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REPORT ON AIRBORNE GEOPHYSICAL SURVEY OF THE STURGEON LAKE AREA OF ONTARIO FOR WESTERN QUEBEC MINES COMPANY LIMITED BY SPARTAN AERO LIMITED

Project No. 71033

2.424

REPORT ON

AIREORNE GEOPHYSICAL SURVEY

OF THE

STURGEON LAKE AREA OF ONTARIO

FOR

WESTERN QUEBEC MINES COMPANY LIMITED

BY

SPARTAN AERO LIMITED

PROJECT NO. 71033

OTTAWA, ONTARIO,
February 25, 1971

E.R. Rockel,
Geophysicist.

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Accompanying this Report:-

- One E.M. Plan Map at the scale 1" = ½ mile
- One Isomagnetic Contour Map at the scale 1" = ½ mile.

REPORT ON
AIRBORNE GEOPHYSICAL SURVEY
OF THE
STURGEON LAKE AREA OF ONTARIO
FOR
WESTERN QUEBEC MINES COMPANY LIMITED

I. INTRODUCTION

This report pertains to the combined airborne electromagnetic and magnetometer survey flown on behalf of Western Quebec Mines Company Limited, in the Sturgeon Lake Area of Ontario. The survey was designed to cover 30 claims recorded with the Ontario Department of Mines. These claims are as follows:

P.A. 246411 to 246431 inclusive

P.A. 246439 - all located on map M1904, Area of Squaw Lake, District of Thunder Bay, Patricia Mining Division (N.T.S. 52J - 2) and

P.A. 246432 to 246438 inclusive

P.A. 246440 - all located on map M2875, Area of Quest Lake, District of Thunder Bay, Patricia Mining Division (N.T.S. 52G - 15).

The flying was accomplished on January 15, 1971 by the Spartan Aero Limited geophysically equipped Canso aircraft (registration CF-JJG) based at Dryden, Ontario.

The survey was flown at a mean terrain clearance of 150' with flight lines spaced at 1/8 mile intervals and oriented north - south. Geophysical data was collected for approximately 38 line miles.

The following Spartan Aero Limited personnel were associated with the project:

P.	Korpatt	Pilot and Navigator
J.	Armstrong	Pilot and Navigator
D.	Kupkee	Electronic Operator
F.	Ricciuto	Data Compiler
W.	Knappers	Data Chief
D.	Fitzsimmons	Chief Draftsman
G.	Curtis	Geophysicist
J.	Barker	Geophysicist
R.W.	Stemp	Chief Geophysicist
E.R.	Rockel	Geophysicist.

The electromagnetic data and all coincident magnetic anomalies are plotted on a plan map at the scale 1" = ¼ mile. An isomagnetic contour map at the same scale has been prepared using magnetic data acquired during the survey. An airphoto laydown provided the base for these maps and horizontal control for the survey.

II. GEOLOGY

Ontario Department of Mines Map No. 2169 was used as a reference in this report. The claim group covers a portion of the contact between rocks described by the above map as being to the east slightly metamorphosed coarse and fine grained sediments, and to the west syenitic rocks such as nepheline syenite, quartz syenite, and mafic syenite or diorite. Towards the north mafic metavolcanic rocks such as massive and pillow lavas, tuff, aglomerate, amphibolite and their derived schists and gneisses pinch put between the above syenitic and metasedimentary rocks.

III. MAGNETICS

Isomagnetic contours describe three main magnetic provinces within the area surveyed. The first is a magnetically quiet region in the southwest corner of the survey area. This low intensity, undisturbed magnetic province is typical of acidic type rocks containing little or no magnetite, and probably represents the syenitic material described in the discussion of geology.

The second province is a zone of high activity starting in the south, stretching north and bending to the west. This may represent basic metasediments and metavolcanics.

The third magnetic province is another quiet magnetic depression encompassing the north and east boundaries of the active zone. Within this province a very large magnetic high appears on

the northernmost part of the map. The low magnetic intensity envelope is believed to be caused by acidic metasediments. The large magnetic high could result from pyrrhotite or magnetite.

IV. DISCUSSION OF RESULTS

Electromagnetic results are discussed with reference to their geologic and magnetic environments. Individual anomalies are grouped into conductor systems where apparent conductivity continuation exists.

The survey discovered five main conductor systems.

System No. 1 falls partially within the western claim boundary. All anomalies indicate a very weak conductor whose validity can be questioned. It lies within the first magnetic province and has poor magnetic association. The geological environment as indicated by the magnetic contours and by map no. 2169 is syenite. This weak conductor system should not be considered for further investigation until all others have been eliminated.

System No. 2 is situated near the northern edge of survey coverage. The conductor strikes east-west and stretches beyond the limits of coverage to the west and east. Lines 1 through 11 show a strong conductor of high conductivity and good direct magnetic association. Lines 1, 3, and 4 show multiplicity in conductivity and could be revealing interbedded conductors.

From line 12 the response amplitude (conductor strength) decreases progressively till line 15 while maintaining good direct magnetic association. Conductivity also decreases from very good to poor.

Between line 15 and 16 conductivity apparently swings south leaving the previously coincident magnetic high. Zone boundaries are dashed in this region because of the possibility that two separate systems may exist. It should be mentioned that the two-system interpretation is on the basis of magnetics only. The positions of the individual anomalies in this region force continuation of the zone boundaries to include the magnetically barren E.M. anomalies number 16C and 17D.

Lines 18 and 19 show the return of a strong response with high conductivity and good direct magnetic association.

There are two possible explanations for conductivity in this system. Closely interbedded magnetite and pyrite may cause an apparent direct correlation between conductivity and magnetics. Pyrite would be highly conductive and produce a strong E.M. response while the nearby magnetite would give a strong apparently coincident magnetic anomaly. This argument is supported by the multiple conductors 1B, 3B, 4B, and 4C. These anomalies have no direct magnetic association and could be caused by pyrite with no nearby magnetite. This situation could also explain the divergence of the conductivity and magnetic high on lines 16 and 17 with reconvergence at line 18.

An alternative explanation is a long zone of pyrrhotite which when massive and in sufficient amounts would produce a strong E.M. response with a proportionately strong magnetic response. This theory is supported by the apparent correlation between the strength of E.M. and strength of magnetism in most anomalies in the system.

Unless more detailed geology in this region can substantiate the interbedded iron formation theory, this conductor system represents a prime target for further investigation due to the association of pyrrhotite with economic sulphides.

System No. 3 is a two line conductor just below system no. 2. Both anomalies are somewhat weak but exhibit good conductivity. Each has a small direct magnetic association which may be caused by pyrrhotite.

Isomagnetic contours suggest that this system may be related to system number 2 by virtue of the fact that the contours which follow system 2 bend to encompass system 3.

Although the response was weak, good conductivity and direct magnetic association make this a desirable target for further investigation.

System No. 4 falls partly within the eastern claim boundary. Only one anomaly, 17B, shows strength and character sufficient to promote it above the questionable category. This anomaly is coincident with a large magnetic high but exhibits

only low conductivity.

Isomagnetic contours seem to support the inclusion of doubtful anomalies 16B, 18A, and 19A into one system. The result is a conductor which has apparent direct magnetic association at one point only, but which does follow the main magnetic trend in this particular region. For this reason further investigation of this conductor system is warranted especially in the vicinity of anomaly 17B.

System No. 5 touches the northern part of the east claim boundary. This conductor was detected both by line 17 (anomaly C) and by the tie line, TL-1.

Although the response amplitude here is mediocre, the "two-direction" response plus the direct magnetic association makes this system very attractive. The direct magnetic association is listed as "side peak" which means a small magnetic anomaly (the coincident part) is on the side on flank of a larger magnetic high. This can be seen on the isomagnetic contour map as a bending of the contours exactly where the system is plotted. System 5 is located on the nose of the aforementioned larger magnetic high which in itself is a desirable situation.

Good geophysical characteristics make this a prime target for further investigation.

Anomaly 16A lies quite far to the south, outside the contoured portion of the survey. Since it is so close to the beginning of the survey line the possibility exists that the response may be spurious, caused by aircraft manoeuvres. If valid its high conductivity makes it a fair target for further investigation. It should be remembered that although line 17 shows no conductivity to the east, insufficient off-area coverage to the west leaves the conductor open to possibly continue in that direction.

Anomaly 17A, north-east of 16A is a weak and questionable response which may be produced by turbulence. If valid there is probably no relationship to anomaly 16A as evidence by a dissimilar magnetic association.

Anomaly 18C is not included in a system but may be related to conductivity in system no. 2. No evidence of conductivity exists at the corresponding position on line 19. If the part of system no. 2 directly below 18C is investigated on the ground, it is recommended that 18C also be looked at because of its fairly high conductivity.

Anomaly 10A is a questionable response with no direct magnetic association. For this reason it was not included in system no. 3. The response is questioned because of its possible turbulence origin.

V. RECOMMENDATIONS AND CONCLUSIONS

It has been found that three conductor systems lie partly within the prescribed claim boundaries. It is probable that ground investigation of these systems will find more conductivity within the boundaries than can be shown by airborne methods.

Of the three, system 5 is rated as the highest priority for ground follow-up. Next, system no. 4 should be investigated, and finally system no. 1.

Respectfully submitted,

E.R. Rockel,
Geophysicist.

OTTAWA, ONTARIO,
February 25, 1971

PROJECT NO. 71033 - STURGEON LAKE AREA

Anomaly	Fiducials	In-Phase Quad	Altitude	Magnetics	Rate	Comments
1A	6209/13	25/15	170	Direct? 30g?	X	
B	6168/71	180?/100	170	S. Flank 2400g	2B	
C	6164/8	+600/230	170	Direct 2400g	1A	
2A	4731/6	25/25	170	Assoc. 30g	X	Possible turbulence
B	4687/93	+600/220	125	Direct 3500g	1A	Double
3A	4891/5	25/20	165	N. Flank 30g	X	
B	4849/54	70/20	175	S. Flank 2400g	3	
C	4844/9	+600/130	150	Direct 2400g	1A	Double
4A	6287/90	25/10	145	N. Flank 20g?	X	
B	6320/3	35/20	175	S. Edge 160g	3	
C	6323/6	120/60	175	S. Side 1700g	2B	
D	6326/30	+500/160	140	Direct 1700g	1A	
5A	4838/42	190/40	250	Direct to. N. 500g	1A	Double
6A	5000/5	280/90	230	Direct 530g	1A	Double
7A	5134/9	320/110	200	Direct 300g	1A	
8A	5280/5	440/120	200	Direct 480g	1A	
9A	5424/8	+600/120	165	Direct 480g	1A	
10A	5569/72	15/25	175	N. Side 1500g	X	Possible turbulence
B	5578/81	+500/120	170	Direct 320g	1A	

PROJECT NO. 71033 - STURGEON LAKE AREA

Anomaly	Fiducials	In-Phase Quad	Altitude	Magnetics	Rate	Comments
11A	5007/10	40/35	170	Direct side peak 40g	3	
B	5001/5	+600/130	160	Direct 500g	1A	
12A	5137/40	40/30	130	Direct side peak 30g	3	
B	5120/4	310/60	175	Direct 350g	2A	
13A	5287/90	130/60	165	Direct 180g	2A	
14A	5439/45	40/30	155	Direct 100g	3	
15A	5605/10	15/30	170	Direct 900g	3	
16A	6010/4	60/30	130	N. Edge 160g	3	Possibly in turn
B	6049/52	725/25	125	S. Side 1200g	X	Weak
C	5765/9	25/35	145	S. Side 900g	3	
17A	5989/92	35/15	130	S. Edge 200g	X	Turbulence?
B	5955/9	50/60	120	Direct 700g	3	
C	5947/51	50/40	125	Direct side peak 50g	3	
D	5927/31	70/60	100	S. Edge 100g	3	Surface conductor - Weak
18A	5701/5	0/25	150	S. Edge 230g	X	Surface conductor - Weak
B	5726/30	250/70	150	Direct 1300g	2A	
C	5731/4	50/25	200	N. Flank 1300g	3	

PROJECT NO. 71033 - STURGEON LAKE AREA

Anomaly	Fiducials	In-Phase Quad	Altitude	Magnetics	Rate	Comments
19A	5856/60	207/30	125	S. Edge 100g	X	Possible turbulence
B	5888/81	260/80	130	Direct 1150g	2A	
TL-A	6108/11	715/30	140	Direct? Side peak 80g	3	Weak

APPENDIX II

A. EQUIPMENT

The electromagnetic unit and magnetometer are key instruments in the Spartan Aero Limited Canso 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 noise detector.

The EM unit is the Canadian Aero Service Limited MARK III low frequency (390 c.p.s.) in-phase/out-of-phase system. The transmitting coil is mounted forward of the nose of the aircraft and the receiving coil is housed inside the distal end of a tail stinger. The coil orientation is vertical coaxial (i.e. both coils have a common horisontal axis).

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, an in-phase component having the same phase as the transmitted field, and an out-of-phase or "quadrature" component which is at right angles to the transmitted field. Because of the time constant used in the electromagnetic unit the EM in-phase and quadrature signals are delayed by about one second. This is taken into account when plotting anomaly positions. The two signal components are continuously recorded on two channels of the six channel rectilinear recorder.

The magnetometer used in the survey was the total intensity MARK III Fluxgate saturable core instrument, developed by Gulf Research and Development Company and installed in a fiberglass housing below the tail stinger of the aircraft.

Output of the magnetometer is presented as one channel on the six channel rectilinear recorder to facilitate correlation with EM traces. It is also presented at a larger scale on a Gulf Research and Development rectilinear recorder with 10 inch chart width.

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 Honeywell radar-altimeter provides a continuous terrain clearance profile on the six channel rectilinear recorder. Because EM response decays rapidly with increasing altitude, this terrain clearance 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, recorded on the six channel rectilinear recorder, is often helpful in recognizing spurious signals on the EM traces caused by air turbulence or drastic manoeuvres.

A vertically mounted Aeropath AS-5 continuous strip 35 mm. camera, using a 14.5 mm. focal length lens, records the entire flight path of the aircraft.

Synchronization of the film strip with the two recorders employed is accomplished by means of an automatic fiducial numbering system, which prints simultaneous time markers on all records at regular time intervals, usually 10 seconds.

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 gamnas is indicated.

Brush Six Channel Record

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

Fiducial marks.

Channel 1) Magnetometer, positive upward, on the 1200 gamma setting full scale deflection is 25 minor divisions and one step approximately 1000 gammas.

Channel 2) EM In-phase, positive upward. One minor division represents approximately 15 parts per million referred to the primary field at the receiving coil. A calibration signal of 550 parts per million is displayed on the trace to provide an accurate measure of the sensitivity.

Channel 3) EM Quadrature, positive upward. One minor division represents approximately 15 parts per million referred to the primary field at the receiving coil. A calibration signal of 550 parts per million is displayed on the trace to provide an accurate measure of the sensitivity.

Channel 4) Radar altimeter, altitude increases upward, 150' centre line and 300' top line of channel.

Channel 6) 60 cycle detector positive upwards, provides a record of power line 60 c.p.s. noise. There is no calibration but the signal is stronger for the larger power lines.

C. SURVEY AND MAP COMPILATION PROCEDURES

Uncontrolled airphoto mosaics usually serve as base maps for flying the survey and for compilation of 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 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 mosaics, with intended flight lines inked and numbered. Navigation along the parallel flight lines is accomplished by visual means based on 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 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 a 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 line positions and 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 employed for the Canso 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: fiducial numbers at the edges of the EM anomaly, in-phase and quadrature amplitudes in parts per million, altitude at which the anomaly was detected, positional relationship of the EM anomaly to magnetic anomalies (if any), a rating, and comments concerning any other pertinent characteristics of the anomaly.

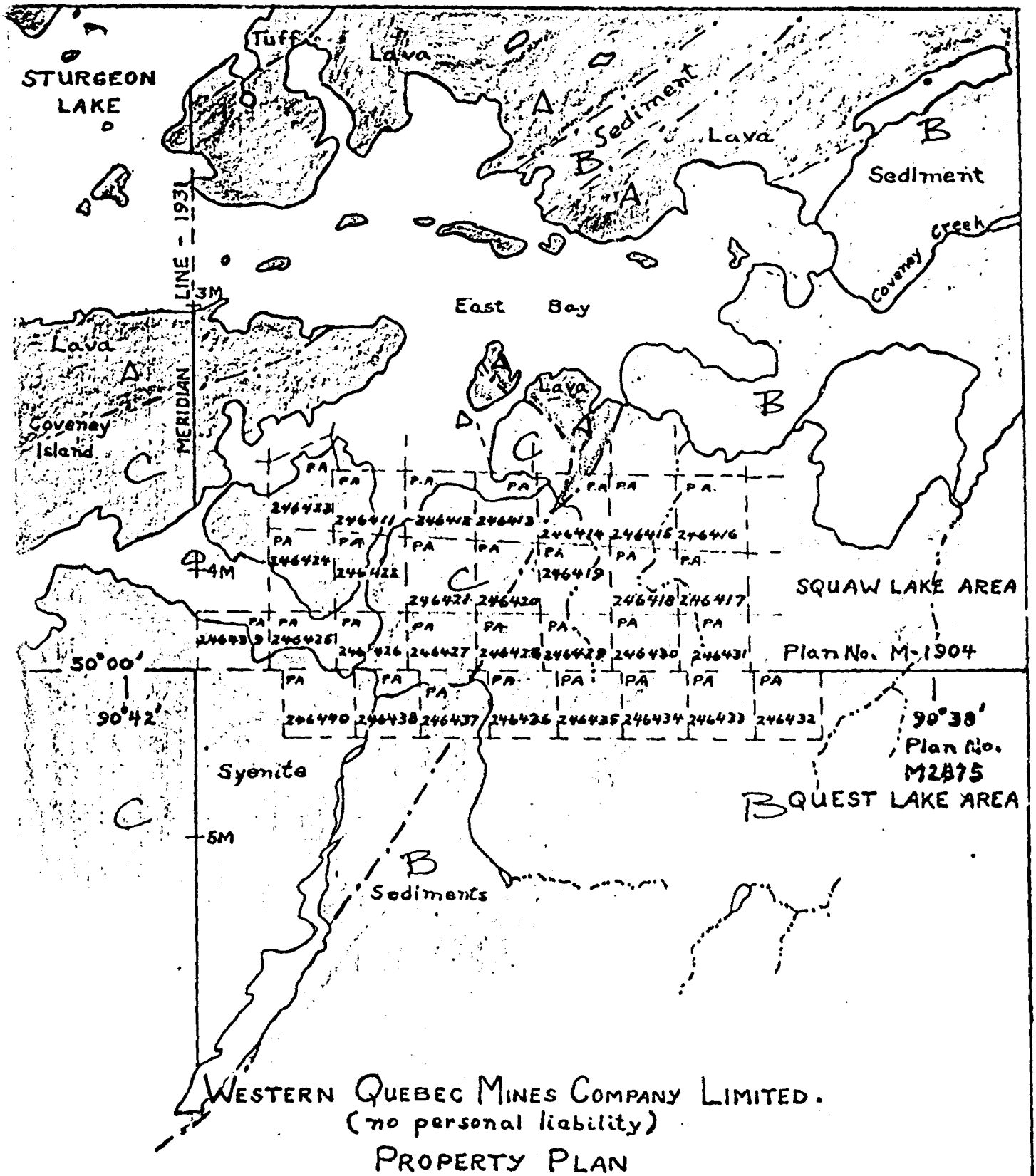
The nomenclature used in the "magnetics" column of the anomaly list requires some explanation. The main terms used are side, flank, edge and direct. These refer to the position of the EM peak relative to the axis of the magnetic feature. "Direct" depicts coincident peaks and similar widths; "edge" is 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 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.

2.426



WESTERN QUEBEC MINES COMPANY LIMITED.
(no personal liability)

PROPERTY PLAN

STURGEON LAKE AREA, ONTARIO.

12/23/70, SCALE:- 1 inch = 2640 feet. R.L.A.

NOTE:

REPORT 2.426 IS IDENTICAL TO REPORT 2.594 WHICH CAN BE FOUND ON MICRO-FICHE # 52J/02SE-0039

AREA CODE -- 416
TELEPHONE -- 365-6918

ONTARIO

2.426

QUEEN'S PARK
TORONTO 182, ONT.

DEPARTMENT OF MINES AND NORTHERN AFFAIRS
MINING LANDS BRANCH

September 14, 1971.

Mr. W. A. Buchan,
Mining Recorder,
Court House,
Sioux Lookout, Ont.

Dear Sir:

Re: Mining Claim No. PA 246411 et al,
Quest and Squaw Lakes Areas.
File 2.426

The Airborne Geophysical (Magnetometer and Electromagnetic) assessment work credits as listed with my Notice of Intent dated August 27, 1971 have been approved as of the date above. Please inform the recorded holder and so indicate on your records.

Yours very truly,

Fred W. Matthews,
Supervisor,
Projects Section.

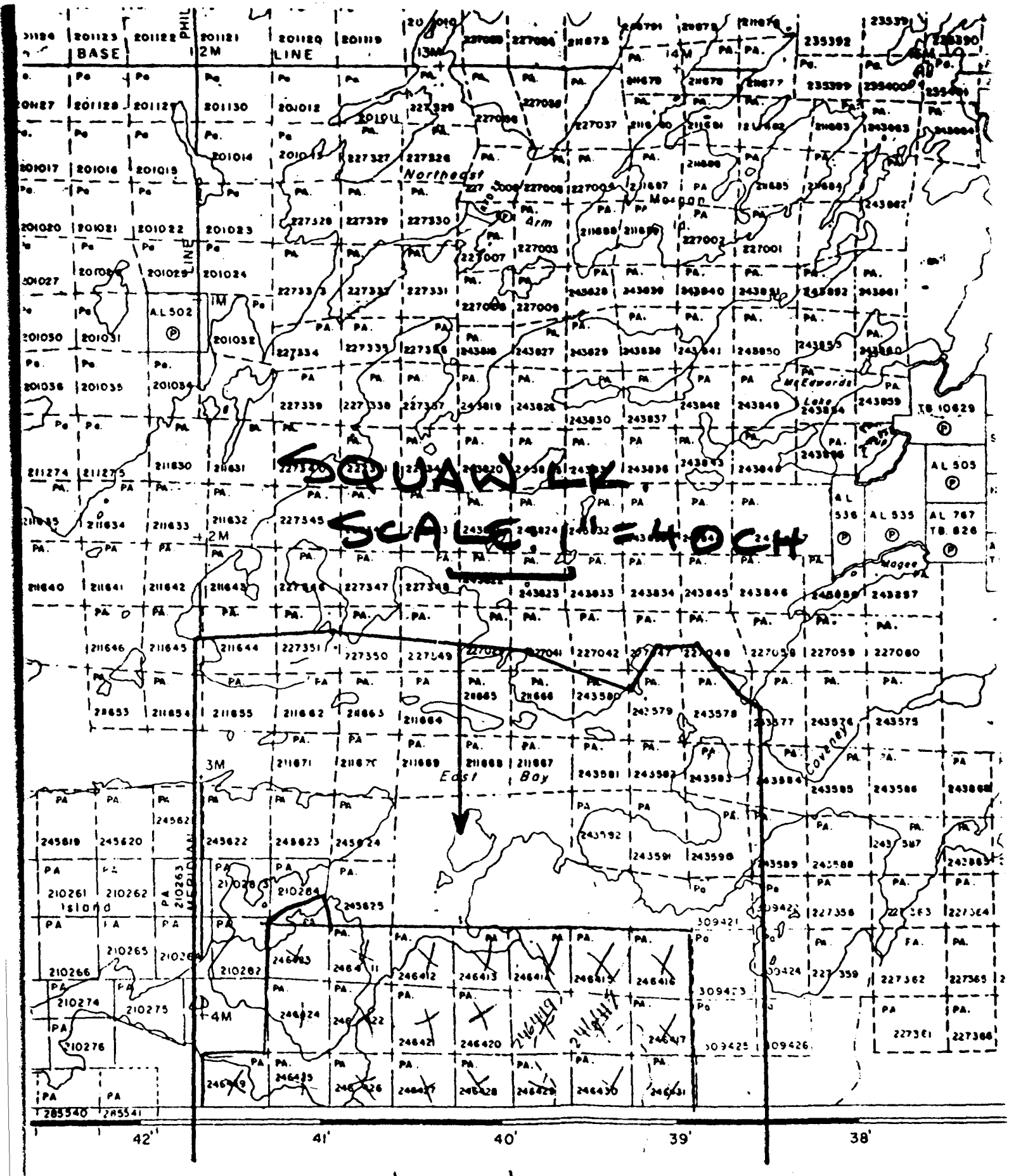
OJ/dg.

c.c. Mr. R. L. Alexander, Geologist.

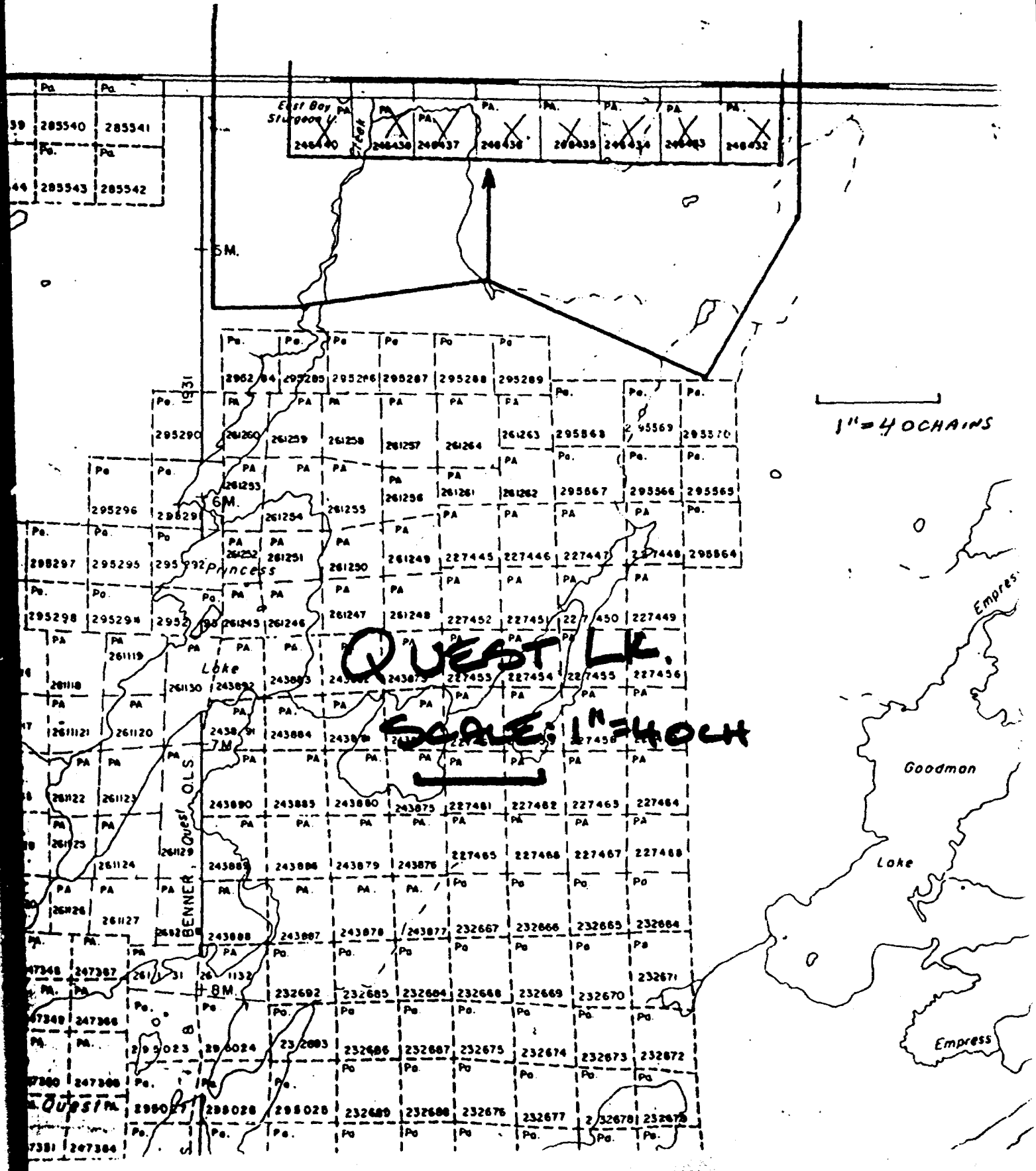
c.c. Western Quebec Mines Co., Ltd.,

c.c. Spartan Aero Ltd.

c.c. Resident Geologist,
Kenora.



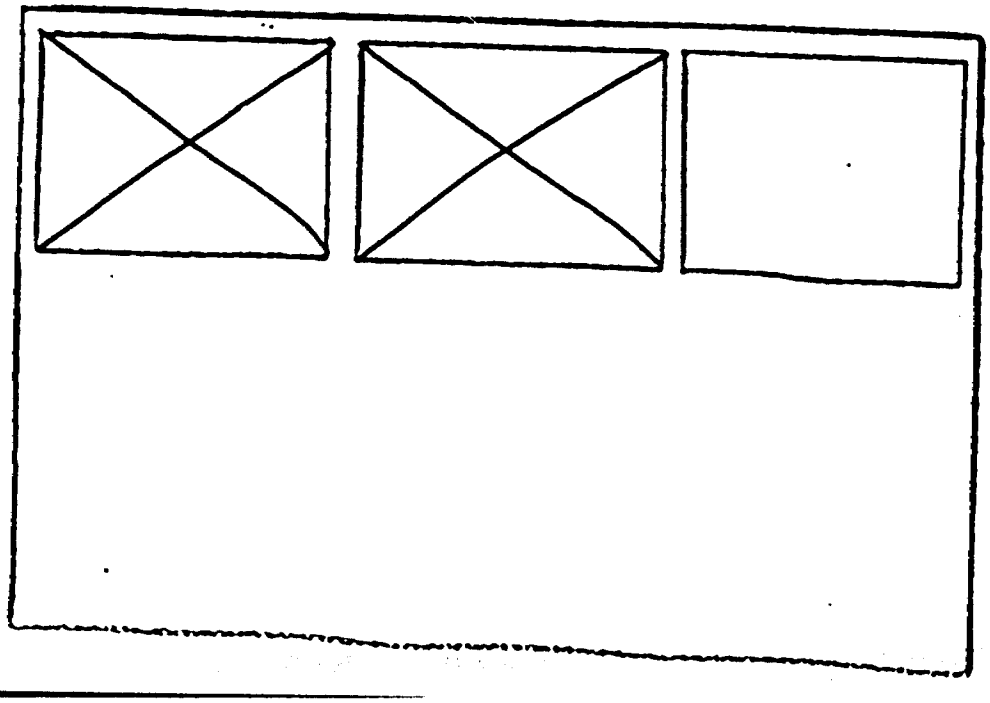
Quest Lake Area

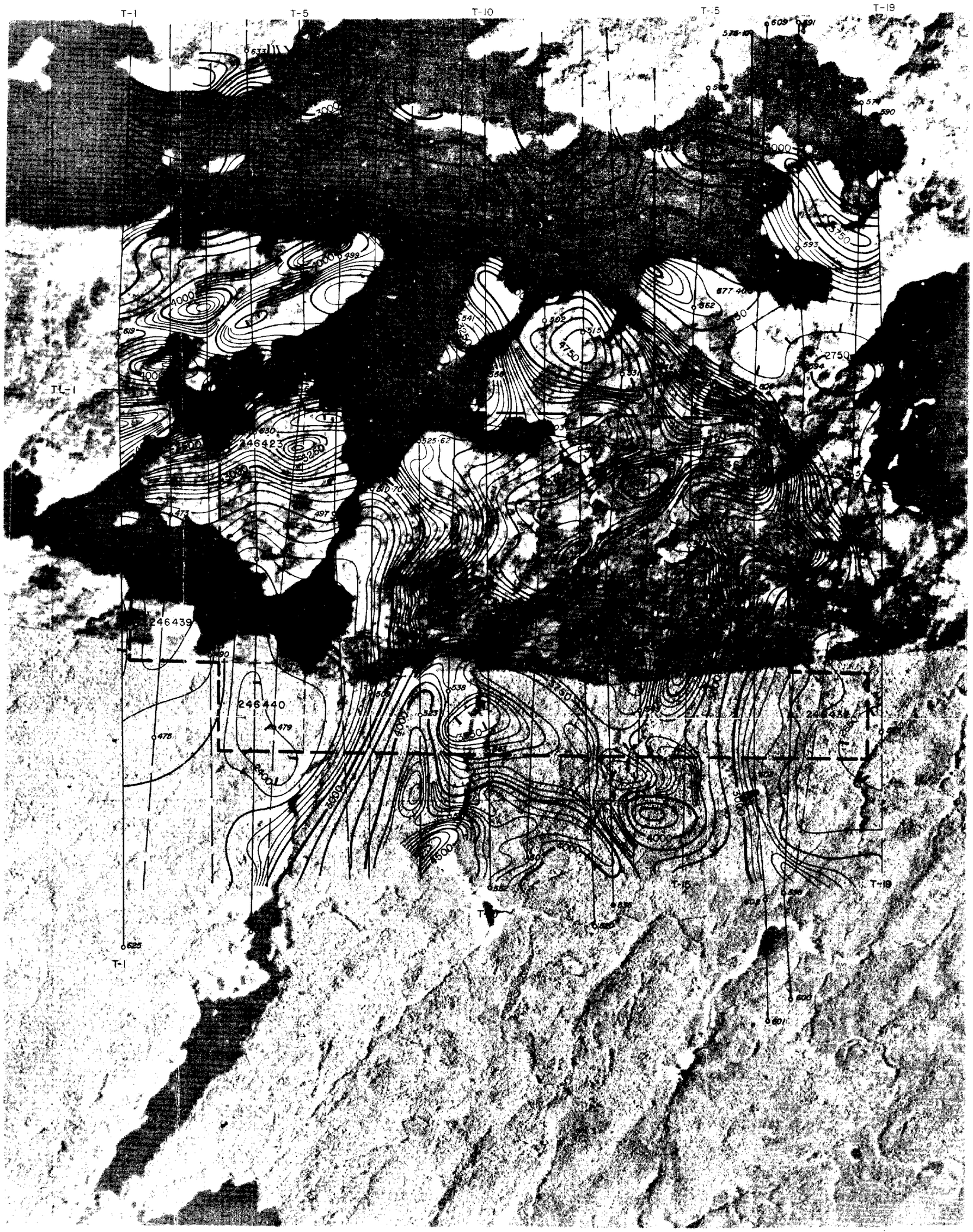

QUEST LK.
SCALE: 1"=40CH
1"=40CHAINS
East Bay
Sturgeon
Creek
5M.
6M.
7M
8M
1931
Princess
Lake
Quest
O.L.S.
BENNER
Goodman
Lake
Empress
Empress

SEE ACCOMPANYING MAP(S) IDENTIFIED AS

52J/02SE-0038-A1, #1 #2

LOCATED IN THE MAP CHANNEL IN THE FOLLOWING SEQUENCE (X)





52J/02SE-0038-A1-#1

LEGEND

50 GAMMA CONTOUR

250 GAMMA CONTOUR

1000 GAMMA CONTOUR

MAGNETIC LOW

(APPROX)

AIRBORNE MAGNETOMETER SURVEY

STURGEON LAKE AREA

ONTARIO

WESTERN QUEBEC MINES COMPANY LIMITED

SCALE : 1 INCH TO 1320 FEET (APPROXIMATELY)

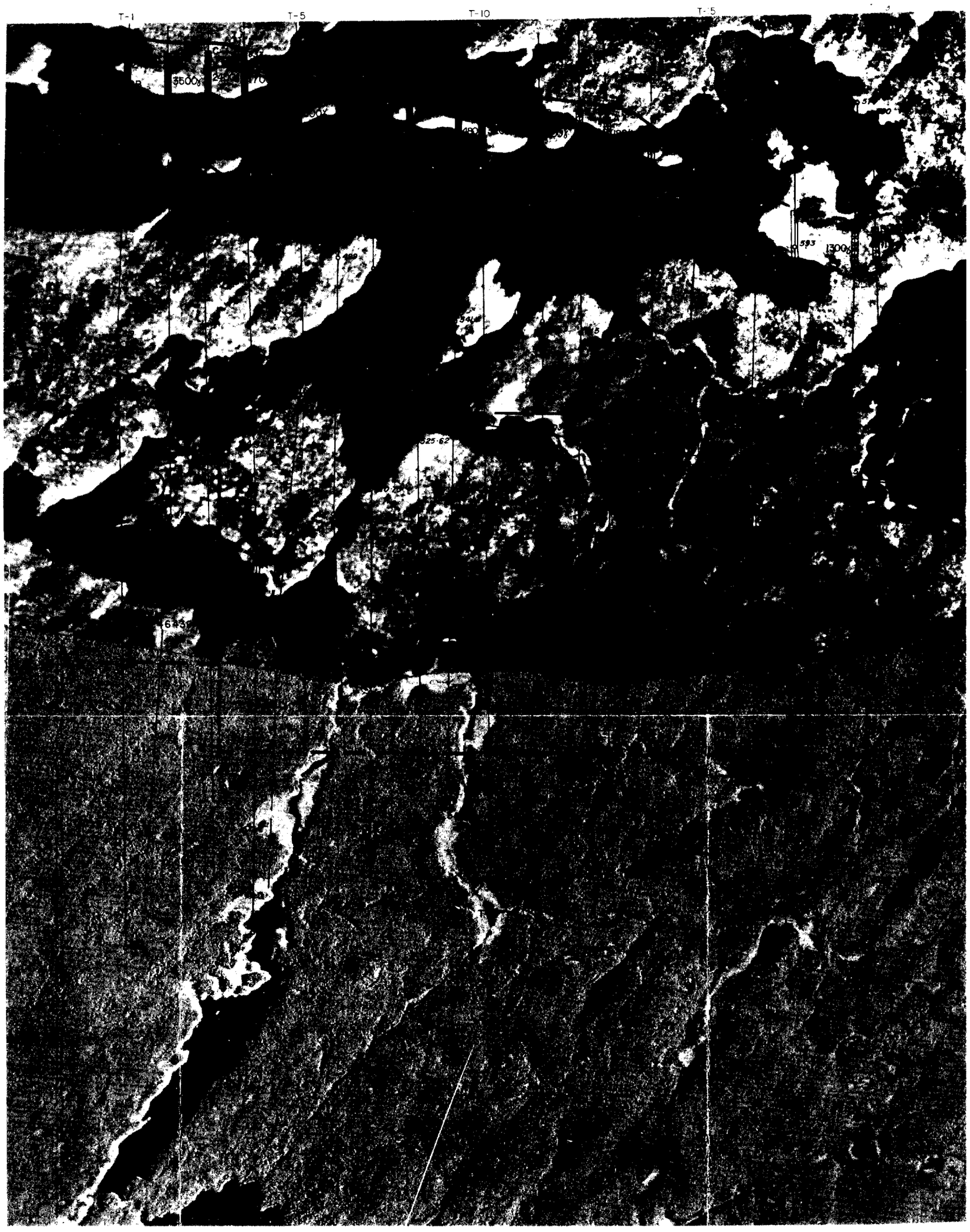
CONTOUR INTERVAL . . . . . 50 GAMMA
BASE INTENSITY . . . . . ARBITRARY
MEAN TERRAIN CLEARANCE . . . . 150 FEET
TRAVERSE INTERVAL . . . . . 1/8 MILE
HORIZONTAL CONTROL . . . . BASED ON PHOTO LAYDOWN

SPARTAN AERO LIMITED
OTTAWA, ONTARIO

2.426

200

S.A.L. 71033



52J/02SE-0038-A1-#2

LEGEND

1 A ANOMALY
1 B ANOMALY
2 A ANOMALY
2 B ANOMALY
3 ANOMALY
X type ANOMALY

(APPROX)

AIRBORNE ELECTROMAGNETIC SURVEY

STURGEON LAKE AREA

ONTARIO

WESTERN QUEBEC MINES COMPANY LIMITED

SCALE - 1 INCH TO 1320 FEET(APPROXIMATELY)

2426

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

SPARTAN AERO LIMITED
OTTAWA , ONTARIO

52J02SE2105 52J02SE0038A1 SQUAW LAKE

S.A.L. 71033