



#### **REPORT ON AN**

# AIRBORNE MAGNETIC AND VLF-EM SURVEY

DOGPAW LAKE AREA
KENORA MINING DIVISION, ONTARIO

for

HINZER/TERNOWESKY

by: TERRAQUEST LTD.

Toronto, Canada June 5, 1988

RECEIVED

AUG 2 1988

MINING LANDS SECTION



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# Introduction

This report describes the specifications and results of a geophysical survey carried out for Hinzer/Ternowesky of 6455 Stamford Green, Niagara Falls, Ontario, L2J 1T2 by Terraquest Ltd., 240 Adelaide Street West, Toronto, Canada. The field work was completed on May 13, 1988 and the data processing, interpretation and reporting from May 14 to July 5, 1988.

The purpose of a survey of this type is two-fold. First to prospect directly for anomalously conductive and magnetic areas in the earth's crust which may be caused by, or at least related to, mineral deposits. A second is to use the magnetic and conductivity patterns derived from the survey results to assist in mapping geology, and to indicate the presence of faults, shear zones, folding, alteration zones and other structures potentially favourable to the presence of gold and base-metal concentration. To achieve this purpose the survey area was systematically traversed by an aircraft carrying geophysical instruments along parallel flight lines spaced at even intervals, 100 metres above the terrain surface, and aligned so as to intersect the regional geology in a way to provide the optimum contour patterns of geophysical data.

# 2. The Property

The property is located in the southeast quadrant of the Dogpaw Lake claims map in the Kenora Mining Division of Ontario about 70 kilometres southeast of the town of Kenora and 15 kilometres northeast of the settlement of Crow Lake. The claims lie between Little Stephen Lake and Weisener Lake. Highway 71 lies approximately 10 kilometres to the west.

The latitude and longitude are 49 degrees 16 minutes, and 93 degrees 48 minutes respectively, and the N.T.S. reference is 52F/5.

The claim numbers are shown in figure 2 and listed below:

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	615319-615323	(5)
	615448	(1)
	615457	(1)
	632320-632322	(3)
	668481-668484	(4)

668585	(1)
668591-668594	(4)
845309-845312	(4)
845314-845317	(4)
845328	(1)
845408-845417	(10)
862209	(1)
874495-874496	(2)
886849-886865	(17)
Total of 60 cla	ims

### 3. Geology

#### **Map References**

1.	Map 2319:	Cedartree Lake		
	-	Scale 1:31,680.		
		ODM 1975		

The claim group is centred about a north to northwest trending belt of felsic to intermediate metavolcanics that are bounded to the west by mafic and ultramafic intrusives and to the east by late felsic intrusives, primarily granodiorite. The metavolcanics are primarily tuff-breccia, lapillituff, tuff and ignimbrite. These rocks host base metal and gold mineralization. The intrusive rocks to the west are semi-conformable with the metavolcanics and are predominantly comprised of gabbro with layered horizons of pyroxenite and peridotite.

The metavolcanics and the gabbroic intrusives are folded about a northeast trending fold axis, referred to as the Emm Bay-Peninsula Bay syncline. Numerous north trending lineaments and faults are indicated on the geology map. Several east-northeast lineaments are parallel to the synclinal axis.

### 4. Survey Specifications

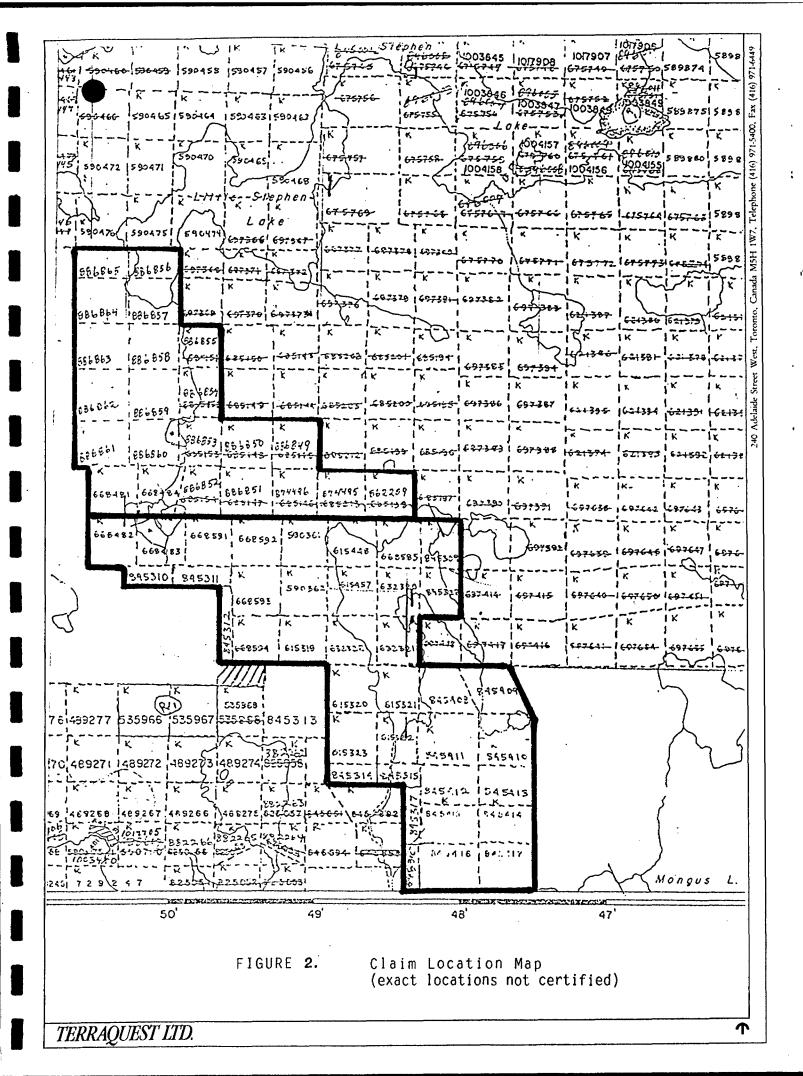
#### 4.1 Instruments

The survey was carried out using a Cessna 182 aircraft, registration C-FAKK, which carries a magnetometer and a VLF electromagnetic detector.

The magnetometer is a proton precession type based on the Overhauser effect. The Overhauser effect allows for polarization of a proton rich liquid of the sensor by adding a "free radical" to it and irradiating it by RF magnetic field. Strong precession signals are generated with modest RF power. The sensor element is mounted in an extension of the right wing tip. It's specifications are as follows:

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FIGURE 1. General Location



Model: GSM-9BA

Manufacturer: GEM Systems Inc.

105 Scarsdale Road,

Don Mills, Ontario

Resolution: 0.5 gamma

Accuracy: 0.5 gamma Cycle time: 0.5 second

Range: 20,000-100,000 gammas in 23

overlapping steps

Gradient tolerance: Up to 5,000 gammas/m

The VLF-EM unit uses three orthogonal detector coils to measure (a) the total field strength of the time-varying EM field and (b) the phase between the vertical coil and both the "along line" coil (LINE) and the "cross-line" coil (ORTHO). The LINE coil is tuned to a transmitter station (Channel 1) that is ideally positioned at right angles to the flight lines, while the ORTHO coil transmitter (Channel 2) should be in line with the flight lines. It's specifications are:

Model: TOTEM 2A

Manufacturer: Herz Industries,

Toronto, Canada

Accuracy: 1%

Reading interval: 0.5 second

The VLF sensor is mounted in the left wing tip extension.

#### Other instruments are:

- King KRA-10A radar altimeter
- PDAS-1100 data acquisition system with two 3.5" floppy disk drives manufactured by Picodas Group Inc., Richmond Hill, Ontario
- Geocam video camera and recorder for flight path recovery, manufactured by Geotech Ltd., Markham, Ontario.
- PBAS-9000 portable field base station with a 3.5" floppy disk drive and an analog print out manufactured by Picodas Group Inc., Richmond Hill, Ontario, coupled with a GSM-8 proton magnetometer manufactured by Gem Systems Inc., Toronto, Ontario.

#### 4.2 Lines and Data

Line spacing:

Lines 1-17: 200 metres Lines 17-40: 100 metres

Line direction: 090 degrees

Terrain clearance: 100 m

Average ground 156 km/hr

speed:

Data point interval:

Magnetic: 27 metres

VLF-EM: 27 metres

Tie Line interval: 1.5 km

Channel 1 (LINE): NAA Cutler, 24.0 kHz

Channel 2 (ORTHO): NSS Annapolis, 21.4 kHz

Line km over total 98 line km

survey area

including overrun:

Line km over claim groups as per

Figure 2:

North half of claim block, 40 km

magnetic survey totals:

VLF-EM survey totals: 40 km

South half of claim block, 34 km

magnetic survey totals:

VLF-EM survey totals: 34 km

#### 4.3 Tolerances

Line spacing: Any gaps wider than twice the line spacing and longer than 10 times the line spacing were filled in by a new line.

Terrain clearance: Portions of line which were flown above 125 metres for more than one km were reflown if safety considerations were acceptable.

Diurnal magnetic variation: Less than twenty gammas deviation from a smooth background over a period of two minutes or less as seen on the base station analogue record.

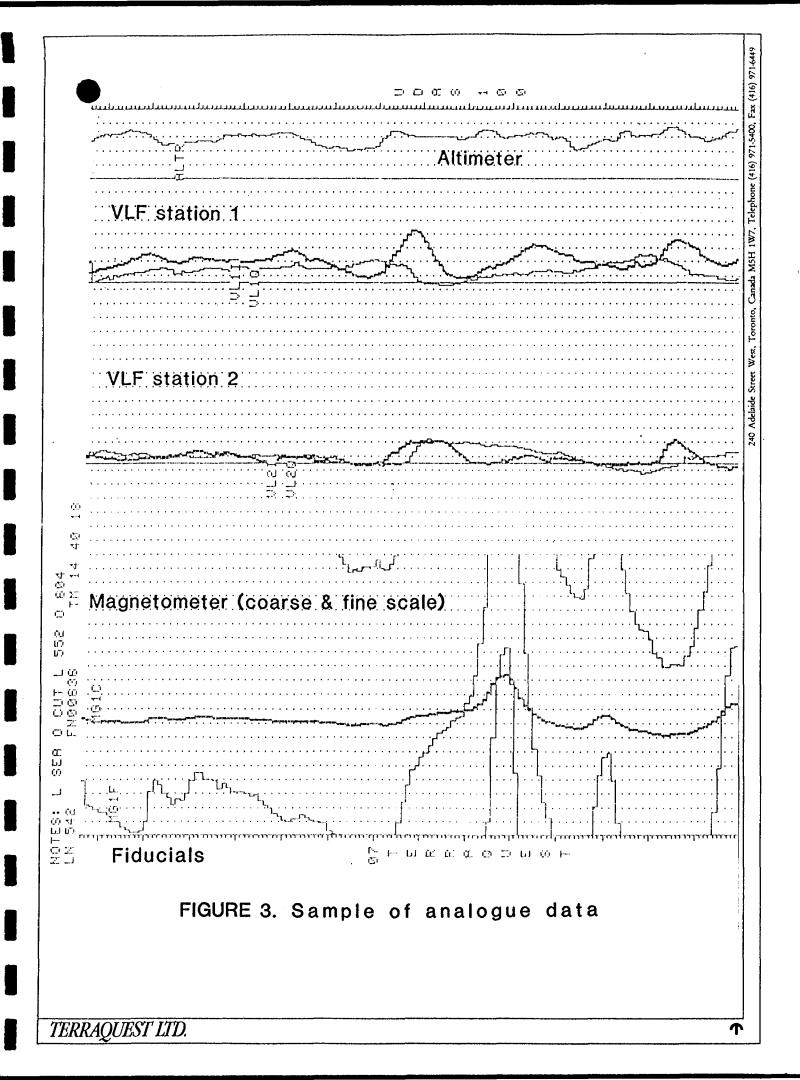
Manoeuvre noise: Approximately +/- 5 gammas.

#### 4.4 Photomosaics

For navigating the aircraft and recovering the flight path, semi-controlled mosaics of aerial photographs were made from existing air photos. Each photograph forming the mosaic was adjusted to conform to the NTS map system before the mosaic was assembled.

# 5. Data Processing

Flight path recovery was carried out in the field using a video tape viewer to observe the flight path



recorded by the Geocam video camera system. The flight path recovery was completed daily to enable reflights to be selected where needed for the following day.

The magnetic data was levelled in the standard manner by tying survey lines to the tie lines. The IGRF has not been removed. The total field was contoured by computer using a program provided by Dataplotting Services Inc. To do this the final levelled data set is gridded at a grid cell spacing of 1/10th of an inch at map scale.

The vertical magnetic gradient is computed from the total field data using a method of transforming the data set into the frequency domain, applying a transfer function to calculate the gradient, and then transforming back into the spatial domain. The method is described by a number of authors including Grant, 1972 and Spector, 1968. The computer program for this purpose is provided by Paterson, Grant and Watson Ltd. of Toronto.

The VLF data was treated automatically so as to normalize the non conductive background areas to 100 (total field strength) and zero (quadrature). The algorithms to do this were developed by Terraquest and will be provided to anyone interested by application to the company.

All of these dataprocessing calculations and map contouring were carried out by Dataplotting Services Inc. of Toronto.

Grant, F.S. and Spector A., 1970: Statistical Models for Interpreting Aeromagnetic Data; Geophysics, Vol 35

Grant, F.S., 1972: Review of Data Processing and Interpretation Methods in Gravity and Magnetics; Geophysics Vol 37-4

Spector, A., 1968: Spectral Analysis of Aeromagnetic maps; unpublished thesis; University of Toronto.

# 6. Interpretation

#### 6.1 General Approach

To satisfy the purpose of the survey as stated in the introduction, the interpretation procedure was carried out onboth the magnetic and VLF data. On a local scale the magnetic gradient contour patterns were used to outline geological units which have different magnetic intensity and patterns or "signa-

tures". Where possible these are related to existing geology to provide a geological identity to the units. On a regional scale the total field contour patterns were used in the same way.

Faults and shear zones are interpreted mainly from lateral displacements of otherwise linear magnetic anomalies but also from long narrow "lows". The direction of regional faulting in the general area is taken into account when selecting faults. Folding is usually seen as curved regional patterns. Alteration zones can show up as anomalously quiet areas, often adjacent to strong, circular anomalies that represent intrusives. Magnetic anomalies that are caused by iron deposits of ore quality are usually obvious owing to their high amplitude, often in tens of thousands of gammas.

VLF anomalies are categorized according to whether the phase response is normal, reverse, or no phase at all. The significance of the differing phase responses is not completely understood although in general reverse phase indicates either overburden as the source or a conductor with considerable depth extent, or both. Normal phase response is theoretically caused by surface conductors with limited depth extent. In some cases, a change in the orientation of the conductor appears to affect the sense of the phase response.

Areas showing a smooth VLF-EM response somewhat above background (ie. 110 or so) are likely caused by overburden which is thick enough and conductive enough to saturate at these frequencies. In this case no response from bedrock is seen.

The VLF-EM conductor axes have been identified and evaluated according to the Terraquest classification system (Figure 4). This system correlates the nature and orientation of the conductor axes with stratigraphic, structural and topographic features to obtain an association from which one or more origins may be selected. Alternate associations are indicated in parentheses.

#### 6.2 Interpretation

The magnetic and VLF-EM data are shown in contoured format on maps at a scale of 1:10,000 in the back pocket. An interpretation map is also provided. The following notes are intended to supplement these maps.

The total magnetic field has a relief of approximately 2,250 gammas and shows the general synclinal trend of the lithologies. The vertical magnetic

#### FIGURE 4

# TERRAQUEST CLASSIFICATION OF VLF-EM CONDUCTOR AXES

SYMBOL	CORRELATION	ASSOCIATION: Possible Origins
a, A	Coincident with magnetic stratigraphy	Bedrock magnetic horizons: stratabound mineralogic origin or shear zone
b, B	Parallel to magnetic stratigraphy	Bedrock non-magnetic horizons: stratabound mineralogic origin or shear zone
<b>c</b> , <b>C</b>	No correlation with magnetic stratigraphy	Association not known: possible small scale stratabound mineralogic origin, fault or shear zone, overburden
d D	Coincident with magnetic dyke	Dyke or possible fault: mineralogic or electrolytic
f, F	Coincident with topographic lineament or parallel to fault system	Fault zone: mineralogic or electrolytic
ob; OB	Contours of total field response conform to topographic depression	Most likely overburden: clayey sediments, swampy mud
cul , CUL	Coincident with cultural sources	Electrical, pipe or railway lines

#### NOTES

- 1 Upper case symbols denote a relatively strong total field strength
- 2 Underlined symbols denote a relatively strong quadrature response
- 3 Mineralogic origins include sulphides, graphite, and in fault zones, gouge
- 4 Electrolytic origins imply conductivity related to porosity or high moisture content

dient improves the resolution of the strong anomalies and enhances the weak anomalies within the centre of the claim block and has been used to delineate the stratigraphy and structure.

The strongest magnetic responses correlate with the intrusive rocks to the east and west of the claim block. Those to the northeast correlate with the outer edge of the granodiorite felsic intrusives, shown on the interpretation map as Unit 6m. The central part of the intrusive correlates with weaker magnetic responses. This variability in magnetic susceptibility may be related to either changes in initial composition within the source magma or to differential crystallization related to the physiochemical parameters of the intrusive environment.

Outcrops of the mafic and ultramafic intrusive rocks correlate with moderate to very strong magnetic responses. In particular the responses measured over the intrusive body between Weisener Lake and Wicks Lake suggest that the moderate magnetic responses are derived from the gabbroic intrusives (Unit 4), and the very strong responses (Unit 4m) are derived from peridotite and pyroxenite. It is assumed that a similar correlation exists for the magnetic responses over the mafic and ultramafic intrusives in this survey area.

Outcrops of the felsic to intermediate metavolcanics are associated with moderate to weak magnetic responses, typical for tuffaceous felsic to intermediate metavolcanic rocks. The vertical magnetic gradient format permits delineation of very subtle magnetic anomalies (Unit 2m) within this suite. These may originate from increased concentrations of magnetic minerals such as pyrrhotite and magnetite, or possibly to more mafic compositions. For example, the narrow ignimbrite horizon to the north correlates with a weak to moderate strength anomaly.

The most prominent displacements and truncations of magnetic units observed on the total magnetic field map correlate well with the major north trending faults and lineaments as shown on the geological map. The vertical magnetic gradient data permits detection of two other fault or shear trends, one at 030 degrees and one at 120 degrees. The 030 degree set is more obvious primarily because it cross-cuts the stratigraphy over most of the survey area whereas the 120 degrees set cross-cuts the stratigraphy only at the northern end of the proper-

ty. Note that many of the mapped mineralized zones lie along the 030 degree faults.

The VLF-EM survey shows weak to strong conductor axes with erratic quadrature values. Most of the lakes and swampy areas correlate with high conductivity suggesting that conductive overburden is confined to topographic depressions. However, those conductor axes that transgress shorelines may possess structural or bedrock sources. The orientation of the Cutler transmitter is favourable to the detection of southeast-northwest conductor axes. Most of these are interpreted to possess structural origins either as a) minerals such as sulphides, gouge or graphite, or b) ionic sources created by porosity or water along the structure or to conductive overburden in overlying topographic depressions. Structures identified either by magnetic of VLF-EM techniques possess potential for mobilized or epithermal type mineralization.

Several conductor axes coincide with magnetic anomalies and therefore may be related to bedrock origins. Several gabbroic horizons correlate with VLF-EM conductors which may be derived from either conductive minerals within the bedrock or to fault contacts. These should be followed up on the ground using EM or IP techniques.

# 7. Summary

An airborne combined magnetic and VLF-EM survey has been done at line intervals of 100 metres over the northern half of the property and 200 metres over the southern half of the property. The total field and vertical gradient magnetic data, VLF-EM data and interpretation maps are produced at a scale of 1:10,000.

The magnetic data has been used to modify and update the existing geology and has shown a number of new contacts and faults. A number of VLF-EM conductor axes were found most of which are associated with structural origins and possess potential for mobilized or epithermal mineralization. Several are believed to have potential sulphide origin and have been recommended for additional

origin and have been recommendation.

TEPHAQUEST LTD.

Charles Q. Barrie, M.Sc.

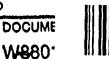
Geologist

Charles Q. Barrie, M.Sc.

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Report of Work

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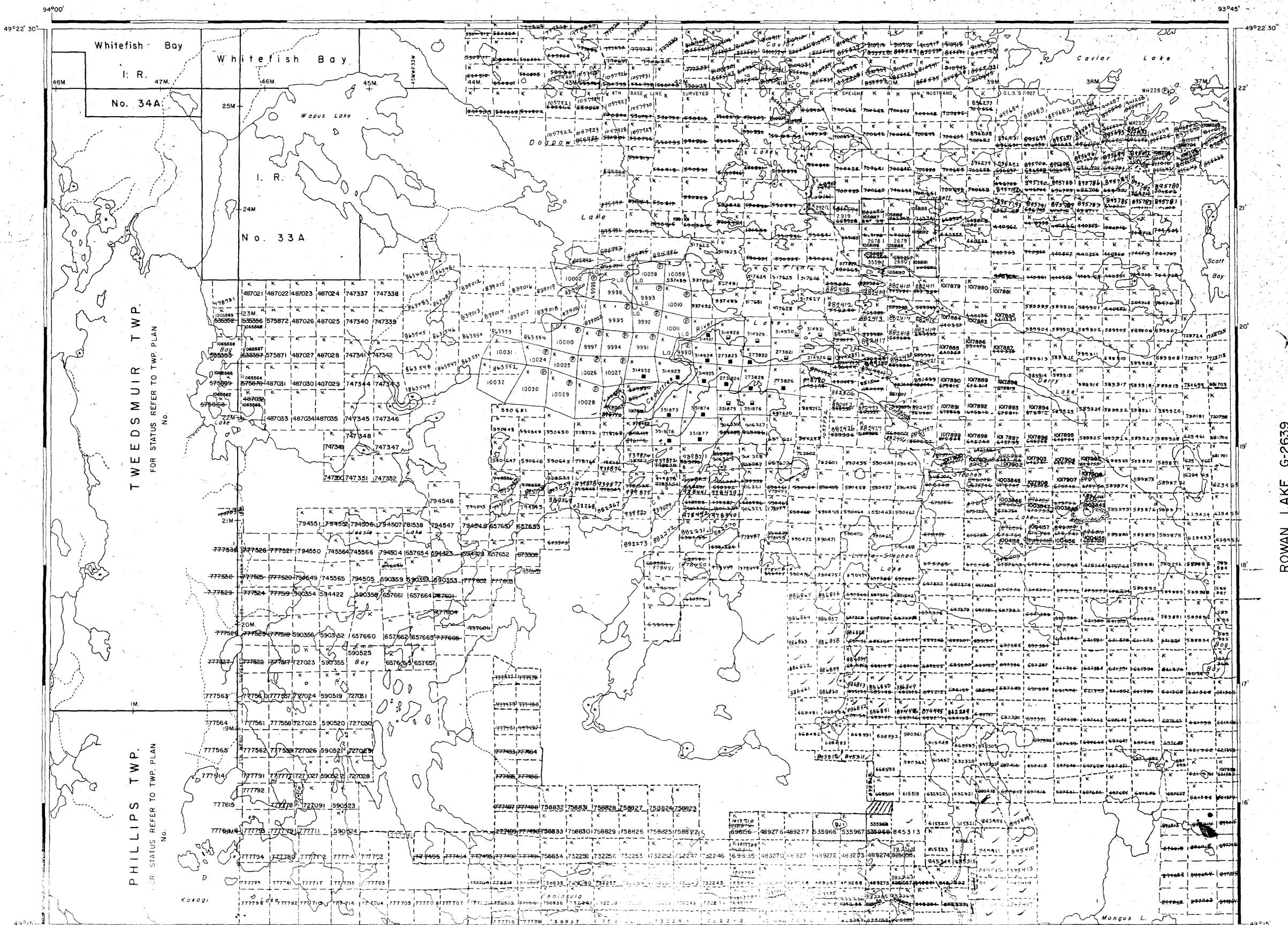




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# LEGEND

HIGHWAY AND ROUTE No. OTHER ROADS TRAILS SURVEYED LINES: TOWNSHIPS, BASE LINES, ETC. LOTS, MINING CLAIMS, PARCELS, ETC UNSURVEYED LINES: PARCEL BOUNDARY MINING CLAIMS ETC. RAILWAY AND RIGHT OF NON-PERENNIAL STREAM RESERVATIONS **ORIGINAL SHORELINE** MARSH OR MUSKEG TRAVERSE MONUMENT

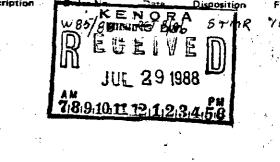
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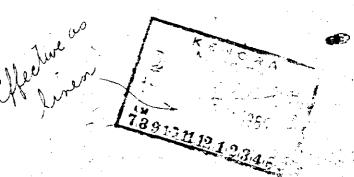
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# REFERENCES

M.R.O. - MINING FLIGHTS ONLY

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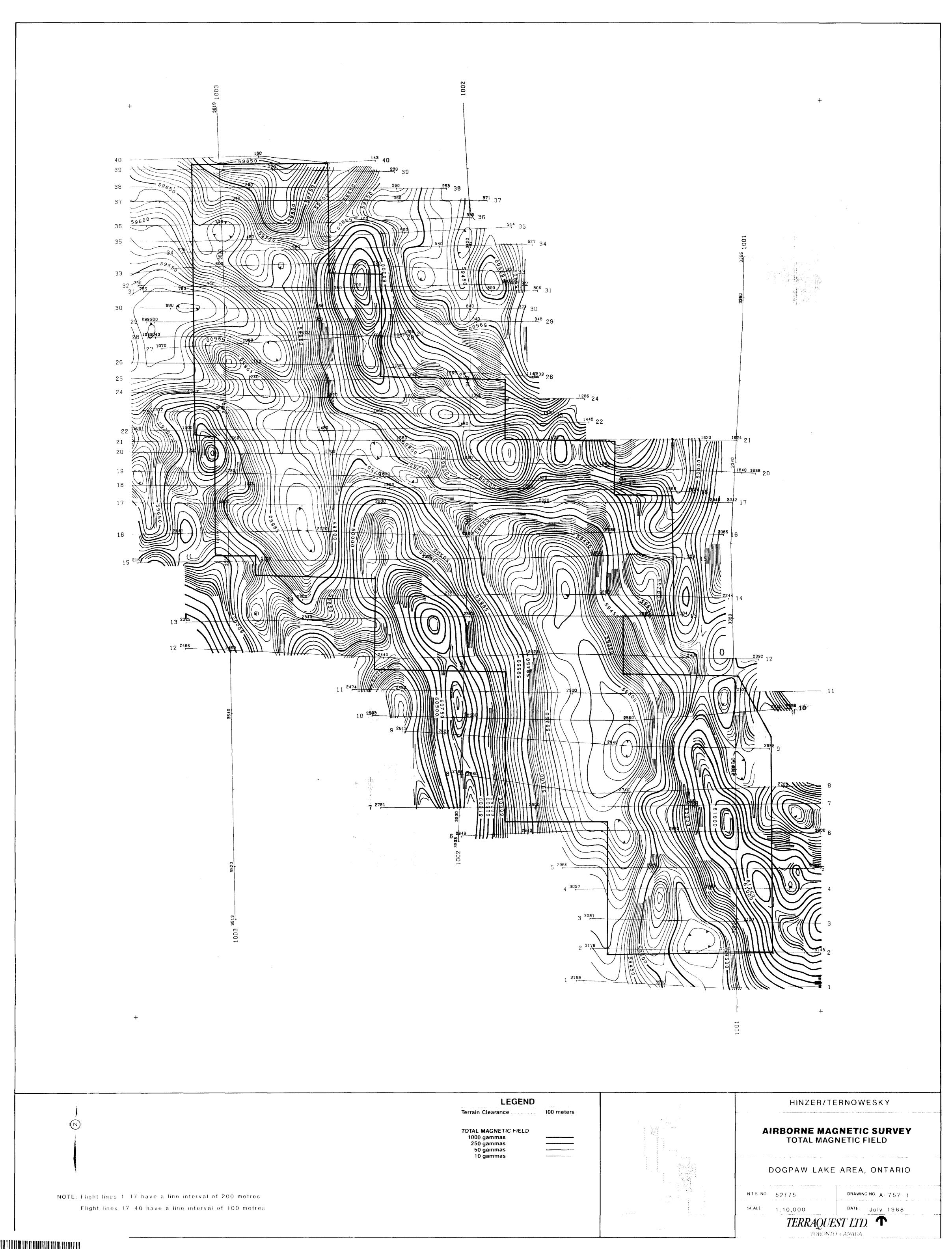


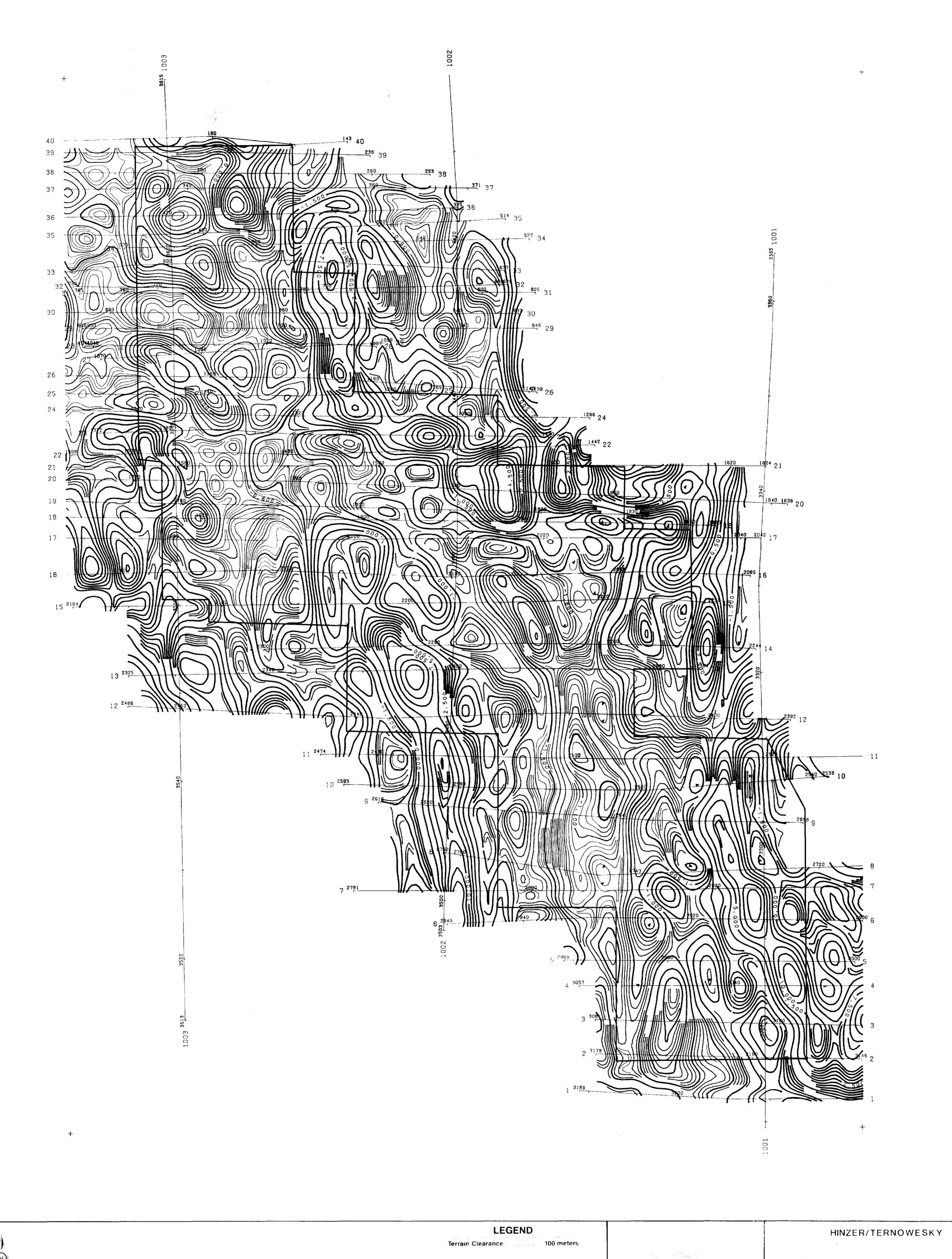


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M.N.R. ADMINISTRATIVE DISTRICT

G-2613





VERTICAL MAGNETIC GRADIENT

2.500 gammas/meter
.500 gammas/meter
.100 gammas/meter
.025 gammas/meter

AIRBORNE MAGNETIC SURVEY VERTICAL MAGNETIC GRADIENT Calculated From Total Field

DOGPAW LAKE AREA, ONTARIO

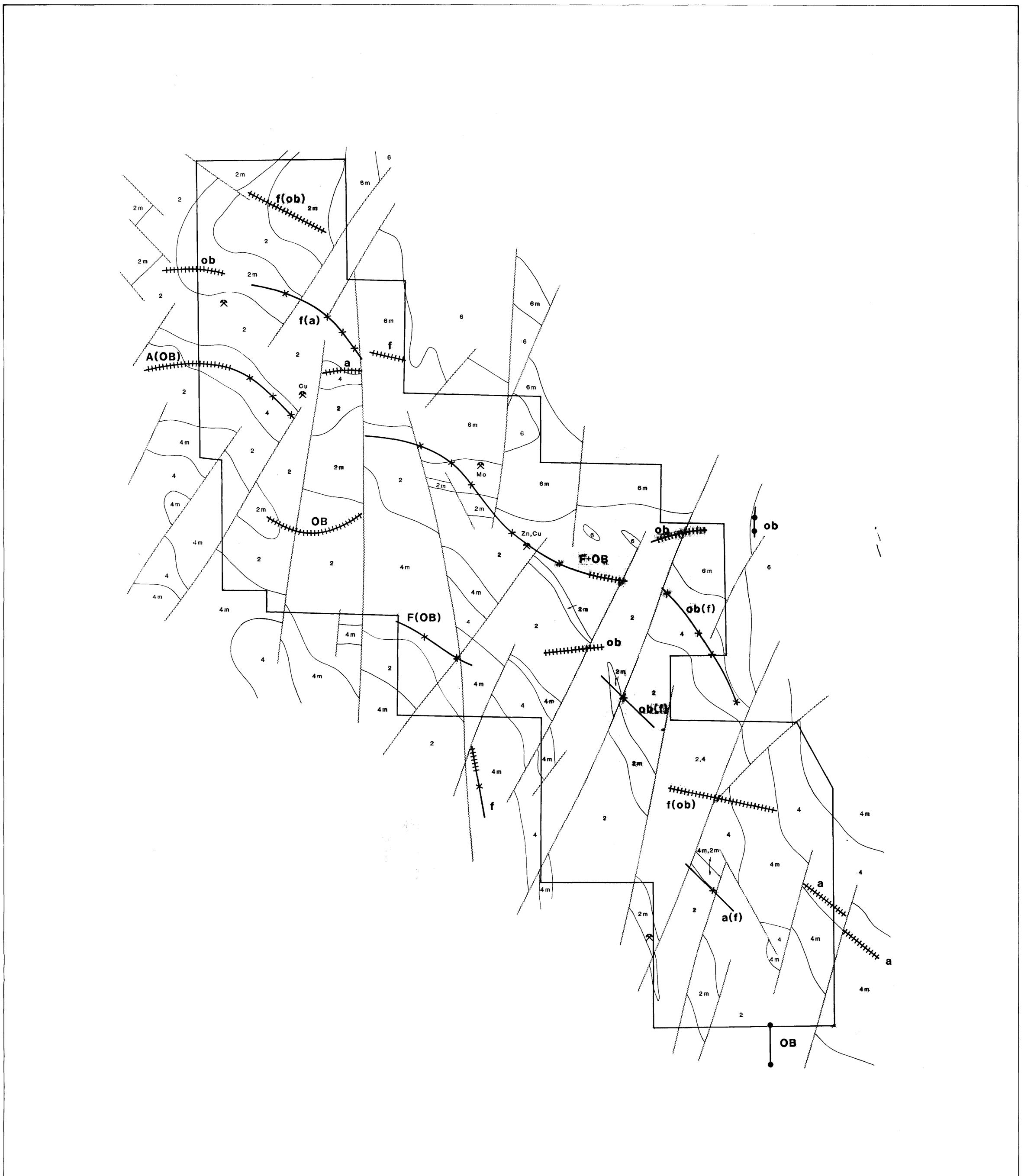
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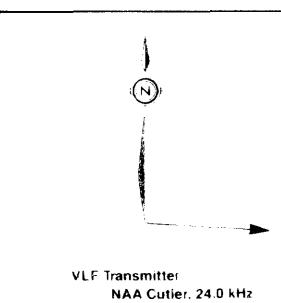
TERRAQUEST LTD.

NOTE: Flight lines 1-17 have a line interval of 200 metres

Flight lines 17-40 have a line interval of 100 metres







Azimuth 094

# LITHOLOGY

4 Gabbio

6m Magnetic Unit Within 6
6 Late Felsic Intrusives

4m Magnetic Unit Within 4

2m Magnetic Unit Within 2

2 Felsic to Intermediate Metavolcanics

**LEGEND** 

Terrain Clearance 100 meters

INTERPRETATION

Contact Fault Property Boundary

VLF-EM Conductor Axes normal quadrature reverse quadrature

> total field only See text for classification of VLF-EM conductor axes



HINZER/TERNOWESKY

# INTERPRETATION

DOGPAW LAKE AREA, ONTARIO

N15 N: 52F/5

PRAWING NO A 757 4 July 1988



