

62-6-5-35

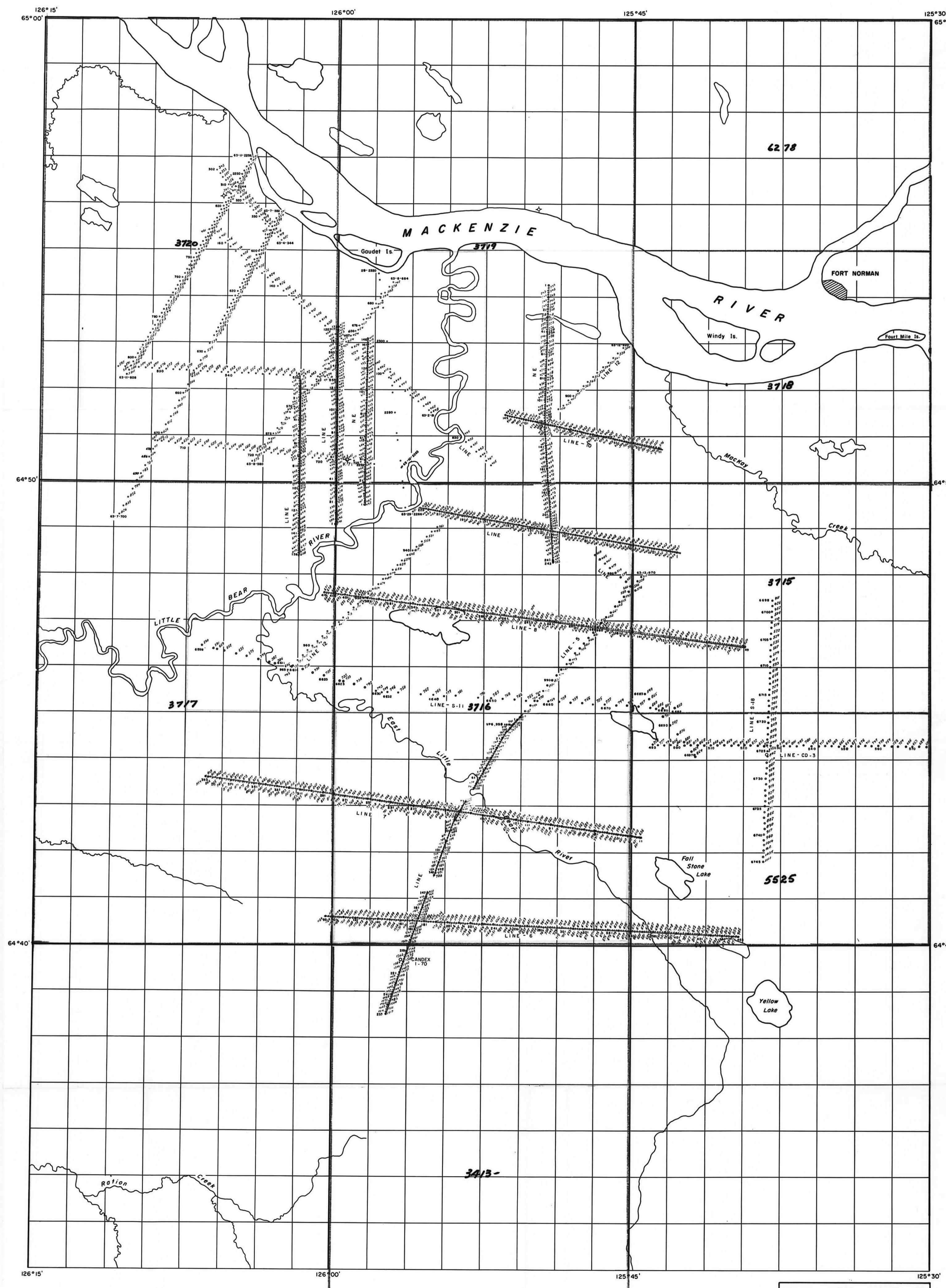
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March 1974



CANADA CITIES SERVICE LTD.

LITTLE BEAR AREA

SURFACE ELEVATIONS

-LINES VIBRATED BY CITIES.

62-6 5-35

062-06-05-035

SEISMIC INVESTIGATION

LITTLE BEAR AREA - FORT NORMAN, N.W.T.

on

Petroleum and Natural Gas Permits
3715 - 3720, 5525

Government Project #62-6-5-73-2

Carried out under Land Use Permit No.
N73B359 during the period March 3rd,
1973 to April 7th, 1973.

by

J. H. Harding: Chief Geophysicist

CANADA-CITIES SERVICE, LTD.

CALGARY, ALBERTA

Submitted in support of statement of Expenditure.



ENCLOSURES

The following enclosures are located in the attached envelope:

Vibrator Point Location and Surface Elevations.
Top of Devonian Carbonate (2-way time structure).
Canyon Creek to Hume Isochron.

The data were forwarded to Calgary and processed by Digitech Ltd. to give stacked structural cross-sections corrected to a datum of sea level using a correctional velocity of 10,000 ft. per second.

The purpose of the survey was to establish further drilling locations in the vicinity of the Cities Service et al Bluefish K-71 well if that well proved to be productive and to attempt to establish a possible drilling location on the option lands to the east of the Little Bear River.

The following maps are enclosed:

1. Vibrator Point Location & Surface Elevation map.
2. Top of Devonian Carbonate (2 way time structure)
3. Canyon Creek to Hume Isochron.

The data shown on the maps includes data acquired from Mobil Oil on a farm-in basis, data acquired from Sigma Explorations Ltd. and data vibrated by Canada-Cities Service, Ltd.

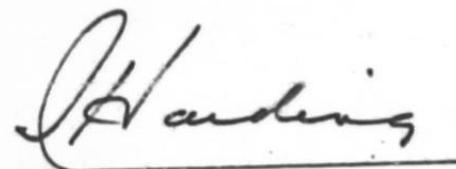
The Canyon Creek to Hume Isochron was mapped only on the data west of the Little Bear River as the Canyon Creek reflection was not present on the cross-sections east of the river. The Isochron shows thickening of the interval in the vicinity of the Cities Service et al Bluefish K-71 well. It was interpreted that this thickening may be due to a reef build-up similar to the Middle Devonian reef that is productive in the Norman Wells field. As the well encountered no reef and had no indications of the presence of hydrocarbons no further activity is planned.

The Devonian Carbonate structure map shows steep south-west dip with good evidence of faulting in the eastern portion of the area. Several other faults are postulated on the basis of fair to poor data. There is little evidence of closure along any of the faults to form a good trap in which to find hydrocarbons, consequently the option to drill a test well will not be exercised.

A final plan of the seismic program was submitted to the Regional Manager, Water, Forests and Land Division in Yellowknife on June 12, 1973.

Respectfully submitted,

CANADA-CITIES SERVICE, LTD.



J. H. Harding
Chief Geophysicist

September 26, 1973

246-09-05-053



FINAL REPORT

MARINE SEISMOGRAPH SURVEY

August - September 1970

GREAT BEAR LAKE

NORTHWEST TERRITORIES

for

ATLANTIC RICHFIELD CANADA LTD.

by

TELEDYNE EXPLORATION LIMITED

Party 715

Conducted Over Permits 6367-6371,
6373, 6858, 6859, 6388, 6389, 6398-
6400, 6868-6870, 6864-6866, 6522,
6523-6531, and 6533

AUTHORS: Teledyne Exploration Limited - Sept./70

K. Brillon, Atlantic Richfield Canada Ltd. - June/73

Project No. 246-9-5-70-4

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Enclosures

1. Bathymetric Maps - four parts
 - a) Part 1 - Fort Franklin and Manitou Island Map Sheet
 - b) Part 2 - Douglas Bay and Cape MacDonnel Map Sheet
 - c) Part 3 - Ikanyo Island and Ekica Island Map Sheet
 - d) Part 4 - Hare Indian River and Crosswise Island Map Sheet
2. Time Structure Map - Geologic Identification Unknown - Two Parts

GENERAL INFORMATION

(a) Location of Survey Area

The area surveyed is located in the Great Bear Lake in the Northwest Territory of Canada between approximate latitudes 65° N to 66° 33' N and longitudes 121° 15' W to 124° 15' W.

(b) Purpose of Survey

The objectives of the survey were as follows:

- (1) To determine the thickness of sedimentary sections
- (2) To establish the configuration of sub-surface strata
- (3) To determine the existence or otherwise of structural features favorable for the accumulation of hydrocarbons within the surveyed area.

(c) Base of Operations

During the survey the following sites were used as operational bases:

(1) Great Bear Landing

Situated at the Southwestern end of the Keith Arm.

This site was used for the mobilization, demobilization and main supply center.

(2) Katseyedie River Camp

A tent camp was set up at this location situated near the mouth of the Katseyedie River; this camp was used for the entire program completed in the Smith Arm.

(3) Fort Franklin

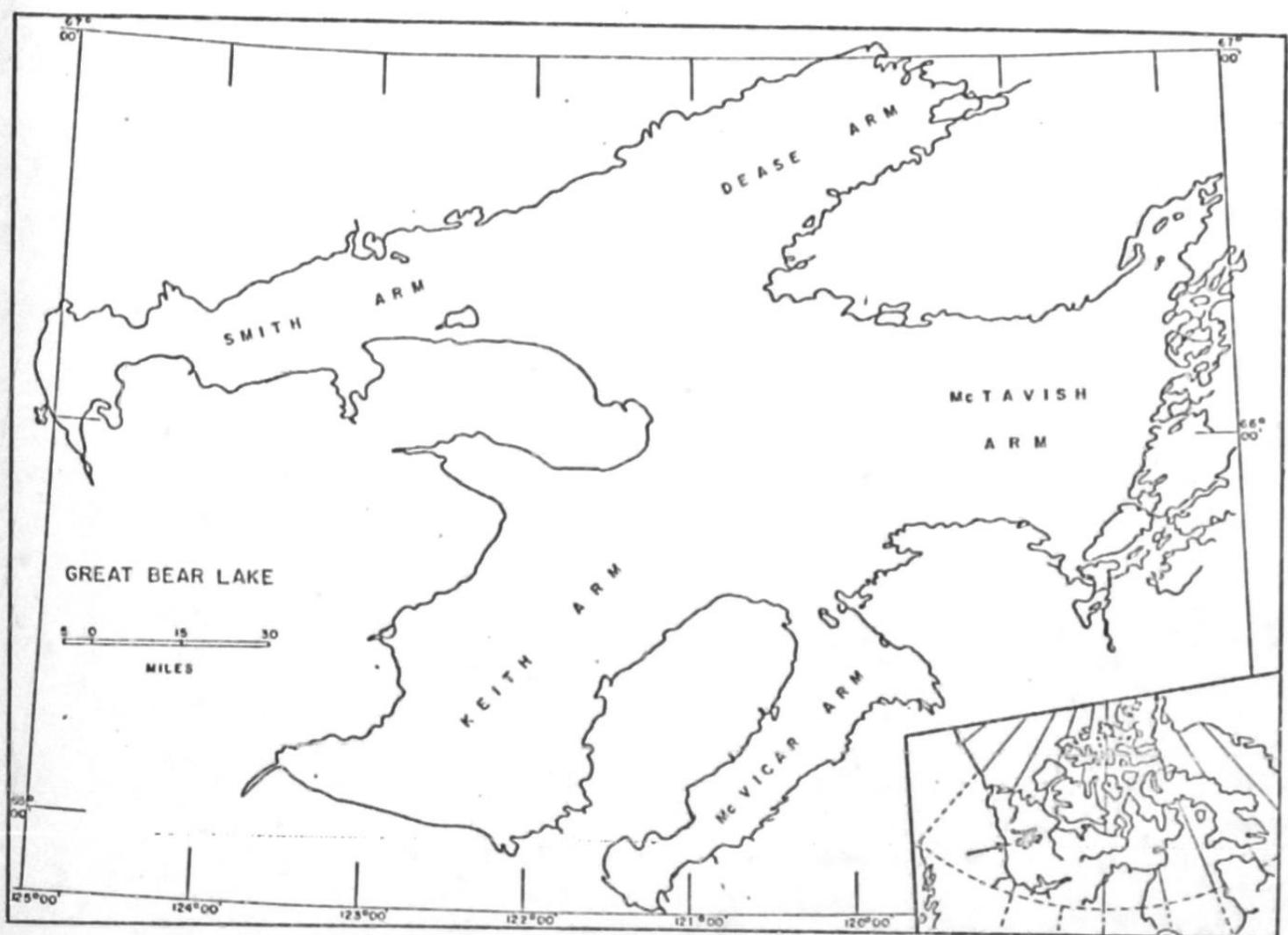
This location situated 7 miles north of the Great Bear Landing, was used as the base for the program conducted in the Keith Arm.

(d) Date of Operations

On July the 28th the crew started mobilization on the vessel at Great Bear Landing. Shooting began in the Smith Arm of the lake on August 20th and was completed on September 9th.

On September the 12th shooting began in the Keith Arm and terminated on September the 20th.

Demobilization was completed on September the 25th.



LOCATION MAP GENERAL

CHRONOLOGY

1970

July 26th Silver Bell arrived Great Bear Landing
July 27th Personnel and "R 32" arrived Great Bear Landing
July 28th Started mobilizing
August 1st Computing Devices technicians arrived
August 2nd Installed Minifix and SSB radio
August 6th-7th Moved to Smith Arm
August 8th-18th Problems with Minifix system. Changed to Hyperbolic system
August 20th Started shooting in Smith Arm
Sept. 9th-10th Completed shooting in Smith Arm. Moving to Fort Franklin
Sept. 12th Started shooting in Keith Arm
Sept. 20th Terminated shooting
Sept. 23rd Started demobilization
Sept. 26th All personnel left Great Bear Lake

STATISTICAL INFORMATION

<u>Line No.*</u>	<u>Miles Shot</u>
L 002	60.12
L 003	15.45
L 003A	30.23
L 004	71.70
L 006	27.38
L 008	14.66
L 011	2.27
L 014	51.93
L 015	10.91
Total miles shot	284.65

Days of shooting	12
Average miles per day	23.72
Weather Days	15
Equipment Failure Days	3

EQUIPMENT

Survey Vessels

(1) Recording

The recording equipment was installed on the "Silver Bell", a wooden hulled vessel, having the following specifications: -

Length 43'6"

Beam 12'4"

Draft 4'7"

Main engine Cummins diesel single screw

This vessel was equipped with a Simirad fathometer Model E.C. 2. Power for the instruments was provided by a 30 K. W. 60 Hz 110/220v generator. This vessel was manned by a crew of two.

(2) Supply

To facilitate operations a 32' shallow draft vessel the R 32 was used. This vessel was equipped with a 385 H. P. gasoline driven Berkley jet powered engine. When required lane count was carried to the recording boat by this vessel.

PERSONNEL

(a)

Technical

Roy Davis	Field Supervisor
John Downs	Senior Operator
James Duggan	Party Manager/Coordinator
Doug Ross	Digital Engineer
James Parkhill	Senior Observer
James Merker	Compressor/Air Gun Mechanic
W. H. Parker	Engineering (instrumentation)

(b)

Support

Julian Mills	Captain "Silver Bell"
Lyle Thurlow	Engineer "Silver Bell"
Jim James	Captain " R 32 "
Colon Harcourt	Helper " R 32 "

A cook and camp helper were provided by Crown Catering Co.

SURVEY NAVIGATION

The electronic navigation system used to determine the position of lines and shotpoints was provided by Computing Devices of Canada Ltd. utilizing the Decca Minifix system.

A mobile receiving unit was installed on the recording boat and operated by two Computing Devices technicians. Three shore based transmitting stations were operated in a hyperbolic mode as the original range - range mode could not be used on board the vessel due to the R. F. interference created by the Decca transmitter.

Dabbs Control Surveys Ltd. of Edmonton performed the survey to establish the base station locations. A total of twelve locations were surveyed in. The coordinates of these stations are shown in Plate VI.

CONDITIONS

During the operational survey period from August 20th to September 20th bad weather prevented operations on 15 days due to high winds and the resulting wave height.

<u>STATION</u>	<u>ZONE</u>	<u>X</u>	<u>Y</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>CONVERGENCE</u>
IKANYO	10	7351929.200	-13447.000	66 17 19.1889	-123 17 58.7632	0 16 27.6987
KIETH	50	10	7193387.473	33030.836	64 51 53.6730	-122 18 11.1116
ROSS	53	10	7254735.510	108818.750	65 23 55.7699	-120 39 25.5101
MINFIX 01	10	7362264.336	-30979.172	66 22 48.4631	-123 41 34.3453	0 38 5.3965
MINFIX 02	10	7337620.039	-17727.652	66 9 36.3060	-123 23 34.9563	0 21 34.2332
MINFIX 03	10	7327441.574	79691.313	66 3 33.2419	-121 14 23.8946	-1 36 31.2824
MINFIX 04	10	7367533.512	110508.008	66 24 33.5209	-120 31 30.1425	-2 16 6.0568
MINFIX 05	10	7278552.434	29084.969	65 37 45.6640	-122 22 6.0407	0 -34 31.3529
MINFIX 06	10	7252944.168	68333.914	65 23 37.5036	-121 31 45.0760	-1 20 14.2778
MINFIX 07	10	7209125.141	26987.258	65 0 23.9499	-122 25 39.3092	0 -31 7.7324
MINFIX 08	10	7227689.303	102412.727	65 9 30.2855	-120 48 54.1681	-1 58 58.6412
MINFIX 09	10	7217452.859	116767.148	65 3 42.7893	-120 31 3.7399	-2 15 3.9810

SURVEY SITE LOCATION

RECORDING TECHNIQUES

(a) Recording Method

A single boat continuous tow operation was used. The recording vessel towed the cable continuously along a predetermined line at an approximate speed of 4 to 5 knots. Two Bolt 600B air guns equipped with a 20 cubic inch and a 40 cubic chamber respectively operating at a working pressure of 2000 P.S.I. were used.

The guns were towed behind the survey vessel at a distance of two hundred feet at a depth of thirty feet, when the correct shotpoint position was reached both guns were fired simultaneously by an electrical impulse synchronized with the recorder.

An electric driven Worthington air compressor supplied the required air.

(b) Marine Cable

The cable used was a neutrally buoyant streamer manufactured by Teledyne Exploration Company. This cable is designed as a continuous tow cable. It is oil filled and contains 50 MP 7B hydrophones per 150 foot section. Depth control is achieved pneumatically and the operating depth of 30 - 40 feet is determined by two electrical depth transducers, one at either end of the active length.

(c) Instrumentation Recording

For the 600% coverage the air guns were fired at 75 foot intervals.

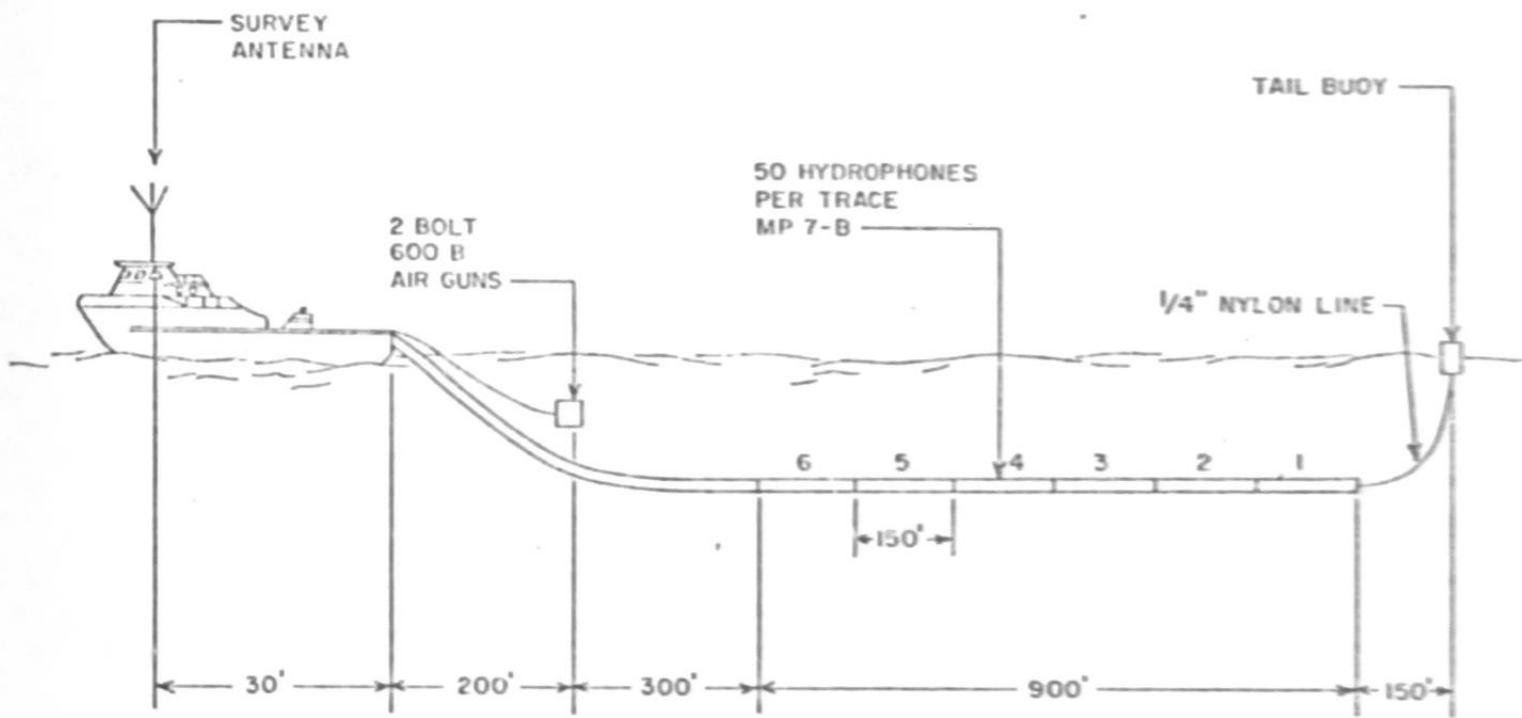
Recordings were made on a 1" tape using a Texas Instrument Incorporated digital field recorder Type 10,000. As only six traces were used, the following channels in the 10,000 system were utilized:-

Trace 6	10,000 Channels	1, 7, 13, & 19
Trace 5	10,000 Channels	2, 8, 14, & 20
Trace 4	10,000 Channels	3, 9, 15, & 21
Trace 3	10,000 Channels	4, 10, 16, & 22
Trace 2	10,000 Channels	5, 11, 17, & 23
Trace 1	10,000 Channels	6, 12, 18, & 24

Paralleling of the digital channels was accomplished at the output of the aliasing filters. Two second records were recorded at a sample rate of 4 milliseconds (Note: - By paralleling inputs an effective sampling rate of 1 millisecond was obtained.)

Simultaneously with the six channel recording, a single trace facsimile section was made from the near trace. A Raytheon Model 196B recorder using NDK dry paper was utilized for this function.

Drywrite camera monitors were made with a Dynatronics camera every 16 shots for quality control.



CABLE AND TOWING ARRAY DIAGRAM

TELEDYNE EXPLORATION

(150' TRACE INTERVAL)

DATA PROCESSING

BY TELEDYNE EXPLORATION LIMITED

(a) INTRODUCTION

The marine data from Great Bear Lake was received by six geophone traces spaced 150 feet apart. The first trace was located 275 feet from the energy source. Two air guns supplied the seismic pulse and were fired every 75 feet. 600 per cent CDP coverage resulted with the above technique. The selection of field parameters was based mainly on the assumption of a very shallow section. Very little is known of the geology in the immediate vicinity of the lake other than that obtained from surface out-crops. The nearest well control lies some 75 miles to the southwest. Water depths ranged from 50 to 500 feet.

(b) ORDER OF DATA PROCESSING

After some two weeks of experimental work with velocities, filters, deconvolution operators, etc. the following procedure was selected for processing the data:

- (1) Demultiplex and edit field reels.
- (2) Digital Filter 12-16/60-80.
- (3) Deconvolution.
- (4) Removal of normal moveout.
- (5) Display of 100% data.

- (6) Stack.
- (7) Digital Filter 12-16/40-50.
- (8) Digital AGC.

(c) VELOCITY FUNCTION

The initial velocity function utilized on the Great Bear Lake data was estimated by projecting interval velocities from three wells located approximately 75 miles to the southwest. This function proved to be inadequate; therefore, "trial and error" methods were employed. The resulting curves corrected the water bottom reflection in addition to another reflection which intermittently occurred between 300 and 400 milliseconds. Attempts made to run automatic velocity analysis were generally failures; this was due mainly to the shallow section, short spread and insufficient stack. The velocity of the water in the lake was assumed to be 4800 feet per second.

(d) DATA CONTENT

In addition to the water bottom reflection and its multiples only one other event believed to be a reflection appeared on the sections. This reflection usually arrived at a two-way time of from 300 - 400 milliseconds. The

average velocity necessary to correct this event was very low, which may indicate the presence of glacial fill.

A comparison of various digital filters indicated a suitable frequency band pass to be from 16 to 40 cycles per second.

Attenuation of multiples and secondary pulses from the air guns was accomplished by deconvolution. An operator 200 m.s. long was selected and designed for each trace over a window from 300 to 1500 m.s. A 28 cycle Ricker wavelet was employed to band limit the deconvolution operator. The effectiveness of the deconvolution process was somewhat questionable when the water depth exceeded 250 feet. At the greater depths the first multiple from the water bottom reflection became troublesome. Despite the limitations of the deconvolution filter, it was felt that the overall section was enhanced by partial deréverberation and wave shaping.

(e) CONCLUSIONS

The absence of a deeper reflection prevented an analogy between interval velocities and geological horizons; however it is felt that a maximum amount of information was obtained from the field data by using the processing techniques previously outlined.

INTERPRETATION

a) Maps Prepared and Reliability of the Data:

Two maps have been prepared for this report, a Bathymetric map and an interpretational map, Geologic Identification Unknown.

The Bathymetric map is a compilation of the Simrad fathometer readings which were then contoured in ten foot intervals.

The depth values can be considered accurate to ± 3 feet while the locations of these depths should be considered dubious.

The interpretational map, Geologic Identification Unknown, is a structural presentation of the one primary seismic reflection which was considered believable. This map is very unreliable and therefore the anomalies observed should be verified with additional seismic. The questionable nature of the interpretation is mainly due to the poor quality of the sections used to produce the final map. The seismic sections are poor in quality for the reasons mentioned in the data processing section of this report, incorrect velocity functions used to correct the data and the interference of water bottom multiples.

b) Results:

The reflection, although sparsely mapped, does indicate structurally anomalous areas that have been designated letters from A to E.

Northern anomalies located in the Smith Arm of Great Bear Lake.

Anomaly A - A fault bounded high

Anomaly B - A broad anticline

Anomaly C - A normal faulted area

Anomaly D - Another normal faulted area

Southern anomalies located in the Keith Arm of Great Bear Lake

Anomaly E - A broad syncline

e) Conclusions:

The marine seismic indicates that the sedimentary section thins and becomes more faulted as the shield is approached. The faults which appear to be high angle normal faults are probably pre-existing displacements which were re-activated during Paleozoic times.

The upthrown blocks and the anticlines mapped would be considered prospective if porosity exists in the older sediments and the younger sediments are of the proper lithology to provide the caprock.

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