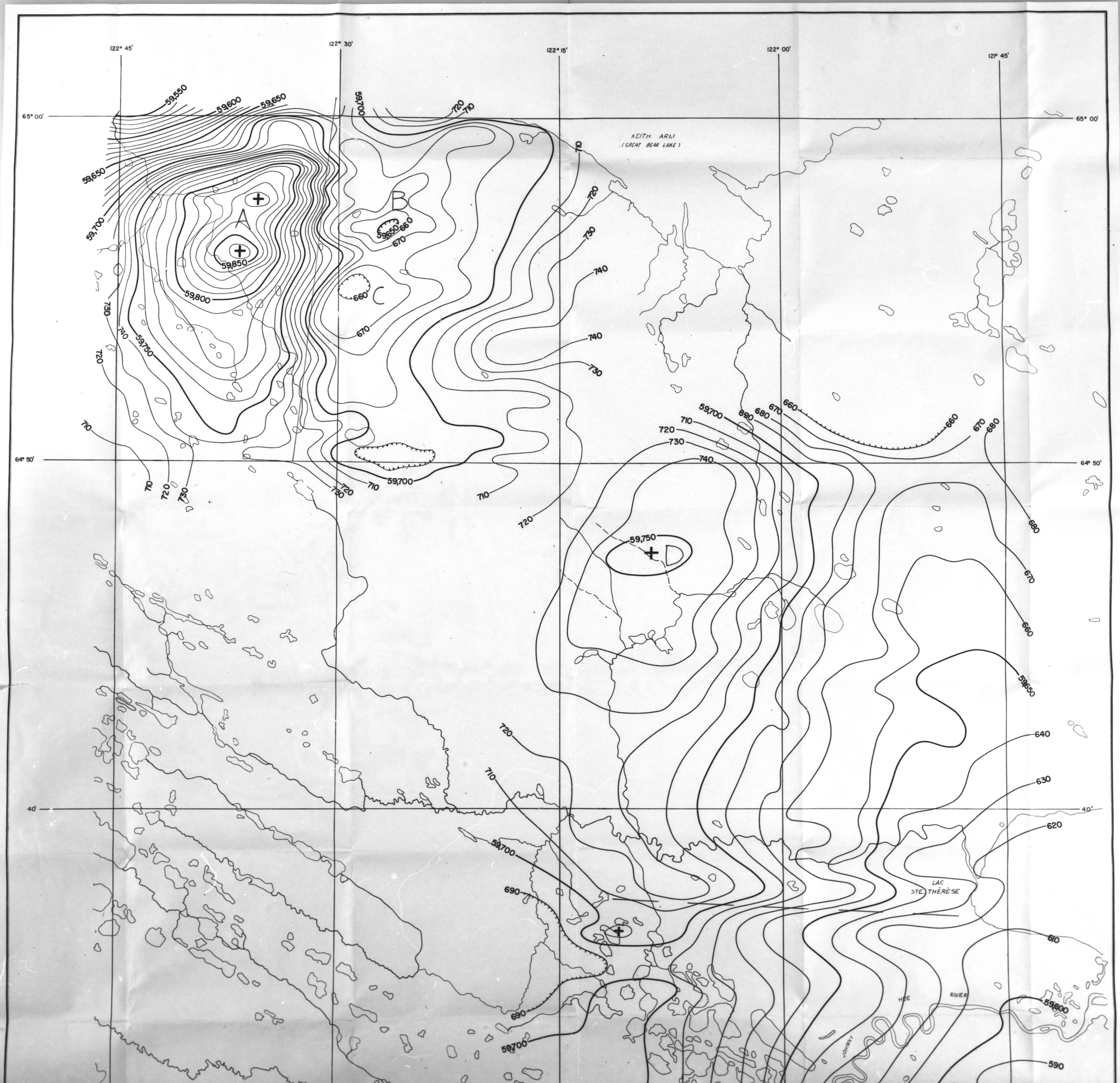
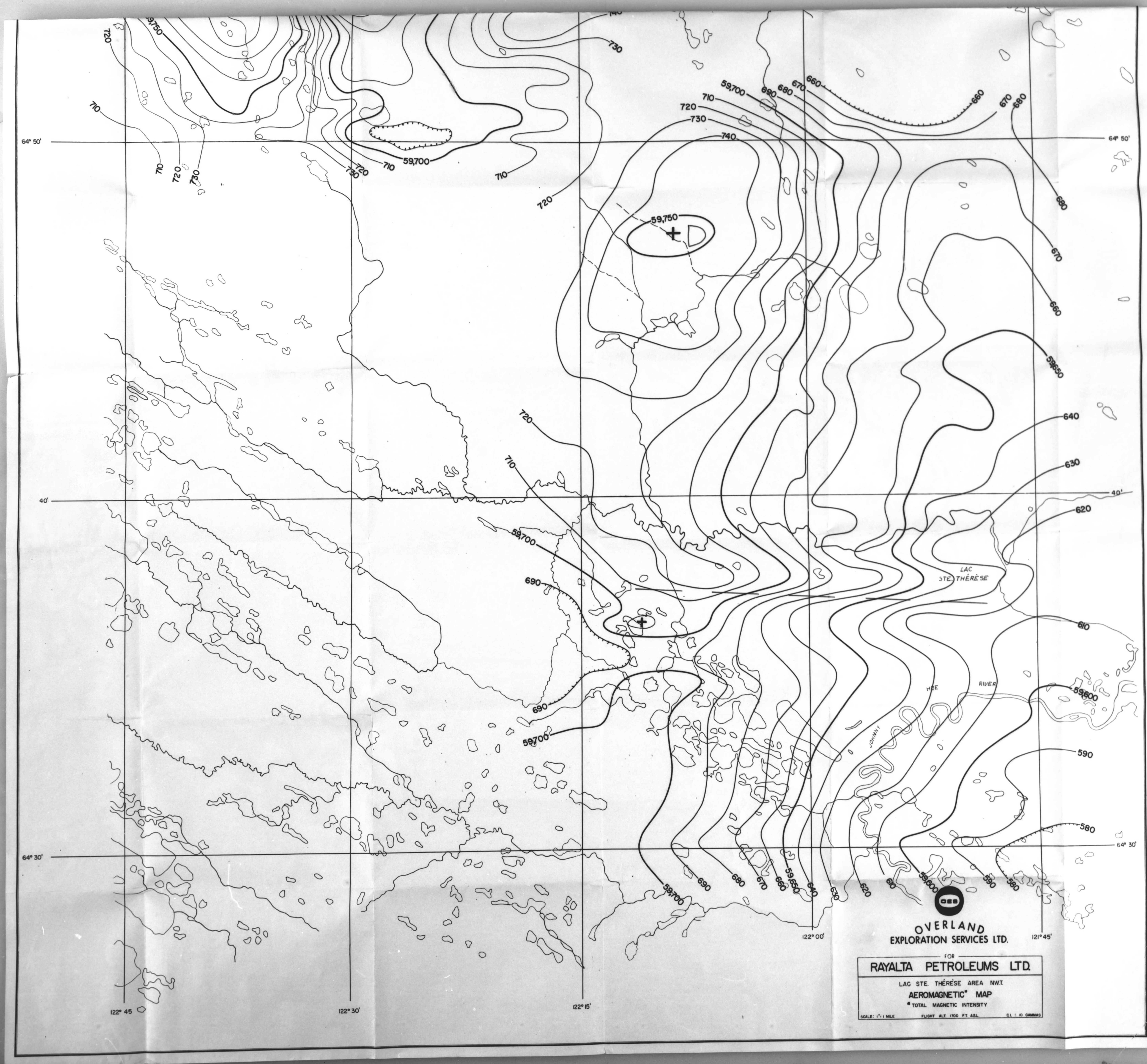

122° 45'
122° 30'
122° 15'
122° 00'
121° 45'
65° 00'
64° 50'
40'
KEITH ARM
(GREAT BEAR LAKE)
A
B
C
D
59,550
59,600
59,650
59,700
59,750
59,800
59,850
LAC
STE. THÉRÈSE
HOE
RIVER
JOHNNY
740
730
720
710
690
680
670
660
650
640
630
620
610
590



OVERLAND
EXPLORATION SERVICES LTD.
FOR
RAYALTA PETROLEUMS LTD.
LAC STE. THÉRÈSE AREA NW.T.
AEROMAGNETIC* MAP
* TOTAL MAGNETIC INTENSITY
SCALE: 1" = 1 MILE
FLIGHT ALT. 1700 FT. ASL.
C.I. : 10 GAMMAS
LAC STE. THÉRÈSE
HOE RIVER
JOHNNY
64° 50'
40'
64° 30'
122° 45
122° 30'
122° 15'
122° 00'
121° 45'


2 of 2

# AERIAL MAGNETIC SURVEY

OF THE

LAC STE. THERESE AREA, N.W.T.

P. & N.G. PERMITS 5076 TO 5081

FOR

GROSMONT OIL & GAS LTD.

BY

SPARTAN AIR SERVICES LTD

INTERPRETATION BY: D. K. Y. CHEN

OF

RAYALTA PETROLEUMS LTD.

662-7-5-31

GENERAL INTRODUCTION
of
AEROMAGNETIC SURVEY

Aeromagnetic survey provides the prime advantage of eliminating distrubing magnetic effects from near surface irregularities which make it difficult to recognize low-gradient anomalies from deep-seated geologic features.

In exploring new areas for petroleum or minerals, particularly unmapped sedimentary basins, the airborne magnetometer is often used as a device for making preliminary estimates of the thickness of the sedimentary section. The premise is that sedimentary rocks are generally non-magnetic, so that any magnetic anomalies must originate from within the igenous crystalline complex i.e. Basement. Calculation of the depth to the magnetic material therefore yields an upper limit to the total thickness of the sedimentary strata. In this application only the depth of the source is required and the details of the shape of the magnetic source are not of importance. Note that the magnetometer when placed in the airplane is so far above the magnetic body that the body no longer appears to be two-dimensional no matter how elongated it may be. Therefore, two-dimensional models are of little value in aeromagnetic interpretation.

In magnetic prospecting one looks for variations in the earth's magnetic field which can be attributed to anomalous magnetic properties in relatively shallow sub-surface rocks. These variations could result from changes in depth to buried magnetic rocks, from changes in its susceptibility, or from both. Since few sedimentary rocks are appreciably magnetized the magnetic method will generally give information only on igneous rocks or one ore deposits with magnetic constituents.

The interpretation of magnetic maps may seem at the outset to be an ardous task since it is, at least theoretically, possible for an infinite number of magnetic mass distributions to produce a given anomaly. Nevertheless, through the solution of simplifying yet reasonable assumptions it becomes possible to make estimates of the depth to magnetic sources.

It is assumed that anomalies large in areal extent and amplitude are usually due to lithologic contrasts in the Basement complex rather than to the relief of the Basement surface. This assumption is based on theoretical considerations, because sharp topographic rises in the Basement rocks will yield anomalies of relatively small amplitude. It is assumed further that the Basement rocks are either magnetized by induction in the earth's magnetic field or have a remanent magnetization in the direction of the field and that this magnetization is constant with depth. Large bodies in the Basement may not be petrologically homogeneous; nevertheless, a reasonable approximation can be made for the average magnetization of the entire mass, even though some rocks have a large remanent magnetization or random orientation in comparison to their induced magnetization. With these fundamental assumptions, computations can be made of the magnetic field for variously shaped models of the Basement rocks from which the depth of magnetic sources is estimated.

## INTERPRETATION
## of the
## TOTAL MAGNETIC INTENSITY MAP

The areomagnetic map of the Lac Ste. Therese area reveals that the regional field generally increases towards the northwest. However, due to a lack of information in the northeast and southwest portions of the surveyed area it is difficult to outline the exact magnetic relationship between the unsurveyed and surveyed regions. Nevertheless, it is interesting to note that the magnetic anomalies present in the northwest and southeast portions are significant not only for their large amplitude but also for their considerable areal extent. Unfortunately no geological information is available and it difficult to interpret these magnetic anomalies in terms of certain geologic features.

The prime anomaly in the northwest region is composed of several highs and lows. They are distributed side by side in an north-south trend. In view of their large amplitude and areal extent these anomalies may be caused by two blocks of different lithologic rocks having different magnetic susceptibility. The boundary between them is probably a fault (marked by red lines). Judging by the well defined elongated shape of the magnetic anomaly "A" it seems reasonable to suspect that this prominent anomaly may also be effected by Basement topography. This possible fault originates within the Basement and the "magnetic high" block is situated on the upthrown side of the fault. From model studies we deduce that this anomaly may have a source, at a depth of approximately 6,000 feet below surface.

There is strong evidence of faulting (marked by dashed red lines) in the area west of the Lac Ste. Therese. This possible fault seems to also originate from within the Basement because of the sharp disruptions between two different magnetic patterns and their persistent changes in patterns over long distances (nine to twelve miles in an east-west direction).

Anomalies "B","C" and "D" with lower and higher magnetic intensity also provide interesting features for further geophysical or geologic investigation. In the Northwest Territories area the regional Pre-Cambrian Basement generally dips to the west and southwest towards the Rocky Mountain trough region. Therefore, this northwest and west rising total magnetic distribution is in contrary to the direction of regional Basement dip. This feature might be caused by the strong earth's magnetic field in high magnetic latitudes and localized Basement lithologic variations as well as by Basement topography.

Therefore, it is significant to state that this small amount of magnetic information does reveal a particular distribution of geologic features in the Lac Ste. Therese area. To determine whether or not these geologic features are related to the special formation in such as reef mass, further detailed geophysical and geological studies are required.

## INTERPRETATION
### of the
### RESIDUAL MAGNETIC MAP

When interpretating any "potential field" data (like those of magnetics and gravity), a through removal of the regional trend may help somewhat towards resolving the anomalies. On contoured maps a suitable array of points were chosen and at each array point or grid point the average value of the field on a circle of suitable radius around the point was evaluated. By substracting this average from the actual value at the grid point the so-called "residual" was obtained. It has been proven by Griffin (Geophysics Vol. 14, No. 1, 1949) that

(a) the number of points used for averaging has hardly any effect on the final residual value,

(b) increasing the size of the circle increases the magnitude of the residual in a non-linear fashion up to a limit, and,

(c) the size of the circle does not

alter the lateral position relations to the maximum and minimum when compared with the original map.

For the Lac Ste. Therese area a length of 6,000 feet is chosen as the radius of the circle because 6,000 feet is the estimated thickness of sediments in this area. As we know the radius must be large enough so that the circle will lie completely outside the local anomaly area, but not so large as to include other anomaly areas.

This residual magnetic map shows that most of the regional magnetic trend in the south-east portion of the map has been removed and in the northwest portion the residual anomalies are more or less in similar locations as shown on the Total Intensity Map. This fact demonstrates that strong magnetized masses occupied a large portion and east of this area a relatively less magnetized mass is present. Between them faulting (marked by red lines) might be present.

The well defined positive anomaly "A" has a source depth of approximately ± 5,500 feet below surface, which differs ± 500 feet compared with the depth calculated from the Total Intensity Map. This ± 500 feet difference may indicate either Basement topography or a relief of magnetic rock above the Basement or the combination of both or even the errors of depth estimation. However, the anomaly "A" is too significant to ignore. The negative anomalies "B", "C" and positive anomaly "D" in the northwest portion of the Lac Ste. Therese area also provide interesting features for detail geophysical and geological study. Magnetically, reef structures often show negative anomalies when a reef or reef trend surrounded by formation having higher magnetic susceptibility but not associated with a Basement high or other structural features. However, positive magnetic anomalies may also reflect reef existence if the reef or reef trend overlies and is associated with a Basement high. Generally speaking, sharp topographic rises in

Basement rock will usually yield anomalies of relatively small amplitude. In view of the large amplitude of anomaly "A" it is probable that this anomaly is mainly caused by higher susceptibility rocks within the Basement and possibly by very small effects of Basement topographic relief.

There is quite a strong evidence of faulting (marked by dashed red lines) in the southeast portion of the surveyed area. This fault separates two blocks of different lithologic rocks. The one north of this fault seems to possess higher susceptibility than the one south of the fault. However, this difference may be involved with the faulting. There are also several not well-defined smaller magnetic features in this region which probably reflect inhomogeneitics in the magnetic rocks.

# INTERPRETATION
# of the
# SECOND VERTICAL DERIVATIVE MAGNETIC MAP

As we know when interpreting any "potential field" data (like those of gravity and magnetics) one soon begins to feel a need for looking at the anomalies under high resolution. A complete removal of the regional itself helps somewhat towards resolving the anomalies but is still far from the ultimate objects, because, for some reasons the common regional-residual separation method is difficult to apply. This makes direct use of the fact that nearby sources, even though they may be small, have a great influence on magnetic gradients (also gravity gradients) than on magnetic (gravity) itself. Accordingly, there is good reason to expect that local features will show up more prominently on the map of one of the derivatives of intensity (magnetic or gravity) than on the map of intensity itself, thus pointing out the places where residual anomalies may be found.

Theoretically, the Second Vertical Derivative of intensity $\frac{d^2 H}{d Z^2}$ can be shown to be practically the same as the "Grid Residual" as far as resolving power is concerned, and the two are related by the following simple function.

Second Vertical Derivative =

$$\frac{(\text{Grid Residual}) \times \text{Constant}}{(\text{Grid Spacing})^2}$$

These two results differ only in the magnitude of the horizontal gradient. The location of the maximum, as well as the minimum and zero contours will appear in exactly the same positions.

It might be worthwhile to give ourselves a better understanding by having a brief description concerning the theory of the Second Vertical Derivative. The basic principle underlying the preparation of the Second Vertical Derivative of magnetic (or gravity) intensity is contained in the Laplace's Equation which holds for any field distribution derivable from a potential. The equation is: $\nabla^2 H = 0$ or

$$\frac{d^2H}{dx^2} + \frac{d^2H}{dy^2} + \frac{d^2H}{dz^2} = 0 \qquad (1)$$

It states that the algebraic sum of the three Second Derivative in three mutually perpendicular directions should always be zero. By transposition we get:

$$\frac{d^2H}{dZ^2} = -\left\{\frac{d^2H}{dX^2} + \frac{d^2H}{dY^2}\right\} \qquad (2)$$

The quantity of the left side of above equation is the one we are searching for and the quantity on the right side should be derivable from an ordinary intensity map in two dimensions. For deriving this, one considers the average value of a function H (X, Y, Z) (Such as the field magnetic intensity) around a circle of radius, r whose center we call the origin. If $\overline{H}(r)$ is the average value this can be expressed into a power series in r about r = 0. Thus;

$$\overline{H}(r) = b_0 + b_2 r^2 + b_4 r^4 + \cdots \qquad (3)$$

and $\left[\frac{d^2H(X,Y,Z)}{dZ^2}\right]$ at origin $= -4b_2$ [2nd Derivative]

The coefficient $b_2$ is obtained by solving the equation (3) and given as:

$$b_2 = N_0 \bar{H}(0) + N_1 \bar{H}(1) + N_2 \bar{H}(\sqrt{2}) + N_3 \bar{H}(\sqrt{5}) + \cdots \quad (4)$$

where No, $N_1$, $N_2$ are the so called "weighting coefficients". $\bar{H}(O)$ is the central value of field, $\bar{H}(O)$, $\bar{H}(\sqrt{2})$ & $\bar{H}(\sqrt{5})$ are the average values of field around circles of radii $1, \sqrt{2}$, & $\sqrt{5}$ times the grid spacing.

There are several equations for Second Deriatives by the different treatment of the weighting coefficients from different authors. For various reasons we prefer to choose the No. (13) equation by Elkins which is expressed as follows:

$$\frac{d^2H}{dZ^2} = \frac{1}{60S^2}\left[64\bar{H}(0) - 8\bar{H}(S) - 16\bar{H}(S\sqrt{2}) - 40\bar{H}(S\sqrt{5})\right] \quad (5)$$

S is the grid spacing in either miles or kilometers. Grid spacing has a very strong control on the "noise" which represents all the undesired anomalies generated by shallow sources. In other words by choosing a suitable grid spacing to bring an anomaly into sharp focus which is often vitiated by the appearance of a series of fictitious anomalies around and masking the actual object of interest. Besides the wise choice of grid spacing, the weighting coefficients on each circle also play a important role to the separation of "noises". Derivative (second or fourth) maps, however, are difficult to interpret quantitively. This is largely because the instability of interpretations due to imperfections in the data with each differentiation. Nevertheless derivative maps provide the same resolving power as does the residual map. Furthermore, as far as magnetic data is concerned, Second Vertical Derivative Maps are useful not only in determining depths to Basement but also in bringing into greater prominence the geologic features that have only slight expression in the magnetic field. They also help delineate those geologic formations which are magnetic. For large anomalies in particular this delineation is accomplished by the zero contour.

In other words, the zero contour of a large magnetic anomaly can be considered as a clue to define the boundary between two different lithology rocks.

The Second Vertical Derivative Magnetic Map shows similar anomalies to those shown on the Residual Map. In the northwest portion the zero contour delineates two different geological formations. The positive anomaly "A" indicates higher magnetic susceptibility rocks in that region. East of this zero contour the anomaly "B" may represent lower magnetic material. There is a strong indication of faulting separating these two blocks of rocks. The positive anomaly "C" should also be investigated further.

In the southeast portion, minor magnetic anomalies are distributed. However, a fault is strongly indicated in the area west of the Lac Ste. Therese.

As mentioned previously the zero contours of the Second Derivative Map can be used to delineate the geological formation - hence, horizontal dimensions of the theoretical model can thus be obtained by considering the dimensions of the zero contour on the observed map. In determing depth, it is significant that for broad anomalies (at least two-depth-units wide) many of the measurements on the Second Derivative anomalies are independent of the horizontal dimensions on the prism (if the theoretical model is a prism). For this reason, it is preferable to select broad anomalies for depth calculations. Moreover, the Residual Map using the same grid system may be subsituted for the Second Derivative Map since it can be shown that the maximum and minimum zero contours appear at approximately the same prospective positions on both maps.

It has been calculated by these methods mentioned above that anomaly "A" may be originating at a depth of $\pm$ 5,300 feet below the surface and this is more or less close to the depth calculated from the residual anomaly.

## CONCLUSIONS

1. Significant anomalies appear in the northwest corner of the surveyed area indicate that certain particular geological features may be present. This formation is situated at a depth ranging from approximately 5,500 feet to 6,000 feet below surface.

2. The positive and negative anomalies can be theoretically considered to relate to the Basement topography or be caused by magnetized rocks having higher or lower susceptibility with its surrounding formation, but without associated Basement highs or other structural features.

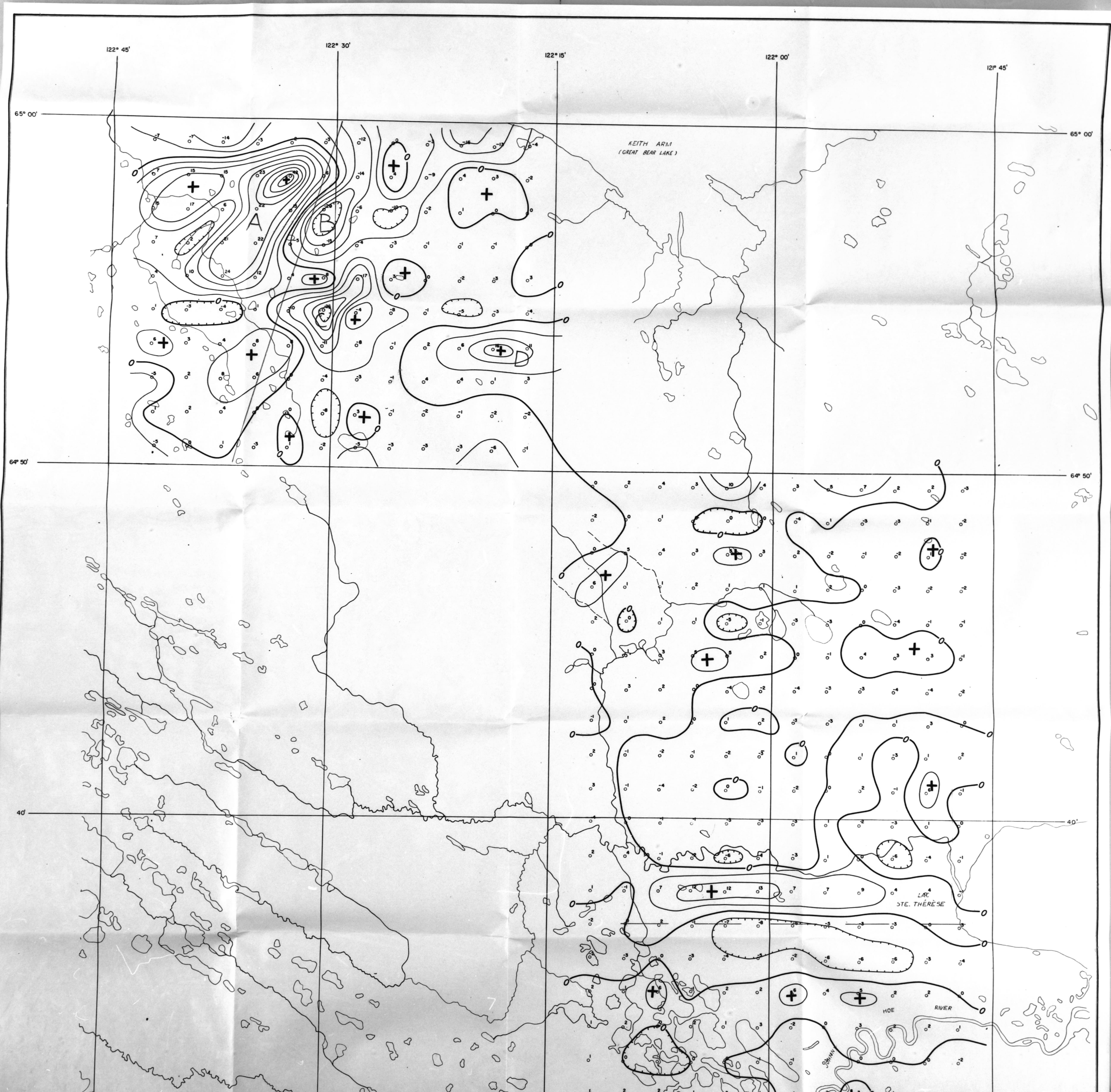
3. Two possible faults may be present in the surveyed area. These tectonic events probably formed certain boundaries between different lithologic blocks of rocks which possess different magnetic susceptibilities.

4. Whether or not these magnetic formations or structures are related with reef material it should be carefully investigated by further geophysical or geological works.

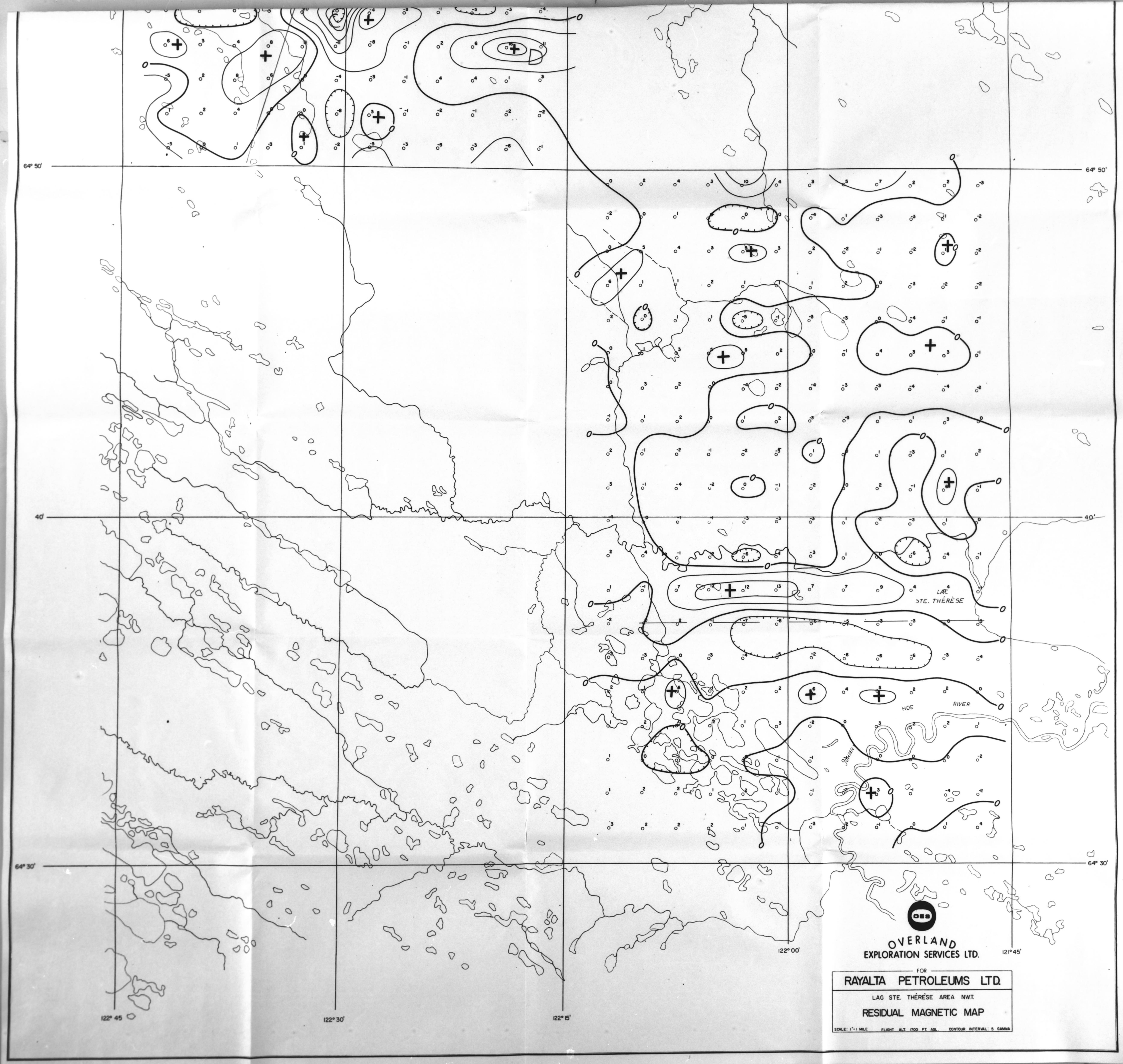
Respectfully submitted by:

RAYALTA PETROLEUMS LTD.

William G. Crook


122° 45'
122° 30'
122° 15'
122° 00'
121° 45'
65° 00'
64° 50'
40'
KEITH ARM
(GREAT BEAR LAKE)
A
B
D
LAC
STE. THÉRÈSE
HOE RIVER

1 OF 2


64° 50'
40'
64° 30'
122° 45'
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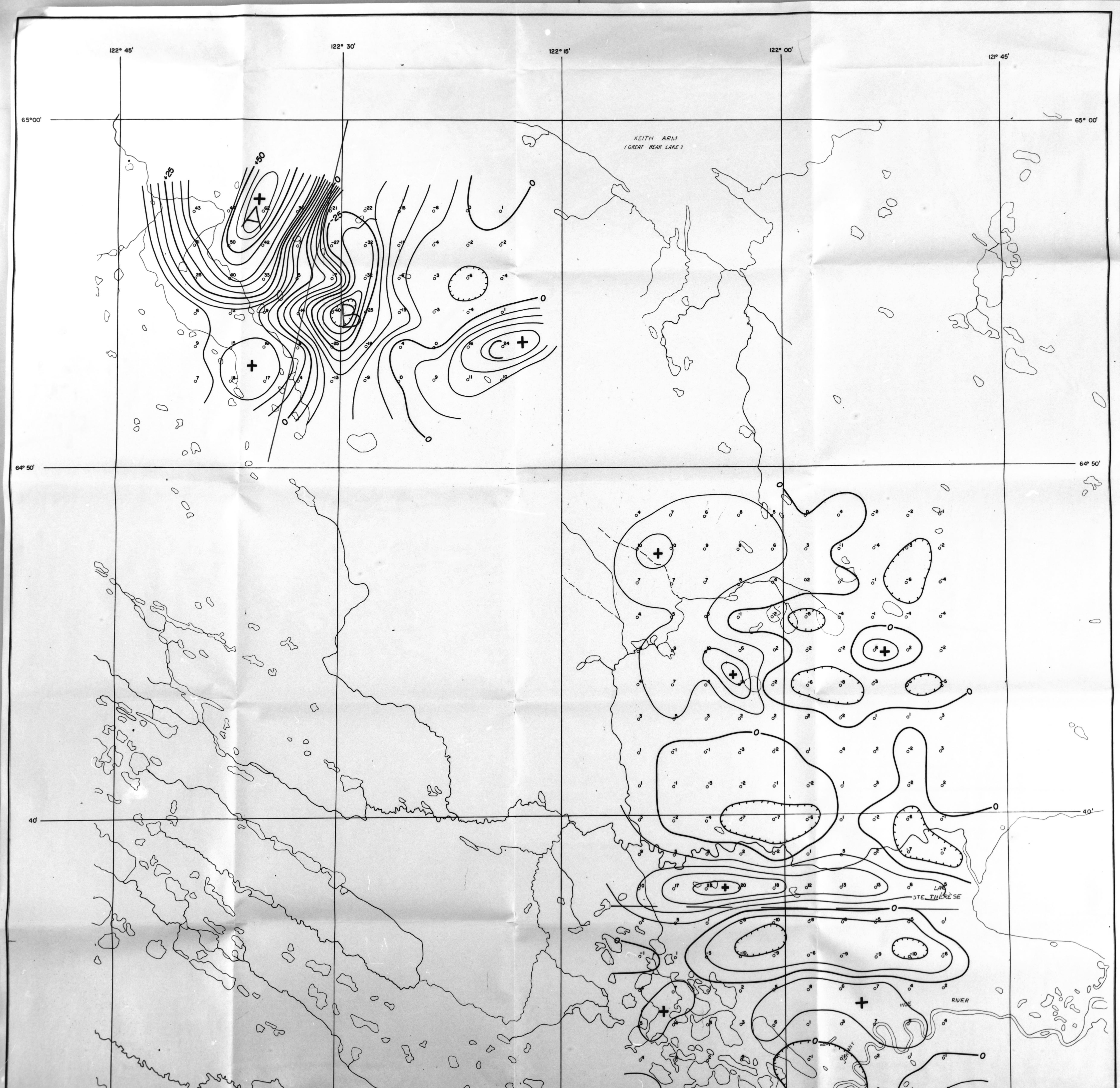
122° 15'
122° 00'
121° 45'
LAC STE. THÉRÈSE
HOE RIVER
JOHNNY
OES
OVERLAND
EXPLORATION SERVICES LTD.
FOR
RAYALTA PETROLEUMS LTD.
LAG STE. THÉRÈSE AREA NW.T.
RESIDUAL MAGNETIC MAP
SCALE: 1" = 1 MILE
FLIGHT ALT. 1700 FT. ASL.
CONTOUR INTERVAL: 5 GAMMA

2 of 2


122° 45'
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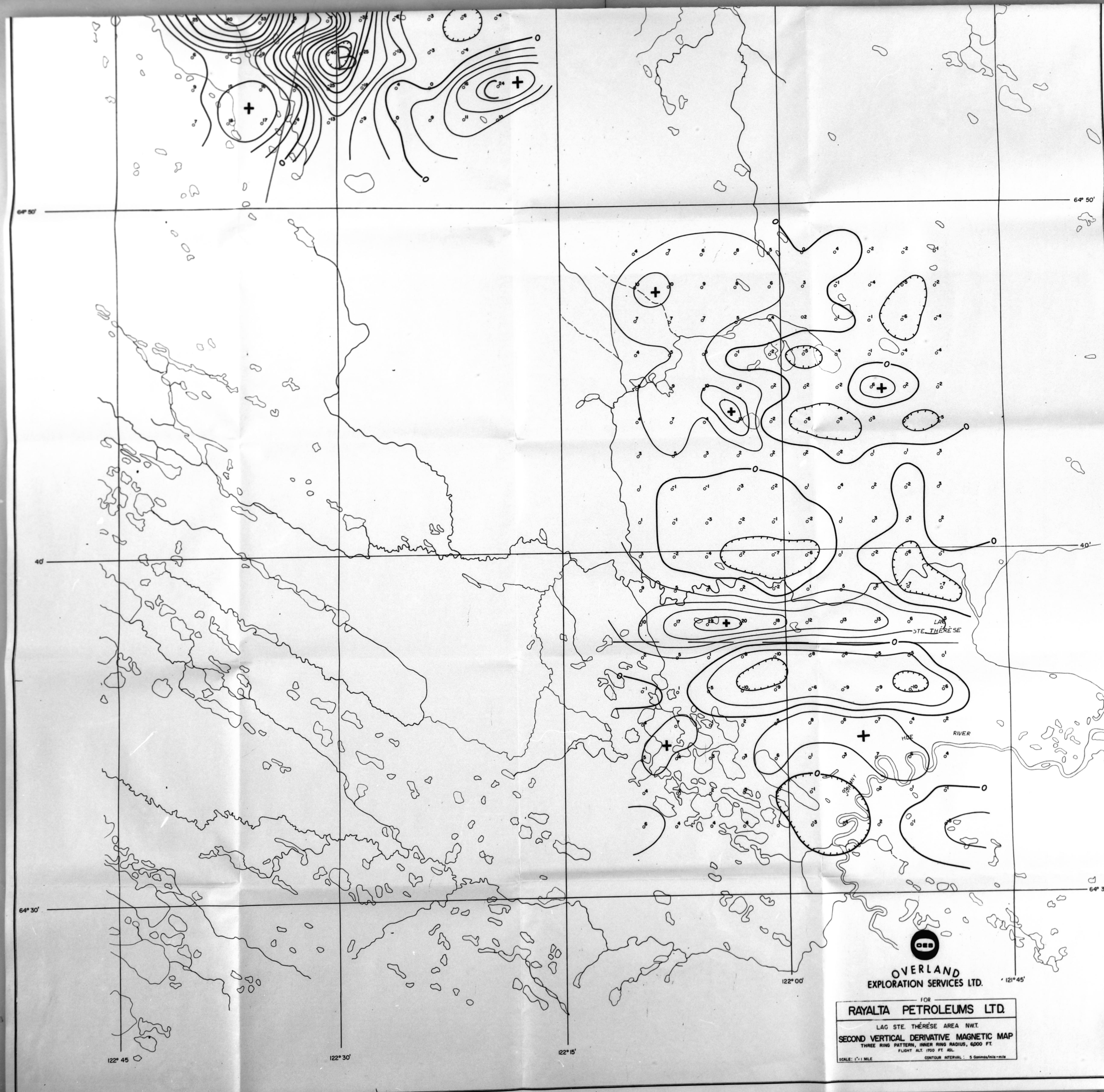
KEITH ARM
(GREAT BEAR LAKE)
LAC
STE. THERÈSE
HOE RIVER

1 of 2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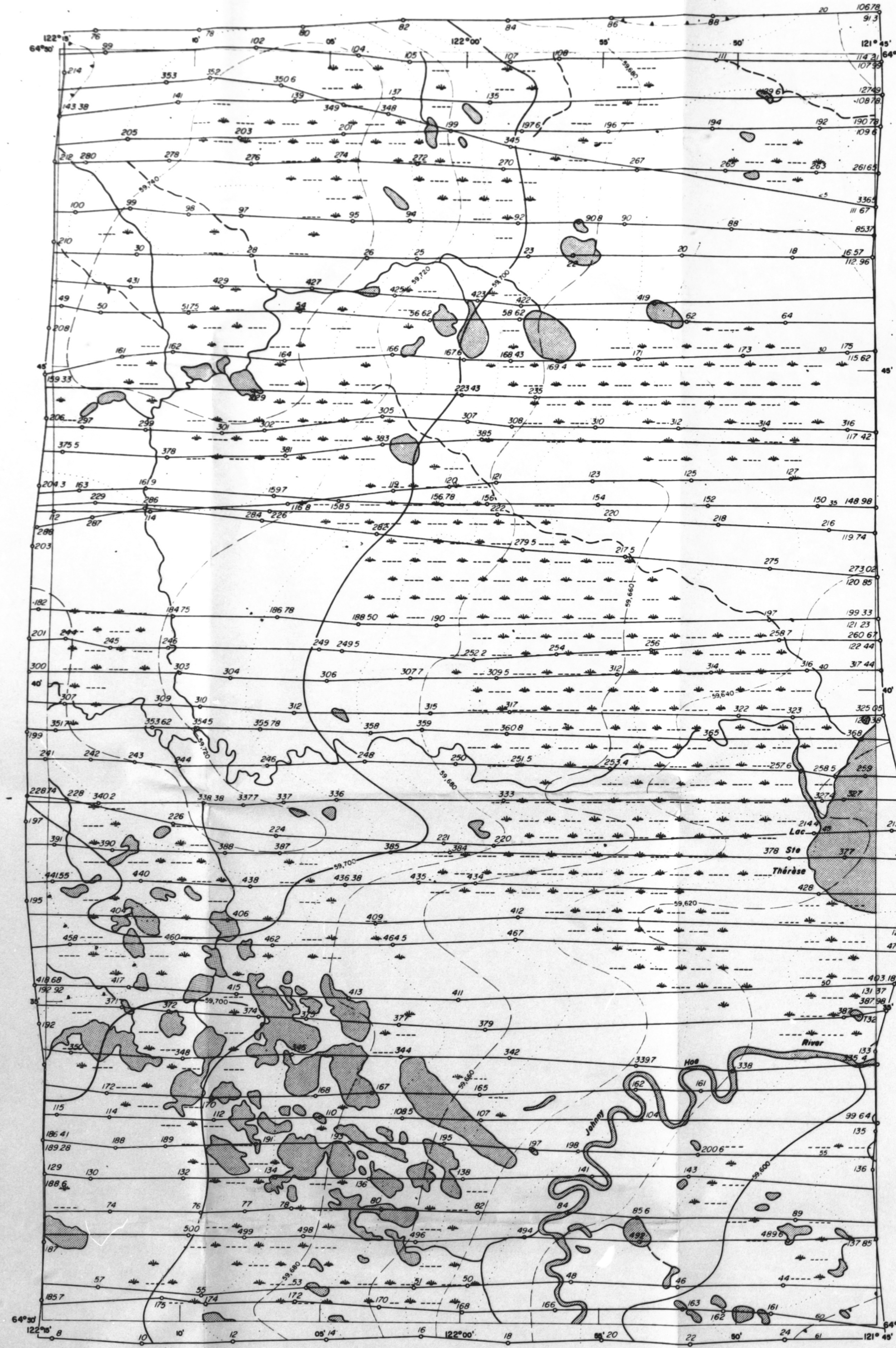
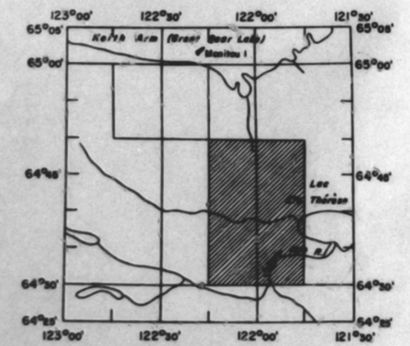
122° 15'
122° 00'
121° 45'
LAC STE. THÉRÈSE
HARE RIVER
OES
OVERLAND
EXPLORATION SERVICES LTD.
FOR
RAYALTA PETROLEUMS LTD.
LAC STE. THÉRÈSE AREA NW.T.
SECOND VERTICAL DERIVATIVE MAGNETIC MAP
THREE RING PATTERN, INNER RING RADIUS, 6,000 FT.
FLIGHT ALT. 1700 FT. ASL.
SCALE: 1" = 1 MILE
CONTOUR INTERVAL: 5 Gammas/mile-mile

2 of 2






AEROMAGNETIC SURVEY

# GREAT BEAR LAKE AREA(2)

## NORTHWEST TERRITORIES

Scale : One Inch to One Mile = $\frac{1}{63,360}$

Miles

1 ½ 0 1 2 3

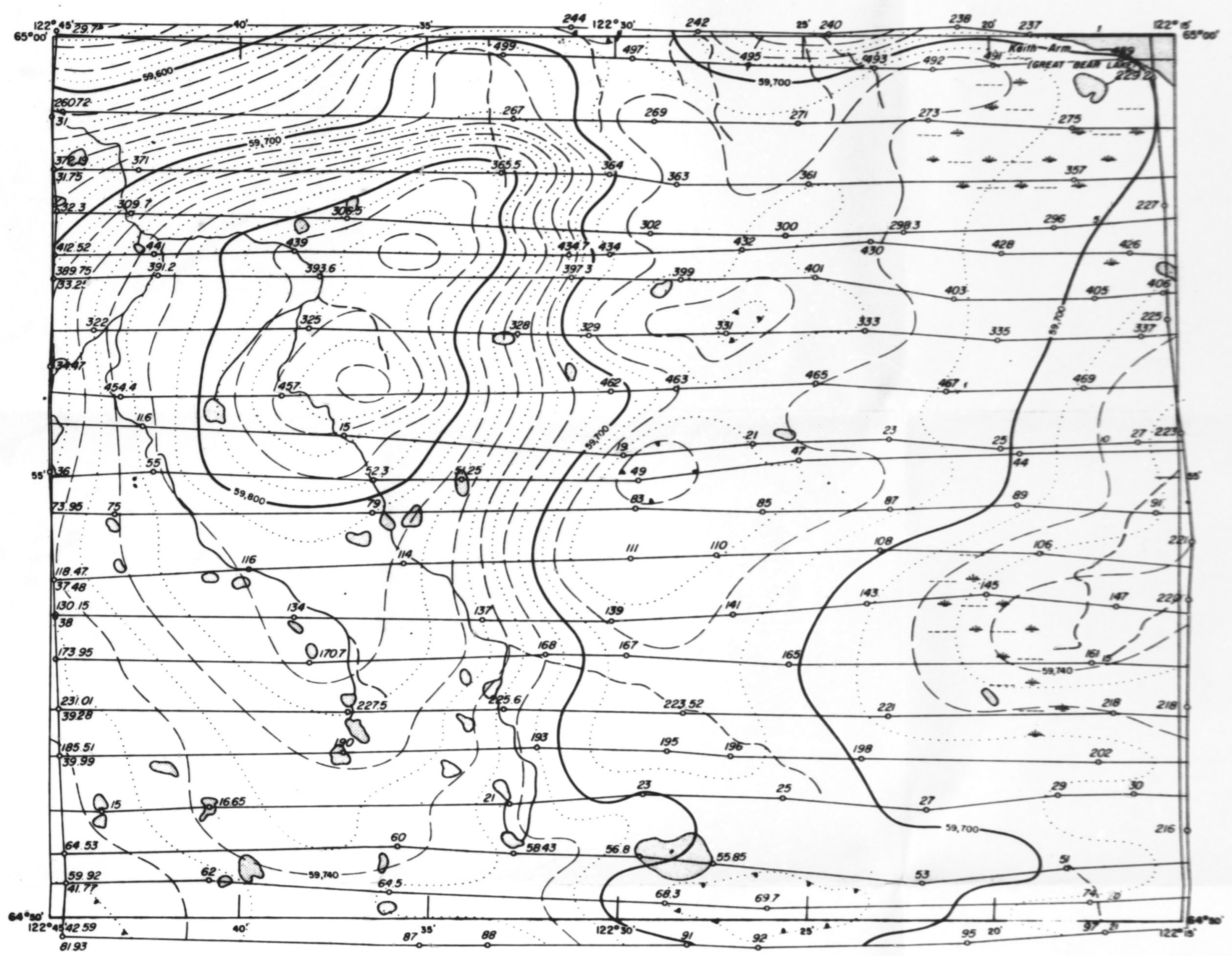
ISOMAGNETIC LINES (absolute total field)

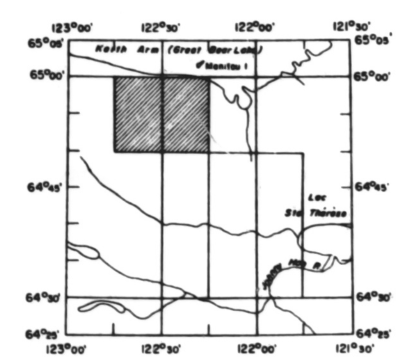
500 gammas
100 gammas
20 gammas
10 gammas
Magnetic depression

Flight lines
Flight altitude 1700' ASL

Regional was removed at the rate of 7 gammas per mile both east west and north south.

SPARTAN AIR SERVICES LIMITED,
OTTAWA, CANADA






AEROMAGNETIC SURVEY

# GREAT BEAR LAKE AREA(1)

## NORTHWEST TERRITORIES

Scale One Inch to One Mile = $\frac{1}{63,360}$

Miles

1 ½ 0 1 2 3

ISOMAGNETIC LINES (absolute total field)

500 gammas
100 gammas
20 gammas
10 gammas
Magnetic depression

Flight lines
Flight altitude 1700' ASL

Regional was removed at the rate of 7 gammas per mile both east west and north south.

SPARTAN AIR SERVICES LIMITED,
OTTAWA, CANADA