

J Ray McDermott Canada, Ltd.  
Technical Report  
Norman Area (Carcajou River), N.W.T.  
632-6-6-70-1



217 ROYALITE BUILDING - 615 - 2nd STREET S.W. - CALGARY 2, ALBERTA

TITLE PAGE

Type of Report: Technical Report of a Reflection Seismograph Survey

Survey Area: Norman Area (Carcajou River), Northwest Territories

Year Done: May 1970

Name of Operator: J. Ray McDernott Canada Ltd.

Name of Contractor: Globe Universal Sciences Canada Ltd.

Permits over which work was done: 4381, 4382, and 4383

Name of Author: F. F. Foster

Date of Report: 25 July 1972

Project Number: 632 - 6 - 6 - 70 - 1



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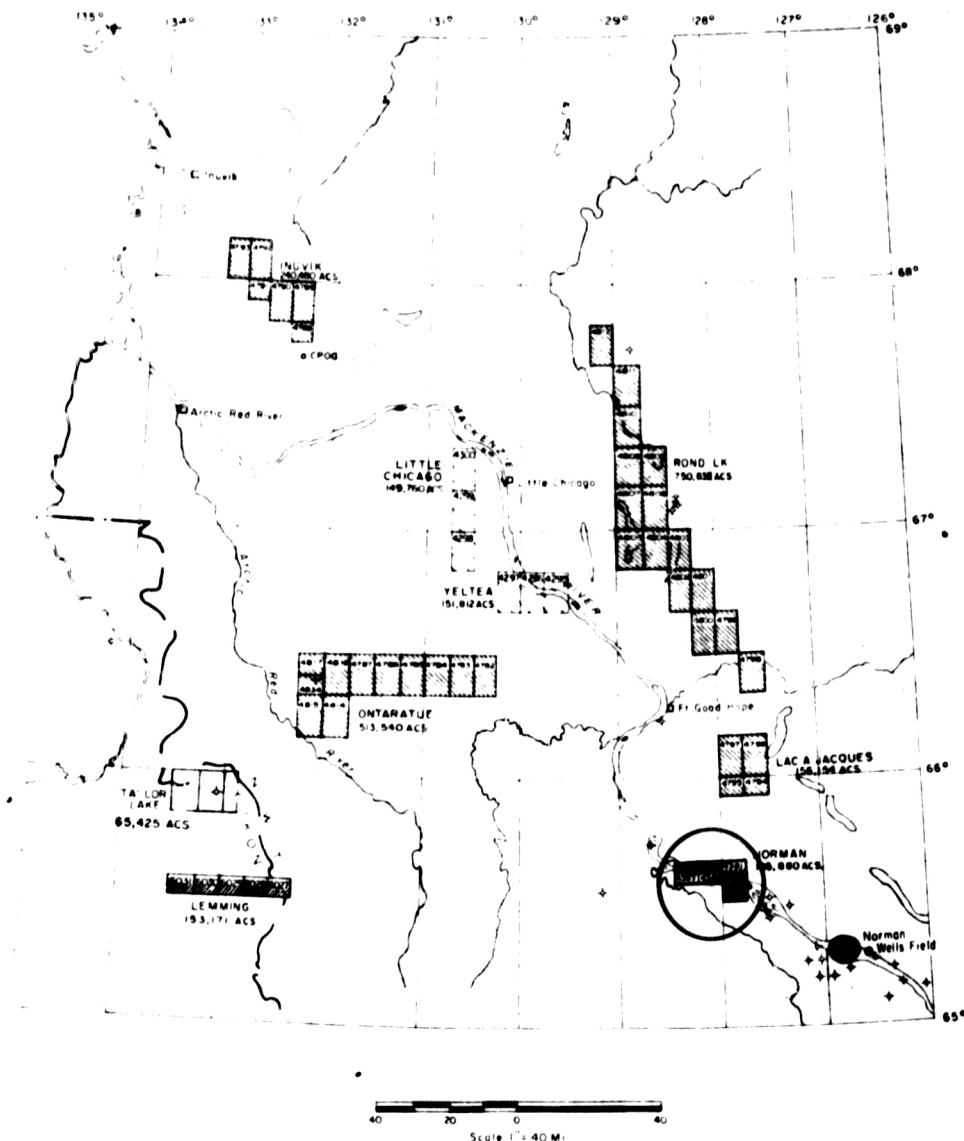
## INTRODUCTION

This survey was conducted by Globe Universal Sciences Canada Ltd. for J. Ray McDermott Canada Ltd. to more fully evaluate a Key Scarp Reef lead that was indicated by earlier shooting (1968) that seem to lie along the south bank of the Mackenzie River within the permit blocks. It is considered to be a semi-detail survey.

The crew was contracted from an insitu location on the river bank close to the Sans Sault Rapids. The crew had finished a winter shoot and had moved out to their summer camp, where we picked them up for this 25+ mile program. Thus mobilization and demobilization were held to an absolute minimum, and only very limited supplies had to be restocked from the south.

The crew operated around the clock on a 24 hour shift, so that we would not get caught by any breakup. The various work shifts were flown in and out of the prospect by helicopter from the up river camp, which was mandatory to complete the program promptly. The vehicles made only one round trip. Minor supplies were also flown in.

Final demobilization of the personnel to points south. at the end of the project was accomplished by helicopter to Norman Wells, and then on by commercial air transport. The cost of this final transport was prorated between the winter client and J. Ray McDermott.



## LOCALITY MAP

## NORMAN AREA, (CARCAJOU RIVER), NORTHWEST TERRITORIES

25.25 MILES OF SEMI-DETAIL REFLECTION SEISMOGRAPH SHOOTING  
COVERS PERMITS # 4381, 4382, and 4383  
PROJECT NUMBER: 632-6-6-70-1

## STATISTICAL DATA

### Dates:

Mobilization 27 April 1970 at Summer Camp site, Mackenzie River.

Demobilization 10 May 1970. Helicopter to Norman Wells, Pacific Western Airlines out to south.

Dozers started 27 April 1970

Drills started 30 April 1970

Recorders left camp on 1 May 1970

Recording commenced on 2 May 1970

Recording completed on 7 May 1970

Crew returned to camp on 8 May 1970

Ceased operations on 9 May 1970, and released.

### Production:

Miles of coverage-----	25.25
Number of Profiles shot-----	285.00
Average miles per day recorded-----	4.20
Average Profiles per day recorded-----	47.50
Days worked-----	9.00
Down-days-----	0.00
Dynamite used-----	3564.51 lbs.
Caps used-----	369.00
Holes drilled-----	333.00
Footage drilled-----	25025 ft.

### Equipment:

#### Drilling:

- 3 Slobe drills - Air/water - Failing CFD-1 - Flextrack 160s
- 2 Bertram drills - Air - Mayhew 1000 - Flextrack 160s
- 1 Bertram drill - Top Drive Auger - Flextrack 160
- 1 Water tender - Flextrack 160
- 1 Flat deck truck
- 1 Fuel truck

#### Dozing:

- 2 D7Es with winch
- 2 D7Es with ripper blade
- 1 D6C with winch

Equipment: (cont'd.)

Other:

- 1 Recording truck
- 1 Shooting truck
- 2 Line trucks
- 1 Survey pickup
- 1 Dynamite magazine

Camp:

A complete field camp with associated equipment for 40 men. This was by far in excess of what we needed but was the total camp used during the entire winter and for convenience we used same.

Recording:

- 1 DFS-3 series Binary Gain Digital field recording system with a 21 track tape unit, a SW100 dry process camera, and a flexible roll-a-long switch.
- 75 strings of geophones - 8 geophones each - Mark L10 - 14 cycle phones.
- 20 900 ft. portable cables with 150 ft. take-out intervals.

<u>Personnel:</u>	<u>Number</u>	<u>Position or Title</u>
	1	Party Chief
	2	Computers
	1	Party Manager
	1	Observer
	1	Assistant Observer
	1	Shooter
	2	Surveyors
	2	Line truck drivers
	7	Observers helpers
	2	Rodmen
	6	Drillers
	6	Drill Helpers
	5	Buldozer operators
	1	Mechanic
	1	Cook
	1	Cook's helper
	1	Camp attendant
	1	Client Representative

Surveying:

The survey crew for the most part consisted of one surveyor and one rodman, however in order to tie in to the control it was necessary to use an additional crew to finish up. The survey instruments were T16 theodolites, and the stations were measured with a steel tape. Geodetic BM #73 was used as the take off point. This BM (elevation 144.7 ft. ASL) was located on the base map by means of Geodetic air photos, and good horizontal ties to creeks and lakes were established. To ensure maximum accuracy in field measurements, all turns and setups were double shot and horizontal angles were repeated.

Conditions:

The survey area is bounded on the north by the Mackenzie River, and south and west by the Carcajou River. Numerous small creeks and lakes were scattered throughout. Vegetation is generally sparse, but with occasional heavy patches of stunted spruce. Some small areas of muskeg were also found to be present. The land dips gently south at a rate of approximately 50 feet per mile, from a high embankment along the south Mackenzie River bank. This embankment was 40-50 feet high and relatively steep, on the order of 400 ft. per mile. The climatic conditions were that of an eminent breakup, and the small creeks had already started to run before we completed the survey. One muskeg had thawed, and presented a problem with one of our drill flextracks breaking through. The Mackenzie River was still iced over, but it was decided that we could not gamble on running our equipment on the ice either from or back to the camp north of the Sans Sault Rapids



## FIELD PROCEDURES

Method Employed: Reflection seismograph surveying.

Charge Size: 10 pound average, preloaded by drillers.

Hole Depth: Average 75 feet. Initially holes were 60 ft., but to improve record quality they were deepened to 80 feet.

Filter: All shots were recorded on out-124 filter. Field playbacks were run in out-124, and 12-64.

Geophone Spread: 1320' - 55' - SP - 55' - 1320' split spread.  
Group interval 110 feet.  
8 geophones per group.  
Geophones were Mark L10 14 cps models.

Lines #70-5 and #70-6 were shot as 2640' single enders.  
Line #70-7 was shot as 1800' splits.

Percentage Stack: 300% CDP stack.

Shothole Spacing: Standard 440 feet interval.

Recording: All data was recorded using the TI DFS-III digital recording system. The sample rate was 2 milliseconds. The total time was recorded to 3 seconds. All this data was stored on 21 track TIAC format. Field playbacks were made for immediate check on quality and some limited interpretation.

## DATA PROCESSING

Tests were run initially to help determine the optimum parameters for processing. The initial decision to use deconvolution on the poor data to the west was last abandoned. Frequency spectrum appeared to be very important in bringing out the variations of the shallow reef reflector. The following procedures were considered the standard format:

Computing: The near surface velocity ranged from 11,000 ft/sec in the east, to 8,000 ft/sec in the west. Since no estimate of the 8,000 ft/sec layer thickness was possible (spread length too short), a constant 11,000 ft/sec correctional velocity was used to reduce the data to a sea level datum.

### Digital Processing:

1. Edit-Demultiplexing
2. Normal Moveout analysis
3. Filter
4. Trace Equalization
5. Digital to Analog Conversion Payout
6. Trace muting
7. Trace Gather
8. D to A conversion and payout
9. Trim statics
10. 300% stack
11. Final static trim
12. Digital Bandpass filter: 93 points  
17/22 - 62/67
13. Amplitude Recovery: Gates: 0 - 150  
350 - 560  
700 - 1150  
1200 - 1700  
1700 - 2800
14. Final stack section film display (non-flattened) on wiggle/trace-variable area.

Name of Processing Agency: Digitech Ltd., Calgary, Alberta, Canada

## RESULTS AND INTERPRETATION

The following maps are included in this report, and represent the interpretation of the data as of the dates shown:

1. Shotpoint location and surface elevation map.
2. Structure Map - base of Canol Formation
3. Structure Map - Reef Platform
4. Structure Map - Top of Mt. Kindle Formation
5. Isopach Map - Top Reef to Platform
6. Isopach Map - Chert Formation
7. Isopach Map - Mt. Kindle Formation

The scale of all the above maps were originally made at 2" = 1 mile (1:31680). This is slightly larger than the scale suggested however, it should suffice. The seismic grid is denoted as semi-detail and was laid to evaluate a lead previously described by a seismic line shot in 1968 along the Mackenzie River. This line has been reinterpreted with this data and is included on the latest interpretation attached.

Data quality ranged from excellent in the east to NG in the west. A sand body of undetermined thickness causes the quality deterioration in the west. Analysis of early arrivals on line #70-7 indicates that the sand extends down to a depth of at least 400 feet, hence it appears that this problem might be resolved with pattern holes rather than shot depth holes vs. one hole. An attempt was made to reduce noise interference on lines #70-5 and #70-6 by shooting 1/2 mile single-enders instead of 1/4 mile splits. It is felt that no improvement in data quality was achieved by this method, probably because the longer shot to detector distances caused a weaker signal to be recorded.

The interpretation of the data was initially confined to a shallow zone which encompassed the Canol, Key Scarp Reef, and Hume events. Seismic events below the Hume and reef platform displayed some severe character changes, and possible multiple interference. However, after the wells were drilled we did go back and interpret the Mt. Kindle and Chert formations as identified by our wells and sonigram.

### Base of Canol Formation

The map title denotes that this horizon was the first event below the Canol formation. In reality it represents the top of the Key Scarp Reef in certain areas, the reef platform in other areas, and also the Hare Indian limestone, and the Hare Indian shale tops in areas to the southeast and east. The purpose of the map was to see the general depth and configuration of the older section below Canol. The most striking feature is the mark flattening and end closure noted in the central portion of the map. This will be explained when we see the reef isopach.

The data was projected to tie the surface outcrops north of the river. Also the older riverbank lines were tie in as noted on the map.

#### Reef Platform

This structural map shows the configuration of the reef platform, and forms a base on which the Reef isopach may be built up. Three things should be particularly noted on this map: (1) We interpret that there is an abrupt edge to the platform on the east side of the shooting and that the platform terminates. (2) The west side of the shooting does not have sufficient quality to distinguish the reef platform from noise and other events. (3) There again is a general flattening, but there is no end closure as seen above this event. The highest point has shifted to the north end of the #70-2 line. Again this map shows the expected depth at which we would have penetrated all the reef and be into platform rock.

#### Isopach Map - Top Reef to Platform

This map was the key map in our initial interpretation. It shows the thickness and distribution of the Key Scarp Reef as determined by our seismic evidence. It is obvious that the southern reef front is inferred, since it is not controlled by data. This was projected on shape basis, and as such is speculative. Again the westerly end is limited by poor data, and may actually have reef section. The north facing front extends out under the river, and has not been fully measured. Here we used the observed dip and the normal projected dip of a reef face in the area ( $21^\circ$ ) to speculate on the extent. There were certain other factors that are noted on the map as special notes, and were used to fully integrate this seismic data to a sound geologic model. The potential of a reef event on the river line to the extreme east was taken into total from our 1968 shooting, and was not further evaluated.

#### PRELIMINARY CONCLUSIONS

The total integration of the reef evidence indicates that the north end of line #70-3 would be an up-dip location, well on the reef, and should encounter significant reef section. The best known reef edge location, although somewhat down-dip, would be on the #70-1 line at approximately shotpoint 87. Recommendation-drill.

#### SECOND STAGE INTERPRETATION

After the wells were drilled we became interested in the lower section, since the reef was found, and had secondary infill within the porous section. At this time we initiated a study of the Chert and Mt. Kindle formations.

### Top of Mt. Kindle Formation and Isopach

The study of the Mt. Kindle formation indicated by the seismic data indicates that on the south side of the river we have truncation of the Mt. Kindle unit by the overlying Bear Rock formation. The best evidence is located at approximately SP 135 on the #70-2 line and SP 125 on the #70-1 line. In addition to this, possible truncation can be inferred at about shotpoint 15 on the # EL-1 river line. Both the present day dip of the Mt. Kindle and the isochron thickening increase to the south and west of the before mentioned points. From the seismic point of view, the south side of the river would offer further opportunity for a stratigraphic trap to the east and south of the east end of line #70-1. Integration of this work with the surface dips north of the river, would indicate that the highest structural position would be across the river to the north on Carcajou Ridge. Projection of the structural attitude of the Mt. Kindle northward from the seismic to geologic model is abrupt under the river, but appears reasonable in light of the dynamic movement in the area. However, it is pointed out that this projection is speculative, and does not represent any seismic measurements.

### Isopach - Chert Formation

In order to perhaps see a little more of the attitude of the older rocks, we made a Chert Isopach, since this did not get affected by truncation. A check of the Carcajou Ridge showed that the Bear Rock appeared to lie directly on the Chert. This map was of limited use, but did show the possibility of elongate noses that generally were striking NNE-SSW similar to the potential at the Mt. Kindle. True thickness of the Chert unit was not possible to the extreme northeast of the seismic area, since there is a distinct possibility that the top has been eroded off, prior to Bear Rock deposition.

### CONCLUSIONS

Any further drilling particularly on the north side of the river would be speculative, and cannot be recommended as a seismic location. However, the cost of shooting data along Carcajou Ridge is very high, and I would recommend that the subsurface and surface lead on that side of the river be tested by a third party, at no expense to us.