

#### **REPORT ON AN**

## AIRBORNE MAGNETIC AND VLF-EM SURVEY

# CHESTER TOWNSHIP PORCUPINE MINING DIVISION, ONTARIO

for

**SEAWAY BASE METALS LTD.** 

by: TERRAQUEST LTD.

Toronto, Canada July 6, 1988

RECEIVED

SEP 22 1988

MINING LANDS SECTION



#### **TABLE OF CONTENTS**

		Page
1.	INTRODUCTION	1
2.	THE PROPERTY	1
3.	GEOLOGY	1
4.	SURVEY SPECIFICATIONS	1
	4.1 Instruments	1
	4.2 Lines and Data	2
	4.3 Tolerances	2
	4.4 Photomosaics	2
5.	DATA PROCESSING	2
б.	INTERPRETATION	
	6.1 General Approach	3
	6.2 Interpretation	3
7	CIIMMADV	1

#### **LIST OF FIGURES**

Figure 1 ~ General Location Map

Figure 2 ~ Survey Area Map

Figure 3 ~ Sample Record

Figure 4 ~ Terraquest Classification of VLF-EM Conductor Axes

#### LIST OF MAPS IN JACKET

No. A-783-1 ~ Total Magnetic Field

No. A-783-2~ Vertical Magnetic Gradient

No. A-783-3 ~ VLF-EM Survey

No. A-783-4 ~ Interpretation

#### Introduction

This report describes the specifications and results of a geophysical survey carried out for Seaway Base Metals Ltd. of 20 Advance Blvd., Brampton, Ontario, L6T 4R7 by Terraquest Ltd., 240 Adelaide Street West, Toronto, Canada. The field work was completed on April 25, 1988 and the data processing, interpretation and reporting from April 26 to July 7, 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 northwest quadrant of Chester township, in the Porcupine Mining Division of Ontario about 115 kilometres southwest of the town of Timmins. The property can be reached from bush roads to the southeast.

The latitude and longitude are 47 degrees 35 minutes, and 81 degrees 55 minutes respectively, and the N.T.S. reference is 4P/12.

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

P 980495-980497 (3) 980501-980524 (24)

881217-881230 (14)

Total of 41 claims

#### 3. Geology

#### Map References

1. Map 2205: Timmins-Kirkland Lake,

Geolog ical Compilation Series.

Scale 1:253,440 O.D.M. 1973.

2. Map P2449: Chester and Yeo Townships

and parts of Neville and

Potier Townships Scale 1:15,840 O.G.S. 1981

The survey area is underlain by an east-west trending belt of mafic metavolcanic flows to the north, and intermediate pyroclastic metavolcanics to the south. Migmatitic rocks occur around the southern half of Bagsverd Lake and are composed primarily of hornblende diorite derived from the metamorphic recyrstallization of the metavolcanics. The metavolcanics are bounded to the north and south by massive granitic rocks of trondhjemitic to granodioritic composition. All rock types have been intruded by a swarm of northwest trending diabase dykes. Regional faults trend to the northwest parallel to the dykes.

Numerous sulphide showings occur within the batholithic intrusives to the south and within the intermediate pyroclastic metavolcanics beyond the property to the east.

#### 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:

Model: GSM-9BA

Manufacturer: GEM Systems Inc.

105 Scarsdale Road Don Mills, Ontario

Resolution: 0.5 gamma

Accuracy: 0.5 gamma

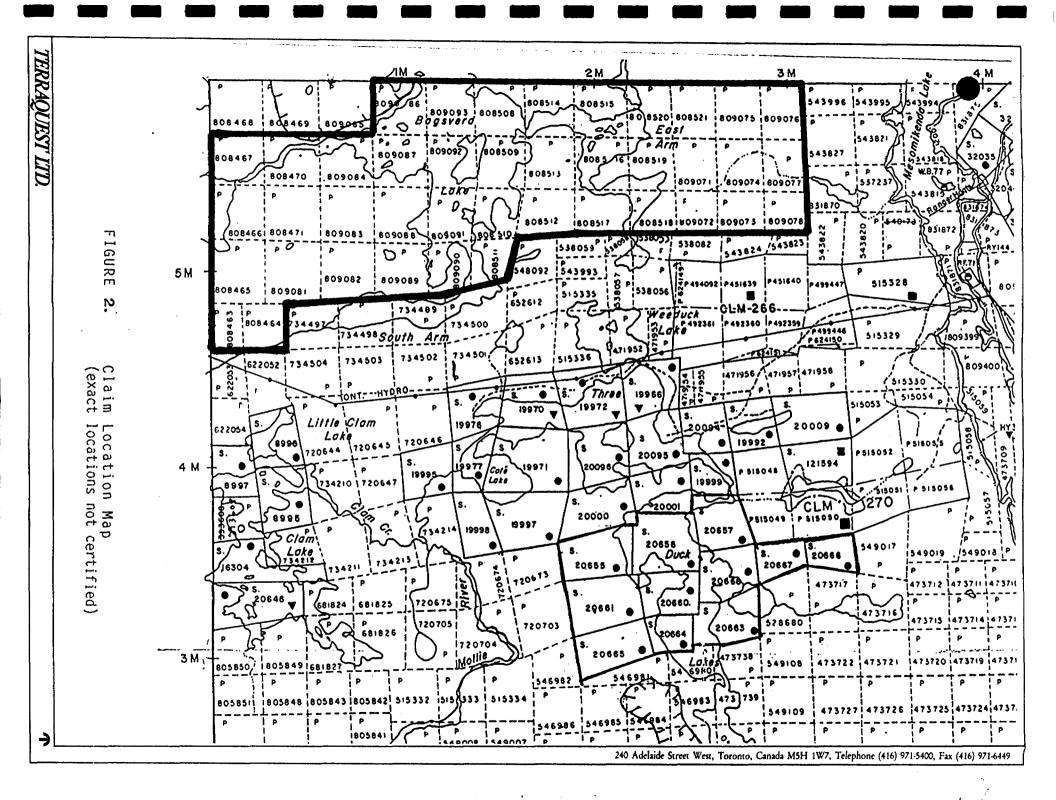
Cycle time: 0.5 second

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

overlapping steps

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FIGURE 1. General Location



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: 100 metres

Line direction: 360 degrees

Terrain clearance: 100 m

Average ground 156 km/hr

speed:

Data point interval:

Magnetic: 27 metres

VLF-EM: 27 metres

Tie Line interval: 2 km

Channel 1 (LINE): NAA Cutler, 24.0 kHz

Channel 2 (ORTHO): NSS Annapolis, 21.4 kHz

Line km over total 135 line km

survey area

including overrun:

Line km over claim

groups:

Magnetic survey 82 line km

totals:

VLF-EM survey 82 line km

totals:

#### 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

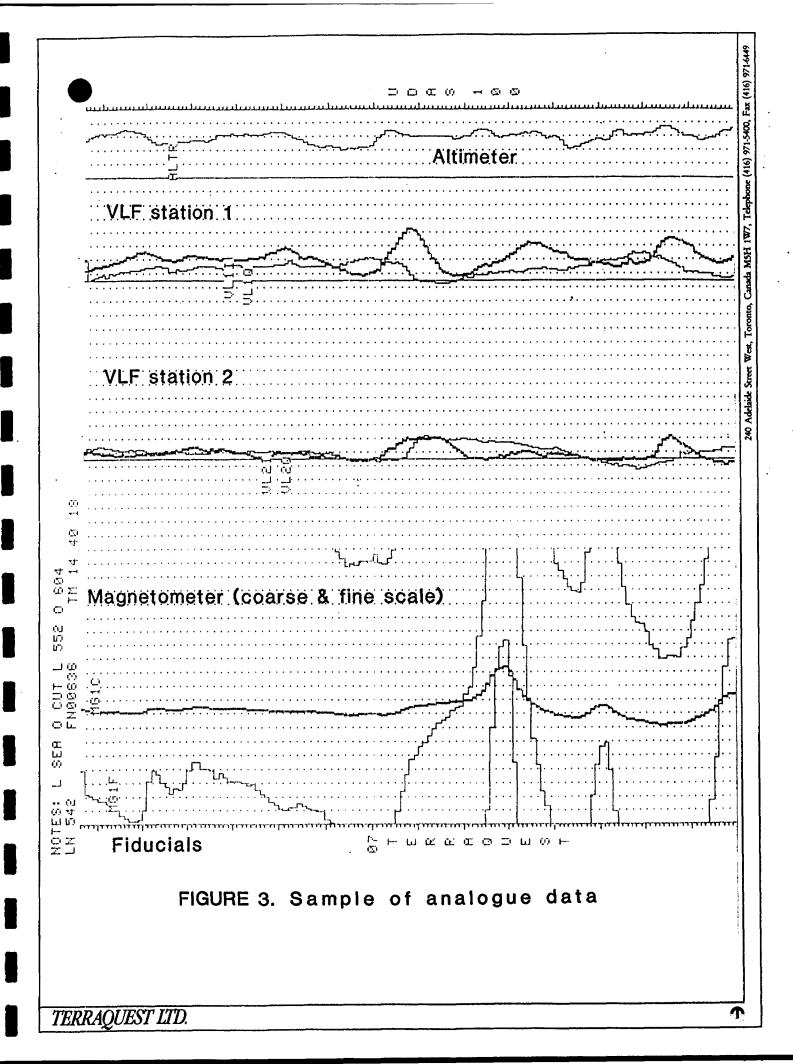
For navigating the aircraft and recovering the flight path, semi-controlled mosaics of aerial photographs were made from existing air photos. Each photograph forming the mosaic was adjusted to conform to the NTS map system before the mosaic was assembled.

#### 5. Data Processing

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



nsfer 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 on both 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 "signatures". 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 450 gammas and is dominated by narrow anomalies trending to the northwest and broad anomalies south of the property trending to the northeast. The vertical magnetic gradient data is particularly useful for the enhancement of the weaker magnetic trends across the central part of the survey area.

The strong magnetic responses to the south correlate with the batholithic intrusive (Unit 6). The strongest responses (Unit 6m) within this unit correlate with sulphide occurrences and therefore are probably related to increased concentrations of pyrrhotite or magnetite.

The narrow northwest trending magnetic anomalies are interpreted as diabase dykes (Unit 8).

#### FIGURE 4

#### TERRAQUEST CLASSIFICATION OF VLF-EM CONDUCTOR AXES

SYMBOL	CORRELATION	ASSOCIATION: Possible Origins
а, А	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
c,C	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

dykes, one to the north-northwest and one to the northwest. The north-northwest set are more frequent and appear to be truncated by the northwest set.

Most of the remaining magnetic responses are interpreted to be derived from either the mafic metavolcanics (Unit 1) or the intermediate pyroclastic metavolcanics (Unit 2). The magnetic responses from these two units are very similar and it is difficult to discriminate between these two rock types, however the mafic metavolcanics to the north correlate with slightly stronger responses. Magnetic horizons within both of these units (Units 1m and 2m) may be related to increased concentrations of magnetic minerals such as magnetite or pyrrhotite, or possibly to more mafic compositions. The magnetic responses over the migmatitic rock (Unit 5) are similar to those of the metavolcanics.

Three fault or shear sets have been identified by the magnetic mapping. East-west faults occur to the north and south of the property and probably represent large scale regional features. Most of the interpreted structures trend to the northeast and are the easiest to detect because they cross-cut both the stratigraphy and the diabase dykes at high angles. A few structures trend to the northwest and appear to be the earliest faults displaced by the northeast trending faults.

The VLF-EM survey has identified numerous weak to strong total field strength conductor axes with moderate quadrature values. Conductive overburden is the probable cause of the conductivity where the contours of the total field strength conform with the lakes, swamps and river valleys and suggests that conductive overburden is restricted to topographic depressions.

Most of the remaining conductor axes are associated with structural sources, either faults or shear zones. This conductivity may originate from a) minerals such as sulphies, graphite or gouge along the structure, or b) an ionic effect created by water or porosity within the structure or to conductive overburden in an overlying topographic depression. Structures identified by VLF-EM or magnetic techniques should be investigated for potential epithermal type mineralization.

#### 7. Summary

An airborne combined magnetic and VLF-EM survey has been done on the property at line intervals of 100 metres. 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. These have been recommended for ground follow up for epithermal type mineralization.

ABBOC/A

TERRAQUEST LTD.

Charles Q. Barrie, M.

Geologist



Ministry of Northern Development and Mines

#### Report of Work

(Geophysical, Geological, Geochemical and Expenditures





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### Ministry of Northern Development

## Geophysical-Geological-Geochemical Technical Data Statement

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#### GEOPHYSICAL TECHNICAL DATA



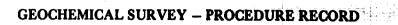
GROUND SURVEYS — If more than one survey, specify data for each type of survey.

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	The state of the s
Method:	Shoot back In line Parallel line
Frequency	(specify V.L.F. station)
	(specify V.L.F. station) (1) 10 10 10 10 10 10 10 10 10 10 10 10 10
Parameters measured	CHILDREN COLOR STREET COLOR STREET
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Instrument	Service services of the servic
	A CONTRACTOR OF THE STATE OF TH
Corrections made	the second of th
Base station value and location	1
	A Committee of the Comm
Elevation accuracy	
Instrument	A STATE OF THE PARTY OF THE PAR
Method  Time Domain	Frequency Domain
	Frequency 244 293 293
- Off time	Range
– Delay time	taring the second of the second secon
Integration time	and the state of t
— Delay time  — Integration time  Power	
Electrode array	and the second s
Electrode spacing	
Type of electrode	

INDUCED POLARIZATION

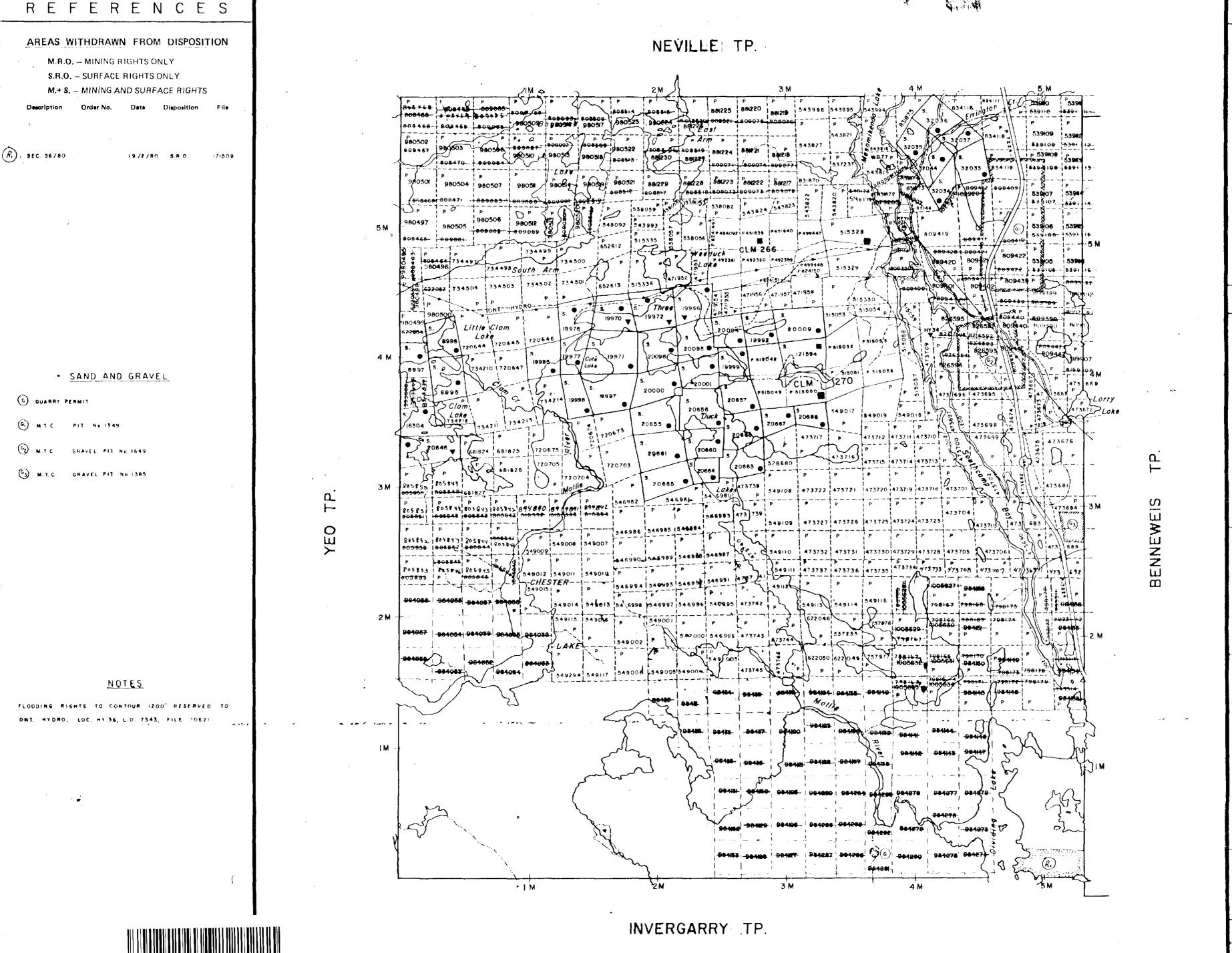
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SELF POTENTIAL	erers s of claims from which sampler taker recules.
nstrument	Range
Survey Method	The state of the s
	22 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Corrections made	in Number of Early services
	The said of the sa
	The state of the s
RADIOMETRIC	
Instrument	The state of the s
Values measured	TO LOUIS NOT THE REAL PROPERTY OF THE PARTY
Energy windows (levels)	and the second of the second o
Height of instrument	Background Count
Size of detector	And the second s
Overhurden	The state of the s
(type, depth - inclu	ide outcrop map)
OTHERS (SEISMIC, DRILL WELL LOGGING ETC.)	· · · · · · · · · · · · · · · · · · ·
Type of survey	
Instrument	
Accuracy	
Parameters measured	The Bullette Administration of the control of
	[18] [19] [19] [19] [19] [19] [19] [19] [19
Additional information (for understanding results)	
AIRBORNE SURVEYS	
Type of survey(s) AIRBORNE MAGNETIC AND	UF-PM DURUCH MANUFACTURE OF THE PARTY OF THE
Instrument(s) (MG) GSM - 9BA (UCF) TOTO (specify for each type	CM 2A  De of survey)
Accuracy (MAG) 0.5 gamma (UF) 1	Section 1 to 1
Aircraft used CESSNA 182 REG-ISTRATIO	
Sensor altitude 100m (on wing tips)	
	-100 refer attivater Port - 1100 dek
Navigation and flight path recovery method KING KRA  acquisition George video Comer PBRS 90	The state of the s
WALLEY CHOCKE ALLES CONTRACT I DED AL	DDC)
A summer a service de 100mm (or morando)	
Aircraft altitude 100m (average)  Miles flown over total area 135 line km	Line Spacing 10 mates  Over claims only 82 law lm.





Numbers of claims from which samples taken	
	to the last the second of the
	urey Method Louis Commences
Total Number of Samples	ANALYTICAL METHODS of another
Type of Sample(Nature of Material)	Values expressed in: per cent
(Nature of Material)  Average Sample Weight	n n m
• •	p. p. b.
Method of Collection	Cu, Pb, Zn, Ni, Co, Ag, Mo, As, (circle)
Soil Horizon Sampled	ம் நாள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்திருள்ள நடித்த
Horizon Development	الأنابيل المناب السياب المتهاب المشهود أناكا المتاب المتاب المتاب والمتاب المتاب والمتاب والمتاب والمتاب
Sample Depth	
Terrain	Analytical Method
	Reagents Used
Drainage Development	Field Laboratory Analysis
Estimated Range of Overburden Thickness	- Parada Barana Bar
	Extraction Method
	Analytical Method
	Reagents Used
	and the second of the second o
SAMPLE PREPARATION (Includes drying, screening, crushing, ashing)	Commercial Laboratory (
Mesh size of fraction used for analysis	Name of Laboratory
Wiesii size of fraction used for analysis	Name of Laboratory
	Analytical Method
	Analytical Method
General	General All (s) Provided to age
<del></del>	V Lvj. AFF - AND Line (2) Incompaled
<del></del>	CIWA COS COMMENTAL (WIT)
<u> </u>	
	The same of the sa
	chen altitude Leading Case wise fight
	Complete and then pain recovery reciped. Re-
	- Carrier when missing is a series of the
	न्त्र । अस्थित होते । अस्य विकास



LEGEND

HIGHWAY AND ROUTE No. OTHER ROADS TRAILS SURVEYED LINES: TOWNSHIPS, BASE LINES, ETC. LOTS, MINING CLAIMS, PARCELS, ETC UNSURVEYED LINES: LOT LINES PARCEL BOUNDARY MINING CLAIMS ETC. **RAILWAY AND RIGHT OF WAY** UTILITY LINES NON-PERENNIAL STREAM FLOODING OR FLOODING RIGHTS

SUBDIVISION OR COMPOSITE PLAN

RESERVATIONS

MINES

ORIGINAL SHORELINE

TRAVERSE MONUMENT

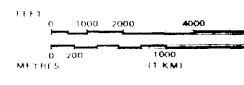
MARSH OR MUSKEG

DISPOSITION OF CROW

TYPE OF DOCUMENT PATENT, SURFACE & MINING RIGHTS ... , SURFACE RIGHTS ONLY.....

NOTE: MINING HIGHTS IN PARCELS PATENTE 1913, VESTED IN ORIGINAL PATENTI LANDS ACT, R.S.O. 1970, CHAP. 380,

SCALE: 1 INCH = 40 CHAINS



TOWNSHIP

M.N.R. ADMINISTRATIVE DISTRIC

GOGAMA MINING DIVISION **PORCUPINE** LAND TITLES / REGISTRY DIVISI

SUDBURY



Ministry of Natural

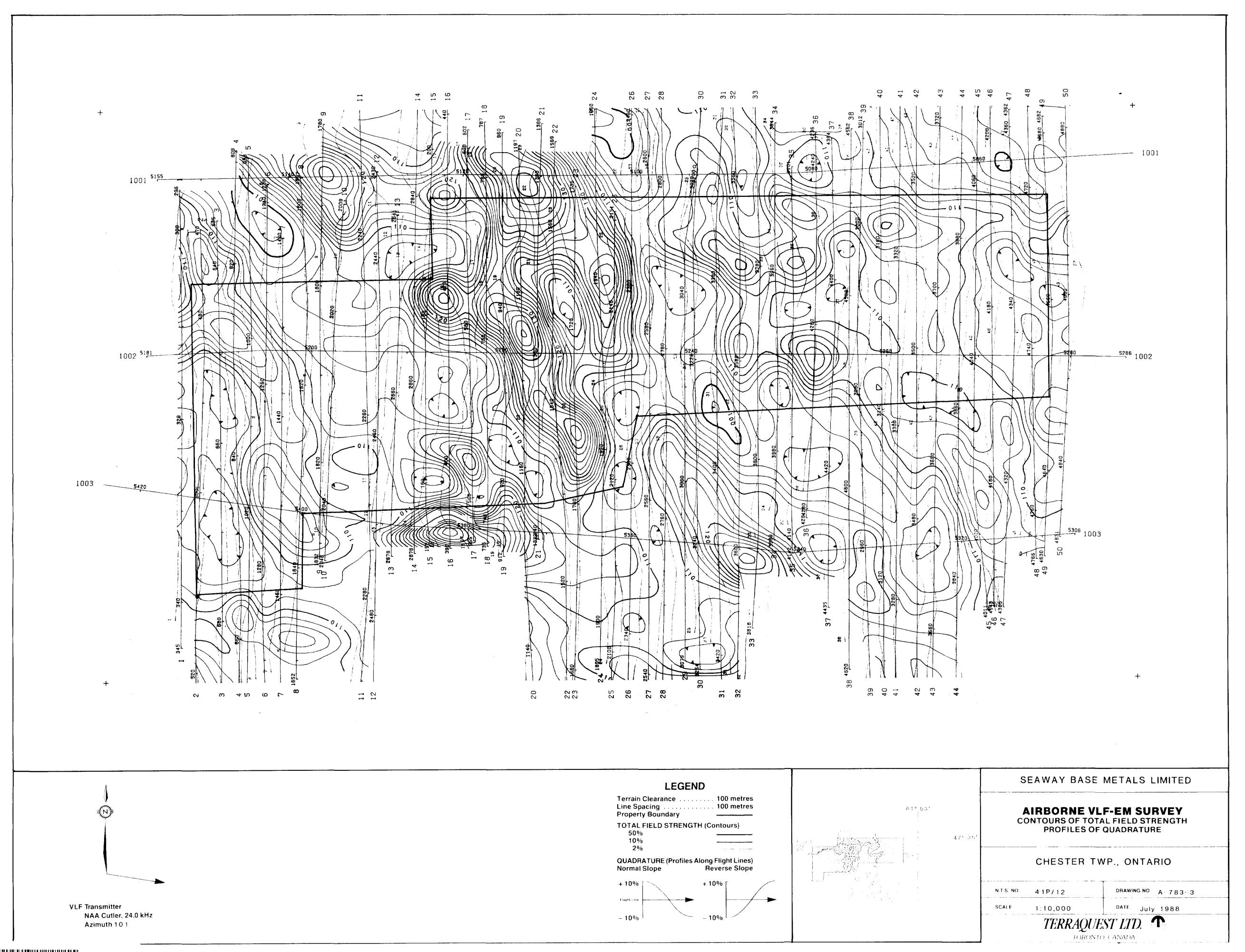
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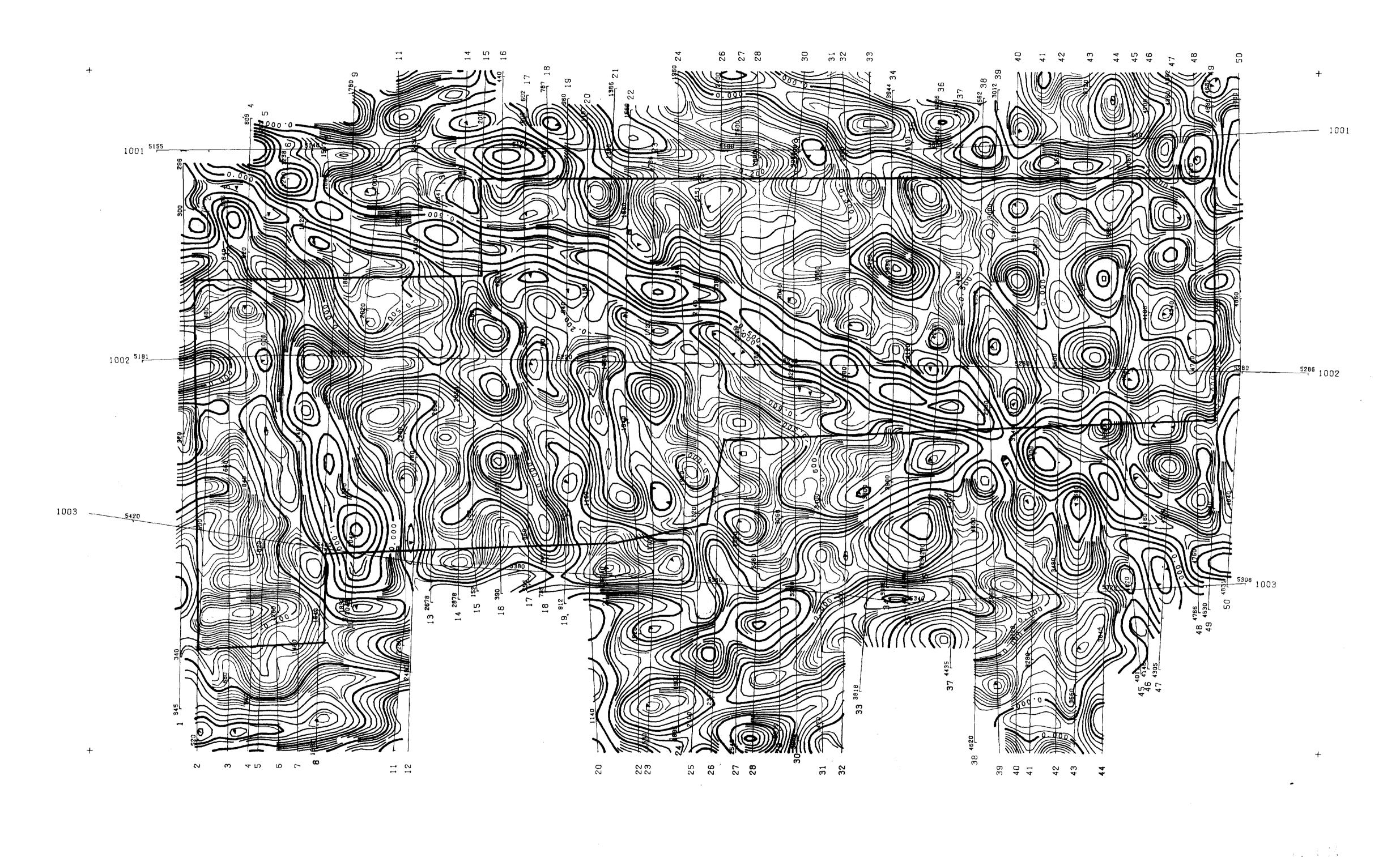
Number

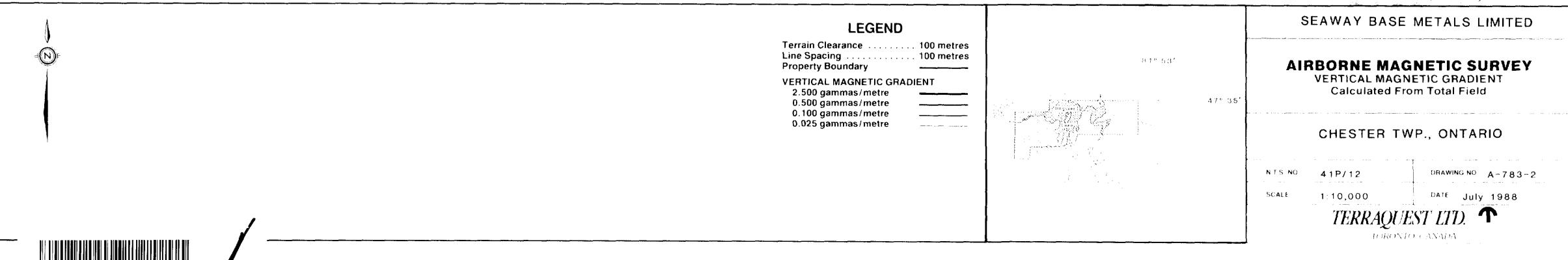
Data MARCH, 1985

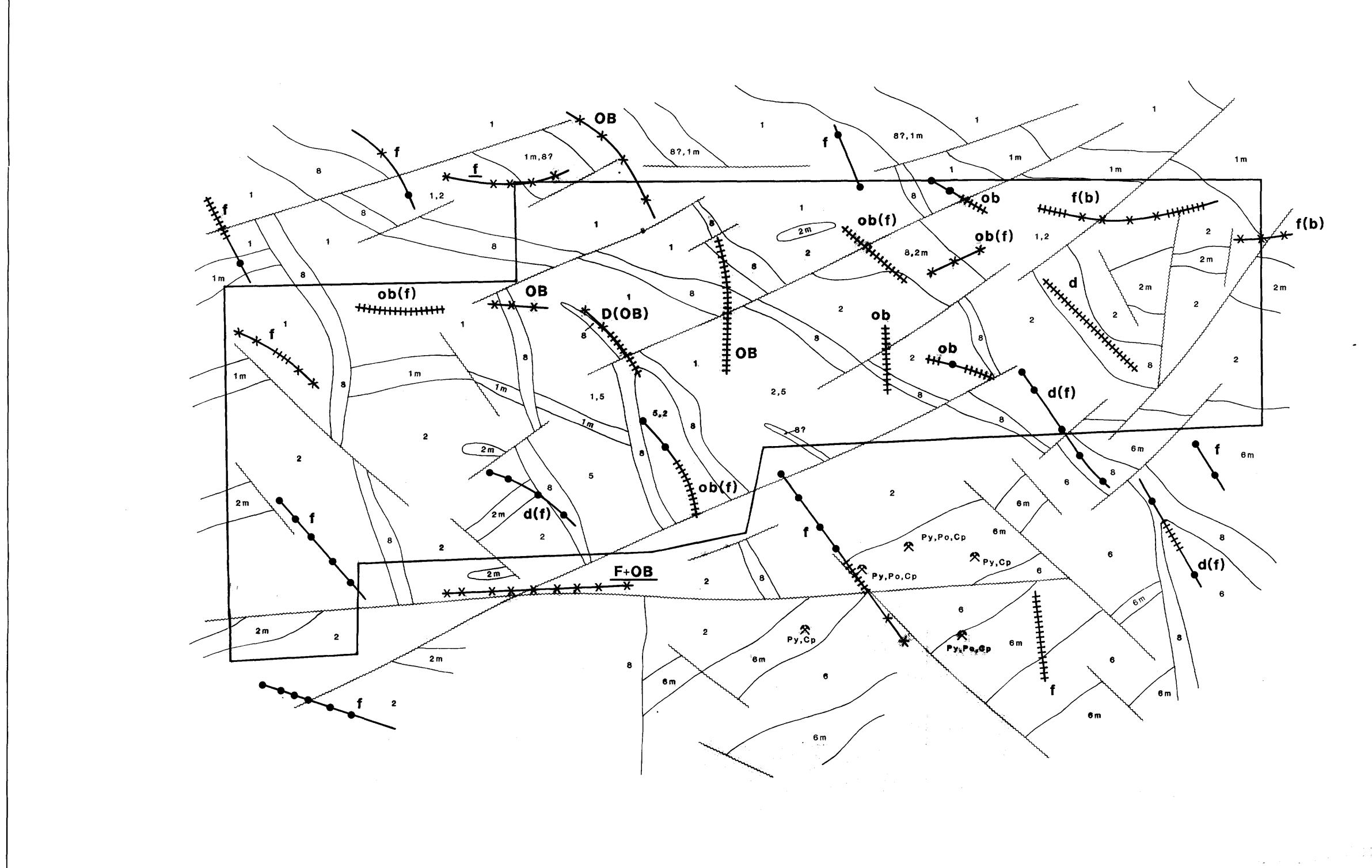
Rec'd apr. 4/85 church lin. **6**-

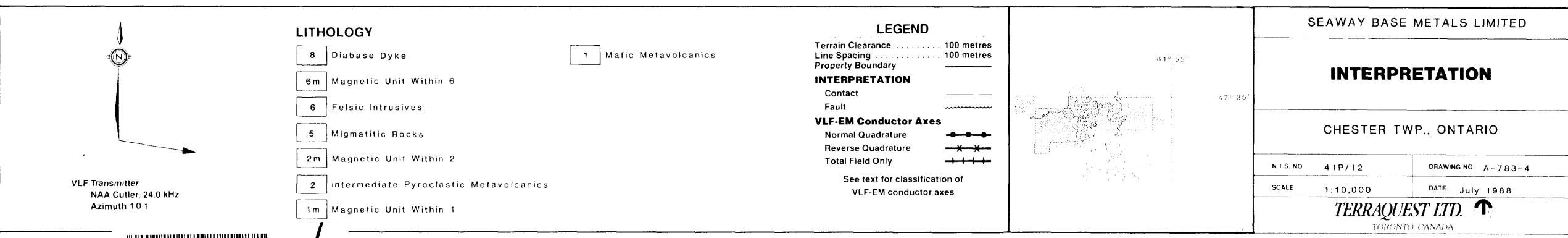
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