

063-06-04-016

Cal.

FINAL GEOPHYSICAL REPORT

Nahanni Butte (Liard River) Area

Type of Survey:

VIBROSEIS SEISMIC SURVEY

063-06-04-016

Location: NTS 95G-3,4 95B-13,14,15

Year Recorded: 1973

Operator:

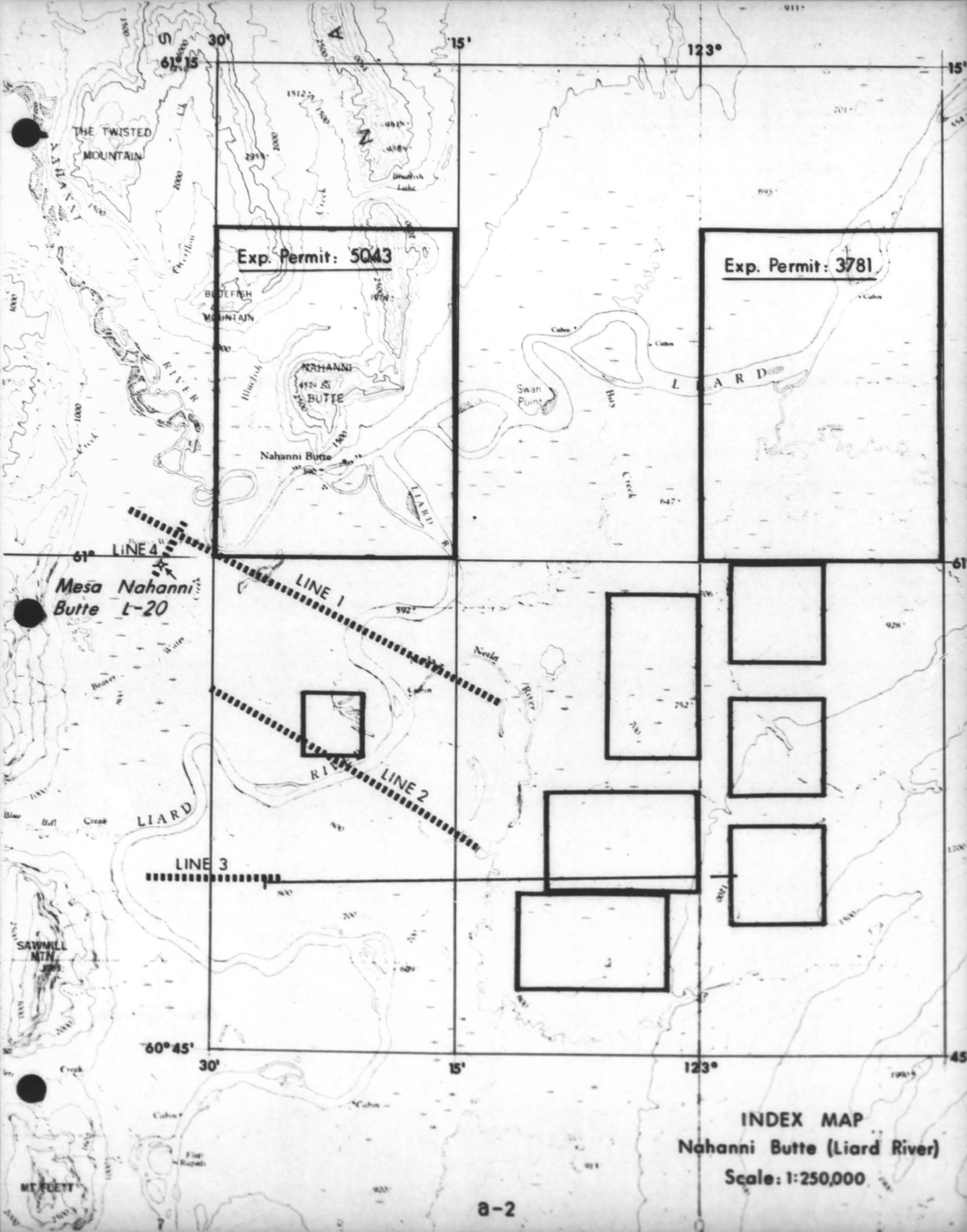
Murphy Oil Company Ltd.

Seismic Contractor: Dresser-Olympic Canada  
7535 Flint Road S.E.  
Calgary, Alberta.

Exploratory Permits: No. 3781, No. 5043  
Report by W.R. Haggard, Jr.  
Report Date: May, 1973

Project No. 63-6-4-73-3





Exp. Permit: 5043

Exp. Permit: 3781

Mesa Nahanni Butte L-20

LINE 1

LINE 2

LINE 3

LINE 4

INDEX MAP

Nahanni Butte (Liard River)

Scale: 1:250,000

**ABSTRACT:**

Report covers seismic operations conducted for Murphy Oil Company Ltd. by Dresser Olympic using the VIBROSEIS seismic method. Four lines were recorded for a total of 29.84 miles during the period from February 15th to 28th. 1973. Results indicate the Middle Devonian Carbonate Horizon to plunge westerly at 400 feet per mile from the southwest flank of the Liard Uplift toward the Disturbed Belt on the west. Laramide thrust faulting is indicated in the northwest portion of the project, with probable local structural closures.

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## FINAL GEOPHYSICAL REPORT

PROJECT NAME: Nahanni Butte (Liard River)  
MAP LOCATION: 95G-3,4 95B-13,14,15  
PROVINCE: Northwest Territories

### 1. Exploration Situation

Project area is located in close proximity to oil and gas lease 239-67 owned 50% by Murphy and 50% by Great Plains, and to exploratory permit Nos. 5043 and 3781 owned 100% by Murphy. Most of the remaining area is open crown. This seismic project was shot with Great Plains as a 50% partner.

### 11. Purpose of Seismic Program

The purpose of the program was to: (1) delineate structures believed associated with Laramide thrust faulting (2) define reef buildups in the Middle Devonian carbonate.

### 111. Geology of Area

The project is located immediately south of Nahanni Butte, at the south end of the Nahanni Range. The area lies at the west edge of the gently dipping southerly interior Plains, and appears to be within a narrow, N-S trending hinge line which separates the stable shelf on the east from the mobile geosyncline belt to the west. This hinge line forms a northerly trending band of comparatively steep dip at about longitude 123° W. Stratigraphic evidence indicates that this structural zone may have been active during several times in geological history.<sup>1</sup> Just east of the hinge line and centered at about lat. 61° 30' N is the Liard Uplift, a NNE-SSW trending positive structural element believed to have occurred in post-Mississippian pre-Cretaceous time. The project area lies along the south west flank of this structure.

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1. Geologic Report on the Mackenzie-Beaufort Basin area, Yukon and District of Mackenzie, Veezay Geodata Ltd.

The primary geological objective is the Middle Devonian carbonate section. Hydrocarbon accumulation can occur either in anticlinal structure or reef type traps. The Slave Point reef front lies southeast of the project, with pinnacle reefs located approximately 25 miles east. Nearest production is at Pointed Mountain field, located 35 miles southwest.

#### IV. Geophysics:

##### A. Statistics:

1. Geophysical Contractor and Party No. -  
Dresser Olympic Party #256
2. Date Shot - Feb. 15 to Feb. 28, 1973
3. No. of miles - 29.84
4. Cost Recording Ops. - \$112,815      Cost per mile - \$3,780
5. Cost Dozing Ops. - \$ 32,194      Cost per mile - \$1,079
6. Cost Line Cleanup- \$ 15,000 (est) Cost per mile - \$ 500
7. Cost processing - \$ 6,517      Cost per mile - \$ 218
8. Total cost - \$166,526      Cost per mile - \$5,580

##### B. Field Operations:

##### 1. General:

Crew and equipment consisted of the following:

- 4 Vibrators - truck mounted
- 1 Recording truck
- 3 Line trucks
- 1 Survey truck
- 2 Utility Vehicles
- 2 D-7 dozers
- 5 camp trailers

Crew operated from on-site camp. Supplies were brought in by truck from Ft. Nelson, B.C. via the Simpson Trail and a road constructed to the Mesa Nahanni Butte well located in the project area.

##### 2. Dozer Operations:

- (a) Dozer Contractor - Tompkins Contracting Ltd.  
P.O. Box 759, Fort St. John, B.C.
- (b) No. and type dozers - rates:  
2-D7-E \$28.00 per hour - \$5.00 per hour for  
ripper.

### 3. Surveying:

- (a) Maps available - Canada Topographic 95B and 95G - scale 1:250,000 Murphy base X-110
- (b) Instruments used - Theodolite
- (c) Monuments used - The Mesa Nahanni Butte L-20 well, located in the NW portion of the project was used for vertical control. Horizontal control was based on ties to topographic features. From this it was found that the Mesa well was actually 800 feet west of the stated location. When tying to the 1960 General Geophysical Line 26-7 at the south end of the project (line 3), it was found that the old line was 1400 feet north of the location shown on the maps.
- (d) Method of checking work - Double instrument turns.

### 4. Terrain Conditions:

- (a) Surface outcrops, vegetation - Area is covered by heavy timber which made dozing difficult. Surface outcrops are recent alluvial sands and silts except between shotpoints 123 to 137 on line 1 which had Middle Devonian dolomites exposed on a steep topographic high.
- (b) Roughness, muskeg, rivers, etc. - Project is located in the Liard River valley which has only slight topographic relief except for a very steep high located on the NW portion of line 1. Lines crossed the Liard and Netla rivers. Muskeg patches were encountered between areas of heavy timber.
- (c) Average Elevation- 700 feet.
- (d) Accessibility to populated areas - Area was accessible to the Alaska Highway via the Simpson Trail and a road constructed by Mesa Oil co. for access to the Mesa Nahanni Butte L-20 well.



5. Field Layout:

- (a) Group interval - 220 feet.
- (b) Stack - 1200%
- (c) Geophone Array length - 550 feet.
- (d) No. Geophones per channel 24 Type - Mark L-10(8 Hz)
- (e) Source Array length - 440 feet.
- (f) No. sweeps, pops, holes - 32
- (g) Type spread (split, long ender etc.) split  
5940' - 880' - 0 - 880' - 5940'
- (h) Offset from center of source to centre of  
first live group - 880 feet.
- (i) Sweep frequency - 55 - 11 Hz - down sweep.

6. Recording Equipment:

- (a) Recording Instruments - Recording Unit -  
Fortune T4 amplifiers, correlator - Mandrel  
DC-100, GeoSpace Plotter MR-101, summing unit  
Mandrel SUM-IT.
- (b) No. Channels - 48

7. Line Clean-up:

- (a) Government Requirements - Clean up requirements  
are stated in Land Use Permit No. N72 B308.  
Clean up will be supervised by Mr. K. Kepke,  
Northwest Lands and Forests Service, Hay River, NWT.
- (b) Date work must be completed - July 1, 1973
- (c) Contractor and rate schedule - Fillion Slashing  
and Location Clearing Ltd., Rocky Mountain House,  
Alberta. Rates: New Line - \$400 per mile. Erosion  
control - \$150 per mile, Seeding - \$30 per mile  
plus cost of seed.
- (d) Status - Will be completed in early summer.

8. Final Plans - Government Reports:

- (a) Government Reports required - Yellowknife re-  
quires a final plan showing cut lines, cleared  
areas, campsites, airfields, etc. within 60  
days after completion of program. Ottawa re-  
quires detailed technical report within 60  
days after expiration of Exploration Permit.
- (b) Date reports must be submitted - May 28, 1973
- (c) Status - In progress.



C. Near Surface Corrections:

1. Method of obtaining refraction data (describe field technique, equipment, reliability of data)  
Refraction data was not obtained since Vibroseis was used. Records were corrected using only datum corrections.
2. Velocities used -  $V_c = 6000$  '/sec.
3. Elevation Datum - + 700 feet.
4. Describe method of applying corrections to data:  
Correction times from surface to datum were calculated for each station, then shot and geophone corrections selected by computer for each trace. Final static corrections were computed by automatic statics program prior to stacking.

D. Processing:

1. Processor - Sefel J. and Associates  
710 - 7th Avenue S.W.  
Calgary, Alberta.
2. Processing Sequence (state operator lengths, windows, type decon., etc.)
  1. Vibroseis correlation
  2. Deconvolution (19 pt. - window .8t 2.2 sec.)
  3. Datum Corrections
  4. Trace gather
  5. Velocity analysis
  6. NMO
  7. Automatic Statics
  8. 1200% Stack
  9. Equalize
  10. Trace Scale
  11. Film display

(a) Statics by: Sefel J. and Associates.

(b) Added description of processing techniques:

A second processed section was made for each line using a coherence filter and Sefel's "Sono" technique.

### 3. Velocity Control

- (a) Function used for NMO corrections (well survey, sonogram etc.) - Velocity control was obtained by velocity analysis of the data.
- (b) Method of checking function on project lines: NMO corrected record displays.

## V. Interpretation:

### A. Maps:

- 1. Maps carried, file designation, map reliability: Middle Devonian - Nahanni Time Structure map. Data quality on Lines 1,2 and 4 was very poor. Map reliability fair to poor.

### B. Horizon Identification:

- 1. Method used, sonograms etc. - Horizon identification was made on Line 3 where data quality was excellent. Velocity analyses at SP 93 indicated interval Velocities up to 14,000 feet per second down to 1.300 sec., then increasing to 19,000 feet per second. This was interpreted to represent the top of the Middle Devonian Carbonate. Below this at 1.6 sec. the velocity increased to 24,500 feet per second. This occurs at the top of an angular unconformity which is interpreted to be the top of the Proterozoic. A sonigram at the Murphy et al Netla M-31, located 6 miles east of the project indicated Post Middle Devonian carbonate interval velocities from 12,000 to 14,000 feet per second, and Middle Devonian carbonate velocities from 20,000 to 22,000 feet per second.

### C. Well Ties:

A line was shot to tie to the Mesa Nahanni Butte L-20 well. Data from this well is not available at the time of this writing.

#### D. Description of mapping, prospects, etc.

Data quality was generally poor except on Line 3, however the gross structural configuration could be mapped. Line 2,3, and the southeast portion of Line 1 indicated westerly monoclinial dip at approximately 400 feet per mile. The Nahanni Horizon contours appear to tie closely with contours of a previous interpretation of 100% dynamite data shot immediately east of the project. This previous interpretation is included on the Nahanni Horizon Time Structure map. The old data delineates the south plunge of the Liard Uplift and the new shooting appears to show only the westward plunge from the Liard Uplift toward the Disturbed Belt.

Lines 1, 2 and 3 also show a major angular unconformity approximately .150 sec. (1500 ft.) below the Nahanni Horizon, with reflection events extending far below this. As described in the section discussing "Horizon Identification", interval velocities in the zone are over 24,000 feet per second, therefore the angular unconformity is believed to represent the top of the Proterozoic. GSC reports describe up to 20,000 feet of Proterozoic strata in the mountains west of the project.

Although data quality is extremely poor at the northwest end of Line 2, there appears to be thrust faulting toward the east. These faults coincide with thrusts mapped in surface horizons in the area north of the Nahanni and Liard Rivers. Line 4, which ties to the Mesa well indicates northeast dip, suggesting that the well was probably drilled on a local closure associated with the thrust faults.

#### V1 Recommendations:

The only anomalous structure in the area appears to be associated with thrust faults in the northwest portion of the project, and it is very likely that the Mesa dry hole is located on one of these. Unfortunately record quality was too poor to adequately define reefing in the Middle Devonian carbonate. For these reasons, it is recommended that no further exploration be undertaken in this area at this time.