



42A05SE0081 2.671 DENTON

010

REPORT ON AIRBORNE MAG. SURVEY
OF GALATA OPTION PROJECT OF ONTARIO
FOR
TEXAS GULF SULPHUR COMPANY
1971

2.671

REPORT ON
AIRBORNE MAGNETOMETER SURVEY
OF GALATA OPTION PROJECT OF ONTARIO
FOR
TEXAS GULF SULPHUR COMPANY

I. INTRODUCTION

This report pertains to the magnetometer portion of the airborne geophysical survey flown on behalf of Texas Gulf Sulphur Company by Spartan Aero Limited. The survey was performed by a geophysically equipped Otter aircraft (registration CF-IGM) based at South Porcupine, Ontario during the 12th. and 13th. of August 1971.

Geophysical data accumulated totalled 209 line miles. Flight lines were spaced 1/8 mile apart and oriented approximately north-south with nine lines near the center of the area oriented east-west. Mean terrain clearance throughout the survey was 150 feet.

Spartan Aero Limited personnel associated with this project were as follows:

M. Bradley	Pilot
B. Peterson	Co-Pilot - Navigator
T. Wallis	Geophysical Operator
H. Hannan	Data Compiler
W. Knappers	Data Chief
D. Fitzsimmons	Chief Draftsman
R.W. Stemp	Chief Geophysicist
K.N. Hendry	Geophysicist.

Two isomagnetic contour maps are presented at a scale of 1 inch = 1320 feet. An uncontrolled airphoto laydown provided the base for these maps.

II. INSTRUMENTATION

The instrument flown is the Gulf Mark III Fluxgate Magnetometer which measures total magnetic intensity. The sensor is mounted inside in the tail section of the aircraft.

Magnetic fields arising from the aircraft have been compensated for. The magnetometer is operated on the 1200 gamma full scale sensitivity setting throughout the survey. The magnetometer output is recorded on a Hewlett Packard rectilinear recorder model 7100B which uses 10 inch chart paper. The short term sensitivity on the 1200 gamma scale is approximately 10 gammas in the above installation and the total dynamic range is 250,000 gammas.

The altitude is monitored using a Bonzer radar altimeter and recorded with the electromagnetic data on a separate recorder (Brush 260).

The entire flight path is recorded by a vertically mounted Aeropath AS-5 35 mm. continuous strip camera.

Synchronization of the film strip and recorders is accomplished by printing numbered markers simultaneously on each record every 10 seconds.

The magnetic record is read in the following manner. With the chart oriented so that fiducial numbers increase from right to left, upward deflections indicate increases in the total magnetic field strength.

The step lengths are 1000 gammas and the step number multiplied by the step value gives an approximate value of the total magnetic field strength in gammas for that area.

Survey altitude is read from the 6 channel Brush 260 recording oriented as described for the magnetic record. The altimeter trace appears on the third channel from the top and altitude increases upward. Calibration is as follows:

50 feet is the bottom of the scale

150 feet is approximately half scale

300 feet is the top of the scale.

III. SURVEY AND MAP COMPILATION PROCEDURES

An airphoto laydown served as a survey base map and with an overlay is used for the compilation of the magnetic data.

Flight path recovery is accomplished by relating the strip film to the laydown. The fiducial numbers on the film are plotted at the corresponding point on the mosaic.

For this survey an arbitrary base level of 3000 gammas was selected. Levelling from line to line is done visually (with reference to the tie line) to reduce all profiles to a common base level. The profiles are then transcribed onto the overlay and contoured at 25 gamma intervals. The final isomagnetic contours are presented at a scale of 1" = 1320 feet on two map sheets. The second sheet contains the data flown in an east-west direction only.

Respectfully submitted,



K.N. Hendry, B.Sc.,
Geophysicist.

OTTAWA, ONTARIO,
October 18, 1971.

A P P E N D I X II

A. EQUIPMENT

The electromagnetic unit and the magnetometer are the key instruments in the Spartan Aero Limited Otter survey system. The remainder of the equipment consists of a radar altimeter, an accelerometer, a continuous-strip camera, two recorders, a fiducial numbering system and a 60 cycle detector.

The EM unit is the Canadian Aero Service Limited MARK IV low frequency (320 c.p.s.) in-phase/out-of-phase system. The transmitting and receiving coils are mounted on the wingtips of the Otter, with a vertical coplanar orientation and a separation of 61 feet. An electronic null device is adjusted so that in the absence of a conductor within the range of the system no signal is recorded. The anomalous signal is divided into two components, the "in-phase" component having the same phase as the transmitted field and the "quadrature" or "out-of-phase" component being at right angles to it. These two measurements are recorded on two channels of the six-channel rectilinear recorder.

Variations in the total magnetic field of the earth are measured by a Gulf Fluxgate magnetometer mounted in the aircraft. Anomalies as small as 10 gammas can normally be distinguished. The output of the magnetometer is presented as one channel on the six-channel recorder to facilitate correlation with the EM traces. It is also presented at a larger scale and in rectilinear form on a separate recorder, these recordings being used in the preparation of isomagnetic contour maps whenever they are required.

Five sensitivity settings are available: 300, 600, 1200, 2400, and 4800 gammas for full 10 inch deflection on the Gulf chart. Corresponding step values are respectively 250, 500, 1000, 2000 and 4000 gammas. The usable short term sensitivity is approximately 5 gammas and the total dynamic ranges are 250,000 gammas for the 4800, 2400, and 1200 gamma settings, 149,800 gammas for the 600 gamma setting and 74,900 gammas on the 300 gamma setting. Generally a sensitivity of 600 or 1200 gammas is used for this type of survey.

A Bonzer radar altimeter provides a terrain clearance profile on one channel of the six-channel recorder. Because EM response decays rapidly with increasing altitude, this information is important in the analysis of the EM data.

A vertical accelerometer mounted in the aircraft provides a record of the air turbulence and of any drastic manoeuvres of the aircraft. The accelerometer trace on the six-channel recorder is often helpful in recognizing spurious blips on the EM traces caused by air turbulence or drastic manoeuvres.

The entire flight path is photographed by a vertically - mounted Aeropath 35 mm. continuous-strip camera.

Synchronization of the film strip with the two recorders is accomplished by means of an automatic fiducial numbering system which prints simultaneous time markers on both records at regular time intervals, normally every ten seconds.

Due to the time constant used in the electromagnetic unit, both the EM in-phase and quadrature recording are delayed by approximately 1 second. This is taken into account when plotting the position of each anomaly.

A 60 cycle detector indicates the presence of power lines which usually provide spurious anomalies on the EM records.

B. DESCRIPTION OF RECORDS

Rectilinear Magnetic Record

With the chart oriented so that fiducial numbers increase from right to left, upward deflections on the chart indicate increases in the total magnetic field of the earth. On the 1200 scale the smallest division on the chart is approximately equivalent to 10 gammas. When the record "steps" a change of approximately 1000 gammas is indicated.

The fiducial marks are normally spaced at 10-second intervals, a spacing which is equivalent to approximately 1500 feet on the ground. The exact horizontal scale of the chart can be established by measuring the fiducial spacing on the map.

Brush Six-Channel Record

With the chart oriented so that fiducial numbers increase from right to left the tracings from the bottom to the top of the chart are as follows:

Fiducial markers - same comments as above.

- Channel 1) Magnetometer - positive upward. On the 1200 scale 1 minor division is approximately equivalent to 25 gammas and a step is approximately 1000 gammas.
- Channel 2) EM In-Phase - positive upward. One minor division represents approximately 20 parts per million referred to the primary field at the receiving coil. A calibration signal of 500 parts per million is displayed on the trace to provide an accurate measure of the sensitivity.
- Channel 3) EM Quadrature - positive upward. Same scale as In-Phase.
- Channel 4) Radar Altimeter. Altitude increases upwards. 150' centre line and 300' top line of channel.
- Channel 5) Accelerometer - an acceleration of $\frac{1}{2}$ "G" is equivalent to a 5 minor divisions deflection from the central point.
- Channel 6) 60 cycle detector.

Fiducial markers - same comments as above.

C. SURVEY AND MAP COMPILATION PROCEDURES

Uncontrolled airphoto mosaics usually serve as base maps for flying the survey and for compilation of the geophysical data. The most common scale is 1/4 mile per inch.

The flight lines are oriented perpendicular to the assumed longest dimension of massive sulphide occurrences anticipated in the survey area. Occasionally two or more line directions have to be used to accommodate changes of geological strike within the area. Line spacings normally range between 1/8 mile and 1/4 mile.

The navigator is provided with "flight strips" of the area to be surveyed. These flight strips are a copy of the airphoto mosaic, with the intended flight lines inked and numbered. Navigation along the parallel flight lines is accomplished by visual means based on the physical detail observed on the photos. The aircraft is flown at a terrain clearance of 150 feet or, in rough terrain, at the lowest safe altitude.

Flight path is recovered in the field by comparison of the 35 mm. strip film with the airphoto mosaics. Identifiable points are marked on the mosaics and designated by numbers determined from the fiducial numbering system on the film. These recovered flight lines provide the positional basis for plotting the geophysical data. The EM anomalies are listed and graded in the field and are often plotted on the field mosaics to permit immediate acquisition of ground.

In our Ottawa office screened positives of the mosaics are prepared, upon which are drafted the recovered fiducial points, the interpolated flight lines positions and the significant geophysical data. The geophysical data are subjected to a careful analysis by a geophysicist who prepares an interpretation report including recommendations for further work.

D. DATA PRESENTATION

The data presentation procedure which we employ for the Otter geophysical system is a combination of an anomaly listing and a plan map plot of graded EM anomalies. The anomaly listing provides the significant details concerning each anomaly and the map gives a "bird's eye view" of the conductors detected.

For purposes of listing and to facilitate reference in the report each EM anomaly is assigned a "name", which is made up of the number of the line upon which the anomaly occurs plus a letter. For example, on line 257 anomalies would be named 257A, 257B, 257C, etc., from south to north or from west to east. The letter which appears beside each EM anomaly on the map is therefore part of its name. These names also appear on the Brush records and in the anomaly list.

The anomaly list contains the fiducial numbers at the edges of the EM anomaly, the in-phase and quadrature amplitudes in p.p.m., the altitude at which the anomaly was detected, the positional relationship of the EM anomaly to magnetic anomalies (if any), a rating, and comments concerning any other pertinent characteristics of the anomaly.

The nomenclature used in the "magnetics" column of the anomaly list requires some explanation. The main terms used are side, flank, edge and direct. These refer to the position of the EM peak relative to the axis of the magnetic feature. "Direct" depicts coincident peaks and similar widths; "edge" is slightly offset; "flank" is somewhere along the flank of the magnetic anomaly; "side" is down near the base. "N. Flank 800g" means that the EM anomaly occurs along the northern flank of a magnetic feature of 800 gammas total amplitude. When one peak of a multiple EM anomaly coincides with a magnetic high the specific peak may be designated. For example, if the southern peak of a double EM anomaly coincided with a 250 gamma magnetic anomaly the nomenclature would be "Dir. S. 250g".

The rating assigned to each EM anomaly in the listing determines the symbol which represents the anomaly on the map. Six categories of anomalies are defined: 1A, 1B, 2A, 2B, 3, and X. The numbers "1", "2" and "3" are primarily a measure of in-phase amplitude corrected for altitude variation: "1" is for very large anomalies, "2" for intermediate, and "3" for relatively weak response. This rating is sometimes affected by the shape, by the in-phase to quadrature ratio, or by the location of the anomaly. The letters "A" and "B" merely refer to the magnetics: "A" indicates a directly coincident magnetic anomaly, and "B" indicates the lack thereof. The "X" rating is reserved for questionable anomalies. The legend on the map shows the symbol used for each of these ratings. In general, the more the rectangle is filled in, the stronger the anomaly.

In the case of directly coincident magnetic anomalies, the amplitude of the magnetic feature is shown on the EM map. It is stencilled beneath the symbol which portrays the EM anomaly.

During the final interpretation stage, EM anomalies are correlated from line to line wherever possible and the conductive zones are outlined. All definite conductors are numbered on the map and discussed in the report.

The rating assigned to each EM anomaly in the listing determines the symbol which represents the anomaly on the map. Six categories of anomalies are defined: 1A, 1B, 2A, 2B, 3, and X. The numbers "1", "2" and "3" are primarily a measure of in-phase amplitude corrected for altitude variation: "1" is for very large anomalies, "2" for intermediate, and "3" for relatively weak response. This rating is sometimes affected by the shape, by the in-phase to quadrature ratio, or by the location of the anomaly. The letters "A" and "B" merely refer to the magnetics: "A" indicates a directly coincident magnetic anomaly, and "B" indicates the lack thereof. The "X" rating is reserved for questionable anomalies. The legend on the map shows the symbol used for each of these ratings. In general, the more the rectangle is filled in the stronger the anomaly.

In case of directly coincident magnetic anomalies, the amplitude of the magnetic feature is shown on the EM map. It is stencilled beneath the symbol which portrays the EM anomaly.

During the final interpretation stage, EM anomalies are correlated from line to line wherever possible and the conductive zones are outlined. All definite conductors are numbered on the map and discussed in the report.



42A05SE0081 2.671 DENTON

RECEIVED

020 0V 12 1971

AIRBORNE ELECTROMAGNETIC SURVEY

PROJECTS
SECTION

GLAZA OPTION PROJECT

IN THE

TIMMINS ONTARIO AREA

FOR

TEXAS GULF SUBMER COMPANY

BY

SPARTAN AERO LIMITED

PROJECT NO. 71211

GLAZA, ONTARIO,
AUGUST 26, 1971.

G.A. Curtis,
Geophysicist.

REPORT ON
AIRBORNE ELECTROMAGNETIC SURVEY
OF GALATA OPTION PROJECT OF ONTARIO
FOR
TEXAS GULF SULPHUR COMPANY

1. INTRODUCTION

This report pertains to the electromagnetic portion of the airborne geophysical survey flown on behalf of Texas Gulf Sulphur Company by Spartan Aero Limited. The survey was performed by a geophysically equipped Otter aircraft (registration CF-IGM) based at South Porcupine, Ontario during the 12th. and 13th of August 1971.

Geophysical data accumulated totalled 209 line miles. Flight lines were spaced 1/8 mile apart and oriented approximately north-south with nine lines near the center of the area oriented east-west. Mean terrain clearance throughout the survey was 150 feet.


Spartan Aero Limited personnel associated with this project were as follows:

M. Bradley	Pilot
B. Peterson	Co-Pilot - Navigator
T. Wallis	Geophysical Operator
H. Hannan	Data Compiler
W. Knappers	Data Chief
D. Fitzsimmons	Chief Draftsman
R.W. Stemp	Chief Geophysicist
G.A. Curtis	Geophysicist.

All E.M. anomalies are presented on a plan map at a scale of 1" = 1320 feet. An uncontrolled airphoto laydown provided the base for the map.

OTTAWA, ONTARIO,
November 5, 1971.

Respectfully submitted,


G.A. Curtis
Geophysicist.

CANADA GEOPHYSICAL SURVEY PROJECT NO. 71211

<u>Locality</u>	<u>Longitude</u>	<u>Tri-Phase Load</u>	<u>Altitude</u>	<u>Remarks</u>	<u>Date</u>	<u>Comments</u>
27A	5446/9	40/80	125	Direct 200g	3	
32A	6219/23	0/50	155	N. Flank 110g	X	
33A	6344/7	20/20	175	N. Edge 40g	3	Possible Power line
103A	693/6	0/60	120	Direct 350g	3	
105A	1141/4	50/40	80	Direct 350g	3	Low altitude

CLAIM NO.DAYS

P 256396	52.5
P 256397	52.5
P 256398	52.5
P 256399	52.5
P 256400	52.5
P 256401	52.5
P 256402	52.5
P 256403	52.5
P 256404	52.5
P 325906	67.6
P 325907	67.6
P 325908	67.6
P 325909	67.6
P 325910	67.6
P 325940	67.6
P 325941	67.6
P 325942	67.6
P 325943	67.6
P 325944	67.6
P 325945	67.6
P 325946	67.6
P 325947	67.6
P 325948	67.6

M. Bradley, Pilot
B. Peterson, Co-pilot - Navigator
T. Wallis, Geophysical Operator
H. Hannan, Data Compiler
W. Knappers, Data Chief
R. W. Stemp, Chief Geophysicist
G. A. Curtis, Geophysicist
K. N. Hendry, Geophysicist

The airborne survey was flown on
12-13 August, 1971, by Sparton Aero Limited,
Ottawa, Ontario. The Sparton personnel
involved in the survey are listed above.

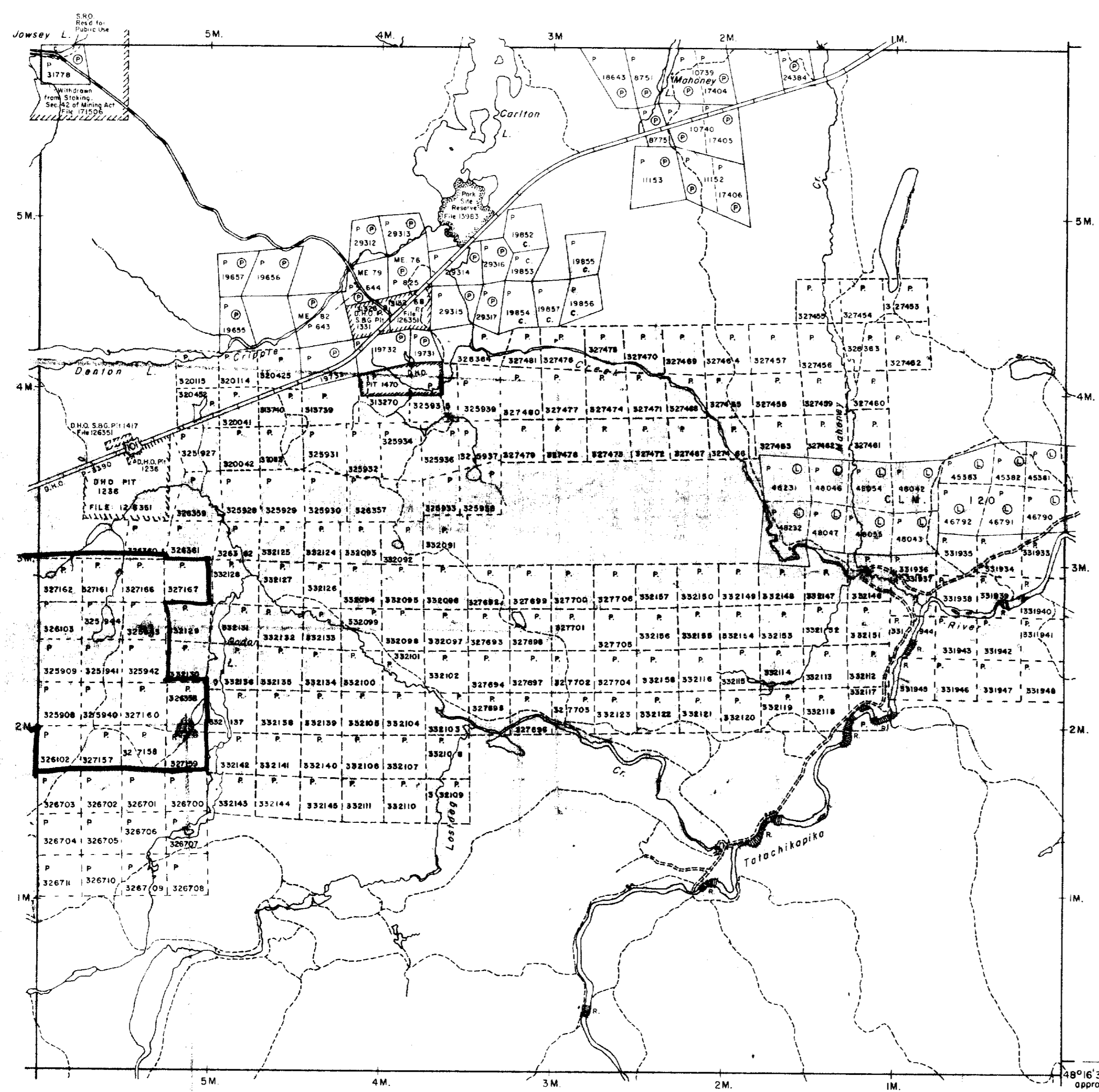
<u>CLAIM NO.</u>	<u>DAYS</u>
P 325949	67.6
P 325950	67.6
P 325951	67.6
P 326088	67.6
P 326089	67.6
P 326090	52.5
P 326091	52.5
P 326092	52.5
P 326093	52.5
P 326094	52.5
P 326095	52.5
P 326097	52.5
P 326102	67.6
P 326103	67.6
P 326104	67.6
P 326105	67.6
P 326106	67.6
P 326107	67.6

W.S.13

DENTON TWP. M.267

W.S.13

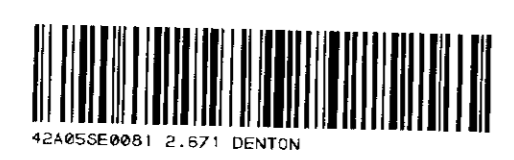
CARSCALLEN TWP. M.267



KEEFER TWP. M.290

THORNLOE TWP. M.313

REYNOLDS TWP. M.308



200

48°16'39" approx.
81°35'49" approx.

McKEOWN TWP. M.299

TOWNSHIP OF
2.671
DENTON
Claim Map
DISTRICT OF
TIMISKAMING
PORCUPINE
MINING DIVISION

SCALE: 1-INCH = 40 CHAINS

LEGEND

- PATENTED LAND (P)
- CROWN LAND SALE (C.S.)
- LEASES (L)
- LOCATED LAND (Loc.)
- LICENSE OF OCCUPATION (L.O.)
- MINING RIGHTS ONLY (M.R.O.)
- SURFACE RIGHTS ONLY (S.R.O.)
- ROADS
- IMPROVED ROADS
- KING'S HIGHWAYS
- RAILWAYS
- POWER LINES
- MARSH OR MUSKEG
- MINES
- CANCELLED (C)

NOTES

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

2.671,4

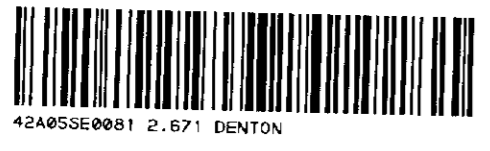
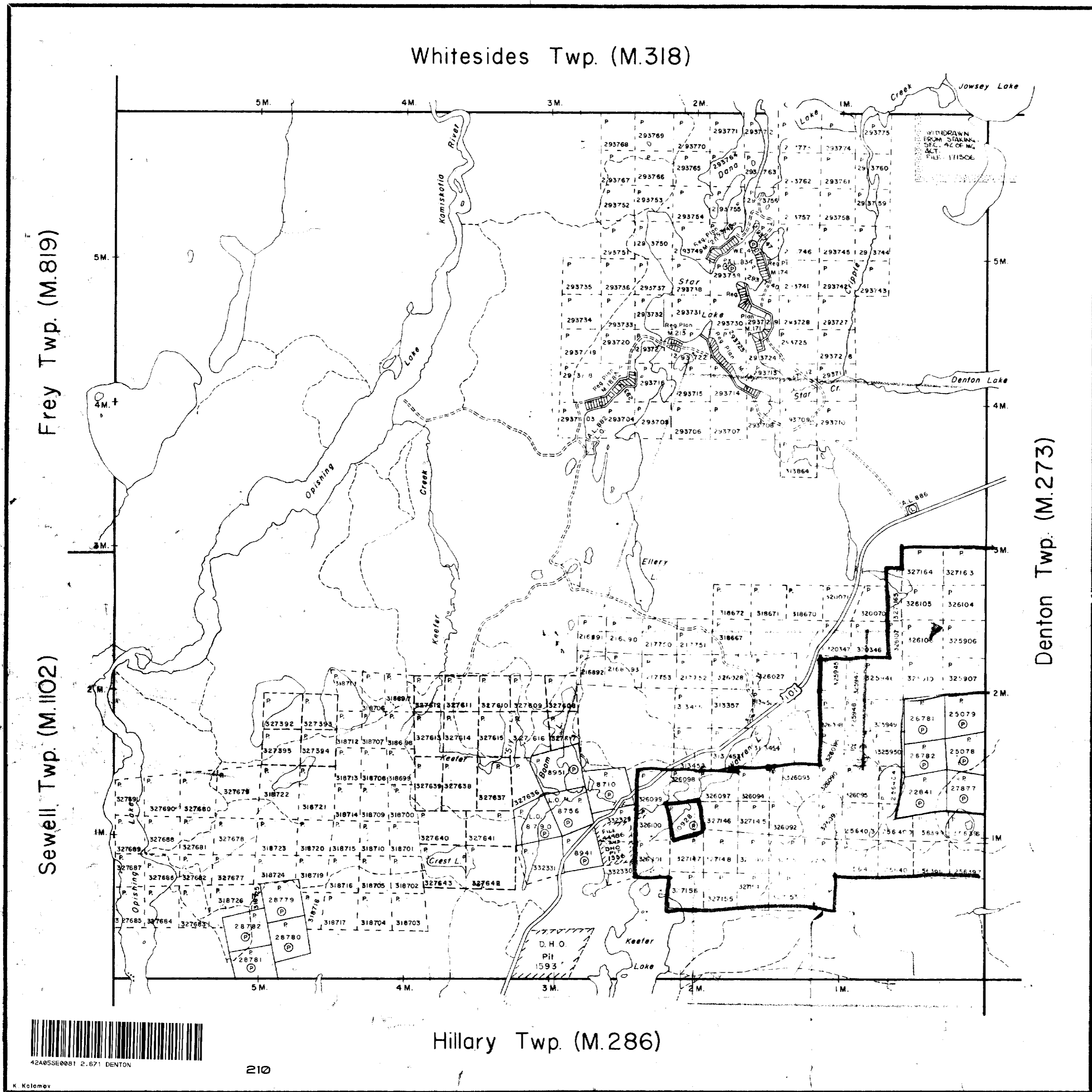
PLAN NO. M.273

ONTARIO
DEPARTMENT OF MINES
AND NORTHERN AFFAIRS

OES.M

KEEFER TWP

W 500



Whitesides Twp. (M.318)

THE TOWNSHIP OF
OF

KEEFER

claim map.
DISTRICT OF
TIMISKAMING

PORCUPINE
MINING DIVISION

SCALE: 1-INCH 40 CHAINS

LEGEND

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

NOTES

400' Surface Rights Reservation around
all lakes and rivers.

PLAN NO. M-290

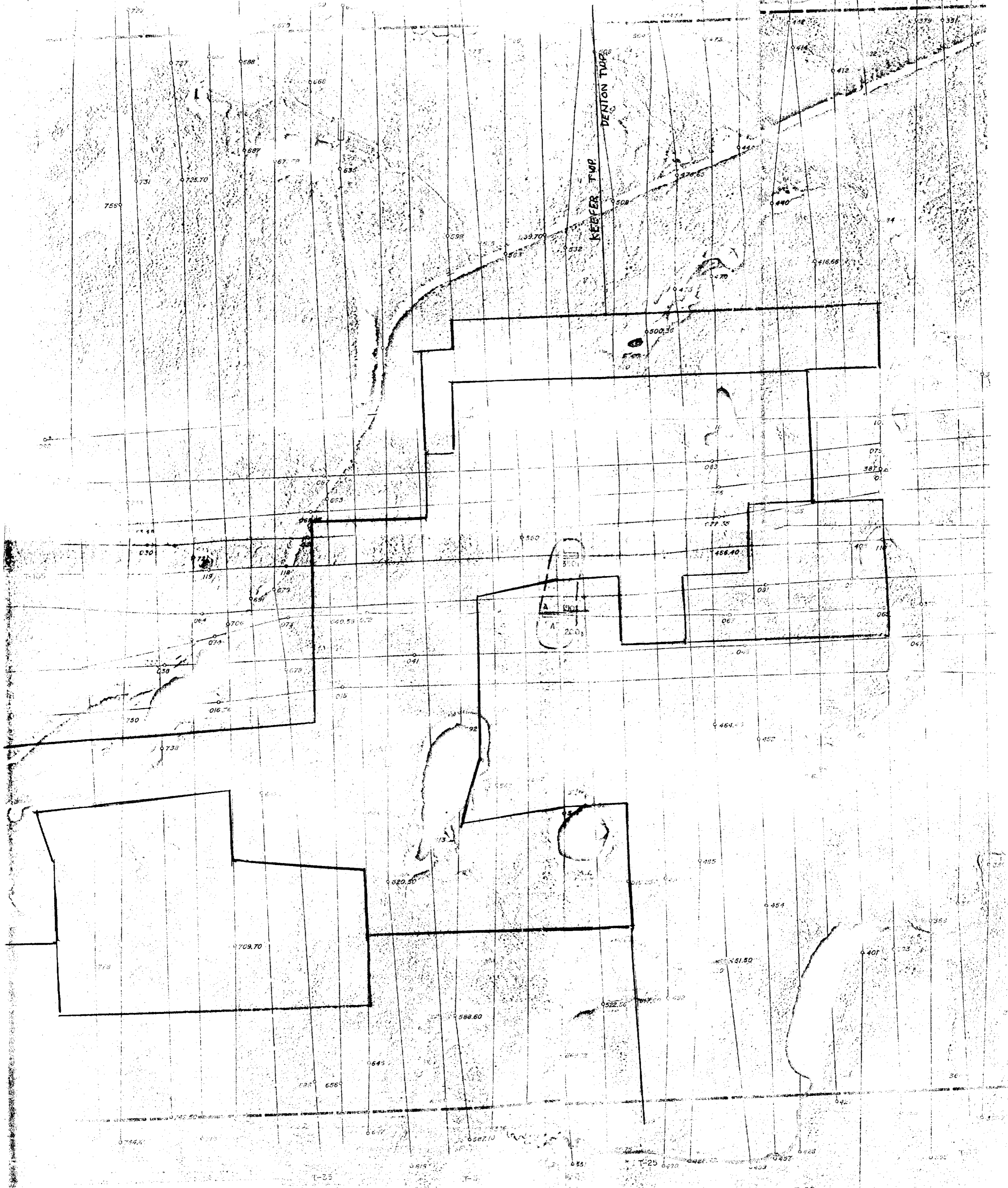
ONTARIO
DEPARTMENT OF MINES
AND NORTHERN AFFAIRS

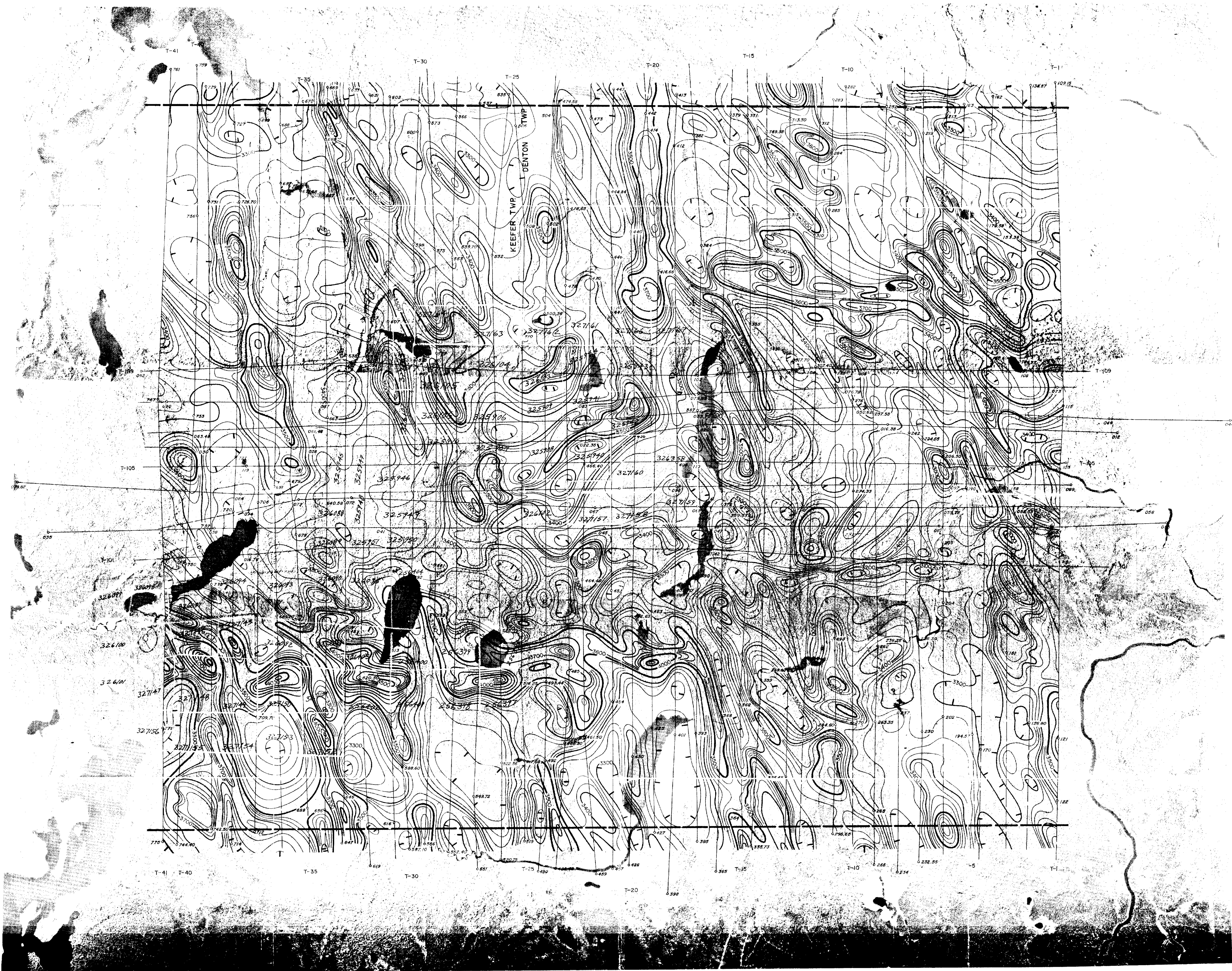
OES.M

KEEFER TWP

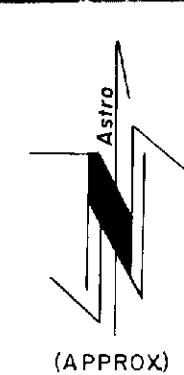
OES.M

2.671,6





- 230
- LEGEND
- 25 GAMMA CONTOUR
 - 100 GAMMA CONTOUR
 - 500 GAMMA CONTOUR
 - MAGNETIC LOW



AIRBORNE MAGNETOMETER SURVEY

GALATA OPTION PROJECT

ONTARIO

TEXAS GULF SULPHUR COMPANY

SCALE: 1 INCH TO 1320 FEET (APPROXIMATELY)

CONTOUR INTERVAL 25 GAMMA

BASE INTENSITY ARBITRARY

MEAN TERRAIN CLEARANCE 150 FEET

TRAVERSE INTERVAL 1/8 MILE

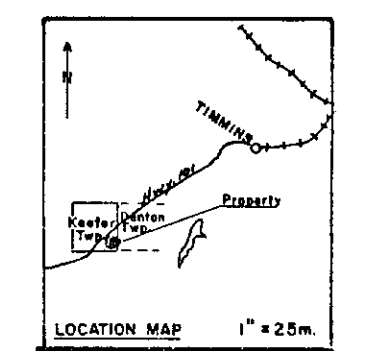
HORIZONTAL CONTROL BASED ON PHOTO LAYDOWN

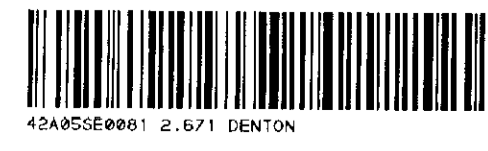
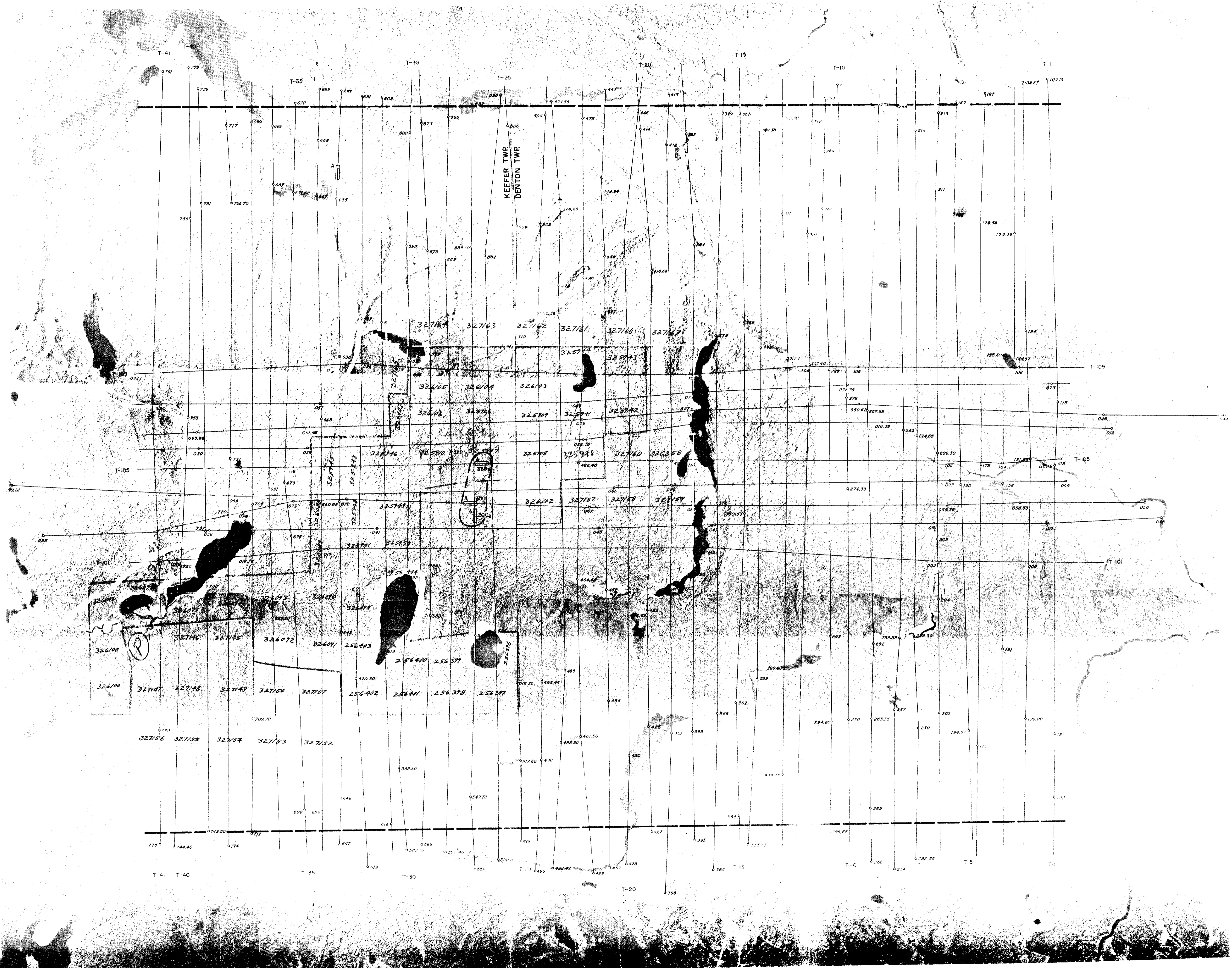
2.671-2

[Signature]

SPARTAN AERO LIMITED

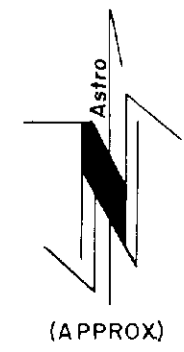
OTTAWA, ONTARIO





240

- LEGEND
- 1 A ANOMALY [Symbol]
 - 1 B ANOMALY [Symbol]
 - 2 A ANOMALY [Symbol]
 - 2 B ANOMALY [Symbol]
 - 3 ANOMALY [Symbol]
 - X type ANOMALY [Symbol]



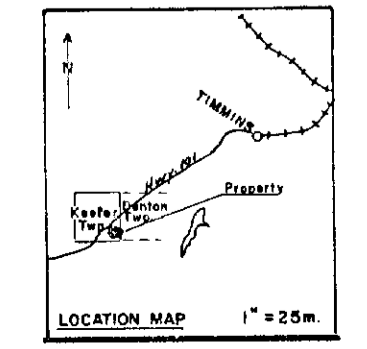
(APPROX)

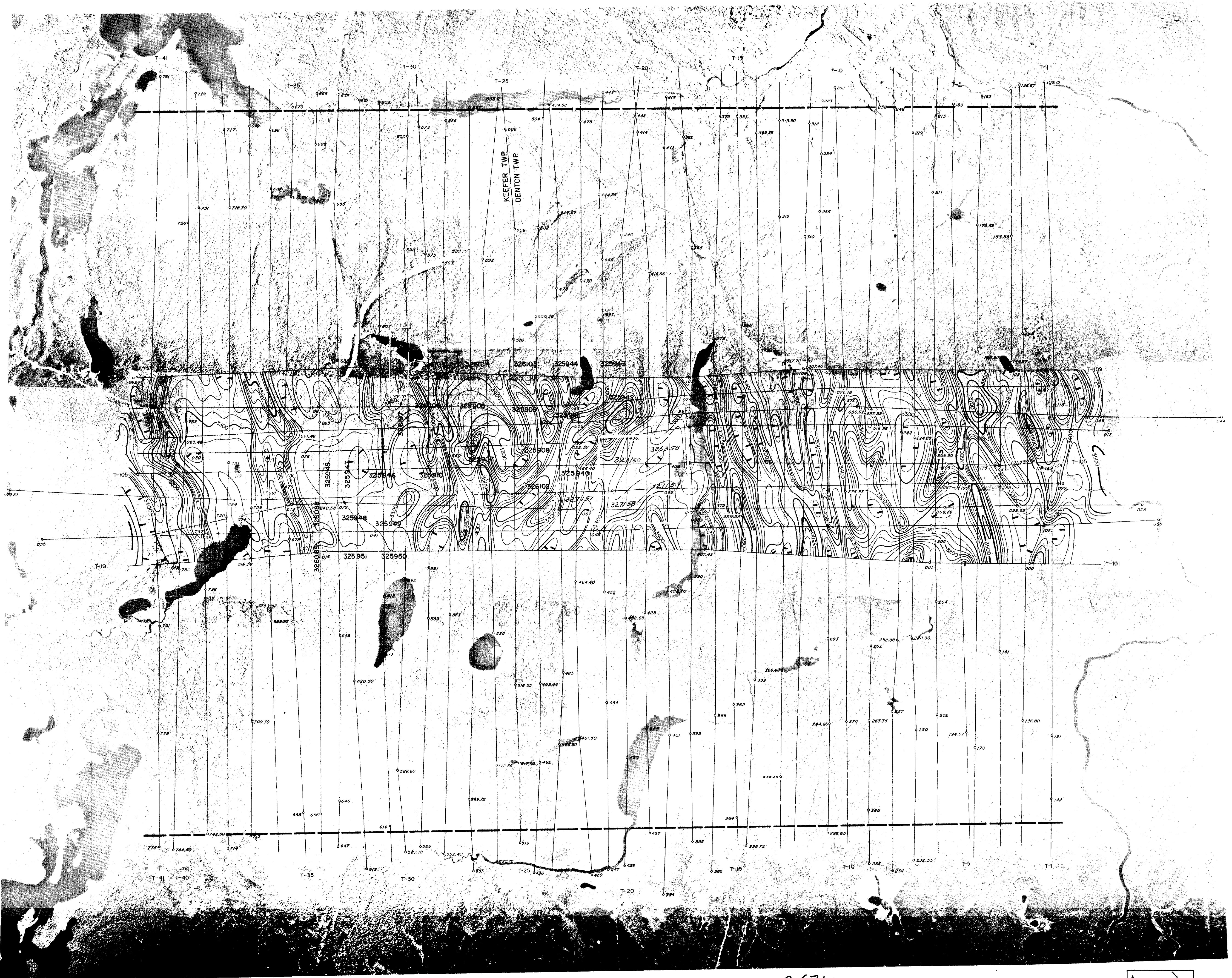
AIRBORNE ELECTROMAGNETIC SURVEY
GALATA OPTION PROJECT
 ONTARIO
 TEXAS GULF SULPHUR COMPANY
 SCALE: 1 INCH TO 1320 FEET (APPROXIMATELY)

2.671-1

MEAN TERRAIN CLEARANCE . . . 150 FEET
 TRAVERSE INTERVAL 1/8 MILE
 HORIZONTAL CONTROL BASED ON
 PHOTO LAYDOWN

SPARTAN AERO LIMITED
 OTTAWA, ONTARIO





2.671,3

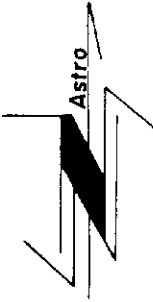
2.671



250

LEGEND

- 25 GAMMA CONTOUR
- 100 GAMMA CONTOUR
- 500 GAMMA CONTOUR
- MAGNETIC LOW



(APPROX)

AIRBORNE MAGNETOMETER SURVEY (Readings on E/W lines only)
GALATA OPTION PROJECT
 ONTARIO

TEXAS GULF SULPHUR COMPANY
 SCALE: 1 INCH TO 1320 FEET (APPROXIMATELY)

- CONTOUR INTERVAL 25 GAMMA
- BASE INTENSITY ARBITRARY
- MEAN TERRAIN CLEARANCE 150 FEET
- TRAVERSE INTERVAL 1/8 MILE
- HORIZONTAL CONTROL BASED ON PHOTO LAYDOWN

Spartan Aero Limited
 SPARTAN AERO LIMITED
 OTTAWA, ONTARIO

