	600	0
LINE 7 (FLIGHT 11)												
A 909 S	1	3	0	5	18	43	1	0	1	15	625	0
B 896 H	1	3	0	6	29	46	1	2	1	26	292	4
C 884 S	0	2	0	4	10	43	1	0	1	13	647	0
LINE 8 (FLIGHT 11)												
B 947 S	0	4	0	9	31	77	1	0	1	14	337	0
C 959 H	2	2	1	2	19	20	1	5	1	30	303	6
D 971 S	1	3	1	4	11	39	1	0	1	19	722	0
LINE 9 (FLIGHT 11)												
A 1116 S	1	5	0	10	42	88	1	0	1	14	213	0
B 1108 S	3	2	0	4	21	43	1	0	1	18	291	0

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

ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M
LINE 9 (FLIGHT 11)												
C 1089 H	1	3	0	4	10	25	1	6	1	16	694	0
D 1064 H?	2	2	2	2	15	25	8	59	1	101	483	25
E 1058 G?	1	1	0	2	6	26	1	2	1	32	619	6
LINE 10 (FLIGHT 11)												
A 1159 S	1	4	0	9	31	77	1	0	1	16	296	0
B 1168 H	1	2	0	4	20	33	1	0	1	27	318	3
C 1188 S	3	2	0	4	10	54	1	0	1	6	1239	0
D 1205 E?	1	4	0	8	21	85	1	0	1	20	606	0
E 1208 S	1	1	0	3	9	36	1	0	1	14	625	0
LINE 11 (FLIGHT 11)												
A 1410 H	0	3	0	5	16	52	1	0	1	30	402	6
B 1401 H	4	2	0	4	12	44	1	0	1	26	460	1
D 1388 H?	0	3	0	5	9	50	1	0	1	22	744	0
E 1356 S	0	5	0	13	17	120	1	0	1	9	679	0
F 1340 H?	1	2	0	5	14	41	1	5	1	36	480	11
G 1330 S	1	15	0	31	68	282	1	0	1	8	239	0
J 1310 B	3	1	4	3	15	17	12	57	1	108	155	59
LINE 12 (FLIGHT 11)												
A 1430 H?	2	2	0	3	11	22	1	0	1	34	419	6
B 1437 H	1	1	0	2	8	20	1	0	1	23	321	0
C 1441 H	2	1	0	3	13	23	1	4	1	32	327	7
D 1447 B?	2	4	3	3	14	29	3	24	2	171	68	124
E 1487 S	4	4	1	10	14	100	1	0	1	7	775	0
F 1491 H?	3	1	1	3	11	30	1	5	1	31	587	5
G 1500 H	3	1	0	1	9	13	1	15	1	33	546	5
H 1525 G?	1	3	3	8	25	50	1	0	1	33	267	11
LINE 13 (FLIGHT 11)												
A 1682 S	1	2	0	3	11	42	1	0	1	18	386	0
B 1674 S	0	2	0	4	12	40	1	0	1	21	308	0
C 1670 H	0	4	0	7	27	65	1	1	1	27	285	6
D 1662 D	6	4	19	8	37	58	23	30	6	111	5	93
E 1645 S	0	3	0	6	7	66	1	0	1	12	1404	0
F 1613 S	2	3	1	8	32	83	1	0	1	17	277	0
G 1600 S	1	1	0	3	11	25	1	0	1	15	486	0
H 1585 D	5	3	11	8	26	15	13	27	2	101	31	69
LINE 14 (FLIGHT 10)												
A 1941 H	0	3	1	2	8	15	1	11	1	28	422	3

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ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M
LINE 14	(FLIGHT	10)										
C 1970 S	0	1	1	2	8	41	1	0	1	12	1166	0
F 1998 S	3	5	0	12	37	96	1	0	1	14	378	0
H 2016 H	0	1	1	3	10	33	1	0	1	36	476	8
LINE 15	(FLIGHT	11)										
A 1716 H	2	2	0	2	9	22	1	6	1	23	349	1
B 1725 H	1	2	0	4	13	43	1	0	1	28	549	1
C 1742 S	0	2	0	8	17	75	1	0	1	16	561	0
D 1756 S	1	5	2	14	53	99	1	0	1	12	228	0
E 1788 S	1	2	2	4	10	41	1	0	1	26	1013	0
LINE 16	(FLIGHT	11)										
A 1982 S	2	4	0	12	27	104	1	0	1	14	331	0
B 1969 H	0	5	0	10	39	94	1	0	1	20	314	0
C 1951 H	0	3	0	6	14	17	1	23	1	24	730	0
D 1937 S	0	7	0	15	57	131	1	0	1	18	181	1
E 1921 S	0	3	0	8	21	72	1	0	1	16	559	0
F 1912 S?	0	3	0	6	8	60	1	0	1	150	1035	0
H 1902 S	0	3	0	5	11	52	1	0	1	16	1113	0
I 1876 S	2	2	0	4	9	44	1	0	1	20	1121	0
LINE 17	(FLIGHT	10)										
A 1592 H	0	3	1	6	21	64	1	0	1	17	344	0
C 1579 S?	2	3	1	7	14	51	1	0	1	20	769	0
E 1551 S	0	5	0	12	47	89	1	0	1	13	166	0
F 1536 H?	0	3	1	7	34	67	1	0	1	25	269	4
G 1508 H?	0	2	2	3	11	33	1	0	1	24	764	0
H 1490 E?	2	3	2	5	11	45	1	0	1	27	1013	0
LINE 18	(FLIGHT	10)										
A 1341 S	0	1	0	3	6	35	1	0	1	17	1238	0
B 1378 H	0	3	0	5	34	52	1	5	1	25	231	5
C 1385 S	0	2	0	3	17	20	1	10	1	20	417	0
D 1392 S	0	1	0	4	5	14	1	0	1	18	722	0
E 1394 S	0	1	0	5	15	49	1	0	1	18	1070	0
G 1419 H	1	3	0	5	17	27	1	6	1	22	464	0
H 1423 S	1	3	0	5	17	41	1	0	1	20	602	0
LINE 19	(FLIGHT	11)										
A 2029 H	1	3	2	4	15	22	1	0	1	26	272	2
B 2037 H	1	2	0	3	10	30	1	0	1	26	758	0

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

207-SH1 FOUR CORNERS

	COAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* M	COND MHOS	DEPTH M	RESIS OHM-M	DEPTH M
LINE 19 (FLIGHT 11)												
C 2066 B	2	1	3	2	15	2	24	39	1	32	297	9
D 2070 S	2	4	0	5	16	59	1	0	1	14	303	0
E 2073 P?	0	3	3	6	23	41	1	1	1	19	244	0
F 2091 S	0	1	0	3	22	19	2	12	1	16	267	0
G 2097 S	0	5	0	10	25	94	1	0	1	13	448	0
H 2108 S?	1	2	0	4	9	15	2	25	1	142	1035	0
I 2120 S	0	4	0	10	35	85	1	0	1	19	279	0
LINE 20 (FLIGHT 10)												
A 1072 H	0	3	0	4	8	27	1	0	1	30	450	4
C 1103 E?	1	2	0	7	14	17	1	21	1	34	384	9
D 1106 S	0	1	0	3	7	28	1	0	1	17	369	0
E 1113 E?	0	2	0	4	13	15	1	15	1	18	552	0
F 1125 S	2	1	0	3	14	23	1	8	1	22	299	1
G 1128 S	1	1	0	3	18	25	1	9	1	20	301	0
H 1136 S	1	4	0	7	18	73	1	0	1	12	326	0
I 1150 H	4	2	0	4	20	45	1	0	1	25	399	1
J 1152 H	5	2	0	5	21	60	1	0	1	24	459	0
LINE 21 (FLIGHT 10)												
A 1055 S	777	4	1	1563	51	66	1	0	1	24	200	4
B 1029 H?	0	3	0	6	11	57	1	0	1	17	859	0
C 1025 S	4	19	2	50	193	391	1	0	1	9	85	0
D 1012 S	0	2	0	6	20	51	1	0	1	14	449	0
E 1001 S	2	5	0	14	40	111	1	0	1	12	376	0
F 997 S	1	4	1	7	23	48	1	5	1	17	258	0
G 995 S	1	3	0	5	24	39	1	1	1	13	263	0
H 991 S	0	1	0	3	11	44	1	0	1	16	391	0
I 984 S	0	3	0	5	23	39	1	1	1	14	292	0
J 966 S	0	4	0	7	24	61	1	0	1	21	442	0
LINE 22 (FLIGHT 10)												
A 875 S	9	8	0	8	46	37	2	1	1	15	189	0
C 885 S	0	2	0	5	17	55	1	0	1	19	615	0
D 899 S	1	8	1	12	33	120	1	0	1	8	322	0
E 903 H?	4	1	0	5	9	61	1	0	1	29	667	3
F 914 S	1	6	0	14	41	117	1	0	1	14	284	0
G 927 S	0	2	0	3	13	34	1	0	1	13	453	0
H 933 S	0	2	1	5	14	26	1	75	1	87	572	63
LINE 23 (FLIGHT 10)												
A 824 G?	1	1	0	3	11	25	1	6	1	49	404	21

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	COAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* M	COND MHOS	DEPTH M	RESIS OHM-M	DEPTH M
LINE 23 (FLIGHT 10)												
B 811 G	2	2	1	4	7	49	1	0	1	39	716	10
C 801 S	1	4	1	8	18	73	1	0	1	16	524	0
D 781 S	0	16	1	33	88	299	1	0	1	8	248	0
E 776 S	6	5	2	8	58	55	6	33	1	7	371	0
F 773 S	0	5	1	14	51	93	1	1	1	11	160	0
G 768 S	0	8	1	9	53	86	1	1	1	12	249	0
I 764 S	0	6	1	7	31	73	1	0	1	11	296	0
K 750 S	3	5	1	14	37	139	1	0	1	11	369	0
L 743 S	1	5	0	10	13	93	1	0	1	10	408	0
LINE 24 (FLIGHT 11)												
A 2207 S	0	8	0	19	69	119	1	0	1	11	171	0
B 2188 S	1	2	0	2	11	32	1	0	1	15	390	0
C 2177 H?	0	3	0	5	21	59	1	0	1	58	790	0
LINE 25 (FLIGHT 10)												
A 569 H?	2	2	2	5	12	44	1	0	1	22	898	0
B 556 S	4	7	2	18	53	161	1	0	1	10	240	0
C 551 H	1	2	0	3	19	37	1	8	1	23	244	4
D 540 S	2	4	2	7	33	64	1	0	1	13	183	0
E 522 H?	3	2	2	5	34	43	1	0	1	14	214	0
F 514 L?	2	1	0	1	8	16	1	12	1	28	995	0
LINE 26 (FLIGHT 11)												
A 2294 S	0	3	0	8	17	78	1	0	1	6	788	0
B 2301 S	3	4	0	12	19	116	1	0	1	2	770	0
D 2310 S	0	5	0	11	35	104	1	0	1	9	347	0
E 2318 S	0	8	0	8	28	90	1	0	1	10	239	0
F 2324 S	0	5	0	12	50	113	1	0	1	11	147	0
G 2335 S	1	6	0	10	38	96	1	0	1	12	246	0
LINE 27 (FLIGHT 10)												
A 298 S	0	9	0	20	53	181	1	47	1	72	266	54
C 287 H	0	3	0	6	13	62	1	0	1	22	673	0
D 262 S	1	1	0	2	8	21	1	1	1	13	355	0
F 242 S	7	6	6	12	38	101	1	0	1	11	278	0
G 232 H	0	5	0	8	18	77	1	0	1	18	565	0
LINE 101 (FLIGHT 8)												
A 297 H	3	4	1	7	25	80	1	0	1	22	513	0
B 288 H	1	4	0	8	13	67	1	0	1	15	478	0

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	COAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* M	COND MHOS	DEPTH M	RESIS OHM-M	DEPTH M
LINE 101 (FLIGHT 8)												
C 281 H	3	3	2	5	11	62	1	0	1	18	339	0
D 276 H	0	2	1	5	11	40	1	0	1	19	334	0
LINE 102 (FLIGHT 8)												
A 346 H	0	3	1	6	18	53	1	0	1	18	299	0
B 349 D	3	4	6	10	32	54	4	30	1	60	159	21
LINE 103 (FLIGHT 8)												
A 386 H	1	3	1	6	17	51	1	0	1	18	237	0
B 382 S	2	4	1	7	28	20	2	0	1	13	210	0
LINE 104 (FLIGHT 8)												
A 447 H	0	3	0	4	17	45	1	0	1	28	514	0
B 475 H	2	2	0	3	21	16	2	94	1	105	230	84
C 478 H	1	4	1	8	36	53	1	70	1	100	250	78
LINE 105 (FLIGHT 8)												
A 543 H	777	3	1	5	15	43	1	0	1	24	338	2
B 528 H	1	2	0	3	12	22	1	12	1	22	328	0
C 501 H?	2	2	1	4	17	21	1	0	1	19	371	0
LINE 106 (FLIGHT 8)												
A 578 H?	3	0	1	1	7	17	1	0	1	32	420	5
LINE 107 (FLIGHT 8)												
A 664 S	3	4	0	7	20	72	1	0	1	15	540	0
B 661 H	2	2	1	3	13	33	1	0	1	19	391	0
C 650 H	4	1	1	3	10	23	1	6	1	25	558	0
D 630 H?	0	1	1	1	6	14	1	0	1	43	499	12
LINE 108 (FLIGHT 8)												
A 704 S	2	3	0	6	23	61	1	0	1	12	372	0
B 711 D	4	3	7	6	23	14	9	33	2	126	43	89
C 726 H	0	2	0	3	5	34	1	0	1	28	1156	0
D 733 H	1	1	0	3	5	33	1	0	1	33	971	4
LINE 109 (FLIGHT 8)												
A 898 S	1551	2	1	4	9	42	1	0	1	19	394	0
B 878 S	1	4	1	8	31	53	1	0	1	13	281	0
C 869 D	6	2	7	2	14	28	39	46	9	161	3	146
LINE 110 (FLIGHT 8)												
A 932 S	2	3	0	7	29	61	1	0	1	14	225	0

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207-SH1 FOUR CORNERS

ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M
LINE 111	(FLIGHT	8)										
A 1066 H	1	3	0	5	13	47	1	0	1	26	308	4
B 1058 H	2	1	1	3	19	24	1	7	1	27	398	2
C 1038 G	3	2	0	4	10	38	1	0	1	33	739	5
E 1007 S	1552	7	0	14	44	119	1	0	1	10	244	0
LINE 112	(FLIGHT	8)										
A 1118 H	0	2	0	4	17	32	1	0	1	24	428	0
B 1129 H	1	3	1	8	40	66	1	0	1	21	256	0
C 1148 G	3	1	0	1	8	11	1	19	1	33	627	4
LINE 113	(FLIGHT	8)										
A 1277 H	2	1	0	2	11	24	1	10	1	26	323	4
B 1266 S?	2	4	0	9	32	88	1	0	1	19	300	0
E 1246 G?	7	1	0	6	6	24	14	53	1	96	938	6
F 1237 D	7	8	3	18	49	89	4	15	1	40	482	0
G 1231 E	5	7	0	15	45	130	2	0	1	68	882	0
H 1230 H	5	6	0	15	45	141	1	0	1	15	251	0
I 1228 S	4	7	0	16	48	146	1	0	1	13	306	0
LINE 114	(FLIGHT	8)										
A 1364 S	1	3	0	8	24	50	1	2	1	24	252	4
B 1369 H	2	3	0	7	33	51	1	8	1	22	246	3
C 1387 S	0	8	0	22	42	186	1	0	1	9	381	0
D 1403 D	30	15	49	36	127	111	27	18	3	70	14	49
E 1410 S	1	34	1	74	269	583	1	2	1	0	261	0
LINE 115	(FLIGHT	8)										
A 1486 H	2	4	1	9	29	64	1	0	1	25	253	4
B 1454 D	4	7	6	16	44	48	3	18	1	58	119	23
C 1445 S	2	12	1	29	108	223	1	0	1	12	122	0
D 1433 E	1	3	4	7	16	10	2	28	1	24	557	0
LINE 116	(FLIGHT	8)										
A 1519 S	5	2	0	3	5	22	1	0	1	25	672	0
B 1537 G	1	1	1	3	14	19	1	12	1	32	368	7
D 1565 S	2	4	0	12	50	81	1	0	1	16	233	0
E 1574 P	4	1	8	3	19	14	25	45	1	73	65	39
F 1578 S	1	3	0	5	16	46	1	0	1	14	345	0
LINE 117	(FLIGHT	8)										
A 1677 H	0	2	0	3	15	18	1	19	1	26	335	3

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207-SH1 FOUR CORNERS

	COAXIAL 900 HZ		COPLANAR 900 HZ		COPLANAR 7200 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH	
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND MHOS	DEPTH* M	COND MHOS	DEPTH M	RESIS OHM-M	DEPTH M
LINE 117	(FLIGHT		8)									
B 1661 H?	0	1	5	6	6	10	1	22	1	47	1036	12
D 1648 S	1	4	0	9	41	79	1	0	1	14	229	0
F 1623 S	3	2	0	3	6	38	1	0	1	21	959	0
G 1618 S	1	2	0	4	6	50	1	0	1	6	1014	0
LINE 118	(FLIGHT		8)									
A 1789 S	2	2	0	3	12	32	1	0	1	14	460	0
B 1794 S	0	3	0	6	20	68	1	0	1	11	442	0
C 1812 S	1	3	0	4	14	45	1	0	1	14	557	0
D 1821 S	1	1	0	4	16	36	1	0	1	20	383	0
E 1829 S	1	3	0	6	2	61	1	0	1	17	532	0
G 1838 H?	6	3	0	6	24	54	7	34	1	92	966	0
LINE 119	(FLIGHT		8)									
A 1935 H?	3	2	0	4	9	52	1	0	1	20	520	0
B 1930 S	1	3	1	6	19	73	1	0	1	15	533	0
D 1903 H	3	5	1	8	42	67	1	0	1	23	206	4
E 1895 S	4	3	1	8	20	83	1	0	1	17	490	0
F 1885 S	4	10	1	23	82	195	2	0	1	16	550	0
LINE 120	(FLIGHT		8)									
A 1975 S	2	1	0	1	6	24	1	0	1	19	774	0
B 1988 S	2	2	1	4	8	39	1	0	1	13	971	0
C 2009 H	1	4	0	7	37	68	1	0	1	25	265	4
D 2013 S	0	5	1	10	35	94	1	0	1	13	410	0
E 2025 S	3	10	1	26	93	208	1	0	1	11	154	0
F 2030 S	4	3	0	4	27	48	1	21	1	47	382	24
LINE 121	(FLIGHT		8)									
B 2114 S	2	1	2	3	6	32	1	0	1	17	1101	0
D 2102 S	1	3	2	5	12	54	1	0	1	11	1064	0
F 2086 H	2	4	1	8	39	85	1	0	1	25	283	4
G 2081 H	2	0	2	0	11	8	2	32	1	24	339	2
I 2069 S	5	14	2	34	122	238	1	0	1	9	169	0
J 2066 S	4	5	1	21	52	43	2	8	1	12	99	0
K 2060 S	4	3	1	8	20	73	1	0	1	15	325	0
LINE 122	(FLIGHT		11)									
A 2771 S	0	6	0	12	13	121	1	0	1	8	1043	0
B 2782 G	2	3	0	5	13	52	1	0	1	27	779	0
C 2799 S	0	2	0	4	11	42	1	0	1	10	1030	0

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207-SH1 FOUR CORNERS

ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M
LINE 122 (FLIGHT 11)												
D 2813 H	3	4	0	8	43	32	2	4	1	21	256	0
E 2821 S	0	3	0	8	23	75	1	0	1	10	284	0
F 2824 S	0	5	0	8	29	69	1	0	1	12	400	0
G 2832 S	2	5	0	13	62	91	1	0	1	10	132	0
H 2841 S	0	3	0	6	11	56	1	0	1	8	471	0
LINE 123 (FLIGHT 8)												
B 2293 H?	0	3	0	6	22	66	1	0	1	18	529	0
C 2276 S	2	2	2	4	13	29	1	0	1	14	635	0
F 2259 H	1	3	2	9	34	68	1	0	1	22	350	0
G 2253 S	2	5	2	10	28	41	1	5	1	17	272	0
I 2244 S	0	6	1	13	28	94	1	0	1	11	232	0
J 2242 S	5	3	1	8	25	80	5	31	1	35	592	0
LINE 124 (FLIGHT 8)												
B 2340 G?	5	2	0	4	10	44	1	0	1	36	572	9
C 2357 S	4	2	0	6	26	54	1	0	1	21	260	0
D 2375 S	1	2	2	3	17	39	1	0	1	18	624	0
E 2383 S	0	5	1	10	50	95	1	0	1	13	188	0
LINE 125 (FLIGHT 8)												
A 2584 S	1	2	0	5	20	41	1	68	1	98	253	76
B 2561 G	2	1	0	2	6	19	1	8	1	43	722	13
C 2534 H?	2	2	0	5	8	52	1	0	1	40	497	12
F 2517 S	0	1	0	2	6	20	1	0	1	164	1035	0
G 2511 S	1	5	0	11	42	94	1	0	1	11	226	0
H 2492 S	0	6	0	12	45	30	3	0	1	12	210	0
LINE 126 (FLIGHT 8)												
A 2621 S	2	1	1	3	5	28	1	0	1	25	443	0
B 2654 E?	6	1	0	4	10	44	1	0	1	18	588	0
C 2688 S	3	5	1	12	46	107	1	0	1	13	229	0
D 2697 S	0	6	1	12	38	116	1	0	1	13	432	0
E 2705 S	776	4	2	7	39	51	1	0	1	13	152	0
LINE 127 (FLIGHT 8)												
B 2751 S	1	6	0	12	40	109	1	0	1	12	290	0
LINE 128 (FLIGHT 8)												
A 2895 S	2	3	2	5	23	50	1	0	1	19	380	0
B 2922 S	2	3	1	6	28	50	1	0	1	14	342	0

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207-SH1 FOUR CORNERS

ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M
LINE 128	(FLIGHT		8)									
C 2929 S	3	2	2	3	18	18	1	5	1	15	337	0
D 2940 S	4	5	2	11	37	96	1	0	1	15	260	0
LINE 129	(FLIGHT		8)									
B 3051 B	5	4	7	8	41	37	8	22	1	74	83	36
C 3020 S	0	2	1	3	8	43	1	0	1	12	670	0
E 3012 S	0	5	1	11	41	97	1	0	1	19	302	0
F 2984 S	3	1	1	2	13	12	1	6	1	16	470	0
G 2977 S	1	2	1	3	8	29	1	0	1	14	455	0
H 2973 S	1	4	1	5	16	58	1	0	1	18	474	0
J 2965 S	0	6	2	12	41	98	1	0	1	14	241	0
LINE 130	(FLIGHT		11)									
B 2613 S	0	7	0	15	39	139	1	0	1	7	332	0
C 2595 S	0	3	1	5	15	54	1	0	1	7	771	0
D 2583 S	0	3	0	5	13	51	1	0	1	7	944	0
E 2572 S	1	1	1	4	25	8	6	12	1	15	232	0
LINE 131	(FLIGHT		8)									
A 3286 S	0	4	0	9	12	84	1	0	1	5	891	0
B 3268 S	0	1	0	1	5	20	1	0	1	29	1610	0
C 3259 S	1	2	1	5	11	49	1	0	1	14	850	0
D 3250 S	1	2	0	4	11	37	1	0	1	8	941	0
LINE 132	(FLIGHT		8)									
B 3354 D	6	1	5	2	13	2	70	43	1	145	70	100
C 3372 H	4	2	0	4	17	49	1	0	1	26	414	1
D 3381 S	0	4	0	7	22	71	1	0	1	14	478	0
LINE 133	(FLIGHT		8)									
A 3467 B	6	4	9	13	51	48	8	14	1	76	60	41
B 3451 H?	1	2	0	6	18	49	1	0	1	23	538	0
C 3443 S	2	2	0	4	10	55	1	0	1	14	614	0
LINE 134	(FLIGHT		8)									
B 3541 D	4	4	6	10	42	49	1	10	1	35	166	16
C 3547 G?	0	2	2	5	16	52	1	2	1	28	912	1
E 3558 H	4	3	0	9	22	34	1	3	1	19	330	0
F 3560 H	2	3	1	5	12	49	1	0	1	18	361	0
LINE 135	(FLIGHT		8)									
B 3623 B	3	5	6	8	44	52	1	7	1	33	226	12

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ANOMALY/ FID/INTERP	COAXIAL 900 HZ REAL PPM	COAXIAL 900 HZ QUAD PPM	COPLANAR 900 HZ REAL PPM	COPLANAR 900 HZ QUAD PPM	COPLANAR 7200 HZ REAL PPM	COPLANAR 7200 HZ QUAD PPM	VERTICAL DIKE COND MHOS	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND MHOS	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M
LINE 135	(FLIGHT 8)											
C 3619 B?	0	1	1	5	12	29	1	6	1	99	766	14
D 3607 S	2	1	1	3	8	17	1	7	1	16	862	0
E 3594 S	1	2	1	4	12	42	1	0	1	16	754	0

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Ministry of Natural Resources
Ontario

Report of Work

(Geophysical, Geological, Geochemical and Expenditures)

W8406-795

42A05NE0062 2.7423 GODFREY

900

Type of Survey(s): Airborne Magnetic and Electromagnetic

Township or Area: Turnbull Township

Claim Holder(s): Chevron Minerals Ltd.

Prospector's Licence No.: T-1690

Address: 167-B Wilson Ave., Timmins, Ontario P4N 2T2

Survey Company: Dighem Limited

Date of Survey (from & to): 02 08 84 03 08 84 (Day Mo. Yr. Day Mo. Yr.)

Total Miles of line Cut: 171 miles flown

Name and Address of Author (of Geo-Technical report): Paul Smith, Dighem Limited, ~~P.O. Box 178, Suite 7010 1 Canadian Place, Toronto~~ 228 Matheson Blvd, Miss. L4Z 1X1

Credits Requested per Each Claim in Columns at right

Special Provisions		Days per Claim
For first survey: Enter 40 days. (This includes line cutting)	Geophysical	
	- Electromagnetic	
	- Magnetometer	
For each additional survey: using the same grid: Enter 20 days (for each)	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Man Days		Days per Claim
Complete reverse side and enter total(s) here	Geophysical	
	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Airborne Credits		Days per Claim
Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic	40
	Magnetometer	40
	Radiometric	

Expenditures (excludes power stripping)

Type of Work Performed:

Performed on Claim(s):

PORCUPINE MINING DIVISION
RECEIVED
SEP 25 1984
A.M. 7 8 9 10 11 12 1 2 3 4 5 6 P.M.

Calculation of Expenditure Days Credits

Total Expenditures $ ÷ 15 = Total Days Credits

Instructions
Total Days Credits may be apportioned at the claim holder's choice. Enter number of days credits per claim selected in columns at right.

Mining Claims Traversed (List in numerical sequence)

Prefix	Number	Expend. Days Cr.	Prefix	Number	Expend. Days Cr.
P	641560		P	757366	
	641561			700701	
	641562			700702	
	641563			700703	
	641564			700704	
	641565			700705	
	689363			757639	
	689364			757640	
	688904			757641	
	688905			757642	
	688872			757812	
	688873			757813	
	688874			757814	
	688875			757815	
	688876			757816	
	688877			757817	
	757359			757951	
	757360			757952	
	757361			757953	
	757362			757954	
	757363			757955	
	757364			757956	
	757365			757957	

Total number of mining claims covered by this report of work: 46

For Office Use Only

Total Days Cr. Recorded: 3680
Date Recorded: Sept 25/84
Date Approved as Recorded: 84.11.23
Mining Recorder / Branch Director: [signature]

Date: Sept. 25/84
Recorded Holder or Agent (Signature): [signature]

Certification Verifying Report of Work

I hereby certify that I have a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work or witnessed same during and/or after its completion and the annexed report is true.

Name and Postal Address of Person Certifying:
Leslie A. Tihor, 81 Graham Lane
Timmins, Ontario. P4N 7Z5

Date Certified: Sept. 25, 1984
Certified by (Signature): [signature]

1362 (81/9)

Ministry of Natural Resources
Ontario

Report of Work
(Geophysical, Geological, Geochemical and Expenditures)

Mining Act

#396/84
27423
W8406-396
Nov. 24th

Instructions: – Please type or print.
– If number of mining claims traversed exceeds space on this form, attach a list.

Note: – Only days credits calculated in the "Expenditures" section may be entered in the "Expend. Days Cr." columns.
– Do not use shaded areas below.

Type of Survey(s): Airborne Magnetic and Electromagnetic
Township or Area: Turnbull Township
Claim Holder(s): Chevron Minerals Ltd.
Prospector's Licence No.: T-1690
Address: 167-B Wilson Ave., Timmins, Ontario P4N 2T2
Survey Company: Dighem Limited
Date of Survey (from & to): 02 08 84 03 08 84 (Day Mo. Yr. Day Mo. Yr.)
Total Miles of line Cut: 171 miles flown
Name and Address of Author (of Geo-Technical report): Paul Smith, Dighem Limited, P.O. Box 178, Suite 7010, 1 Canadian Place, Toron

Credits Requested per Each Claim in Columns at right

			Days per Claim
Special Provisions	For first survey: Enter 40 days. (This includes line cutting)	Geophysical - Electromagnetic	
		- Magnetometer	
	For each additional survey: using the same grid: Enter 20 days (for each)	- Radiometric	
		- Other	
		Geological	
		Geochemical	
Man Days	Complete reverse side and enter total(s) here	Geophysical - Electromagnetic	
		- Magnetometer	
		- Radiometric	
		- Other	
		Geological	
		Geochemical	
Airborne Credits	Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic	40
		Magnetometer	40
		Radiometric	

RECEIVED SEP 28 1984

Mining Claims Traversed (List in numerical sequence)

Prefix	Number	Expend. Days Cr.
P	757958	
	757959	
	757960	
	757961	
	757829	
	757830	
	757831	
	757865	
	757866	
	757867	
	757868	
	757874	
	758289	
	758290	
	758292	
	758293	
	758294	
	758295	
	757650	

Expenditures (excludes power stripping)

Type of Work Performed

Performed on Claim(s)

Calculation of Expenditure Days Credits

Total Expenditures				Total Days Credits
$	÷	15	=	

PORCUPINE MINING DIVISION
RECEIVED
SEP 25 1984
A.M. P.M.
7 8 9 10 11 12 1 2 3 4 5 6

RECORDED
SEP 25 1984
Receipt No. [illegible]

Instructions
Total Days Credits may be apportioned at the claim holder's choice. Enter number of days credits per claim selected in columns at right.

Total number of mining claims covered by this report of work: 19

For Office Use Only		
Total Days Cr. Recorded: 1520	Date Recorded: Sept 25/84	Mining Recorder: [signature]
	Date Approved as Recorded: 84.11.23	Branch Director: [signature]

Date: Sept. 25/84.
Recorded Holder or Agent (Signature): [signature]

Certification Verifying Report of Work

I hereby certify that I have a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work or witnessed same during and/or after its completion and the annexed report is true.

Name and Postal Address of Person Certifying:
Leslie A. Tihor, 81 Graham Lane
Timmins, Ontario P4N 7Z5

Date Certified: Sept. 25, 1984.
Certified by (Signature): [signature]

1362 (81/9)

Nov. 24th

Ministry of Natural Resources

Ontario

Report of Work

(Geophysical, Geological, Geochemical and Expenditures)

#397/84

2.7423

WP406-397

Mining Act

Instructions: – Please type or print.
– If number of mining claims traversed exceeds space on this form, attach a list.

Note: – Only days credits calculated in the "Expenditures" section may be entered in the "Expend. Days Cr." columns.
– Do not use shaded areas below.

Type of Survey(s): Airborne Magnetic and Electromagnetic

Township or Area: Godfrey Township

Claim Holder(s): Chevron Minerals Ltd.

Prospector's Licence No.: T-1690

Address: 167-B Wilson Ave., Timmins, Ontario P4N 2T2

Survey Company: Dighem Limited

Date of Survey (from & to): 02 08 84 03 08 84 (Day Mo. Yr. Day Mo. Yr.)

Total Miles of line Cut: 171 miles flown

Name and Address of Author (of Geo-Technical report): Paul Smith, Dighem Limited, P.O. Box 178, Suite 7010,1 Canadian Place, Toront

Credits Requested per Each Claim in Columns at right

Special Provisions	Geophysical	Days per Claim
For first survey: Enter 40 days. (This includes line cutting)	- Electromagnetic	
	- Magnetometer	
For each additional survey: using the same grid:	- Radiometric	
Enter 20 days (for each)	- Other	
	Geological	
	Geochemical	

Man Days	Geophysical	Days per Claim
Complete reverse side and enter total(s) here	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Airborne Credits		Days per Claim
Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic	40
	Magnetometer	40
	Radiometric	

Mining Claims Traversed (List in numerical sequence)

Prefix	Number	Expend. Days Cr.
P	757818	
	757819	
	757820	
	757821	
	757822	
	757823	
	757824	
	757825	
	757826	
	757827	
	757828	

RECORDED SEP 25 1984 Receipt No.

Expenditures (excludes power stripping)

Type of Work Performed

Performed on Claim(s)

PORCUPINE MINING DIVISION RECEIVED SEP 25 1984 A.M. 7,8,9,10,11,12,1,2,3,4,5,6 P.M.

Calculation of Expenditure Days Credits

Total Expenditures $ ÷ 15 = Days Credits

Instructions
Total Days Credits may be apportioned at the claim holder's choice. Enter number of days credits per claim selected in columns at right.

Total number of mining claims covered by this report of work: 11

For Office Use Only

Total Days Cr. Recorded	Date Recorded	Mining Recorder
880	Sept 25/84	
	Date Approved as Recorded	Branch Director
	84/11/23	

Date	Recorded Holder or Agent (Signature)
Sept. 25/84	L A Tihor

Certification Verifying Report of Work

I hereby certify that I have a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work or witnessed same during and/or after its completion and the annexed report is true.

Name and Postal Address of Person Certifying

Leslie A. Tihor, 81 Graham Lane
Timmins, Ontario. P4N 7Z5

Date Certified: Sept. 25, 1984

Certified by (Signature): L A Tihor

1362 (81/...)

Ministry of Natural Resources
Ontario

Report of Work

(Geophysical, Geological, Geochemical and Expenditures)

#398/84

WP406-398

Mining Act 27423

Nov. 24th

Instructions: – Please type or print.
– If number of mining claims traversed exceeds space on this form, attach a list.
Note: – Only days credits calculated in the "Expenditures" section may be entered in the "Expend. Days Cr." columns.
– Do not use shaded areas below.

Type of Survey(s): Airborne Magnetic and Electromagnetic

Township or Area: Bristol Township

Claim Holder(s): Chevron Minerals Ltd.

Prospector's Licence No.: T-1690

Address: 167-B Wilson Ave., Timmins, Ontario P4N 2T2

Survey Company: Dighem Limited

Date of Survey (from & to): 02 08 84 03 08 84 (Day Mo. Yr. Day Mo. Yr.)

Total Miles of line Cut: 171 miles flown

Name and Address of Author (of Geo-Technical report): Paul Smith, Dighem Limited, P.O. Box 178, Suite 7010, 1 Canadian Place, Toronto

Credits Requested per Each Claim in Columns at right

Special Provisions		Days per Claim
For first survey: Enter 40 days. (This includes line cutting)	Geophysical	
	- Electromagnetic	
	- Magnetometer	
For each additional survey: using the same grid: Enter 20 days (for each)	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Man Days		Days per Claim
Complete reverse side and enter total(s) here	Geophysical	
	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Airborne Credits		Days per Claim
Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic	40
	Magnetometer	40
	Radiometric	

RECEIVED SEP 28 1984 MINING LANDS SECTION

Expenditures (excludes power stripping)

Type of Work Performed:

Performed on Claim(s):

PORCUPINE MINING DIVISION RECEIVED SEP 25 1984 A.M. 7 8 9 10 11 12 1 2 3 4 5 6 P.M.

Calculation of Expenditure Days Credits

Total Expenditures $ ÷ 15 = Total Days Credits

Instructions
Total Days Credits may be apportioned at the claim holder's choice. Enter number of days credits per claim selected in columns at right.

Mining Claims Traversed (List in numerical sequence)

Prefix	Number	Expend. Days Cr.
P	687681	
	687682	
	687683	
	687684	
	687685	
	688886	
	688887	
	688888	
	688889	
	688890	
	688891	
	688892	

RECORDED SEP 25 1984 Receipt No. 21

Total number of mining claims covered by this report of work: 12

For Office Use Only		
Total Days Cr. Recorded: 960	Date Recorded: Sept 25/84	Mining Recorder: [signature]
	Date Approved as Recorded: 84.11.23	Branch Director: [signature]

Date: Sept. 25/84

Recorded Holder or Agent (Signature): [signature]

Certification Verifying Report of Work

I hereby certify that I have a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work or witnessed same during and/or after its completion and the annexed report is true.

Name and Postal Address of Person Certifying:
Leslie A. Tihor, 81 Graham Lane
Timmins, Ontario P4N 7Z5

Date Certified: Sept. 25, 1984

Certified by (Signature): [signature]

1362 (81/9)

Nov. 24th

Ministry of Natural Resources

Ontario

Report of Work

(Geophysical, Geological, Geochemical and Expenditures) #399/84

27423

WF406 - 799

Mining Act

Instructions: – Please type or print.
– If number of mining claims traversed exceeds space on this form, attach a list.

Note: – Only days credits calculated in the "Expenditures" section may be entered in the "Expend. Days Cr." columns.
– Do not use shaded areas below.

Type of Survey(s): Airborne Magnetic and Electromagnetic

Township or Area: Carscallen Township

Claim Holder(s): Chevron Minerals Ltd.

Prospector's Licence No.: T-1690

Address: 167-B Wilson Ave., Timmins, Ontario P4N 2T2

Survey Company: Dighem Limited

Date of Survey (from & to): 02 08 84 03 08 84 (Day Mo. Yr. Day Mo. Yr.)

Total Miles of line Cut: 171 miles flown

Name and Address of Author (of Geo-Technical report): Paul Smith, Dighem Limited, P.O. Box 178, Suite 7010,1 Canadian Place, Toront

Credits Requested per Each Claim in Columns at right

Special Provisions	Geophysical	Days per Claim
For first survey: Enter 40 days. (This includes line cutting)	- Electromagnetic	
	- Magnetometer	
For each additional survey: using the same grid: Enter 20 days (for each)	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Man Days	Geophysical	Days per Claim
Complete reverse side and enter total(s) here	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Airborne Credits		Days per Claim
Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic	40
	Magnetometer	40
	Radiometric	

RECEIVED SEP 28 1984 MINING LANDS SECTION

RECORDED SEP 25 1984 Receipt No. C1

PORCUPINE MINING DIVISION RECEIVED SEP 25 1984 A.M. P.M. 7,8,9,10,11,12,1,2,3,4,5,6

Expenditures (excludes power stripping)

Type of Work Performed:

Performed on Claim(s):

Calculation of Expenditure Days Credits

Total Expenditures				Total Days Credits
$	÷	15	=	

Instructions

Total Days Credits may be apportioned at the claim holder's choice. Enter number of days credits per claim selected in columns at right.

Date	Recorded Holder or Agent (Signature)
Sept. 25/84	[signature]

Mining Claims Traversed (List in numerical sequence)

Prefix	Number	Expend. Days Cr.	Prefix	Number	Expend. Days Cr.
P	661851		P	700845	
	661852			700846	
	660863			700847	
	660864			700848	
	660865			757367	
	689131			757368	
	689132			688893	
	689133			688894	
	689134			688895	
	689135			688896	
	689136			688897	
	689137			688898	
	689138			688899	
	689139			688900	
	689140			757869	
	700837			757870	
	700838			757871	
	700839			757872	
	700840			757873	
	700841			758041	
	700842			758042	
	700843			688901	
	700844			688902	

Total number of mining claims covered by this report of work: 46

For Office Use Only		
Total Days Cr. Recorded	Date Recorded	Mining Recorder
3680	Sept 25/84	[signature]
	Date Approved as Recorded	Branch Director
	84.11.23	[signature]

Certification Verifying Report of Work

I hereby certify that I have a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work or witnessed same during and/or after its completion and the annexed report is true.

Name and Postal Address of Person Certifying

Leslie A. Tihor, 81 Graham Lane

Timmins, Ontario. P4N 7Z5

Date Certified	Certified by (Signature)
Sept. 25, 1984	[signature]

1362 (81/9)

Ontario

Ministry of Natural Resources

Report of Work

(Geophysical, Geological, Geochemical and Expenditures)

Mining Act

#400/84

2.7423

W8406-400

Nov. 24th

Instructions:
- Please type or print.
- If number of mining claims traversed exceeds space on this form, attach a list.

Note:
- Only days credits calculated in the "Expenditures" section may be entered in the "Expend. Days Cr." columns.
- Do not use shaded areas below.

Type of Survey(s): Airborne Magnetic and Electromagnetic

Township or Area: Carscallen Township

Claim Holder(s): Chevron Minerals Ltd.

Prospector's Licence No.: T-1690

Address: 167-B Wilson Ave., Timmins, Ontario P4N 2T2

Survey Company: Dighem Limited

Date of Survey (from & to): 02 08 84 03 08 84 (Day Mo. Yr. / Day Mo. Yr.)

Total Miles of line Cut: 171 miles flown

Name and Address of Author (of Geo-Technical report): Paul Smith, Dighem Limited, P.O. Box 178, Suite 7010, 1 Canadian Place, Toron

Credits Requested per Each Claim in Columns at right

Special Provisions	Geophysical	Days per Claim
For first survey: Enter 40 days. (This includes line cutting)	- Electromagnetic	
	- Magnetometer	
For each additional survey: using the same grid: Enter 20 days (for each)	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Man Days	Geophysical	Days per Claim
Complete reverse side and enter total(s) here	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Airborne Credits		Days per Claim
Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic	40
	Magnetometer	40
	Radiometric	

Expenditures (excludes power stripping)

Type of Work Performed:

Performed on Claim(s):

Calculation of Expenditure Days Credits

Total Expenditures: $ ÷ 15 = Total Days Credits:

Instructions: Total Days Credits may be apportioned at the claim holder's choice. Enter number of days credits per claim selected in columns at right.

Mining Claims Traversed (List in numerical sequence)

Prefix	Number	Expend. Days Cr.
P	688903	

Total number of mining claims covered by this report of work: 1

PORCUPINE MINING DIVISION RECEIVED SEP 25 1984 A.M. P.M. 7 8 9 10 11 12 1 2 3 4 5 6

RECORDED SEP 25 1984 Receipt No. 41

RECEIVED SEP 28 1984 MINING LANDS SECTION

For Office Use Only

Total Days Cr. Recorded	Date Recorded	Mining Recorder
80	Sept 25/84	B Hanley
	Date Approved as Recorded: 84.11.23	Branch Director: [signature]

Date	Recorded Holder or Agent (Signature)
Sept. 25/84.	[signature]

Certification Verifying Report of Work

I hereby certify that I have a personal and intimate knowledge of the facts set forth in the Report of Work annexed hereto, having performed the work or witnessed same during and/or after its completion and the annexed report is true.

Name and Postal Address of Person Certifying: Leslie A. Tihor, 81 Graham Lane, Timmins, Ontario P4N 7Z5

Date Certified: Sept. 25, 1984

Certified by (Signature): [signature]

1362 (81/9)

Chevron

Chevron Canada Resources Limited
Minerals Staff
167B Wilson Ave., Timmins, Ontario P4N 2T2 Phone (705) 264-2291

RECEIVED
NOV 20 1984
MINING LANDS SECTION

November 19, 1984.

Mining Lands Section,
Ontario Ministry of Natural Resources,
Room 6610 Whitney Block,
Queen's Park,
Toronto, Ontario.
M7A 1W3

Attention: Mr. Fred Matthews

Dear Mr. Matthews:

I am submitting two copies of DIGHEM III airborne surveys and claim maps covering our Four Corners, Ontario, project area.

The property surrounds the four contiguous corners of Turnbull, Carscallen, Godfrey and Bristol Townships. The claims covered are P 641560 et al as listed in the attached copies of our Reports of Work.

Yours truly,

Leslie A. Tihor

LAT/cs
Enclosures

Mining Lands Section

Control Sheet

File No 27423

TYPE OF SURVEY

✓ GEOPHYSICAL

____ GEOLOGICAL

____ GEOCHEMICAL

____ EXPENDITURE

MINING LANDS COMMENTS:

LGD

LD

Signature of Assessor

21/10/84

Date


758295
728293
757831
757957
757958
758294
758292
757830
757959
757960
757961
P. 4151
758289
757874
757829
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757952
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757641
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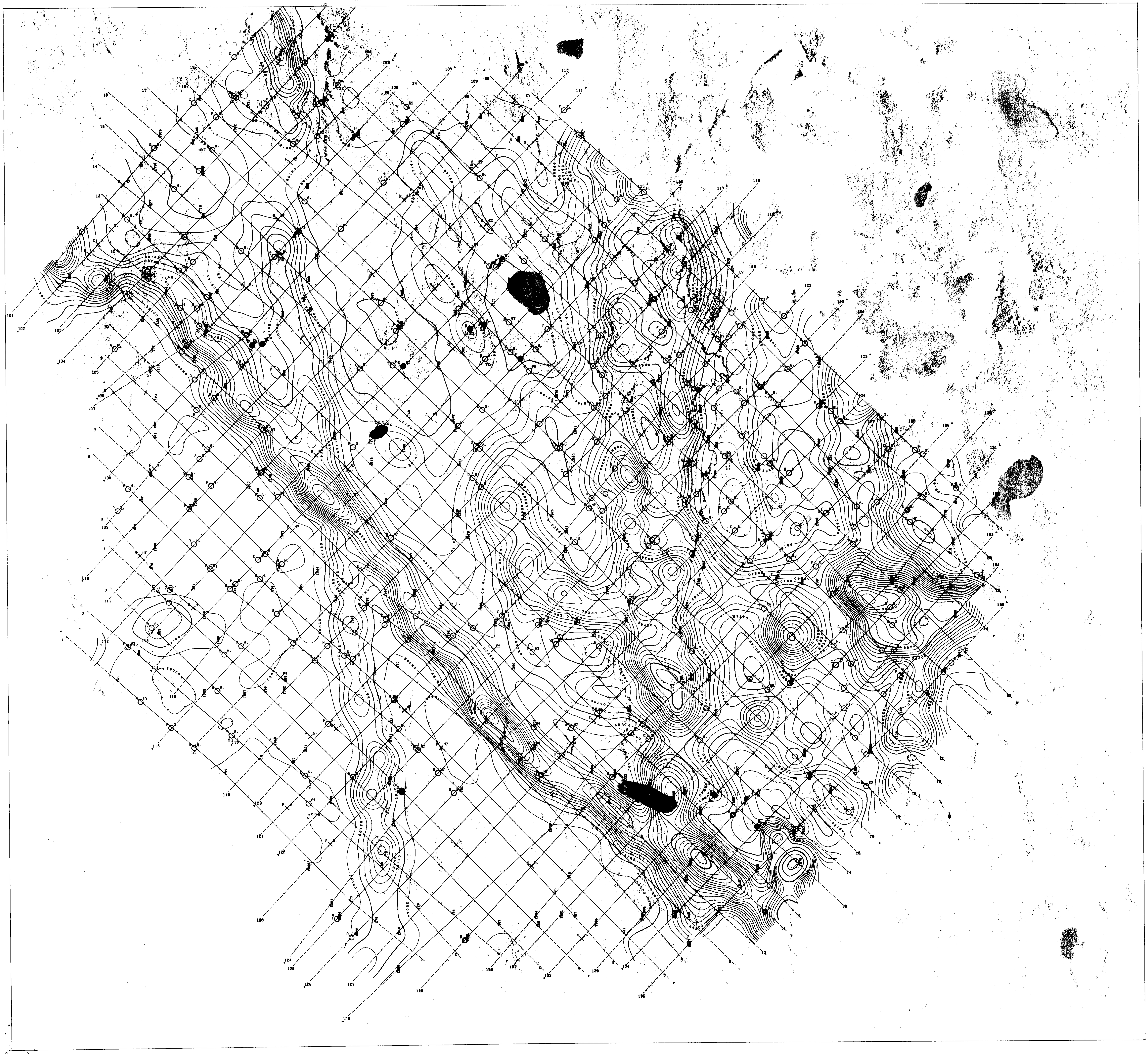
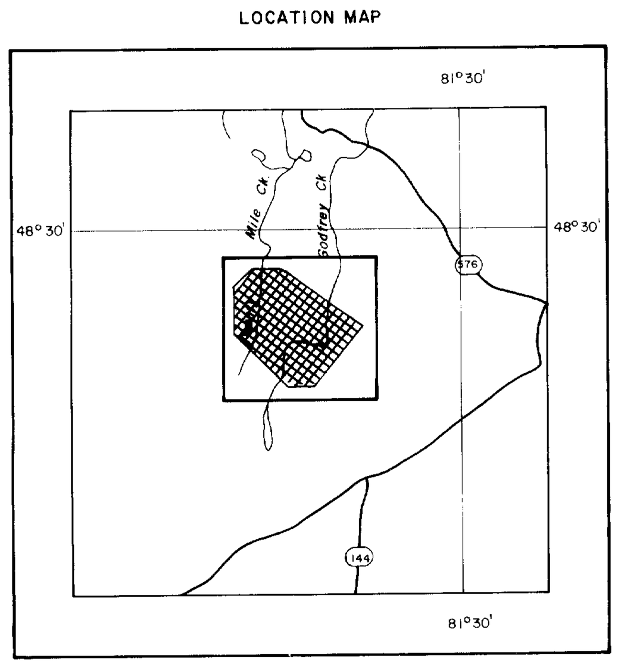
757363
757364
757365
688877
688876
688875
757820
757823
757866
757360
641563
641564
641565
757366
688874
688873
688872
757819
757824
757825
757828
757865
757359
641562
641561
641560
688904
688905
689363
689364
757818
25476
757826
757827
Post Destroyed
Post Replaced
Post Destroyed
Post Destroyed
757872
757869
689131
689132
688903
661852
688899
688898
688893
S1148
S1147
687682
687681
757873
757870
689134
689133
688902
688901
688900
661851
688894
688889
688888
687683
687684
757871
689135
689136
689137
689138
689139
689140
688895
688890
688887
688886
687685
700837
700840
700841
700844
700845
700848
688896
688891
700838
700839
700842
700843
700846
700847
688897
688892
758041
757367
757368
758042
660863
660864
660865
Godfrey Cr.
Godfrey Creek
Thunder Cr.
LEGEND
LOCATED CLAIM POST
CLAIM POST - ASSUMED POSITION
LAND WITHIN PROPERTY BOUNDARY NOT HELD BY CHEVRON
KEY MAP
Chevron Canada Resources Limited
Minerals Staff
FOUR CORNERS PROJECT
CLAIM MAP
27423
FIGURE No
PROJECT No. M 538
November 9/84
November 19, 1984
S.W.

200



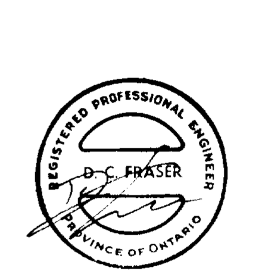
LOCATION MAP



Scale 1:250,000

DIGHEM[III] SURVEY

FOUR CORNERS AREA
TIMMINS ONTARIO
TOTAL FIELD MAGNETICS
FOR
CHEVRON CANADA RESOURCES LTD.

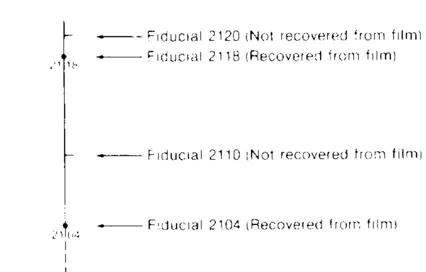


Scale 1:10,000

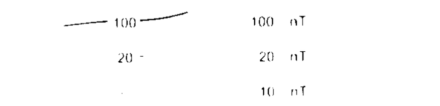
1 2 0 1 2 1 Kilometres

1 4 0 1 4 1 2 Miles

Flight Line



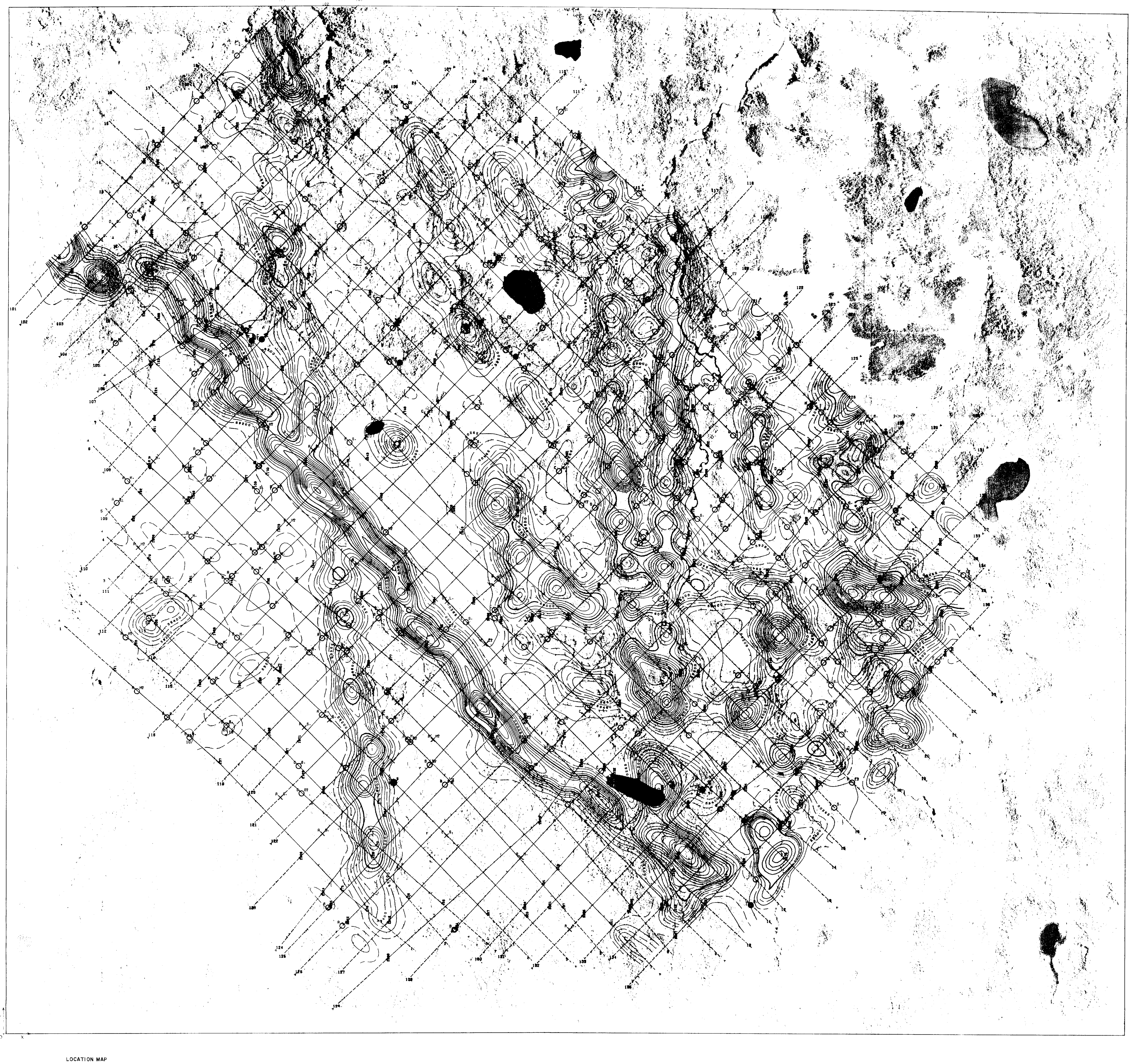
ISOMAGNETIC LINES
(total field)



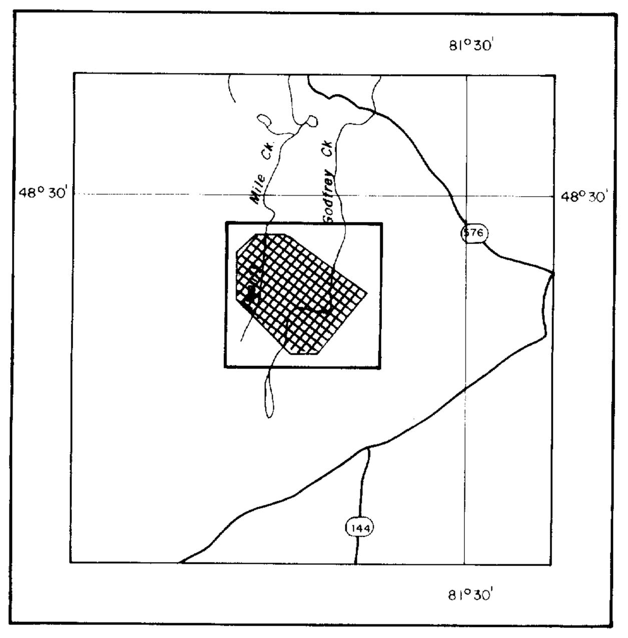
Magnetic inclination within the survey area 76°

JOB	DATE	DRAWN BY	CHECKED BY
207	OCT / 84	B.P.	

210



LOCATION MAP



Scale 1:250,000

DIGHEM[III] SURVEY

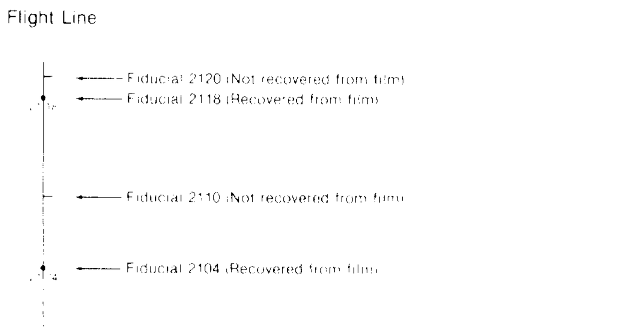
FOUR CORNERS AREA
TIMMINS ONTARIO
ENHANCED MAGNETICS
FOR
CHEVRON CANADA RESOURCES LTD.

Scale 1:10,000

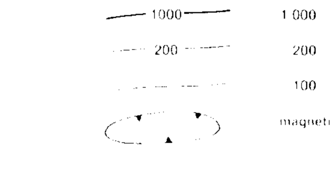
1 2 — 0 — 1 2 — 1 Kilometres

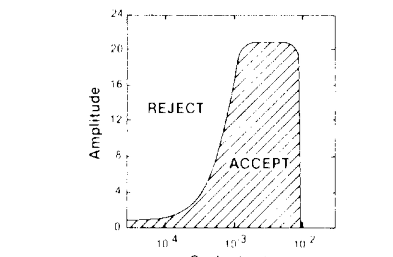
1 4 — 0 — 1 4 — 1 2 Miles

Flight Line



ISOMAGNETIC LINES
(enhanced field)

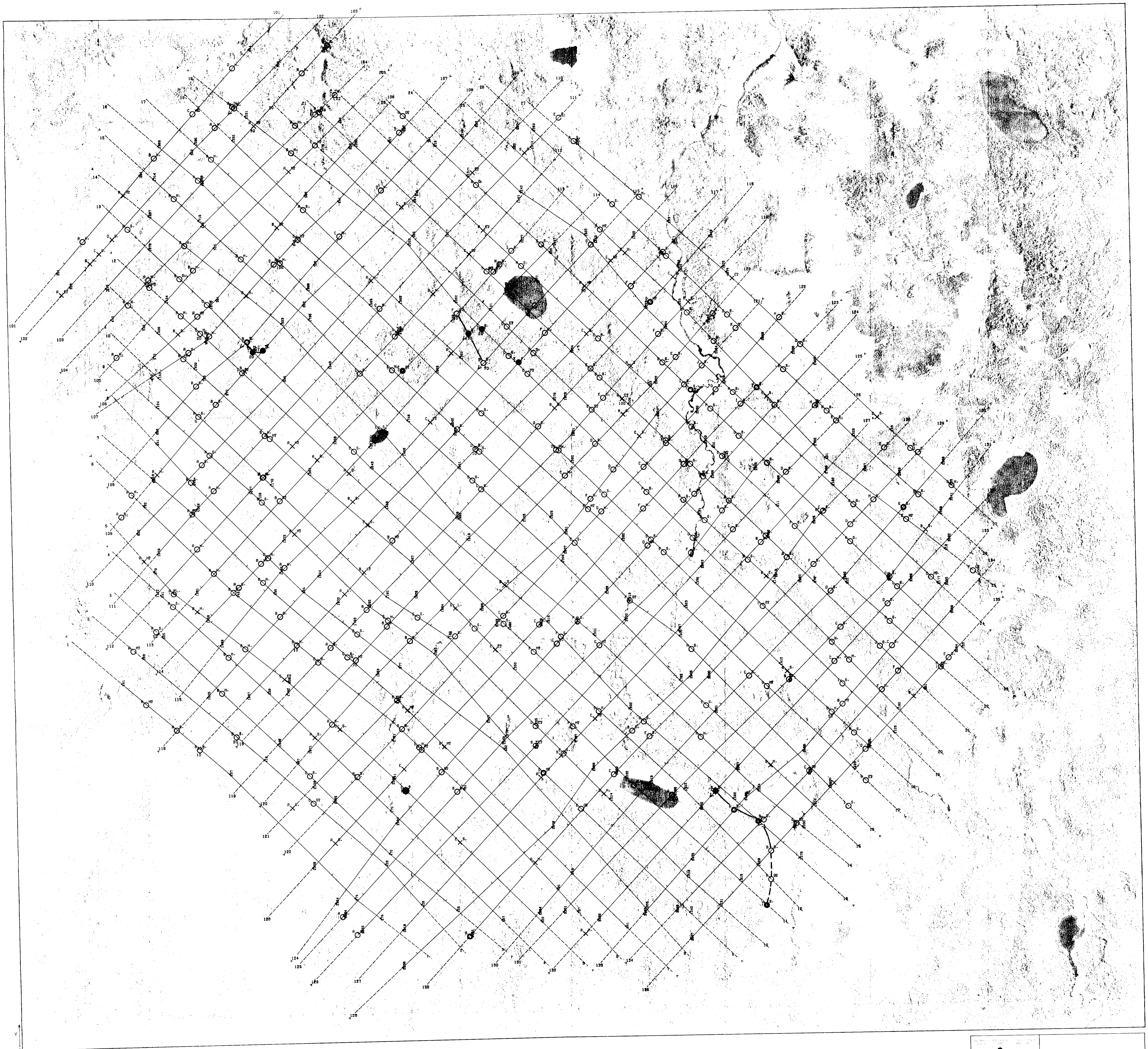




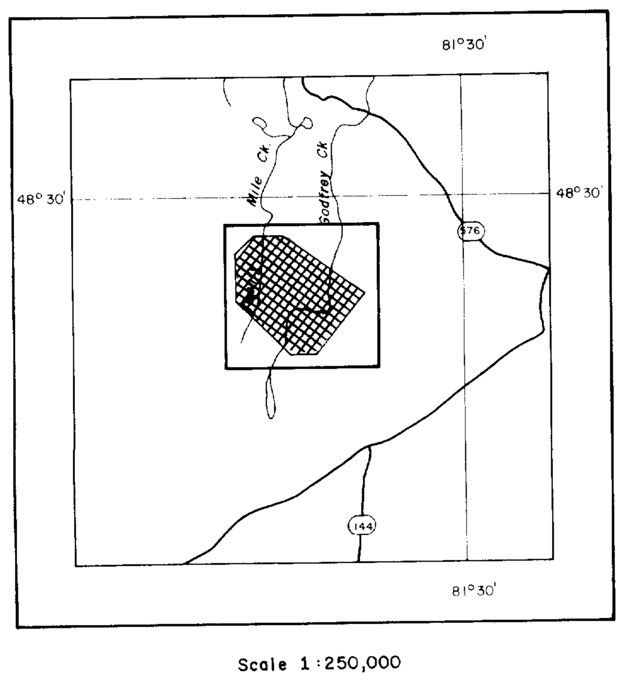
Frequency response of magnetic operator

JOB	DATE	DRAWN BY	CHECKED BY
207	OCT / 84	B.P.	Z.D.

220



LOCATION MAP



Scale 1:250,000

DIGHEM III SURVEY

FOUR CORNERS AREA
TIMMINS ONTARIO
ELECTROMAGNETIC ANOMALIES
FOR
CHEVRON CANADA RESOURCES LTD.

Scale 1:10,000

1/2 0 1/2 1 Kilometres

1/4 0 1/4 1/2 Miles

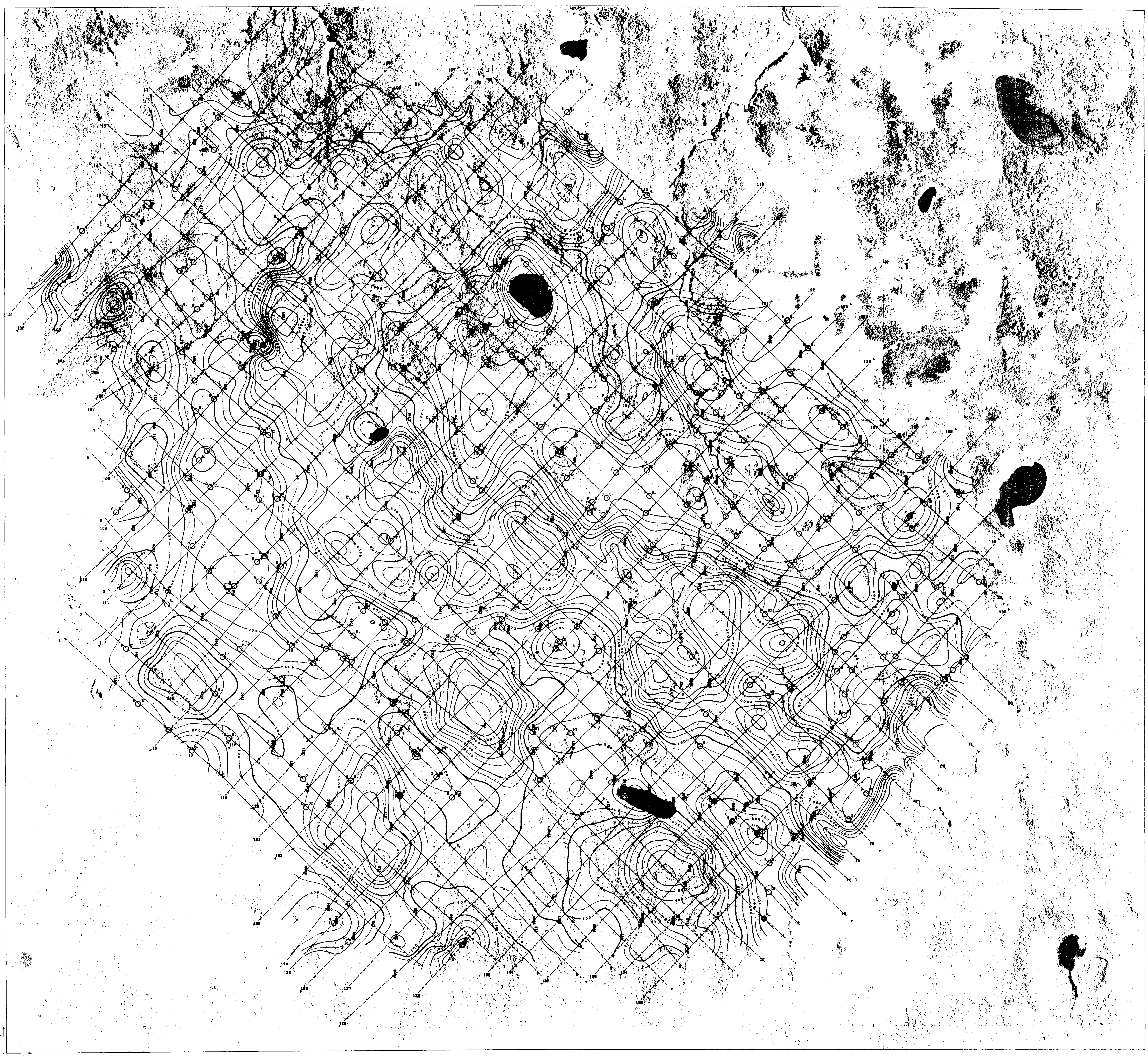
Flight Line

Fiducial 2120 (Not recovered from film)
Fiducial 2118 (Recovered from film)
Fiducial 2112 (Not recovered from film)
Fiducial 2104 (Recovered from film)
Line number and Flight direction

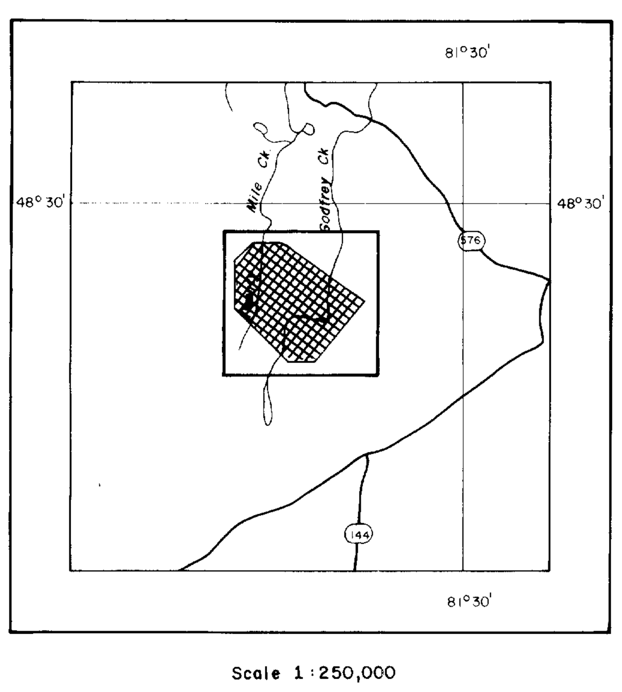
arcs indicate the conductor has a thickness > 10 m

dip direction
magnetic correlation in gammas
conductor axis
flight line

JOB	DATE	DRAWN BY	CHECKED BY
207	OCT / 84	B.P.	E.D.



LOCATION MAP



Scale 1:250,000

DIGHEM[III] SURVEY

FOUR CORNERS AREA
TIMMINS ONTARIO
RESISTIVITY
FOR
CHEVRON CANADA RESOURCES LTD.

REGISTERED PROFESSIONAL ENGINEER
D. C. FRASER
PROVINCE OF ONTARIO

Scale 1:10,000

1 2 — 0 — 1 2 — 1 Kilometres

1 4 — 0 — 1 4 — 1 2 Miles

Flight Line

- Fiducial 2120 (Not recovered from film)
- Fiducial 2118 (Recovered from film)
- Fiducial 2110 (Not recovered from film)
- Fiducial 2104 (Recovered from film)

301 — Line number and Flight direction

LEGEND

Contours in ohm — m
at ten intervals per decade

1000
800
600
500
400
300
250
200
150
125
100

Note

The numbers face in the direction of increasing value.

JOB	DATE	DRAWN BY	CHECKED BY
207	OCT / 84		

240