GEOPHYSICAL EVALUATION
KILEKALE LAKE AREA, N.W.T.
Permits 6834 - 6839 Incl.
6766 - 6771 Incl.

Prepared For
RAM PETROLEUMS LTD.

By
JORDAN LEWIS & JOSE
GEOPHYSICAL CONSULTANTS LTD.

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March 1973

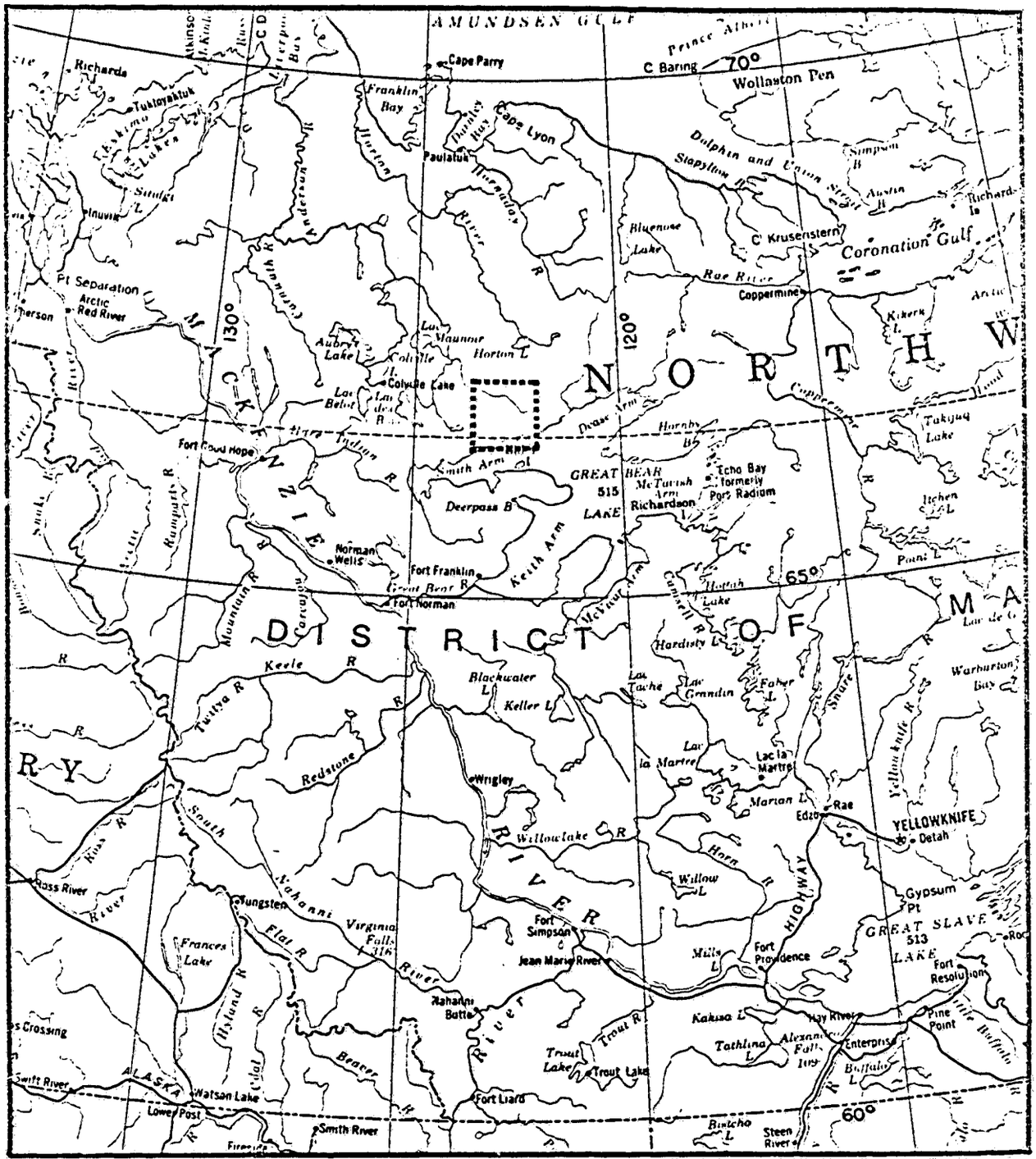
ENCLOSURES

Shot Point Location and Surface Elevation Map

Surface To Unconformity -Time And Average Velocity Map

Paleozoic Time Structure Map

Test Sections - Line 7 SP 590 - 610



SCALE: 1" = 100 MILES

KILEKALE LAKE

SMITH ARM

PLATE 1

INTRODUCTION

The project area is located on the north shore of Smith Arm on Great Bear Lake (see index map). Geophysical operations were carried out by Western Geophysical Company Party M-85 and the Ram program was carried out in conjunction with the Mobil Oil Canada Ltd. program on adjoining acreage to the west. A copy of Western's geophysical operations report is attached (Appendix II).

Total reflection seismic program on Ram permits 6766, 6767, 6768 and 6769 amounted to 30.7 miles. A similar amount of seismic was obtained in a trade with Mobil Oil and is covered by this report.

GENERAL GEOLOGY

The project area includes some 1000 square miles between latitudes 66°30' and 67°00' north and longitudes 122°00' and 123°00' west. Closest well control consists of the Mobil Colville Lake well some 100 miles WNW and the Arco Lost Hill Lake F62 well some 80 miles SSW. Because of high morainal hills and thick Quarternary deposits there is little or no surface geological information in the map area. Outcrops of Lower Ronning and Cambrian rocks occur to the west, north and east of the map area. On the basis of scattered outcrop and well data, it might be expected that up to 2500' of combined Ronning and Cambrian sediments could occur over the map area. Prospective reservoirs can be anticipated in dolomites of the Mount Cap Formation and in the Old Fort Island Sandstone. Pronounced stratigraphic and interval changes can be expected in both Formations in association with Pre-Cambrian topography. Because Ronning rocks are exposed at the Pre-Cretaceous unconformity, possibility of hydrocarbon trapping in this formation (Ronning) has to be downgraded. In the Kilekale Map area, up to 2000' of Quarternary morainal deposits and Cretaceous shale can be expected above the pre-Cretaceous unconformity.

GEOPHYSICAL DISCUSSION

Results of the vibroseis program are disappointing. Record quality is generally poor to unusable. Only one mappable reflection can be seen on the Mobil - Ram seismic, and because of lack of definitive velocity control, the origin of this reflection is dubious. Analysis of step-out data from uncorrected dynamite shots and vibroseis transfers indicates an average velocity of 7000'/second to 8000'/second to this reflection. This average velocity figure indicates a depth of +100 to +500' above sea-level for the reflection supporting an origin at the top of the Paleozoic (Pre-Cretaceous unconformity). Little or no identifiable or continuous seismic energy can be seen below the unconformity on data seen to date.

Results of reprocessing of SP's 590 - 610 on line 7 are summarized in Appendix I. Improvement is judged to be marginal and we would not recommend additional reprocessing at this time.

Copies of two interpretive maps are attached:

1) Surface To Unconformity -Time And Average Velocity

Data for this map were obtained from conventional dynamite monitors shot in conjunction with the vibroseis survey. The map shows thick time values along an axis centred on the west end of line 3 and shot point 1080 on line 4. Isopach values in this thick are estimated at 2000'. The interval thins rapidly eastward to minimum values of 500' to 1000'. Note that interval velocities calculated below the unconformity at shot points on the west end of line 3 are in the 20,000'/second range indicating a carbonate lithology below the unconformity.

2) Paleozoic Time Structure

Datum +1200'/replacement velocity 10,000'/second-contour interval .025 seconds. Note that the thick indicated on the previous map is shown as

a pronounced structural low on this map. There is reasonable evidence for a high trend striking NE across Ram Permit 6768 ... this is supported by fairly well documented east dip on line 3 between shot points 1795 and 1845. The west dip in the south-west corner of Permit 6766 was confirmed by reprocessing part of line 7.

Poor record quality is thought to be at least in part a result of unsuitability of the vibroseis method for this type of section and area. A good deal of energy dispersion is suspected in the high velocity perma-frost zone overlying low velocity Quarternary and Cretaceous sediments. Abrupt variations in perma-frost thicknesses contribute a good deal of coherent noise. In addition to these problems, abrupt changes in average velocity at and below the Paleozoic top make data playback difficult.

Mobil data, processed by Teledyne, exhibits a good degree of amplitude and continuity on the Paleozoic reflection ... this was accomplished by using the reflection on individual traces as a datum. This method, when used in conjunction with good data with adequate velocity corrections, works well. However, in this case this process has resulted in complete degradation of any additional data in the section.

Efforts to obtain better reflection resolution below the unconformity were not successful despite careful programming of interpreted velocities, muting of noisy traces, etc. (see Appendix I).

CONCLUSIONS AND RECOMMENDATIONS

Interpretation of 60 miles of vibroseis data has indicated a seismic high on the Paleozoic (Pre-Cretaceous unconformity) striking NE across Ram Permit 6768.

Overall poor record quality does not permit an interpretation of sub-unconformity events. Sparse geologic and geophysical information indicates that up to 2500' of Ronning and Cambrian sediments can be expected below the

unconformity. Possible reservoir rocks can be anticipated in the Mount Cap and Old Fort Island formations.

Lack of reliable velocity information and poor reflection energy return have resulted in generally poor data processing results in this area. Analysis of line 7 has indicated that little or no energy return is present in the interval up to 1500' from the vibrator points. Energy return beyond the 1500' point is thought to be mostly refraction energy from the Paleozoic carbonate surface. No additional seismic reprocessing is recommended.

If additional seismic work is contemplated, we recommend that a conventional dynamite crew be used rather than vibroseis. Any additional program should be augmented by periodic refraction shots to establish the unconformity depth.

Respectfully Submitted,

R.P. Jordan, P. Eng.

APPENDIX I - KILEKALE LAKE

INTRODUCTION

Original processing of Ram's Kilekale Lake vibroseis control was done by Geodigit and tie lines obtained from Mobil were processed by Teledyne Ltd. Neither format seemed adequate so a decision was made to attempt to upgrade the data by reprocessing a portion of Line 7. Teledyne Ltd. was selected for this work.

Play Back Procedures:

Sequential correlated transfer monitors for SP's 680 - 690 and 590 to 600 were played out using only a 20-60 hz/s band pass filter. SP's 590 - 600 (see Figure 1) appeared to offer the best opportunity for improvement, SP's 680 to 690 were essentially N.G.

Analysis of normal move-out on SP's 590 - 600 indicated an average velocity of close to 7000'/second for the reflection event near -5 seconds and accordingly these SP's were played out using a constant velocity correction of 7000'/second (Figure 2). At this point a new velocity function was applied using an interval velocity of 18,000'/second below what is believed to be the Pre-Cretaceous unconformity (see Figure 3).

The final stage involved play-out of filtered NMO corrected near trace and far trace gathers (Figures 4 and 5). From these displays it is obvious that there is little or no reflection return for V.P. to station distances less than 1500'. Best energy return at the unconformity level occurs at station distances greater than 1500'. The critical distance for refractions at the unconformity occurs at 1200', assuming a 7000'/second/18,000'/second interface at .45 seconds. This leads to the fairly obvious conclusion that reflection energy in the 0-1500' station distance interval is severely attenuated by the large step-out times introduced across the 600' long vibroseis/geophone array. Neither of the trace gather displays indicate much reflection energy in the zone below the unconformity.

The final stack section, using only the far trace gathers, is not significantly different from the original Geodigit processed section although there is a slight improvement in signal resolution below the unconformity.

CONCLUSIONS AND RECOMMENDATIONS

Reprocessing has failed to provide any useful additional information not already present on the Geodigit sections. This work, however, has provided a better insight into problems unique to this area. Because of long vibrator drag and geophone arrays necessary to cancel vibrator created noise, reflection return from the zone of interest is marginal. This, together with noise and erratic statics created by permafrost variations, has resulted in extremely poor data. Despite high cost of drilling in frozen gravel, we recommend that any new program utilize 600% CDP with maximum 1800' symmetrical spreads and single hole dynamite shots. Long (4000' to 5000') reversed refraction arrays should be shot at regular intervals to obtain unconformity depths.

APPENDIX II - KILEKALE LAKE

Report of Reflection Seismograph Survey

KILEKALE LAKE

NORTHWEST TERRITORIES

Project: Smith Arm

Permit No: N72B048

N.T.S. Map No: 96-J

Dates of Shooting

March 24, 1972 thru April 15, 1972
Inclusive

For

RAM PETROLEUMS LTD.

Report by

J.L. Robblee - Party Chief

Party M-85

WESTERN GEOPHYSICAL COMPANY OF CANADA, LTD.

Calgary, Alberta

June, 1972

Western

TABLE OF CONTENTS

INTRODUCTION

"Kilekale Lake" is located north of the Smith Arm of Great Bear Lake, approximately 130 miles northeast of Fort Norman, Northwest Territories.

The survey was conducted by Western Geophysical Company of Canada, Ltd., Licence No.'s 0173 and 0208, working on behalf of Ram Petroleums Ltd., Permit No. N72B048.

The work periods were March 24, 1972 thru April 15, 1972 inclusive. There were normally 48 men, including all contractors, stationed in portable camps on the prospect. These men were engaged in field operations. The data preparation group consisted of two men who were located at 530 - 71st Avenue South East, Calgary, Alberta.

The operation was under the supervision of Mr. R. Jordan of Jordan, Lewis and Jose, representing Ram Petroleums Ltd., and Mr. G.P. Bates of Western Geophysical Company of Canada, Ltd. The Party Manager was Mr. D. Holt.

Bulldozing operations were contracted by MacMillan Construction and were under the supervision of Mr. D. Gardener.

The catering was extended by Western Geophysical Company of Canada, Ltd. who owned the seismic camp.

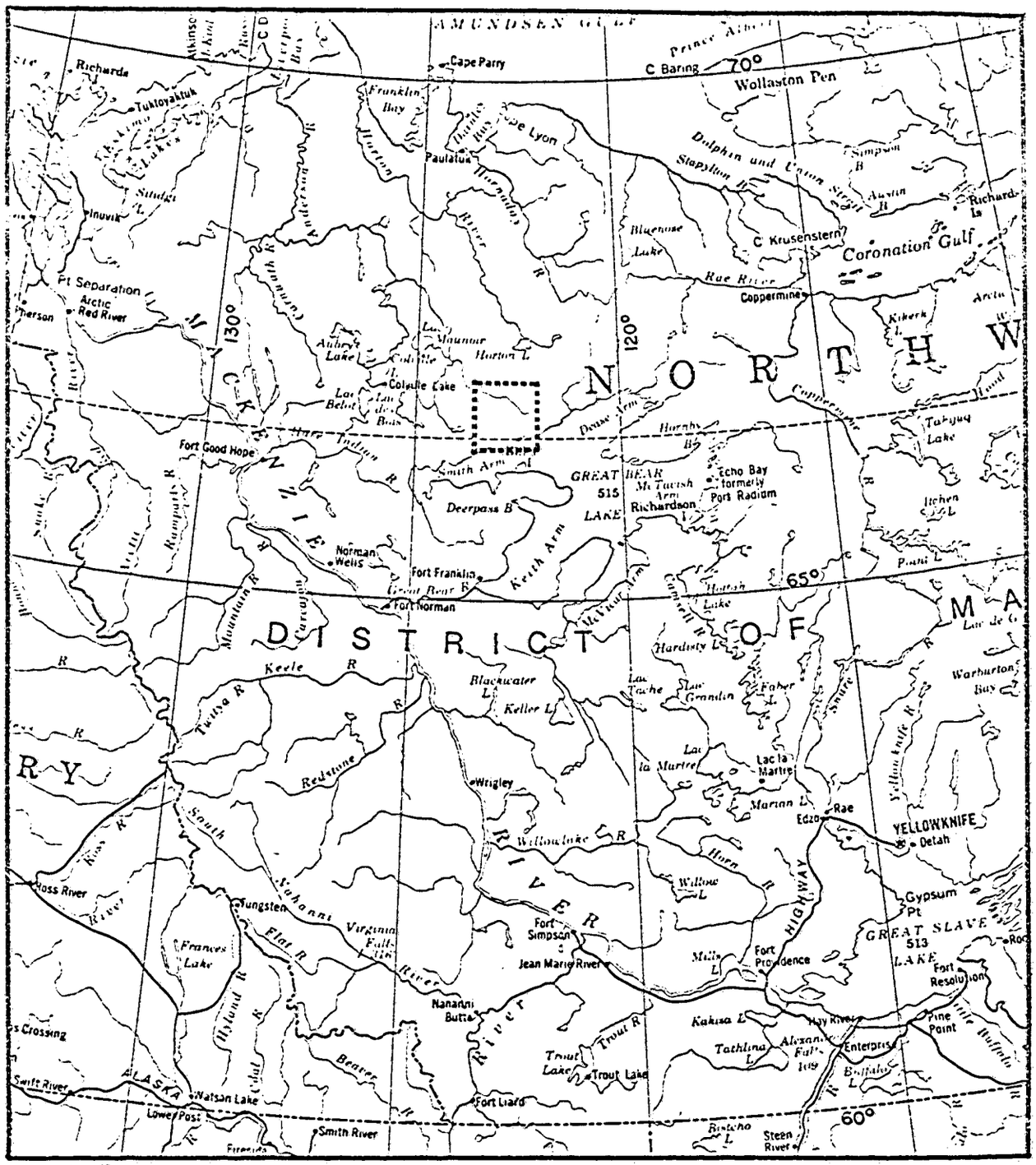
LOGISTICS

At the beginning the camp, vehicles, equipment and fuel were taken into the area by barge. A supply dump was established on the north shore of Great Bear Lake (see base camp on shot point map - Plate 3). As the portable camp was moved from place to place on the prospect fuel was hauled from the supply dump using a bulldozer and sleighs. The sleighs carried 500 gallon tanks for hauling diesel fuel as well as a Kitchen-Diner-Sleeper unit and a power plant for use of the fuel haul cat-skinners. They were also equipped with a single sideband two-way radio for communication. The seismic crew eventually reached a point that was too far from the supply to make the fuel haul feasible. Diesel fuel was then brought in from Norman Wells by a DC-3 aircraft. The aircraft carried 750 gallons of diesel per trip in a fuel bladder. The DC-3 required a 3500 foot landing strip to be plowed on approximately 30 inches of good ice. All motorized equipment on the seismic crew and the bulldozing operations were diesel powered and the camps were heated by diesel fuel. Total fuel consumption was approximately 800 gallons per day.

A four-place, ski equipped, Cessna 185 and a nine-place Islander aircraft on wheels were used to haul groceries and supplies from Norman Wells to camp. The planes were also shared with another crew. These two aircraft were chartered for the entire winter from Peace Air Ltd. of Peace River, Alberta. The Cessna could carry approximately 1000 pounds of freight while the Islander could carry approximately 2000 pounds. The Islander could not be used until the ice was thick enough to support a bulldozer as

airstrips had to be snowplowed for this wheel equipped plane. At the beginning of the season groceries and supplies were flown to Norman Wells from Calgary and Edmonton by commercial airlines. This method of transport proved to be very unreliable as there was no regular schedule for freight flights. In order to supply groceries on a regular schedule it was decided to arrange a weekly truck service from Peace River, where groceries were purchased, to Fort Simpson. The Islander would fly from Norman Wells to Fort Simpson and return direct to camp with the groceries. An occasional DC-3 flight was arranged from Norman Wells to Peace River and return when warranted by the volume of freight.

A full time expeditor and helper were maintained in Norman Wells. They were housed in a trailer which was equipped with a telephone and single sideband radio for communication. A crew cab vehicle was supplied for expediting people and supplies. Storage space was rented at the airport from Mid-Arctic expeditors. An expediting service was also contracted in Peace River for the purpose of buying and expediting groceries and supplies for the truck haul to Fort Simpson and for the occasional aircraft flights to Norman Wells. After completing the winter project the camp and equipment were parked at the base camp, on the north shore of Great Bear Lake, where it could be picked up by barge, after the spring break-up, or left to be available for the following winter season.

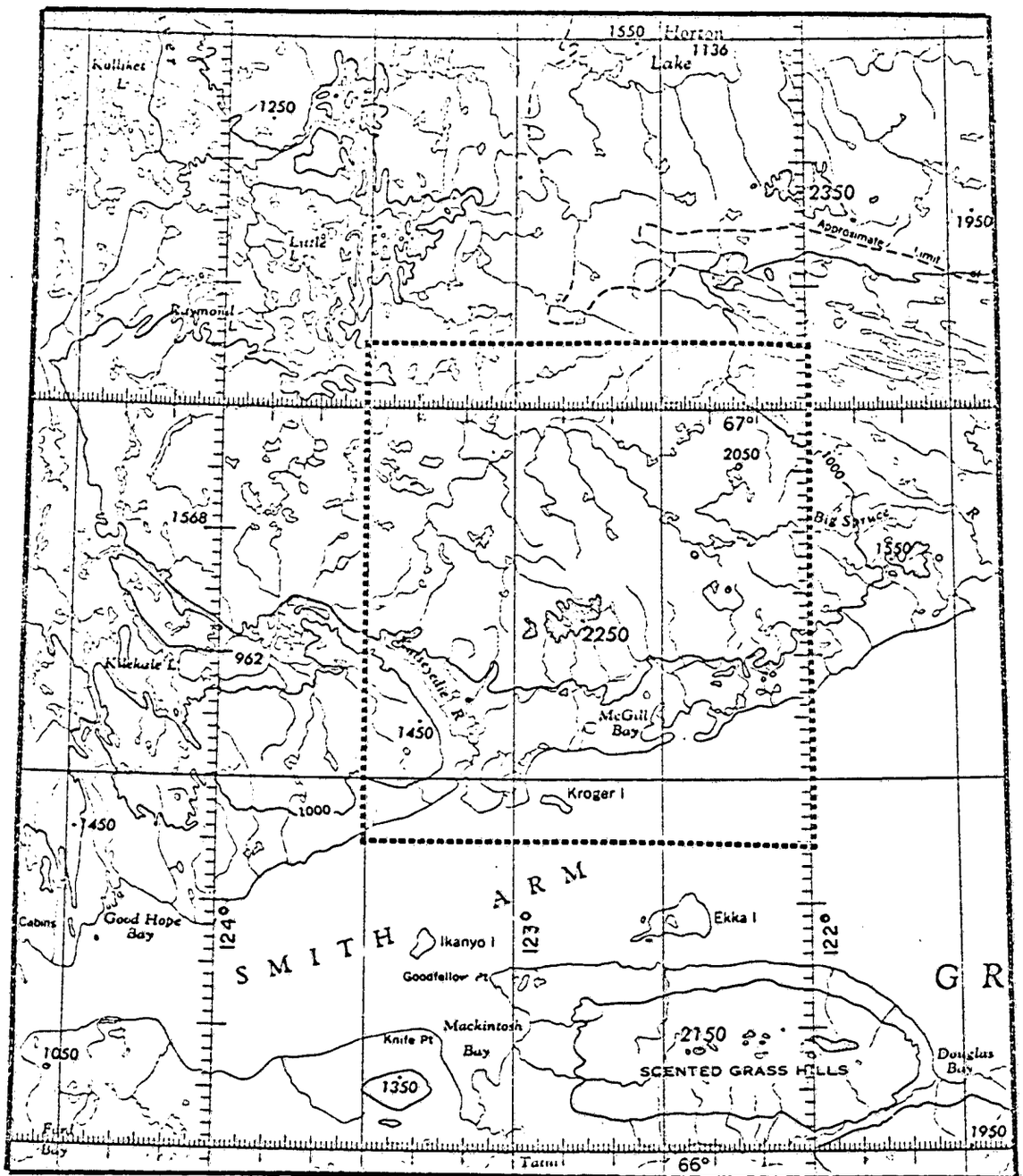


SCALE: 1" = 100 MILES

KILEKALE LAKE

SMITH ARM

Western



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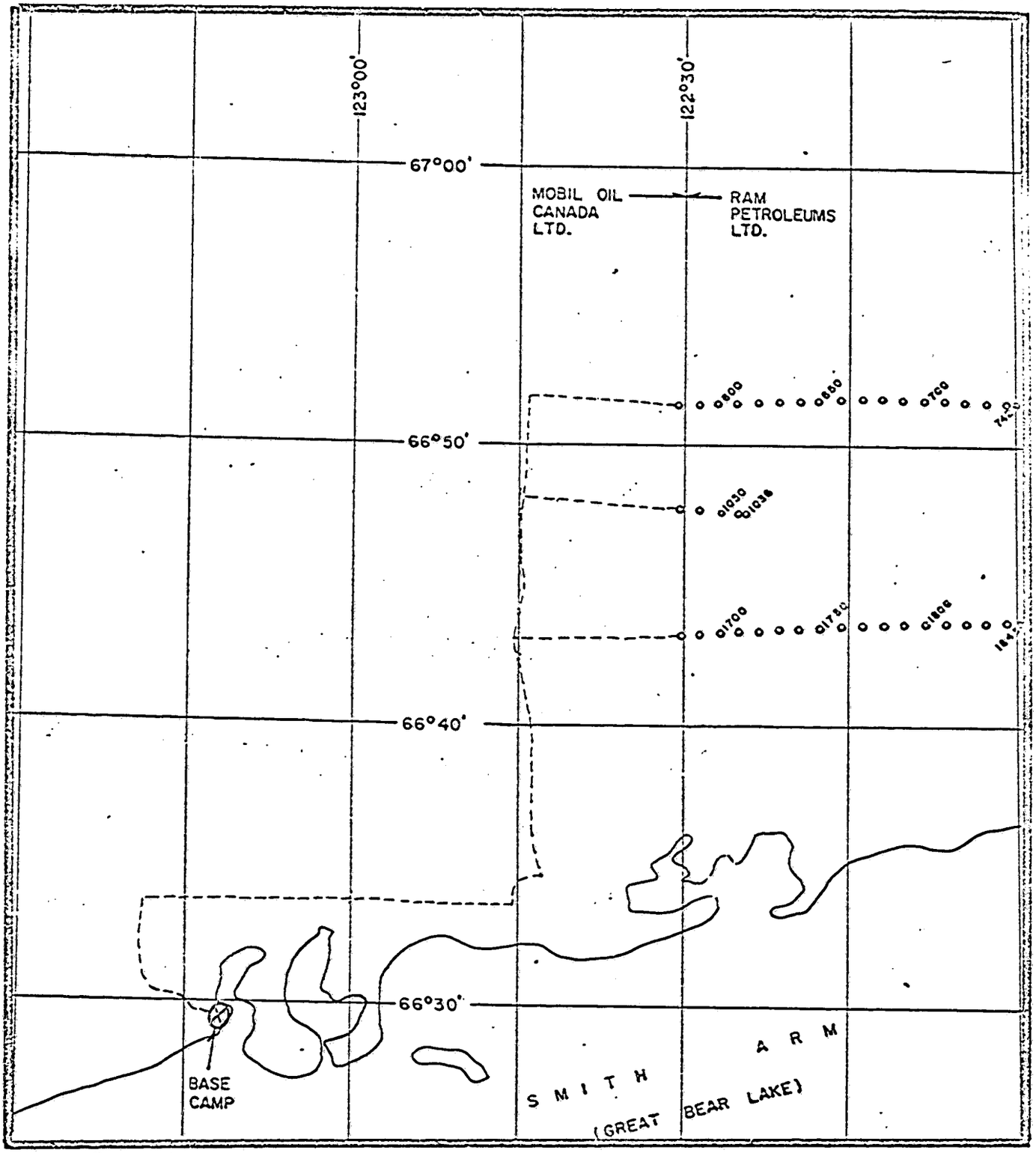
KILEKALE LAKE

SMITH ARM

Western

PLATE 2



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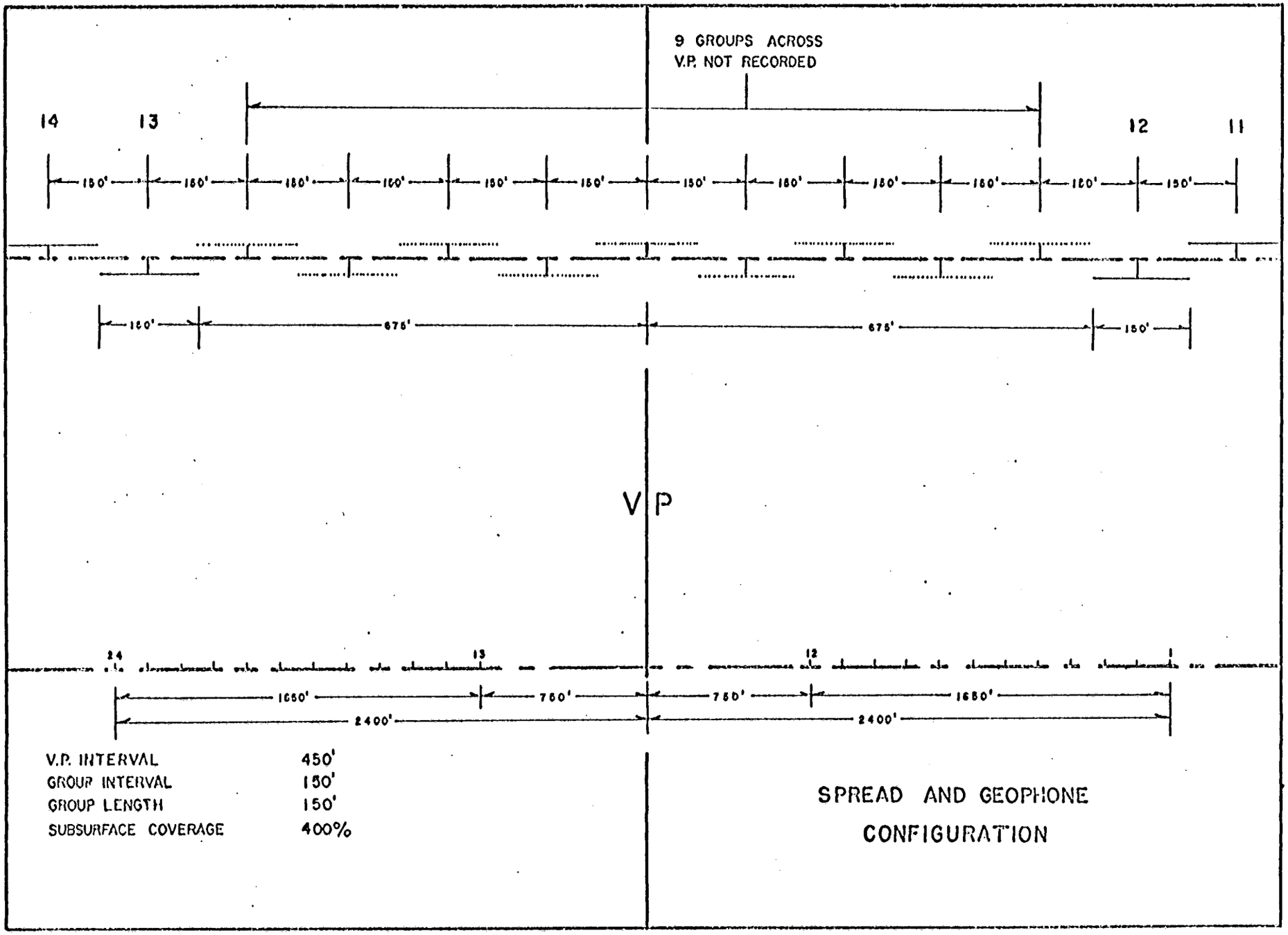
KILEKALE LAKE

SMITH ARM

Western

PLATE 3



V.P. INTERVAL	450'
GROUP INTERVAL	150'
GROUP LENGTH	150'
SUBSURFACE COVERAGE	400%

SPREAD AND GEOPHONE CONFIGURATION

PLATE 4

Western

TECHNIQUES

FIELD:

Sub-surface coverage of 400% was obtained in the field by recording vibrations made at intervals of 450 feet. Recordings from 24 seismometer groups were made for each Vibrator Point. Four vibrators mounted on two Flextrac Nodwells were utilized, using a 64-16 sweep and a 150 foot drag. These were centered on a group, with that group and the four adjacent on either side not being recorded. This yielded a balanced, gapped spread. (See Plate 4 for spread configuration.) The seismometer groups for each profile were laid end to end in a straight line, with 18 seismometers per group spaced evenly over 150 feet. The group interval was 150 feet. The seismometer type was Mark L-10, 14 cycle. The recording instruments were S.D.S. 1010, digital type, with a Potter tape transport and a Western Summing Unit.

Intermittent dynamite shots were recorded, utilizing the above spread layout, except that only one group was not recorded at the shot point.

OFFICE:

After being received from the field, data was compiled and transmitted to Mr. J. Reynolds of Geo-Digit where the data processing was to commence.

LITHOLOGY

The average shot hole depth was 41 feet. Gravel was encountered in approximately 60% of the shot holes, ranging from 0 to 30 feet in depth. There were intermittent findings of limestone and sandstone.

SURVEY AND BULLDOZING

The survey crew utilized two Wild T-16 theodolites. The elevations were tied, assuming the elevation of the ice on Great Bear Lake to be 511 feet above sea level. Horizontal control was derived from major topographic features.

All production lines in the prospect were newly bulldozed, and all airstrips were on ice formed on lakes. Campsites and airstrips used were not located on this prospect, but were to the West.

EQUIPMENT

RECORDING CREW: 26 Men

1 - Recording Unit, Flextrac Nodwell, Model FN-110, diesel powered

2 - Dual Vibrators, Flextrac Nodwell, Model FN-240, diesel powered

2 - Cable Units, Robin Nodwell, Model FN-110, diesel powered

1 - Shooting Unit, Flextrac Nodwell, Model FN-110, diesel powered

1 - Field Shop Unit, Robin Nodwell, Model FN-110, diesel powered

DRILLING CREW: 4 Men

1 - 1000 Mayhew Air Drill, Robin Nodwell, Model FN-110, diesel powered

CAMP: 7 Men

1 - Party Manager's Unit, Bombardier, diesel powered

1 - Supply Unit, Flextrac Nodwell, Model FN-110, diesel powered

1 - Kitchen/Diner/Sleeper Combination (6 man), Nodwell Bros., Model FN-110, diesel powered

1 - Utility/Sleeper Combination (12 man), Nodwell Bros., Model FN-110, diesel powered

1 - Office/Sleeper Combination (16 man), Nodwell Bros. trailer

1 - Sleeper (8 man), Nodwell Bros. trailer

1 - Shop Unit, Nodwell Bros. trailer

1 - Storage Shack, sleigh mounted

1 - Fuel Sloop, 2000 gallon capacity

1 - Propane Sloop

BULLDOZING CREW: 7 Men

1 - D-6 Bulldozer

2 - D-7 Bulldozers

1 - Kitchen/Diner Combination, sleigh mounted, main camp

1 - Kitchen/Diner/Sleeper Combination (4 man), sleigh mounted, fuel haul

1 - Sleeper (12 man), sleigh mounted, main camp

1 - Power Unit with generator, sleigh mounted, fuel haul

1 - Shop Unit with generator, sleigh mounted, main camp

1 - Bombardier Personnel Carrier, diesel powered

2 - Fuel Sloops, 2000 gallon capacity each

SURVEY CREW: 4 Men

1 - Flextrac Nodwell, Model FN-110

STATISTICS

Production vibrating	5.25 days
Refraction dynamite shooting	1.75 days
Profiles	361
Sweeps	19,162
Miles recorded	30.681
Coverage per production day (miles)	5.84
Shots	54
Holes drilled	45
Footage drilled	1847
Average hole depth	41.044
Pounds of dynamite used	1035
Pounds of dynamite per shot	19.17

The foregoing report is respectfully submitted by

WESTERN GEOPHYSICAL COMPANY OF CANADA, LTD.

J.J. Robblee

J.J. Robblee - Party Chief

6-9-72.

Date

123° 45' 30' 15' 122°

67° 50' 40'

6766 6767 6768 6769 6770 6771

7430000 m N
7420000 m N
7410000 m N
7400000 m N
7390000 m N

- LINE 5 -
- LINE 7 -
- LINE 6 -
- LINE 4 -
- LINE 3 -
- LINE 2 -

Indicated 2000' of section below u/c

2000' ± section below u/c

Generally poor. No resolution below unconformity.

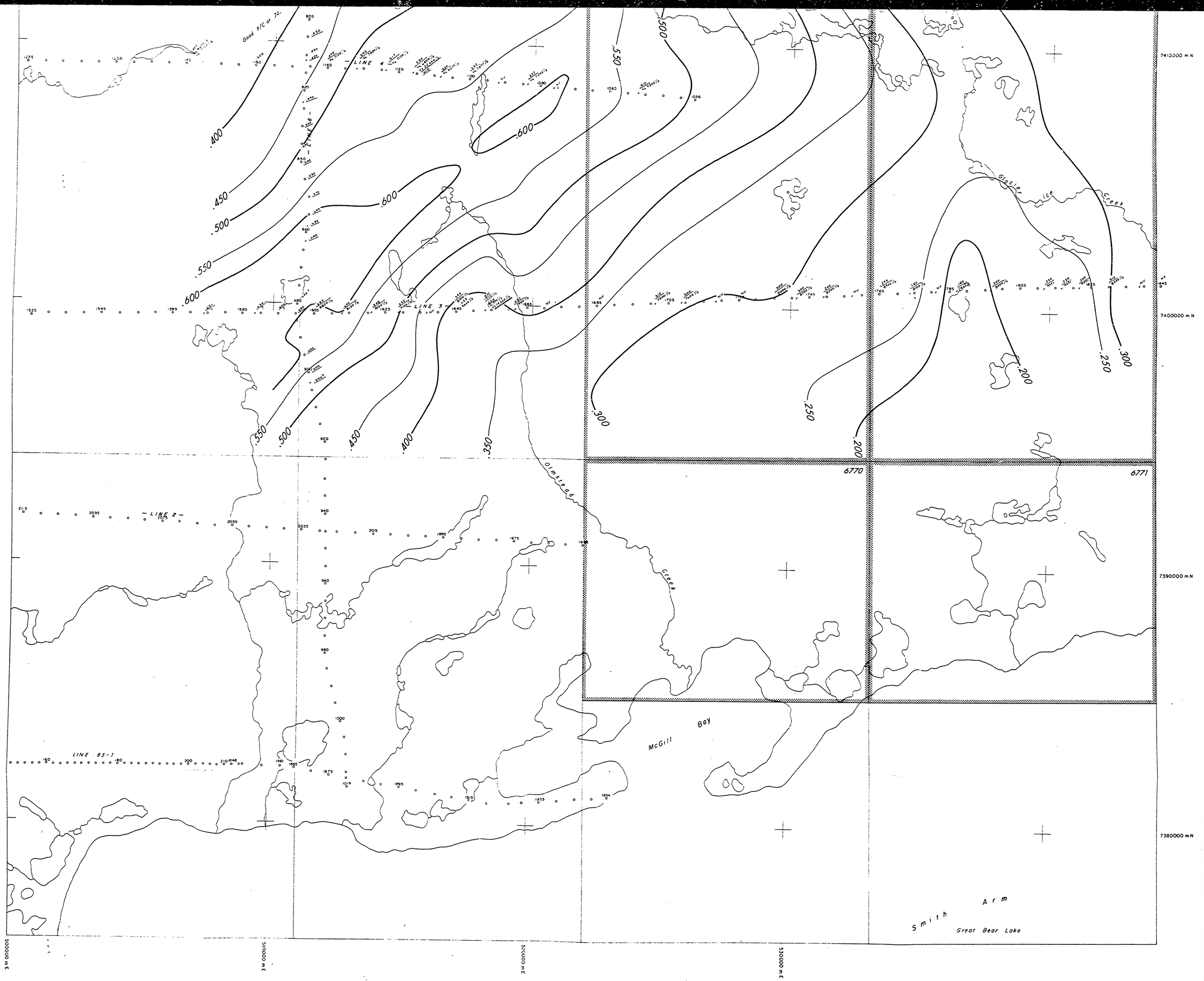
Good P/C at 740

.200 .250 .300 .350 .400 .450 .500 .550 .600

Big Spruce River

Glacier Ice Creek

Olmstead Creek



RAM PETROLEUMS LTD.

KILEKALE LAKE AREA

NORTHWEST TERRITORIES

PERMITS 6766 - 6771

** RAW TIME AND Va TO PALEOZOIC*

* SOURCE 100% DYNAMITE MONITORS

SCALE : 1" = 1 Mile		C.I. : .050 sec.
DATE : Jan. 1973		

JORDAN – LEWIS & JOSE

CALGARY GEOPHYSICAL CONSULTANTS LTD. ALBERTA

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— LINE 2 —

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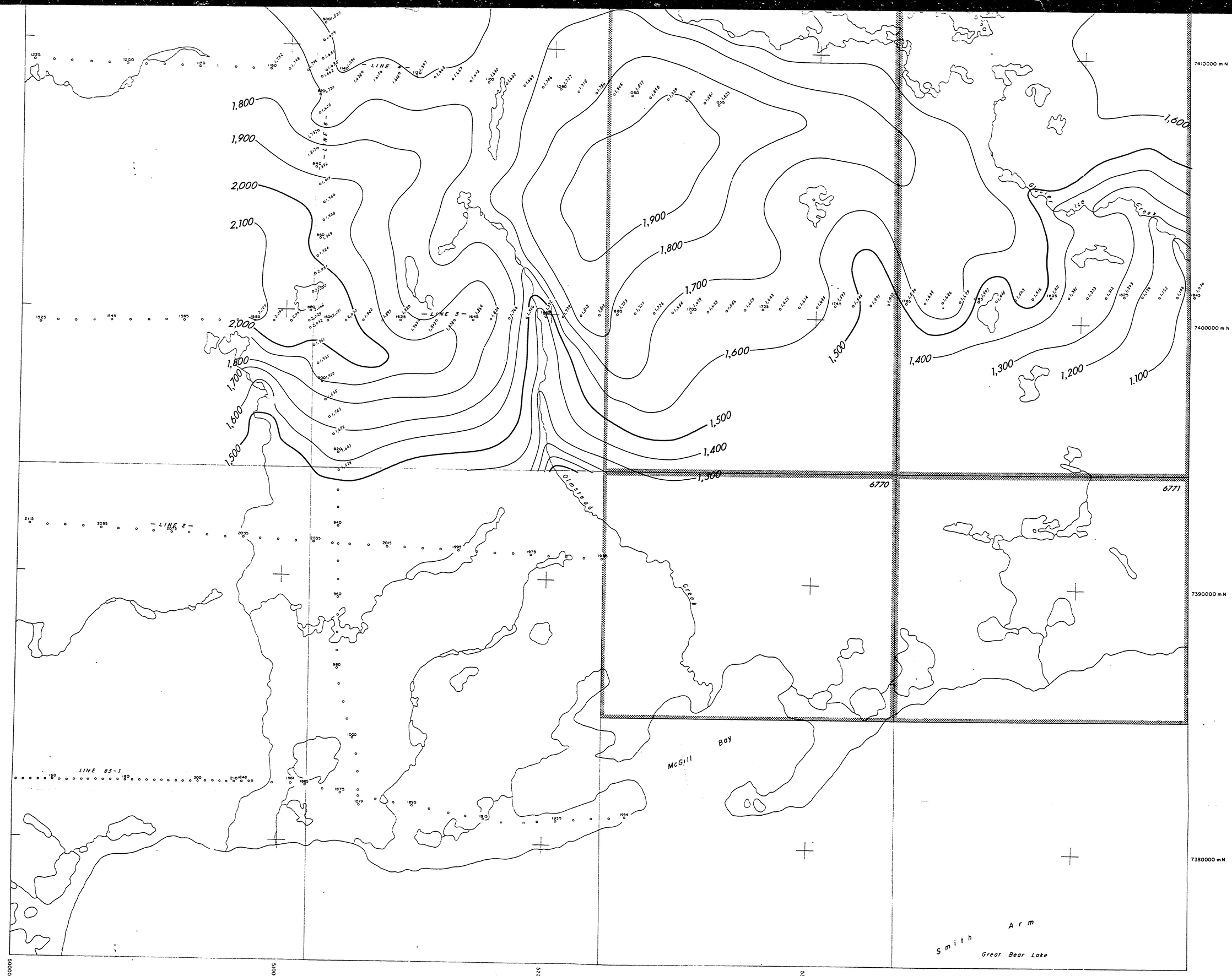
Big Spruce River

Glacier Ice Creek

Olmstead Creek



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KILEKALE LAKE AREA

NORTHWEST TERRITORIES

PERMITS 6766 - 6771

SHOT POINT LOCATIONS & SURFACE ELEVATIONS

SCALE : 1" = 1 Mile		
DATE : Jan. 1973		

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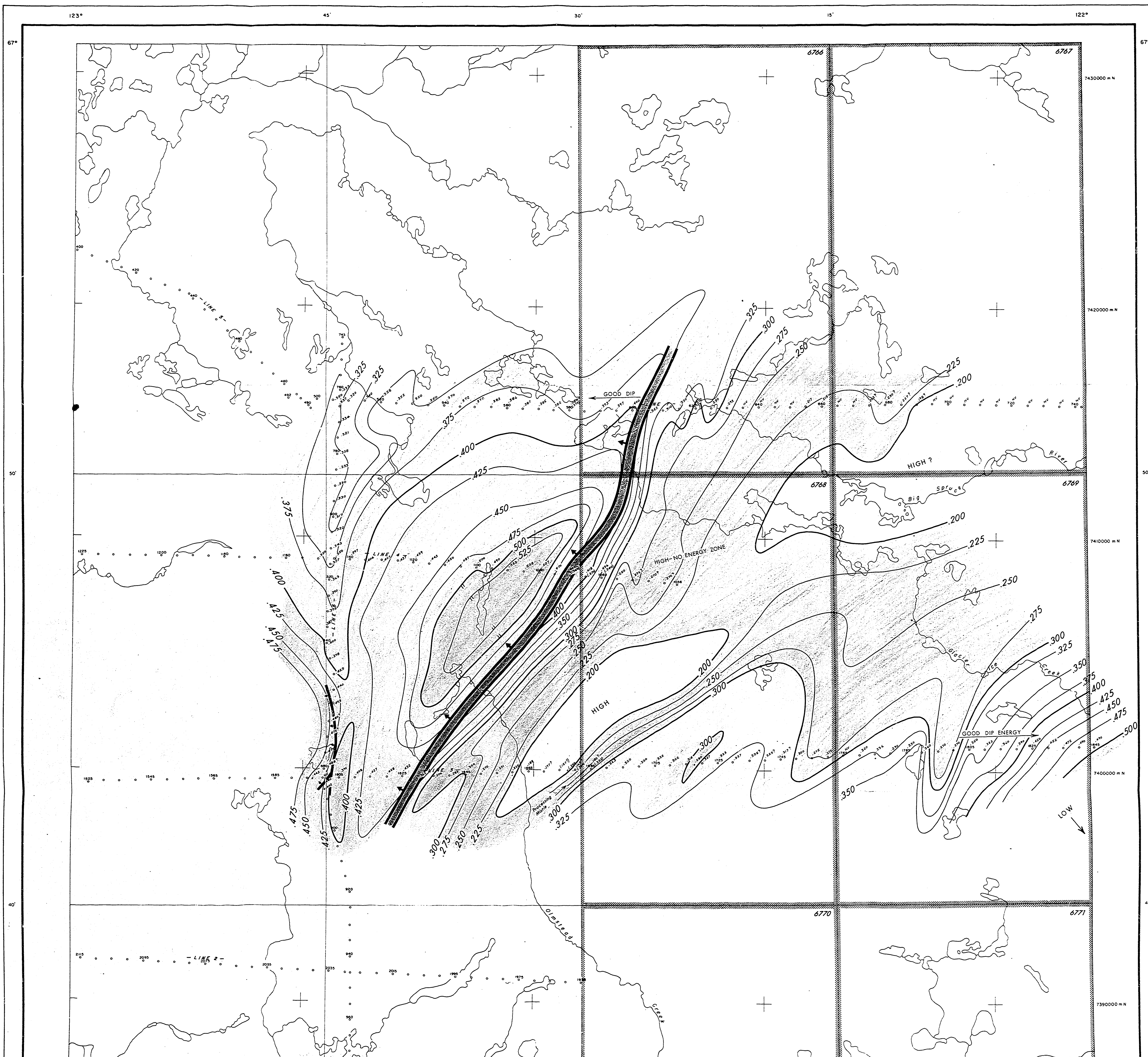
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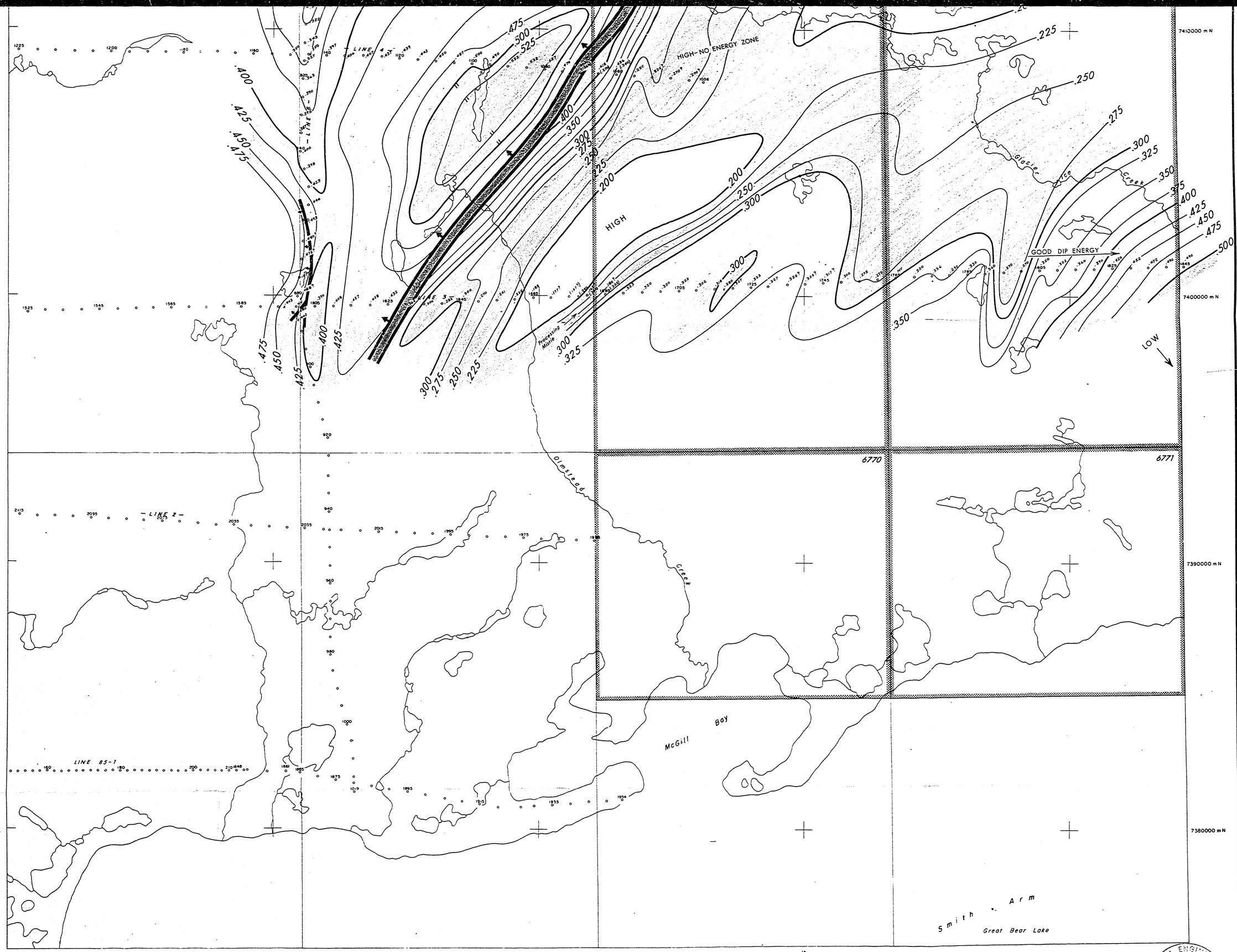

PROFESSIONAL ENGINEER ALBERTA

RAM PETROLEUMS LTD.

KILEKALE LAKE AREA

NORTHWEST TERRITORIES

PERMITS 6766 - 6771

TIME STRUCTURE ON PALEOZOIC

SCALE : 1" = 1 Mile		DATUM : +1200'
DATE : Jan. 1973	-	C.I. : .025 sec.

JORDAN – LEWIS & JOSE

CALGARY GEOPHYSICAL CONSULTANTS LTD. ALBERTA

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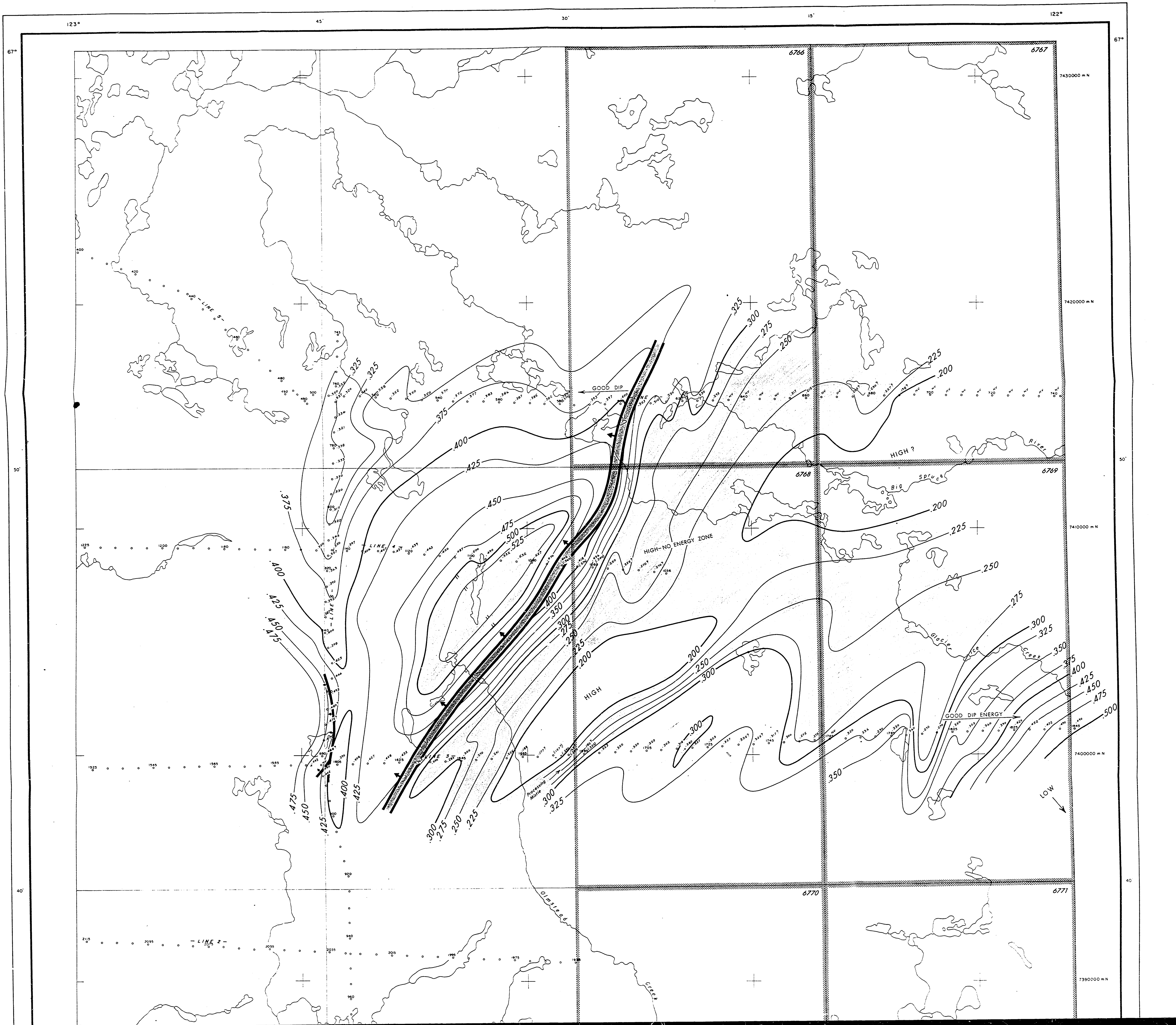

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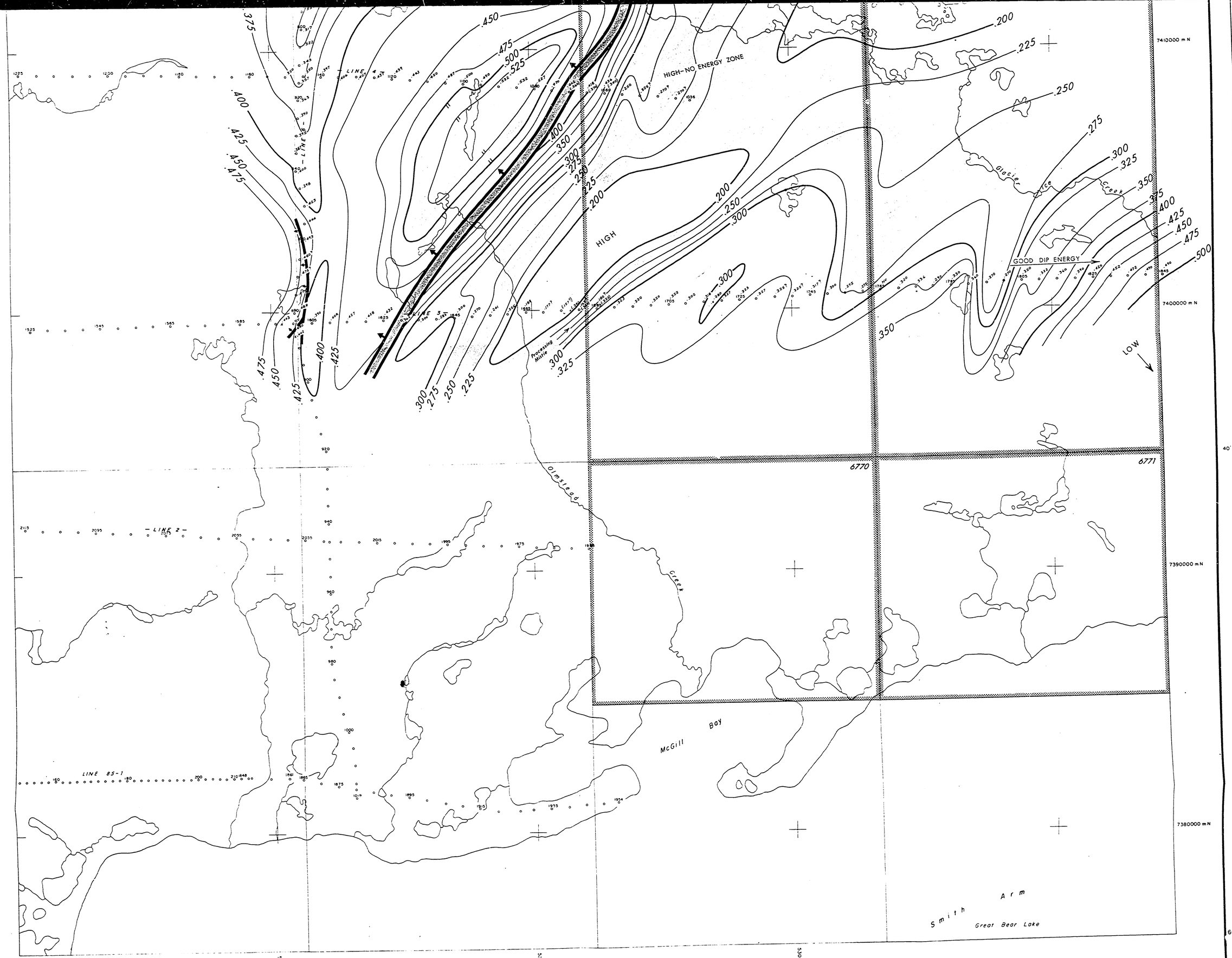

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KILEKALE LAKE AREA

NORTHWEST TERRITORIES

PERMITS 6766 - 6771

TIME STRUCTURE ON PALEOZOIC

SCALE : 1" = 1 Mile		DATUM : +1200'
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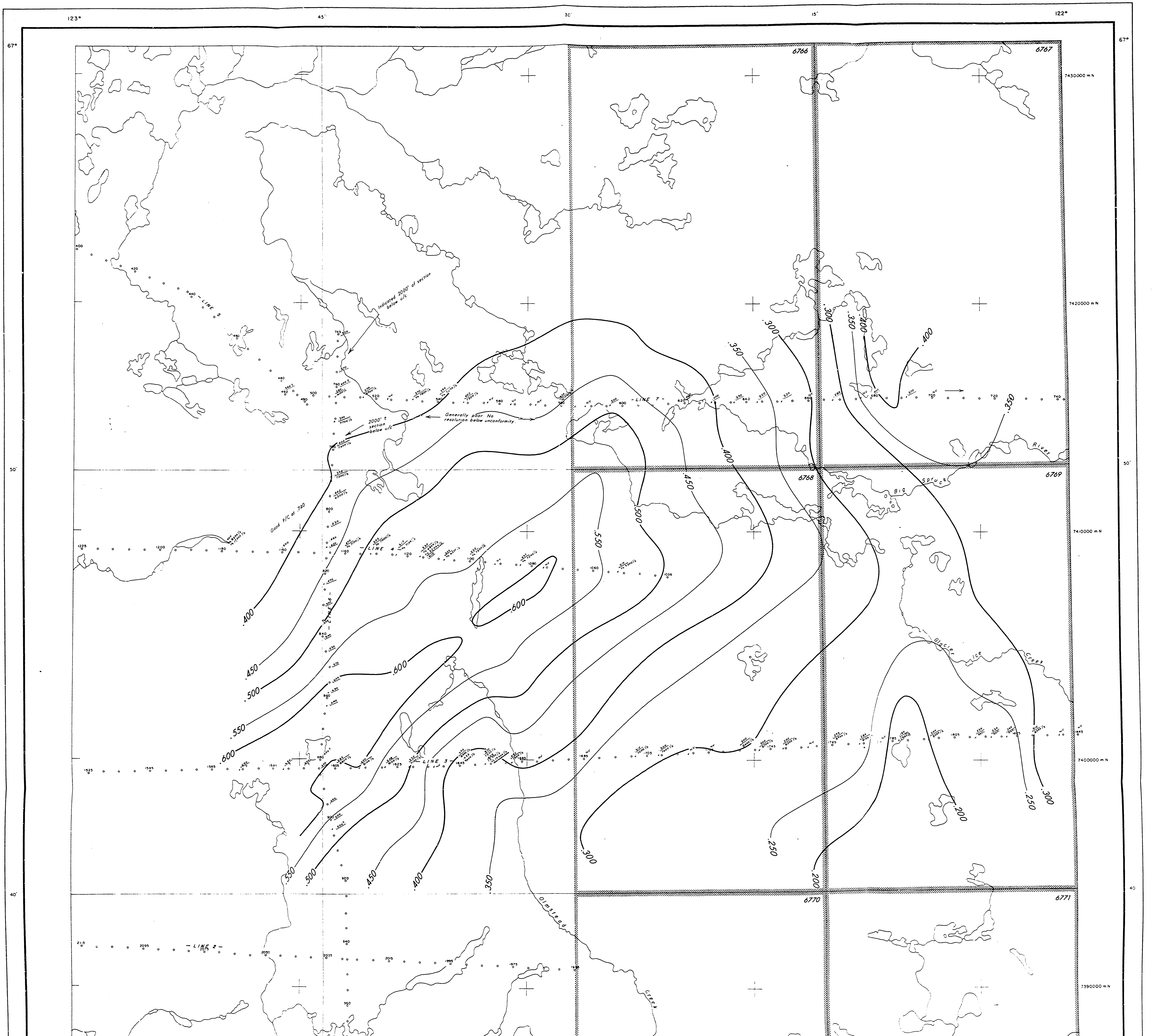

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Indicated 2000' of section below u/c
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Generally poor. No resolution below unconformity.
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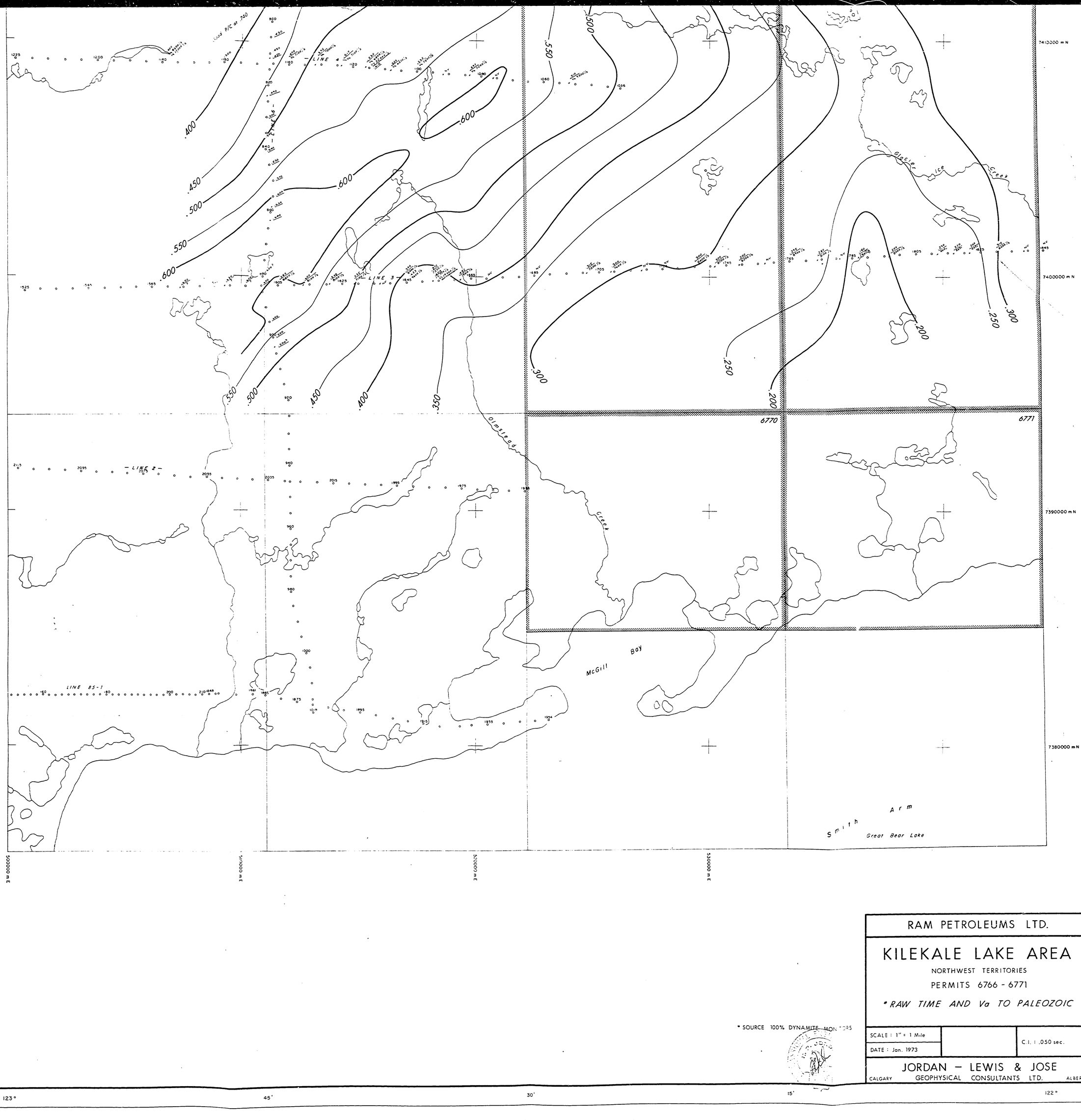

RAM PETROLEUMS LTD.

KILEKALE LAKE AREA

NORTHWEST TERRITORIES

PERMITS 6766 - 6771

** RAW TIME AND Va TO PALEOZOIC*

* SOURCE 100% DYNAMITE MONOBRS

SCALE : 1" = 1 Mile		C.I. : .050 sec.
DATE : Jan. 1973		

JORDAN – LEWIS & JOSE

CALGARY GEOPHYSICAL CONSULTANTS LTD. ALBERTA

2