


OVERLAND
EXPLORATION SERVICES LTD.

FOR
GOLDEN EAGLE
OIL AND GAS LIMITED
KELLER LAKE AREA
PERMIT No. 5321
RESIDUAL GRAVITY MAP
SCALE 1:1 mile
CONTOUR INT. 20 ft

GRAVITY AND MAGNETIC SURVEY
OF P. & N.G. PERMIT NO. 5321

KELLER LAKE AREA

N.W.T.

GRAVITY SURVEY

of the

KELLER LAKE AREA, N.W.T.

(PERMIT NO. 5321)
(64° 00' N. 121° 30' N.)

for



GOLDEN EAGLE OIL AND GAS LIMITED

by

OVERLAND EXPLORATION
SERVICES (1969) LTD.



Prepared by: W.T. Sall

April, 1970.

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MAGNETIC SURVEY

STRATIGRAPHY

CONCLUSIONS

GENERAL

In February 1970, Overland Exploration Services (1969) Ltd., conducted a gravity survey for Golden Eagle Oil and Gas Limited on Petroleum and Natural Gas Permit No. 5321 in the Northwest Territories. In all, 61 miles of combined gravity and magnetics were run and 287 stations were recorded.

This work was operated from an Overland camp located 15 miles southwest of Keller Lake. Four-wheel-drive vehicles were used for transport to and from the lake and ski-doos were used for the actual gravity and magnetic operations on the frozen lake surface.

WEATHER & TERRAIN

This Permit is situated about 90 percent on Keller Lake itself with only a portion along the south boundary plus another small area in the northwest corner being on land. Of this current program 6 3/4 miles were run on land with the remainder being situated on the ice of Keller Lake.

The weather during the survey period was typical for the Northwest Territories winter months. The daily temperatures ranged from zero to 30 degrees below zero with a very slight amount of snowfall.

SURVEY & FIELD
PROCEDURE

With the majority of the survey being run on ice the vertical survey required was negligible. The only levelling that had to be done was the 6 3/4 miles of survey run on land.

Stations were laid out across the ice with pickets and distances between stations measured by stadia. Soundings of the lake bottom were taken at various intervals to aid with a water depth correction for the gravity processing.

The gravity work was conducted with a LaCoste & Romberg Model G gravity meter using the repeat station check method. In this system of metering every run contains several repeat stations from other runs; thereby giving a continuous check on the meter repeatability. The widest divergence found on

the repeated stations was 0.05 milligals with the majority falling in the 0.00 to 0.02 range. All station runs from Base were made on a 2 1/2 hour time interval. Daily plots were made of the Base readings and diurnal tidal drift was corrected to these plots.

DATA

TECHNICAL DATA

- Bouguer Free-Air-Correction
was made to a Sea Level datum.
- Bouguer Free-Air-Factor used
was 0.065.
- Density 2.3
- Meter Constant 1.0556
- Latitude Correction
- No terrain corrections were needed.

DATA PRESENTED

- Bouguer Gravity Map
- Residual Gravity Map
- Bouguer Gravity Profiles
- Depth of Lake Map
- Data Sheets
- Survey Data

- Interpretation
- All field data has been processed
in Overlands Programma 101 computer.

INTERPRETATION

The interpretation of the Keller Lake gravity program is based on the Residual and Bouguer Gravity Maps. From the mapped data we have attempted to:

- (1) Evaluate the depth of sediments
- (2) Define mass distribution which may have a source relatable to Basement surface topography.
- (3) Isolate density variations that may emanate from within the sedimentary section and relate these variations to some assumed geological parameters.

The following is a discussion of the gravity maps.

BOUGUER MAP

The Bouguer Map displays a west dipping regional gradient which strikes north-south across Keller Lake. On this map we can see two prominent features:

- (1) A steepening of gradient on the west portion of the survey.
- (2) A nose trending northwest-southeast through the center of the project.

The steepening of gradient (we feel) relates to a sharper dip in the Basement on the west side of Keller Lake. We have marked the edge of this event with a red line on the Bouguer Map. This steepening of gradient probably represents a hinge effect on the Basement; further, this hinge is the edge of a suspected shallow Basement platform lying to the east of Keller Lake which strikes northwest-

southeast. West of the hinge line there is a very good possibility that the thickness of the sedimentary section increases very rapidly.

The second feature appearing on the Bouguer Map is a density high nose which is parallel to and lies east of the above mentioned hinge line. This feature is well defined on the Residual Map and is discussed at length in that section of the report.

RESIDUAL MAP

The Residual Gravity Map of the Keller Lake Project represents the difference between observed Bouguer Gravity and a Regional Gravity gradient. The Gravity gradient is constructed in a manner which attempts to filter out all events emanating from deep within the Basement. The remaining residual maxima and minima density anomalies are then construed to be sourced either near the Basement surface or from within the sedimentary section.

The Keller Lake Residual Gravity Map displays one large positive residual anomaly located near the middle of the area. The southwest flank of this positive is sharper and better defined than the northeast flank, but, we feel that the source of the density contrast is the same for both edges. Working with the southwest edge we feel that the depth to source is a maximum of 4,000 to 5,000 feet below surface.

Probably the anomaly is shallower than this estimated depth, and we are looking at structure on the Basement surface. When we use a moderate density contrast to investigate such Basement topography quantitatively we find that there must be 150 feet or more relief involved with this gravity high. We can only assume that this residual positive is associated with the suspected hinge line which lies slightly to the southwest of the axis of the residual anomaly.

BOUGUER PROFILES

The Bouguer Profiles form a density cross section of the area. The large residual high is well defined on the profiles and it is from these lines that the two dimensional investigations were made. Lines 2, 3, 4 and 5 show the break in gradient which we assume to be the steepening in the Basement gradient (hinge line).

CONCLUSIONS

We feel that the Keller Lake Permit is located on the west edge of a high Basement platform. The western third of the Permit appears to be in the hinge line area (thickening sediments), but it is doubtful if very much section will be gained by the time the west boundary of the Permit is reached. The one feature of interest is the suspected Basement high striking northwest-southeast through the center of the Permit and which has been discussed in the Residual Map section of this report. This could represent a Basement topography of 150 feet or more and may form a structural high in the overlying sediments.

Respectfully submitted by:

OVERLAND EXPLORATION
SERVICES (1969) LTD.

W.T. SALT

WTS/jp

STRATIGRAPHY

The sedimentary section under Petroleum & Natural Gas Permit No. 5321 is about 2,400 feet thick and the Ordovician, Devonian and Cretaceous systems are represented. The section may be somewhat thicker in the southwest corner of the Permit. An unconformity is present between the Ordovician and Devonian systems; (between the Chedabucto Lake Formation and the Chinchaga Formation) and another is present between the Devonian and the Cretaceous. The Ordovician is mostly clastics with some amount of carbonate while the Devonian section is composed of evaporite and carbonate rocks. The Cretaceous is composed of clastics.

ORDOVICIAN

The Ordovician section is about 650 feet thick and is divided into the Old Fort Island, La Matre

Falls and Chedabucto Lake Formations. The section is mostly shales and carbonates with dolomite and limy dolomite being the dominant carbonate rock type. A sandstone unit occurs at the base of the section.

OLD FORT ISLAND FORMATION

The Old Fort Island Formation is the oldest Paleozoic rock unit present in the area north and northwest of Great Slave Lake. The unit is probably a "Granite Wash" type of deposit and where exposed in outcrops consists essentially of sandstone. Norris (1962) describes the unit as "consisting of thin to thick bedded, fine to coarse grained, varicolored but mainly white, friable, quartzose sandstone; some thin beds of greenish gray and dusky red siltstone; and occasional laminae and partings of green shale". The sandstones are usually porous and often friable. Norris's description of this unit sounds very similar to the present writer's description of the Granite Wash Formation as present in the Red Earth Oil Field in Township 87, Range 8,

West of the Fifth Meridian (Alberta).

As the Old Fort Island Formation has yielded no fossils as yet its exact age is unknown and a similar age problem exists with the Granite Wash in northern Alberta. However, both formations appear to be conformable with the overlying beds and both are often confined to topographic low areas on the Pre-Cambrian Shield. The age of the Old Fort Island Formation is, therefore, probably Middle Ordovician, but older than the La Matre Falls Formation. The sandstone beds of this unit are an excellent potential reservoir.

LA MATRE FALLS FORMATION

The LaMatre Falls Formation is 300 to 350 feet thick in the region under discussion, and consists of red and green shale, fine to coarse grained sandstone and silty to sandy dolomite. The base of the La Matre Falls is often an argillaceous silty,

oolitic limestone with some sandy and conglomeratic dolomite and sandstone. Gypsum and salt are also often present.

The shales are platy, fissile and are vari-colored with red and green being the most common color, but pinks, brown and gray also being present, silty to sandy and at times slightly dolomitic. The sandstone beds are medium to light gray, and fine to coarse grained. Where the sandstone lies directly on the Pre-Cambrian Shield it is often arkosic and in this area it is a "Granite Wash". Grapholite remains, date this formation as Middle Ordovician. The sandstone and dolomite members of this formation are good potential reservoir horizons.

CEDABUCTO LAKE FORMATION

The Chedabucto Lake Formation is about 200 to 250 feet thick in the vicinity of the Permit and the unit consists of massive, cliff-forming

dolomites some of which are sandy and conglomeratic. Norris (1962) describes the formation "consists of a thick bedded to massive, highly resistant, scarp-forming, fine grained, granular, in places minutely vuggy, medium brown dolomite, commonly weathering a pale orange or orange-brown in the south, and a yellowish brown and gray in the north". Purple mottling is common and chert is often present. The age of the Chedabucto Lake Formation is Upper Ordovician. The reservoir possibilities of this unit in the subsurface do not appear to be great as only minor vugs are reported from the surface exposures. This formation is overlain unconformably by the Middle Devonian System and the Chinchaga Formation of the Middle Devonian is the overlying unit.

DEVONIAN

The Devonian section is about 1,075 feet thick and consists of the Chinchaga Formation plus units

which are equivalent to the Keg River and Muskeg Formations. The exact sequence present is unknown due to a lack of wells in the area plus the lack of surface knowledge in this northern area. In addition, the Middle Devonian succession in this area is very complex and many abrupt lithologic changes are present. The Chinchaga Formation is recognized as a mapable unit but the units above the Chinchaga cannot be correlated to the northern Alberta type section area.

CHINCHAGA FORMATION

The Chinchaga is about 325 feet thick and in this area the unit consists of evaporites, some minor dolomite plus some dolomite and limestone breccia. The Chinchaga unconformably overlies the Chedabucto Lake Formation and is conformably overlain by younger Middle Devonian beds. Norris (1965) states, "The Chinchaga formation is mostly gypsum....easily eroded and does not produce good

outcrops. The gypsum is generally white, or banded light to dark gray, and weathers to a material of soft, powder, or putty-like consistency when moistened. In places the gypsum beds are contorted and brecciated. One of the more complete sequences of the lower beds of the Chinchaga consist (s) of thickly bedded to massive, pale brown, extremely vuggy, gypsiferous limestone, succeeded by a poorly exposed interval of thinly bedded, light gray weathering limestone, and overlain by massive, cliff-forming pale brown limestone. Within a distance of about 10 miles... there lower beds change to gypsum and brecciated gypsum". Brecciated gypsum and carbonate beds are present through the entire section in the area north of Great Slave Lake.

KEG RIVER EQUIVALENT

The section which correlates with the Keg River Formation is called the Lonely Bay Formation. Norris (1963) describes the lower part of the Lonely

Bay Formation as"massive dark brown aphanitic in part stylolitic limestone; thinly bedded light gray fine grained to aphanitic limestone, weathering orange-brown; irregularly thin-bedded light olive gray to medium gray, fine grained limestone; medium-bedded aphanitic slightly dolomitic limestone; and thinly bedded pale brown slightly argillaceous limestone. A younger section is described as consisting of.. "massive, dark to medium brown, fine grained to fetid limestone, overlain by irregularly thin-bedded medium brown, fine grained to aphanitic limestone interbedded with nodular limestone".

MUSKEG FORMATION EQUIVALENT

In the area north of Great Slave Lake there are units present which correlate to the muskeg of northwestern Alberta. It is up to 500 feet thick in this area and is comprised of a lower 100 feet of bituminous shale; a middle

175 feet of green calcareous shale; and an upper member up to 225 feet thick which consists of gray to white reefal dolomite. This upper member correlates to the Presquile reef of the Pine Point area.

CRETACEOUS

The Cretaceous sediments are about 400 to 800 feet thick depending on surface elevation. The thicker sections are present under the hills.

Lithologically the section consists of dark gray, concretionary, gypsiferous shales. These shales are Lower Cretaceous in age and are probably equivalent to the Peace River and Spirit River Formations of northern Alberta.

TERTIARY

A thin layer of glacial clay, sand boulders and till lies on the surface of the map area. The thickness of these deposits varies from place to place but probably does not exceed 100 feet.

MAGNETIC MAPS

The strike of the Magnetic Map is variable over different areas of the map sheet. In the southeast portion where the contour lines are relatively close, the strike is nearly northeast-southwest and this strike continues over a major portion of the Permit area. Along the north boundary of the Permit the strike swings to nearly east-west and along the west border the strike is nearly north-south along the possible termination of a magnetic high nose. Two features dominate the map. One is a magnetic high area which is present in the southeast corner of the map sheet, and the other is a broad magnetic high nose which occupies the north-central portion of this Permit. A sharp magnetic low area separates these two high areas. The magnetic values drop again to the north of the map. Total magnetic variation within the project area is 216 gammas with the highest reading being 858 gammas while the lowest reading

is 642 gammas. An arbitrary datum was selected for this work and the readings are not relavent to any other work or to any intensity of the earth's field.

The data we have collected leads us to suspect that two northeast-southwest trending faults are present in the central and southeast portions of this Permit area. We have shown the positions of these faults on the Total Vertical Field and Derivative Maps. Regional data has been collected and interpreted to the south and southeast of the Permit area, and indicates that there is a large linear Basement magnetic high southeast of Permit No. 5321 which trends northwest-southeast. The above mentioned fault is the northwest termination of this large magnetic feature. This magnetic high is probably caused by a change in rock-type within the crystalline Basement, and may be accompanied by some topographic relief. Further interpretative work will have to be done before we can take a more positive stand on such a

statement. In any case, this magnetic feature ends rather abruptly in the southeast corner of this Permit. It may well swing to the east, but we do not have enough data to determine this.

The previously mentioned magnetic nose which trends northeast-southwest and which is present over most of the northern portion of the map area is probably caused by a topographic high on the Basement surface due in turn, to a second fault having less displacement. We say this because the contoured spacing is rather broad and the total relief in gammas is something in the order of 100. A contour squeeze is present along the north boundary of the Permit and it could be that further minor faulting is present in this locality.

The Second Derivative Magnetic Map of Petroleum and Natural Gas Permit Number 5321 shows a strike which is roughly equivalent to the strike of the Total Vertical Intensity Magnetic Map. However, the strike of the contours on this map is more pronounced and definitely has a northeast-southwest trend. The strike is parallel to the two suspected faults which are marked on the map. The southern fault probably has the greatest displacement on the Basement. This statement could be subject to question because of the involvement of magnetic intensity emanating from the change in rock-type situated southeast of Keller Lake. However, the Second Derivative Map has attempted to lessen the effect of the deeper and greater intensity contrast to this Basement change. From this we will have to accept the greater magnitude of the southeastern magnetic high as representing greater displacement.

CONCLUSIONS

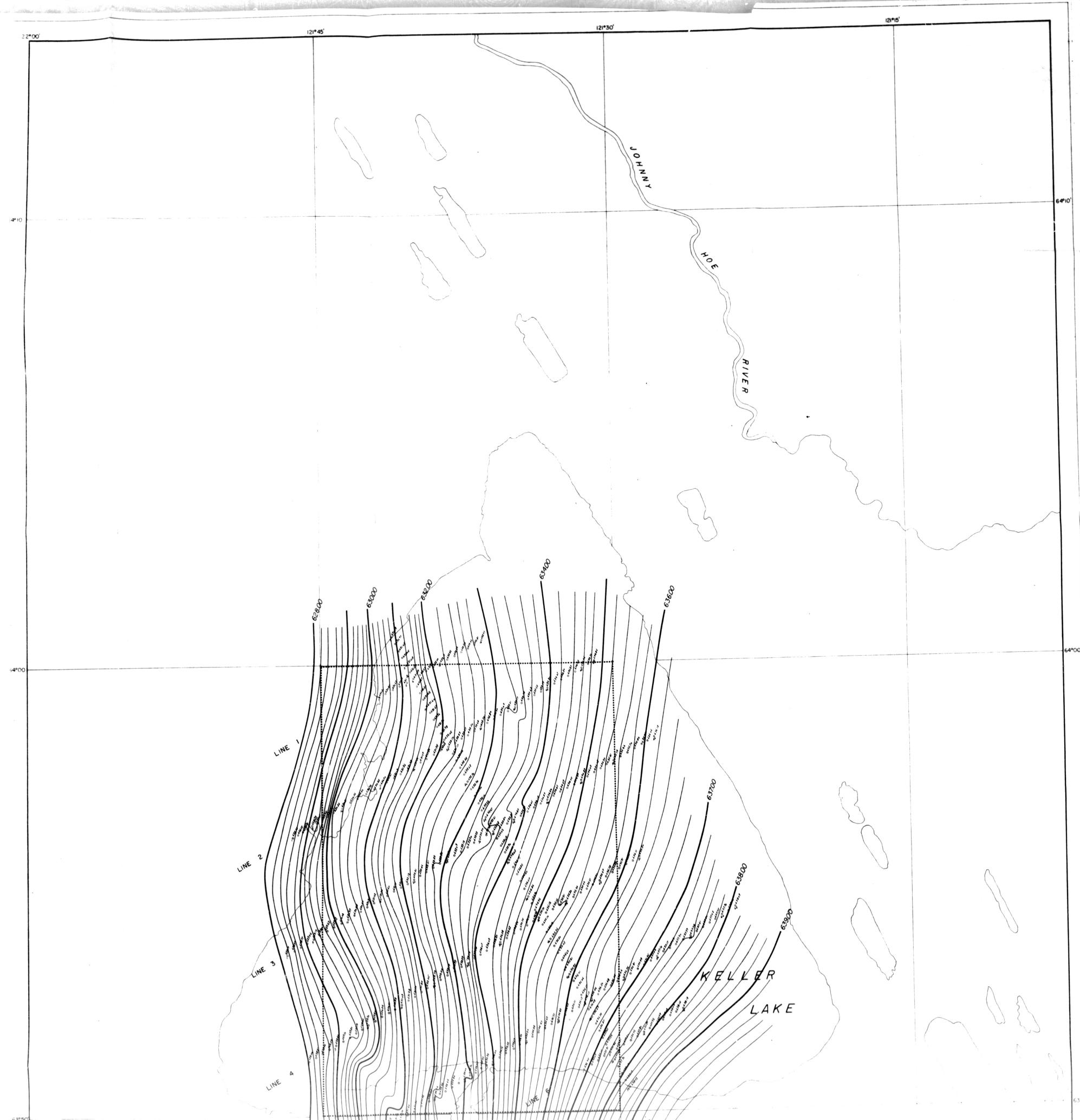
The overall magnetic picture suggests that there is a Basement high in the southeast corner of Keller Lake. From this high we expect to find the Basement dipping steeply to the north and to the west. This dip can be expected to be further steepened by the existence of two faults which are down-faulted to the northwest.

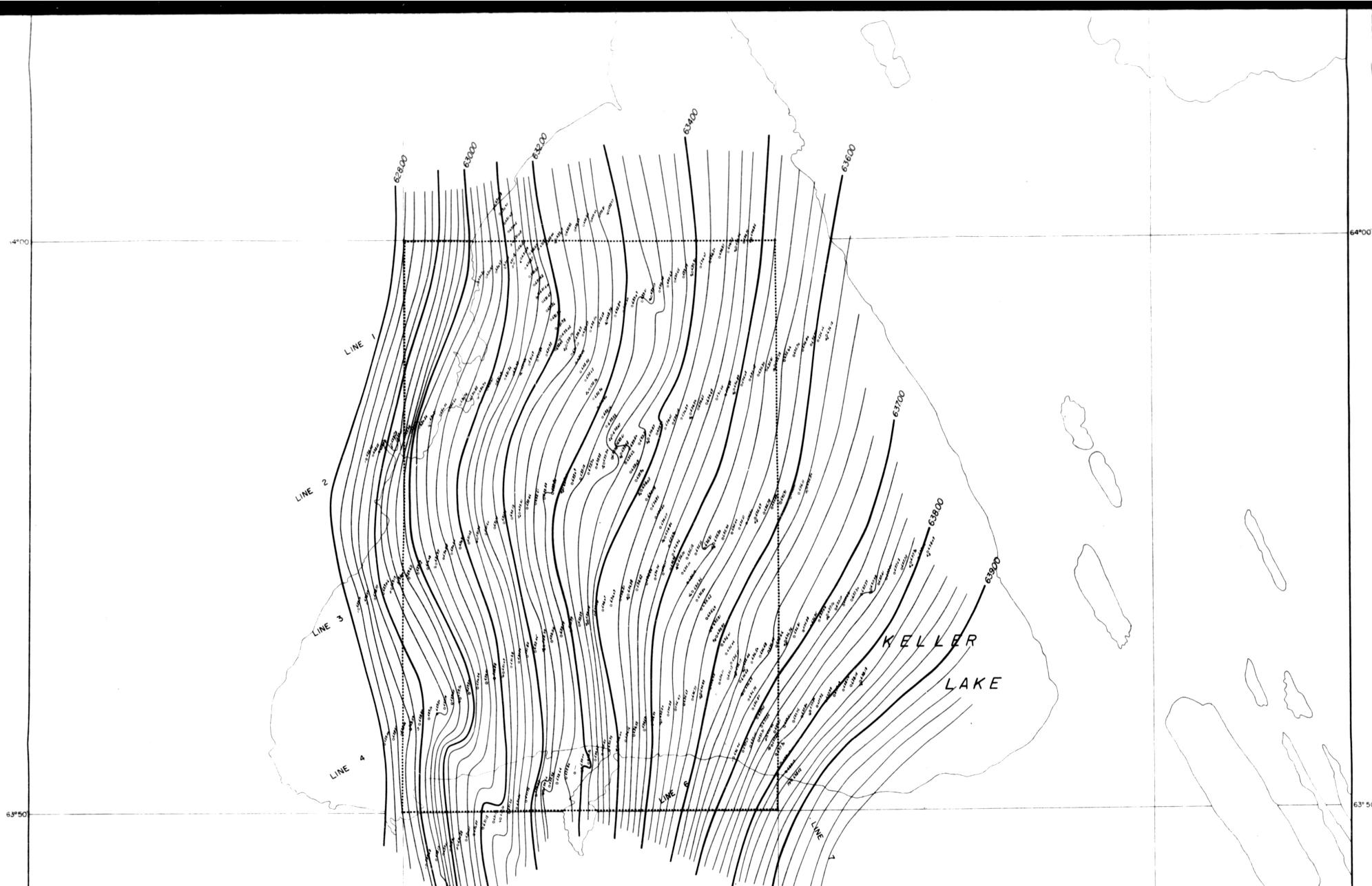
Respectfully submitted by:

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W. T. SALT

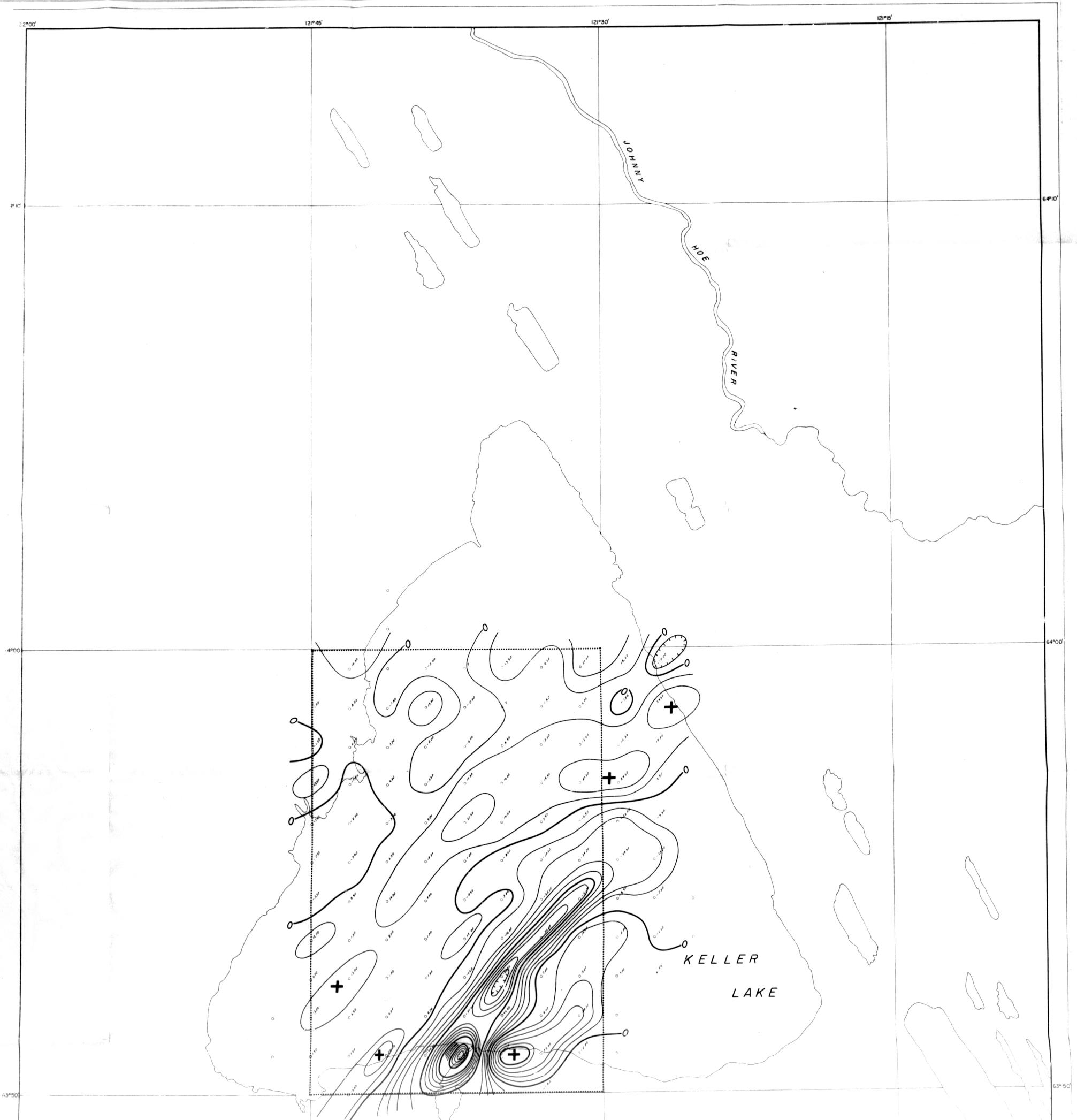
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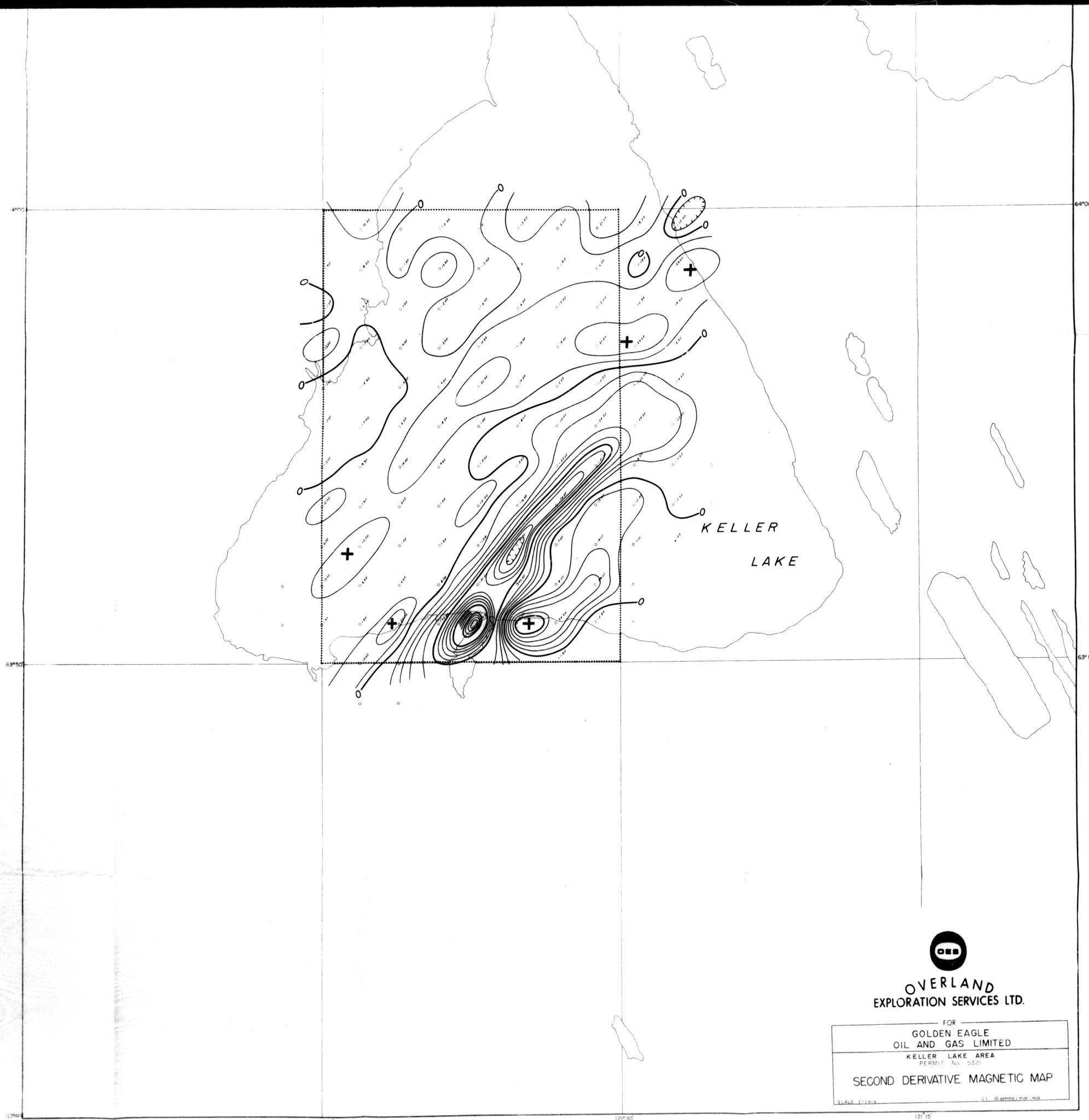


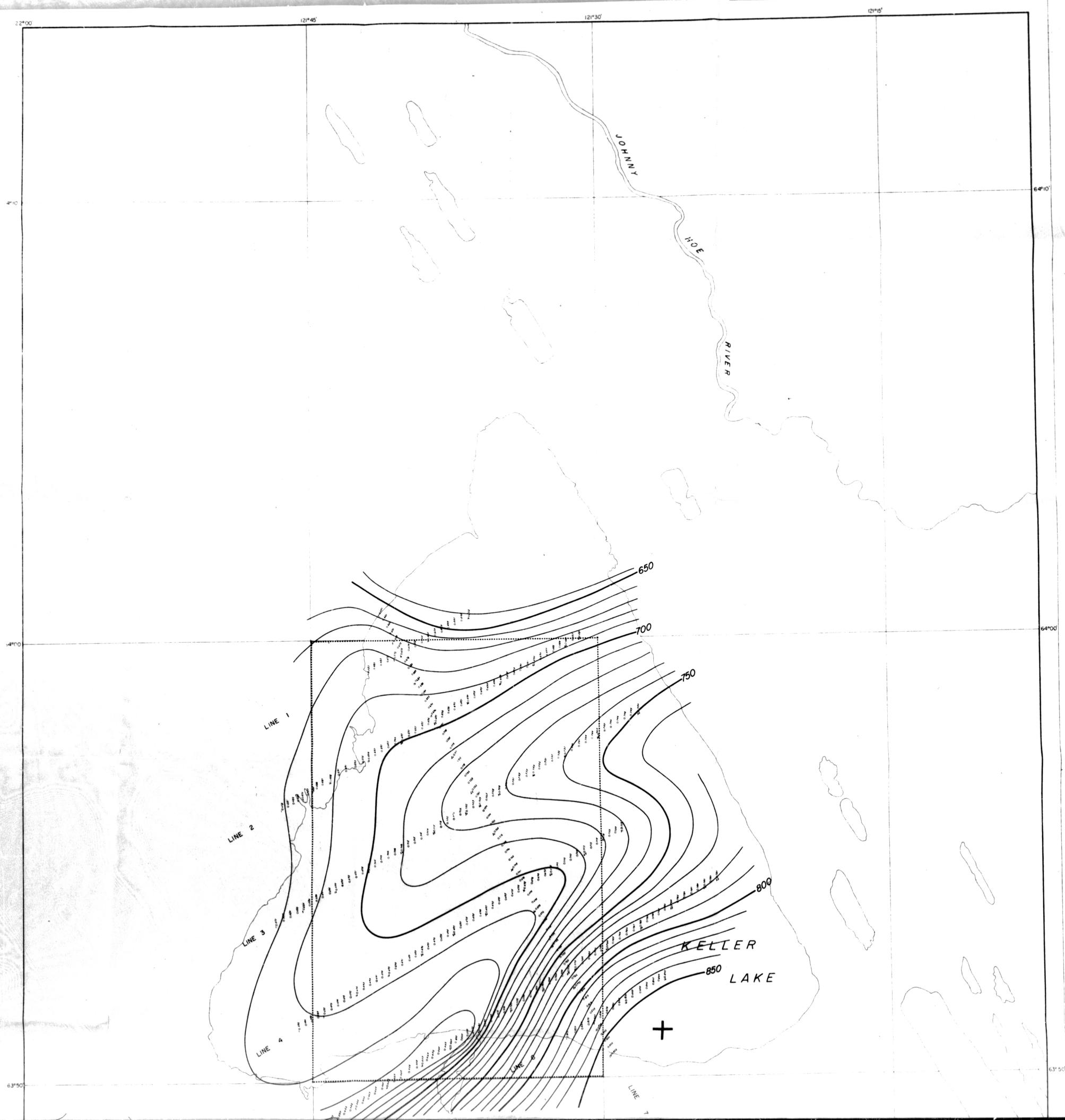


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FOR	
GOLDEN EAGLE	OIL AND GAS LIMITED
KELLER LAKE AREA	PERMIT No. 5321
BOUGUER GRAVITY MAP	
SCALE 1:100,000	



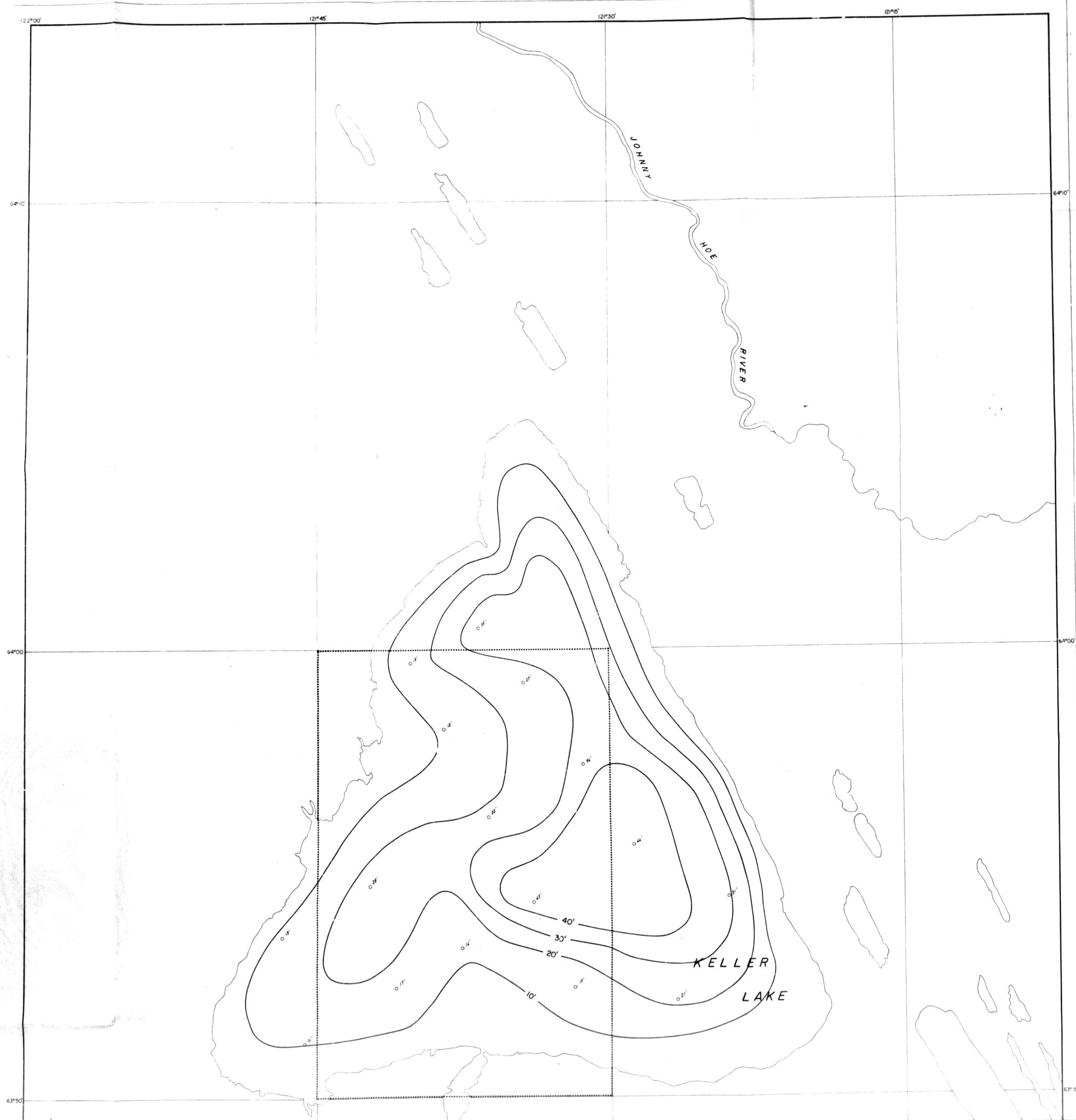


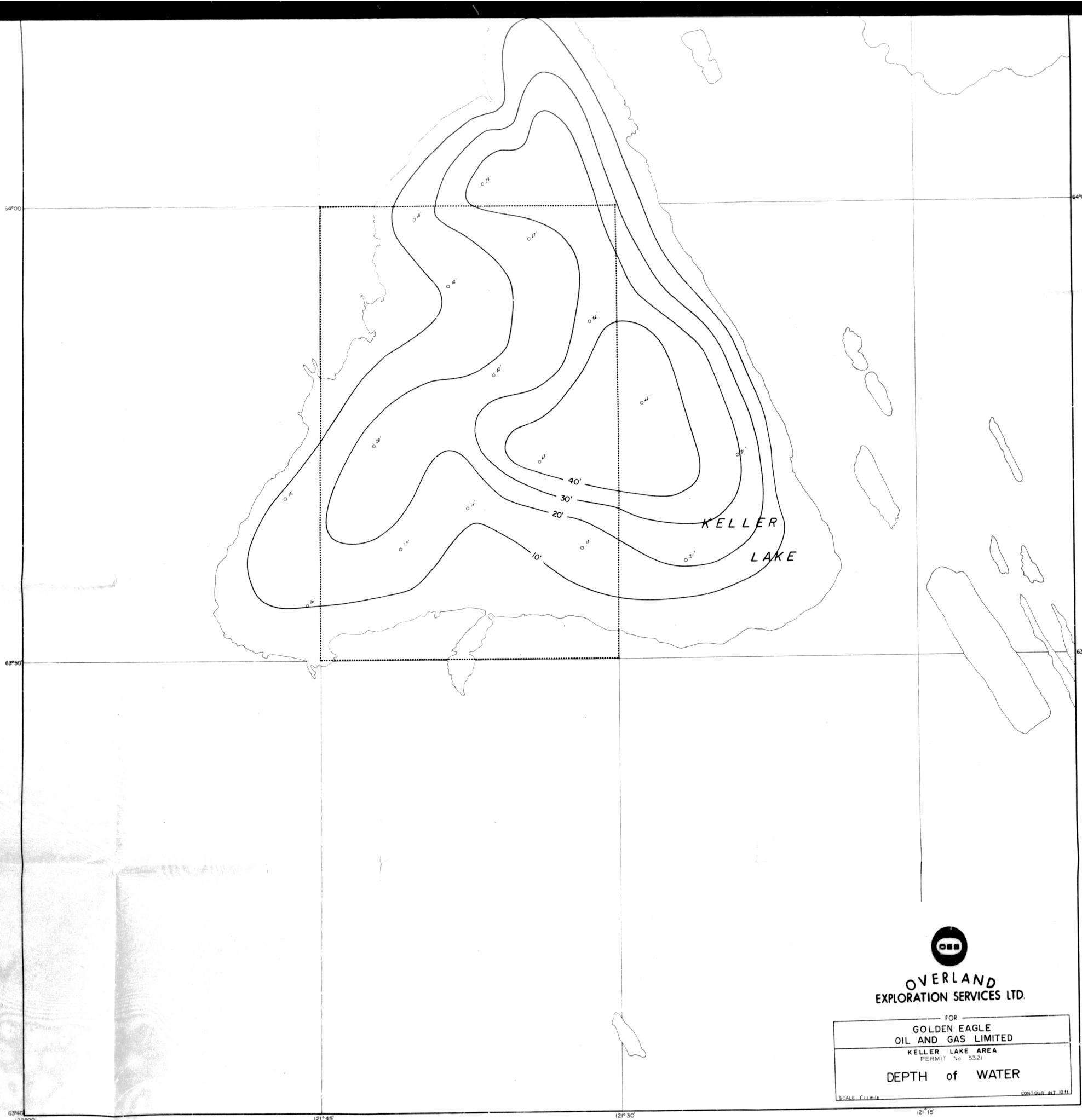





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FOR	GOLDEN EAGLE
	OIL AND GAS LIMITED
	KELLER LAKE AREA
	PERMIT No. 5321
GROUND MAGNETIC * MAP	
RELATIVE VERTICAL MAGNETIC INTENSITY	
SCALE 1:100,000	CL 10 gamma





OVERLAND
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FOR	
GOLDEN EAGLE	
OIL AND GAS LIMITED	
KELLER LAKE AREA	
PERMIT No 5321	
DEPTH of WATER	
SCALE 1' = 1 mile	CONTOUR INT 10 ft