

9229-B59-10E

RANGER OIL LIMITED

REPORT ON A SEISMIC SURVEY

CONDUCTED ON

EL 363

FORT LIARD AREA, N.W.T.

COVERING THE PROGRAM CONDUCTED BETWEEN

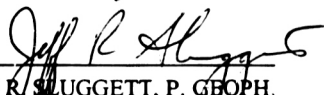
NOVEMBER 1998 – DECEMBER 1998

SUBMITTED TO THE NATIONAL ENERGY BOARD

CALGARY, ALBERTA

JULY 2000

By



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NEB AUTHORIZATION #S – 9229-BO59-0010E

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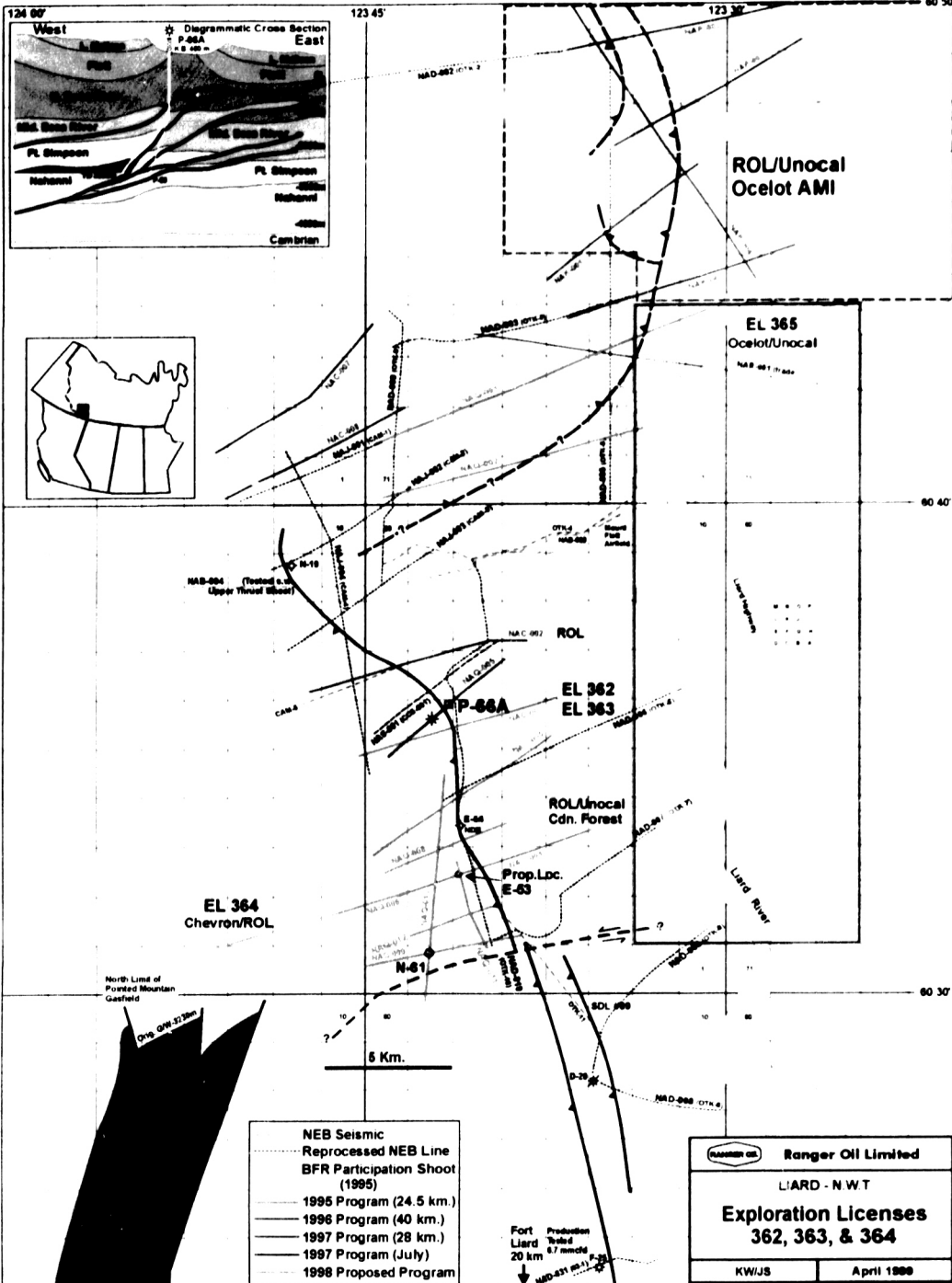
I ABSTRACT

A 7.8 km heliportable 2D seismic survey was conducted on the southern portion of Ranger's EL 363 from November to December 1998 (see Index Map). This program was designed to delineate the thrust structures of the Middle Devonian Nahanni formation, specifically to detail a following location the P-66A gas discovery.

After a lengthy processing sequence including post-stack time migration and pre-stack time migration, a time structure map was prepared on the Nahanni carbonate.

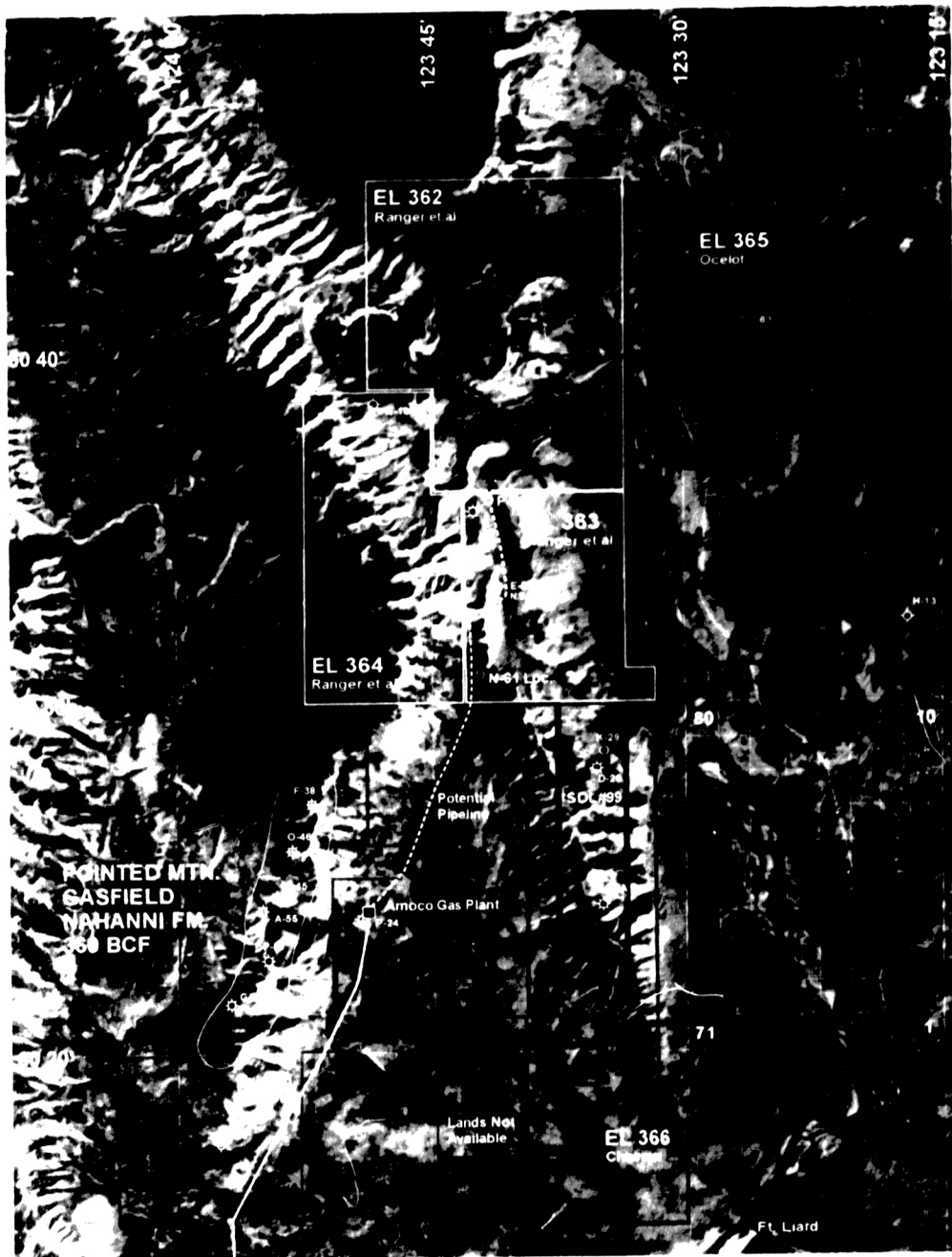
The resultant Nahanni Time Structure Map shows that the previous integration (ie pre lines NAQ-011, 12) still holds and that there is a potential location at N-61.

II INDEX MAPS



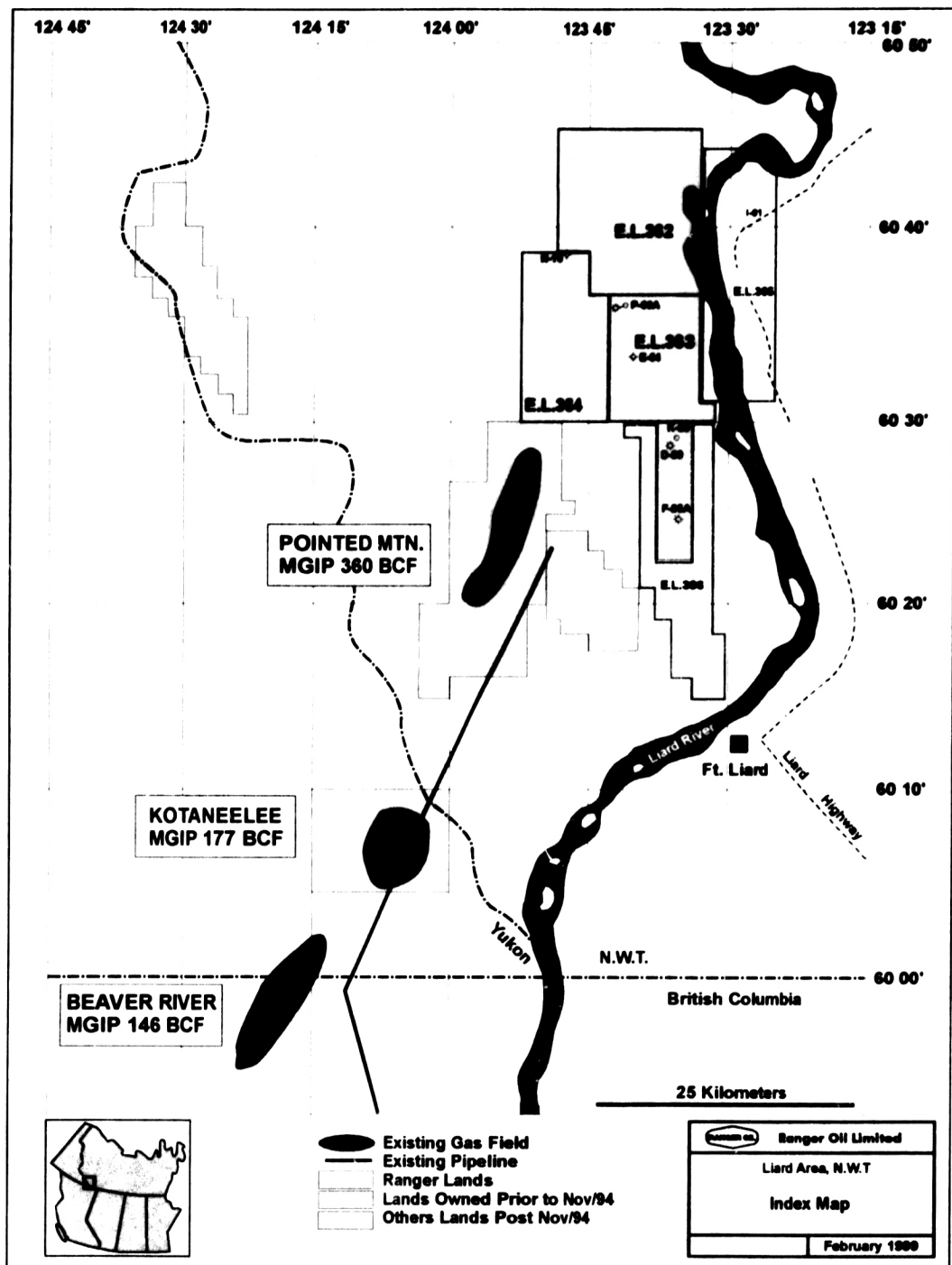


LIARD AREA, N.W.T



REPEAT

LIARD AREA, N.W.T



III OPERATIONS REPORT FOR LINES NAQ-011,12

1. Introduction

NEB authorization #9229-B050-0010E

A 2D seismic reflection survey was conducted for Ranger Oil Limited in the Fort Liard area of the Northwest Territories. The Advance work for the Survey began in late November and recording ended in late December of 1998. The survey was conducted by Geco-Prakla, Party 1263

The program consisted of 2 lines totaling 7.84 kilometers.

The topography was low lying wetlands progressing into mountainous regions as you crossed the Franklin Range.

Food, fuel and supplies came generally from Fort Liard and Fort Nelson.

2. Statistical Data

1.0 Personnel

Recording Crew Personnel

Supervisor	Bob Dreaver
Party manger	Doug Rainey/Jamie Paterson
Vibe Tech	
Head Surveyor	Craig Davis
Surveyor	
Field Administrator	Mardon Day
Instrument Tech.	James Courterielle
Cable Repair	

Survey Personnel

Craig Davis
Bill Baker

Field Positions

Supplied by Beaver Enterprises and JBX Surveys Ltd.

2.0 Equipment

Recording Equipment

- 1 INPUT/OUTPUT SYSTEM TWO digital telemetry system, comprising:
 - 92 MRX's with solar batteries
 - 100 Spare battery modules
 - 2 Battery Charging systems
 - 3 ALX's (Advance Line Taps)
 - 1 LIM's (Line Input Module)
 - 1 SCM (System Control Module)
 - 1 SIM (System Interface Module)
 - 1 CSM (Correlator/Stacker Module)
 - 2 SCSI (3480 Cartridge Drives)
 - 1 OCM (Operator Control Module)
 - 2 HHT's (Hand Held Terminal)
 - 1 Printer
- 600 Strings of 10Hz geophones (6 phones/string)
- 115 Tescorp RSC interconnect cables (6 takeouts @ 25m)

Survey Equipment

The survey was done using conventional methods, EDM and theodolites. The control was put in by means of single frequency GPS. The crews would drive to staging areas along the highway and airlifted in by helicopter. The crews had a total 10 shifts and 4 shifts lost due to weather.

Communication/Office Equipment

- 16 VHF mobile radio transceivers fitted to vehicles
- 8 VHF handheld radio transceivers
- 1 Facsimile machine
- 1 Photocopier
- 1 Portable computer
- 2 IBM Compatible P.C.'s for administration and cost control

Camp

- 1 43 man camp fully enclosed with a kitchen, wash car, office trailer and recreation room. The camp was located at the Hire North yard north and east of the town of Fort Liard. Advance crews and Recording crew stayed here throughout the program. The Advance crew stayed here from November 26 to December 19. The recording crew stayed from December 15 to December 21.

3.0 Production Statistics

Total SP's	89
Days Worked	26
Kms Recorded	7.84 Weatherdays
Weather days	2
Total Hours	

3. Field Procedures

1.0 Topography

The topography was low lying wetlands progressing into mountainous regions as you crossed the Franklin Range.

2.0 Survey

The survey was one using conventional methods, EDM and theodolites. The control was put in by means of single frequency GPS.

3.0 Camp

One camp was in operation for this survey and was located at the Hire North yard north and east of the town of Fort Liard.

4. Data Acquisition

4.0 Recording System Parameters

Instrument Type	I/O System Two digital telemetry
Filters Low Cut	3/12
Record Length	5 sec
Pre Amp Gain	12 dB/octave slope
Sample Rate	2 ms

4.1 Spread Parameters

	<u>NAQ-011.12</u>
Program Size	7.84 kms
No. of Groups Active	524
Receiver Interval	15 m
Phones/ Group	6
Source Interval	90 m
No. Receiver Points	524
No. Source Points	89

5. Data Processing Parameters

1.0 Seismic Data Processing Sequence

The data acquired from the Mt. Flett area was processed by Kelman Seismic Processing. To the two lines in the survey, the following sequence was applied:

Demultiplex:

Process sample rate:	2.0 ms
Process record length:	4.0 sec

Amplitude Recovery:

Exponential gain curve:	K[T]PWR[N][EXP[AT]] K=1 A=0 N=2
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Trace editing

Phase compensation

Type:	Instrument and geophone
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FK Filter

Transparent:	For calculation of deconvolution operators Only
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Deconvolution

Type:	Surface consistent spiking
Operator Length:	80 ms
Prewhitening:	1 %
Design gate:	700 – 2500 ms at 25 m offset 1600 – 2900 ms at 3500 m offset
Offset range:	25 – 3500 m

Partial Spectral Balancing:

Frequency:	8 – 120 Hz
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Equalization:

Design gate: same window as decon

Statics(refraction)

Method: GLI
Frequency spacing: Every shot
Datum elevation: 500 m
Weathering velocity: 762 m/sec
Replacement Velocity: 4000 m/sec

Sort:

To common depth point

Velocity (Residual):

Type: Automatic surface consistent
Correlation Window: 400-2200 ms
Maximum Shift: +/- 32 ms
Correlations per trace: 15
Number of iterations: 2

Velocity Analysis:

Type: Constant percentage moveout

Statics (Residual): Second Pass

Type: Automatic surface consistent
Correlation Window: 400-2200 ms
Maximum shift: +/- 16 ms
Correlation per trace: 15
Number of iterations: 2

Pre-Stk Mig. Vel. Analysis:

Type: Constant percentage moveout

Mute Pattern:

Distance: 250 450 1800 5000 m
Time: -500 200 700 1600 ms

Equalization:

Design window: 500 ms AGC

Full Pre-Stack Time Migration:

Type: Kirchhoff summation
Datum referenced, to plotted weathering replaced surface,
separately at shot and receiver

Stack:

Spike Suppression
Fold

3:1 threshold
50

Filter:

Frequency

8/13 – 50/58 Hz

Equalization:

Design window

600 ms AGC

Display Parameters**Film Display:**

Horizontal: 48 Traces/Inch
Vertical: 5 Inches/second

IV SAFETY PROGRAM

For the advance crews, general safety meetings were held once a week and each crew was involved in a start-up safety meeting before going to the field.

For the recording crew safety briefings were held every morning by Jamie Paterson and there was a startup meeting at the beginning of the job.

Several spot safety briefings were held throughout the job pertaining to general health and safety and hazards on the program to be aware of.

V TECHNICAL DISCUSSION and INTERPRETATION

1. Data Quality

The key parameters that led to improved data quality in the heliportable surveys were (in order of priority):

IN ACQUISITION

- high fold/short group interval > 50 FOLD, 15m GI
- deep charges – 20kg @ 20m (double tamped holes)
- marsh phones – pushed by pole through the moss
- a I/O digital telemetry system – 24 bit recording

IN PROCESSING

- careful analysis of migration panels to maximize the quality of the pre-stack time migration
- careful muting
- careful velocity work on the depth migration

2. Reflection Identification

Well ties were a problem since there were only 4 wells in the area:

- | | |
|-----------|--|
| E-54: | did not reach the Nahanni target and only a partial poor quality sonic is available |
| D-29: | is missing most of the sonic log and the velocities below 2500m look unreliable |
| F-25/25A: | together they provide a fair tie to the reflections on line NAD-831 but the well is near the end of the line so the migration is not as good as most of the area |
| N-19: | no sonic log is available for this well but using approximately velocities the tie to the Nahanni on line NAB-004 at 580m is fair. |
| P-66A: | a fair tie with the Nahanni to was achieved |

3. Velocity Control

- see previous reports by Jeff Sluggett
- see included synthetic on the P-66A well

4. Interpretation

- see previous reports by Jeff Sluggett

Lines NAQ-011,12 can be correlated to tie lines NAQ-009 and NAC-004 (see earlier interpretations), i.e. there exists a small N-S trending secondary thrust fault that cuts line NAQ-012 at approx. sp 281. This small fault, with a relief of approx. 80 m, sets up a potential location at sp 321 on line NAQ-012 at N-61.

V CONCLUSIONS

1. High-fold, (i.e., 50+fold) is needed in this rugged area to acquire good data.
2. The time structure map shows a potential drilling location at N-61 but the relief on the structure is low and there is a strong risk that there will not be sufficient fracturing at this location to create economic gas deliverability.