# AUTHORITY TO DRILL A WELL

CANADA

Exploratory [X]
Development [ ]

Delineation [ ]
Service [ ]

# AUTHORITY TO DRILL A WELL

## APPLICATION

This application is submitted with Section 82 of the Canada Oil and Gas Drilling Regulations. When approved under Section 83 of the Regulations, it is the requisite authority for the commencement of drilling operations.

Well Name in Full: RANGER ET AL LITTLE BEAR M-39

Operator: RANGER OIL LIMITED

Contractor: Shehtah Drilling Limited — Drilling Program No.: --

Drilling Rig or Unit: Rig #1 — Permit or Lease No.: EL-372

Location-Unit: M — Section: 39 — Estimated Well Cost: $3,200,000

Coordinates: Lat.: 64° 48' 58" — Grid Area: 64° 50', 126° 15'

Area: Tulita (Fort Norman) — Long.: 126° 22' 22"

Elevation GR/KB: 258 (ASL) — Field/Pool: New Exploration

Approx. Spud Date: Feburary 5, 1998 — Sea Ice: -- (BRT)

Anticipated Total Depth: 2400 — Estimated Days on Location: 35

Target Horizon(s): Upper Devonian Sands, Mount Kindle

## EVALUATION PROGRAM

Ten-metre sample intervals: None

Five-metre sample intervals: Surface to Total Depth, 3 vials and 1 bagged

Canned sample intervals: None

Conventional cores at: Possible 18 m slimhole cores in Upper Devonian, Mt. Kindle

Logs and Tests: As per program

## CASING AND CEMENTING PROGRAM

| O.D. | Weight: | Grade: | Setting Depth Below Seafloor: | Cementing Program (Volumes): |
|---|---|---|---|---|
| 339.7 mm | 81.1 kg/m | K-55 | 150 m | Arctic set cement to surface |
| 244.4 mm | 53.6 kg/m | J-55 | 600 m | Arctic set cement 150 m to surface |
| | | | | RFC cement 600 m to 150 m |
| 139.7 mm | 23.0 kg/m | K-55 | 2200 m | RFC cement 1400 m to 570 m |
| 139.7 mm | 25.3 kg/m | K-55 | 2400 m | REC cement 2400 m to 1970 m |

B.O.P. Equipment: 508 mm, 14 MPa, diverter system on 508 mm conductor pipe and 339 mm conductor casing
346 mm, 21 MPa, 2 pipe rams, 1 blind ram, annular preventor

Other Information: Gel chemical mud system on surface and main holes

Signed: [signature] Title: Drilling & Completions Superintendent

Date: December 12, 1997 Company: Ranger Oil Limited

## APPROVAL

An approved copy of this notice is to be posted at each wellsite.

Signed: [signature]
Chief Conservation Officer

Date: Jan. 21/98

File: 9211-R26-2-3, WID 1838
UWI 300M396450126150

Canada

# WELL TERMINATION RECORD

CANADA

# WELL TERMINATION RECORD

This record is submitted in triplicate in compliance with Section 184 of the Canada Oil and Gas Drilling Regulations.

## WELL DATA

Well Name: RANGER ET AL LITTLE BEAR M-39 Area: Tulita

Grid Area: 64° 50', 126° 15' Field/Pool: New Exploration

Permit or Lease No.: EL-372 Final Coordinates: Lat.: 64° 48' 58" Long: 126° 22' 22"

Drilling Unit: Shehtah Drilling Rig #1 Elevations KB/KB: 259.22 GL: 253.87

Spud Date: 20:30 hrs 98-02-23 Rig Released: 18:00 hrs 98-03-19 Total Depth: 1550 mKB

## CASING AND CEMENTING

| O.D.: | Weight: | Grade: | Depth Set: | Cement and Additives: |
|---|---|---|---|---|
| 508 mm | 139.8 kg/m | K-55 | 17.74 mKB | 23T Artic set + 7.4% D71 +0.5% D65 + 0.5% B71 |
| 339.7mm | 81.1 kg/m | K-55 | 149.7 mKB | 28T Artic set + 7.4% D71 +0.5% D65 + 0.5% B71 |
| 244.5mm | 53.5 kg/m | J-55 | 602.0 mKB | 7T Artic set a.a. 25T RFC +0.9% B30 + 0.2% D46 |
| 177.8mm | 34.2 kg/m | IK-55 | 1550.6 mKB | 20T RFC + 1% B30 + 0.3% B71 + 0.2% D46 |

## PLUGGING PROGRAM

Approval of the following program was obtained by (person) ..... from

(person) ..... by means of

..... on ..... 19 .

| Type of Plug: | Interval: | Felt: | Cement and Additives: |
|---|---|---|---|
| No plugs | | | |
| Casing not drilled out | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Lost Circulation/Overpressure Zones: None

Equipment left on Seafloor (Describe): None

Provision for Re-entry (Describe and attach sketch): N/A

Cores: Type: None Intervals:

DST No. 1 1388 - 1408 mKB

Other Downhole Completion/Suspension Equipment: Wellhead assembly installed Chained and locked

## CERTIFICATION

I certify on the basis of personal knowledge of operations undertaken at the above named well that the above information is accurate.

Signed: [signature] Title: Drilling & Completions Superintendent

Name: Don Sorkilmo Date: March 31, 1998

Acknowledged by: [signature]
Engineering Branch

Date: Apr. 29/98

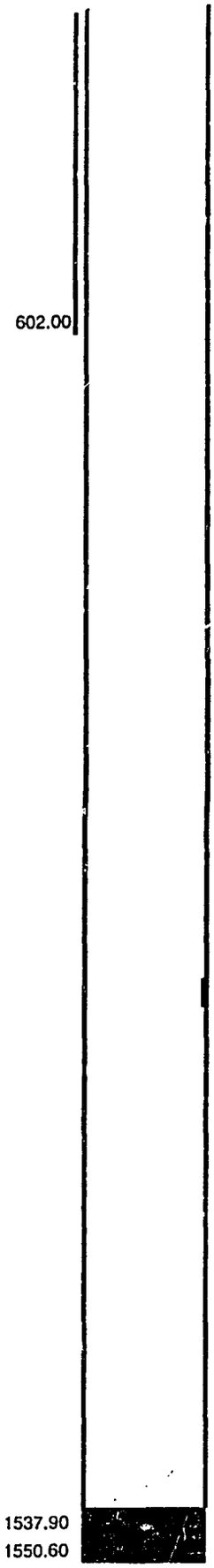
Well Status
Suspended ☒
Completed ☐
Abandoned ☐

File: 9211-R36-2-3, WID 1838
UWI 300M396450T25150

Canada

# RANGER OIL LIMITED

## EXISTING DOWNHOLE WELL PROFILE




Location: RANGER et al LITTLE BEAR M-39 Date: 98-03-31

KB (m) 259.22 GL (m) 253.87 KB to SCF 5.10 KB to THF

Origional PBTD

Current PBTD

| | | No. Jts. | Size OD mm | Weight kg/m | Grade | Thread | Landed mKB | Top mKB |
|---|---|---|---|---|---|---|---|---|
| Conductor Casing | | 12 | 339.70 | 81.10 | K55 | STC | 149.70 | |
| Cement: | | 28t Articset + 7.4%D71 + .5% D65 + .5%B70 | | | | | | |
| Surface Casing: | | 46 | 244.50 | 53.50 | J55 | LTC | 602.00 | |
| Cement: | | 7t Articset a.a. , 25t RFC + .9%B30 + .2%D48 | | | | | | |
| Production Casing: | | 119 | 177.80 | 34.20 | K55 | LTC | 1550.60 | |
| | | | | | | | | |
| Cement: | Filler: | | | | | | | |
| | Tail: | 20t RFC + 1%B30 + .3% B71 + .2% D46 | | | | | | |
| Tubing | | No tubing in well | | | | | | |

| | | | |
|---|---|---|---|
| Perforated Interval (mKB): | None | to | |
| | | to | |

**FINAL TUBING STRING (Bottom Up)**

| Item | Description | Length (m) | Top mKB |
|---|---|---|---|
| | | | |
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| | |
|---|---|
| Total String Length (m) | |
| KB to Tubing Hanger Flange | |
| Setting Depth (mKB) | |

| Tubing Weight | daN | Wt. on Anchor | daN | Wt. on Hanger | daN |
|---|---|---|---|---|---|
| | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Wellhead | Make: | Barber ASL | W.P | 21Mpa | Type: | Flanged |
| Master Valve | Make: | Barton | W.P. | 21Mpa | Type: | Flanged |
| | Size: | 73mm | Trim | T24 | | |
| Casing Valves | Make: | Barton | W.P. | 21Mpa | Type: | Flanged |
| | Size: | 52mm | Trim | T24 | | |
| Choke | Make: | NA | | | | |

Surf. Casing Status: STATIC

Remarks: Wellhead sign installed

# FINAL WELL REPORT

N.E.B. COPY

# FINAL WELL REPORT

# RANGER ET AL LITTLE BEAR M-39

## Tulita Area, NT

Prepared by Ken Kindjerski
October, 1998

NATIONAL ENERGY BOARD
ENGINEERING BRANCH
OCT 2 2 1998

## INTRODUCTION

### 1. Program Summary

Ranger Oil Limited programmed to drill a 2394 m deep exploration well to evaluate a primary Devonian Sand objective and a secondary Mount Kindle objective.

The primary objective was evaluated after reaching a total depth of 1550 mKB.

Operating time constraints with the closure of the "Winter Road" did not allow drilling forward to the secondary objective. The well was cased with 177.8 mm casing to allow for further evaluation work and also to permit deepening of the well in another winter season.

Shehtah Drilling Limited Rig #1E was contracted to drill the well. Drilling equipment was mobilized from Ranger's Nota Creek C-17 wellsite. The rig was demobilized back to Norman Wells, NT in late March, 1998.

### 2. Location Map

Attached is a topographic map (1:50,000) showing the M-39 well location and access route in relationship to geographic features and the winter road.

## GENERAL DATA

| | |
|---|---|
| Well Name: | Ranger et al Little Bear M-39 |
| Exploration Licence: | EL 372 |
| Location: | Unit M, Section 39<br>Grid Area: 64° 50', 126° 15' |
| Well Location: | See attached well plan. |
| Unique Well Identifier: | 300M396450126150 |
| Operator: | Ranger Oil Limited<br>1600, 321 – 6th Avenue S.W.<br>Calgary, Alberta T2P 3H3 |
| Drilling Contractor: | Shehtah Drilling Limited<br>Suite 277, 200 Rivercrest Drive S.E.<br>Calgary, Alberta T2C 2X5 |
| Drilling Rig: | Shehtah Rig #1E<br>Troy Model 600 (triple) |

Position Keeping/Support Craft: N/A.

| | |
|---|---|
| Difficulties & Delays: | An ice bridge crossing over the MacKenzie River restricts the program startup to early February. The drilling time window is then limited to 5 – 6 weeks before closure of the winter road. |
| Total Well Costs: | $3,200,000 |

## SUMMARY OF DRILLING OPERATIONS

| | | |
|---|---|---|
| Elevations: | GL | 253.90 m |
| | KB | 259.20 m |
| | KB – CF | 5.10 m |
| Total Depth: | 1550 mKB | |
| Spud Date: | 1998-02-23 @ 20:30 Hours. | |
| Rig Release Date: | 1998-03-19 @ 18:00 Hours. | |
| Well Status: | Cased and Suspended | |
| Hole Sizes: | 660.4 mm to 17.7 mKB | |
| | 444.5 mm to 149.0 mKB | |
| | 311.0 mm to 602.0 mKB | |
| | 222.0 mm to 1550.0 mKB | |

**Casing Strings:**

**Conductor Pipe** - 2 jts, 508 mm, 139.8 kg/m, K55, BT&C landed at 17.7 mKB.

Cemented with 23 tonnes Arctic Set + 7.4% D71 + 0.5% D65 + 0.5% B71. Cement to surface.

**Conductor Casing** - 12 jts, 339.7 mm, 81.1 kg/m, K55, ST&C landed at 149.0 mKB.

Cemented with 28 tonnes Arctic Set + 7.4% D71 + 0.5% D65 + 0.5% B71. Cement to surface.

**Surface Casing** - 49 jts, 244.5 mm, 53.57 kg/m, J55, LT&C landed at 602 mKB.

Cemented with 7 tonnes Arctic Set + 7.4% D71 + 0.5% D65 + 0.5% B71, followed by 25 tonnes RFC + 0.9% B30 + 0.2% D46. Cement to surface.

**Intermediate/ Production** - 119 jts, 177.8 mm, 34.23 kg/m, IK55 and SOO55, LT&C landed at 1550 mKB.

Cemented with 20 tonnes RFC + 1% B30 + 0.3% B71 + 0.2% D46. Calculated cement top 525 mKB.

**Casing Bowl:** Rector RH-CA 279 mm x 244 mm, 21 MPa, flanged outlet casing bowl.

**Tubing Head:** Barber ASL 279 mm x 179 mm, 21 MPa flanged c/w 2 – 52 mm, 21 MPa T24 flanged valves.
Single 65 mm T24 flanged mastervalve.

**Drilling Fluid:** Fresh water gel chemical mud – see attached fluid summary for details.

| | |
|---|---|
| Sidetacks/Fishing: | None. |
| Well Kicks: | None. |
| Lost Circulation: | None. |
| Formation Leak-off Test: | Leak off test was run at 610 mKB. Formation gradient 22 kPa/m. |
| Deviation Surveys: | See the attached Survey Report and Survey Calculation Program for wellbore coordinates to 1532 mKB. |

Time Distribution:

| | |
|---|---|
| Drilling | 171.50 hours |
| Tripping | 55.25 hours |
| Rig Service | 12.25 hours |
| Surveys | 16.00 hours |
| Condition Mud | 31.25 hours |
| Handle Tools | 40.75 hours |
| Reaming | 11.00 hours |
| Nipple up | 92.25 hours |
| Casing | 27.75 hours |
| Cementing | 8.40 hours |
| W.O.C. | 36.25 hours |
| Repairs | 26.25 hours |
| Miscellaneous | 7.25 hours |
| Logging | 19.75 hours |
| Testing | 6.50 hours |
| Rig out | 11.00 hours |
| **TOTAL** | **573.50 hours** |

## GEOLOGY

**Drill Cuttings:**

Five metre interval samples were taken from 20 m to 1550 mKB.

One vial sample for the above section is stored at Ranger Oil Limited's Calgary office.

Bagged samples were sent to the Institute of Sedimentary and Petroleum Geology, Core & Sample Lab, in Calgary, Alberta.

**Formation Tops:**

See the attached summary.

**Lithology:**

See the attached lithology report for sample description.

**Cores:**

No cores were taken.

**Open Hole Logs:**

The following open hole logs were run by Schlumberger of Canada.

| | | |
|---|---|---|
| Run #1 | 1998 – 03 – 05 | |
| Phasor Induction SFL/GR | | 595 m to 148.5 m |
| BHCS – GR – C | | 575 m to 148.5 m |
| GR | | 148.5 m to 50 m |
| Run #2 | 1998 – 03 – 15 | |
| Phasor Induction SFL/GR | | 1534.2 m to 601 m |
| BHCS – GR – C | | 1521.5 m to 601 m |
| CNL – LDT - GR | | 1539.7 m to 601 m |

**Drill Stem Tests:**

DST No.1 1388 m to 1408 mKB. Conventional straddle test by Baker Oil Tool 1998-03-16. See the attached drill stem test report for details.

April 27, 1998
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# APPENDICIES TO WELL HISTORY REPORT

1. Area Topographic Map
2. Well Survey Plan
3. Serval Drilling Fluid Summary
4. Well Survey Report and Survey Calculation Program
5. Formation Tops
6. Lithology Report
7. Geological Sample Log
8. Drill Stem Test Report
9. Composite Well Summary

# RANGER OIL LIMITED
## WELL SUMMARY - DRILLING SERVICES

RANGER et al LITTLE BEAR M-39

| | | | | | |
|---|---|---|---|---|---|
| WELL STATUS: | Cased and Suspended | AFE NO.: | E7D-031 | UWI: | 300M396450126150 |
| DRILLING RIG: | Shehtah Rig 1E | SPUD: | 98-02-23@2030hr | RIG RELEASE: | 98-03-19@1800hr |

| | GROSS DRY HOLE COST | GROSS CASED HOLE COST | # CORES | # TESTS |
|---|---|---|---|---|
| AFE ESTIMATE: | | $3,100,000 | 1 | 2 |
| FIELD ESTIMATE: | | $3,200,000 | 0 | 1 |

| DRILLING FLUID TYPE | INTERVAL (m) | DRILLING FLUID PROPERTIES | | | | | |
|---|---|---|---|---|---|---|---|
| | | DEPTH (m) | DENSITY (kg/m3) | VISC. (s/l) | Y.P. (Pa) | W.L. (cc) | pH |
| Spud Mud ( gel slurry ) | 0-149 | 76 | 1110 | 50 | 5 | NC | 9 |
| Fresh water Gel Chemical | 149-602 | 286 | 1080 | 39 | 2 | NC | 9 |
| Fresh water Gel Chemical | 602-1550 | 602 | 1165 | 60 | 6.5 | 8.5 | 8.5 |
| | | 758 | 1130 | 49 | 4.5 | 9 | 8.5 |
| ELEVATIONS | | 1146 | 1130 | 43 | 5.5 | 8.4 | 8.5 |
| Ground: 253.9 Cut/Fill: 1.0 fill m | | 1361 | 1125 | 44 | 6 | 9 | 8.5 |
| K.B.: 259.2 Csg. Bowl: 5.1 m | | 1550 | 1125 | 72 | 13 | 8 | 8 |

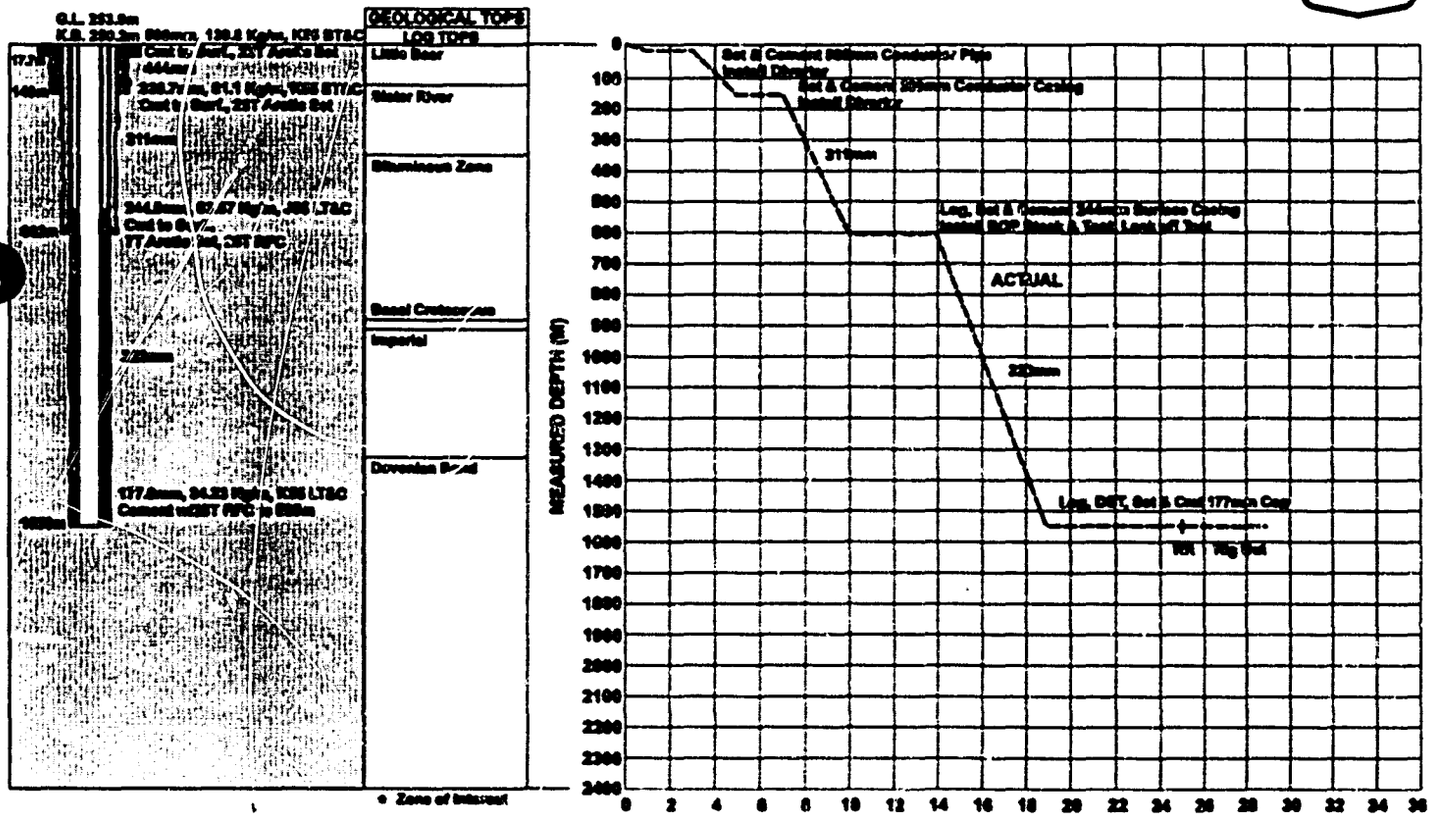
RIG TIME BREAKDOWN (DAYS)

| Drilling | Evaluation | Problems | Total |
|---|---|---|---|
| 521 | 26.25 | 26.25 | 573.5 |

Rig repairs 26.25hr., W O Loggers 5.5hr, W O Cementers 24hr, Nipple ups and pressure tests 92.25hr.

PROBLEM TIME BREAKDOWN (HOURS):

**Ranger et al Little Bear M-39**




## BIT RECORD

| No. | Size (mm) | Type | Serial Number | Jets (mm) | Depth out (m) | Drilled (m) | Hours | WOB (1000 daN) | RPM | P. Press. (kPa) | P. Vol. (m3/min) | Condition (T / B / G) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 444 | Reed RT | 808925 | 3-15.9 | 10 | 10 | 4.75 | 1-2 | 35 | 1000 | 2 | 2-2-I |
| 2A | 311 | GT-1 | R36YE | 3-15.9 | 17 | 7 | 4 | 1-2 | 35 | 1000 | 2 | 1-1-I |
| 3A | 444 | Reed RR | 808925 | 3-15.9 | 17 | 7 | 1.5 | 1-2 | 35 | 1000 | 2 | 2-2-I |
| 4A | 660 | 3A | HE020 | open | 17 | 7 | 1.5 | 1-2 | 35 | 1000 | 2 | 1-1-I |
| 5A | 444 | PG3 | V00BA | 3-15.9 | 118 | 135 | 26.25 | 3-4 | 130 | 2800 | 2.8 | 4-4-I |
| 6A | 444 | SDGH | NC6304 | 3-15.9 | 149 | 13 | 3 | 4 | 130 | 2800 | 2.8 | 1-1-I |
| 1B | 311 | FM2943 | 34524 | 8-14.3 | 602 | 453 | 44.75 | 3-12 | 50-70 | 5800 | 2.4 | 95% |
| 1 | 222 | J4 | V58XJ | 3-8.7 | 610 | 8 | 1.5 | 4-8 | 60 | 7000 | 1.4 | 1-1-I |
| 2 | 222 | FM2745 | 5983670 | 7-8.7 | 1550 | 940 | 79.5 | 1-5 | 60-70 | 6000 | 1.4 | 98% |
| | | | | | | | | | | | | |

# SERVAL DRILLING FLUIDS INC.

## SERVAL DRILLING FLUID SUMMARY

RANGER OIL LIMITED.
1600, 321-6th Avenue S.W.
Calgary, Alberta

## RANGER et al LITTLE BEAR M-9

( 64`- 50' – 126`- 15' )

SERVAL FLUID SERVICES
3200, 715 - 5TH AVENUE S.W.
CALGARY, ALBERTA, CANADA T2P 2X6
TEL: (403) 531-0490 FAX: (403) 531-0464
TOLL-FREE: 1-800-867-0490



INTEGRATED
ENERGY
SERVICES

# WELL INFORMATION SYNOPSIS

*OPERATOR: RANGER OIL LIMITED.*

*WELL NAME: RANGER et al LITTLE BEAR M-9*

*LOCATION: UNIT M, SECTION 39*
*GRID AREA: 64` 50', 126` 15'*

*CONTRACTOR AND RIG NO: SHEHTAH RIG# 1E*

*SPUD DATE / TIME: 98-02-23 @ 20:30hrs*

*RIG RELEASE DATE / TIME: 98-03-19 @ 18:00hrs*

*TOTAL DEPTH (meters): 1550*

*OPERATOR'S REPRESENTATIVE: Jack / Lee Brazel*

*CONTRACTOR'S REPRESENTATIVE: Dale Braxandall*

*FIELD REPRESENTATIVE: Fred Huette/David Lauscher*

| HOLE SIZE (mm) | CASING SIZE (mm) | DEPTH (m) | FLUID TYPE | TIME | COST |
|---|---|---|---|---|---|
| 444 | 339.7 | 149 | Gel Slurry | 3 | $3,184.89 |
| 311 | 244.5 | 602 | Gel/Chem | 3 | $3,540.00 |
| 222 | 177.8 | 1550 | Gel/Chem | 5 | $12,504.37 |
| | | | | *TOTAL:* | *$19,229.26* |

# CONDUCTER HOLE SECTION

| | | | |
|---|---|---|---|
| SPUD DATE: | 02-23-98 | SPUD TIME: | 19:30 hrs |
| SPUD MUD TYPE: | Gel Slurry | | |
| SURFACE CASING DEPTH (meters): | 149 | DATE / TIME CEMENTED: | 02-28-98 22:15 hrs |
| CASING OD (mm): | 339.7 | WEIGHT (kg/m3): | 81.1 |
| PROBLEMS RUNNING CASING: | No problems | | |

# COMMENTS, OBSERVATIONS, RECOMMENDATIONS

No rathole was dug for this hole, so initially, a 660mm hole was dug to 18m and 508mm conductor pipe was set.
This hole was severely washed, Due to spudding with a lighter vis of 70s/L and a pump rate of 1.65(m3/min).
On the Bear Rock hole, Tricity 16 we started with a higher initial viscosity (80 s/L) and slowed our pump rate down. This led to a minimal wash out of our conductor pipe.
So for future wells, running a higher vis and lowering the pump rate down is recommended.
Foaming problems also occurred due to some INVERT that was left in rig tanks from prior hole.
Cemented conductor pipe with 23m3 of cement, due to wash out
Drilled 444mm hole, this section was drilled slowly due to sand. At 149m called T.D. cemented conductor casing.

# SURFACE HOLE SECTION

| | | | |
|---|---|---|---|
| INTERVAL: | 149-602m | DRILL OUT DATE/TIME: | 03-02-98 17:45 hrs |
| FLUID TYPE: | Gel/Chem system | | |
| CASING: | 244.5mm | WEIGHT: | 53.57kg/m3 |
| TOTAL DEPTH: | 602m | MUD UP DATE TIME: | 03-02-98 20:45 hrs |

# COMMENTS, OBSERVATIONS, RECOMMENDATIONS

Drilled out with water.
Mudded up just under shoe.
Mudded up on the fly with Gel and Aquapac Reg.
Drilled to 602m, Surface T.D. was called on 02-28-98.
Waited on cement for 1.5 days.
No problems with mud or drilling this section.

# MAIN HOLE SECTION

| | | | |
|---|---|---|---|
| INTERVAL: | 602-1550m | MUD UP DEPTH: | 03-09-98<br>22:00 hrs |
| FLUID TYPE: | Gel/Chem system | | |
| TOTAL DEPTH: | 1550m | | |
| CASING: | 177.8mm | WEIGHT: | 34.23kg/m3 |

# COMMENTS, OBSERVATIONS, RECOMMENDATIONS

Drilled out with water, mudded up under the shoe with light Gel and Aquapac.
The density climbed up to 1160 kg/m3 in short order, using the centrifuge , dumping sand trap ery connection and heavy dilution.
Density was brought back down to 1120-1128 kg/m3 in 1.5 days.
The hole stayed in excellent shape throughout.
Hole was logged after 1st wiper trip.
Another clean out trip for testing with no recorded problems.
After testing, pipe was run in the hole in preparation to run casing.
There was 0 fill on bottom.

# CONDUCTOR HOLE

## PRODUCT & COST SUMMARY

| | |
|---|---|
| INTERVAL FROM (m): | 0-149 |
| DAYS TO DRILL: | 5 |
| TOTAL INTERVAL COST: | $3,184.89 |
| COST PER METER: | $21.37 |

| PRODUCT | AMOUNT | UNIT COST | TOTAL COST |
|---|---|---|---|
| Bentonite | 189 | $15.00 | $2,835.00 |
| Sodium bicarbonate | 3 | $93.75 | $281.25 |
| Defoamer TDL-29 | 7 | $221.94 | $1,553.58 |
| Desco | 1 | $112.00 | $112.00 |
| SAPP | 2 | $137.00 | $274.00 |
| Soda ash | 1 | $40.00 | $40.00 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | TOTAL PRICE: | $5,095.83 |
| | | (LESS 37.5% DISCOUNT): | $1,910.94 |
| | | TOTAL BID PRICE: | $3,184.89 |

# SURFACE HOLE SECTION

## PRODUCT & COST SUMMARY

| | |
|---|---|
| INTERVAL FROM (m): | 149-602 |
| DAYS TO DRILL: | 5 |
| TOTAL INTERVAL COST: | $3,540.^{00}$ |
| COST PER METER: | $7.^{81}$ |

| PRODUCT | AMOUNT | UNIT COST | TOTAL COST |
|---|---|---|---|
| Bentonite | 182 | $15.^{00}$ | $2,730.^{00}$ |
| Aquapac Reg | 5 | $390.^{00}$ | $1,950.^{00}$ |
| Barite | 40 | $18.^{00}$ | $720.^{00}$ |
| Desco | 2 | $112.^{00}$ | $224.^{00}$ |
| Soda ash | 1 | $40.^{00}$ | $40.^{00}$ |
| | | | |
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| | | | |
| | | | |
| | | | |
| | | TOTAL PRICE: | $5,664.^{00}$ |
| | | (LESS 37.5% DISCOUNT): | $2,124.^{00}$ |
| | | TOTAL BID PRICE: | $3,540.^{00}$ |

# MAIN HOLE SECTION

## PRODUCT & COST SUMMARY

| | |
|---|---|
| INTERVAL FROM (m): | 602-1550 |
| DAYS TO DRILL: | 5 |
| TOTAL INTERVAL COST: | $12,504.37 |
| COST PER METER: | $13.19 |

| PRODUCT | AMOUNT | UNIT COST | TOTAL COST |
|---|---|---|---|
| Bentonite | 287 | $15.00 | $4,305.00 |
| Aquapac Reg | 21 | $390.00 | $8,190.00 |
| Kelzan XCD | 3 | $845.00 | $2,535.00 |
| Lignite | 3 | $15.25 | $45.75 |
| Caustic soda | 2 | $77.00 | $154.00 |
| Barite | 218 | $18.00 | $3,924.00 |
| Sawdust | 25 | $7.25 | $181.25 |
| Desco | 6 | $112.00 | $672.00 |
| | | | |
| | | | |
| | | TOTAL PRICE: | $20,007.00 |
| | | (LESS 37.5% DISCOUNT): | $7,502.63 |
| | | TOTAL BID PRICE: | $12,504.37 |

# FIELD REPORTS

**Midas Drilling Fluids**

Telephone - 24 Hr. 1-800-929-3570
Fax - (403) 531-0464

# DRILLING MUD SERVICE REPORT

SPUD DATE _____ DATE 99/02/22

WELL NAME and LOCATION Ranger et-al Little Bear 64°49' 126° 22' REPORT NO. 1

OPERATOR Ranger Oil Ltd. CONTRACTOR Shetah II

REPORT FOR Jack Brazel REPORT FOR Doyle

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO. | | SIZE (mm) | | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (≈) | MAKE | Mission | |
| TYPE | | VELOCITY (m / s) | | LAST CASING | | | | MODEL | 8P30 | 8P30 |
| SIZE (mm) | 445 | JET FORCE (N) | | LINER | | | | LINER DIA (mm) | 18 | 152 |
| DEPTH IN (m) | | HHP (kW) | | OPEN HOLE | 114 mmDP | | | ROD DIA (mm) | | |
| DEPTH OUT (m) | | DEVIATION RECORD | | OPEN HOLE | mmDC | | | STROKE (mm) | 216 | 216 |
| HOURS RUN | | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mmDC | | | DISP (L/stk) | 11.8 | 11.8 |
| W O B (daN) | | | | CIRCULATION TIMES (min) | | | | SPM | | |
| RPM | | | | MUD TANKS / SUMP | | BOTTOMS UP | | OUTPUT (m³/min) | | |
| ROP (m/hour) | | | | DRILL STRING | | TOTAL | | PRESSURE (kPa) | | |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | | SOLIDS CONTROL | | | |
|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | | EQUIPMENT | | | |
| | | | | HOLE | | OVERFLOW DENSITY (kg/m³) | | | |
| | | | | TOTAL | | UNDERFLOW DENSITY (kg/m³) | | | |
| | | | | LOST TO HOLE | | UNDERFLOW RATE (L/min) | | | |
| | | | | LOST TO EQUIP | | SOLIDS REMOVAL RATE (kg/hr) | | | |
| | | | | DUMPED | | LIQUID REMOVAL RATE (L/min) | | | |
| | | | | NEW WATER | | HOURS RUN | | | |
| | | | | NEW MUD / PREMIX | | SHAKER 1 | MESH | SHAKER 2 | MESH |

| | |
|---|---|
| COST SINCE LAST CHECK | |
| PREVIOUS COST | |
| TOTAL COST | |

| RHEOLOGY | | |
|---|---|---|
| 600 | 200 | 6 |
| 300 | 100 | 3 |
| n/k | | |

| | |
|---|---|
| ☐ FLOWLINE ☐ SUCTION TEMP °C | |
| SAMPLE TIME (hr) | |
| MEASUREMENT DEPTH (m) | |
| DENSITY (kg/m³) | |
| PORE PRESSURE GRADIENT (kPa/m) | |
| FUNNEL VISCOSITY (s/L) | |
| PLASTIC VISCOSITY (mPa•s) @ _____ °C | |
| YIELD POINT (Pa) @ _____ °C | |
| GEL STRENGTHS (Pa) 10 sec / 10 min | / |
| API FILTRATE (mL/30min) @ 700 kPa | |
| FILTER CAKE (mm) | |
| HT-HP F.L. (mL/30 min) _____ kPa _____ °C | |
| HT-HP FILTER CAKE (mm) | |
| pH ☐ STRIP ☐ METER | |
| ALKALINITY (Pm/Mf) | / |
| HYDROXYLS (mg/L) | |
| CARBONATES (mg/L) | |
| BICARBONATES (mg/L) | |
| CALCIUM (mg/L) | |
| CHLORIDES (mg/L) | |
| % SAND - VOLUME FRACTION | |
| % OIL - VOLUME FRACTION | |
| % TOTAL SOLIDS - VOLUME FRACTION | |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | |
| DRILLED SOLIDS (kg/m³) | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | |
| POLYMER CONCENTRATION (kg/m³) | |

Surface Csg
- When well run the 244mm Csg raise vis to 55-65s/L prior to running. Use Gel (a) 4 min/St.

## WELL HISTORY & REMARKS

SPUD REPORT

## RECOMMENDATIONS

- Fill tanks ≈ ½ full ⇒ water
- Mix up a light Gel slurry prior to spudding ⇒ Gel @ 3-4 min/St. ⇒ Vis 38-40 s/L
- DO not add caustic
- If further hole cleaning is required raise Vis as necessary ⇒ Gel 3-4 min/St.

Potential problems

Mud Rings - If encountered add SAPP down pipe or thru suction. Use 1 Visup per connection until problem solved. # Try not to get SAPP on Pipe threads, it's corrosive.

Lost Circulation - If encountered Isolate a suction tank. Build a vis of ≈ 80 s/L ⇒ Gel + small amounts of Hydrated Lime (3-4 Visups)
- Then Add Primaseal Medium: Primaseal coarse + Sawdust in a 1:1:10 ratio. Mix until a thick LCM Pill forms. Pump pill across thief zone & repeat if necessary.

SERVICE REP: Fred Huette PHONE / MOBILE:

WAREHOUSE: PHONE:

In consideration of the furnishing of this report and any oral suggestions it is agreed that MIDAS DRILLING FLUIDS shall not be liable for any damages resulting from them, nor shall they be construed as authorizing the infringement of any valid patent.

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Fax - (403) 531-0464

# DRILLING MUD SERVICE REPORT

SPUD DATE 98/02/23 DATE 98/02/24

WELL NAME and LOCATION Ranger et al Bittle Bear 64-49 126 22' REPORT NO 2

OPERATOR Ranger Oil CONTRACTOR Shetah 1E

REPORT FOR Jack Brazel REPORT FOR Dale

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | |
|---|---|---|---|---|---|---|---|---|---|
| NO | 1A | SIZE (mm) | | ANNULUS | OD / ID | LENGTH (m) | VELOCITY | MAKE | National |
| TYPE | | VELOCITY (m/s) | | LAST CASING | | | | MODEL | 8P80's |
| SIZE (mm) | 445 | JET FORCE (N) | | LINER | | | | LINER DIA (mm) | 152 152 |
| DEPTH IN (m) | | HHP (kW) | | OPEN HOLE | mmDP | | | ROD DIA (mm) | |
| DEPTH OUT (m) | | DEVIATION RECORD | | OPEN HOLE | 229 mmDC | | | STROKE (mm) | 216 216 |
| HOURS RUN | | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mmDC | | | DISP (L/stk) | 11.7 11.7 |
| W.O.B. (daN) | | | | CIRCULATION TIMES (min) | | | | SPM | 70 70 |
| RPM | | | | MUD TANKS / SUMP | | BOTTOMS UP | | OUTPUT (m³/min) | 1.65 |
| ROP (m/hour) | | | | DRILL STRING | | TOTAL | | PRESSURE (kPa) | 1200 |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | | SOLIDS CONTROL | |
|---|---|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | | EQUIPMENT | |
| | | | | HOLE | | OVERFLOW DENSITY (kg/m³) | |
| | | | | TOTAL | | UNDERFLOW DENSITY (kg/m³) | |
| | | | | LOST TO HOLE | | UNDERFLOW RATE (L/min) | |
| | | | | LOST TO EQUIP | | SOLIDS REMOVAL RATE (kg/hr) | |
| | | | | DUMPED | | LIQUID REMOVAL RATE (L/min) | |
| | | | | NEW WATER | | HOURS RUN | |
| | | | | NEW MUD / PREMIX | | SHAKER 1 MESH | SHAKER 2 MESH |

COST SINCE LAST CHECK
PREVIOUS COST
TOTAL COST

**RHEOLOGY**

| | | | | | |
|---|---|---|---|---|---|
| 600 | 68 | 200 | | 6 | |
| 300 | 55 | 100 | | 3 | |
| n/K | | | | | |

| | |
|---|---|
| ☐ FLOWLINE ☐ SUCTION TEMP °C | |
| SAMPLE TIME (hr) | 2:20 |
| SAMPLE DEPTH (m) | 12 |
| DENSITY (kg/m³) | 1220 |
| PRESSURE GRADIENT (kPa/m) | |
| FUNNEL VISCOSITY (s/L) | 74 |
| PLASTIC VISCOSITY (mPa·s) @ °C | 13 |
| YIELD POINT (Pa) @ °C | 21 |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 15 / 22 |
| API FILTRATE (mL/30min) @ 700 kPa | |
| FILTER CAKE (mm) | |
| HT-HP FL (mL/30 min) kPa °C | |
| HT-HP FILTER CAKE (mm) | |
| pH ☑ STRIP ☐ METER | 7.5 |
| ALKALINITY (P/M) | .1 / .2 |
| HYDROXYLS (mg/L) | Nil |
| CARBONATES (mg/L) | 120 |
| BICARBONATES (mg/L) | Nil |
| CALCIUM (mg/L) | 60 |
| CHLORIDES (mg/L) | 1200 |
| % SAND - VOLUME FRACTION | |
| % OIL - VOLUME FRACTION | |
| % TOTAL SOLIDS - VOLUME FRACTION | |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | |
| DRILLED SOLIDS (kg/m³) | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | |
| POLYMER CONCENTRATION (kg/m³) | |

**WELL HISTORY & REMARKS**

- Spud well @ 19:30 23rd
Droped chain down hole & retrieved it.
Hole thru permafrost very washed ≈ 10 ft wide.
Bolders & coal, sandstone & gravel
- Problems = mud foaming due to residual Invert in tanks.

**RECOMMENDATIONS**

Mud is fine for running Csg: -

Thanx

SERVICE REP: Fred Huette PHONE / MOBILE:
WAREHOUSE: PHONE:

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# DRILLING MUD SERVICE REPORT

SPUD DATE 98/02/23 DATE 98/02/25

WELL NAME and LOCATION Ranger et al Littlebear 64°49'126°22' REPORT NO 3

OPERATOR Ranger Oil CONTRACTOR Shetah 1E

REPORT FOR Jack Brazel REPORT FOR Pole

| BIT RECORD | | NOZZLE DATA | |
|---|---|---|---|
| NO | 1A | SIZE mm | 3 |
| TYPE | | VELOCITY m/s | |
| SIZE mm | 444 | JET FORCE N | |
| DEPTH IN m | | HHP/in² | |
| DEPTH OUT m | | **DEVIATION RECORD** | |
| HOURS RUN | | DEPTH (m) | ANGLE - DIRECTION |
| WOB 1000 | | | |
| RPM | | | |
| ROP m/hour | | | |

| ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|
| ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m/min) | MAKE | Mission | Mission |
| LAST CASING | | | | MODEL | 8P80 | 8P80 |
| LINER | | | | LINER DIA mm | 152 | 152 |
| OPEN HOLE | 114 mmOP | | 20 | ROD DIA mm | | |
| OPEN HOLE | 229 mmOC | | 25 | STROKE mm | 216 | 216 |
| OPEN HOLE | mmOC | | | DISP L/stk | 11.9 | 11.8 |
| **CIRCULATION TIMES (min)** | | | | SPM | 120 | 120 |
| MUD TANKS / SUMP | | BOTTOMS UP | 9 | OUTPUT m³/min | 2.8 | |
| DRILL STRING | 3 | TOTAL | 12 | PRESSURE kPa | 1400 | |

| DRILLING MUD PRODUCTS | | | |
|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST |
| Gel | 15.00 | .92 | 1380.00 |
| TQ-24 | 2625. | .2 | 524.50 |
| Soda Ash | 40.00 | 1 | 40.00 |
| COST SINCE LAST CHECK | | | 1944.50 |
| PREVIOUS COST | | | |
| TOTAL COST | Not Discontal | | 1944.50 |

| MUD VOLUMES (m³) | |
|---|---|
| TANK / SUMP | 30 |
| HOLE | 2.5 |
| TOTAL | 32.5 |
| LOST TO HOLE | |
| LOST TO EQUIP | |
| DUMPED | |
| NEW WATER | |
| NEW MUD / PREMIX | |

| SOLIDS CONTROL | | | |
|---|---|---|---|
| EQUIPMENT | | | |
| OVERFLOW DENSITY (kg/m³) | | | |
| UNDERFLOW DENSITY (kg/m³) | | | |
| UNDERFLOW RATE (L/min) | | | |
| SOLIDS REMOVAL RATE (kg/hr) | | | |
| LIQUID REMOVAL RATE (L/min) | | | |
| HOURS RUN | | | |
| SHAKER 1 | 50 | MESH | SHAKER 2 MESH |

**RHEOLOGY**

| | | | |
|---|---|---|---|
| 600 | 44 | 200 | 6 |
| 300 | 32 | 100 | 3 |
| n/n | | | |

| | | |
|---|---|---|
| ☐ FLOWLINE ☐ SUCTION TEMP °C | | |
| SAMPLE TIME (hr) | 23:45 | |
| DEPTH (m) | 1175 | |
| MW (kg/m³) | | |
| MW PRESSURE GRADIENT (kPa/m) | | |
| FUNNEL VISCOSITY (s/L) | 48 | |
| PLASTIC VISCOSITY mPa·s @ °C | 16 | |
| YIELD POINT (Pa) @ °C | 8 | |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 7 / 12 | |
| API FILTRATE mL/30min @ 700 kPa | 18 | |
| FILTER CAKE mm | 2 | |
| HTHP FL mL/30 min @ kPa °C | | |
| HTHP FILTER CAKE mm | | |
| pH ☐ STRIP ☐ METER | 10 | |
| ALKALINITY (Pm) | .2 / .35 | |
| HYDROXYLS mg/L | 17 | |
| CARBONATES mg/L | Nil | |
| BICARBONATES mg/L | Nil | |
| CALCIUM mg/L | 360 | |
| CHLORIDES mg/L | 1400 | |
| % SAND - VOLUME FRACTION | 3 | |
| % OIL - VOLUME FRACTION | | |
| % TOTAL SOLIDS - VOLUME FRACTION | | |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | | |
| DRILLED SOLIDS (kg/m³) | | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | | |
| POLYMER CONCENTRATION (kg/m³) | | |

**WELL HISTORY & REMARKS**

98/02/23 Spud 20:20 Drill 444mm Pilot hole 3m Ream 20:30 to

98/02/24 1:45. Switch to 311 bit drill to 18m to 5:45. Switch to 444m bit & drill to 28:00. Drill 660mm hole 11:30 to 13:00 to 18m. Cement 20:30

98/02/25 - Nipple up Diverter

**RECOMMENDATIONS**

- Drill out 22:30

MUD MAINTAINENCE

Viscosity - 45 - 50 S/L in Gel @ 4 min/St. If further hole cleaning is required, raise vis as necessary.

PH - No Control unless requested

Waterloss - No Control

Density - Run in Water @ ± 20 LPM or as necessary to maintain Tank Vol ± 40 cubes.
- Run Centrifuge to reduce sand build up.
- Pump Sand trap regularly -

For Mudrings, or Lost Circulation see Spud Report.

For Running Egg:
Raise Vis to 55 - 65 S/L in Gel

# Tonight add 2 sks of Biocide

SERVICE REP Fred Huette PHONE / MOBILE:
WAREHOUSE PHONE:

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# Midas Drilling Fluids

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## DRILLING MUD SERVICE REPORT

SPUD DATE 78/02/23 DATE 78/02/26

WELL NAME and LOCATION Ranger et al Little Bear REPORT NO 4

OPERATOR Ranger Oil Ltd. CONTRACTOR Shetah #E

REPORT FOR Jack Brazel REPORT FOR Dale

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | |
|---|---|---|---|---|---|---|---|---|---|
| IADC | 5A | SIZE mm | 3+15.9 | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m/min) | MAKE | Wirth 6 |
| TYPE | PG-3 | VELOCITY m/min | 77 | LAST CASING | 6 1/4 / 5.0 | 18 | | MODEL | SP 80 |
| SIZE mm | 4 1/4 | JET FORCE N | 3571 | LINER | | | | LINER DIA mm | 152 152 |
| DEPTH IN m | 18 | HHP kW | 153 | OPEN HOLE | 11.4 mm OD | | 19 | ROD DIA mm | |
| DEPTH OUT m | 171 | DEVIATION RECORD | | OPEN HOLE | 22.7 mm OD | 28 | 24 | STROKE mm | 216 216 |
| HOURS RUN | 15 | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mm OD | | | DISP (L/stk) | 11.8 11.8 |
| WOB kN | 2/3 | 14m | 0.1 | CIRCULATION TIMES (min) | | | | SPM | 130 105 |
| RPM | 130 | 55m | 0.25 | MUD TANKS / SUMP | | BOTTOMS UP | 4 | OUTPUT m³/min | 2.77 |
| ROP m/hr | | | | DRILL STRING | 2 | TOTAL | 18 | PRESSURE kPa | 2600 |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | | SOLIDS CONTROL | |
|---|---|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | 40 | EQUIPMENT | Cent |
| Gel | 17.00 | 5 | 85.00 | HOLE | 11 | OVERFLOW DENSITY kg/m³ | 1000 (Shut down for |
| | | | | TOTAL | 51 | UNDERFLOW DENSITY kg/m³ | 1700 5 hrs) |
| | | | | LOST TO HOLE | | UNDERFLOW RATE L/min | |
| | | | | LOST TO EQUIP | | SOLIDS REMOVAL RATE kg/hr | |
| | | | | DUMPED | ≈10 | LIQUID REMOVAL RATE L/min | |
| | | | | NEW WATER | | HOURS RUN | |
| | | | | NEW MUD / PREMIX | | SHAKER 1 50 MESH | SHAKER 2 80 MESH |

| | | | WELL HISTORY & REMARKS |
|---|---|---|---|
| COST SINCE LAST CHECK | | 85.00 | 78/02/25 - Drilled 22:15 to 23:30 |
| PREVIOUS COST | | 1744.50 | |
| TOTAL COST | Not Discounted | 3029.50 | 98/02/26 - Drilling Ahead w spud mud |
| RHEOLOGY | | | mud is foaming (likely due to |
| 600 | 24 58 200 6 | | residual Invert) causing problems |
| 300 | 16 29 100 3 | | mixing. |
| n/n | .15/3.2 Reynolds # 645 | | Cuttings - sand/sized particles soft clay-shale |
| ☐ FLOWLINE ☐ SUCTION TEMP °C | | | RECOMMENDATIONS |
| TIME (hr) | 16:00 | 11:45 | Mud Maintainence |
| DEPTH m | 50 | 78 | |
| DENSITY kg/m³ | gasified mud 1000 | 1110 | Viscosity - 45 - 50 s/L w Gel |
| HYD PRESSURE GRADIENT kPa/m | | | Add thru Premix or thru |
| FUNNEL VISCOSITY s/L | 42 | 50 | hopper @ 4 min/5 t. If further |
| PLASTIC VISCOSITY mPa·s @ °C | 8 | 9 | hole cleaning is required raise |
| YIELD POINT Pa @ °C | 4 | 5 | Vis as necessary. |
| GEL STRENGTH Pa 10 sec / 10 min | 4 8 | 7.5 13 | |
| API FILTRATE mL/30min @ 700 kPa | High | High (20) | pH - No control for now. |
| FILTER CAKE mm | Thick | Thick | |
| HT/HP FL mL/30 min @ kPa °C | | | Density - Run centrifuge |
| HT/HP FILTER CAKE mm | | | - Maintain tank Vol ≈ 40 m³ |
| pH ✓ STRIP ☐ METER | 9.0 | 9.0 | with Premix additions or |
| ALKALINITY (Pm) | .07 .15 | .05 .15 | a steady flow of water 30 to 35 L/m. |
| HYDROXYLS mg/L | Nil | Nil | |
| CARBONATES mg/L | 84 | 60 | |
| BICARBONATES mg/L | 12 | 61 | Mud Rings - Do not add SAPP unless |
| CALCIUM mg/L | 100 | 80 | a mud ring occurs if pressure |
| CHLORIDES mg/L | 1500 | 1200 | increases. Then add @ suction |
| % SAND - VOLUME FRACTION | 1 | 2.5 | by sprinkling in a viscup every |
| % MBT - VOLUME FRACTION | | | 15 to 30 min until problem |
| % TOTAL SOLIDS - VOLUME FRACTION | | 6.8 | solved. |
| MBT (TOTAL BENTONITE SOLIDS) kg/m³ | 38 | 40 | |
| DRILLED SOLIDS kg/m³ | | | - Dump tanks & rebuild volume as |
| TOTAL HIGH GRAVITY SOLIDS kg/m³ | | | necessary to control foaming & improve |
| TOTAL LOW GRAVITY SOLIDS kg/m³ | | | mud condition. Dump only as volume |
| POLYMER CONCENTRATION kg/m³ | | | permits.!! |
| ECD # | 1003 g | | |
| Oil Content | 5.2% | | Thank |
| Water check | | | |
| Chlorides 50 ppm | | | |
| Hardness 40 ppm | | | |
| Solids 0.85 | | | |
| Additions Nil Hydrol Nil Bicarb 61 | | | SERVICE REP Fred Huette PHONE / MOBILE: |
| | | | WAREHOUSE PHONE |

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# Midas Drilling Fluids

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Fax - (403) 531-0464

## DRILLING MUD SERVICE REPORT

SPUD DATE 98/02/26 DATE 98/03/01

WELL NAME and LOCATION Ranger et al Little Bear REPORT NO. 5

OPERATOR Ranger Oil Ltd. CONTRACTOR Shetab #E

REPORT FOR Jack Brazel REPORT FOR Pyle

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO | #6 | SIZE (mm) | 3+15.4 | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m/min) | MAKE | Nat. Oilwell | |
| TYPE | SP617 | VELOCITY (m / s) | | LAST CASING | 445/340 | 149 | | MODEL | 8P80 | |
| SIZE (mm) | 444 | JET FORCE (N) | | LINER | | | | LINER DIA (mm) | 152 | 152 |
| DEPTH IN (m) | | HHP (kW) | | OPEN HOLE | 114 mmDP | | 20 | ROD DIA (mm) | | |
| DEPTH OUT (m) | 149 | DEVIATION RECORD | | OPEN HOLE | 227 mmDC | | 25 | STROKE (mm) | 216 | 216 |
| HOURS RUN | 174 | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mmDC | | | DISP (L/stk) | 11.8 | 11.8 |
| W O B (daN) | | 140 | 0.6 | CIRCULATION TIMES (min) | | | | SPM | 130 | 110 |
| RPM | 120 | | | MUD TANKS / SUMP | | BOTTOMS UP ≈ 8 | | OUTPUT (m³/min) | 2.53 | |
| ROP (m/hour) | | | | DRILL STRING | ≈ 7 | TOTAL ≈ 35 | | PRESSURE (kPa) | 6600 | |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | | SOLIDS CONTROL | | | |
|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | +/0 | EQUIPMENT | | | |
| | | | | HOLE | 82 | OVERFLOW DENSITY (kg/m³) | | | |
| | | | | TOTAL | 92 | UNDERFLOW DENSITY (kg/m³) | | | |
| | | | | LOST TO HOLE | | UNDERFLOW RATE (L/min) | | | |
| | | | | LOST TO EQUIP. | | SOLIDS REMOVAL RATE (kg/h) | | | |
| | | | | DUMPED | | LIQUID REMOVAL RATE (L/min) | | | |
| | | | | NEW WATER | | HOURS RUN | | | |
| | | | | NEW MUD / PREMIX | | SHAKER 1 | MESH | SHAKER 2 | MESH |
| COST SINCE LAST CHECK | | | | | | | | | |
| PREVIOUS COST | | | | | | | | | |
| TOTAL COST | | | | | | | | | |

| RHEOLOGY | | | |
|---|---|---|---|
| 600 | 200 | 6 | |
| 300 | 100 | 3 | |
| n/K | | | |

| | |
|---|---|
| ☐ FLOWLINE ☐ SUCTION TEMP °C | |
| SAMPLE TIME (hr) | |
| DEPTH (m) | |
| DENSITY (kg/m³) | 149 |
| PRESSURE GRADIENT (kPa/m) | |
| FUNNEL VISCOSITY (s/L) | V |
| PLASTIC VISCOSITY (mPa·s) @ °C | I |
| YIELD POINT (Pa) @ °C | P |
| GEL STRENGTHS (Pa) 10 sec / 10 min | |
| API FILTRATE (mL/30min) @ 700 kPa | |
| FILTER CAKE (mm) | P |
| HT/HP F.L. (mL/30 min) kPa °C | |
| HT/HP FILTER CAKE (mm) | |
| pH ☐ STRIP ☐ METER | L |
| ALKALINITY (Pm) | I |
| HYDROXYLS (mg/L) | |
| CARBONATES (mg/L) | N |
| BICARBONATES (mg/L) | |
| CALCIUM (mg/L) | G |
| CHLORIDES (mg/L) | |
| % SAND - VOLUME FRACTION | |
| % OIL - VOLUME FRACTION | V |
| % TOTAL SOLIDS - VOLUME FRACTION | |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | |
| DRILLED SOLIDS (kg/m³) | D |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | |
| POLYMER CONCENTRATION (kg/m³) | |

Properties

V.S - 38 - 42 s/L = Gel + Aquapac R 0.1

P/F - 8.0 = ~~caustic~~ Soda Ash

Waterloss - 9 - 12 mL = Aquapac

Stability - Low or Possible Run Centrifuge ASAP

### WELL HISTORY & REMARKS

98/02/28 Repair SCR to 4:45. T.P. surface 6:30. Cement Csg D.15

98/03/01 Nippling Up

### RECOMMENDATIONS

Drill out

- Drill out = water
- Isolate system to pill tank or suction. Drillout = water & discard contaminated water to sump.

Mud Up

- We will mud up on the fly
- Fill tanks = 50-60 m³ water.
- Pretreat = 2 sks of Bicarb & 1 sk Soda Ash.
- After Drillout begin to circulate water in tanks.
- Mud up on the fly. = Gel & Aquapac Regular in a 20:1 ratio.
  - Mix Gel @ 5 min/sk
  - Mix Aquapac Regular @ 2 min/sk

Mix until you get stable properties

# There are 2 kinds of Aquapac, Regular & 20 Vis. Regular builds viscosity 20 Vis does not.

SERVICE REP: Fred Huette PHONE / MOBILE:

WAREHOUSE: PHONE:

In consideration of the furnishing of this report and any oral suggestions it is agreed that MIDAS DRILLING FLUIDS shall not be liable for any damages resulting from them, nor shall they be construed as authorizing the infringement of any valid patent.

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# DRILLING MUD SERVICE REPORT

SPUD DATE 98/02/23 DATE 98/03/02

WELL NAME and LOCATION Ranger et-al Little Bear m-39 REPORT NO. #6

OPERATOR Ranger Oil Ltd CONTRACTOR Shetah 1E

REPORT FOR Lee & Jack Brazel REPORT FOR Dale

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO | 1B | SIZE (mm) | 8+17-3 | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m/min) | MAKE | Mud Kings | |
| TYPE | DBS FM2743 | VELOCITY (m/s) | | LAST CASING | 340/317 | | | MODEL | 8P80's | |
| SIZE (mm) | 311 | JET FORCE (N) | | LINER | | | | LINER DIA (mm) | 152 | 152 |
| DEPTH IN (m) | 149 | HHP (kW) | | OPEN HOLE | 11" mmDP | | 36 | ROD DIA (mm) | | |
| DEPTH OUT (m) | 171 | DEVIATION RECORD | | OPEN HOLE | 22" mmDC | 73 | 67 | STROKE (mm) | 11.8 | 118 |
| HOURS RUN | | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mmDC | | | DISP (L/stk) | 9.216 | 2.16 |
| W O B (daN) | | | | CIRCULATION TIMES (min) | | | | SPM | 101 | 100 |
| RPM | | | | MUD TANKS / SUMP | | BOTTOMS UP | 4 | OUTPUT (m³/min) | 2.4 | |
| ROP (m/hour) | | | | DRILL STRING | 4 | TOTAL | 22 | PRESSURE (kPa) | 2450 | |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | | SOLIDS CONTROL | | | |
|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | 41 | EQUIPMENT | | | |
| Gel | 15.00 | 20 | 300.00 | HOLE | 10 | OVERFLOW DENSITY (kg/m³) | | | |
| | | | | TOTAL | 51 | UNDERFLOW DENSITY (kg/m³) | | | |
| | | | | LOST TO HOLE | | UNDERFLOW RATE (L/min) | | | |
| | | | | LOST TO EQUIP. | | SOLIDS REMOVAL RATE (kg/hr) | | | |
| | | | | DUMPED | | LIQUID REMOVAL RATE (L/min) | | | |
| | | | | NEW WATER | | HOURS RUN | | | |
| | | | | NEW MUD / PREMIX | | SHAKER 1 | MESH | SHAKER 2 | MESH |

| | |
|---|---|
| COST SINCE LAST CHECK | |
| PREVIOUS COST | 2029.50 ~~1999~~ |
| TOTAL COST | 2329.5 |

| RHEOLOGY | | | | | |
|---|---|---|---|---|---|
| 600 | 23 | 200 | | 6 | |
| 300 | 14 | 100 | | 3 | |
| n/K | .27 / 1.3 | Reynolds # 2031 | | | |

| | | |
|---|---|---|
| ☐ FLOWLINE ☐ SUCTION TEMP °C | | |
| SAMPLE TIME (hr) | 22:30 | |
| SAMPLE DEPTH (m) | | |
| DENSITY (kg/m³) | 1020 | |
| PRESSURE GRADIENT (kPa/m) | | |
| FUNNEL VISCOSITY (s/L) | 42 | |
| PLASTIC VISCOSITY (mPa·s) @ ____ °C | 9 | |
| YIELD POINT (Pa) @ ____ °C | 2.5 | |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 2 / 6 | / |
| API FILTRATE (mL/30min) @ 700 kPa | 12.5 | |
| FILTER CAKE (mm) | 0.5 | |
| HT-HP F.L. (mL/30 min) ____ kPa ____ °C | | |
| HT-HP FILTER CAKE (mm) | | |
| pH ☑ STRIP ☐ METER | 9.5 | |
| ALKALINITY (Pf/Mf) | 1.5 / 1.30 | / |
| HYDROXYLS (mg/L) | Nil | |
| CARBONATES (mg/L) | 180 | |
| BICARBONATES (mg/L) | Nil | |
| CALCIUM (mg/L) | 40 | |
| CHLORIDES (mg/L) | 100 | |
| % SAND - VOLUME FRACTION | TRACE | |
| % OIL - VOLUME FRACTION | | |
| % TOTAL SOLIDS - VOLUME FRACTION | 1-3 | |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | 25 | |
| DRILLED SOLIDS (kg/m³) | 10 | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | 34 | |
| POLYMER CONCENTRATION (kg/m³) | | |
| ECD 11 | 1037 | |

## WELL HISTORY & REMARKS

98/03/02 Reweld Csg. pad & fix leaks - Drill out 14.45 - 17.45 Mud up to 20.45 then pulled Ahead. Mud up @ 153m.

Cuttings - Very Soft shale silt sized to 3mm.

## RECOMMENDATIONS

MUD Maintainence

Viscosity - 38 to 40 s/L in Gel ~~Mix 5 to 10~~
Mix no faster than 5min/sk
Thats 4 per Circulation

PH - No control for now.

Water loss - 8-12 mls for now use Aquagel Regular or LO Vis. If Regular builds Viscosity while LO Vis does not.

Density - Low as possible
- Run Centrifuge ASAP
- build Volume in a steady trickle of water 10 - 25 bph.
- Pump sand trap regularly.

Thanx

SERVICE REP: Fred Huettle PHONE/1

WAREHOUSE: P

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## DRILLING MUD SERVICE REPORT

SPUD DATE 98/02/23 DATE 98/03/03

WELL NAME and LOCATION Ranger et-al Little Bear REPORT NO. 7

OPERATOR Ranger Oil Ltd CONTRACTOR Shetah 1E

REPORT FOR Lee Brazel REPORT FOR Doug

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO | 1A | SIZE (mm) | 8+14.3 | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m) | MAKE | National 6 | |
| TYPE | PDC FM2943 | VELOCITY (m/s) | 32 | LAST CASING | 340/317 | 149 | | MODEL | 8P80 | |
| SIZE (mm) | 311 | JET FORCE (N) | | DRILL BHA | | 225 | | LINER DIA (mm) | 152 | 152 |
| DEPTH IN (m) | 149 | HHP (kW) | | OPEN HOLE | 11.4 mmDP | | 37 | ROD DIA (mm) | | |
| DEPTH OUT (m) | 170 | DEVIATION RECORD | | OPEN HOLE | 16.9 mmDC | 138 | 45 | STROKE (mm) | 216 | 216 |
| HOURS RUN | 21 | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | 12.7 mmDC | 75 | 68 | DISP (L/stk) | 11.8 | 11.8 |
| W.O.B. (daN) | 6/12 | 330 | 1° | CIRCULATION TIMES (min) | | | | SPM | 105 | 105 |
| RPM | 75 | | | MUD TANKS / SUMP | | BOTTOMS UP | 9 | OUTPUT (m³/min) | 2.98 | |
| ROP (m/hour) | ≈12 | | | DRILL STRING | 9 | TOTAL | 31 | PRESSURE (kPa) | 5400 | |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | | SOLIDS CONTROL | | | |
|---|---|---|---|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | 50 | EQUIPMENT | Cent | | |
| Soda Ash | 40.00 | 1 | 40.00 | HOLE | 24 | OVERFLOW DENSITY (kg/m³) | 1100 | | |
| Bicarb | 93.75 | 2 | 187.50 | TOTAL | 74 | UNDERFLOW DENSITY (kg/m³) | ≈ 1950 | | |
| Gel | 15.00 | 2 | 30.00 | LOST TO HOLE | | UNDERFLOW RATE (L/min) | | | |
| | | | | LOST TO EQUIP. | | SOLIDS REMOVAL RATE (kg/hr) | | | |
| | | | | DUMPED | | LIQUID REMOVAL RATE (L/min) | | | |
| | | | | NEW WATER | | HOURS RUN | | | |
| | | | | NEW MUD / PREMIX | | SHAKER 1 | 84S MESH | SHAKER 2 | 84S MESH |

| | |
|---|---|
| COST SINCE LAST CHECK | 257.50 |
| PREVIOUS COST | |
| TOTAL COST | 5349.50 |

| RHEOLOGY | | | | | | |
|---|---|---|---|---|---|---|
| 600 | 24 | 29 | 200 | | 6 | |
| 300 | 14 | 17 | 100 | | 3 | |
| n/K | | .31/1.2 | Reynolds # | | 1924 | |

| | | |
|---|---|---|
| ☐ FLOWLINE ☐ SUCTION TEMP °C | 19 | 20 |
| SAMPLE TIME (hr) | 8:45 | 21:00 |
| DEPTH (m) | 286 | 386 |
| DENSITY (kg/m³) | 1080 | 1120 |
| PRESSURE GRADIENT (kPa/m) | | |
| FUNNEL VISCOSITY (s/L) | 39 | 42 |
| PLASTIC VISCOSITY (mPa·s) @ ____ °C | 10 | 12 |
| YIELD POINT (Pa) @ ____ °C | 2 | 2.5 |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 2.5 | 2.5/6 |
| API FILTRATE (mL/30min) @ 700 kPa | 11 | 9.0 |
| FILTER CAKE (mm) | 0.5 | 0.5 |
| HT/HP F.L. (mL/30 min) ____ kPa ____ °C | | |
| HT/HP FILTER CAKE (mm) | | |
| pH ☐ STRIP ☐ METER | 9.0 | 9.0 |
| ALKALINITY (Pm/Mf) | .1/1.2 | .07/1.3 |
| HYDROXYLS (mg/L) | Nil | Nil |
| CARBONATES (mg/L) | 120 | 84 |
| BICARBONATES (mg/L) | Nil | 195 |
| CALCIUM (mg/L) | 40 | 40 |
| CHLORIDES (mg/L) | 150 | 150 |
| % SAND - VOLUME FRACTION | TRACE | TRACE |
| % OIL - VOLUME FRACTION | | |
| % TOTAL SOLIDS - VOLUME FRACTION | 5.0 | 7.5 |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | 45 | 50 |
| DRILLED SOLIDS (kg/m³) | | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | | 195 |
| POLYMER CONCENTRATION (kg/m³) | | |
| FCD | | 1136 |

### WELL HISTORY & REMARKS

98/02/02 - Pullout 17.43 Makeup to 20.45 Drilled to Mid depth of 182

98/03/03 - Drilling Ahead in ~~Gel~~ Gel/Chem sys.

Cuttings: Soft to Medium Soft shales.

### RECOMMENDATIONS

Mud Maintinence

Viscosity - 45-50 S/L in Gel and or Aquapac Regular.
- Mix Gel no faster than 5min/sk.
- Mix Aquapac Reg 1hr/sk.

PH - No control unless requested.

Waterloss - 8-10mls in Aquapac Regular or Lo Vis.
#Regular builds Vis
Lo Vis does not.

Density - 1100 to 1120 kg/m³
- Run centrifuge
- Build volume in 9 stand, flow pf water 15-25LPM.
- Dump Sand trap Regularly.
- Maintain tank volume of 50m³.

Thank.

SERVICE REP: Fred Huette PHONE / MOBILE:

WAREHOUSE: PHONE:

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# DRILLING MUD SERVICE REPORT

SPUD DATE 98/02/23 DATE 98/03/07

WELL NAME and LOCATION Ranger Little Bear M-31 REPORT NO 8

OPERATOR Ranger Oil Ltd. CONTRACTOR Shetah #E

REPORT FOR Lee Brazel REPORT FOR Doug Rourke

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| # | 1B | SIZE (mm) | 9/14 | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m/min) | MAKE | National | |
| TYPE | FM2743 | VELOCITY (m/s) | 32 | LAST CASING | 244/224 | 602 | | MODEL | 8P80's | |
| SIZE (mm) | 311 | JET FORCE (N) | | LINER | | | | LINER DIA (mm) | 152 | 152 |
| DEPTH IN (m) | 149 | HHP (kW) | | OPEN HOLE | 114 mm DP | | 46 | ROD DIA (mm) | | |
| DEPTH OUT (m) | 602 | DEVIATION RECORD | | OPEN HOLE | 169 mm DC | 138 | 80 | STROKE (mm) | 216 | 216 |
| HOURS RUN | 44 1/2 | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mm DC | @ Hostk | | DISP (L/stk) | 11.8 | 11.8 |
| W.O.B (daN) | 8/12 | 515 | 3/4 | CIRCULATION TIMES (min) P.O. = 1.5 | | | | SPM | 105 | 100 |
| RPM | 70 | 592 | 0.2 | MUD TANKS / SUMP | | BOTTOMS UP | 12 | OUTPUT (m³/min) | | 2.48 |
| ROP (m/hour) | | | | DRILL STRING | 3 | TOTAL | 58 | PRESSURE (kPa) | 7400 | |

## DRILLING MUD PRODUCTS

| MATERIAL | | UNITS | COST | TOTAL COST |
|---|---|---|---|---|
| Gel | 15.00 | 182 | | 2730.00 |
| Aquagel Reg | 390.00 | 5 | | 1950.00 |
| Resinex | 112.00 | 2 | | 224.00 |
| Bucite | 18.00 | 40 | | 720.00 |

| | |
|---|---|
| COST SINCE LAST CHECK | 5624.00 |
| PREVIOUS COST | 5349.50 |
| TOTAL COST | 10973.50 |

## MUD VOLUMES (m³)

| | |
|---|---|
| TANK / SUMP | ≈55 |
| HOLE | 20 |
| TOTAL | 75 |
| LOST TO HOLE | |
| LOST TO EQUIP | |
| DUMPED | |
| NEW WATER | |
| NEW MUD / PREMIX | |

## SOLIDS CONTROL

| | |
|---|---|
| EQUIPMENT | Cent |
| OVERFLOW DENSITY (kg/m³) | |
| UNDERFLOW DENSITY (kg/m³) | |
| UNDERFLOW RATE (L/min) | |
| SOLIDS REMOVAL RATE (kg/hr) | |
| LIQUID REMOVAL RATE (L/min) | |
| HOURS RUN | |
| SHAKER 1 | MESH |
| SHAKER 2 | MESH |

## RHEOLOGY

| | | | |
|---|---|---|---|
| 600 | 57 | 200 | 6 |
| 300 | 35 | 100 | 3 |
| n/K | 0.35/2.03 | Reynolds # 1158 | |

| | |
|---|---|
| ☐ FLOWLINE ☐ SUCTION TEMP °C | Tank check |
| SAMPLE TIME (hr) | |
| DEPTH (m) | 602 |
| DENSITY (kg/m³) | 1165 |
| PRESSURE GRADIENT (kPa/m) | |
| FUNNEL VISCOSITY (s/L) | ≈60 |
| PLASTIC VISCOSITY (mPa·s) @ °C | 22 |
| YIELD POINT (Pa) @ °C | 6.5 |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 3.5 / 9 |
| API FILTRATE (mL/30min) @ 700 kPa | 8.5 |
| FILTER CAKE (mm) | 2.5 |
| HT-HP F.L. (mL/30 min) kPa °C | |
| HT-HP FILTER CAKE (mm) | |
| pH ☐ STRIP ☐ METER | 7.5 |
| ALKALINITY (PM/MF) | 0 / 0.4 |
| HYDROXYLS (mg/L) | Nil |
| CARBONATES (mg/L) | Nil |
| BICARBONATES (mg/L) | 488 |
| CALCIUM (mg/L) | 80 |
| CHLORIDES (mg/L) | 400 |
| % SAND - VOLUME FRACTION | TRACE |
| % OIL - VOLUME FRACTION | |
| % TOTAL SOLIDS - VOLUME FRACTION | 10.3 |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | 95 |
| DRILLED SOLIDS (kg/m³) | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | |
| POLYMER CONCENTRATION (kg/m³) | |

## WELL HISTORY & REMARKS

98/02/05 - Mill to T.P. for intermediate @ 00:30. POOH & Log ≡ Dowell.

98/03/06 - Run Csg. & Wait on Cementers Circ Csg.

98/03/07 - Cement Csg 8:15 presently waiting on Welder.

## RECOMMENDATIONS

Tonight:

- Dump & clean shaker tank.
- [redacted]

Drillout instructions

- We will drill out ≈ water thru Pill tank.
- Fill Pill tank & Have water truck ready to displace hole to water.
- Displace Mud from hole to sump.
- After Drill out discard contaminted water to Sump.
- Then open suctions to mud tanks & displace hole to Mud & close in system. Hole is 20 m³ Tmks / 1700 strokes.

Thank

SERVICE REP: Fred Huette PHONE / MOBILE:

WAREHOUSE: PHONE:

In consideration of the furnishing of this report and any oral suggestions it is agreed that MIDAS DRILLING FLUIDS shall not be liable for any damages resulting from the... construed as authorizing the infringement of any valid patent.

$\frac{V(W_2 - W_1)}{W_2 - 1000}$ = Vol for Dilution

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# DRILLING MUD SERVICE REPORT

SPUD DATE 98/02/23 DATE 98/03/09

WELL NAME and LOCATION: Ranger et al Little Bear M-39 REPORT NO 9

OPERATOR Ranger Oil Ltd. CONTRACTOR Shetah 1E

REPORT FOR Lee Brazel REPORT FOR Doug Rourke

| BIT RECORD | | NOZZLE DATA | |
|---|---|---|---|
| NO. | 2B | SIZE | 7/11.1 |
| TYPE | FM2745 | VELOCITY | 35 |
| SIZE | 222 | JET FORCE | |
| DEPTH IN | 605 | HHP | |
| DEPTH OUT | in | DEVIATION RECORD | |
| HOURS RUN | 42 | DEPTH | ANGLE - DIRECTION |
| ACC. DEV. | | | |
| WOB | | | |
| RPM | | | |

| ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | |
|---|---|---|---|---|---|
| ANNULUS | OD/ID | LENGTH (m) | VELOCITY (m/min) | MAKE | Mission |
| LAST CASING | 244/224 | 602 | | MODEL | 6x80 |
| LINER | | | | LINER DIA (mm) | 152 152 |
| OPEN HOLE | 114 mod | | 50 | ROD DIA (mm) | |
| OPEN HOLE | 169 mod | 139 | 87 | STROKE (mm) | 216 216 |
| OPEN HOLE | 8.68 mod | 207 | | DISP L/stk | 11-8 11-8 |
| CIRCULATION TIMES (min) | | | | SPM | 60 60 |
| MUD TANKS: SUMP | | BOTTOMS UP | 43 | OUTPUT (m³/min) | 1.42 |
| DRILL STRING | 2 | TOTAL | 53 | PRESSURE (kPa) | |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | |
|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | 55 |
| | | | | HOLE | 20 |
| | | | | TOTAL | 75 |
| | | | | LOST TO HOLE | |
| | | | | LOST TO EQUIP | |
| | | | | DUMPED | |
| | | | | NEW VOLUME | 15 |
| | | | | NEW MUD / PREMIX | |

| SOLIDS CONTROL | |
|---|---|
| EQUIPMENT | Cent |
| | |
| | |
| | |
| | |
| | |
| SHAKER 1 | 175 MESH |
| SHAKER 2 | 110 MESH |

| | |
|---|---|
| COST SINCE LAST CHECK | 0.00 |
| PREVIOUS COST | |
| TOTAL COST | 10932.20 |

| RHEOLOGY | | | |
|---|---|---|---|
| 600 | 53 | 300 | |
| 200 | 36 | 100 | |
| 6 | 9 | 3 | |
| 3 | | | |

| | | |
|---|---|---|
| ☑ PUMP ☐ SUCTION TEMP °C | Tank | Tank |
| SAMPLE TIME hh:mm | 12:30 | 23:45 |
| SAMPLE DEPTH m | | 618 |
| MUD WT. (ppg) | 1145 | 1105 |
| FUNNEL VISCOSITY sec/L | ≈60 | 37 |
| PLASTIC VISCOSITY cPs @ °C | 21 | 8 |
| YIELD POINT Pa @ °C | 7.5 | 0.5 |
| GEL STRENGTH Pa 10 sec / 10 min | 3.9 / | 1 / 3 |
| API FILTRATE mL/30min @ 700 kPa | 8.4 | 11 |
| FILTER CAKE mm | 2.0 | 1.5 |
| HTHP FL mL/30min @ °C | | |
| HTHP FILTER CAKE mm | | |
| pH STRIP ☐ METER | 7.5 | 9.0 |
| ALKALINITY (Pm) | 0 / 0.5 | .05 .4 |
| CHLORIDES (mg/L) | Nil | Nil |
| CARBONATES (mg/L) | Nil | 60 |
| BICARBONATES (mg/L) | 661 | 366 |
| CALCIUM (mg/L) | 40 | 60 |
| CHLORIDES (mg/L) | 350 | 300 |
| % SAND VOLUME FRACTION | | TRACE |
| % OIL VOLUME FRACTION | | |
| % TOTAL SOLIDS VOLUME FRACTION | | 6.5 |
| WET CHEMISTRY SOLIDS (kg/m³) | 80 | 60 |
| DRILLED SOLIDS (kg/m³) | | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | | 114 |
| BENTONITE CONCENTRATION (kg/m³) | | |

Vis:
10:40 44
16:15 37
23:30 36

## WELL HISTORY & REMARKS

98/03/09 - Drill out 8:00 - 13:00
Pooh 15:30 for PDC Bit
RIH to 21:30, Displaced hole to mud by 22:00.
- Add 15m³ water to build vol.

## RECOMMENDATIONS

MUD MAINTENANCE

Viscosity - 40 S/L = Gel
Mix 5 to 10 over Circulation
Circulation 5-3 min

pH - No Control for now.

Water loss - 8 to 10 ml/s = Aquapac Regular or Lo Vis.
Use Regular if you want an increase in Vis.
Use Lo Vis if you dont want any Vis increases.
Mix @ 1 sk / 106 min

Density - Low as possible
- Run Centrifuge
- Pump Sand trap regularly
- Run as fine as possible screens on shaker.
- Maintain Vol 55 - 65 m³
= a steady flow of water 15 - 25 L/min.

Tonight:
Mud is a little thin
Add 10 Gel + 1 sk Aquapac Reg.
check properties & adjust if necessary.

Thank

SERVICE REP Fred Huette PHONE / MOBILE:
WAREHOUSE PHONE:

In consideration of the furnishing of this report and any oral suggestions it is agreed that MIDAS DRILLING FLUIDS shall not be liable for any damages resulting from them, nor shall it be construed as warranting the infringement of any valid patent.

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# DRILLING MUD SERVICE REPORT

SPUD DATE 98/04/23 DATE 98/03/10

WELL NAME and LOCATION Ranger et-al Little Bear M-39 REPORT NO 10

OPERATOR Ranger Oil Ltd. CONTRACTOR Sheish 1E

REPORT FOR Lee Brazel REPORT FOR Dale Burandall

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | |
|---|---|---|---|---|---|---|---|---|---|
| NO | 26 | SIZE mm | 7x11.1 | ANNULUS | OD/ID | LENGTH (m) | VELOCITY (m/min) | MAKE | Nationals |
| TYPE | FM 2745 | VELOCITY m/s | 35 | LAST CASING | 244/224 | 602 | | MODEL | 8P80 |
| SIZE mm | 220 | JET FORCE kN | | LINER | | | | LINER DIA mm | 152 152 |
| DEPTH IN m | 608 | HHP kW | | OPEN HOLE | 14 mm OD | | 50 | ROD DIA mm | |
| DEPTH OUT m | m | DEVIATION RECORD | | OPEN HOLE | 169 mm OD | 139 | 87 | STROKE mm | 216 216 |
| HOURS RUN | 21/8 | DEPTH m | ANGLE - DIRECTION | OPEN HOLE | mm OD | | | DISP L/stk | 11.8 11.8 |
| W.O.B kN | 6/8 | 885 | 1° | CIRCULATION TIMES (min) | | | | SPM | 60 60 |
| RPM | 70 | | | MUD TANKS / SUMP | | BOTTOMS UP | 17 | OUTPUT m³/min | 1.42 |
| ROP m/hr | 20-30 | | | DRILL STRING | 4 | TOTAL | 60 | PRESSURE kPa | 4800 |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | | SOLIDS CONTROL | |
|---|---|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | 53 | EQUIPMENT | Cent |
| | | | | HOLE | 30 32 | DENSITY kg/m³ | 1150 |
| | | | | TOTAL | 85 | VISCOSITY s/L | ~1100 |
| | | | | LOST TO HOLE | | | |
| | | | | LOST TO EQUIP | | | |
| | | | | DUMPED | | | |
| | | | | NEW WATER | | | |
| | | | | NEW MUD / PREMIX | | SHAKER 1 175 MESH | SHAKER 2 250 MESH |

| | |
|---|---|
| COST SINCE LAST CHECK | |
| PREVIOUS COST | |
| TOTAL COST | not Discarded 10973.50 |

**WELL HISTORY & REMARKS**

98/03/10 - Drilling Ahead in stata b.t weight is a problem.

Cuttings - Mostly soft clay like shale.

**RHEOLOGY**

| | | | | | |
|---|---|---|---|---|---|
| 600 | 31 | 200 | | | |
| 300 | 18 | 100 | | 3 | 3 |
| n/K | 39/0.81 | | | | |

| ☐ FLOWLINE ☐ SUCTION TANK °C | | | |
|---|---|---|---|
| SAMPLE TIME (hr) | | 7:00 | 16:30 |
| PRESENT DEPTH (m) | | 758 | 888 |
| DENSITY (kg/m³) | | 1130 | 1160 |
| PRESSURE GRADIENT (kPa/m) | | | |
| FUNNEL VISCOSITY (s/L) | | 49 | 39 |
| PLASTIC VISCOSITY (mPa·s) @ °C | | 17 | 13 |
| YIELD POINT (Pa) @ °C | | 4.5 | 2.5 |
| GEL STRENGTHS (Pa) 10 sec / 10 min | | 3 / 8 | 1.5 / 6 |
| API FILTRATE (mL/30min) @ 700 kPa | | 9.2 | 8.5 |
| FILTER CAKE (mm) | | 2 | 1.5 |
| HT/HP FL (mL/30 min) @ kPa °C | | | |
| HT/HP FILTER CAKE (mm) | | | |
| pH ☐ STRIP ☐ METER | | 8.5 | 8.0 |
| ALKALINITY (Pm) | | 1/4.1 | 0 / 0.3 |
| HYDROXYLS (mg/L) | | Nil | Nil |
| CARBONATES (mg/L) | | 120 | Nil |
| BICARBONATES (mg/L) | | 244 | 610 |
| CALCIUM (mg/L) | | 60 | 40 |
| CHLORIDES (mg/L) | | 300 | 300 |
| % SAND - VOLUME FRACTION | | 0.5 | 0.25 |
| % OIL - VOLUME FRACTION | | | |
| % TOTAL SOLIDS - VOLUME FRACTION | | 8.1 | 10 |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | | 70 | 80 |
| DRILLED SOLIDS (kg/m³) | | | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | | | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | | 211 | 260 |
| POLYMER CONCENTRATION (kg/m³) | | | |
| Flo | | | |

**RECOMMENDATIONS**

Mud Maintenance

Vis - 40-45 s/L in Gel + Aquapac Regular in a 10:1 ratio.
- Mix Gel @ 6 min/sk
- Mix Aquapac Regular @ 1 hr/sk
# If Aquapac blinds off screens then mix over 2 hrs.

PH - No control unless requested.

Waterloss - 8-9 mls in Aquapac Regular or 20 Vis.
# Regular builds Vis while 20 Vis does not.
Mix @ 1 hr/sk.

Density - As low as possible!!
- Pump Sand trap every connection.
- Run desilter & centrifuge
- Maintain tank Vol of 55 m³ in a steady flow of water 20-35 LPM.

# when running water hard make sure to keep Vis up by adding Gel. Keep working to get weight down.

Thank

| | | | |
|---|---|---|---|
| SERVICE REP | Fred Huette | PHONE / MOBILE | |
| WAREHOUSE | | PHONE | |

In consideration of the furnishing of this report and any oral suggestions it is agreed that MIDAS DRILLING FLUIDS shall not be liable for any damages resulting from them, nor shall they be construed as authorizing the infringement of any valid patent.

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# DRILLING MUD SERVICE REPORT

SPUD DATE 98-02-25 DATE 98-03-11

WELL NAME and LOCATION RANGER et al LITTLE BEAR M-39 REPORT NO 11

OPERATOR RANGER OIL LTD CONTRACTOR SHETAH I.E

REPORT FOR LEE BRAZEL REPORT FOR DALE BRAXANDALL

| BIT RECORD | | HOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO | 5 | SIZE | 3X11.1 | ANNULUS | OD/ID | LENGTH (m) | VELOCITY (m) | MAKE | NATIONAL | |
| TYPE | FM3745 | VELOCITY | 88 | JET CASING | 244/224 | 602 | | MODEL | 8P80's | |
| SIZE | 222 | JET FORCE | 215925 | LINER | | | | LINER DIA (mm) | 152 | 152 |
| DEPTH IN | 602 | HHP/in² | 97 | OPEN HOLE | 114 mwd | | 50 | ROD DIA (mm) | | |
| DEPTH OUT | — | DEVIATION RECORD | | OPEN HOLE | 169 mwd | 139 | 87 | STROKE (mm) | 216 | 216 |
| HOURS RUN | 28 | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mwd | | | DISP (L/stk) | 11.8 | 11.8 |
| WOB (M) | 3-8 | 1073 | 1.8 | CIRCULATION TIMES (min) | | | | SPM | 60 | 60 |
| RPM | 75 | 1007 | 2.0 | MUD TANKS / SUMP | 3 | BOTTOMS UP | 23 | OUTPUT (m³/min) | .708 | .708 1.4 |
| ROP (m/hr) | | 955 | 1.5 | DRILL STRING | 8 | TOTAL | 70 | PRESSURE (kPa) | 5800 | |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | | SOLIDS CONTROL | |
|---|---|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | 54 | EQUIPMENT | CENT |
| GEL | 42 | 15.00 | 630.00 | HOLE | 44 | OVERFLOW DENSITY (ppg) | 1120 |
| BICARB | 3 | 93.75 | 281.25 | TOTAL | 98 | UNDERFLOW DENSITY (ppg) | 1820 |
| AQUAPAC | 5 | 390.00 | 1950.00 | LOST TO HOLE | | UNDERFLOW RATE (L/min) | |
| | | | | LOST TO EQUIP | | SOLIDS REMOVAL RATE (kg/hr) | |
| | | | | DUMPED | | LIQUID REMOVAL RATE (L/min) | |
| | | | | NEW WATER | | HOURS RUN | 24 |
| | | | | NEW MUD / PREMIX | | SHAKER 1 | 175 MESH SHAKER 2 250 MESH |

| | |
|---|---|
| COST SINCE LAST CHECK | 2861.25 |
| PREVIOUS COST | 10975.50 |
| TOTAL COST | 13836.75 |

**WELL HISTORY & REMARKS**

10th DRILLED TO 962m - SOFT CLAY TYPE SHALES HARD TO CONTROL DENSITY

| RHEOLOGY | | | | | |
|---|---|---|---|---|---|
| 600 | 39 | 300 | 19 | 6 | 4 |
| 300 | 25 | 100 | 13 | 3 | 3 |
| n/k | .46/.723 | Fanns # | 1914 | | |

| | | |
|---|---|---|
| FLOWLINE / SUCTION TEMP °C | 21 | 21 |
| SAMPLE TIME (hr) | 01:00 | 16:30 |
| CURRENT DEPTH (m) | 19.8 | 1146 |
| DENSITY (ppg) | 1140 | 1130 |
| PRESSURE GRADIENT (kPa/m) | — | 10705.75 |
| FUNNEL VISCOSITY (s/L) | 40 | 43 |
| PLASTIC VISCOSITY (mPa·s) @ °C | 14 | 14 |
| YIELD POINT (Pa) @ °C | 9.5 | 5.5 |
| GEL STRENGTH (Pa) 10 sec / 10 min | 1.5 6 | 1.5 13/14 |
| API FILTRATE (mL/30min) @ 700 kPa | 8.5 | 8.4 |
| FILTER CAKE (mm) | 1.5 | 1.5 |
| HTHP FILTRATE (mL/30 min) @ kPa °C | — | — |
| HTHP FILTER CAKE (mm) | — | — |
| pH STRIP / METER | 7.5 | 8.5 |
| ALKALINITY (Mf/Pf) | 0.5 | 0.8 / 4.8 |
| HYDROXYLS (mg/L) | n.c | |
| CARBONATES (mg/L) | n.c | 96 |
| BICARBONATES (mg/L) | 610 | 528 |
| CALCIUM (mg/L) | 40 | 40 |
| CHLORIDES (mg/L) | 300 | 300 |
| % SAND - VOLUME FRACTION | TR | .0025 |
| % OIL - VOLUME FRACTION | — | — |
| % TOTAL SOLIDS - VOLUME FRACTION | — | 8.3 |
| MBT (TOTAL BENTONITIC SOLIDS) (kg/m³) | 70 | 70 |
| DRILLED SOLIDS (kg/m³) | — | — |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | — | — |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | — | 211 |
| POLYMER CONCENTRATION (kg/m³) | — | — |

600@39 300@25
200@10 100@13
6@4 3@3

ECD 1 11637

**RECOMMENDATIONS**

CONTROL VISCOSITY @ 42-45 S/L W/ GEL @ 6-8 min/SK

PH - NEUTRAL - NO CONTROL

WATER LOSS - 8-10 cm³ W/ AQUAPAC - REQ. @ 60 min/SK THRU THE HOPPER

DENSITY - AS LOW AS POSSIBLE
- DUMP SAND TRAP AFTER EVERY CONNECTION
- RUN CENTRIFUGE & DESILTER @ ALL TIMES
- RUN 25-35 m³ WATER BELOW THE SHAKER WHILE DRLG
- MAINTAIN TANK VOLUME @ 55 m³ ± 5

TONITE = ADD 2 SXS OF LIGNITE / SK @ TIME THRU THE CHEM QUICK 70 min PER SACK

THANK YOU

SERVICE REP DAVID LAUSCHER PHONE / MOBILE

WAREHOUSE PHONE

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# DRILLING MUD SERVICE REPORT

SPUD DATE 98-02-23 DATE 98-03-12

WELL NAME and LOCATION RANGER et al LITTLE BEAR M-39 REPORT NO 12

OPERATOR RANGER OIL LTD CONTRACTOR SHETAH LE

REPORT FOR LEE BRAZEL REPORT FOR DALE BRAXANDALL

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO | 2B | SIZE (mm) | 3X11.1 | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m/min) | MAKE | NAT | NAT |
| TYPE | FM2745 | VELOCITY (m/s) | 80.9 | LAST CASING | 244/224 | 602 | | MODEL | 8P80 | 8P80 |
| SIZE (mm) | 222 | JET FORCE (N) | 2149 | LINER | | | | LINER DIA (mm) | 152 | 152 |
| DEPTH IN (m) | 602 | HHP (kW) | 96.6 | OPEN HOLE | 114 mmDP | | 50 | ROD DIA (mm) | | |
| DEPTH OUT (m) | | DEVIATION RECORD | | OPEN HOLE | 169 mmDC | 139 | 87 | STROKE (mm) | 216 | 216 |
| HOURS RUN | 40.25 | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mmDC | | | DISP (L/stk) | 11.8 | 11.8 |
| W.O.B (daN) | 4 | 1148 | 1.6 | CIRCULATION TIMES (min) | | | | SPM | 60 | 60 |
| RPM | 75 | 1073 | 1.8 | MUD TANKS / SUMP | 36,36 | BOTTOMS UP | 25,27 | OUTPUT (m³/min) | .708 | .708 = 1.4 |
| ROP (m/hour) | 14.4 | 1007 | 2.0 | DRILL STRING | 7 10 | TOTAL | 71,73 | PRESSURE (kPa) | 5300 | 6100 |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | | SOLIDS CONTROL | |
|---|---|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | 51 51 | EQUIPMENT | CENT |
| GEL | 50 | 15.00 | 750.00 | HOLE | 49 51 | OVERFLOW DENSITY (kg/m³) | 1110 |
| AQUAPAC | 5 | 390.00 | 1950.00 | TOTAL | 100 102 | UNDERFLOW DENSITY (kg/m³) | 1560 |
| CAUSTIC SODA | 1 | 77.00 | 77.00 | LOST TO HOLE | | UNDERFLOW RATE (L/min) | |
| LIGNITE | 1 | 15.25 | 15.25 | LOST TO EQUIP | | SOLIDS REMOVAL RATE (kg/hr) | |
| | | | | DUMPED | | LIQUID REMOVAL RATE (L/min) | |
| | | | | NEW WATER | | HOURS RUN | |
| | | | | NEW MUD / PREMIX | | SHAKER 1 3 X 175 MESH | SHAKER 2 3 X 250 MESH |

| | |
|---|---|
| COST SINCE LAST CHECK | 2792.25 |
| PREVIOUS COST | 13834.75 |
| TOTAL COST | 16627.00 |

**WELL HISTORY & REMARKS**

11th - DRILL 222mm hole F/962-1200

**RHEOLOGY**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 600 | 42,36 | 200 | 20,18 | 6 | 5,4 | | |
| 300 | 27,24 | 100 | 17,12 | 3 | 4,3 | | |
| n/K | .444 / 1.039 | | .445 / 1.733 | | | | |

| | | |
|---|---|---|
| FLOWLINE ☐ SUCTION TEMP °C | 25 | 30 |
| SAMPLE TIME (hr) | 0600 | 2100 |
| DEPTH (m) | 1261 | 1361 |
| DENSITY (kg/m³) | 1125 | 1125 |
| PRESSURE GRADIENT (kPa/m) | 13916.7 | 15020 |
| FUNNEL VISCOSITY (s/L) | 44 | 43 |
| PLASTIC VISCOSITY (mPa·s) @ ____ °C | 15 | 12 |
| YIELD POINT (Pa) @ ____ °C | 6 | 6 |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 2/4/5 | 2/3/4 |
| API FILTRATE (mL/30min) @ 720 kPa | 8.0 | 9.0 |
| FILTER CAKE (mm) | 1.5 | 1.5 |
| HT-HP F.L. (mL/30 min) ____ kPa ____ °C | | |
| HT-HP FILTER CAKE (mm) | | |
| pH ☑ STRIP ☐ METER | 8.0 | 8.0 |
| ALKALINITY (P/M) | .05 / 1.5 | .05 / 1.5 |
| HYDROXYLS (mg/L) | 14 | 14 |
| CARBONATES (mg/L) | 60 | 60 |
| BICARBONATES (mg/L) | 570 | 570 |
| CALCIUM (mg/L) | 60 | 80 |
| CHLORIDES (mg/L) | 300 | 350 |
| % SAND - VOLUME FRACTION | .0025 | .0025 |
| % OIL - VOLUME FRACTION | | |
| % TOTAL SOLIDS - VOLUME FRACTION | 8.0 | 8.0 |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | 70 | 65 |
| DRILLED SOLIDS (kg/m³) | | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | 203 | 203 |
| POLYMER CONCENTRATION (kg/m³) | | |
| REYNOLDS # | 1711 | 1971 |
| ECD | 1163 | 1156.5 |

**RECOMMENDATIONS**

CONTROL:
VISCOSITY: @ 42-45 S/L W/ GEL.
@ 6-8 min / SK.

PH - NEUTRAL - No CONTROL

WATERLOSS - 8-10 cm³ W/ AQUAPAC-Lignite
@ 2-1 RATIO OVER
/ CIRC

DENSITY - AS LOW AS POSSIBLE.
- RUN 25-35 m H₂O below
THE SHAKER While DRLG.
- DUMP SAND TRAP EVERY CONNECTION
- RUN CENTRIFUGE AND RESILTER
AT ALL TIMES.
- MAINTAIN 55 m³ OF VOLUME
ON SURFACE.

THANK You

SERVICE REP DAVID LAUSCHER PHONE / MOBILE:

WAREHOUSE: PHONE:

In consideration of the furnishing of this report and any oral suggestions it is agreed that MIDAS DRILLING FLUIDS shall not be liable for any damages resulting from them, nor shall they be construed as authorizing the infringement of any valid patent.

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# DRILLING MUD SERVICE REPORT

SPUD DATE 98-02-23 DATE 98-03-13

WELL NAME and LOCATION RANGER et al LITTLE BEAR M-39 REPORT NO. 13

OPERATOR RANGER OIL LTD CONTRACTOR SHETAH #E

REPORT FOR LEE BRAZEL REPORT FOR DALE BRAXANDALL

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO | 2D | SIZE (mm) | 7X11.1 | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (↑) | MAKE | NAT | NAT |
| TYPE | FM2745 | VELOCITY (m / s) | | LAST CASING | 244/224 | 602 | | MODEL | SP80 | SP80 |
| SIZE (mm) | 222 | JET FORCE (N) | | LINER | | | | LINER DIA (mm) | 152 | 152 |
| DEPTH IN (m) | 602 | HHP (kW) | | OPEN HOLE | 114 mmOP | | 50 | ROD DIA (mm) | — | |
| DEPTH OUT (m) | | DEVIATION RECORD | | OPEN HOLE | 169 mmOC | 139 | 87 | STROKE (mm) | 216 | 216 |
| HOURS RUN | | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mmOC | | | DISP (L/stk) | 11.8 | 11.8 |
| W.O.B. (daN) | 4 | 1347 | 1.1 | CIRCULATION TIMES (min) | | | | SPM | 60 | 60 |
| RPM | 75-80 | 1243 | 1.5 | MUD TANKS / SUMP | 53 | BOTTOMS UP | 30 | OUTPUT (m³/min) | .708 | .708 1.4 |
| ROP (m/hour) | 14 | | | DRILL STRING | 10 | TOTAL | 80 | PRESSURE (kPa) | 5900 | |

## DRILLING MUD PRODUCTS

| MATERIAL | UNITS | COST | TOTAL COST |
|---|---|---|---|
| GEL | 60 | 15.00 | 900.00 |
| AQUAPAC | 5 | 390.00 | 1950.00 |
| LIGDITE | 3 | 15.25 | 45.75 |

| | |
|---|---|
| COST SINCE LAST CHECK | 2895.75 |
| PREVIOUS COST | 16627.60 |
| TOTAL COST | 19523.35 |

## MUD VOLUMES (m³)

| | |
|---|---|
| TANK / SUMP | 54 |
| HOLE | 56 |
| TOTAL | 110 |
| LOST TO HOLE | |
| LOST TO EQUIP | |
| DUMPED | |
| NEW WATER | |
| NEW MUD / PREMIX | |

## SOLIDS CONTROL

| | |
|---|---|
| EQUIPMENT | CENT |
| OVERFLOW DENSITY (ppm) | 1105 |
| UNDERFLOW DENSITY (ppm) | 1830 |
| UNDERFLOW RATE (L/min) | |
| SOLIDS REMOVAL RATE (kg/m) | |
| LIQUID REMOVAL RATE (L/min) | |
| HOURS RUN | |

SHAKER 1: 3X175 MESH | SHAKER 2: 3X250 MESH

## RHEOLOGY

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 600 | 40 | 78 | 200 | 20 | 41 | 6 | 5 | 10 |
| 300 | 26 | 52 | 100 | 14 | 28 | 3 | 4 | 8 |
| n/K | | .406 | | 1.053 | .406 | | 2.1 | |

| | | |
|---|---|---|
| ✓ FLOWLINE ☐ SUCTION TEMP °C | 31 | 38 |
| SAMPLE TIME (hr) | 05:15 | 21:10 |
| DEPTH (m) | 1440 | 1550 |
| DENSITY (kg/m³) | 1120 | 1125 |
| HYD. PRESSURE GRADIENT (kPa/m) | 15821.5 | 17068 |
| FUNNEL VISCOSITY (s/L) | 47 | 72 |
| PLASTIC VISCOSITY (mPa·s) @ ____ °C | 14 | 26 |
| YIELD POINT (Pa) @ ____ °C | 6 | 13 |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 2/4 | 6/35 |
| API FILTRATE (mL/30min) @ 700 kPa | 9.5 | 8.0 |
| FILTER CAKE (mm) | 1.5 | 1.5 |
| HT-HP F.L. (mL/30 min) ____ kPa ____ °C | | |
| HT-HP FILTER CAKE (mm) | | |
| pH ✓ STRIP ☐ METER | 8.0 | 8.0 |
| ALKALINITY (Pf/Mf) | .05/.5 | .02/.53 |
| HYDROXYLS (mg/L) | 14 | 0 |
| CARBONATES (mg/L) | 60 | 0 |
| BICARBONATES (mg/L) | 570 | 636 |
| CALCIUM (mg/L) | 60 | 60 |
| CHLORIDES (mg/L) | 400 | 350 |
| % SAND - VOLUME FRACTION | .002 | .002 |
| % OIL - VOLUME FRACTION | | |
| % TOTAL SOLIDS - VOLUME FRACTION | 7.6 | 8 |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | 65 | 70 |
| DRILLED SOLIDS (kg/m³) | | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | 195 | 203 |
| POLYMER CONCENTRATION (kg/m³) | | |
| Reynolds # | 1761 | 8846 |
| ECD | 1156 | 1196 |

## WELL HISTORY & REMARKS

12 Drill 222mm hole F/1200-1375

## RECOMMENDATIONS

Control
Viscosity @ 45-50 s/L W/ GEL @ 6-8 min / Sack @ 70°/+ For Logging.
PH - Neutral - no Control

Water Loss - 8-10cm³ W/ AQUAPAC @ UCR & CIRCULATION - Thru The Hopper

DENSITY - Low As Possible
- Run Centrifuge & DESILTER @ All Times
- Keep Sand Trap Clean
- Run 25-35 m³ Water Below Shaker
- Maintain Volume @ 55m³ In Surface Tanks

THANK You

SERVICE REP: DAVID LAUSCHER PHONE / MOBILE:
WAREHOUSE: PHONE:

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# DRILLING MUD SERVICE REPORT

SPUD DATE 98-02-23 DATE 98-03-14

WELL NAME and LOCATION RANGER et al LITTLE BEAR M-39 REPORT NO. 14

OPERATOR RANGER OIL LTD CONTRACTOR SHEHTAH I.E.

REPORT FOR LEE BRAZEL REPORT FOR DALE BAXANDALL

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO. | 2B | SIZE (mm) | 7 X 11.1 | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m/min) | MAKE | NAT | NAT |
| TYPE | FM2745 | VELOCITY (m/s) | | LAST CASING | 244/224 | 602 | | MODEL | 8P80 | 8P80 |
| SIZE (mm) | 222 | JET FORCE (N) | | LINER | | | | LINER DIA (mm) | 152 | 152 |
| DEPTH IN (m) | 602 | HHP (kW) | | OPEN HOLE | 114 mmDP | | 45 | ROD DIA (mm) | | |
| DEPTH OUT (m) | 1550 | DEVIATION RECORD | | OPEN HOLE | mmDC | | | STROKE (mm) | 216 | 216 |
| HOURS RUN | 79 | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | 169 mmDC | 139 | 79 | DISP (L/min) | 11.8 | 11.8 |
| W.O.B. (daN) | — | 1532 | 25° NW | CIRCULATION TIMES (min) | | | | SPM | 55 | 55 |
| RPM | — | 1441 | 19° NE | MUD TANKS / SUMP | 35 | BOTTOMS UP | 35 | OUTPUT (m³/min) | .649 | .649 1.3 |
| ROP (m/hour) | — | | | DRILL STRING | 11 | TOTAL | 81 | PRESSURE (kPa) | | |

| DRILLING MUD PRODUCTS | | | | MUD VOLUMES (m³) | | SOLIDS CONTROL | |
|---|---|---|---|---|---|---|---|
| MATERIAL | UNITS | COST | TOTAL COST | TANK / SUMP | 45 | EQUIPMENT | Cent |
| GEL | 80 | 15.00 | 1200.00 | HOLE | 60 | OVERFLOW DENSITY (kg/m³) | |
| AQUAPAC | 7 | 390.00 | 2730.00 | TOTAL | 105 | UNDERFLOW DENSITY (kg/m³) | Shut |
| KELZAN XCD | 1 | 845.00 | 845.00 | LOST TO HOLE | | UNDERFLOW RATE (L/min) | |
| | | | | LOST TO EQUIP | | SOLIDS REMOVAL RATE (kg/hr) | OFF |
| | | | | DUMPED | | LIQUID REMOVAL RATE (L/min) | |
| | | | | NEW WATER | | HOURS RUN | |
| | | | | NEW MUD / PREMIX | | SHAKER 1 | 3X175 MESH |
| | | | | | | SHAKER 2 | 3X250 MESH |

| | |
|---|---|
| COST SINCE LAST CHECK | 4775.00 |
| PREVIOUS COST | 166279.73 |
| TOTAL COST | 214027.73 |

**WELL HISTORY & REMARKS**

13- Drlg 222 - Hole F/1375-1550 m
Circ - Work Pipe, & Circ
Hole Pump Pill, POOH

**RHEOLOGY**

| | | | | | |
|---|---|---|---|---|---|
| 600 | 94 | 200 | 49 | 6 | 10 |
| 300 | 62 | 100 | 33 | 3 | 9 |
| n/k | 2.19 | 12.32 | | | |

| | |
|---|---|
| ☑ FLOWLINE ☐ SUCTION TEMP °C | 38 |
| SAMPLE TIME (hr) | 0650 |
| DEPTH (m) | 1550 |
| DENSITY (kg/m³) | 1140 |
| PRESSURE GRADIENT (kPa/m) | 17.35.9 |
| FUNNEL VISCOSITY (s/L) | 77 |
| PLASTIC VISCOSITY (mPa·s) @ °C | 32 |
| YIELD POINT (Pa) @ °C | 15 |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 4.5 8 |
| API FILTRATE (mL/30min) @ 700 kPa | 7.8 |
| FILTER CAKE (mm) | 1.5 |
| HT-HP F.L. (mL/30 min) kPa °C | |
| HT-HP FILTER CAKE (mm) | |
| pH ☐ STRIP ☐ METER | 8 |
| ALKALINITY (Pm/Pf) | .02 / .55 |
| HYDROXYLS (mg/L) | 0 |
| CARBONATES (mg/L) | 0 |
| BICARBONATES (mg/L) | 636 |
| CALCIUM (mg/L) | 60 |
| CHLORIDES (mg/L) | 350 |
| % SAND - VOLUME FRACTION | .002 |
| % OIL - VOLUME FRACTION | |
| % TOTAL SOLIDS - VOLUME FRACTION | 8.9 |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | 70 |
| DRILLED SOLIDS (kg/m³) | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | 227.5 |
| POLYMER CONCENTRATION (kg/m³) | |
| REYNOLDS # | 659.7 |
| ECD | 1220 |

**RECOMMENDATIONS**

Control Fdk Logging & Testing
Visc @ 75 s/L + W/ Gel
@ 8 min/Sk

When Circulating Run
5-8 L/m Water Below The
Shaker - * Make Sure The
Water is Turned OFF While
Tripping

Thank You

SERVICE REP: DAVID LAUSCHER PHONE / MOBILE:
WAREHOUSE: PHONE:

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**Midas Drilling Fluids**
Telephone - 24 Hr 1-800-929-3570
Fax - (403) 531-0464

# DRILLING MUD SERVICE REPORT

SPUD DATE 98-02-23 DATE 98-03-15

WELL NAME and LOCATION RANGER et al LITTLE BEAR M-39 REPORT NO 15

OPERATOR RANGER OIL LTD CONTRACTOR SHEMTAH 1E

REPORT FOR LEE BRAZEL REPORT FOR DALE BAXANDALL

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO | 3RR | SIZE (mm) | 0 | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m/min) | MAKE | NAT | NAT |
| TYPE | ATJ-64 | VELOCITY (m/min) | P | LAST CASING | 244/224 | 602 | | MODEL | 8P80 | 8P80 |
| SIZE (mm) | 222 | JET FORCE (N) | E | LINER | | | | LINER DIA (mm) | 152 | 152 |
| DEPTH IN (m) | 1550 | HHP (kW) | N | OPEN HOLE | 114 mmDP | | | ROD DIA (mm) | | |
| DEPTH OUT (m) | 1550 | DEVIATION RECORD | | OPEN HOLE | mmDC | | | STROKE (mm) | 216 | 216 |
| HOURS RUN | 7 | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | 169 mmDC | 139 | | DISP (L/stk) | 11.8 | 11.8 |
| WOB (daN) | 8000 | | | CIRCULATION TIMES (min) | | | | SPM | 60 | 60 |
| RPM | 95 | | | MUD TANKS / SUMP | 35 | BOTTOMS UP | 30 | OUTPUT (m³/min) | .708 | .708 1.4 |
| ROP (m/hour) | | | | DRILL STRING | 10 | TOTAL | 75 | PRESSURE (kPa) | 5000 | |

## DRILLING MUD PRODUCTS

| MATERIAL | UNITS | COST | TOTAL COST |
|---|---|---|---|
| GEL | 15 | 1500 | 22500 |
| BARITE | 34 | 1800 | 61200 |

| COST SINCE LAST CHECK | 837.50 |
|---|---|
| PREVIOUS COST | 21402.75 |
| TOTAL COST | 22239.25 |

## MUD VOLUMES (m³)

| | |
|---|---|
| TANK / SUMP | 52 |
| HOLE | 60 |
| TOTAL | 112 |
| LOST TO HOLE | |
| LOST TO EQUIP | |
| DUMPED | |
| NEW WATER | |
| NEW MUD / PREMIX | |

## SOLIDS CONTROL

| EQUIPMENT | |
|---|---|
| OVERFLOW DENSITY (kg/m³) | |
| UNDERFLOW DENSITY (kg/m³) | |
| UNDERFLOW RATE (L/min) | |
| SOLIDS REMOVAL RATE (kg/hr) | |
| LIQUID REMOVAL RATE (L/min) | |
| HOURS RUN | |

SHAKER 1 3 X 175 MESH | SHAKER 2 3 X 250 MESH

## RHEOLOGY

| | | | | | |
|---|---|---|---|---|---|
| 600 | 116 | 200 | 60 | 6 | 15 |
| 300 | 78 | 100 | 42 | 3 | 13 |
| n/K | .389 | 3.52 | | | |

| | |
|---|---|
| ☑ FLOWLINE ☐ SUCTION TEMP °C | 38 |
| SAMPLE TIME (hr) | 1400 |
| DEPTH (m) | 1550 |
| DENSITY (kg/m³) | 1125 |
| PRESSURE GRADIENT (kPa/m) | 17275 |
| FUNNEL VISCOSITY (s/L) | 115 |
| PLASTIC VISCOSITY (mPa·s) @ ____ °C | 38 |
| YIELD POINT (Pa) @ ____ °C | 20 |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 7.16 |
| API FILTRATE (mL/30min) @ 700 kPa | 7 |
| FILTER CAKE (mm) | 1.7 |
| HT-HP F.L. (mL/30 min) ____ kPa ____ °C | |
| HT-HP FILTER CAKE (mm) | |
| pH ☑ STRIP ☐ METER | 8.5+ |
| ALKALINITY (Pf/Mf) | .06/.15 |
| HYDROXYLS (mg/L) | 204 |
| CARBONATES (mg/L) | 72 |
| BICARBONATES (mg/L) | 54 |
| CALCIUM (mg/L) | 60 |
| CHLORIDES (mg/L) | 400 |
| % SAND - VOLUME FRACTION | .0025 |
| % OIL - VOLUME FRACTION | |
| % TOTAL SOLIDS - VOLUME FRACTION | 8.6 |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | 80 |
| DRILLED SOLIDS (kg/m³) | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | 227.5 |
| POLYMER CONCENTRATION (kg/m³) | |
| ECD | 1245 |

## WELL HISTORY & REMARKS

14 Ream Tite Hole @ 936m POOH TO 602 - R/H. Ream F/1505-1550, Circ & Cond Hole POOH, Wait on Loggers, Rig To Log Well

## RECOMMENDATIONS

Control Visc @ 100 s/qt W/ Gel @ 5-6 min/sk.

Run 8-10 4m H2o Below Shaker W/Drlg.

SERVICE REP: DAVID LAUSCHER PHONE / MOBILE:

WAREHOUSE: PHONE:

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Fax - (403) 531-0464

# DRILLING MUD SERVICE REPORT

SPUD DATE 98-02-23 DATE 98-03-16

WELL NAME and LOCATION RANGER et al LITTLE BEAR M-39 REPORT NO. 16

OPERATOR RANGER OIL LTD CONTRACTOR SHEHTAH #E

REPORT FOR LEE & JACK BRAZEL REPORT FOR DALE BAXANDALL

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NO | | SIZE (mm) | | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m/min) | MAKE | | | |
| TYPE | | VELOCITY (m / s) | | LAST CASING | | | | MODEL | | | |
| SIZE (mm) | | JET FORCE (N) | | LINER | | | | LINER DIA (mm) | | | |
| DEPTH IN (m) | | HHP (kW) | | OPEN HOLE | mmDP | | | ROD DIA (mm) | | | |
| DEPTH OUT (m) | | DEVIATION RECORD | | OPEN HOLE | mmDC | | | STROKE (mm) | | | |
| HOURS RUN | | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mmDC | | | DISP (L/stk) | | | |
| WOB (daN) | | | | CIRCULATION TIMES (min) | | | | SPM | | | |
| RPM | | | | MUD TANKS / SUMP | | BOTTOMS UP | | OUTPUT (m³/min) | | | |
| ROP (m/hour) | | | | DRILL STRING | | TOTAL | | PRESSURE (kPa) | | | |

## DRILLING MUD PRODUCTS

| MATERIAL | UNITS | COST | TOTAL COST |
|---|---|---|---|
| GEL | 40 | 15.00 | 600.00 |
| CAUSTIC | 1 | 77.00 | 77.00 |
| BARITE | 15 | 18.00 | 270.00 |
| KELZAN XCD | 2 | 845.00 | 1690.00 |

| | |
|---|---|
| COST SINCE LAST CHECK | 7651.50 |
| PREVIOUS COST | 22239.75 |
| TOTAL COST | 24876.75 |

## MUD VOLUMES (m³)

| | |
|---|---|
| TANK / SUMP | |
| HOLE | |
| TOTAL | |
| LOST TO HOLE | |
| LOST TO EQUIP | |
| DUMPED | |
| NEW WATER | |
| NEW MUD / PREMIX | |

## SOLIDS CONTROL

| EQUIPMENT | | | |
|---|---|---|---|
| OVERFLOW DENSITY (kg/m³) | | | |
| UNDERFLOW DENSITY (kg/m³) | | | |
| UNDERFLOW RATE (L/min) | | | |
| SOLIDS REMOVAL RATE (kg/hr) | | | |
| LIQUID REMOVAL RATE (L/min) | | | |
| HOURS RUN | | | |
| SHAKER 1 | MESH | SHAKER 2 | MESH |

## RHEOLOGY

| | | | | | |
|---|---|---|---|---|---|
| 600 | 133 | 200 | 67 | 6 | 13 |
| 300 | 86 | 100 | 44 | 3 | 11 |
| n/k | | | | | |

☐ FLOWLINE ☑ SUCTION TEMP °C DST TOOL

| | |
|---|---|
| SAMPLE TIME (hr) | 1930 |
| DEPTH (m) | 1550 |
| DENSITY (kg/m³) | 1135 |
| PRESSURE GRADIENT (kPa/m) | 17275 |
| FUNNEL VISCOSITY (s/L) | — |
| PLASTIC VISCOSITY (mPa·s) @ ____ °C | 47 |
| YIELD POINT (Pa) @ ____ °C | 19.5 |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 5 / 11 |
| API FILTRATE (mL/30min) @ 700 kPa | 7 |
| FILTER CAKE (mm) | 2.0 |
| HT-HP F.L. (mL/30 min) ____ kPa ____ °C | |
| HT-HP FILTER CAKE (mm) | |
| pH ☑ STRIP ☐ METER | 8.0 |
| ALKALINITY (Pm) | .05/.52 |
| HYDROXYLS (mg/L) | 14 |
| CARBONATES (mg/L) | 60 |
| B.CARBONATES (mg/L) | 566 |
| CALCIUM (mg/L) | 40 |
| CHLORIDES (mg/L) | 400 |
| % SAND - VOLUME FRACTION | .001 |
| % OIL - VOLUME FRACTION | 2 |
| % TOTAL SOLIDS - VOLUME FRACTION | 8.6 |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | 80 |
| DRILLED SOLIDS (kg/m³) | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | |
| POLYMER CONCENTRATION (kg/m³) | |

## WELL HISTORY & REMARKS

15 - Log W/SCHLUMBERGER, M/U BHA 9
RIH 7615.25 Ream to 1550, Cond Mud
9 Hole POOH, Make Up DST #1

## RECOMMENDATIONS

SERVICE REP. DAVID LAUSCHER PHONE / MOBILE:
WAREHOUSE: PHONE:

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Fax - (403) 531-0464

# DRILLING MUD SERVICE REPORT

SPUD DATE 98-02-23 DATE 98-03-18

WELL NAME and LOCATION RANGER et al LITTLE BEAR M-39 REPORT NO. 17

OPERATOR RANGER OIL LTD CONTRACTOR SHEHTAH I/E

REPORT FOR JACK BRAZEL REPORT FOR DALE BAXANDALL

| BIT RECORD | | NOZZLE DATA | | ANNULAR GEOMETRY and VELOCITY | | | | PUMP DATA | | |
|---|---|---|---|---|---|---|---|---|---|---|
| NO | | SIZE (mm) | | ANNULUS | OD / ID | LENGTH (m) | VELOCITY (m/min) | MAKE | NAT | NAT |
| TYPE | | VELOCITY (m / s) | | LAST CASING | 244.5 | 602 | | MODEL | 8P80 | 8P80 |
| SIZE (mm) | | JET FORCE (N) | | LINER | 177.8 | 1550 | | LINER DIA (mm) | 152 | 152 |
| DEPTH IN (m) | | HHP (kW) | | OPEN HOLE | mmDP | | | ROD DIA (mm) | | |
| DEPTH OUT (m) | | DEVIATION RECORD | | OPEN HOLE | mmDC | | | STROKE (mm) | 216 | 216 |
| HOURS RUN | | DEPTH (m) | ANGLE - DIRECTION | OPEN HOLE | mmDC | | | DISP (L/stk) | 11.8 | 11.8 |
| W.O.B (daN) | | | | CIRCULATION TIMES (min) | | | | SPM | 60 | 70 |
| RPM | | | | MUD TANKS / SUMP | | BOTTOMS UP | | OUTPUT (m³/min) | .708 | .826 |
| ROP (m/hour) | | | | DRILL STRING | | TOTAL | | PRESSURE (kPa) | 1800 | 3500 |

## DRILLING MUD PRODUCTS

| MATERIAL | UNITS | COST | TOTAL COST |
|---|---|---|---|
| BARITE | 17 | 18.00 | 306.00 |
| DESCO | 6 | 112.00 | 672.00 |

| | |
|---|---|
| COST SINCE LAST CHECK | 672.00 |
| PREVIOUS COST | 24876.75 |
| TOTAL COST | 25548.75 |

## MUD VOLUMES (m³)

| | |
|---|---|
| TANK / SUMP | |
| HOLE | |
| TOTAL | |
| LOST TO HOLE | |
| LOST TO EQUIP. | |
| DUMPED | |
| NEW WATER | |
| NEW MUD / PREMIX | |

## SOLIDS CONTROL

| EQUIPMENT | |
|---|---|
| OVERFLOW DENSITY (kg/m³) | |
| UNDERFLOW DENSITY (kg/m³) | |
| UNDERFLOW RATE (L/min) | |
| SOLIDS REMOVAL RATE (kg/hr) | |
| LIQUID REMOVAL RATE (L/min) | |
| HOURS RUN | |
| SHAKER 1 | MESH |
| SHAKER 2 | MESH |

## RHEOLOGY

| | | | | | |
|---|---|---|---|---|---|
| 600 | 63 | 200 | 28 | 6 | 6 |
| 300 | 38 | 100 | 19 | 3 | 4 |
| n/K | | | | | |

## WELL HISTORY & REMARKS

16- M/U TEST TOOLS RIH & RUN DST #2
HOIST & RECOVER CHARTS WAIT ON ORDERS
17- RIG OUT TEST TOOLS, RIH CIRC TO BTM
NO FLU HOIST SIDEWAYS RIG UP TO RUN CSG.
18- RUN 177.8mm CSG CIRC 1m TO BTM. COND MUD & HOLE TO CEMENT.
CEMENT @

| | |
|---|---|
| ☑ FLOWLINE ☐ SUCTION TEMP °C | |
| SAMPLE TIME (hr) | 1940 |
| DEPTH (m) | 1550 |
| DENSITY (kg/m³) | 1145 |
| PRESSURE GRADIENT (kPa/m) | |
| FUNNEL VISCOSITY (s/L) | 62 |
| PLASTIC VISCOSITY (mPa·s) @ °C | 25 |
| YIELD POINT (Pa) @ °C | 6.5 |
| GEL STRENGTHS (Pa) 10 sec / 10 min | 2 / 3.5 |
| API FILTRATE (mL/30min) @ 700 kPa | |
| FILTER CAKE (mm) | |
| HT-HP F.L. (mL/30 min) kPa °C | |
| HT-HP FILTER CAKE (mm) | |
| pH ☑ STRIP ☐ METER | 8.0 |
| ALKALINITY (Pf/Mf) | 0.1/0.46 |
| HYDROXYLS (mg/L) | |
| CARBONATES (mg/L) | |
| BICARBONATES (mg/L) | |
| CALCIUM (mg/L) | 40 |
| CHLORIDES (mg/L) | 400 |
| % SAND - VOLUME FRACTION | |
| % OIL - VOLUME FRACTION | |
| % TOTAL SOLIDS - VOLUME FRACTION | |
| MBT (TOTAL BENTONITIC SOLIDS kg/m³) | |
| DRILLED SOLIDS (kg/m³) | |
| TOTAL HIGH GRAVITY SOLIDS (kg/m³) | |
| TOTAL LOW GRAVITY SOLIDS (kg/m³) | |
| POLYMER CONCENTRATION (kg/m³) | |

## RECOMMENDATIONS

MUD, LOOKS GOOD
TO CEMENT W/ RIG

FRANK

SERVICE REP DAVID LAUSCHER PHONE / MOBILE:
WAREHOUSE: PHONE:

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## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 20 - 35 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, some dried bitumen, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, trace pyrite; |
| 35 - 50 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, some dried bitumen, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, trace pyrite; |
| 50 - 60 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, some dried bitumen, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, trace pyrite; |
| 60 - 70 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, some dried bitumen, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, trace pyrite; |
| 70 - 85 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, some dried bitumen, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, trace pyrite; |
| 85 - 100 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, some dried bitumen, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, trace pyrite; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 100 - 115 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, some dried bitumen, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, trace pyrite; |
| 115 - 125 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, some dried bitumen, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, abundant pyrite beds, disseminated crystals, pore fillings, 5% to 10% of sample; |
| 125 - 136 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, abundant pyrite beds, disseminated crystals, pore fillings, 5% to 10% of sample; **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; |
| Slater River | (136mKB: +123.12mKB) |
| 136 - 137 | **SHALE** - dark gray, soft, gummy; **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; |
| 137 - 147 | **SHALE** - dark gray, soft, gummy, abundant silty; **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; |
| 147 - 149 | **SANDSTONE**, light gray, salt and pepper, friable, blocky, quartzitic, abundant clear quartz grains, angular to subangular, trace chert grains, some pyrite, fine grained some medium, thin beds of siltstone, occasional light tan siderite nodules. |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 149 - 179 | **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 179 - 209 | **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 209 - 239 | **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 239 - 269 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, abundant pyrite beds, disseminated crystals, pore fillings, 5% to 10% of sample; **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 269 - 299 | **SHALE** - light gray, platy - blocky, soft - hard, abundant silty, slightly sandy, trace pyrite; **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 100 - 115 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, some dried bitumen, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, trace pyrite; |
| 115 - 125 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, some dried bitumen, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, abundant pyrite beds, disseminated crystals, pore fillings, 5% to 10% of sample; |
| 125 - 136 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, abundant pyrite beds, disseminated crystals, pore fillings, 5% to 10% of sample; **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; |
| Slater River | (136mKB: +123.12mKB) |
| 136 - 137 | **SHALE** - dark gray, soft, gummy; **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; |
| 137 - 147 | **SHALE** - dark gray, soft, gummy, abundant silty; **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; |
| 147 - 149 | **SANDSTONE**, light gray, salt and pepper, friable, blocky, quartzitic, abundant clear quartz grains, angular to subangular, trace chert grains, some pyrite, fine grained some medium, thin beds of siltstone, occasional light tan siderite nodules. |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 149 - 179 | **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 179 - 209 | **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 209 - 239 | **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 239 - 269 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, abundant pyrite beds, disseminated crystals, pore fillings, 5% to 10% of sample; **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 269 - 299 | **SHALE** - light gray, platy - blocky, soft - hard, abundant silty, slightly sandy, trace pyrite; **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 299 - 310 | **SANDSTONE** - light gray, salt and pepper; friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, abundant pyrite beds, disseminated crystals, pore fillings, 5% to 10% of sample; **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 310 - 322 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, abundant pyrite beds, disseminated crystals, pore fillings, 5% to 10% of sample; **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 322 - 335 | **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 335 - 350 | **SANDSTONE** - light gray, salt and pepper, friable, blocky, quartzitic, very fine grained to fine grained and some medium grained, angular to subangular, poorly sorted, fair intergranular porosity, thin beds of siltstone, abundant quartz clear grains, some feldspar, occasional mica dark, abundant pyrite beds, disseminated crystals, pore fillings, 5% to 10% of sample; **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft - hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; |

Bituminous zone (350 m on samples: 344m on 150 cut off on GR log.)
Bituminous zone base (358 m on GR log data)

| | |
|---|---|
| 350 - 365 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil, platy - blocky, fair organic porosity, gas show and thin veinlets of dried black lustre bitumen, fish remains, abundant silty, common sandy, trace pyrite, trace calcite, trace carbonaceous; |
| 365 - 380 | **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil, platy - blocky, micromicaceous, fair organic porosity, gas show and thin dried black lustre bitumen veinlets, fish remains, abundant silty, common sandy, trace pyrite, common calcite in streaks, trace carbonaceous; **SHALE** - tan - light brown, platy, blocky in part, hard, fossil, WHITE SPECKS, slightly calcite, common sandy, common silty, abundant micromicaceous, slightly pyrite; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 380 - 395 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil, platy - blocky, micromicaceous, fish remains, trace calcite bioclasts, abundant silty, common sandy, trace pyrite, common calcite in streaks, trace carbonaceous; |
| 395 - 415 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil, platy - blocky, micromicaceous, fish remains, trace calcite bioclasts, abundant silty, common sandy, trace pyrite, common calcite in streaks, trace carbonaceous; |
| 415 - 435 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil, platy - blocky, micromicaceous, fish remains, trace calcite bioclasts, abundant silty, common sandy, trace pyrite, common calcite in streaks, trace carbonaceous; |
| 435 - 455 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil, platy - blocky, micromicaceous, fish remains, trace calcite bioclasts, abundant silty, common sandy, trace pyrite, common calcite in streaks, trace carbonaceous; |
| 455 - 480 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil, platy - blocky, micromicaceous, fish remains, trace calcite bioclasts, abundant silty, common sandy, trace pyrite, common calcite in streaks, trace carbonaceous; |
| 480 - 500 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil, platy - blocky, micromicaceous, fish remains, trace calcite bioclasts, abundant silty, common sandy, trace pyrite, common calcite in streaks, trace carbonaceous; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 500 - 510 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, trace fish remains in part, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 510 - 520 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, trace fish remains in part, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 520 - 530 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, trace fish remains in part, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 530 - 540 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, trace fish remains in part, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 540 - 550 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, trace fish remains in part, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 550 - 565 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, trace fish remains in part, thin microcrystalline dark brown **LIMESTONE** beds, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes, common calcite microfracture fill; **LIMESTONE** - dark brown, hard, blocky, microcrystalline, associated with fractures; |
| 565 - 575 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, trace fish remains in part, thin microcrystalline dark brown **LIMESTONE** beds, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes, common calcite microfracture fill; **LIMESTONE** - dark brown, hard, blocky, microcrystalline, associated with fractures; |
| 575 - 585 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, trace fish remains in part, thin microcrystalline dark brown **LIMESTONE** beds, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes, common calcite microfracture fill; |
| 585 - 602 | **SHALE** -dark gray - black in part, fossil in part, platy - blocky, micromicaceous, trace fish remains in part, thin microcrystalline dark brown **LIMESTONE** beds, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes, common calcite microfracture fill; |
| 602 - 625 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 625 - 650 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 650 - 675 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 675 - 700 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil in part, platy - blocky, micromicaceous, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 700 - 725 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossiliferous in part, platy - blocky, micromicaceous, abundant silty, traces pyrite, sandy, and carbonaceous flakes; |
| 725 - 750 | **SILTSTONE** - light gray, platy - blocky, soft -hard, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil. in part, platy - blocky, micromicaceous, abundant silty, trace pyrite, trace sandy, trace carbonaceous flakes; |
| 750 - 775 | **SILTSTONE** - light gray, platy - blocky, soft -hard, numerous very thin shale interbeds, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil. in part, platy - blocky, micromicaceous, frequent very thin siltstone beds, abundant silty, trace pyrite, trace sandy, trace calcite micro fracture fill; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 775 - 800 | **SILTSTONE** - light gray, platy - blocky, soft -hard, numerous very thin shale interbeds, common micromicaceous, trace pyrite, trace sandy, trace carbonaceous flakes; **SHALE** - dark gray - black in part, fossil. in part, platy - blocky, micromicaceous, frequent very thin siltstone beds, abundant silty, trace pyrite, trace sandy, trace calcite micro fracture fill; |
| 800 - 825 | **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; **SHALE** - light gray, platy - blocky, soft - hard, slightly silty, trace sandy, trace pyrite, common micromicaceous, minor sideritic nodules light tan; **SHALE** - dark gray - black in part, fossil. in part, platy - blocky, micromicaceous, frequent very thin siltstone beds, abundant silty, and trace pyrite, sandy, calcite micro fracture fill; |
| 825 - 850 | **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; **SHALE** - light gray, platy, soft, slightly silty, trace sandy, trace pyrite, some micromicaceous; **SHALE** - black - dark gray in part, fossiliferous in part, platy - blocky, frequent very thin siltstone beds, slightly silty, trace pyrite, trace sandy, trace calcite micro fracture fill, slightly micromicaceous; |
| 850 - 878 | **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; **SHALE** - light gray, platy, soft, slightly silty, trace sandy, trace pyrite, some micromicaceous; **SHALE** - black - dark gray in part, fossil in part., platy - blocky, frequent very thin siltstone beds, slightly silty, trace pyrite, trace sandy, trace calcite micro fracture fill, slightly micromicaceous; |
| Basal Cretaceous | (878m: -618.83mKB) (Not clear on logs.) |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 878 - 904 | **SILTSTONE** - light brown - tan, hard, blocky, shards, slightly dolomitic, some quartz clear grains, some mica flakes, occasional pyrite; **SHALE** - light gray, platy, soft, slightly silty, trace sandy, trace pyrite, some micromicaceous; **SHALE** - black - dark gray in part, fossiliferous in part, platy - blocky, frequent very thin siltstone beds, slightly silty, trace pyrite, trace sandy, trace calcite micro fracture fill, slightly micromicaceous; **SANDSTONE** - light gray -white, salt and pepper, quartzitic, very fine grained to fine grained, subrounded, well sorted, abundant glauconite grains; |

Imperial (907m: -647.88mKB on samples) (911.8m: -652.28mKB on logs)

| | |
|---|---|
| 904 - 925 | **SHALE** - light gray, platy, soft, slightly silty, trace sandy, trace pyrite, some micromicaceous; **SHALE** - black - dark gray in part, fossil in part, platy - blocky, frequent very thin siltstone beds, slightly silty, trace pyrite, trace sandy, trace calcite micro fracture fill, slightly micromicaceous; **LIMESTONE** - dark brown, hard, blocky, microcrystalline, associated with fractures; **SANDSTONE** - light gray - white, salt and pepper, quartzitic, very fine grained to fine grained, subrounded, well sorted, abundant glauconite grains; |
| 925 - 950 | **SHALE** - light gray, trace dark gray in part, fossil in part, platy - blocky, frequent very thin siltstone beds; **SHALE** - black, slightly silty, trace pyrite, trace sandy, trace calcite micro fracture fill, slightly micromicaceous; **LIMESTONE** - dark brown, hard, blocky, microcrystalline, associated with fractures; **SANDSTONE** - light gray - white, salt and pepper, quartzitic, very fine grained to fine grained, subrounded, well sorted, abundant glauconite grains; |

[Fracture zone: 925m - 950m or -665.88m to -690.88mKB on samples. On logs: 931.4m - 949.50 or -672.28m to -690.38mKB)

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| | Calcite microfacture fill with calcite crystals positioned vertical to the fracture plane characterizes the rock interval between 925mKB and 950mKB. The crystals grew perpendicular to the fracture plane, they are elongated prisms of the same length at either side of the fracture plane. These crystals grew as long as the fracture continued to open up. The bore hole wall will have a thick filter cake throughout this interval. Likely and real spot for tight hole conditions. |
| 950 - 975 | **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone and light gray blue bentonite, **SANDSTONE**, trace brown **LIMESTONE**, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, salt and pepper, quartzitic, very fine grained to fine grained, subangular to subrounded, moderately sorted, trace intergranular porosity, minor dead oil stain, abundant glauconite grains, trace chert black grains; |
| 975 - 995 | **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, light gray blue bentonite, sandstone, and trace brown limestone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, salt and pepper, quartzitic, very fine grained to fine grained, subangular to subrounded, moderately sorted, trace intergranular porosity, minor dead oil stain, abundant glauconite grains, trace chert black grains; |
| 995 - 1015 | **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, light gray blue bentonite, sandstone, and trace brown limestone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, salt and pepper, quartzitic, very fine grained to fine grained, subangular to subrounded, moderately sorted, trace intergranular porosity, minor dead oil stain, abundant glauconite grains, trace black chert grains; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1015 - 1035 | **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, light gray blue bentonite, sandstone, and trace brown limestone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, salt and pepper, quartzitic, very fine grained to fine grained, subangular to subrounded, moderately sorted, trace intergranular porosity, minor dead oil stain, abundant glauconite grains, trace black chert grains; |
| 1035 - 1055 | **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, light gray blue bentonite, sandstone, and trace brown limestone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, salt and pepper, quartzitic, very fine grained to fine grained, subangular to subrounded, moderately sorted, trace intergranular porosity, minor dead oil stain, abundant glauconite grains, trace black chert grains; |
| 1055 - 1075 | **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, light gray blue bentonite, sandstone, and trace brown limestone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, salt and pepper, quartzitic, very fine grained to fine grained, subangular to subrounded, moderately sorted, trace intergranular porosity, minor dead oil stain, abundant glauconite grains, trace black chert grains; |
| 1075 - 1100 | **SILTSTONE** - light gray - light tan, hard, platy; **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, sandstone, trace brown limestone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace black chert, trace mica, slightly calcareous; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1100 - 1125 | **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, light gray blue bentonite, sandstone, and trace brown limestone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace black chert, trace mica, slightly calcareous; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; |
| 1125 - 1150 | **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, light gray blue bentonite, sandstone, trace brown limestone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; |
| 1150 - 1165 | **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, light gray blue bentonite, sandstone, trace brown limestone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable -hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1165 - 1190 | **SILTSTONE** - light gray - light tan, hard, platy; **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, trace light gray blue bentonite, sandstone, trace brown limestone slightly silty, trace sandy, rare calcite microfracture fill; **SANDSTONE** - light gray -white, quartzitic, platy - splintery, friable -hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; |
| 1190 - 1215 | **SILTSTONE** - light gray - light tan, hard, platy; **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, trace light gray blue bentonite, sandstone, trace brown limestone, slightly silty, trace sandy, trace calcite micro fracture fill; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; |
| 1215 - 1240 | **SILTSTONE** - light gray - light tan, hard, platy; **SHALE** - black - dark gray in part, platy - blocky, splintery in part, micromicaceous, interbeds of thin siltstone, trace light gray blue bentonite, sandstone, trace brown limestone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1240 - 1263 | **SHALE** - black - dark gray in part, platy -blocky, splintery in part, micromicaceous, interbeds of thin siltstone, trace light gray blue bentonite, sandstone, trace brown limestone, slightly silty, trace sandy, trace calcite micro fracture fill; **SANDSTONE** - light gray -white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; |
| 1263 - 1286 | **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite fracture fill; |
| 1286 - 1301 | **SANDSTONE** - light gray - white, quartzitic, platy - splintery hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1301 - 1312 | **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SANDSTONE** - white, salt and pepper, hard - very hard, quartzitic, siliceous cement, very fine grained and some fine grained, subangular to subrounded, moderately to well sorted, rare intergranular porosity, rare pinpoint porosity, trace oil stain, trace chert green black, trace pyrite very fine crystalline; |
| 1312 - 1327 | **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SANDSTONE** - white, salt and pepper, hard - very hard, quartzitic, siliceous cement, very fine grained and some fine grained, subangular to subrounded, moderately to well sorted, rare intergranular porosity, rare pinpoint porosity, trace oil stain, finely laminated light gray and white layers, trace chert green black, trace pyrite very fine crystalline; |

Devonian Sand (1327m - 1364 on samples. logs: 1328.80m -1349.00mKB)

LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1327 - 1350 | **SHALE** - black - dark gray in part, platy - blocky, splintery in part, micromicaceous, interbeds of thin siltstone, sandstone, slightly silty, trace sandy, common calcite micro fracture fill; **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SANDSTONE** - white, salt and pepper, hard - very hard, quartzitic, siliceous cement, very fine grained and some fine grained, subangular to subrounded, moderately to well sorted, rare intergranular porosity, rare pinpoint porosity, trace oil stain, finely laminated light gray and white layers, grading to SILTSTONE, trace chert green black, trace pyrite very fine crystalline; |
| 1350 - 1364 | **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SANDSTONE** - white, salt and pepper, hard - very hard, quartzitic, siliceous cement, very fine grained and some fine grained, subangular to subrounded, moderately to well sorted, rare intergranular porosity, rare pinpoint porosity, trace oil stain, finely laminated light gray and white layers, grading to **SILTSTONE**, trace chert green black, trace pyrite very fine crystalline; |
| Base Devonian Sand ( 1364m on samples -1069m: On log data: 1328.80m) | |
| 1364 - 1380 | **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SHALE** - black - dark gray in part, platy - blocky, splintery in part, micromicaceous, interbeds of thin siltstone, sandstone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1380 - 1390 | **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SANDSTONE** -light gray - white, quartzitic, platy - splintery, friable -hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SANDSTONE** - white and green, blocky, friable, very fine grained and some fine grained, subangular to angular, poorly to moderately sorted, excellent intergranular porosity, trace oil stain, gas flushed?, common calcareous cement; |

In the Imperial Formation there are several sandstone/siltstone intervals from which mud gas was recorded. These intervals are: 1410m -1416m; 1388m - 1398m; and, 1324m - 1325m. Promising additional zones are: 1345m - 1348m and 1278m - 1285m. A filter cake was expected and present over the 1388m - 1398mKB interval. This might possibly account for tight hole conditions over that interval, during dummy trip.]

| | |
|---|---|
| 1390 - 1400 | **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SHALE** - black - dark gray in part, platy - blocky, splintery in part, micromicaceous, interbeds of thin siltstone, sandstone, slightly silty, trace sandy, common calcite microfracture fill; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SANDSTONE** - white and green, blocky, friable, very fine grained and some fine grained, subangular to angular, poorly to moderately sorted, excellent intergranular porosity, trace oil stain, gas flushed?, common calcareous cement; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1400 - 1420 | **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SHALE** - black - dark gray in part, platy - blocky, splintery in part, micromicaceous, interbeds of thin siltstone, sandstone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SANDSTONE** - white and green, blocky, friable, very fine grained and some fine grained, subangular to angular, poorly to moderately sorted, excellent intergranular porosity, trace oil stain, gas flushed?, common calcareous cement; |
| 1420 - 1450 | **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SILTSTONE** - light gray - white, friable - hard, blocky, rare pinpoint porosity, trace calcareous cement, trace mica; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1450 - 1470 | **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SHALE** - black - dark gray in part, platy - blocky, splintery in part, micromicaceous, interbeds of thin siltstone, sandstone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; |
| 1470 - 1485 | **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SILTSTONE** - light gray - white, friable - hard, blocky, rare pinpoint porosity, trace calcareous cement, trace mica; **SANDSTONE** - light gray - white, quartzitic, platy - splintery, friable - hard, very fine grained to fine grained and some medium grained, subangular to subrounded, poorly to moderately sorted, rare intergranular porosity, trace oil stain, moderately glauconite, trace chert black, trace mica, slightly calcareous; **SANDSTONE** - white and green, blocky, friable, very fine grained and some fine grained, subangular to angular, poorly to moderately sorted, excellent intergranular porosity, trace oil stain, gas flushed?, common calcareous cement; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1485 - 1500 | **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SHALE** - black - dark gray in part, platy - blocky, splintery in part, micromicaceous, interbeds of thin siltstone, sandstone, slightly silty, trace sandy, common calcite micro fracture fill; **SANDSTONE** - white and green, blocky, friable, very fine grained and some fine grained, subangular to angular, poorly to moderately sorted, excellent intergranular porosity, trace oil stain, gas flushed?, common calcareous cement; |
| 1500 - 1515 | **SHALE** - reddish gray, platy, splintery, slightly silty, slightly micromicaceous, trace calcareous; **SHALE** - green gray, platy - splintery, slightly silty, common micromicaceous, trace calcite micro fracture fill; **SANDSTONE** - white and green, blocky, friable, very fine grained and some fine grained, subangular to angular, poorly to moderately sorted, excellent intergranular porosity, trace oil stain, gas flushed?, common calcareous cement; |
| 1515 - 1530 | **SHALE** - light gray - medium gray, platy, soft, slightly micromicaceous, trace silty; |
| 1530 - 1545 | **SHALE** - light gray - medium gray, platy, soft, slightly micromicaceous, trace silty; Bottom portion of this interval drills slow. |
| 1545 - 1550 | **SHALE** - light gray - medium gray, platy, soft, slightly micromicaceous, trace silty. Very slow drilling. This section seems to slough; |

## LITHOLOGY

Formation tops
Sample interval
(in meters) SAMPLE DESCRIPTION

Regular weight and size well cutting samples were collected from 20mKB to 149mKB - surface casing point, and from 150mKB to 602mKB. Large samples, required 1500 grams unwashed dried, had to be collected from 602mKB to T.D. At the high rate of penetration with the PDC bit, this proved to be impractical. A request was put to the N.E.B. to rinse/wash the samples, as it turned out to be impractical to dry unwashed samples at the rig. Since plastic lined bags are no longer commonly used, the samples were stored in cloth bags. These bags oozed and leaked liquids and this caused an unacceptable alarming growing mess. Normally, the cooling fans of the power generators are excellent sample driers. In this case, the large samples packed in crates in front of the generator cooling fans posed a traffic safety hazard for the drilling crew. Extra man power had to be hired to prepare, rinse/wash the samples, and drying necessarily had to be done in Calgary. The N.E.B. approved the request made by the wellsite geologist on location, and official approval was obtained immediately following. A crate of over 1800 lbs weight that contained most of the large samples was shipped to Calgary. Additional costs had to be incurred to further wash/rinse, dry, and re-bag the samples in Calgary by PetroCraft Products.

## FORMATION TOPS (m)

| PERIOD<br>GROUP<br>FORMATION<br>(LOCAL UNITS) | PROGNOSIS (KB 264 est.) (KB) | (subsea) | SAMPLES (KB 259.12) (KB) | (Subsea) | LOGS (KB 259.12) (KB) | (Subsea) |
|---|---|---|---|---|---|---|
| Soil, gravel, boulders | --- | --- | 5.25 | 253.87 | ------ | ------ |
| Little Bear | spud | 254 | 12.00 | 247.12 | ------ | ------ |
| Slater River | 100 | 164 | 136.00 | 123.12 | ------ | ------ |
| Bituminous Zone | 370 | - 106 | 355.00 | - 95.88 | 344.00 | - 84.88 (1) |
| " Base | --- | --- | ------ | ------ | 358.00 | - 98.88 (1) |
| Basal Cretaceous | --- | --- | 878.00 | - 618.88 | (Not clear on logs) | |
| Imperial | 880 | - 616 | 907.00 | - 647.88 | 911.80 | - 652.68 |
| Fracture zone | --- | --- | 925.00 | - 665.88 | 931.40 | - 672.28 (2) |
| " " base | --- | --- | 950.00 | - 690.88 | 949.50 | - 690.38 |
| Devonian Sand | 1305 | -1041 | 1327.00 | -1067.88 | 1328.80 | -1069.68 (3) |
| Base Dev. Sand | 1325 | -1061 | 1364.00 | -1104.88 | 1349.00 | -1089.88 |
| Hume | 1812 | -1548 | --- | --- | --- | --- |
| Landry/Gossage | 1930 | -1666 | --- | --- | --- | --- |
| Arnica | 1950 | -1686 | --- | --- | --- | --- |
| Bear Rock | 1980 | -1716 | --- | --- | --- | --- |
| Mount Kindle | 2330 | -2066 | --- | --- | --- | --- |
| Franklin Mountain | 2380 | -2116 | --- | --- | --- | --- |
| T.D. | 2400 | -2136 | 1550.00 | -1290.88 | 1540.00 | -1280.88 |

(1) Note: Top and base of Bituminous zone at 150 cut-off on Gamma Ray logs.
(2) Note: Fracture zone based upon abundant micro fractures filled with calcite and thin microcrystalline (diagenetic) limestone beds.
(3) Note: The lower portion of this sand includes the top portion of a coarsening-up sedimentary cycle.

# DRILLSTEM TEST

## DRILLSTEM TEST No. 1

| | | |
|---|---|---|
| Date: | March 15, 1998 | |
| Formation: | Imperial | |
| Interval: | 1388.0 m to 1408.0 m | |
| Test type: | Conventional straddle | |
| Packers: | Conventional - 178 mm | |
| Hole size: | 222 mm | |
| Drill pipe: | OD: 114 mm | ID: 86 mm |
| Collars: | OD: 170 mm | ID: 74 mm |
| Testing Company: | Baker Oil Tools | |

| | PRESSURES: | | | Times: | |
|---|---|---|---|---|---|
| | IH: | 16071 | kPa | | |
| 1st | IPF: | 346 | kPa | PF: | 15 min |
| | FPF: | 303 | kPa | | |
| | ISI: | 1071 | kPa | ISI: | 29.5 min |
| 2nd | IF: | 257 | kPa | VO: | 60 min |
| | FF: | 278 | kPa | | |
| | FSI: | 3032 | kPa | FSI: | 129 min |
| | FH: | 15605 | kPa | BHT: | 61.5 C |

Results:

Flow comments - Preflow - S.A.B decreasing to fair steady throughout N.G.T.S.. Final flow - S.A.B. decreasing to weak steady throughout N.G.T.S.

Recovery - Liquid recovery of 7.00 meters drilling mud. Field mud laboratory analysis showed 2% oil, 2% solids, 96% water, 400 ppm, Ca 40 ppm. The laboratory analyses demonstrate that the recovered mud is the same as the mud in the hole prior to the D.S.T. The 2% oil indicate that the reservoir contains some oil. Mud gas log recordings show that the same zone, a drilling break, was characterized by liberated gas followed by produced gas.

Test comments - Recorder # 71130 at 1390mKB indicates a tight reservoir.

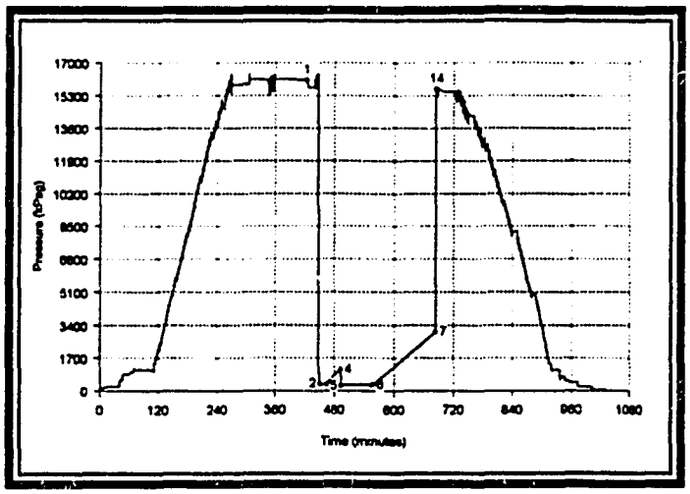
# RANGER ET AL LITTLE BEAR M-39
## 00/ 64.816 / 126.373 /00
## DST# 1

WELL FILE

**Formation:** Imperial
**Interval - from:** 1,388.00 **to:** 1,408.00 meters

**Test Date:** 1998-03-16
**Test Type :** Conventional Straddle (Blank Off)

## Recorder# 71130 at 1,390.00 meters




Max Btm Hole Temperature @ FSI: 61.5 C

| | | *Pressure (kPag)* | *Time (min)* | *Extrapolated Pressure (kPag)* |
|---|---|---|---|---|
| 1 | Initial Hydrostatic | 16071 | | |
| 2 | Start of 1st Flow | 346 | | |
| 3 | End of 1st Flow | 303 | 14.0 | |
| 4 | End of 1st Shut-in | 1071 | 29.5 | |
| 5 | Start of 2nd Flow | 228 | | |
| 6 | End of 2nd Flow | 268 | 62.0 | |
| 7 | End of 2nd Shut-in | 3032 | 127.5 | |
| 14 | Final Hydrostatic | 15605 | | |

## Liquid Recovery 7.00 meters

Salinity : 660 g/m3

| *Recovery* | *Description* |
|---|---|
| 7.00 m | DRILLING MUD |

## Blow Description:

PREFLOW: Strong air blow decreasing to fair, steady throughout. No gas to surface.

FINAL FLOW: Strong air blow decreasing to weak, steady throughout. No gas to surface.

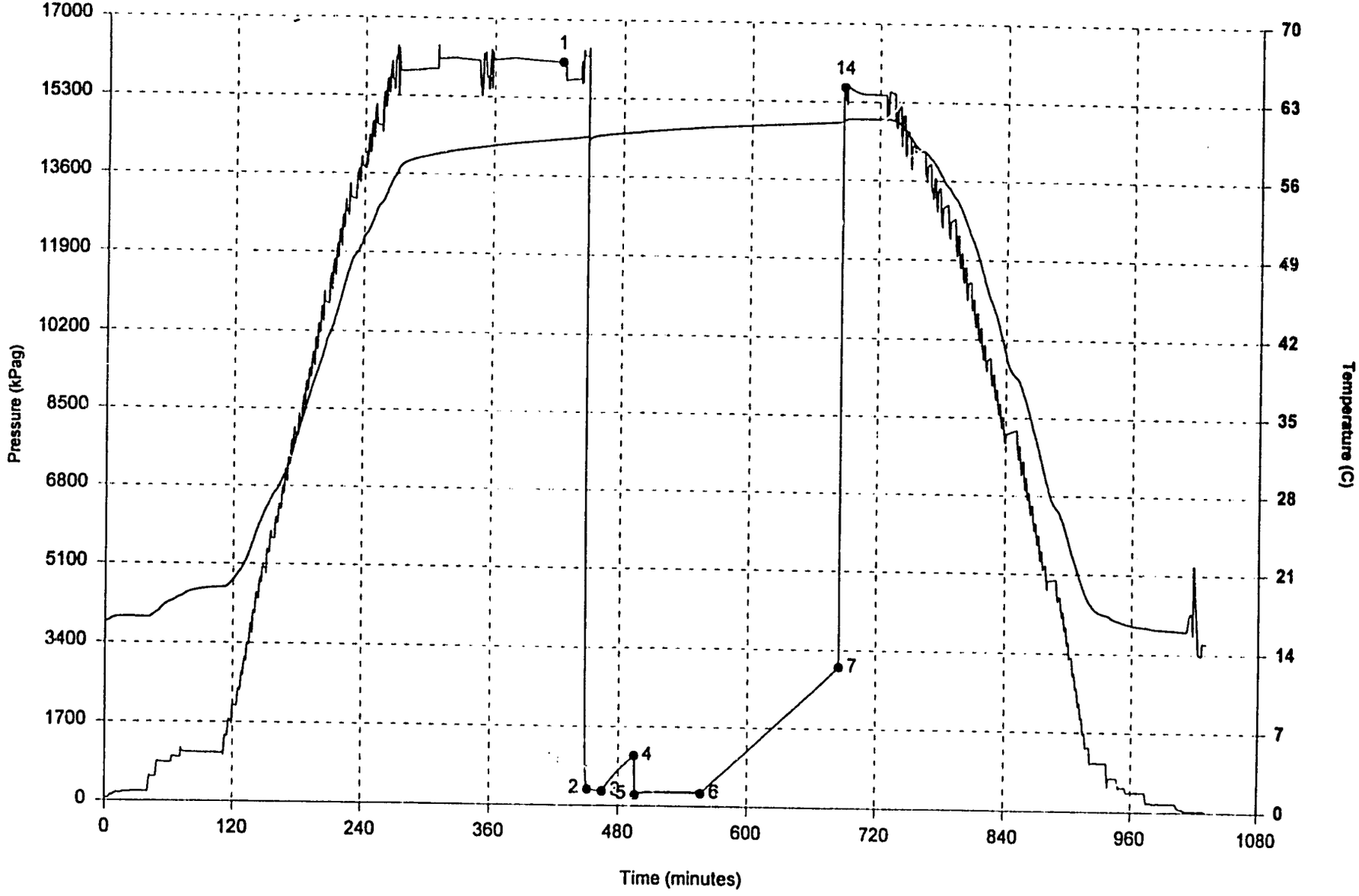
## Remarks:

Mechanically successful test. Results suggest very low permeability within the interval tested.

RANGER ET AL LITTLE BEAR M-39
00/ 64.816 / 126.373 /00
DST #: 1
Recorder: 71130

Pressure (kPag) at Critical Points:

| | | | | | |
|---|---|---|---|---|---|
| 1: | 16071 | 4: | 1071 | 7: | 3032 |
| 2: | 346 | 5: | 228 | 14: | 15605 |
| 3: | 303 | 6: | 268 | | |



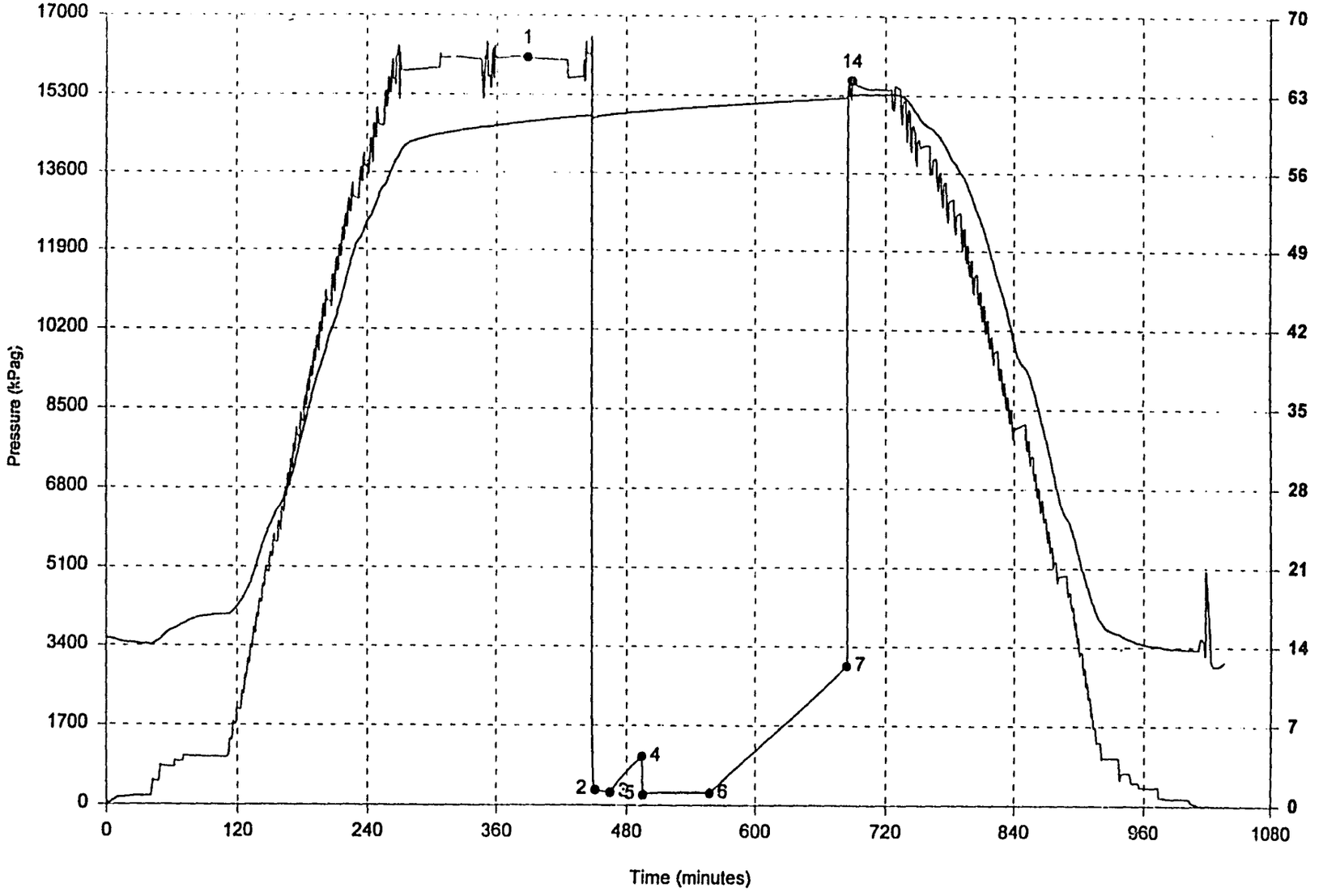

BAKER OIL TOOLS / LYNES DRILL STEM TESTING

RANGER ET AL LITTLE BEAR M-39
00/ 64.816 / 126.373 /00
DST #: 1
Recorder: 71122

Pressure (kPag) at Critical Points:

| | | | | | |
|---|---|---|---|---|---|
| 1: | 16094 | 4: | 1032 | 7: | 2977 |
| 2: | 318 | 5: | 215 | 14: | 15625 |
| 3: | 273 | 6: | 247 | | |

Second electronic gauge




BAKER OIL TOOLS / LYNES DRILL STEM TESTING

# RANGER ET AL LITTLE BEAR M-39
# 00/ 64.816 / 126.373 /00
# DST# 1

## General Information:

| | |
|---|---|
| Operator: | Ranger Oil (Canada) Limited<br>1600, 321 - 6th Ave. S.W.<br>Calgary Alberta T2P 3H3 |
| Licence#: | 1838 |
| Tester: | March J |
| Ticket#: | 806936 |
| Reverse Circulated? | N |
| KB Elevation: | 259.12 meters |
| Ground Elevat'n: | 372.00 meters |
| Total Depth: | 1,550.00 meters |

## Mud Data:

| | |
|---|---|
| Weight: | 1135 kg/m3 |
| Type: | Gel Chemical |
| Viscosity: | 77 s/l |
| Water Loss: | 8.0 cc/s |
| Filter Cake: | 1.0 mm |

## Hole Data:

| | |
|---|---|
| Drilled Hole Size: | 222 mm |
| Calipered Hole Size: | 226 mm |
| Hole Condition at Test Time: | Fair |
| Conditioned prior to this test? | N |

## Recorder Summary:

| *Recorder#* | *Type* | *Location* | *Capacity* | *Units* | *Depth* | *Comments* |
|---|---|---|---|---|---|---|
| 9495 | K-3 | Inside | 21000 | kPag | 1,373.00 | Recovery Recorder |
| 13131 | K-3 | Inside | 19700 | kPag | 1,379.00 | Above Interval |
| 71122 | SPAR | Outside | 34500 | kPag | 1,390.00 | Second electronic gauge |
| 71130 | SPAR | Outside | 68900 | kPag | 1,390.00 | |
| 9995 | K-3 | Outside | 21000 | kPag | 1,549.00 | Below Interval - Loaded Incorrectly |

## Distributions:

Reports Sent To: Don Sorkilmo

Fluid Samples - no of: 2

| *Bottom Hole Sampler#* | *Sent To* |
|---|---|
| 311 | |

# RANGER ET AL LITTLE BEAR M-39
# 00/ 64.816 / 126.373 /00
# DST# 1

## Tool Sequence:

| Diagram | Description | Length |
|---|---|---|
| | Pump Out Sub | 0.33 m |
| | Cross Over Sub | 0.30 m |
| | Pump Out Sub | 0.33 m |
| | Recorder Carrier | 1.38 m |
| | Rotating Shut-in Tool | 2.58 m |
| | Bottom Hole Sampler | 1.03 m |
| | Hydraulic Tool | 1.50 m |
| | Recorder Carrier | 1.38 m |
| | Hydraulic Jars | 2.22 m |
| | Safety Joint | 0.65 m |
| | Bypass Hanger Sub | 0.25 m |
| | Conventional Packer | 2.28 m |
| | Conventional Packer | 1.24 m |
| | Packer Stick Down | 1.04 m |
| | Bypass Receiver Sub | 0.25 m |
| | Recorder Carrier | 2.02 m |
| | Spacing | 16.71 m |
| | Packer Stick Up | 0.45 m |
| | Conventional Packer | 1.83 m |
| | Conventional Packer | 2.28 m |
| | Spacing | 136.44 m |
| | Perforations | 1.50 m |
| | Anchor Shoe (Bull Nose) | 0.60 m |

| | |
|---|---|
| Tool String Length: | 178.59 m |
| Drill Collar I.D.: 74 mm | 74.65 m |
| Drill Pipe O.D.: 114 mm | 1,306.40 m |
| Collar Pipe Total: | 1,381.05 m |
| Stick Up: | 8.52 m |
| Tool Above: | 15.47 m |
| Interval Tested: | 20.00 m |
| Bottom Hole Choke Size: | 25.40 mm |

# RANGER ET AL LITTLE BEAR M-39
# 00/ 64.816 / 126.373 /00
# DST# 1

## Recorder# 13131

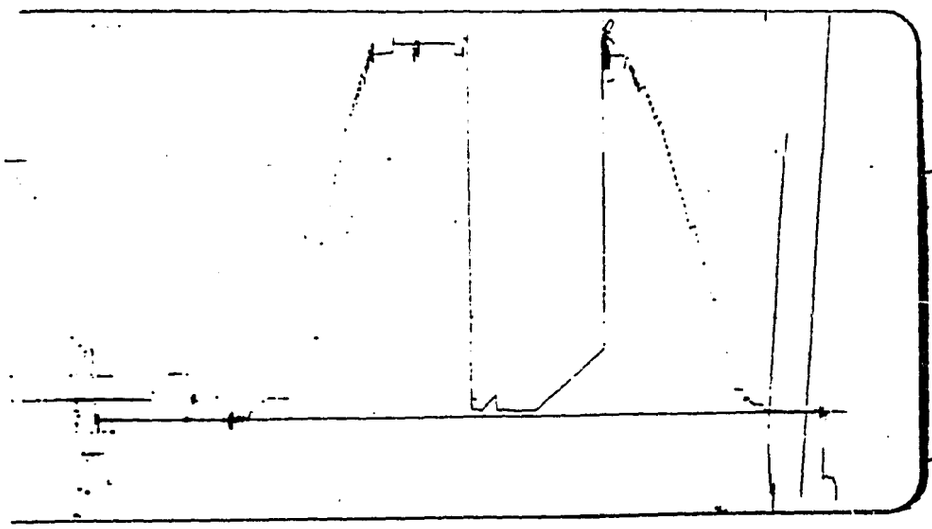
Depth: 1,379.00 m

Location: Inside

Recorder Type: K-3

Capacity: 19,700 kPag

Comments: Above Interval



| | | Pressure (kPag) | Time (min) |
|---|---|---|---|
| 1 | Initial Hydrostatic | 15981 | |
| 2 | Start of 1st Flow | 335 | |
| 3 | End of 1st Flow | 326 | 14.0 |
| 4 | End of 1st Shut-in | 974 | 29.5 |
| 5 | Start of 2nd Flow | 307 | |
| 6 | End of 2nd Flow | 246 | 62.0 |
| 7 | End of 2nd Shut-in | 2933 | 127.5 |
| 14 | Final Hydrostatic | 15599 | |

## Recorder# 71122

Depth: 1,390.00 m

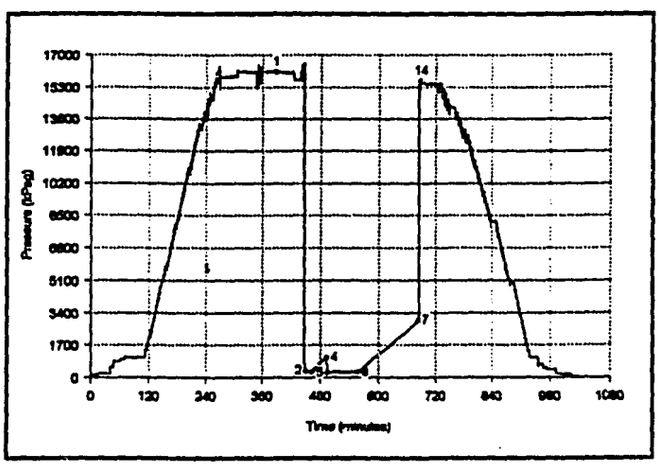
Temperature: 61.9 C

Location: Outside

Recorder Type: SPAR

Capacity: 34,500 kPag

Comments: Second electronic gauge



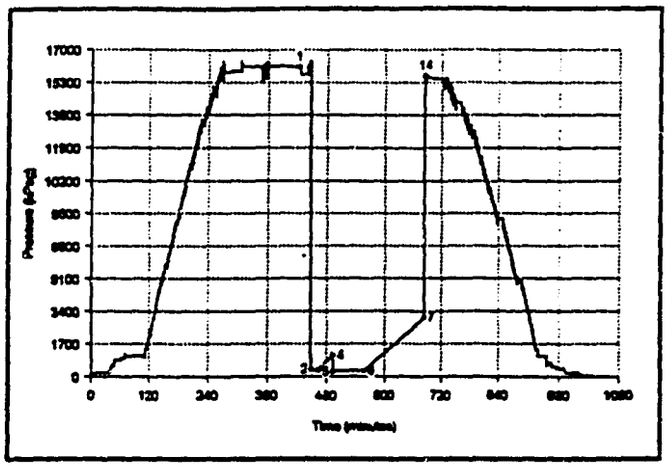

| | | Pressure (kPag) | Time (min) |
|---|---|---|---|
| 1 | Initial Hydrostatic | 16094 | |
| 2 | Start of 1st Flow | 318 | |
| 3 | End of 1st Flow | 273 | 14.0 |
| 4 | End of 1st Shut-in | 1032 | 29.5 |
| 5 | Start of 2nd Flow | 215 | |
| 6 | End of 2nd Flow | 247 | 62.0 |
| 7 | End of 2nd Shut-in | 2977 | 127.5 |
| 14 | Final Hydrostatic | 15625 | |

# RANGER ET AL LITTLE BEAR M-39
# 00/ 64.816 / 126.373 /00
# DST# 1

## Recorder# 71130

Depth: 1,390.00 m
Temperature: 61.5 C
Location: Outside

Recorder Type: SPAR
Capacity: 68,900 kPag

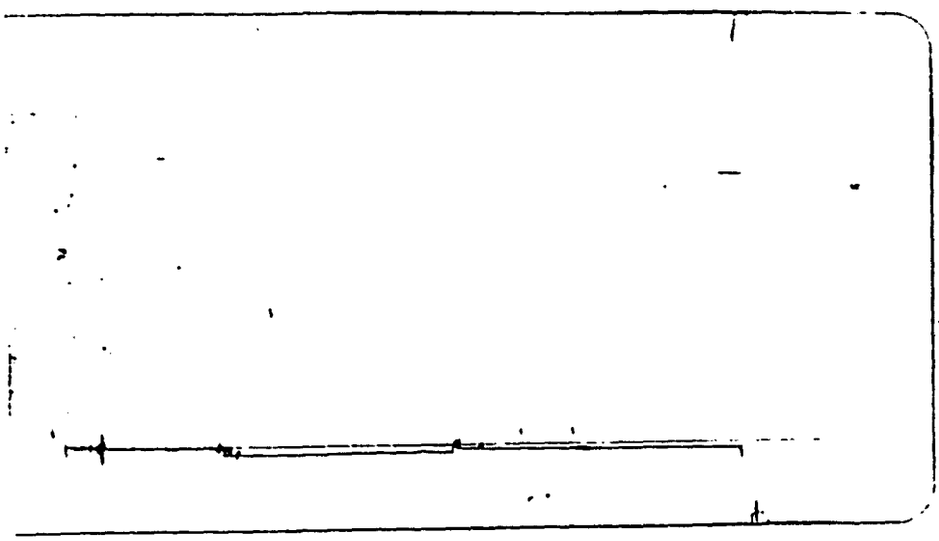



| | | Pressure (kPag) | Time (min) |
|---|---|---|---|
| 1 | Initial Hydrostatic | 16071 | |
| 2 | Start of 1st Flow | 346 | |
| 3 | End of 1st Flow | 303 | 14.0 |
| 4 | End of 1st Shut-in | 1071 | 29.5 |
| 5 | Start of 2nd Flow | 228 | |
| 6 | End of 2nd Flow | 268 | 62.0 |
| 7 | End of 2nd Shut-in | 3032 | 127.5 |
| 14 | Final Hydrostatic | 15605 | |

## Recorder# 9495

Depth: 1,373.00 m
Location: Inside

Recorder Type: K-3
Capacity: 21,000 kPag
Comments: Recovery Recorder



| | | Pressure (kPag) | Time (min) |
|---|---|---|---|
| 2 | Start of 1st Flow | 0 | |
| 3 | End of 1st Flow | 298 | 14.0 |
| 5 | Start of 2nd Flow | 152 | |
| 6 | End of 2nd Flow | 91 | 62.0 |
| 7 | End of 2nd Shut-in | 91 | 127.5 |

# RANGER ET AL LITTLE BEAR M-39
# 00/ 64.816 / 126.373 /00
# DST# 1

**Recorder#** **9995**

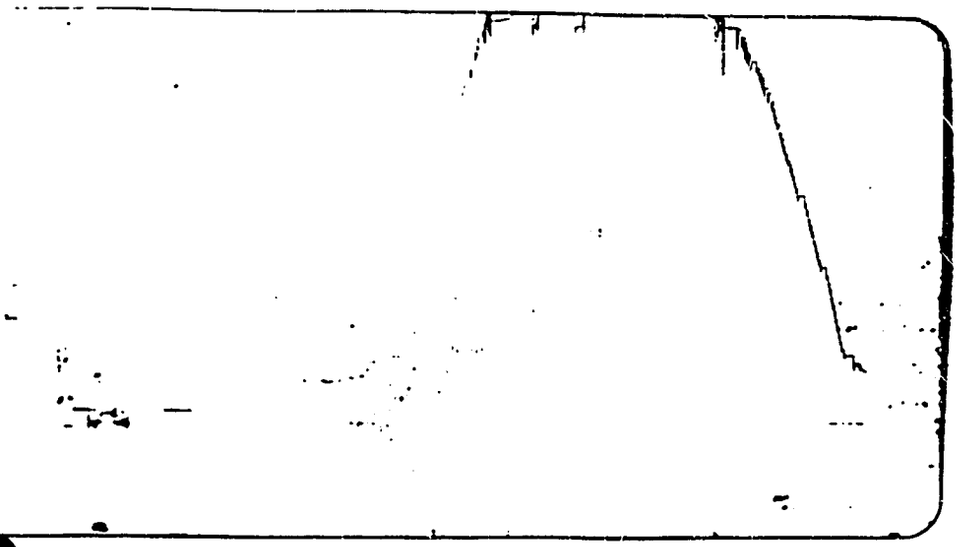
Depth: 1,549.00 m

Location: Outside

Recorder Type: K-3

Capacity: 21,000 kPag

Comments: Below Interval - Loaded Incorrectly



# FIELD REPORT

LYNES

## TEST DATA

TEST No 1 LUS. TEST No 1
FORMATION TESTED IMPERIAL T.D. 1550 m
INTERVAL TESTED: From 1388 m to 1408 m
TOTAL INTERVAL TESTED 20 m
TEST TYPE CONV. STRADDLE RESET: YES ☐ NO ☒
CUSHION: YES ☐ NO ☒ TYPE AMOUNT m
STARTED IN HOLE @ 04:00 HRS. OPENED TOOL 10:45 HRS.
DATE & TIME OUT OF HOLE 1998-03-16 @ 19:30 HRS.
TEST TIMES:
PRE-FLOW 15 MIN. INITIAL SHUT-IN 30 MIN.
SECOND FLOW MIN. SECOND SHUT-IN MIN.
FINAL FLOW 60 MIN. FINAL SHUT-IN 120 MIN.
PRE-FLOW BLOW DESCRIPTION: S.A.B. DECREASING TO FAIR STEADY THROUGHOUT N.G.T.S.

FINAL FLOW BLOW DESCRIPTION: S.A.B. DECREASING TO WEAK STEADY THROUGHOUT N.G.T.S.

## MECHANICAL RECORDERS

| No. | INSIDE ☒ OUTSIDE ☐ | No. | INSIDE ☒ OUTSIDE ☐ | No. | INSIDE ☐ OUTSIDE ☒ |
|---|---|---|---|---|---|
| 9495 | | 13131 | | 9995 | |
| DEPTH | 1373 m | DEPTH | 1379 m | DEPTH | 1549 m |
| CLOCK | 20955 | CLOCK | 17155 | CLOCK | 19298 |
| REC. SEC. # | 12523 | REC. SEC. # | 11174 | REC. SEC. # | 11798 |
| No. | INSIDE ☐ OUTSIDE ☐ | No. | INSIDE ☐ OUTSIDE ☐ | No. | INSIDE ☐ OUTSIDE ☐ |
| DEPTH | m | DEPTH | m | DEPTH | m |
| CLOCK | | CLOCK | | CLOCK | |
| REC. SEC. # | | REC. SEC. # | | REC. SEC. # | |

## ELECTRONIC RECORDERS

| No. | INSIDE ☐ OUTSIDE ☒ | No. | INSIDE ☐ OUTSIDE ☒ | No. | INSIDE ☐ OUTSIDE ☐ |
|---|---|---|---|---|---|
| 30 | | 71122 | | | |
| | 1390 m | DEPTH | 1390 m | DEPTH | m |
| EMP. | 61.5 | TEMP. | 61.9 | TEMP. | |
| ILE | r6949a.dec | FILE | r6949aa.dec | FILE | |

## FIELD READINGS

REC. No. 71130 REC. No.

| DEFLECTION | | PRESSURE kPa | DEFLECTION | | PRESSURE kPa |
|---|---|---|---|---|---|
| | 1 | 16071.11 | | 1 | |
| | 2 | 345.78 | | 2 | |
| | 3 | 303.40 | | 3 | |
| | 4 | 1070.53 | | 4 | |
| | 5 | 257.46 | | 5 | |
| | 6 | 277.55 | | 6 | |
| | 7 | 3032.24 | | 7 | |
| | 8 | | | 8 | |
| | 9 | | | 9 | |
| | 10 | | | 10 | |
| | 11 | | | 11 | |
| | 12 | | | 12 | |
| | 13 | | | 13 | |
| | 14 | 15604.99 | | 14 | |

## REMARKS

SEQUENCE OF TEST EVENTS:

## GENERAL INFORMATION

COMPANY RANGER OIL LTD.
CONTACT IN CALGARY PETER GOETZ
CONTACT'S PHONE 271-1403 FAX
WELL NAME RANGER ET AL LITTLEBEAR
LOCATION 69-49-58-M-39
K.B. 259.12 m GROUND ELEV 253.87 m
COMPANY REP LEE BRAZEL
TESTER JEFF MARCH
JAR No 207 HYDRAULIC TOOL No 93
UNIT # PUMP No
CONTRACTOR SHEHTAH RIG No 1E
TICKET No 806936 DATE 1998-03-16

## MUD & HOLE DATA

HOLE CONDITION @ TEST TIME:
EXCELLENT ☐ GOOD ☐ FAIR ☒ POOR ☐
WAS HOLE CONDITIONED PRIOR TO TEST: YES ☐ NO ☒
HOLE DEVIATION: YES ☐ NO ☒ AMOUNT DEGREES
CALIPER LOG RUN PRIOR TO TEST: YES ☒ NO ☐
CALIPERED HOLE SIZE @ TEST DEPTH 226 MAX. mm
MUD TYPE GEL CHEM.
WEIGHT 1135 kg/m³ VISCOSITY 77 WATER LOSS 8.0
FILTER CAKE 1.0 mm
DRILL PIPE SIZE: O.D. 114 mm I.D. 86 mm WEIGHT 24.7 kg/m
DRILL COLLARS: O.D. 170 mm I.D. 74 mm RUN 74.65 m
MAIN HOLE OR CASING SIZE 222 mm
BOTTOM HOLE OR CHOKE SIZE 25.4 mm
PACKER RUBBER SIZE: DIAM. IN mm 178 LENGTH IN m 1.0
RUBBER LEFT IN HOLE: YES ☐ NO ☒
TOP PACKER: SERIAL No CONDITION
BTM PACKER: SERIAL No CONDITION

## GAS MEASUREMENTS

MEASURED WITH:
SIDE STATIC ☐ CRITICAL FLOW PROVER ☐
FLOOR MANIFOLD ☐ ORIFICE WELL TESTER ☐
CLOSED CHAMBER ☐ OTHER
RISER SIZE

| FLOW # | TIME | CHOKE mm | READING kPa | RATE m3/D |
|---|---|---|---|---|
| | | | | |

## RECOVERY

RECOVERY VERIFICATION SIGNATURE:

TOTAL FLUID RECOVERED 7 m CONSISTING OF:
7 m OF DRLG. MUD SALINITY 660
m OF SALINITY
m OF SALINITY
m OF SALINITY
TEST WAS REVERSED OUT: YES ☐ NO ☒

BTM. H. SAMPLER # 311 SENT TO
GAS BOMB # – SENT TO
No. OF FLUID SAMPLES TAKEN 2 SENT TO

# TEST TOOL & PIPE RECORD

Well Name: RANGER ET AL LITT... Location: 69-49-58-M-39 Date 1998-03-16 Ticket # 806936

Interval Tested: from 1388 to 1408 Total Depth 1550 Test No. 1

## CONVENTIONAL

| Tool | Length |
|---|---|
| POS | 0.33 |
| XOS | 0.30 |
| POS | 0.33 |
| Car | 1.38 |
| RST | 2.58 |
| BHS | 1.03 |
| Hydr | 1.50 |
| Car | 1.38 |
| Jar | 2.22 |
| SJ | 0.65 |
| ByHSub | .25 |
| TCPack | 2.28 |
| [illegible]ack | 1.24 |
| 1388.0 Top Packer Seal Depth | |
| CPSD | 1.04 |
| ByRSub | .25 |
| Car | 2.02 |
| Spg | 16.71 |
| CPSU | .45 |
| 1408.5 Btm Packer Seal Depth | |
| BCPack | 1.83 |
| BCPack | 2.28 |
| Spg | 136.44 |
| [illegible]rf | 1.50 |
| BNose | .60 |

## DRILL COLLARS

| JOINT | LENGTH | JOINT | LENGTH |
|---|---|---|---|
| 1 | 27.59 | 11 | |
| 2 | 27.95 | 12 | |
| 3 | 19.11 | 13 | |
| 4 | | 14 | |
| 5 | | 15 | |
| 6 | | 16 | |
| 7 | | 17 | |
| 8 | | 18 | |
| 9 | | 19 | |
| 10 | | 20 | |
| 1st TOTAL | 74.65 | 2nd TOTAL | |
| 31 | 28.11 | 41 | 28.10 |
| 32 | 28.54 | 42 | 27.77 |
| 33 | 28.55 | 43 | 28.02 |
| 34 | 28.98 | 44 | 28.13 |
| 35 | 28.30 | 45 | 28.40 |
| 36 | 28.05 | 46 | 28.61 |
| 37 | 28.58 | 47 | 9.22 |
| 38 | 28.27 | 48 | |
| 39 | 28.04 | 49 | |
| 40 | 29.09 | 50 | |
| 6th TOTAL | 284.51 | 7th TOTAL | 178.25 |
| 81 | | 91 | |
| 82 | | 92 | |
| 83 | | 93 | |
| 84 | | 94 | |
| 85 | | 95 | |
| 86 | | 96 | |
| 87 | | 97 | |
| 88 | | 98 | |
| 89 | | 99 | |
| 90 | | 100 | |
| 11th TOTAL | | 12th TOTAL | |

## DRILL PIPE

| | | | | | |
|---|---|---|---|---|---|
| 1 | 28.44 | 11 | 28.17 | 21 | 28.51 |
| 2 | 28.48 | 12 | 28.11 | 22 | 28.25 |
| 3 | 28.08 | 13 | 28.11 | 23 | 28.16 |
| 4 | 27.72 | 14 | 28.04 | 24 | 27.76 |
| 5 | 28.14 | 15 | 28.03 | 25 | 28.12 |
| 6 | 27.71 | 16 | 27.67 | 26 | 27.71 |
| 7 | 28.45 | 17 | 28.59 | 27 | 28.06 |
| 8 | 28.59 | 18 | 27.76 | 28 | 27.74 |
| 9 | 28.01 | 19 | 28.22 | 29 | 28.58 |
| 10 | 28.17 | 20 | 28.55 | 30 | 27.71 |
| 3rd TOTAL | 281.79 | 4th TOTAL | 281.25 | 5th TOTAL | 280.60 |
| 51 | | 61 | | 71 | |
| 52 | | 62 | | 72 | |
| 53 | | 63 | | 73 | |
| 54 | | 64 | | 74 | |
| 55 | | 65 | | 75 | |
| 56 | | 66 | | 76 | |
| 57 | | 67 | | 77 | |
| 58 | | 68 | | 78 | |
| 59 | | 69 | | 79 | |
| 60 | | 70 | | 80 | |
| 8th TOTAL | | 9th TOTAL | | 10th TOTAL | |
| 101 | | | | | |
| 102 | | | | | |
| 103 | | | | | |
| 104 | | | | | |
| 105 | | | | | |
| 106 | | | | | |
| 107 | | | | | |
| 108 | | | | | |
| 109 | | | | | |
| 110 | | | | | |
| 13th TOTAL | | | | | |

## INFLATABLE

| Tool | Length |
|---|---|
| | |

Top Packer Seal Depth

Btm Packer Seal Depth

| | |
|---|---|
| TOOL | 178.59 |
| 1st TOTAL | 74.65 |
| 2nd TOTAL | |
| 3rd TOTAL | 281.79 |
| 4th TOTAL | 281.25 |
| 5th TOTAL | 280.60 |
| 6th TOTAL | 284.51 |
| 7th TOTAL | 178.25 |
| 8th TOTAL | |
| 9th TOTAL | |
| 10th TOTAL | |
| 11th TOTAL | |
| 12th TOTAL | |
| 13th TOTAL | |

## BEFORE TEST IN DERRICK

| | |
|---|---|
| TOTAL DRILL COLLARS | 3 |
| TOTAL DRILL PIPE | 47 |

## TESTING

| | IN | OUT | TOTAL |
|---|---|---|---|
| DRILL COLLARS | 3 | 0 | 3 |
| DRILL PIPE | 46 | 1 | 47 |

## CONVENTIONAL PIPE TALLY

| | |
|---|---|
| BELOW BOTTOM PACKER SEAL | 142.65 |
| BETWEEN PACKER SEALS | 20.47 |
| TOOL ABOVE PACKER SEAL | 15.47 |
| DRILL COLLARS | 74.65 |
| DRILL PIPE | 1306.40 |
| TOTAL STRING | 1559.64 |
| TOTAL DEPTH | 1550.00 |
| TOP SINGLE ABOVE TABLE | 9.64 |

## INFLATE PIPE TALLY

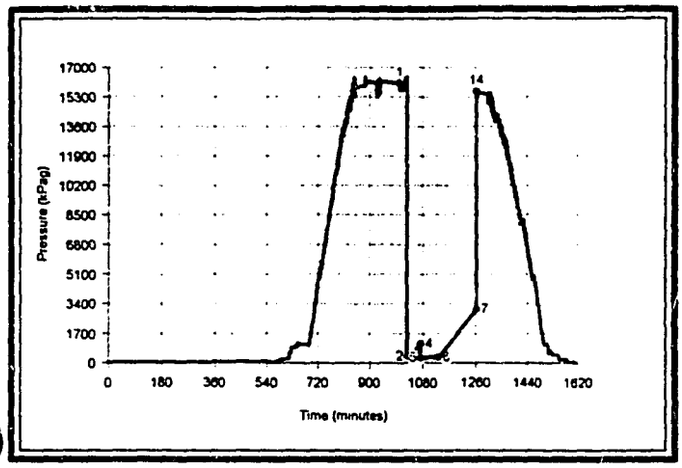
| | |
|---|---|
| TOOL ABOVE INTERVAL | |
| DRILL COLLARS | |
| DRILL PIPE | |
| TOTAL STRINGS ABOVE INTERVAL | |
| BOTTOM OF TOP PACKER SEAL DEPTH | |
| TOP SINGLE ABOVE TABLE | |

Tester Signature _____ Approved by Oil Co. Rep. _____

# RANGER ET AL LITTLEBEAR
## 69-49-58-M-39
## DST# 1

**Formation:** IMPERIAL
**Interval - from:** 1388 **to:** 1408 m

## Recorder# 71130 at 1390 m




Maximum Btm Hole Temperature @ FSI: 61.5 C

| | | *Pressure (kPag)* | *Time (min)* | *Extrapolated Pressure (kPag)* |
|---|---|---|---|---|
| 1 | Initial Hydrostatic | 16071 | | |
| 2 | Start of 1st Flow | 346 | | |
| 3 | End of 1st Flow | 303 | 14.0 | |
| 4 | End of 1st Shut-in | 1071 | 29.5 | |
| 5 | Start of 2nd Flow | 257 | | |
| 6 | End of 2nd Flow | 278 | 60.0 | |
| 7 | End of 2nd Shut-in | 3032 | 129.0 | |
| 14 | Final Hydrostatic | 15605 | | |

## Liquid Recovery of 7.00 m

| *Recovery* | *Description* | *Salinity* |
|---|---|---|
| 7.00 m | DRLG MUD | 660 |

**Test Date:** 1998-03-16
**Test Type:** CONV. STRADDLE
**Tester Name:** JEFF MARCH
**Drill Pipe O.D.:** 114.00 mm
**Drill Collar I.D.:** 74.00 mm
**Drill Collar Length:** 74.65 m
**Hole Size:** 222.00 mm

## Blow Description:

PREFLOW - S.A.B. DECREASING TO FAIR STEADY THROUGHOUT N.G.T.S. FINAL FLOW - S.A.B. DECREASING TO WEAK STEADY THROUGHOUT N.G.T.S.

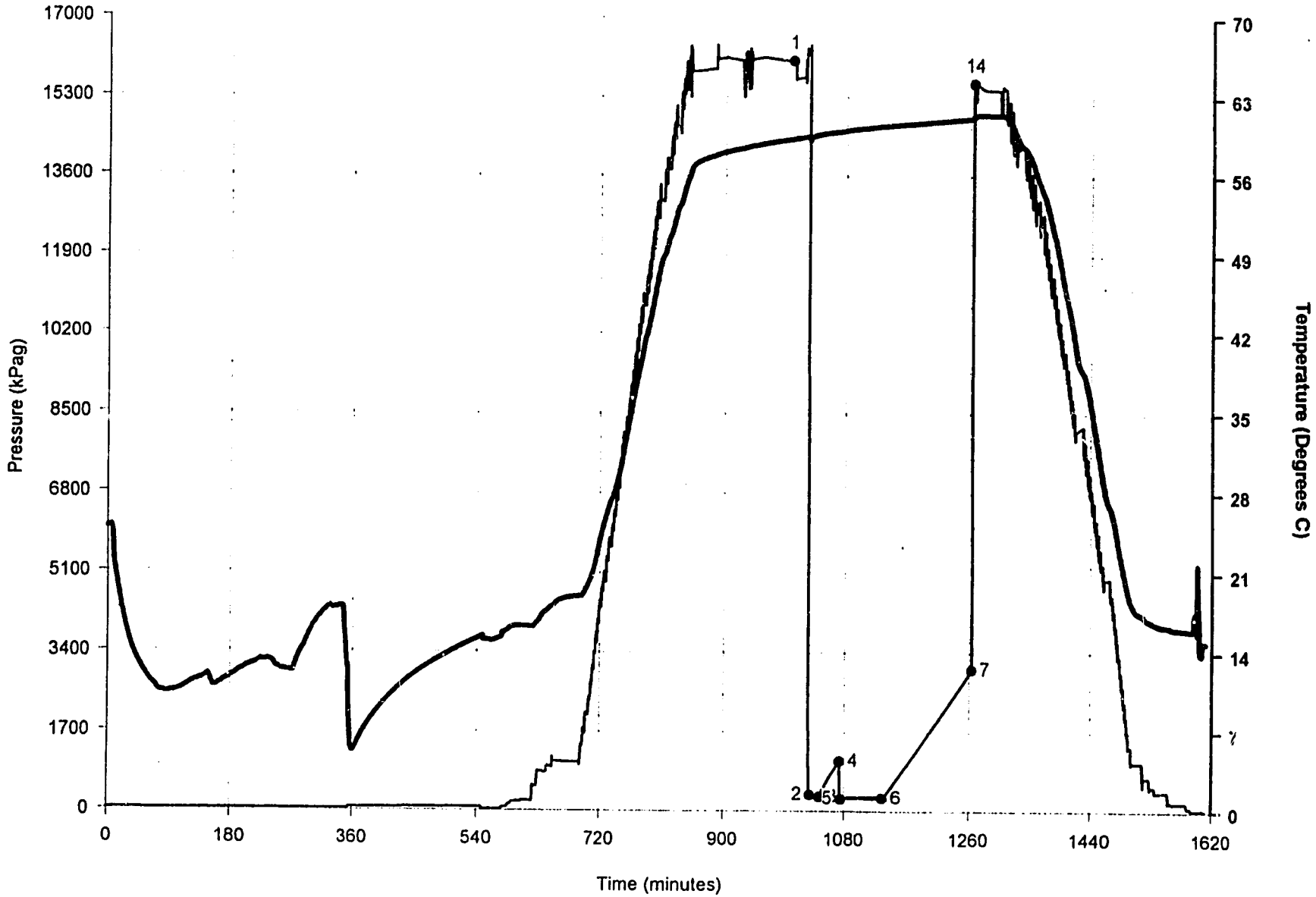
## Remarks:

BAKER OIL TOOLS CANADA / LYNES DRILL STEM TESTING

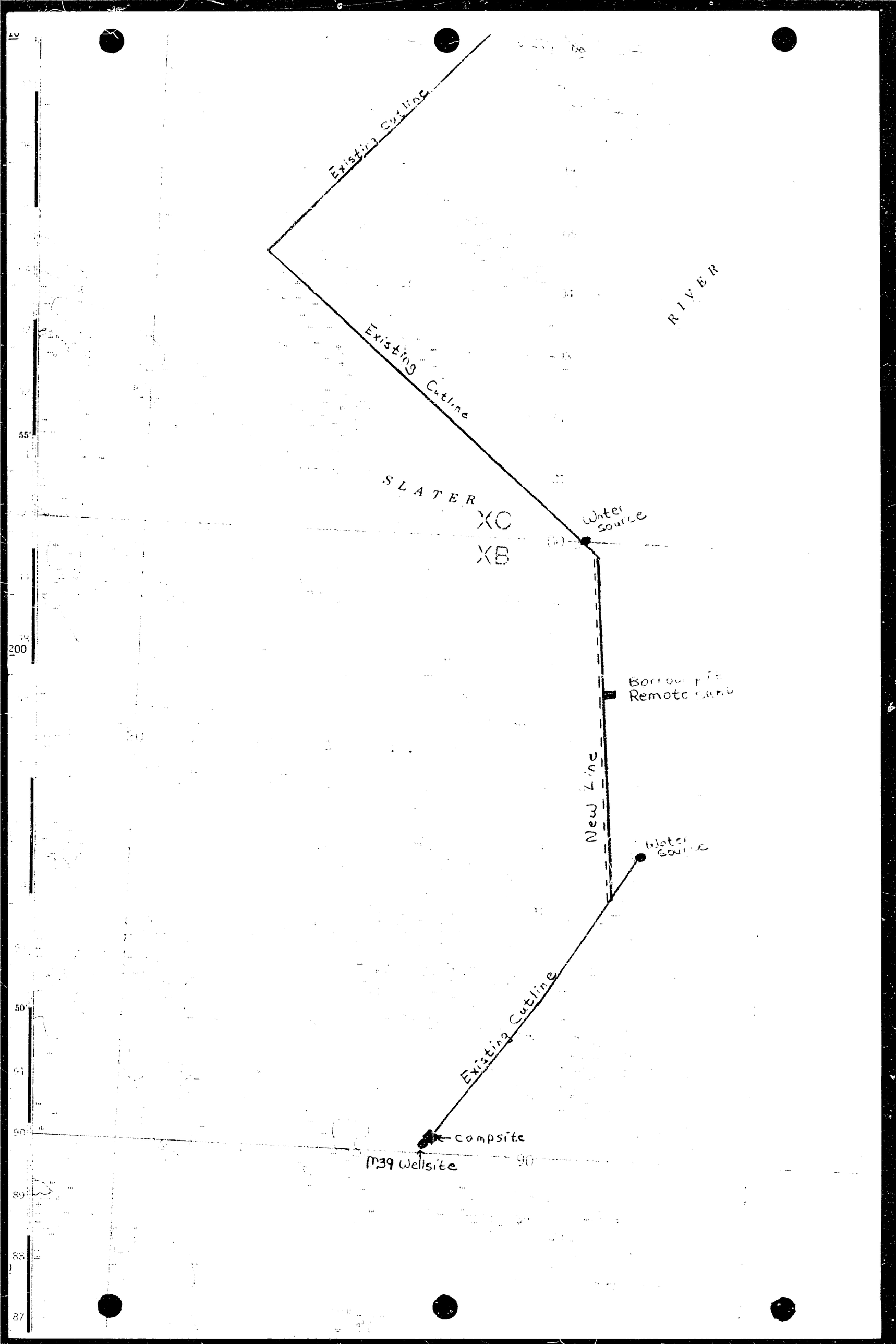
RANGER ET AL LITTLEBEAR
69-49-58-M-39
DST #: 1
Recorder: 71130

Pressure (kPag) at Critical Points:

| | | | | | |
|---|---|---|---|---|---|
| 1: | 16071 | 4: | 1071 | 7: | 3032 |
| 2: | 346 | 5: | 257 | 14: | 15605 |
| 3: | 303 | 6: | 278 | | |



EXISTING OUTLINE
EXISTING OUTLINE
RIG STANDBY SITE
WATER SOURCE
ICE BRIDGE
HALFWAY
ISLAND
10
60


Existing Cutline
RIVER
Existing Cutline
SLATER
XC
XB
Water Source
Borrow Pit
Remote Camp
New Line
Water Source
Existing Cutline
Campsite
M39 Wellsite

LEGIBILITY
OF LOG
COULD VARY
DUE TO
COLOR
CONTENT

# TEST REPORTS

N.E.B COPY 1838

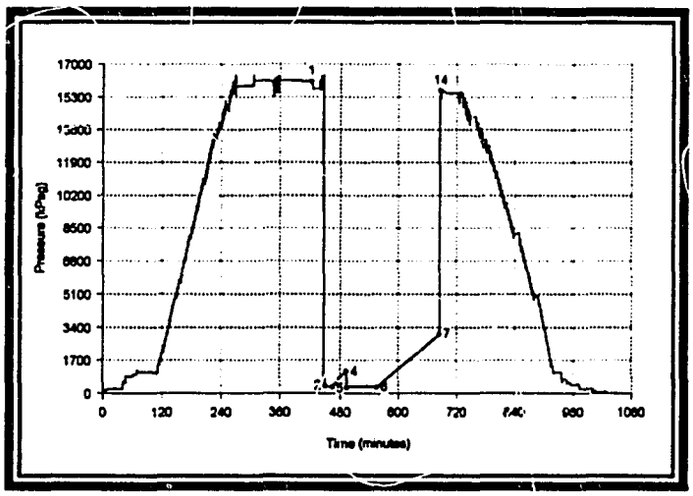
BAKER OIL TOOLS
A Baker Hughes Company

# RANGER ET AL LITTLE BEAR M-39
## 00/ 64.816 / 126.373 /00
## DST# 1

**Formation:** Imperial
**Interval - from:** 1,388.00 **to:** 1,408.00 meters

**Test Date:** 1998-03-16
**Test Type :** Conventional Straddle (Blank Off)

## Recorder# 71130 at 1,390.00 meters




Max Btm Hole Temperature @ FSI: 61.5 C

| | | *Pressure (kPag)* | *Time (min)* | *Extrapolated Pressure (kPag)* |
|---|---|---|---|---|
| 1 | Initial Hydrostatic | 16071 | | |
| 2 | Start of 1st Flow | 346 | | |
| 3 | End of 1st Flow | 303 | 14.0 | |
| 4 | End of 1st Shut-in | 1071 | 29.5 | |
| 5 | Start of 2nd Flow | 228 | | |
| 6 | End of 2nd Flow | 268 | 62.0 | |
| 7 | End of 2nd Shut-in | 3032 | 127.5 | |
| 14 | Final Hydrostatic | 15605 | | |

## Liquid Recovery 7.00 meters

Salinity : 660 g/m3

| *Recovery* | *Description* |
|---|---|
| 7.00 m | DRILLING MUD |

## Blow Description:

PREFLOW: Strong air blow decreasing to fair, steady throughout. No gas to surface.

FINAL FLOW: Strong air blow decreasing to weak, steady throughout. No gas to surface.

## Remarks:

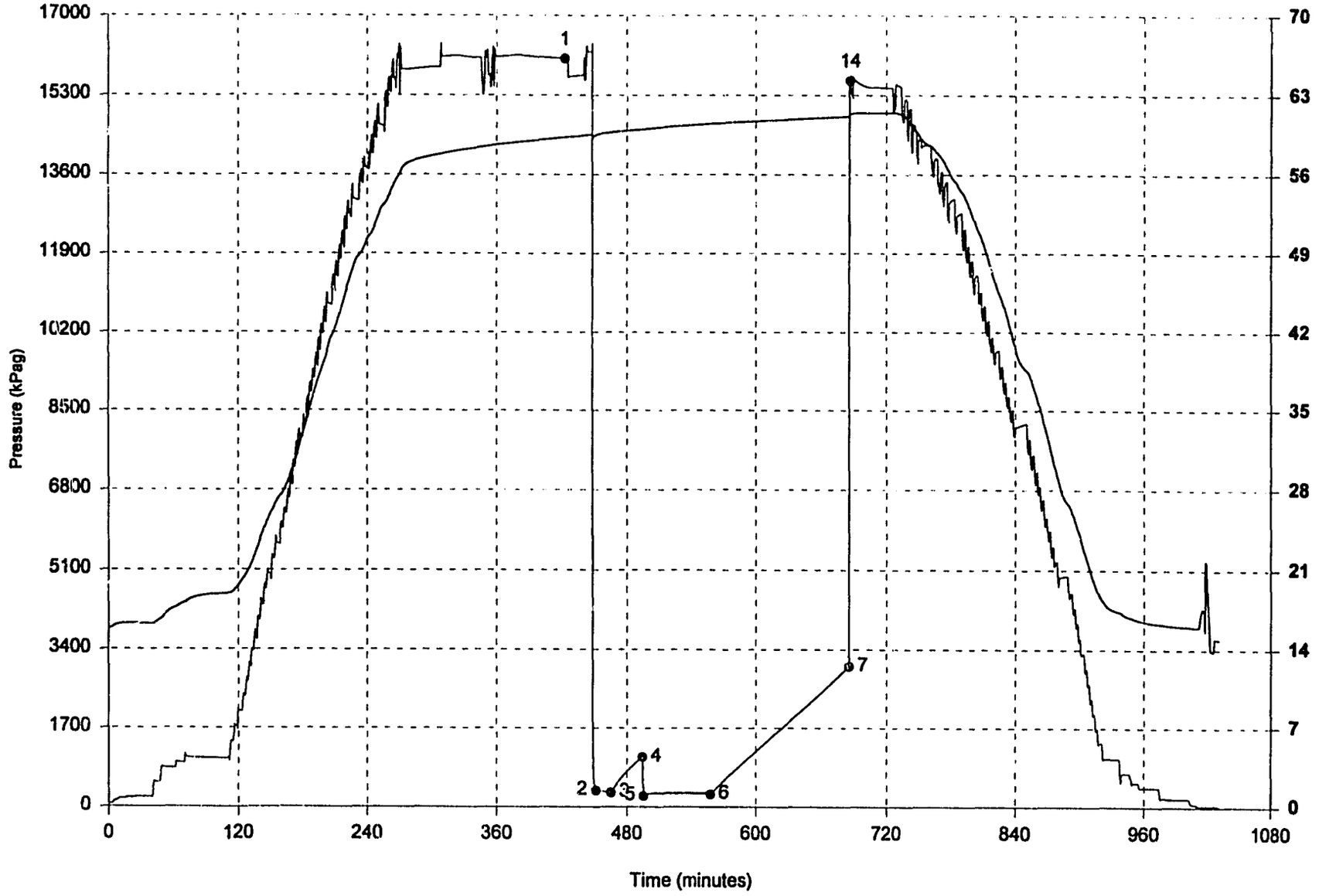
Mechanically successful test. Results suggest very low permeability within the interval tested.

NATIONAL ENERGY BOARD
RESEARCH
MAR 3 1 1998

RANGER ET AL LITTLE BEAR M-39
00/ 64.816 / 126.373 /00
DST #: 1
Recorder: 71130

Pressure (kPag) at Critical Points:

| | | | | | |
|---|---|---|---|---|---|
| 1: | 16071 | 4: | 1071 | 7: | 3032 |
| 2: | 346 | 5: | 228 | 14: | 15605 |
| 3: | 303 | 6: | 268 | | |



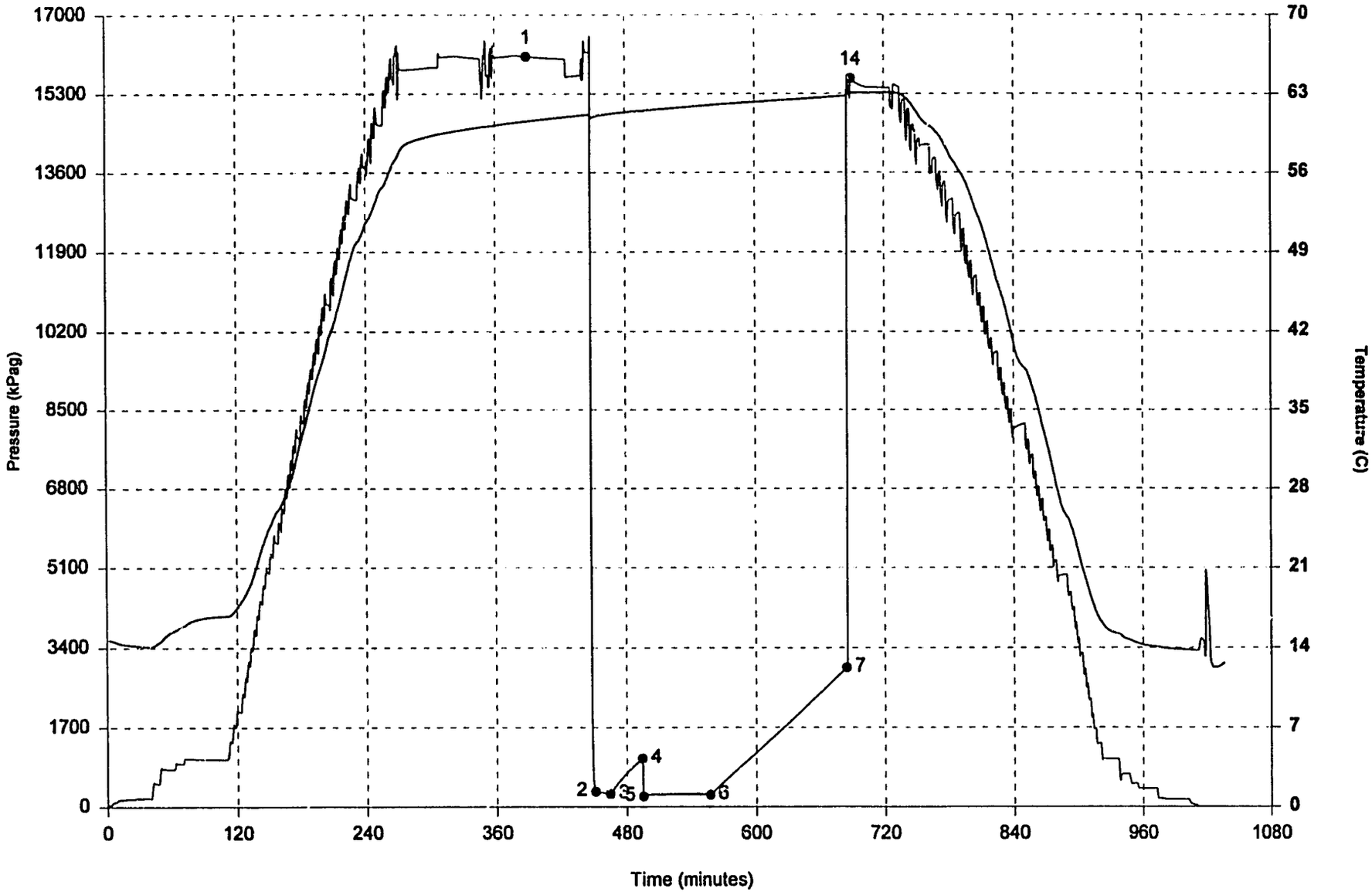

BAKER OIL TOOLS / LYNES DRILL STEM TESTING

RANGER ET AL LITTLE BEAR M-39
00/ 64.816 / 126.373 /00
DST #: 1
Recorder: 71122

Pressure (kPag) at Critical Points:

| | | | | | |
|---|---|---|---|---|---|
| 1: | 16094 | 4: | 1032 | 7: | 2977 |
| 2: | 318 | 5: | 215 | 14: | 15625 |
| 3: | 273 | 6: | 247 | | |

Second electronic gauge




BAKER OIL TOOLS / LYNES DRILL STEM TESTING

# RANGER ET AL LITTLE BEAR M-39
# 00/ 64.816 / 126.373 /00
# DST# 1

## General Information:

Operator: Ranger Oil (Canada) Limited
1600, 321 - 6th Ave. S.W.
Calgary Alberta T2P 3H3

Licence#: 1838
Tester: March J
Ticket#: 806936
Reverse Circulated? N
KB Elevation: 259.12 meters
Ground Elevat'n: 372.00 meters
Total Depth: 1,550.00 meters

## Mud Data:

Weight: 1135 kg/m3
Type: Gel Chemical
Viscosity: 77 s/l
Water Loss: 8.0 cc/s
Filter Cake: 1.0 mm

## Hole Data:

Drilled Hole Size: 222 mm
Calipered Hole Size: 226 mm
Hole Condition at Test Time: Fair
Conditioned prior to this test? N

## Recorder Summary:

| *Recorder#* | *Type* | *Location* | *Capacity* | *Units* | *Depth* | *Comments* |
|---|---|---|---|---|---|---|
| 9495 | K-3 | Inside | 21000 | kPag | 1,373.00 | Recovery Recorder |
| 13131 | K-3 | Inside | 19700 | kPag | 1,379.00 | Above Interval |
| 71122 | SPAR | Outside | 34500 | kPag | 1,390.00 | Second electronic gauge |
| 71130 | SPAR | Outside | 68900 | kPag | 1,390.00 | |
| 9995 | K-3 | Outside | 21000 | kPag | 1,549.00 | Below Interval - Loaded Incorrectly |

## Distributions:

Reports Sent To: Don Sorkilmo
Fluid Samples - no of: 2

| *Bottom Hole Sampler#* | *Sent To* |
|---|---|
| 311 | |

# RANGER ET AL LITTLE BEAR M-39
# 00/ 64.816 / 126.373 /00
# DST# 1

## Tool Sequence:

| *Diagram* | *Description* | *Length* |
|---|---|---|
| | Pump Out Sub | 0.33 m |
| | Cross Over Sub | 0.30 m |
| | Pump Out Sub | 0.33 m |
| | Recorder Carrier | 1.38 m |
| | Rotating Shut-in Tool | 2.58 m |
| | Bottom Hole Sampler | 1.03 m |
| | Hydraulic Tool | 1.50 m |
| | Recorder Carrier | 1.38 m |
| | Hydraulic Jars | 2.22 m |
| | Safety Joint | 0.65 m |
| | Bypass Hanger Sub | 0.25 m |
| | Conventional Packer | 2.28 m |
| | Conventional Packer | 1.24 m |
| | Packer Stick Down | 1.04 m |
| | Bypass Receiver Sub | 0.25 m |
| | Recorder Carrier | 2.02 m |
| | Spacing | 16.71 m |
| | Packer Stick Up | 0.45 m |
| | Conventional Packer | 1.83 m |
| | Conventional Packer | 2.28 m |
| | Spacing | 136.44 m |
| | Perforations | 1.50 m |
| | Anchor Shoe (Bull Nose) | 0.60 m |

| | |
|---|---|
| Tool String Length: | 178.59 m |
| Drill Collar I.D.: 74 mm | 74.65 m |
| Drill Pipe O.D.: 114 mm | 1,306.40 m |
| Collar Pipe Total: | 1,381.05 m |
| Stick Up: | 8.52 m |
| Tool Above: | 15.47 m |
| Interval Tested: | 20.00 m |
| Bottom Hole Choke Size: | 25.40 mm |

# RANGER ET AL LITTLE BEAR M-39
# 00/ 64.816 / 126.373 /00
# DST# 1

## Recorder# 13131

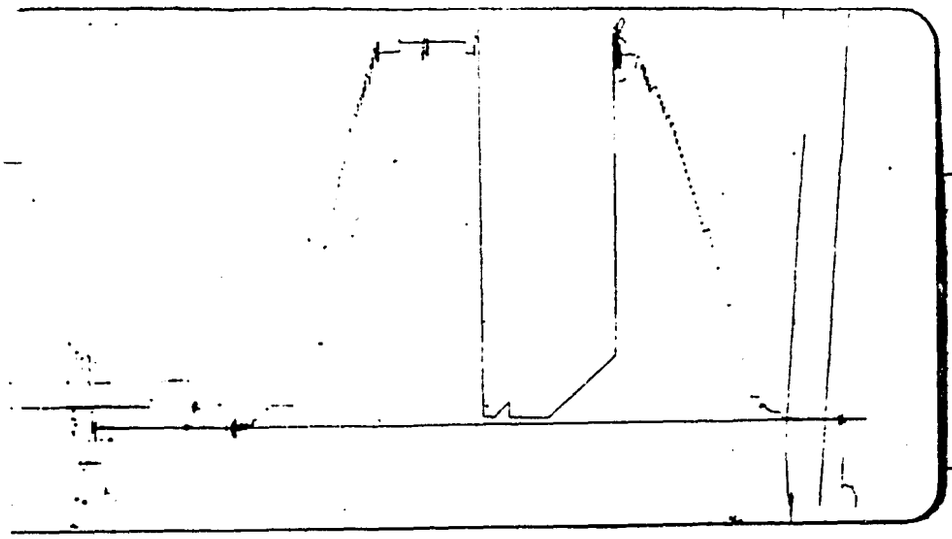
Depth: 1,379.00 m

Location: Inside

Recorder Type: K-3

Capacity: 19,700 kPag

Comments: Above Interval



| | | *Pressure (kPag)* | *Time (min)* |
|---|---|---|---|
| 1 | Initial Hydrostatic | 15981 | |
| 2 | Start of 1st Flow | 335 | |
| 3 | End of 1st Flow | 326 | 14.0 |
| 4 | End of 1st Shut-in | 974 | 29.5 |
| 5 | Start of 2nd Flow | 307 | |
| 6 | End of 2nd Flow | 246 | 62.0 |
| 7 | End of 2nd Shut-in | 2933 | 127.5 |
| 14 | Final Hydrostatic | 15599 | |

## Recorder# 71122

Depth: 1,390.00 m

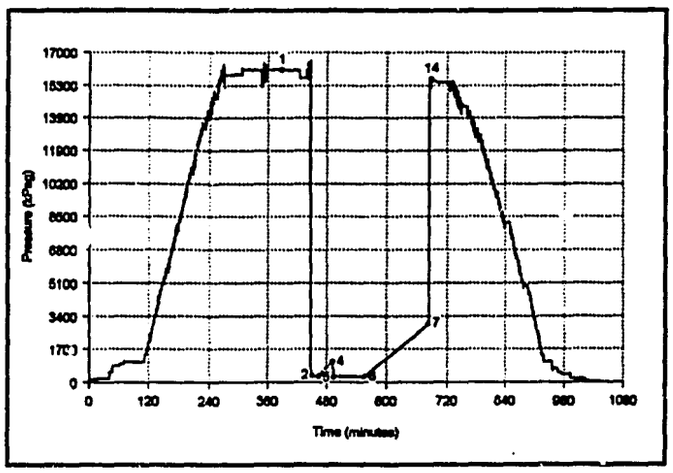
Temperature: 61.9 C

Location: Outside

Recorder Type: SPAR

Capacity: 34,500 kPag

Comments: Second electronic gauge



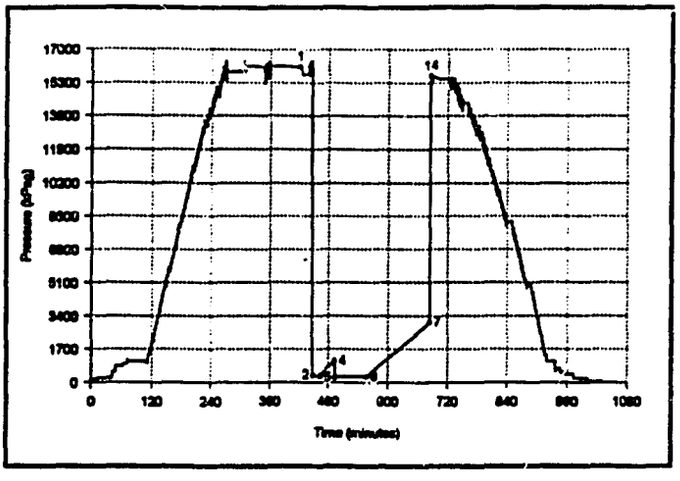

| | | *Pressure (kPag)* | *Time (min)* |
|---|---|---|---|
| 1 | Initial Hydrostatic | 16094 | |
| 2 | Start of 1st Flow | 318 | |
| 3 | End of 1st Flow | 273 | 14.0 |
| 4 | End of 1st Shut-in | 1032 | 29.5 |
| 5 | Start of 2nd Flow | 215 | |
| 6 | End of 2nd Flow | 247 | 62.0 |
| 7 | End of 2nd Shut-in | 2977 | 127.5 |
| 14 | Final Hydrostatic | 15625 | |

# RANGER ET AL LITTLE BEAR M-39
# 00/ 64.816 / 126.373 /00
# DST# 1

## Recorder# 71130

Depth: 1,390.00 m
Temperature: 61.5 C
Location: Outside

Recorder Type: SPAR
Capacity: 68,900 kPag

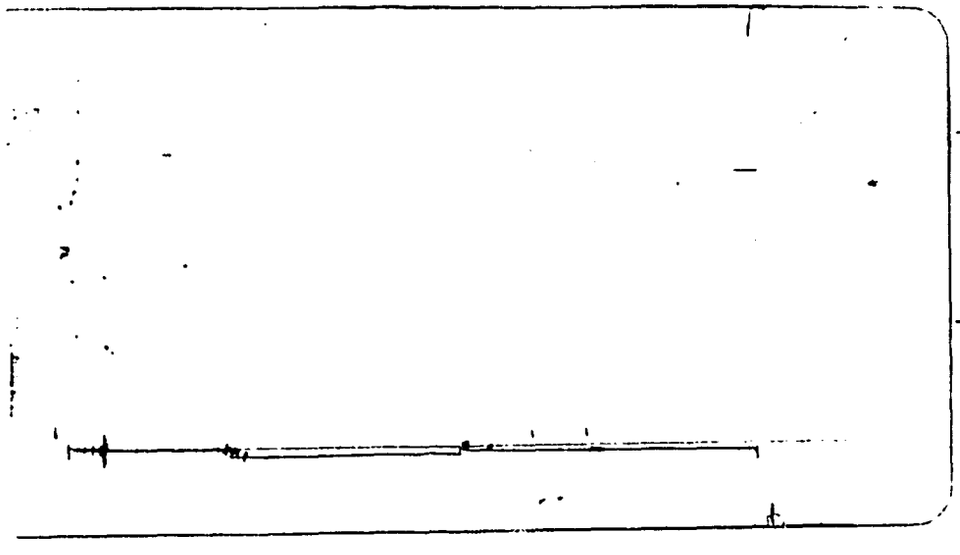



| | | Pressure (kPag) | Time (min) |
|---|---|---|---|
| 1 | Initial Hydrostatic | 16071 | |
| 2 | Start of 1st Flow | 346 | |
| 3 | End of 1st Flow | 303 | 14.0 |
| 4 | End of 1st Shut-in | 1071 | 29.5 |
| 5 | Start of 2nd Flow | 228 | |
| 6 | End of 2nd Flow | 268 | 62.0 |
| 7 | End of 2nd Shut-in | 3032 | 127.5 |
| 14 | Final Hydrostatic | 15605 | |

## Recorder# 9495

Depth: 1,373.00 m
Location: Inside

Recorder Type: K-3
Capacity: 21,000 kPag
Comments: Recovery Recorder



| | | Pressure (kPag) | Time (min) |
|---|---|---|---|
| 2 | Start of 1st Flow | 0 | |
| 3 | End of 1st Flow | 298 | 14.0 |
| 5 | Start of 2nd Flow | 152 | |
| 6 | End of 2nd Flow | 91 | 62.0 |
| 7 | End of 2nd Shut-in | 91 | 127.5 |

# RANGER ET AL LITTLE BEAR M-39
# 00/ 64.816 / 126.373 /00
# DST# 1

**Recorder# 9995**

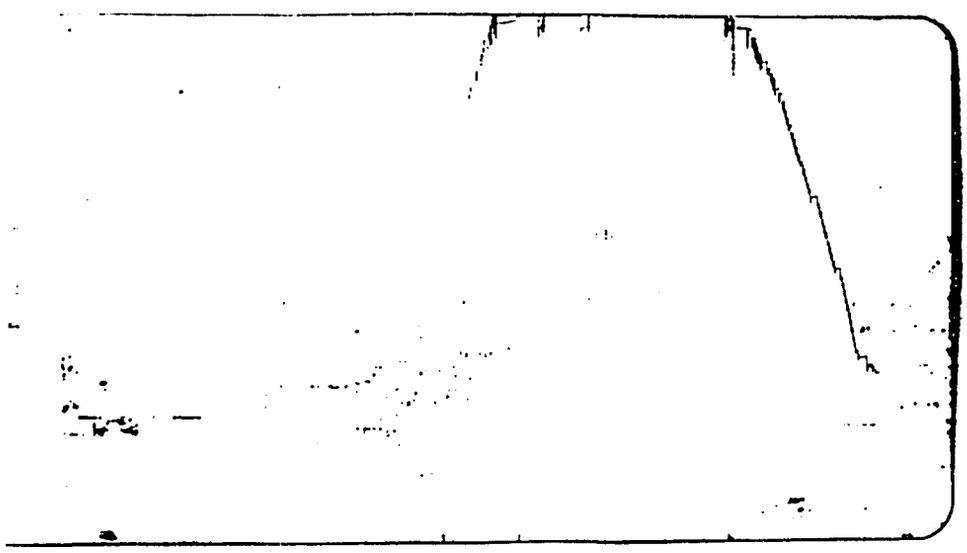
Depth: 1,549.00 m

Location: Outside

Recorder Type: K-3

Capacity: 21,000 kPag

Comments: Below Interval - Loaded Incorrectly



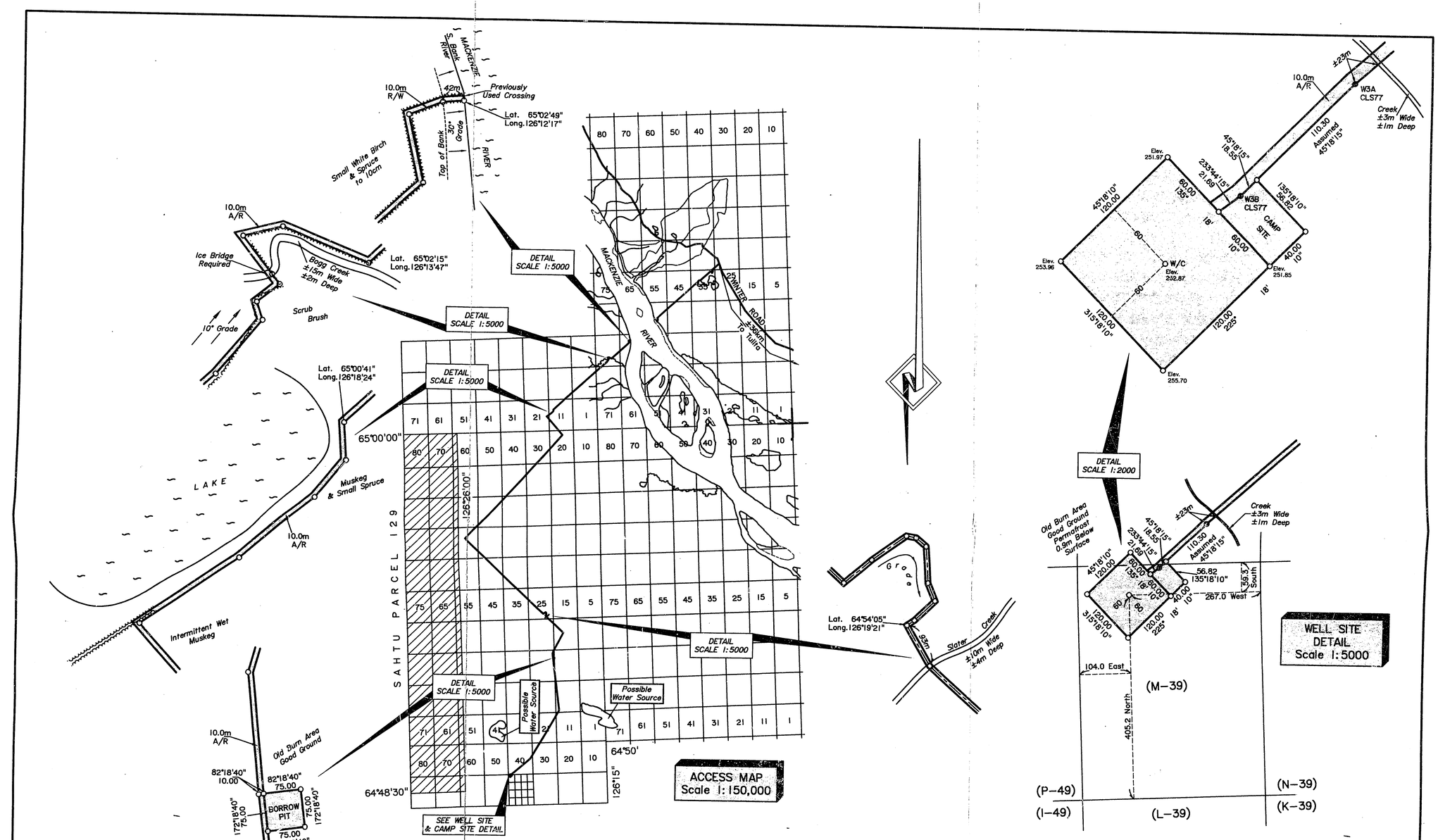
OVERSIZED

DOCUMENT

FILMED

ON

35mm




NAD 27 Co-ordinates:

| | Latitude | Longitude | Northing | Easting |
|---|---|---|---|---|
| W/H: | 64°48'58" | 126°22'22" | 7190363.802 | 624717.466 |
| Borrow Pit: | 64°52'44" | 126°18'48" | 7197453.000 | 627250.000 |
| CampSite: | 64°48'59" | 126°22'16" | 7190398.745 | 624795.433 |

405.2 North of South } of M-39
267.0 West of East }

LEGEND

PL. CLS 77 Post: ——— ○
Pl. 25cm Iron Spike: ——— △

AREA REQUIRED FOR:

| | Length (m) | ha | Ac. |
|---|---|---|---|
| W/S: | – | 1.440 | 3.56 |
| 10.0m A/R: | 353.13 | 35.313 | 87.26 |
| Borrow Pit: | – | 0.563 | 1.39 |
| Camp Site: | – | 0.234 | 0.58 |
| Total: | – | 32.55 | 92.79 |

OPERATOR:

RANGER OIL

RANGER OIL LIMITED

I CURTIS E. HENRIE, CERTIFY THAT THE SURVEY REPRESENTED BY THIS PLAN IS CORRECT AND TRUE TO THE BEST OF MY KNOWLEDGE, IS IN ACCORDANCE WITH THE GENERAL INSTRUCTIONS OF THE SURVEYOR GENERAL, AND WAS COMPLETED ON THE 1st DAY OF AUGUST, 1997.

CANADA LANDS SURVEYOR — 4 Sept, 1997 DATE

# RANGER LITTLE BEAR M-39
# IN UNIT M, SECTION 39
# GRID AREA 64°50', 126°15'

SESL

Surveyor: BA Calculator: DD
Draftsperson: BD Chk'd.: DD
Job No.: 97F138C

| No. | Revision | Date |
|---|---|---|
| 1 | Added Elevations | 97/09/24 |

STUART ENGINEERING & SURVEYING LTD. 200, 517 - 10TH AVENUE S.W. CALGARY, ALBERTA, CANADA T2R 0A8 (403) 234-9018 FAX. (403) 266-2919

# RESISTIVITY/ CONDUCTIVITY

N.E.B. COPY 1838

COMPANY: RANGER OIL LIMITED

WELL: RANGER ET AL LITTLE BEAR M-39

FIELD: LITTLE BEAR

TERRITORY: N.W.T.

TERRITORY: N.W.T.
Field: LITTLE BEAR
Location: 69-49-58-129
Well: RANGER ET AL LITTLE BEAR M
Company: RANGER OIL LIMITED

9211-R36-2-3

Schlumberger

# PHASOR INDUCTION SFL

LOCATION: 69-49-58-129

Elev.: K.B. 259.22 M; G.L. 253.87 M; D.F. 258.92 M

| | | | |
|---|---|---|---|
| Permanent Datum: | GROUND LEVEL | Elev.: | 253.87 M |
| Log Measured From: | KELLY BUSHING | 5.4 M | above Perm. Datum |
| Drilling Measured From: | KELLY BUSHING | | |

| API Serial No. | SECTION | TOWNSHIP | RANGE |
|---|---|---|---|
| | | | |

| | | | | |
|---|---|---|---|---|
| Logging Date | 5-MARCH-1998 | | | |
| Run Number | 1 | | | |
| Depth Driller | 602.6 M | | | |
| Schlumberger Depth | 598.5 M | | | |
| Bottom Log Interval | 595 M | | | |
| Top Log Interval | 148.5 M | | | |
| Casing Driller Size @ Depth | 339.700 MM | @ 149.7 M | @ | |
| Casing Schlumberger | 148.5 M | | | |
| Bit Size | 311.000 MM | | | |
| Type Fluid In Hole | GEL CHEM | | | |
| MUD Density / Viscosity | 1155 K/M3 | 63 S | | |
| MUD Fluid Loss / PH | 9 C3 | 8 | | |
| MUD Source Of Sample | FLOWLINE | | | |
| RM @ Measured Temperature | 3.340 OHMM | @ 24 DEGC | @ | |
| RMF @ Measured Temperature | 32.420 OHMM | @ 18 DEGC | @ | |
| RMC @ Measured Temperature | 3.420 OHMM | @ 15 DEGC | @ | |
| Source RMF / RMC | PRESS | PRESS. | | |
| RM @ MRT / RMF @ MRT | 2.690 @ 35 | 22.672 @ 35 | @ | @ |
| Maximum Recorded Temperatures | 35 DEGC | | | |
| Circulation Stopped / Time | 5-MAR-1998 | 1:30 | | |
| Logger On Bottom / Time | 5-MAR-1998 | 12:00 | | |
| Unit Number / Location | 2 | NORMAN WELLS | | |
| Recorded By | GREG MCISAAC | | | |
| Witnessed By | HENRI WENNEKERS | | | |

| | Run 1 | Run 2 | Run 3 | Run 4 |
|---|---|---|---|---|
| Logging Date | | | | |
| Run Number | | | | |
| Depth Driller | | | | |
| Schlumberger Depth | | | | |
| Bottom Log Interval | | | | |
| Top Log Interval | | | | |
| Casing Driller Size @ Depth | @ | @ | @ | @ |
| Casing Schlumberger | | | | |
| Bit Size | | | | |
| Type Fluid In Hole | | | | |
| MUD Density / Viscosity | | | | |
| MUD Fluid Loss / PH | | | | |
| MUD Source Of Sample | | | | |
| RM @ Measured Temperature | @ | @ | @ | @ |
| RMF @ Measured Temperature | @ | @ | @ | @ |
| RMC @ Measured Temperature | @ | @ | @ | @ |
| Source RMF / RMC | | | | |
| RM @ MRT / RMF @ MRT | @ | @ | @ | @ |
| Maximum Recorded Temperatures | | | | |
| Circulation Stopped / Time | | | | |
| Logger On Bottom / Time | | | | |
| Unit Number / Location | | | | |
| Recorded By | | | | |
| Witnessed By | | | | |

ALL INTERPRETATIONS ARE OPINIONS BASED ON INFERENCES FROM ELECTRICAL OR OTHER MEASUREMENTS AND WE CANNOT, AND DO NOT GUARANTEE THE ACCURACY OR CORRECTNESS OF ANY INTERPRETATIONS, AND WE SHALL NOT, EXCEPT IN THE CASE OF GROSS OR WILLFUL NEGLIGENCE ON OUR PART, BE LIABLE OR RESPONSIBLE FOR ANY LOSS, COSTS, DAMAGES OR EXPENSES INCURRED OR SUSTAINED BY ANYONE RESULTING FROM ANY INTERPRETATION MADE BY ANY OF OUR OFFICERS, AGENTS OR EMPLOYEES. THESE INTERPRETATIONS ARE ALSO SUBJECT TO CLAUSE 4 OF OUR GENERAL TERMS AND CONDITIONS AS SET OUT IN OUR CURRENT PRICE SCHEDULE.

OTHER SERVICES1
OS1: BHC SONIC
OS2:
OS3:
OS4:
OS5:

OTHER SERVICES2
OS1:
OS2:
OS3:
OS4:
OS5:

REMARKS: RUN NUMBER 1
SONIC-INDUCTION COMBINATION
DISALLOWED SP, TOO NOISY
CME-Z CENTRALIZERS USED ON SONIC
38 MM STANDOFFSU USED ON DITE
CEMENT VOL BASED ON 244.5 MM INTERMEDIATE CASING

REMARKS: RUN NUMBER 2

| RUN 1 | | | RUN 2 | | |
|---|---|---|---|---|---|
| SERVICE ORDER #: | 1210883 | | SERVICE ORDER #: | | |
| PROGRAM VERSION: | 8C0-609 | | PROGRAM VERSION: | | |
| FLUID LEVEL: | | | FLUID LEVEL: | | |
| LOGGED INTERVAL | START | STOP | LOGGED INTERVAL | START | STOP |

# EQUIPMENT DESCRIPTION

RUN 1 | RUN 2

SURFACE EQUIPMENT

STM-C
GSR-U/Y
TCM-AB

DOWNHOLE EQUIPMENT

TCC-B (ECH-KC, TCC-B) — TelStatus, CTEM — 22.53 — 23.44
SGT-L (SGH-K, SGC-SA, SGD-TAA) — Gamma Ray — 22.25 — 22.53
SDT-C (SDC-C3, ECH-KR, SLS-WA) — U-N, U-F VDL — 15.82, 15.52; L-F, L-N — 14.68, 14.38 — 20.85
PCD-B (PCM-A, PCH-A, PCC-H) — PCDB Data — 11.66 — 13.34
AH-107 (AH-107) — 10.74
AH-107 (AH-107) — 10.13
DIT-E (DIC-EB, MIH-ZA, DIS-HB) — 9.52 — SP 3.15; Deep Ind 2.90; Aux Meas SFL 1.98; Med Ind 1.83; PCDB Stat HV, Status, Tension 0.00

TOOL ZERO

MAXIMUM STRING DIAMETER 148 MM
MEASUREMENTS RELATIVE TO TOOL ZERO
ALL LENGTHS IN METERS

## Input DLIS Files

DEFAULT DITE .011 FN:9 FIELD 05-Mar-1998 12:33 600.2 M 47.0 M

## Output DLIS Files

DEFAULT DITE .015 FN:13 FIELD 05-Mar-1998 14:46 600.2 M 47.1 M

## OP System Version: 8C0-609

MCM

| | | | |
|---|---|---|---|
| DIT-E | 8C0-609 | PCD-B | 8C0-609 |
| SDT-C | 8C0-609 | SGT-L | 8C0-609 |
| TCC-B | 8C0-609 | | |

PIP SUMMARY

Time Mark Every 60 S

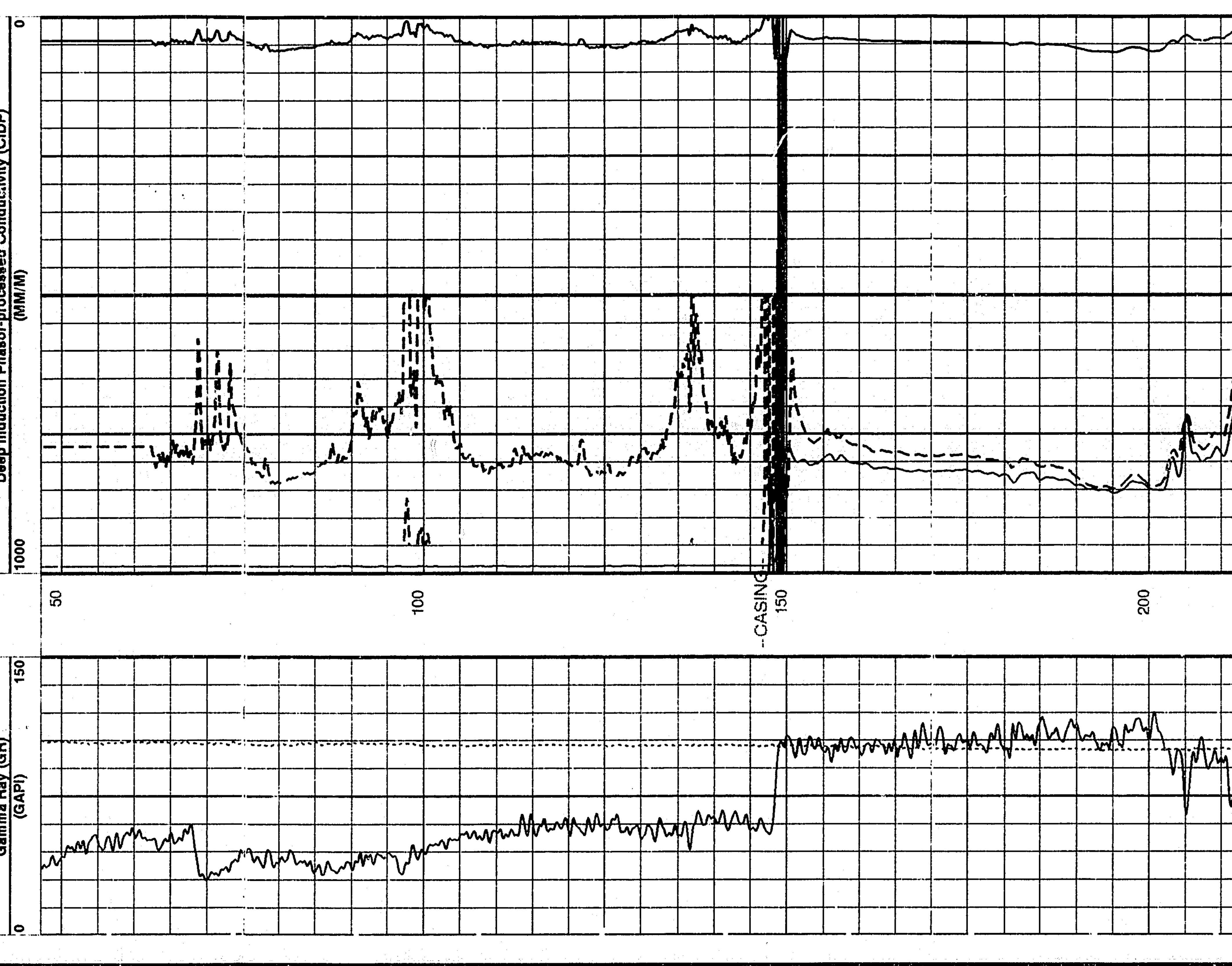
Tension (TENS) (LBF) 4000 — 0

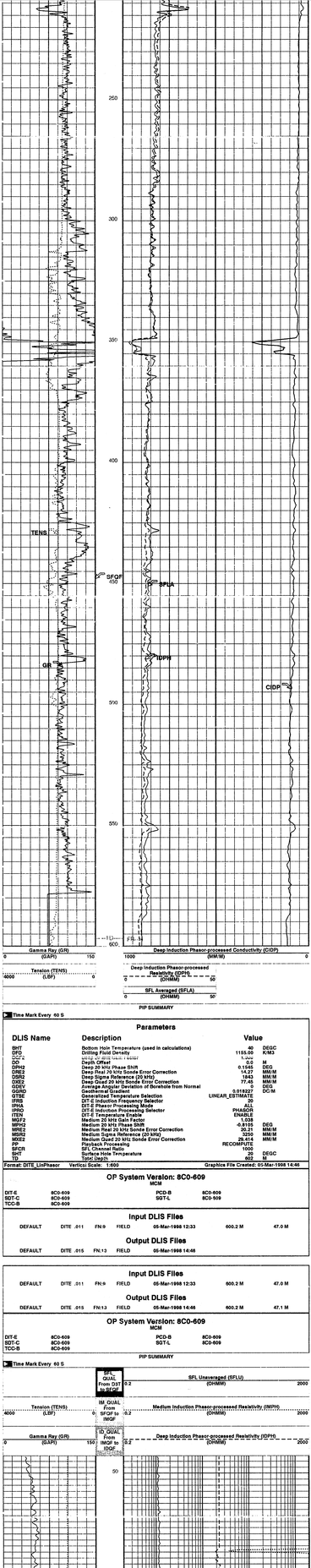
Gamma Ray (GR) (GAPI) 0 — 150

SFL Averaged (SFLA) (OHMM) 0 — 50

Deep Induction Phasor-processed Resistivity (IDPH) (OHMM) 0 — 50

Deep Induction Phasor-processed Conductivity (CIDP) (MM/M) 1000 — 0






Gamma Ray (GR) (GAPI) 0 150

Tension (TENS) (LBF) 4000 0

Deep Induction Phasor-processed Conductivity (CIDP) (MMHO) 1000 0

Deep Induction Phasor-processed Resistivity (IDPH) (OHMM) 0 60

SFL Averaged (SFLA) (OHMM) 0 50

PIP SUMMARY

Time Mark Every 60 S

## Parameters

| DLIS Name | Description | Value | |
|---|---|---|---|
| BHT | Bottom Hole Temperature (used in calculations) | 40 | DEGC |
| DFD | Drilling Fluid Density | 1155.05 | K/M3 |
| DFV | Drilling Fluid Viscosity | 1.000 | |
| DO | Depth Offset | 0.0 | M |
| DPH2 | Deep 20 kHz Phase Shift | 0.1546 | DEG |
| DRE2 | Deep Real 20 kHz Sonde Error Correction | 14.47 | MM/M |
| DRE4 | Deep Quad 20 kHz Sonde Error Correction | 1.127 | MM/M |
| DXE2 | Deep Quad 20 kHz Sonde Error Correction | 77.45 | MM/M |
| GDEV | Average Angular Deviation of Borehole from Normal | 0 | DEG |
| GDRO | Geothermal Gradient | 0.018227 | DC/M |
| GTSE | Generated Temperature Selection | LINEAR_ESTIMATE | |
| IPRE | DIT-E Induction Frequency Selector | 20 | |
| IPRM | DIT-E Induction Processing Mode | PASS | |
| IPRO | DIT-E Induction Processing Selector | PHASOR | |
| ITEN | DIT-E Temperature Enable | ENABLE | |
| MST2 | Medium 20 kHz Gain Factor | 1.038 | |
| MPH2 | Medium 20 kHz Phase Shift | -0.8105 | DEG |
| MRE2 | Medium Real 20 kHz Sonde Error Correction | 29.41 | MM/M |
| MSR2 | Medium Sigma Reference (20 kHz) | 3200 | MM/M |
| MXE2 | Medium Quad 20 kHz Sonde Error Correction | 29.414 | MM/M |
| PP | Playback Processing | RECOMPUTE | |
| SFCR | SFL Channel Radio | 1000 | |
| TEMP | Sonde Temperature | 40 | DEGC |
| TD | Total Depth | 602 | M |

Format: DITE_LisPhasor Vertical Scale: 1:600 Graphics File Created: 05-Mar-1998 14:46

## OP System Version: 8C0-609

MCM

| | | | |
|---|---|---|---|
| DIT-E | 8C0-609 | PCD-B | 8C0-609 |
| SDT-C | 8C0-609 | SGT-L | 8C0-609 |
| TCC-B | 8C0-609 | | |

## Input DLIS Files

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DEFAULT | DITE .011 | FN:9 | FIELD | 05-Mar-1998 12:33 | 600.2 M | 47.0 M |

## Output DLIS Files

| | | | | | | |
|---|---|---|---|---|---|---|
| DEFAULT | DITE .015 | FN:13 | FIELD | 05-Mar-1998 14:46 | | |

## Input DLIS Files

| | | | | | | |
|---|---|---|---|---|---|---|
| DEFAULT | DITE .011 | FN:9 | FIELD | 05-Mar-1998 12:33 | 600.2 M | 47.0 M |

## Output DLIS Files

| | | | | | | |
|---|---|---|---|---|---|---|
| DEFAULT | DITE .015 | FN:13 | FIELD | 05-Mar-1998 14:46 | 600.2 M | 47.1 M |

## OP System Version: 8C0-609

MCM

| | | | |
|---|---|---|---|
| DIT-E | 8C0-609 | PCD-B | 8C0-609 |
| SDT-C | 8C0-609 | SGT-L | 8C0-609 |
| TCC-B | 8C0-609 | | |

PIP SUMMARY

Time Mark Every 60 S

SFL QUAL From DIT to SFQF

SFL Unaveraged (SFLU) (OHMM) 0.2 2000

Tension (TENS) (LBF) 4000 0

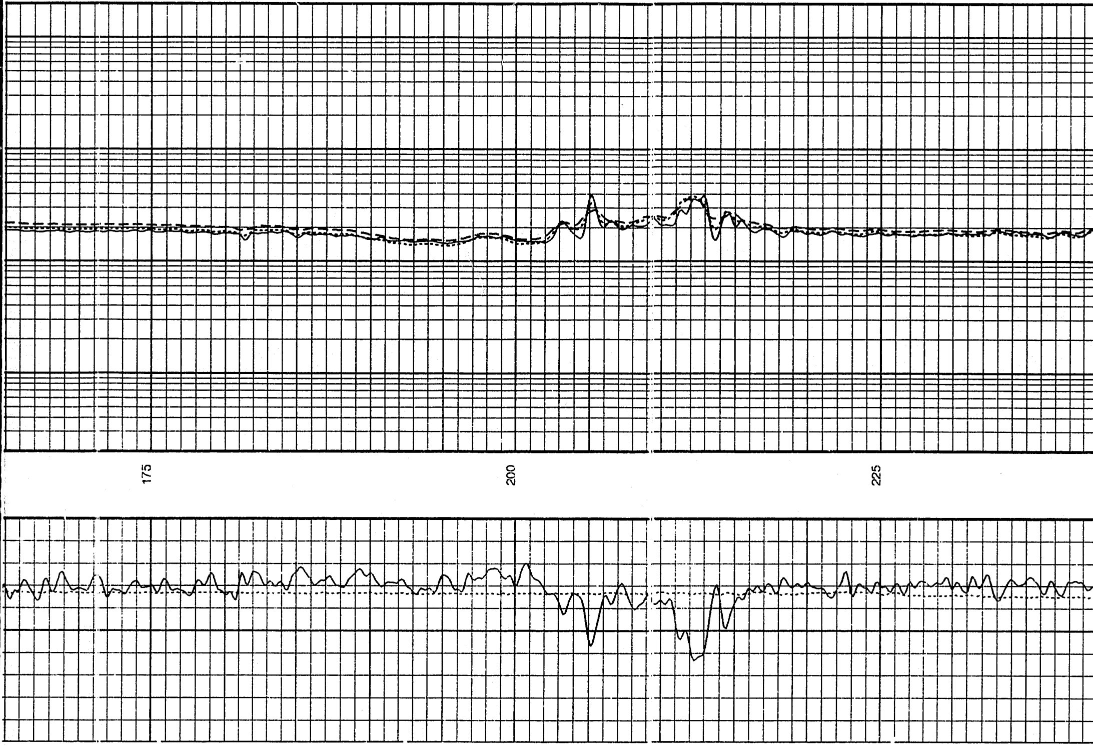
IM QUAL From SFQF to IMQF

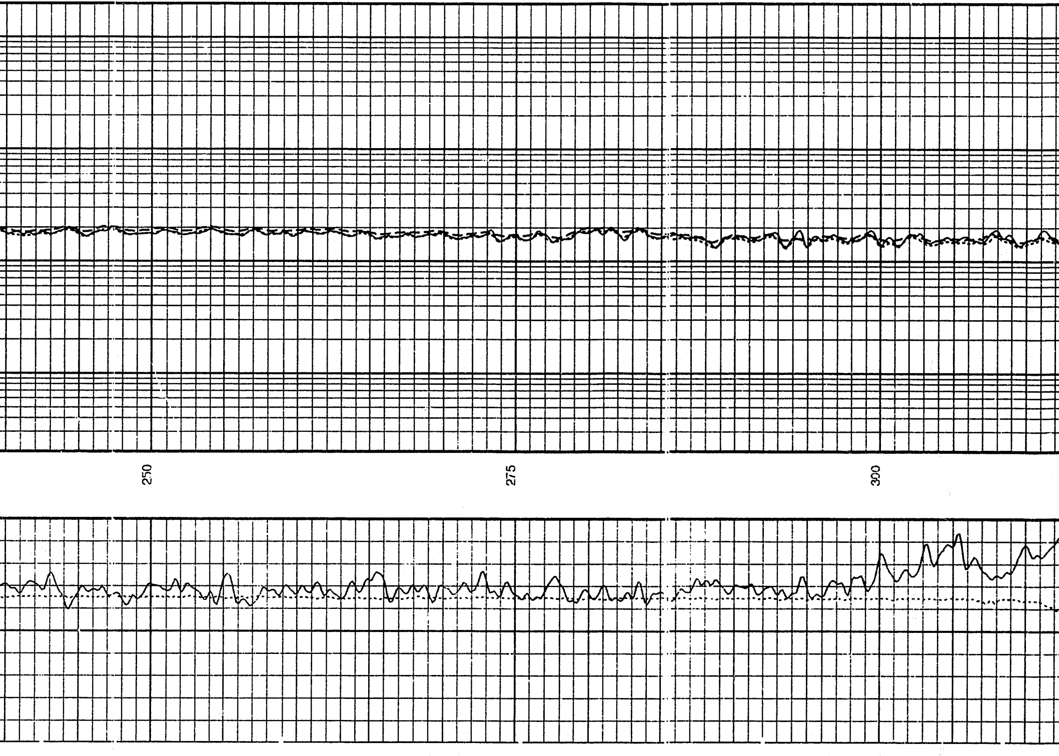
Medium Induction Phasor-processed Resistivity (IMPH) (OHMM) 0.2 2000

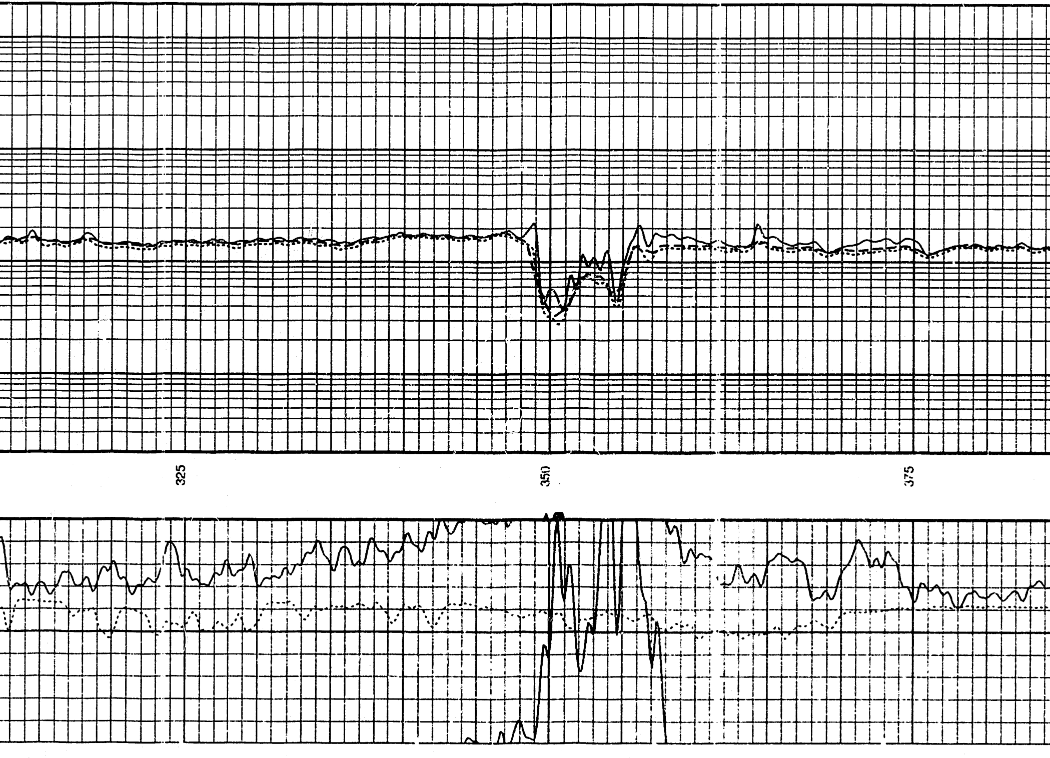
ID QUAL From IMQF to IDQF

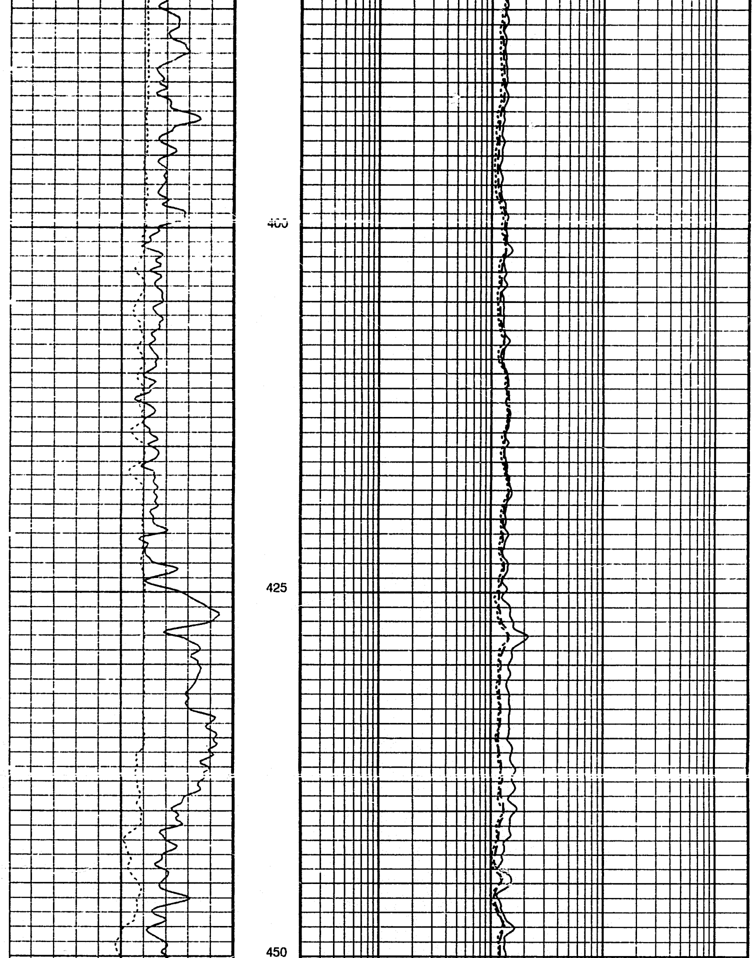
Gamma Ray (GR) (GAPI) 0 150

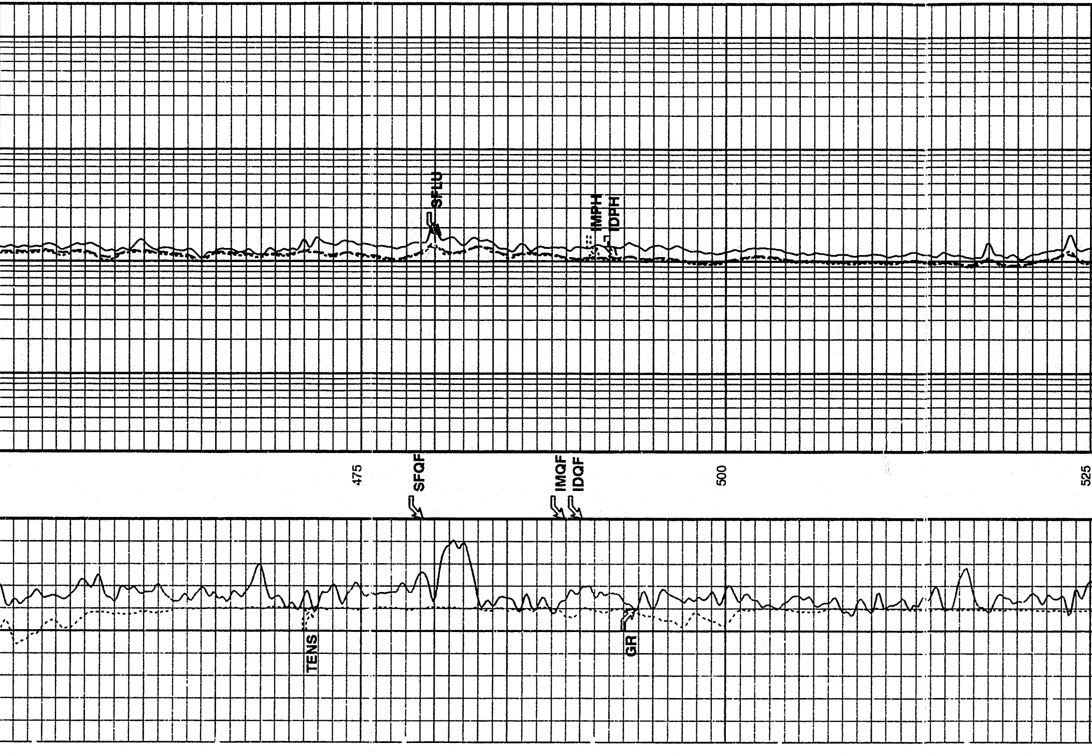
Deep Induction Phasor-processed Resistivity (IDPH) (OHMM) 0.2 2000

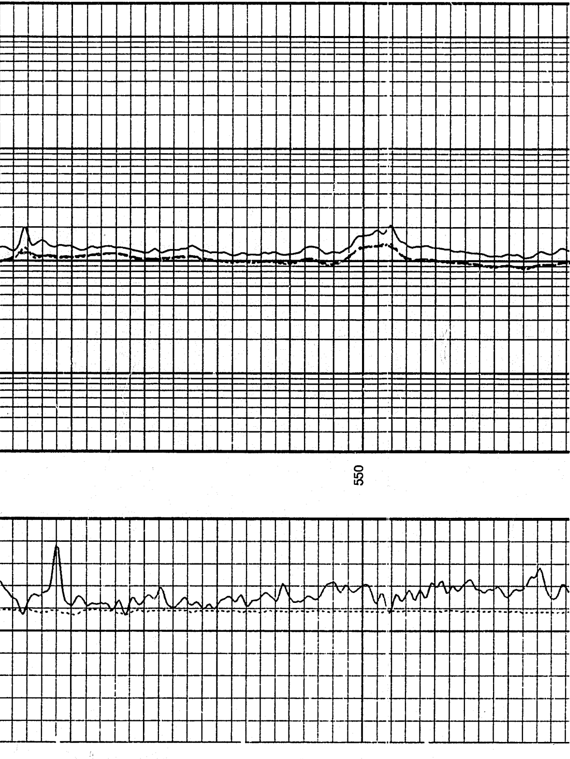

175
200
225

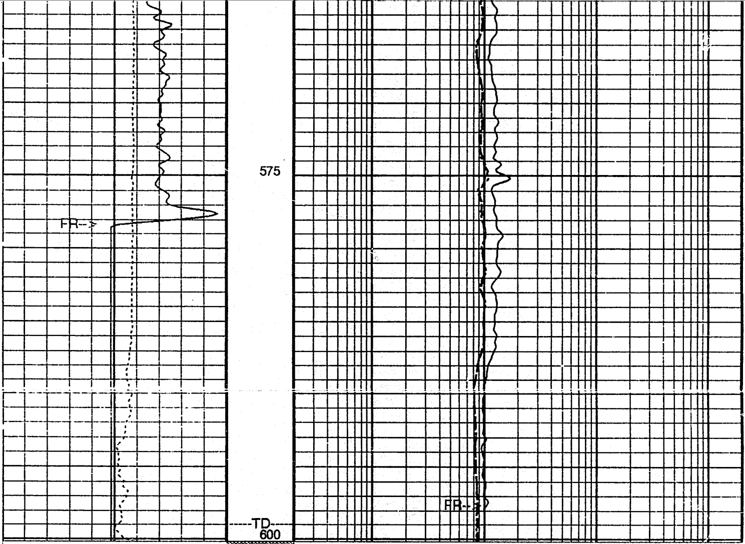

250
275
300


325
350
375


400
425
450


SFLU
IMPH
IDPH
475
SFQF
IMQF
IDQF
500
525
TENS
GR


550



Gamma Ray (GR) 0 (GAPI) 150	ID_QUAL From IMQF to IDQF	Deep Induction Phasor-processed Resistivity (IDPH) 0.2 (OHMM) 2000
Tension (TENS) 4000 (LBF) 0	IM_QUAL From SFQF to IMQF	Medium Induction Phasor-processed Resistivity (IMPH) 0.2 (OHMM) 2000
	SFL_ QUAL From D3T to SFQF	SFL Unaveraged (SFLU) 0.2 (OHMM) 2000

PIP SUMMARY

Time Mark Every 60 S

Parameters

DLIS Name	Description	Value	
BHT	Bottom Hole Temperature (used in calculations)	40	DEGC
DFD	Drilling Fluid Density	1155.00	K/M3
DGF2	Deep 20 kHz Gain Factor	1.008	
DO	Depth Offset	0.0	M
DPH2	Deep 20 kHz Phase Shift	0.1545	DEG
DRE2	Deep Real 20 kHz Sonde Error Correction	14.27	MM/M
DSR2	Deep Sigma Reference (20 kHz)	1843	MM/M
DXE2	Deep Quad 20 kHz Sonde Error Correction	77.45	MM/M
GDEV	Average Angular Deviation of Borehole from Normal	0	DEG
GGRD	Geothermal Gradient	0.018227	DC/M
GTSE	Generalized Temperature Selection	LINEAR_ESTIMATE	
IFRS	DIT-E Induction Frequency Selector	20	
IPHA	DIT-E Phasor Processing Mode	ALL	
IPRO	DIT-E Induction Processing Selector	PHASOR	
ITEN	DIT-E Temperature Enable	ENABLE	
MGF2	Medium 20 kHz Gain Factor	1.038	
MPH2	Medium 20 kHz Phase Shift	-0.8105	DEG
MRE2	Medium Real 20 kHz Sonde Error Correction	20.21	MM/M
MSR2	Medium Sigma Reference (20 kHz)	3250	MM/M
MXE2	Medium Quad 20 kHz Sonde Error Correction	29.414	MM/M
PP	Playback Processing	RECOMPUTE	
SFCR	SFL Channel Ratio	1000	
SHT	Surface Hole Temperature	20	DEGC
TD	Total Depth	602	M

Format: DITE_LogPhasor Vertical Scale: 1:240 Graphics File Created: 05-Mar-1998 14:46

OP System Version: 8C0-609
MCM

DIT-E	8C0-609	PCD-B	8C0-609
SDT-C	8C0-609	SGT-L	8C0-609
TCC-B	8C0-609		

Input DLIS Files

DEFAULT	DITE .011	FN:9	FIELD	05-Mar-1998 12:33	600.2 M	47.0 M

Output DLIS Files

DEFAULT	DITE .015	FN:13	FIELD	05-Mar-1998 14:46		

Input DLIS Files

DEFAULT	DITE .010	FN:8	FIELD	05-Mar-1998 12:20	599.8 M	504.9 M

Output DLIS Files

DEFAULT	DITE .012	FN:10	FIELD	05-Mar-1998 14:35	599.8 M	504.9 M

OP System Version: 8C0-609
MCM

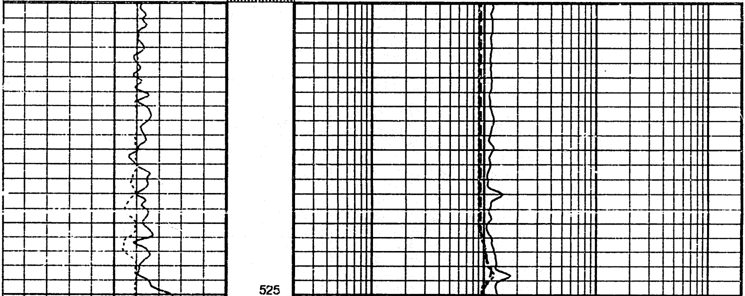
DIT-E	8C0-609	PCD-B	8C0-609
SDT-C	8C0-609	SGT-L	8C0-609
TCC-B	8C0-609		

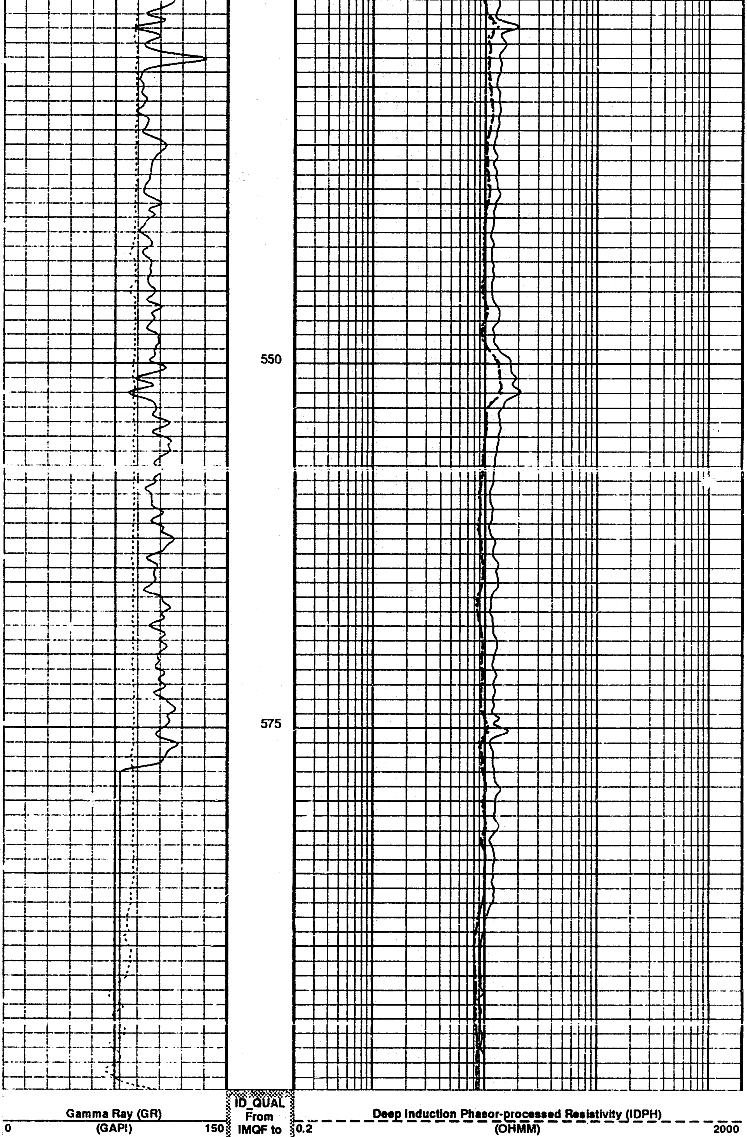
PIP SUMMARY

REPEAT SECTION

Time Mark Every 60 S

	SFL_QUAL From D3T to SFQF	SFL Unaveraged (SFLU) 0.2 (OHMM) 2000
Tension (TENS) 4000 (LBF) 0	IM_QUAL From SFQF to IMQF	Medium Induction Phasor-processed Resistivity (IMPH) 0.2 (OHMM) 2000
Gamma Ray (GR) 0 (GAPI) 150	ID_QUAL From IMQF to IDQF	Deep Induction Phasor-processed Resistivity (IDPH) 0.2 (OHMM) 2000





Tension (TENS) (LBF)	IDQF	Medium Induction Phasor-processed Resistivity (IMPH) (OHMM)
4000 … 0	IM_QUAL From SFQF to IMQF	0.2 … 2000
	SFL_ QUAL From D3T to SFQF	SFL Unaveraged (SFLU) (OHMM) 0.2 … 2000

PIP SUMMARY

REPEAT SECTION

Time Mark Every 60 S

Parameters

DLIS Name	Description	Value	
BHT	Bottom Hole Temperature (used in calculations)	40	DEGC
DFD	Drilling Fluid Density	1155.00	K/M3
DGF2	Deep 20 kHz Gain Factor	1.008	
DO	Depth Offset	0.0	M
DPH2	Deep 20 kHz Phase Shift	0.1545	DEG
DRE2	Deep Real 20 kHz Sonde Error Correction	14.27	MM/M
DSR2	Deep Sigma Reference (20 kHz)	1843	MM/M
DXE2	Deep Quad 20 kHz Sonde Error Correction	77.45	MM/M
GDEV	Average Angular Deviation of Borehole from Normal	0	DEG
GGRD	Geothermal Gradient	0.018227	DC/M
GTSE	Generalized Temperature Selection	LINEAR_ESTIMATE	
IFRS	DIT-E Induction Frequency Selector	20	
IPHA	DIT-E Phasor Processing Mode	ALL	
IPRO	DIT-E Induction Processing Selector	PHASOR	
ITEN	DIT-E Temperature Enable	ENABLE	
MGF2	Medium 20 kHz Gain Factor	1.038	
MPH2	Medium 20 kHz Phase Shift	-0.8105	DEG
MRE2	Medium Real 20 kHz Sonde Error Correction	20.21	MM/M
MSR2	Medium Sigma Reference (20 kHz)	3250	MM/M
MXE2	Medium Quad 20 kHz Sonde Error Correction	29.414	MM/M
PP	Playback Processing	NORMAL	
SFCR	SFL Channel Ratio	1000	
SHT	Surface Hole Temperature	20	DEGC
TD	Total Depth	602	M

Format: DITE_LogPhasor   Vertical Scale: 1:240   Graphics File Created: 05-Mar-1998 14:35

OP System Version: 8C0-609

MCM

DIT-E	8C0-609	PCD-B	8C0-609
SDT-C	8C0-609	SGT-L	8C0-609
TCC-B	8C0-609		

Input DLIS Files

DEFAULT	DITE .010	FN:8	FIELD	05-Mar-1998 12:20	599.8 M	504.9 M

Output DLIS Files

DEFAULT	DITE .012	FN:10	FIELD	05-Mar-1998 14:35

Calibration and Check Summary

Measurement	Nominal	Master	Before	After	Change	Limit	Units
Powered Caliper Device - B Wellsite Calibration - Large Arm Calibration Before: Mar 05 11:04 1998							
Large Arm Small Ring	203.2	N/A	182.1	N/A	N/A	N/A	MM
Large Arm Large Ring	304.8	N/A	281.3	N/A	N/A	N/A	MM
Powered Caliper Device - B Wellsite Calibration - Small Arm Calibration Before: Calibration not done							
Small Arm Small Gauge	25.40	N/A	N/A	N/A	N/A	N/A	MM
Small Arm Large Gauge	127.0	N/A	N/A	N/A	N/A	N/A	MM
Powered Caliper Device - B Wellsite Calibration - Micro Inverse Calibration Before: Calibration not done After: Calibration not done							
Micro Inverse Zero	0	N/A	N/A	N/A	N/A	0.1000	OHMM
Micro Inverse Plus	5.000	N/A	N/A	N/A	N/A	0.2000	OHMM
Powered Caliper Device - B Wellsite Calibration - Micro Normal Calibration Before: Calibration not done After: Calibration not done							
Micro Normal Zero	0	N/A	N/A	N/A	N/A	0.1000	OHMM
Micro Normal Plus	5.000	N/A	N/A	N/A	N/A	0.2000	OHMM

Scintillation Gamma-Ray - L Wellsite Calibration - Detector Calibration
Before: Mar 05 11:00 1998 After: Calibration not done

Gamma Ray Background	30.00	N/A	11.00	N/A	N/A	N/A	GAPI
Gamma Ray (Jig - Bkg)	159.1	N/A	159.1	N/A	N/A	14.46	GAPI
Gamma Ray (Calibrated)	165.0	N/A	165.0	N/A	N/A	15.00	GAPI

Dual Induction - E / Equipment Identification

Primary Equipment:	
Dual Induction Sonde	DIS - HB
Dual Induction Cartridge	DIC - EB
Auxiliary Equipment:	
Mass Isolated Housing	MIH - ZA

Dual Induction - E Wellsite Calibration

Induction Electronics (10 kHz)

Phase	ID Elect Real Offset 10 kHz MM/M	Value	Phase	ID Elect Real Gain 10 kHz	Value	Phase	ID Elect Phase 10 kHz DEG	Value
Before		25.12	Before		0.9454	Before		7.311
	-300.0 (Minimum) 0 (Nominal) 300.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)			-10.00 (Minimum) 0 (Nominal) 10.00 (Maximum)	
Phase	ID Elect Quad Offset 10 kHz MM/M	Value	Phase	ID Elect Quad Gain 10 kHz	Value	Phase	IM Elect Phase 10 kHz DEG	Value
Before		33.44	Before		0.9550	Before	EXCEEDS LIMIT	10.09
	-300.0 (Minimum) 0 (Nominal) 300.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)			-10.00 (Minimum) 0 (Nominal) 10.00 (Maximum)	
Phase	IM Elect Real Offset 10 kHz MM/M	Value	Phase	IM Elect Real Gain 10 kHz	Value			
Before		[illegible]	Before		0.8900			
	-550.0 (Minimum) 0 (Nominal) 550.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)				
Phase	IM Elect Quad Offset 10 kHz MM/M	Value	Phase	IM Elect Quad Gain 10 kHz	Value			
Before		85.92	Before		0.9214			
	-550.0 (Minimum) 0 (Nominal) 550.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)				

Before: Mar 05 11:26 1998

Dual Induction - E Wellsite Calibration

Induction Electronics (20 kHz)

Phase	ID Elect Real Offset 20 kHz MM/M	Value	Phase	ID Elect Real Gain 20 kHz	Value	Phase	ID Elect Phase 20 kHz DEG	Value
Before		9.918	Before		0.9477	Before		-2.870
	-125.0 (Minimum) 0 (Nominal) 125.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)			-15.00 (Minimum) 0 (Nominal) 15.00 (Maximum)	
Phase	ID Elect Quad Offset 20 kHz MM/M	Value	Phase	ID Elect Quad Gain 20 kHz	Value	Phase	IM Elect Phase 20 kHz DEG	Value
Before		13.29	Before		0.9572	Before		0.7746
	-125.0 (Minimum) 0 (Nominal) 125.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)			-15.00 (Minimum) 0 (Nominal) 15.00 (Maximum)	
Phase	IM Elect Real Offset 20 kHz MM/M	Value	Phase	IM Elect Real Gain 20 kHz	Value			
Before		15.18	Before		0.9384			
	-225.0 (Minimum) 0 (Nominal) 225.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)				
Phase	IM Elect Quad Offset 20 kHz MM/M	Value	Phase	IM Elect Quad Gain 20 kHz	Value			
Before		35.29	Before		0.9618			
	-225.0 (Minimum) 0 (Nominal) 225.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)				

Before: Mar 05 11:27 1998

Dual Induction - E Wellsite Calibration

Induction Electronics (40 kHz)

Phase	ID Elect Real Offset 40 kHz MM/M	Value	Phase	ID Elect Real Gain 40 kHz	Value	Phase	ID Elect Phase 40 kHz DEG	Value
Before		6.575	Before		0.9243	Before		7.920
	-85.00 (Minimum) 0 (Nominal) 85.00 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)			-20.00 (Minimum) 0 (Nominal) 20.00 (Maximum)	
Phase	ID Elect Quad Offset 40 kHz MM/M	Value	Phase	ID Elect Quad Gain 40 kHz	Value	Phase	IM Elect Phase 40 kHz DEG	Value
Before		8.863	Before		0.9330	Before		11.01
	-85.00 (Minimum) 0 (Nominal) 85.00 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)			-20.00 (Minimum) 0 (Nominal) 20.00 (Maximum)	
Phase	IM Elect Real Offset 40 kHz MM/M	Value	Phase	IM Elect Real Gain 40 kHz	Value			
Before		10.05	Before		0.9501			
	-130.0 (Minimum) 0 (Nominal) 130.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)				
Phase	IM Elect Quad Offset 40 kHz MM/M	Value	Phase	IM Elect Quad Gain 40 kHz	Value			
Before		23.31	Before		0.9735			
	-130.0 (Minimum) 0 (Nominal) 130.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)				

Before: Mar 05 11:28 1998

Dual Induction - E Wellsite Calibration

SFL Electronics

Phase	SFL Voltage Offset MV	Value	Phase	SFL Voltage Gain	Value
Before		1.345	Before		0.9956
	-15.00 (Minimum) 0 (Nominal) 15.00 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)	
Phase	SFL Current Offset MA	Value	Phase	SFL Current Gain	Value
Before		0.03893	Before		0.9922
	-0.6000 (Minimum) 0 (Nominal) 0.6000 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)	

Before: Mar 05 11:28 1998

Dual Induction - E Wellsite Calibration

Electronics Calibration Changes

0.0 - 0.0 1: 12192.0 - 12182.7 1: 221.9 - 576.2 10: 599.8 - 504.9 11: 600.2 - 47.1 13: 600.2 - 501.5 14: 600.2 - 47.1 15: 600.2 - 47.1 16 600.2 - 47.1

Phase	ID (R > 27 OHM-M) MM/M	Value	Phase	ID (R < 27 OHM-M) %	Value	Phase	SFL (R < 1 OHM-M) OHMM	Value
After		0.04107	After		0.0007527	After		0

| 0 (Minimum) | 0 (Nominal) | 0.7500 (Maximum) | 0 (Minimum) | 0 (Nominal) | 2.000 (Maximum) | 0 (Minimum) | 0 (Nominal) | 0.02000 (Maximum) |
|---|---|---|---|---|---|---|---|---|
| Phase | IM (R > 27 OHM-M) MM/M | Value | Phase | IM (R < 27 OHM-M) % | Value | | | |
| After | | 0.05302 | After | | 0.0008039 | | | |
| 0 (Minimum) | 0 (Nominal) | 0.7500 (Maximum) | 0 (Minimum) | 0 (Nominal) | 2.000 (Maximum) | | | |
| Phase | SFL (R > 27 OHM-M) MM/M | Value | Phase | SFL (R < 27 OHM-M) % | Value | | | |
| After | | 0.09265 | After | | 0.003516 | | | |
| 0 (Minimum) | 0 (Nominal) | 0.7500 (Maximum) | 0 (Minimum) | 0 (Nominal) | 2.000 (Maximum) | | | |

After: Mar 05 15:13 1998

## Powered Caliper Device - B / Equipment Identification

| | |
|---|---|
| Primary Equipment: | |
| Powered Caliper Cartridge - H | PCC - H |
| Powered Caliper Mechanical (sonde) - A | PCM - A |
| Auxiliary Equipment: | |
| Powered Caliper Housing - A | PCH - A |

### Powered Caliper Device - B Wellsite Calibration
#### Micro Inverse Calibration

| Phase | Micro Inverse Zero OHMM | Value | Phase | Micro Inverse Plus OHMM | Value |
|---|---|---|---|---|---|
| Before | NOT DONE | N/A | Before | NOT DONE | N/A |
| After | NOT DONE | N/A | After | NOT DONE | N/A |
| -1.000 (Minimum) | 0 (Nominal) | 1.000 (Maximum) | 4.250 (Minimum) | 5.000 (Nominal) | 5.750 (Maximum) |

Before: Calibration not done — After: Calibration not done

### Powered Caliper Device - B Wellsite Calibration
#### Micro Normal Calibration

| Phase | Micro Normal Zero OHMM | Value | Phase | Micro Normal Plus OHMM | Value |
|---|---|---|---|---|---|
| Before | NOT DONE | N/A | Before | NOT DONE | N/A |
| After | NOT DONE | N/A | After | NOT DONE | N/A |
| -1.000 (Minimum) | 0 (Nominal) | 1.000 (Maximum) | 4.250 (Minimum) | 5.000 (Nominal) | 5.750 (Maximum) |

Before: Calibration not done — After: Calibration not done

## Scintillation Gamma-Ray - L / Equipment Identification

| | |
|---|---|
| Primary Equipment: | |
| Scintillation Gamma Cartridge | SGC - SA |
| Scintillation Gamma Detector | SGD - TAA |
| Auxiliary Equipment: | |
| Scintillation Gamma Housing | SGH - K |
| Gamma Source Radioactive | GSR - U/Y |

### Scintillation Gamma-Ray - L Wellsite Calibration
#### Detector Calibration

| Phase | Gamma Ray Background GAPI | Value | Phase | Gamma Ray (Jig - Bkg) GAPI | Value | Phase | Gamma Ray (Calibrated) GAPI | Value |
|---|---|---|---|---|---|---|---|---|
| Before | | 11.00 | Before | | 159.1 | Before | | 165.0 |
| After | NOT DONE | N/A | After | NOT DONE | N/A | After | NOT DONE | N/A |
| 0 (Minimum) | 30.00 (Nominal) | 120.0 (Maximum) | 144.6 (Minimum) | 159.1 (Nominal) | 173.6 (Maximum) | 150.0 (Minimum) | 165.0 (Nominal) | 180.0 (Maximum) |

Before: Mar 05 11:00 1998 — After: Calibration not done

NATIONAL ENERGY BOARD
ENGINEERING BRANCH
MAR 13 1998

COMPANY: RANGER OIL LIMITED

WELL: RANGER ET AL LITTLE BEAR M-39

FIELD: LITTLE BEAR

TERRITORY: N.W.T.

| | |
|---|---|
| BOTTOM LOG INTERVAL | 595 M |
| SCHLUMBERGER DEPTH | 598.5 M |
| DEPTH DRILLER | 602.6 M |
| KELLY BUSHING | 259.22 M |
| DRILL FLOOR | 258.92 M |
| GROUND LEVEL | 253.87 M |

Schlumberger

# PHASOR INDUCTION SFL

N.E.B. COPY 1838

9211-R36-2-3

Schlumberger

PHASOR INDUCTION SFL

TERRITORY N.W.T.
FIELD LITTLE BEAR
LOCATION
WELL RANGER ET AL LITTLE BEAR M-39
COMPANY RANGER OIL LIMITED

COMPANY RANGER OIL LIMITED

WELL RANGER ET AL LITTLE BEAR M-39

FIELD LITTLE BEAR

TERRITORY N.W.T.

LOCATION 69-49-58-129

Other Services:
BHC-SONIC
LDT-CNT
LOGNET

API SERIAL NO.	**SECT.**	**TWP.**	**RANGE**

Permanent Datum	GROUND LEVEL	Elev.	253.9 M	**Elev.:** K.B.259.2 M
Log Measured From	KELLY BUSHING	5.4 M	**above Perm. Datum**	D.F.258.9 M
Drilling Measured From	KELLY BUSHING			G.L.253.9 M

Date	15-MARCH-1998			
Run No.	TWO			
Depth Driller	1550.0 M			
Depth Logger (Schl.)	1540.0 M			
Btm. Log Interval	1534.2 M			
Top Log Interval	601.0 M			
Casing-Driller	244.5 MM @ 602.6 M	@	@	
Casing-Logger	601.0 M			
Bit Size	311 MM @ 602.6 M	222 @ 1550.0 M	@	
Type Fluid in Hole	GEL CHEM			
Dens. / **Visc.**	1135. K/M3	77.0 S		
pH / **Fld. Loss**	9.0	8.0 C3		
Source of Sample	FLOWLINE			
Rm @ Meas. Temp.	4.850 OHMM @ 18.0 DEGC		@	
Rmf @ Meas. Temp.	4.810 OHMM @ 10.0 DEGC		@	
Rmc @ Meas. Temp.	3.390 OHMM @ 10.0 DEGC		@	
Source: Rmf / **Rmc**	PRESS	PRESS		
Rm @ BHT	2.299 OHMM @ 62.0 DEGC		@	
TIME **Circulation Ended**	09:00/14TH			
TIME **Logger on Bottom**	22:20/14TH			
Max. Rec. Temp.	62.0 DEGC			
Equip. / **Location**	8416	NORMAN WELLS		
Recorded By	G. MCISAAC			
Witnessed By	HENRI WENNEKERS			

The well name, location and borehole reference data were furnished by the customer.

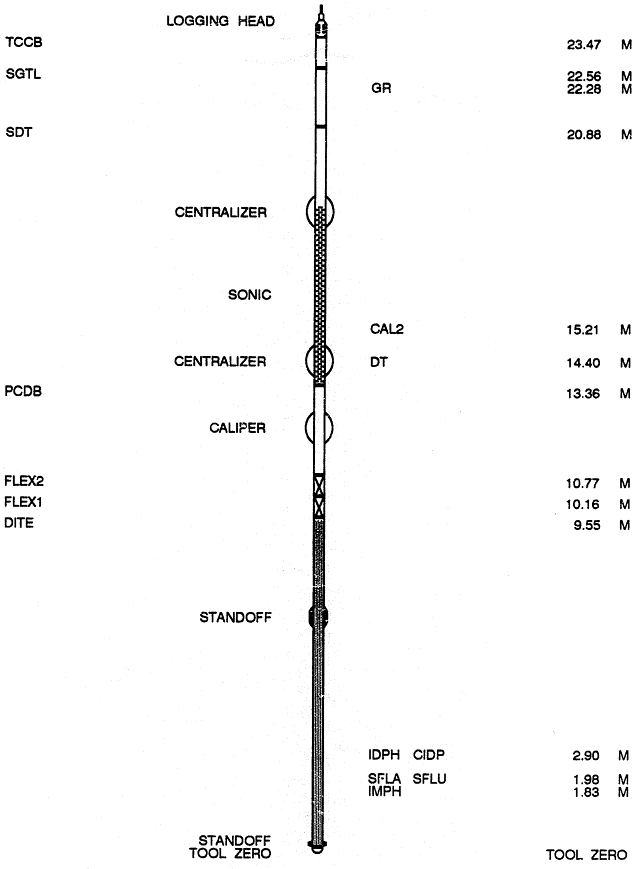
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretations made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.

Run No.	TWO	
Service Order No.	1210887	
Drilling Fluid Level		
Salinity		
Rmf @ BHT	1.821 OHMM @ 62.0 DEGC	@
Rmc @ BHT	1.283 OHMM @ 62.0 DEGC	@
Logging Speed	1000.0 M/HR	
EQUIPMENT DATA		
Tool Number 1	TCC-B 319	
Tool Number 2	SGC-SA 1048	
Tool Number 3	DAC-CA 1077	
Tool Number 4	SDC-CA 59	
Tool Number 5	SLS-WA 1483	
Tool Number 6	DIC-EB 83	
Tool Number 7	DIS-HC 81	
Tool Number 8		
Tool Number 9		
Tool Number 10		
Tool Number 11		
Tool Number 12		

REMARKS:

CORRELATED TO SCC DITE DATED 5-MARCH-1998
PHASOR - SONIC COMBINATION
38 MM STANDOFFS USED ON DITE
CME-Z CENTRALIZERS USED ON SONIC
CEMENT VOL BASED ON 177.8 MM PRODUCTION CASING

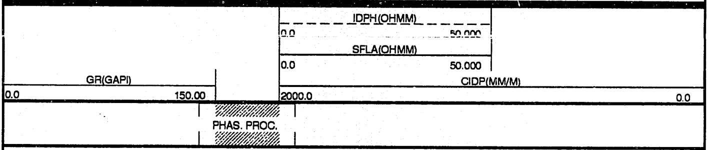
LOGGING TOOL STRING SKETCH


LOGGING HEAD
TCCB
23.47 M
SGTL
22.56 M
GR
22.28 M
SDT
20.88 M
CENTRALIZER
SONIC
CAL2
15.21 M
CENTRALIZER
DT
14.40 M
PCDB
13.36 M
CALIPER
FLEX2
10.77 M
FLEX1
10.16 M
DITE
9.55 M
STANDOFF
IDPH CIDP
2.90 M
SFLA SFLU
1.98 M
IMPH
1.83 M
STANDOFF
TOOL ZERO
TOOL ZERO

TOTAL TOOL STRING LENGTH IS 24.49 M.
TOTAL TOOL STRING WEIGHT IS 684.0 KG IN AIR.

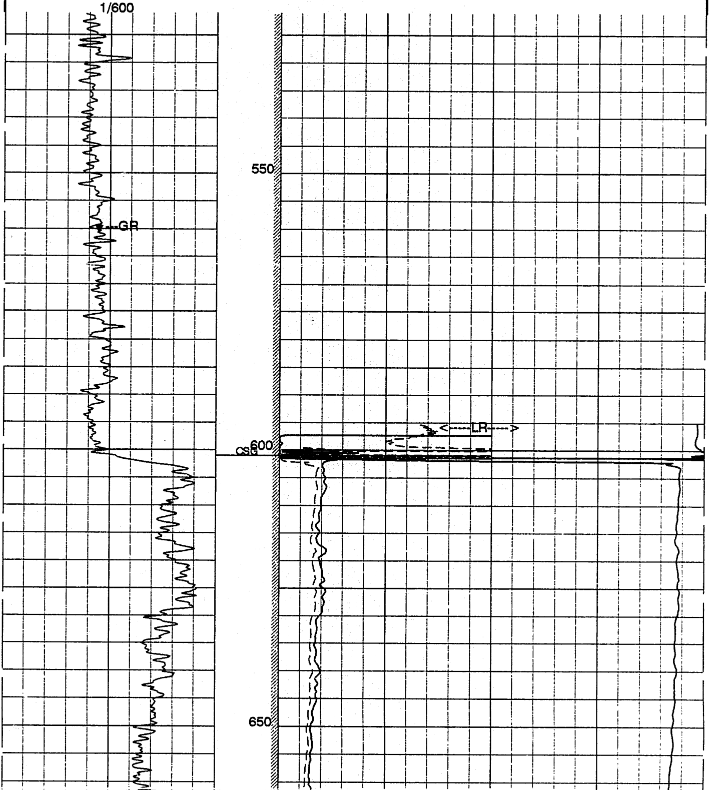
ACCUMULATED INTEGRATION VALUES SUMMARY:

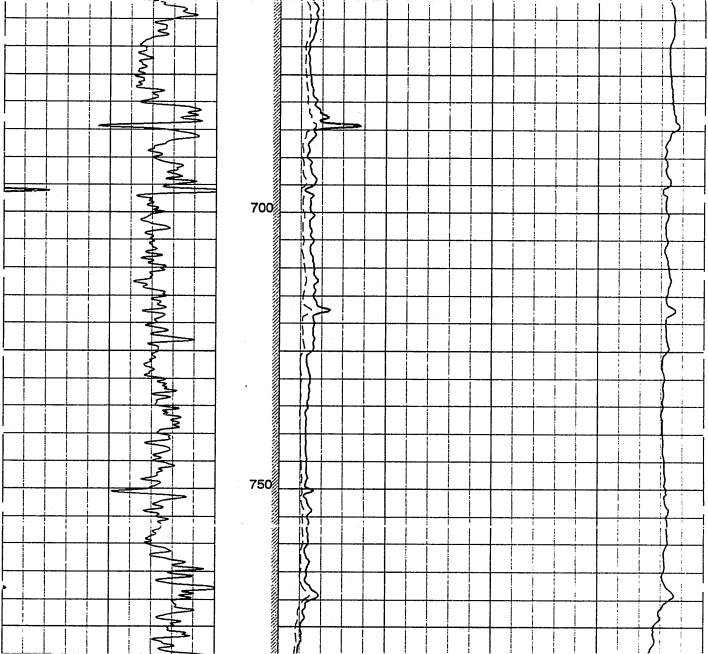
Integrated Hole Volume: 35.3095 M3 FROM 1537.40 M TO 601.000 M
Integrated Cement Volume: 12.0633 M3 FROM 1537.40 M TO 601.000 M
(ASSUMING 177.800 MM O.D. CASING)
Integrated Transit Time: .264305 S FROM 1537.40 M TO 601.000 M

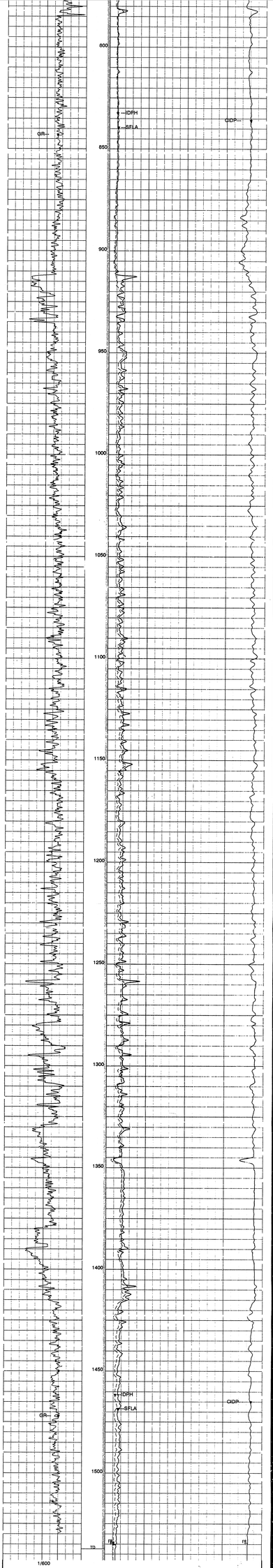

IDPH(OHMM)
0.0
50.000
SFLA(OHMM)
0.0
50.000
GR(GAPI)
0.0
150.00
CIDP(MM/M)
2000.0
0.0
PHAS. PROC.

CP 43.007 FILE 15 15-MAR-1998 05:55

INPUT FILE(S) CREATION DATE
12 15-MAR-1998 04:54
11 15-MAR-1998 04:05








CP 43.007 FILE 15 15-MAR-1998 05:32

INPUT FILE(S) CREATION DATE
12 15-MAR-1998 04:54
11 15-MAR-1998 04:05

PHAS PROC

IDPH(OHMM)
0.0 50.000
SFLA(OHMM)
0.0 50.000
CIDP(MMHO)
2000.0 0.0
GR(GAPI)
0.0 150.00

PARAMETERS

| NAME | VALUE | UNIT | NAME | VALUE | UNIT |
|---|---|---|---|---|---|
| SMB | DISA | | VDLR | 2IN | |
| PP | NORM | | DO | 0.0 | M |
| DO2 | 0.0 | M | WMUD | 1135.00 | K/M3 |
| TD | 1537.40 | M | FCO | 177.800 | MM |
| IFRS | 20 | KHZ | SBR | 1.00000 | OHMM |
| MXE2 | 29.4100 | MM/M | DXE2 | 77.4500 | MM/M |
| MRE2 | 20.2100 | MM/M | DRE2 | 14.2700 | MM/M |
| MPH2 | -81.0500 | DEG | DPH2 | 1.54600 | DEG |
| MSF2 | 1.03600 | | DSF2 | 1.00800 | |
| DESF | DISA | | SFLE | ALLO | |
| DCAS | 601.000 | M | ITEN | ALLO | |
| DEVI | 0.0 | DEG | DBES | HI12 | |
| IPRO | PHAS | | IPHA | NORM | |
| TGCA | ALLO | | MODE | BHC | |
| DETE | E2 | | MGAI | 4000.00 | |
| AGC | ALLO | | SLEV | 5000.00 | MV |
| GAI | 40.0000 | | SFAF | 0.0 | DB/M |
| SGAD | ALLO | | SGW | 60 | US |
| NMSG | 180 | US | SGDT | 50 | US/F |
| DTCM | NORM | | SLC | C | |
| SLS | WA | | SPLE | 0 | IN |
| RATE | 15 | HZ | SOAP | AUTO | |

DDSL.0 US DSIN.10 US
DWCO 500 RMOD 8
WMOD BHC WIAC ALLO
WQOT 797.401 US/M WSAI 20.0000
ITTS DT SPSO DT
SPFS R-H DTM 189.727 US/M
SVS DT NCJT DSRV
GTSE TEMP SHT 5.00000 DEGC
BHT 58.0000 DEGC SPAE DISA
BS 222.000 MM BHS OPEN

ACCUMULATED INTEGRATION VALUES SUMMARY:

Integrated Hole Volume: 35.3095 M3 FROM 1537.40 M TO 601.000 M
Integrated Cement Volume: 12.0633 M3 FROM 1537.40 M TO 601.000 M
(ASSUMING 177.800 MM O.D. CASING)
Integrated Transit Time: 284305 S FROM 1537.40 M TO 601.000 M

SFQF
0.0 10.000
IMQF
0.0 10.000
IDQF
0.0 10.000
MTHCHWA
20000 2000.0
SFLUCHWA
20000 2000.0
ZDHCHWA
20000 2000.0
TENSW.IF1
4000.0 0.0
GRSDAPS
0.0 150.00
LD FLAG
ILM FLAG
SFL FLAG
PHAS. PROC.

CP 43.007 FILE 15 15-MAR-1998 05:55

INPUT FILE(S) CREATION DATE
12 15-MAR-1998 04:54
11 15-MAR-1998 04:05

1/240

525
550
TENS
GR
SFQF
IMQF
IDQF
575
600
CNS
LD
ILM
SFL
600
625
650
675
700
725
750
775
800
825
TENS
GR
SFQF
IMQF
IDQF
MPH
SFLU
ZDPH
850

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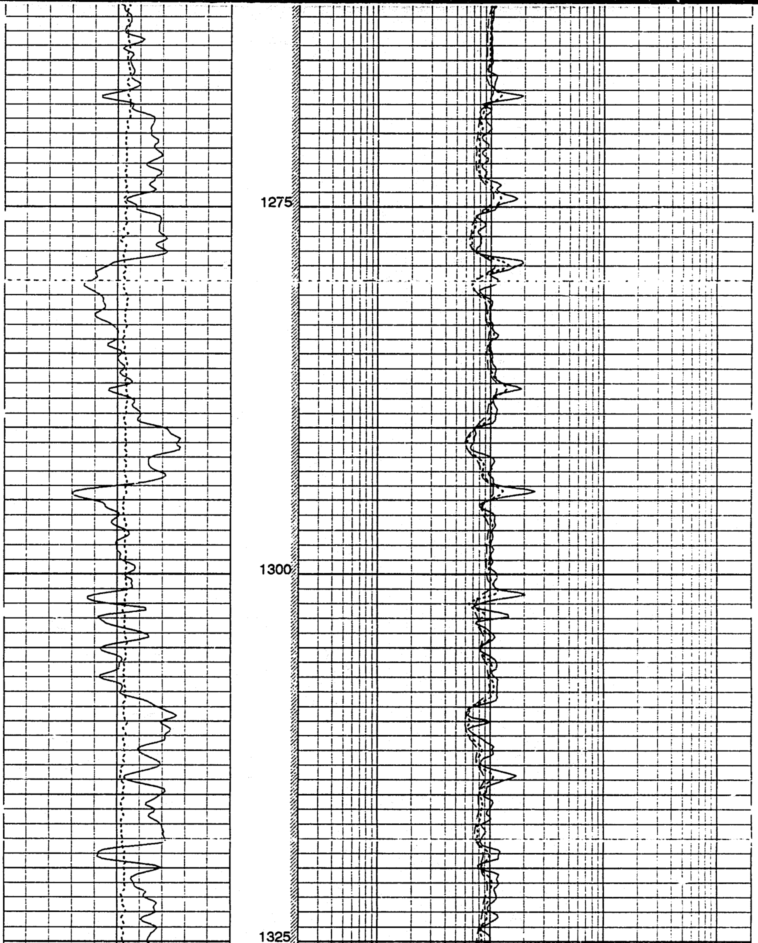
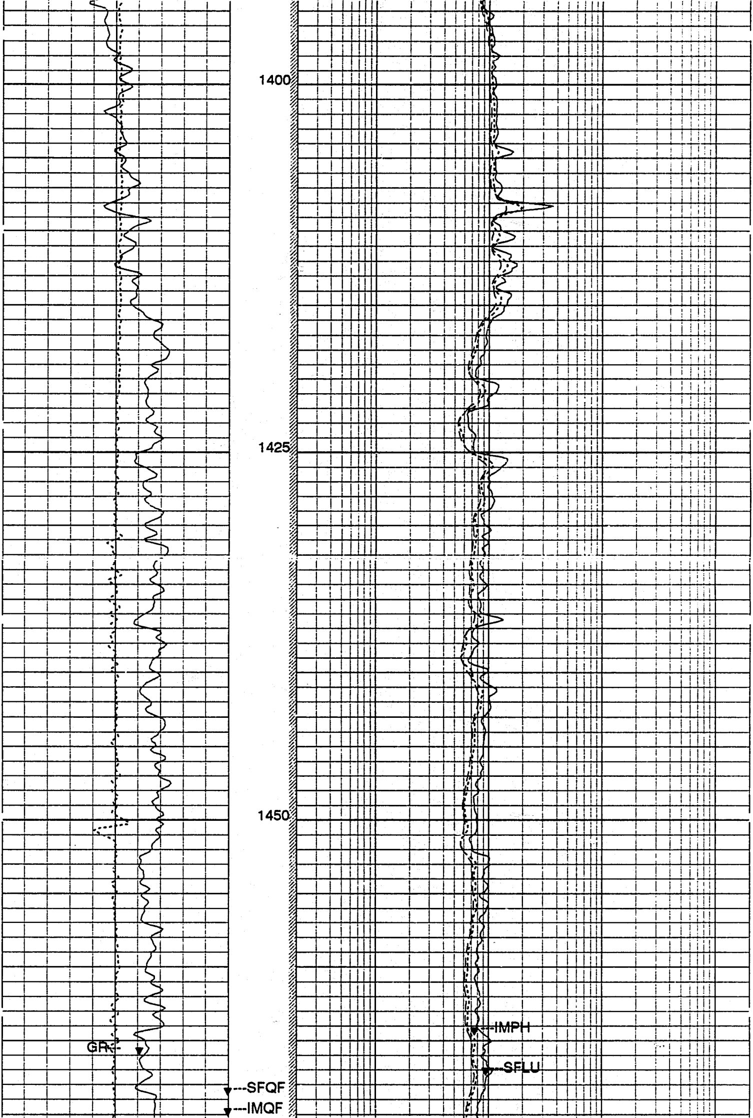
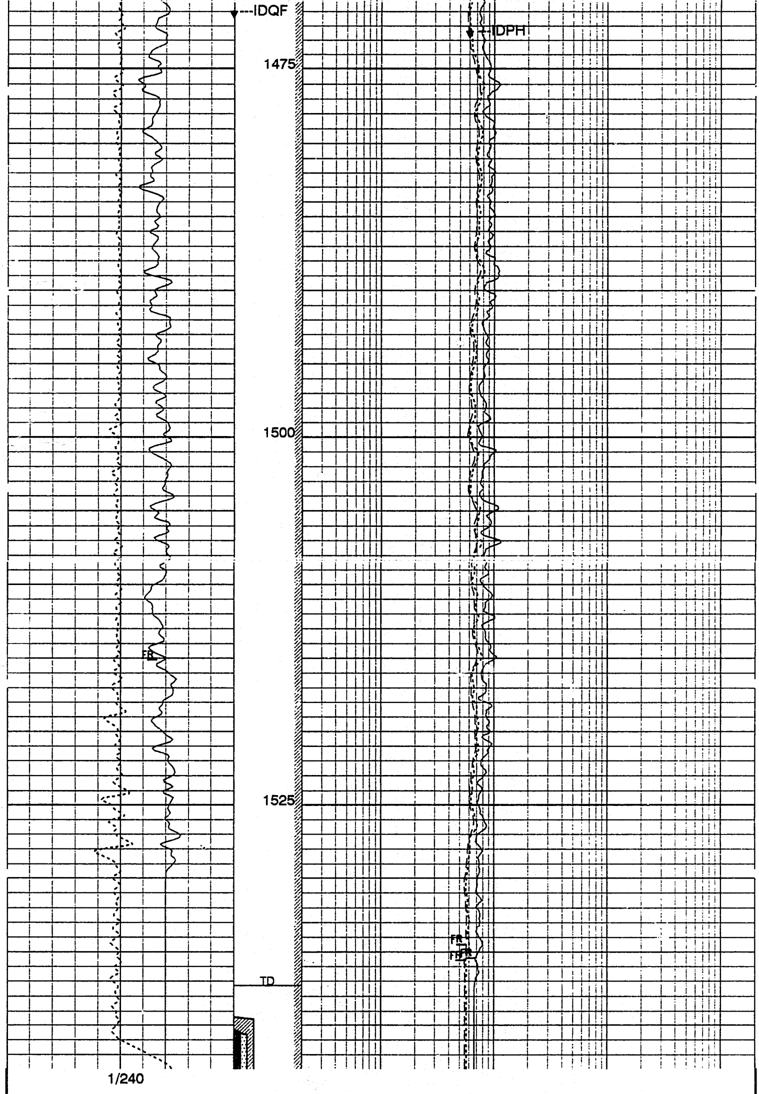
1175
1200
1225
1250


1275
1300
1325





```
CP 43.007       FILE  15     15-MAR-1998 05:32

          INPUT FILE(S)  CREATION DATE
               12        15-MAR-1998 04:54
               11        15-MAR-1998 04:05
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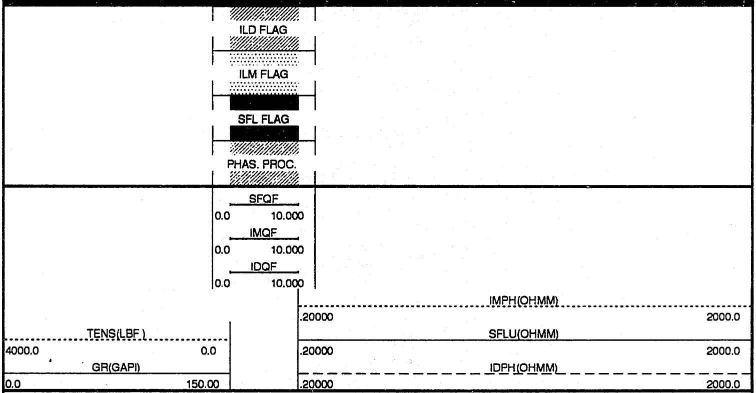
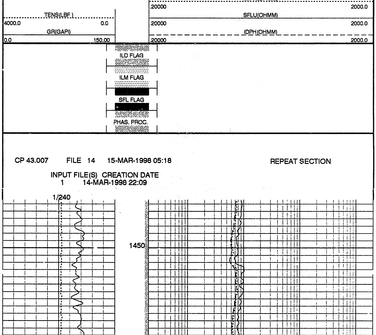
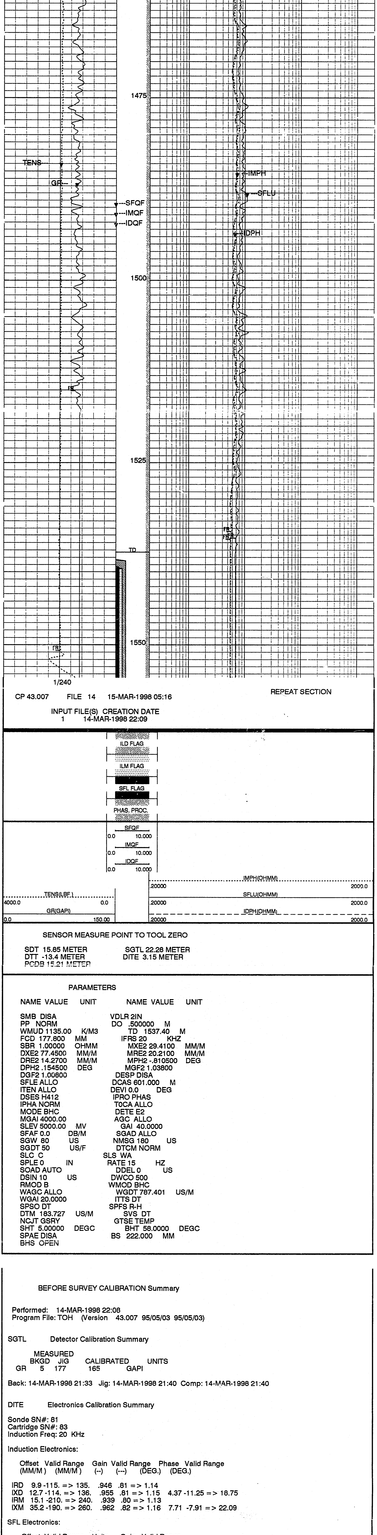

ILD FLAG
ILM FLAG
SFL FLAG
PHAS. PROC.
SFQF
0.0 10.000
IMQF
0.0 10.000
IDQF
0.0 10.000
IMPH(OHMM)
.20000 2000.0
TENS(LBF)
4000.0 0.0
SFLU(OHMM)
.20000 2000.0
GR(GAPI)
0.0 150.00
IDPH(OHMM)
.20000 2000.0

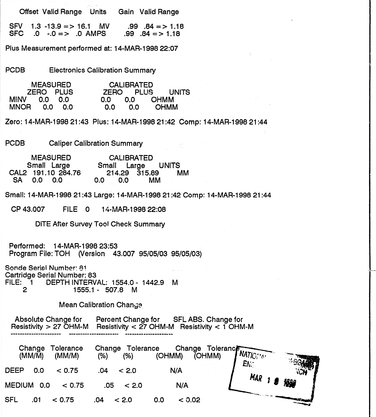
```
                 PARAMETERS

   NAME  VALUE     UNIT          NAME  VALUE     UNIT

   SMB  DISA                   VDLR 2IN
   PP   NORM                   DO   0.0       M
   DO2  0.0         M          WMUD 1135.00    K/M3
   TD   1537.40    M            FCD  177.800    MM
   IFRS 20        KHZ          SBR  1.00000    OHMM
   MXE2 29.4100     MM/M           DXE2 77.4500     MM/M
   MRE2 20.2100     MM/M           DRE2 14.2700     MM/M
   MPH2 -.810500   DEG           DPH2 .154500    DEG
   MGF2 1.03800                 DGF2 1.00800
   DESP DISA                   SFLE ALLO
   DCAS 601.000     M             ITEN ALLO
   DEVI 0.0       DEG           DSES H412
   IPRO PHAS                   IPHA NORM
   TOCA ALLO                   MODE BHC
   DETE E2                    MGAI 4000.00
   AGC  ALLO                   SLEV 5000.00    MV
   GAI  40.0000                 SFAF 0.0       DB/M
   SGAD ALLO                     SGW  80        US
   NMSG 180        US            SGDT 50        US/F
   DTCM NORM                      SLC  C
   SLS  WA                    SPLE 0          IN
   RATE 15         HZ           SOAD AUTO
   DDEL 0          US           DSIN 10         US
   DWCO 500                     RMOD B
   WMOD BHC                       WAGC ALLO
   WGDT 787.401     US/M            WGAI 20.0000
   ITTS DT                    SPSO DT
   SPFS R-H                    DTM  183.727     US/M
   SVS  DT                    NCJT GSRY
   GTSE TEMP                     SHT  5.00000     DEGC
```







GTSE TEMP
BHT 58.0000 DEGC
BS 222.000 MM

SHT 5.00000 DEGC
SPAE DISA
BHS OPEN

ACCUMULATED INTEGRATION VALUES SUMMARY:

Integrated Hole Volume: 4.86730 M3 FROM 1537.40 M TO 1443.38 M
Integrated Cement Volume: 2.53642 M3 FROM 1537.40 M TO 1443.38 M
(ASSUMING 177.800 MM O.D. CASING)
Integrated Transit Time: .0249793 S FROM 1537.40 M TO 1443.38 M

SFQF
0.0 10.000
IMQF
0.0 10.000
IDQF
0.0 10.000
IMPH(OHMM)
.20000 2000.0
TENS(LBF)
4000.0 0.0
SFLU(OHMM)
.20000 2000.0
GR(GAPI)
0.0 150.00
IDPH(OHMM)
.20000 2000.0
ILD FLAG
ILM FLAG
SFL FLAG
PHAS. PROC.

CP 43.007 FILE 14 15-MAR-1998 05:18 REPEAT SECTION

INPUT FILE(S) CREATION DATE
1 14-MAR-1998 22:09

REPEAT SECTION

CP 43.007 FILE 14 15-MAR-1998 05:16

INPUT FILE(S) CREATION DATE
1 14-MAR-1998 22:09

ILD FLAG
ILM FLAG
SFL FLAG
PHAS. PROC.
SFQF
0.0
10.000
IMQF
0.0
10.000
IDQF
0.0
10.000
IMPH(OHMM)
.20000
2000.0
SFLU(OHMM)
.20000
2000.0
IDPH(OHMM)
.20000
2000.0
TENS(LBF)
4000.0
0.0
GR(GAPI)
0.0
150.00

SENSOR MEASURE POINT TO TOOL ZERO

SDT 15.85 METER
DTT -13.4 METER
PCDB 15.21 METER

SGTL 22.28 METER
DITE 3.15 METER

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
SMB	DISA		VDLR	2IN	
PP	NORM		DO	.500000	M
WMUD	1135.00	K/M3	TD	1537.40	M
FCD	177.800	MM	IFRS	20	KHZ
SBR	1.00000	OHMM	MXE2	29.4100	MM/M
DXE2	77.4500	MM/M	MRE2	20.2100	MM/M
DRE2	14.2700	MM/M	MPH2	-.810500	DEG
DPH2	.154500	DEG	MGF2	1.03800	
DGF2	1.00800		DESP	DISA	
SFLE	ALLO		DCAS	601.000	M
ITEN	ALLO		DEVI	0.0	DEG
DSES	H412		IPRO	PHAS	
IPHA	NORM		TOCA	ALLO	
MODE	BHC		DETE	E2	
MGAI	4000.00		AGC	ALLO	
SLEV	5000.00	MV	GAI	40.0000	
SFAF	0.0	DB/M	SGAD	ALLO	
SGW	80	US	NMSG	180	US
SGDT	50	US/F	DTCM	NORM	
SLC	C		SLS	WA	

```
    SPLE 0         IN              RATE 15        HZ
    SOAD AUTO                        DDEL 0         US
    DSIN 10        US               DWCO 500
    RMOD B                          WMOD BHC
    WAGC ALLO                         WGDT 787.401     US/M
    WGAI 20.0000                     ITTS DT
    SPSO DT                         SPFS R-H
    DTM  183.727     US/M              SVS  DT
    NCJT GSRY                        GTSE TEMP
    SHT  5.00000     DEGC              BHT  58.0000    DEGC
    SPAE DISA                       BS   222.000     MM
    BHS  OPEN
```

```
          BEFORE SURVEY CALIBRATION Summary


 Performed:    14-MAR-1998 22:08
 Program File: TOH    (Version    43.007  95/05/03  95/05/03)


SGTL          Detector Calibration Summary

        MEASURED
      BKGD   JIG        CALIBRATED        UNITS
  GR     5    177         165           GAPI

Back: 14-MAR-1998 21:33   Jig: 14-MAR-1998 21:40  Comp: 14-MAR-1998 21:40


DITE          Electronics Calibration Summary

Sonde SN#: 81
Cartridge SN#: 83
Induction Freq: 20  KHz

Induction Electronics:

    Offset  Valid Range    Gain  Valid Range    Phase   Valid Range
    (MM/M )   (MM/M )      (--)     (---)       (DEG.)    (DEG.)

 IRD   9.9 -115. => 135.   .946  .81 => 1.14
 IXD  12.7 -114. => 136.   .955  .81 => 1.15   4.37 -11.25 => 18.75
 IRM  15.1 -210. => 240.   .939  .80 => 1.13
 IXM  35.2 -190. => 260.   .962  .82 => 1.16   7.71  -7.91 => 22.09

SFL Electronics:

     Offset  Valid Range   Units     Gain   Valid Range

 SFV   1.3  -13.9 => 16.1   MV        .99  .84 => 1.18
 SFC    .0   -.0 =>  .0 AMPS          .99  .84 => 1.18

Plus Measurement performed at: 14-MAR-1998 22:07


PCDB          Electronics Calibration Summary

       MEASURED                CALIBRATED
      ZERO   PLUS            ZERO    PLUS       UNITS
 MINV    0.0   0.0           0.0      0.0      OHMM
 MNOR      0.0    0.0          0.0      0.0      OHMM

Zero: 14-MAR-1998 21:43  Plus: 14-MAR-1998 21:42  Comp: 14-MAR-1998 21:44


PCDB          Caliper Calibration Summary

       MEASURED                CALIBRATED
      Small  Large           Small   Large     UNITS
 CAL2  191.10 284.76           214.29  315.89       MM
  SA    0.0   0.0            0.0     0.0        MM

Small: 14-MAR-1998 21:43 Large: 14-MAR-1998 21:42 Comp: 14-MAR-1998 21:44

  CP 43.007        FILE   0     14-MAR-1998 22:08
```

DITE After Survey Tool Check Summary

Performed: 14-MAR-1998 23:53
Program File: TOH (Version 43.007 95/05/03 95/05/03)

Sonde Serial Number: 81
Cartridge Serial Number: 83
FILE: 1 DEPTH INTERVAL: 1554.0 - 1442.9 M
2 1555.1 - 507.8 M

Mean Calibration Change

	Absolute Change for Resistivity > 27 OHM-M		Percent Change for Resistivity < 27 OHM-M		SFL ABS. Change for Resistivity < 1 OHM-M	
	Change (MM/M)	Tolerance (MM/M)	Change (%)	Tolerance (%)	Change (OHMM)	Tolerance (OHMM)
DEEP	0.0	< 0.75	.04	< 2.0	N/A	
MEDIUM	0.0	< 0.75	.05	< 2.0	N/A	
SFL	.01	< 0.75	.04	< 2.0	0.0	< 0.02

NATIO... EN... ...BOARD ...NCH
MAR 1 [illegible] 1998

CP 43.007 FILE 3 14-MAR-1998 23:53 (UP)

COMPANY	RANGER OIL LIMITED	**SCHL.**	**FR**	1534.2 M
		SCHL.	**TD**	1540.0 M
WELL	RANGER ET AL LITTLE BEAR M-39	**DRLR.**	**TD**	1550 0 M
FIELD	LITTLE BEAR	**Elev:**	**KB**	259.2 M
			DF	258.9 M
TERRITORY	N.W.T.		**GL**	253.9 M

Schlumberger

PHASOR INDUCTION SFL

# SONIC

# NEUTRON

# DENSITY

N.E.B. COPY 1838

COMPANY: RANGER OIL LIMITED

WELL: RANGER ET AL LITTLE BEAR M-39

FIELD: LITTLE BEAR

TERRITORY: N.W.T.

TERRITORY:N.W.T.
Field: LITTLE BEAR
Location: 69-49-58-129
Well: RANGER ET AL LITTLE BEAR M
Company: RANGER OIL LIMITED

9211-R36-2.3

Schlumberger

BOREHOLE COMPENSATED SONIC LOG

LOCATION: 69-49-58-129

Elev.: K.B. 259.22 M
G.L. 253.87 M
D.F. 258.92 M

Permanent Datum: GROUND LEVEL Elev.: 253.87 M
Log Measured From: KELLY BUSHING 5.4 M above Perm. Datum
Drilling Measured From: KELLY BUSHING

API Serial No.	SECTION	TOWNSHIP	RANGE

Logging Date	5-MARCH-1998	
Run Number	1	
Depth Driller	602.6 M	
Schlumberger Depth	598.5 M	
Bottom Log Interval	575 M	
Top Log Interval	148.5 M	
Casing Driller Size @ Depth	339.700 MM @ 149.7 M	@
Casing Schlumberger	148.5 M	
Bit Size	311.000 MM	
Type Fluid in Hole	GEL CHEM	
MUD Density / Viscosity	1155 K/M3 / 63 S	
MUD Fluid Loss / PH	9 C3 / 8	
MUD Source Of Sample	FLOWLINE	
RM @ Measured Temperature	3.340 OHMM @ 24 DEGC	@
RMF @ Measured Temperature	32.420 OHMM @ 18 DEGC	@
RMC @ Measured Temperature	3.420 OHMM @ 15 DEGC	@
Source RMF / RMC	PRESS. / PRESS	
RM @ MRT / RMF @ MRT	2.690 @ 35 / 22.072 @ 35	@ / @
Maximum Recorded Temperatures	35 DEGC	
Circulation Stopped / Time	5-MAR-1998 / 1:30	
Logger On Bottom / Time	5-MAR-1998 / 12:00	
Unit Number / Location	2 / NORMAN WELLS	
Recorded By	GREG MCISAAC	
Witnessed By	HENRI WENNEKERS	

	Run 1	Run 2	Run 3	Run 4

Logging Date		
Run Number		
Depth Driller		
Schlumberger Depth		
Bottom Log Interval		
Top Log Interval		
Casing Driller Size @ Depth	@	@
Casing Schlumberger		
Bit Size		
Type Fluid In Hole		
MUD Density / Viscosity		
MUD Fluid Loss / PH		
MUD Source Of Sample		
RM @ Measured Temperature	@	@
RMF @ Measured Temperature	@	@
RMC @ Measured Temperature	@	@
Source RMF / RMC		
RM @ MRT / RMF @ MRT	@ / @	@ / @
Maximum Recorded Temperatures		
Circulation Stopped / Time		
Logger On Bottom / Time		
Unit Number / Location		
Recorded By		
Witnessed By		

ALL INTERPRETATIONS ARE OPINIONS BASED ON INFERENCES FROM ELECTRICAL OR OTHER MEASUREMENTS AND WE CANNOT, AND DO NOT GUARANTEE THE ACCURACY OR CORRECTNESS OF ANY INTERPRETATIONS, AND WE SHALL NOT, EXCEPT IN THE CASE OF GROSS OR WILLFUL NEGLIGENCE ON OUR PART, BE LIABLE OR RESPONSIBLE FOR ANY LOSS, COSTS, DAMAGES OR EXPENSES INCURRED OR SUSTAINED BY ANYONE RESULTING FROM ANY INTERPRETATION MADE BY ANY OF OUR OFFICERS, AGENTS OR EMPLOYEES. THESE INTERPRETATIONS ARE ALSO SUBJECT TO CLAUSE 4 OF OUR GENERAL TERMS AND CONDITIONS AS SET OUT IN OUR CURRENT PRICE SCHEDULE.

OTHER SERVICES1	OTHER SERVICES2
OS1: DITE	OS1:
OS2:	OS2:
OS3:	OS3:
OS4:	OS4:
OS5:	OS5:
REMARKS: RUN NUMBER 1	REMARKS: RUN NUMEER 2
SONIC-INDUCTION COMBINATION	
DISALLOWED SP, TOO NOISY	
CME-Z CENTRALIZERS USED ON SONIC	
38 MM STANDOFFSU USED ON DITE	
CEMENT VOL BASED ON 244.5 MM INTERMEDIATE CASING	

RUN 1		RUN 2	
SERVICE ORDER #:	1210883	SERVICE ORDER #:	
PROGRAM VERSION:	8C0-609	PROGRAM VERSION:	
FLUID LEVEL:		FLUID LEVEL:	

LOGGED INTERVAL	START	STOP	LOGGED INTERVAL	START	STOP

EQUIPMENT DESCRIPTION

RUN 1

RUN 2

SURFACE EQUIPMENT

STM-C
GSR-U/Y
TCM-AB

DOWNHOLE EQUIPMENT

TCC-B
ECH-KC
TCC-B

SGT-L
SGH-K
SGC-SA
SGD-TAA

SDT-C
SDC-CB
ECH-KR
SLS-WA

TelStatus
CTEM
22.53
23.44
Gamma Ray
22.25
22.53
20.85
U-N
U-F VDL
15.82
15.52
L-F
L-N
14.68
14.38

PCD-B
PCM-A
PCH-A
PCC-H
PCDB Data
13.34
11.66
AH-107
AH-107
10.74
AH-107
AH-107
10.13
DIT-E
DIC-EB
MIH-ZA
DIS-HB
9.52
SP
Deep Ind
3.15
2.90
Aux Meas SFL
Med Ind
1.98
1.83
PCDB Stat HV
Status
Tension
0.00
TOOL ZERO

MAXIMUM STRING DIAMETER 148 MM
MEASUREMENTS RELATIVE TO TOOL ZERO
ALL LENGTHS IN METERS

Input DLIS Files

DEFAULT	DITE .011	FN:9	FIELD	05-Mar-1998 12:33	600.2 M	47.0 M

Output DLIS Files

DEFAULT	DITE .015	FN:13	FIELD	05-Mar-1998 14:46	600.2 M	47.1 M

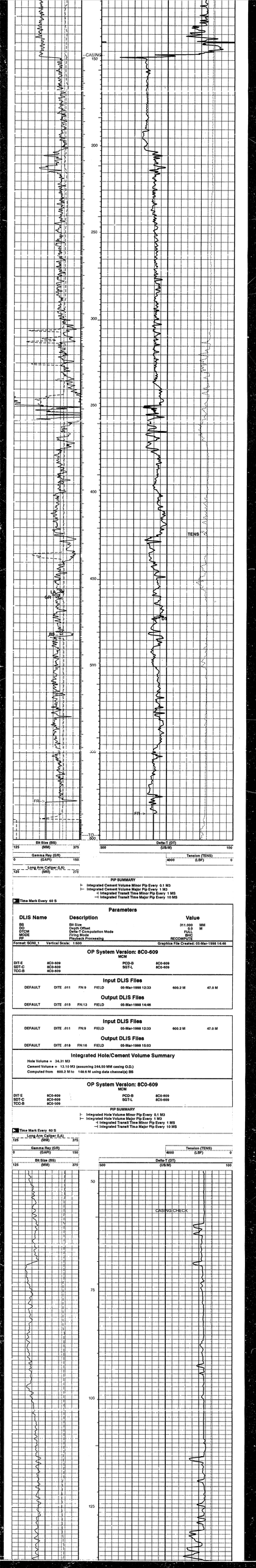
OP System Version: 8C0-609

MCM

DIT-E	8C0-609	PCD-B	8C0-609
SDT-C	8C0-609	SGT-L	8C0-609
TCC-B	8C0-609		

PIP SUMMARY

⊢ Integrated Cement Volume Minor Pip Every 0.1 M3
⊢ Integrated Cement Volume Major Pip Every 1 M3
⊣ Integrated Transit Time Minor Pip Every 1 MS
⊣ Integrated Transit Time Major Pip Every 10 MS




PIP SUMMARY

- Integrated Cement Volume Minor Pip Every 0.1 M3
- Integrated Cement Volume Major Pip Every 1 M3
- Integrated TransII Time Minor Pip Every 1 MS
- Integrated TransII Time Major Pip Every 10 MS

Time Mark Every 60 S

## Parameters

| DLIS Name | Description | Value |
|---|---|---|
| BS | Bit Size | 311.000 MM |
| DO | Depth Offset | 0.0 M |
| DTCM | Delta-T Computation Mode | FULL |
| MODE | Firing Mode | BHC |
| PP | Playback Processing | RECOMPUTE |

Format: SONI_1 Vertical Scale: 1:600 Graphics File Created: 05-Mar-1998 14:46

## OP System Version: 8C0-609

MCM

| | | | |
|---|---|---|---|
| DIT-E | 8C0-609 | PCD-B | 8C0-609 |
| SDT-C | 8C0-609 | SGT-L | 8C0-609 |
| TCC-B | 8C0-609 | | |

## Input DLIS Files

| | | | | | | |
|---|---|---|---|---|---|---|
| DEFAULT | DITE .011 | FN:9 | FIELD | 05-Mar-1998 12:33 | 600.2 M | 47.0 M |

## Output DLIS Files

| | | | | | | |
|---|---|---|---|---|---|---|
| DEFAULT | DITE .015 | FN:13 | FIELD | 05-Mar-1998 14:46 | | |

## Input DLIS Files

| | | | | | | |
|---|---|---|---|---|---|---|
| DEFAULT | DITE .011 | FN:9 | FIELD | 05-Mar-1998 12:33 | 600.2 M | 47.0 M |

## Output DLIS Files

| | | | | | | |
|---|---|---|---|---|---|---|
| DEFAULT | DITE .018 | FN:16 | FIELD | 05-Mar-1998 15:03 | | |

## Integrated Hole/Cement Volume Summary

Hole Volume = 34.31 M3
Cement Volume = 13.10 M3 (assuming 244.50 MM casing O.D.)
Computed from 600.2 M to 148.8 M using data channel(s) BS

## OP System Version: 8C0-609

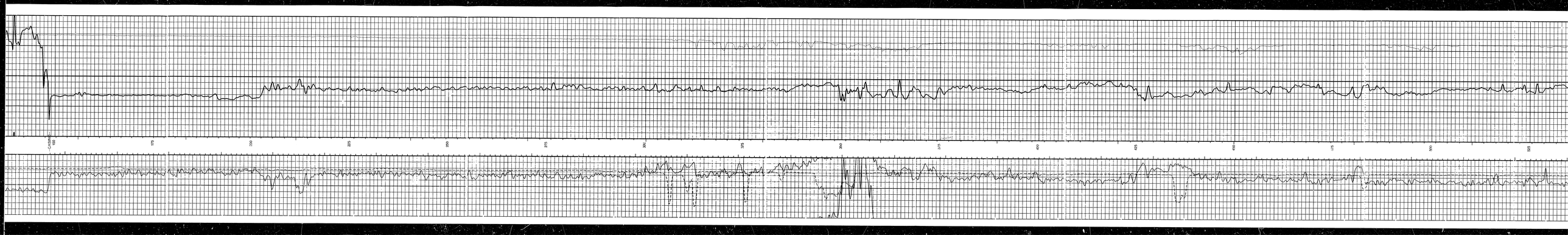
MCM

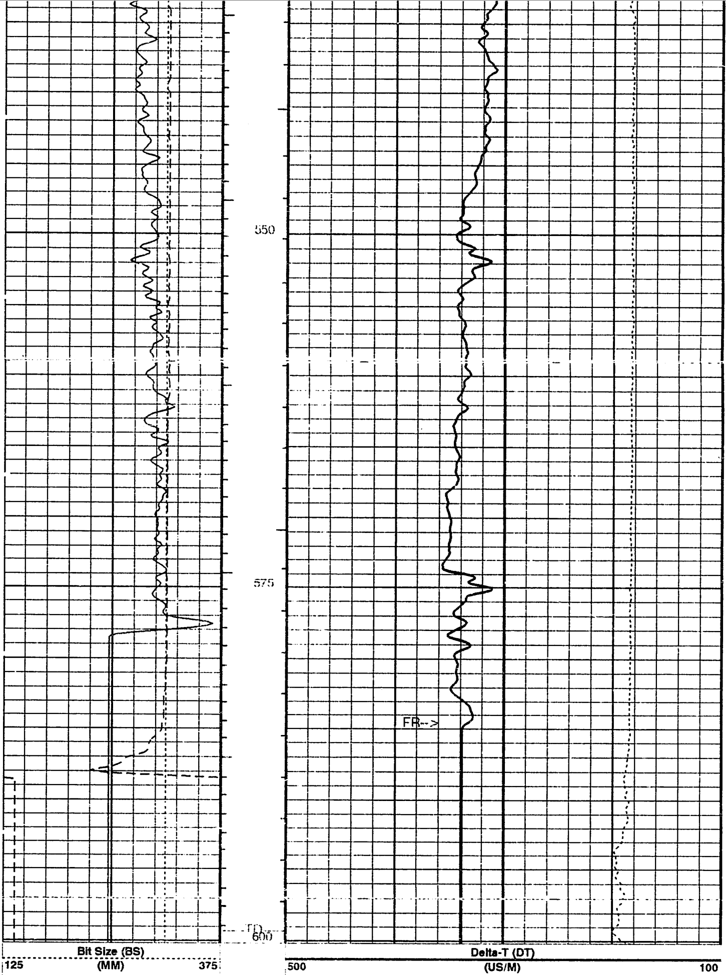
| | | | |
|---|---|---|---|
| DIT-E | 8C0-609 | PCD-B | 8C0-609 |
| SDT-C | 8C0-609 | SGT-L | 8C0-609 |
| TCC-B | 8C0-609 | | |

PIP SUMMARY

- Integrated Hole Volume Minor Pip Every 0.1 M3
- Integrated Hole Volume Major Pip Every 1 M3
- Integrated TransII Time Minor Pip Every 1 MS
- Integrated TransII Time Major Pip Every 10 MS

Time Mark Every 60 S


CASING
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500
525



Gamma Ray (GR)		
0	(GAPI)	150

Long Arm Caliper (LA)		
125	(MM)	375

Tension (TENS)		
4000	(LBF)	0

PIP SUMMARY

├ Integrated Hole Volume Minor Pip Every 0.1 M3
├─ Integrated Hole Volume Major Pip Every 1 M3
┤ Integrated Transit Time Minor Pip Every 1 MS
─┤ Integrated Transit Time Major Pip Every 10 MS

Time Mark Every 60 S

Parameters

DLIS Name	Description	Value	
BS	Bit Size	311.000	MM
DO	Depth Offset	0.0	M
DTCM	Delta-T Computation Mode	FULL	
MODE	Firing Mode	BHC	
PP	Playback Processing	RECOMPUTE	

Format: SONI Vertical Scale: 1:240 Graphics File Created: 05-Mar-1998 15:03

OP System Version: 8C0-609

MCM

DIT-E	8C0-609	PCD-B	8C0-609
SDT-C	8C0-609	SGT-L	8C0-609
TCC-B	8C0-609		

Input DLIS Files

DEFAULT	DITE .011	FN:9	FIELD	05-Mar-1998 12:33	600.2 M	47.0 M

Output DLIS Files

DEFAULT	DITE .018	FN:16	FIELD	05-Mar-1998 15:03

Input DLIS Files

DEFAULT	DITE .010	FN:8	FIELD	05-Mar-1998 12:20	599.8 M	504.9 M

Output DLIS Files

DEFAULT	DITE .012	FN:10	FIELD	05-Mar-1998 14:35	599.8 M	504.9 M

Integrated Hole/Cement Volume Summary

Hole Volume = 17.91 M3

Cement Volume = 13.44 M3 (assuming 244.50 MM casing O.D.)

Computed from 599.8 M to 504.9 M using data channel(s) HDIA

OP System Version: 8C0-609

MCM

DIT-E	8C0-609	PCD-B	8C0-609
SDT-C	8C0-609	SGT-L	8C0-609
TCC-B	8C0-609		

PIP SUMMARY

├ Integrated Hole Volume Minor Pip Every 0.1 M3
├─ Integrated Hole Volume Major Pip Every 1 M3
┤ Integrated Transit Time Minor Pip Every 1 MS
─┤ Integrated Transit Time Major Pip Every 10 MS

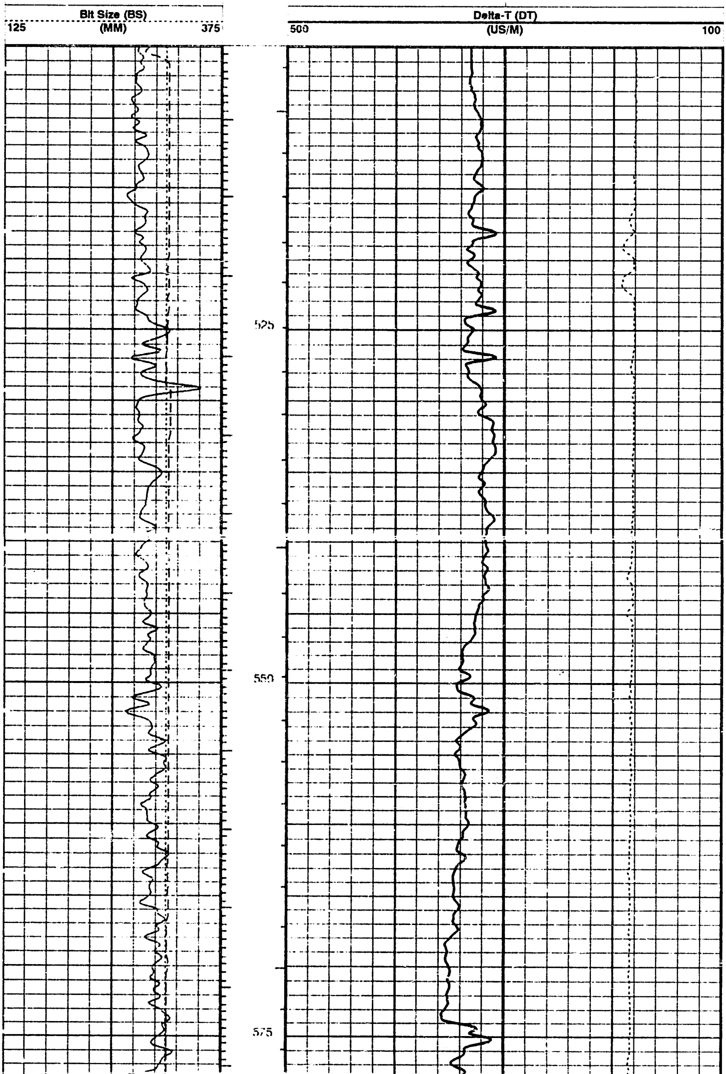
Time Mark Every 60 S

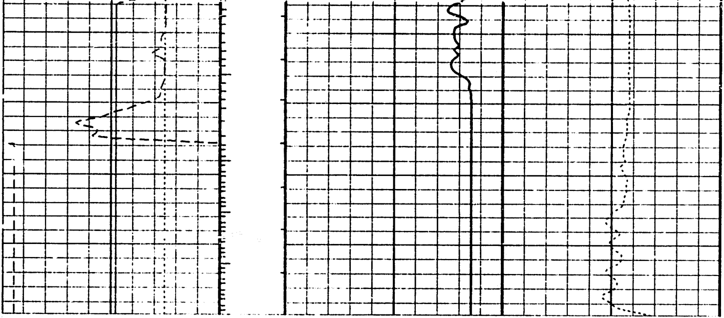
Long Arm Caliper (LA)		
125	(MM)	375

Gamma Ray (GR)		
0	(GAPI)	150

REPEAT SECTION

Tension (TENS)		
4000	(LBF)	0





PIP SUMMARY

⊢ Integrated Hole Volume Minor Pip Every 0.1 M3
⊢ Integrated Hole Volume Major Pip Every 1 M3
⊣ Integrated Transit Time Minor Pip Every 1 MS
⊣ Integrated Transit Time Major Pip Every 10 MS

Time Mark Every 60 S

Parameters

DLIS Name	Description	Value	
BS	Bit Size	311.000	MM
DO	Depth Offset	0.0	M
DTCM	Delta-T Computation Mode	FULL	
MODE	Firing Mode	BHC	
PP	Playback Processing	NORMAL	

Format: SONI Vertical Scale: 1:240 Graphics File Created: 05-Mar-1998 14:35

OP System Version: 8C0-609

MCM

DIT-E	8C0-609	PCD-B	8C0-609
SDT-C	8C0-609	SGT-L	8C0-609
TCC-B	8C0-609		

Input DLIS Files

DEFAULT	DITE .010	FN:8	FIELD	05-Mar-1998 12:20	599.8 M	504.9 M

Output DLIS Files

DEFAULT	DITE .012	FN:10	FIELD	05-Mar-1998 14:35

Calibration and Check Summary

Measurement	Nominal	Master	Before	After	Change	Limit	Units
Powered Caliper Device - B Wellsite Calibration - Large Arm Calibration Before: Mar 05 11:04 1998							
Large Arm Small Ring	203.2	N/A	182.1	N/A	N/A	N/A	MM
Large Arm Large Ring	304.8	N/A	281.3	N/A	N/A	N/A	MM

Powered Caliper Device - B Wellsite Calibration - Small Arm Calibration
Before: Calibration not done

Small Arm Small Gauge	25.40	N/A	N/A	N/A	N/A	N/A	MM
Small Arm Large Gauge	[illegible]	N/A	N/A	N/A	N/A	N/A	MM

Powered Caliper Device - B Wellsite Calibration - Micro Inverse Calibration
Before: Calibration not done After: Calibration not done

Micro Inverse Zero	0	N/A	N/A	N/A	N/A	0.1000	OHMM
Micro Inverse Plus	5.000	N/A	N/A	N/A	N/A	0.2000	OHMM

Powered Caliper Device - B Wellsite Calibration - Micro Normal Calibration
Before: Calibration not done After: Calibration not done

Micro Normal Zero	0	N/A	N/A	N/A	N/A	0.1000	OHMM
Micro Normal Plus	5.000	N/A	N/A	N/A	N/A	0.2000	OHMM

Scintillation Gamma-Ray - L Wellsite Calibration - Detector Calibration
Before: Mar 05 11:00 1998 After: Calibration not done

Gamma Ray Background	30.00	N/A	11.00	N/A	N/A	N/A	GAPI
Gamma Ray (Jig - Bkg)	159.1	N/A	159.1	N/A	N/A	14.46	GAPI
Gamma Ray (Calibrated)	165.0	N/A	165.0	N/A	N/A	15.00	GAPI

Dual Induction - E / Equipment Identification

Primary Equipment:	
Dual Induction Sonde	DIS - HB
Dual Induction Cartridge	DIC - EB
Auxiliary Equipment:	
Mass Isolated Housing	MIH - ZA

Dual Induction - E Wellsite Calibration

Induction Electronics (10 kHz)

Phase	ID Elect Real Offset 10 kHz MM/M	Value	Phase	ID Elect Real Gain 10 kHz	Value	Phase	ID Elect Phase 10 kHz DEG	Value
Before		26.12	Before		0.9454	Before		7.311
-300.0 (Minimum)	0 (Nominal)	300.0 (Maximum)	0.8500 (Minimum)	1.000 (Nominal)	1.200 (Maximum)	-10.00 (Minimum)	0 (Nominal)	10.00 (Maximum)
Phase	ID Elect Quad Offset 10 kHz MM/M	Value	Phase	ID Elect Quad Gain 10 kHz	Value	Phase	IM Elect Phase 10 kHz DEG	Value
Before		33.44	Before		0.9550	Before	EXCEEDS LIMIT	10.09
-300.0 (Minimum)	0 (Nominal)	300.0 (Maximum)	0.8500 (Minimum)	1.000 (Nominal)	1.200 (Maximum)	-10.00 (Minimum)	0 (Nominal)	10.00 (Maximum)
Phase	IM Elect Real Offset 10 kHz MM/M	Value	Phase	IM Elect Real Gain 10 kHz	Value			
Before		[illegible]	Before		[illegible]			
-550.0 (Minimum)	0 (Nominal)	550.0 (Maximum)	0.8500 (Minimum)	1.000 (Nominal)	1.200 (Maximum)			
Phase	IM Elect Quad Offset 10 kHz MM/M	Value	Phase	IM Elect Quad Gain 10 kHz	Value			
Before		85.92	Before		0.9214			
-550.0 (Minimum)	0 (Nominal)	550.0 (Maximum)	0.8500 (Minimum)	1.000 (Nominal)	1.200 (Maximum)			

Before: Mar 05 11:26 1998

Dual Induction - E Wellsite Calibration

Induction Electronics (20 kHz)

Phase	ID Elect Real Offset 20 kHz MM/M	Value	Phase	ID Elect Real Gain 20 kHz	Value	Phase	ID Elect Phase 20 kHz DEG	Value
Before		9.918	Before		0.9477	Before		-2.570
-125.0 (Minimum)	0 (Nominal)	125.0 (Maximum)	0.8500 (Minimum)	1.000 (Nominal)	1.200 (Maximum)	-15.00 (Minimum)	0 (Nominal)	15.00 (Maximum)
Phase	ID Elect Quad Offset 20 kHz MM/M	Value	Phase	ID Elect Quad Gain 20 kHz	Value	Phase	IM Elect Phase 20 kHz DEG	Value
Before		13.29	Before		0.9572	Before		0.7746
-125.0 (Minimum)	0 (Nominal)	125.0 (Maximum)	0.8500 (Minimum)	1.000 (Nominal)	1.200 (Maximum)	-15.00 (Minimum)	0 (Nominal)	15.00 (Maximum)
Phase	IM Elect Real Offset 20 kHz MM/M	Value	Phase	IM Elect Real Gain 20 kHz	Value			
Before		15.18	Before		0.9384			
-225.0 (Minimum)	0 (Nominal)	225.0 (Maximum)	0.8500 (Minimum)	1.000 (Nominal)	1.200 (Maximum)			
Phase	IM Elect Quad Offset 20 kHz MM/M	Value	Phase	IM Elect Quad Gain 20 kHz	Value			
Before		35.29	Before		0.9618			
-225.0 (Minimum)	0 (Nominal)	225.0 (Maximum)	0.8500 (Minimum)	1.000 (Nominal)	1.200 (Maximum)			

Before: Mar 05 11:27 1998

Dual Induction - E Wellsite Calibration

Induction Electronics (40 kHz)

Phase	ID Elect Real Offset 40 kHz MM/M	Value	Phase	ID Elect Real Gain 40 kHz	Value	Phase	ID Elect Phase 40 kHz DEG	Value
Before		6 575	Before		0.9243	Before		7.920
	-85.00 (Minimum) 0 (Nominal) 85.00 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)			-20.00 (Minimum) 0 (Nominal) 20.00 (Maximum)	
Phase	ID Elect Quad Offset 40 kHz MM/M	Value	Phase	ID Elect Quad Gain 40 kHz	Value	Phase	IM Elect Phase 40 kHz DEG	Value
Before		8 963	Before		0.9330	Before		11 01
	-85.00 (Minimum) 0 (Nominal) 85.00 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)			-20.00 (Minimum) 0 (Nominal) 20.00 (Maximum)	
Phase	IM Elect Real Offset 40 kHz MM/M	Value	Phase	IM Elect Real Gain 40 kHz	Value			
Before		10.05	Before		0.9501			
	-130.0 (Minimum) 0 (Nominal) 130.0 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)				
Phase	IM Elect Quad Offset 40 kHz MM/M	Value	Phase	IM Elect Quad Gain 40 kHz	Value			
Before		23 31	Before		0.9735			
	-130.0 (Minimum) 0 (Nominal) 130.0 (Maximum)			0.8500 (Minimum) 1 000 (Nominal) 1.200 (Maximum)				

Before: Mar 05 11:28 1998

Dual Induction - E Wellsite Calibration

SFL Electronics

Phase	SFL Voltage Offset MV	Value	Phase	SFL Voltage Gain	Value
Before		1.345	Before		0.9956
	-15.00 (Minimum) 0 (Nominal) 15.00 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)	
Phase	SFL Current Offset MA	Value	Phase	SFL Current Gain	Value
Before		0.03893	Before		0.9922
	-0.6000 (Minimum) 0 (Nominal) 0.6000 (Maximum)			0.8500 (Minimum) 1.000 (Nominal) 1.200 (Maximum)	

Before: Mar 05 11:28 1998

Dual Induction - E Wellsite Calibration

Electronics Calibration Changes

0.0 - 0.0 1: 12192.0 - 12182.7 1: 221.9 - 576.2 10: 599.8 - 504.9 11: 600.2 - 47.1 13: 600.2 - 501.5 14: 600.2 - 47.1 15: 600.2 - 47.1 16: 600.2 - 47.1

Phase	ID (R > 27 OHM-M) MM/M	Value	Phase	ID (R < 27 OHM-M) %	Value	Phase	SFL (R < 1 OHM-M) OHMM	Value

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| After | | 0.04107 | After | | 0.0007527 | After | | 0 |
| 0 (Minimum) | 0 (Nominal) | 0.7500 (Maximum) | 0 (Minimum) | 0 (Nominal) | 2.000 (Maximum) | 0 (Minimum) | 0 (Nominal) | 0.02000 (Maximum) |

| Phase | IM (R > 27 OHM-M) MM/M | Value | Phase | IM (R < 27 OHM-M) % | Value |
|---|---|---|---|---|---|
| After | | 0.05302 | After | | 0.0008039 |
| 0 (Minimum) | 0 (Nominal) | 0.7500 (Maximum) | 0 (Minimum) | 0 (Nominal) | 2.000 (Maximum) |

| Phase | SFL (R > 27 OHM-M) MM/M | Value | Phase | SFL (R < 27 OHM-M) % | Value |
|---|---|---|---|---|---|
| After | | 0.09265 | After | | 0.003516 |
| 0 (Minimum) | 0 (Nominal) | 0.7500 (Maximum) | 0 (Minimum) | 0 (Nominal) | 2.000 (Maximum) |

After: Mar 05 15:13 1998

## Powered Caliper Device - B / Equipment Identification

| | |
|---|---|
| Primary Equipment: | |
| Powered Caliper Cartridge - H | PCC - H |
| Powered Caliper Mechanical (sonde) A | PCM - A |
| Auxiliary Equipment: | |
| Powered Caliper Housing - A | PCH - A |

### Powered Caliper Device - B Wellsite Calibration

Micro Inverse Calibration

| Phase | Micro Inverse Zero OHMM | Value | Phase | Micro Inverse Plus OHMM | Value |
|---|---|---|---|---|---|
| Before | NOT DONE | N/A | Before | NOT DONE | N/A |
| After | NOT DONE | N/A | After | NOT DONE | N/A |
| -1.000 (Minimum) | 0 (Nominal) | 1.000 (Maximum) | 4.250 (Minimum) | 5.000 (Nominal) | 5.750 (Maximum) |

Before: Calibration not done — After: Calibration not done

### Powered Caliper Device - B Wellsite Calibration

Micro Normal Calibration

| Phase | Micro Normal Zero OHMM | Value | Phase | Micro Normal Plus OHMM | Value |
|---|---|---|---|---|---|
| Before | NOT DONE | N/A | Before | NOT DONE | N/A |
| After | NOT DONE | N/A | After | NOT DONE | N/A |
| -1.000 (Minimum) | 0 (Nominal) | 1.000 (Maximum) | 4.250 (Minimum) | 5.000 (Nominal) | 5.750 (Maximum) |

Before: Calibration not done — After: Calibration not done

## Scintillation Gamma-Ray - L / Equipment Identification

| | |
|---|---|
| Primary Equipment: | |
| Scintillation Gamma Cartridge | SGC - SA |
| Scintillation Gamma Detector | SGD - TAA |
| Auxiliary Equipment: | |
| Scintillation Gamma Housing | SGH - K |
| Gamma Source Radioactive | GSR - U/Y |

### Scintillation Gamma-Ray - L Wellsite Calibration

Detector Calibration

| Phase | Gamma Ray Background GAPI | Value | Phase | Gamma Ray (Jig - Bkg) GAPI | Value | Phase | Gamma Ray (Calibrated) GAPI | Value |
|---|---|---|---|---|---|---|---|---|
| Before | | 11.00 | Before | | 159.1 | Before | | 165.0 |
| After | NOT DONE | N/A | After | NOT DONE | N/A | After | NOT DONE | N/A |
| 0 (Minimum) | 30.00 (Nominal) | 120.0 (Maximum) | 144.6 (Minimum) | 159.1 (Nominal) | 173.6 (Maximum) | 150.0 (Minimum) | 165.0 (Nominal) | 180.0 (Maximum) |

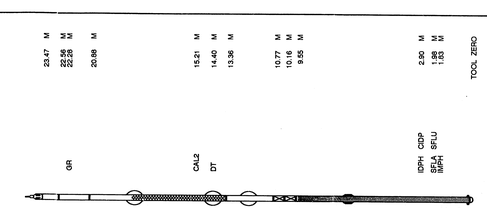
Before: Mar 05 11:00 1998 — After: Calibration not done

NATIONAL ENERGY BOARD
[illegible]
MAR 18 [illegible]

| | | | |
|---|---|---|---|
| COMPANY: | RANGER OIL LIMITED | BOTTOM LOG INTERVAL | 575 M |
| | | SCHLUMBERGER DEPTH | 598.5 M |
| WELL: | RANGER ET AL LITTLE BEAR M-39 | DEPTH DRILLER | 602.6 M |
| FIELD: | LITTLE BEAR | KELLY BUSHING | 259.22 M |
| TERRITORY: | N.W.T. | DRILL FLOOR | 258.92 M |
| | | GROUND LEVEL | 253.87 M |

Schlumberger

# BOREHOLE COMPENSATED SONIC LOG



N.E.B. COPY

1838

9211-R36-2-3

Schlumberger

BOREHOLE COMPENSATED SONIC LOG

TERRITORY N.W.T.
FIELD LITTLE BEAR
LOCATION
WELL RANGER ET AL LITTLE BEAR M-39
COMPANY RANGER OIL LIMITED

COMPANY RANGER OIL LIMITED

WELL RANGER ET AL LITTLE BEAR M-39

FIELD LITTLE BEAR

TERRITORY N.W.T.

LOCATION 69-49-58-129

Other Services:
DITE
LDT-CNT
LOGNET

API SERIAL NO.	SECT.	TWP.	RANGE

Permanent Datum	GROUND LEVEL	Elev.	253.9 M	Elev.: K.B.259.2 M
Log Measured From	KELLY BUSHING	5.4 M	above Perm. Datum	D.F.258.9 M
Drilling Measured From	KELLY BUSHING			G.L.253.9 M

Date	15-MARCH-1998			
Run No.	TWO			
Depth Driller	1550.0 M			
Depth Logger (Schl.)	1540.0 M			
Btm. Log Interval	1521.5 M			
Top Log Interval	601.0 M			
Casing-Driller	244.5 MM @602.6 M	@	@	
Casing-Logger	601.0 M			
Bit Size	311 MM @602.6 M	222 @1550.0 M	@	
Type Fluid in Hole	GEL CHEM			
Dens. / Visc.	1135. K/M3	77.0 S		
pH / Fld. Loss	9.0	8.0 C3		
Source of Sample	FLOWLINE			
Rm @ Meas. Temp.	4.850 OHMM @ 18.0 DEGC		@	
Rmf @ Meas. Temp.	4.810 OHMM @ 10.0 DEGC		@	
Rmc @ Meas. Temp.	3.390 OHMM @ 10.0 DEGC		@	
Source: Rmf / Rmc	PRESS	PRESS		
Rm @ BHT	2.299 OHMM @ 62.0 DEGC		@	
TIME Circulation Ended	09:00/14TH			
TIME Logger on Bottom	22:20/14TH			
Max. Rec. Temp.	62.0 DEGC			
Equip. / Location	8416	NORMAN WELLS		
Recorded By	G. MCISAAC			
Witnessed By	HENRI WENNEKERS			

The well name, location and borehole reference data were furnished by the customer.

All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretations made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.

Run No.	TWO	
Service Order No.	1210887	
Drilling Fluid Level		
Salinity		
Rmf @ BHT	1.821 OHMM @ 62.0 DEGC	@
Rmc @ BHT	1.283 OHMM @ 62.0 DEGC	@
Logging Speed	1000.0 M/HR	
EQUIPMENT DATA		
Tool Number 1	TCC-B 319	
Tool Number 2	SGC-SA 1048	
Tool Number 3	CAC-CA 1077	
Tool Number 4	SDC-CA 59	
Tool Number 5	SLS-WA 1483	
Tool Number 6	DIC-EB 83	
Tool Number 7	DIS-HC 81	
Tool Number 8		
Tool Number 9		
Tool Number 10		
Tool Number 11		
Tool Number 12		

REMARKS:

CORRELATED TO SOC DITE DATED 5-MARCH-1998
PHASOR - SONIC COMBINATION
38 MM STANDOFFS USED ON DITE
CME-Z CENTRALIZERS USED ON SONIC
CEMENT VOL BASED ON 177.8 MM PRODUCTION CASING

LOGGING TOOL STRING SKETCH

LOGGING HEAD
TCCB
23.47 M
SGTL
22.56 M
GR
22.28 M
SDT
20.88 M

CENTRALIZER
SONIC
CAL2
15.21 M
CENTRALIZER
DT
14.40 M
PCDB
13.36 M
CALIPER
FLEX2
10.77 M
FLEX1
10.16 M
DITE
9.55 M
STANDOFF
IDPH CIDP
2.90 M
SFLA SFLU
1.98 M
IMPH
1.83 M
STANDOFF
TOOL ZERO
TOOL ZERO

TOTAL TOOL STRING LENGTH IS 24.49 M.
TOTAL TOOL STRING WEIGHT IS 684.0 KG IN AIR.

ACCUMULATED INTEGRATION VALUES SUMMARY:

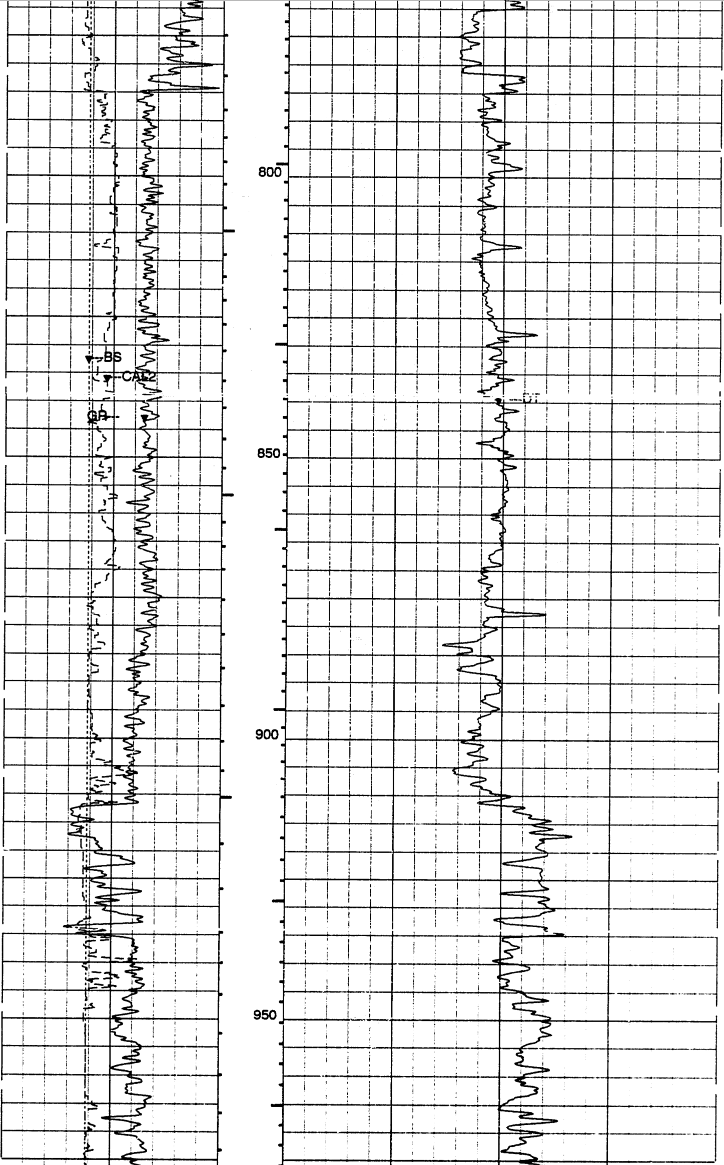
Integrated Hole Volume: 35.3095 M3 FROM 1537.40 M TO 601.000 M
Integrated Cement Volume: 12.0633 M3 FROM 1537.40 M TO 601.000 M
(ASSUMING 177.800 MM O.D. CASING)
Integrated Transit Time: .264305 S FROM 1537.40 M TO 601.000 M

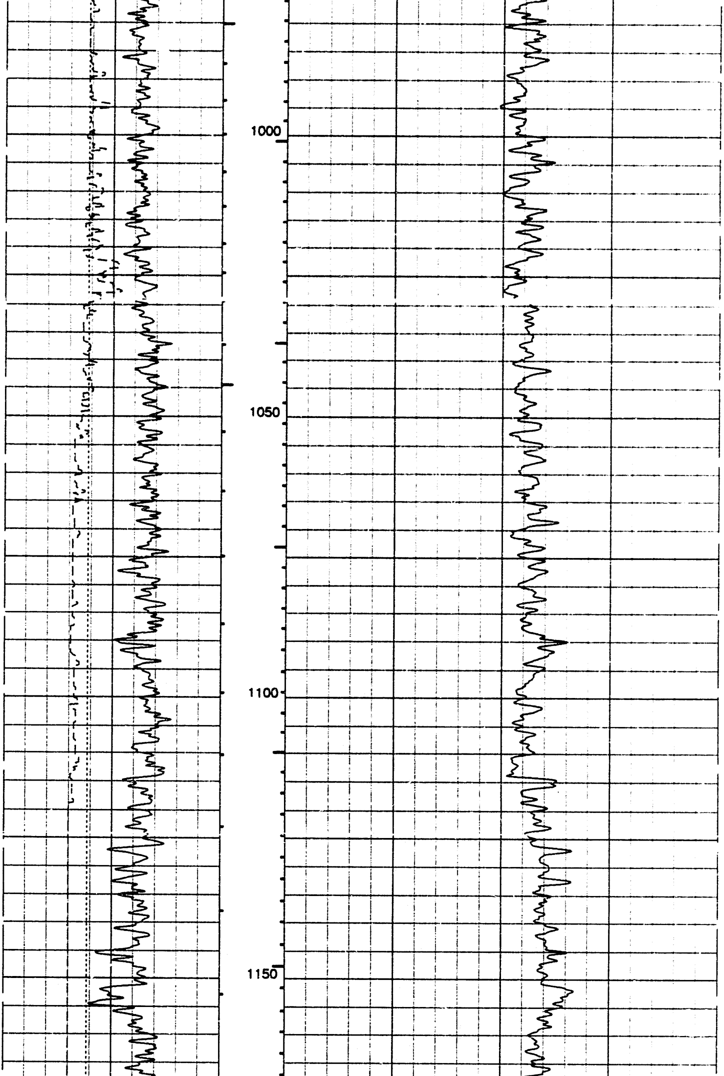
EVENT MARK SUMMARY:

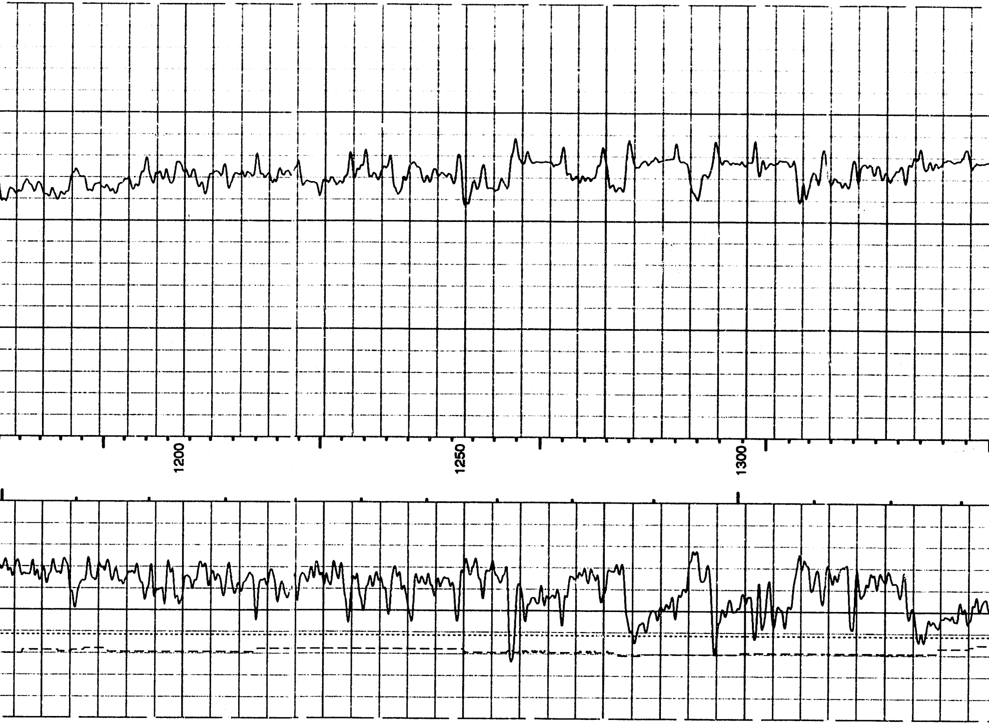
OUTPUT	INTERVAL BETWEEN PIPS	DEPTH TRACK EDGE
Integrated Cement Volume	.100000 M3	LEFT EDGE
Integrated Transit Time	.00100000 S	RIGHT EDGE

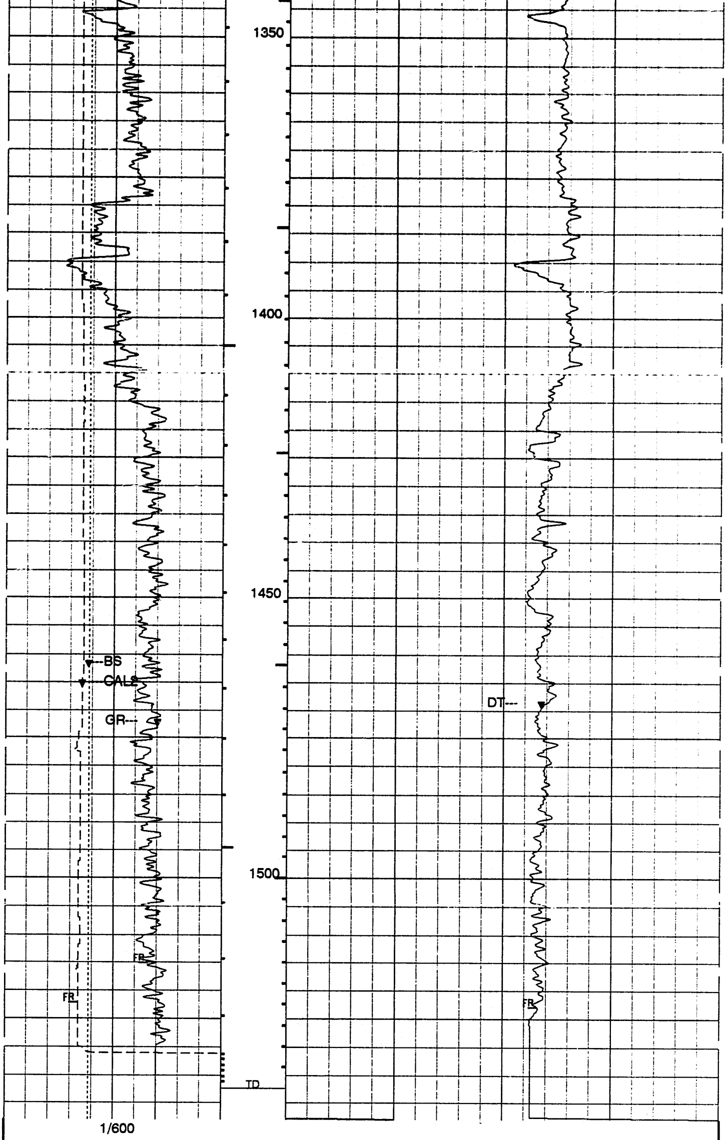
CP 43.007 FILE 15 15-MAR-1998 05:55

INPUT FILE(S) CREATION DATE
12 15-MAR-1998 04:54
11 15-MAR-1998 04:05









CP 43.007 FILE 15 15-MAR-1998 05:32

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        INPUT FILE(S)  CREATION DATE
           12        15-MAR-1998 04:54
           11        15-MAR-1998 04:05

..............BS(MM )...............
125.00                        375.00
_ _ _ _ _ _ CAL2(MM ) _ _ _ _ _ _ _
125.00                        375.00
             GR(GAPI)                                        DT(US/M)
0.0                           150.00      500.00                                             100.00

                  PARAMETERS

   NAME  VALUE     UNIT            NAME  VALUE     UNIT

   SMB  DISA                      VDLR 2IN
   PP   NORM                       DO   0.0        M
   DO2  0.0        M              WMUD 1135.00     K/M3
   TD   1537.40    M               FCD  177.800    MM
   IFRS 20         KHZ             SBR  1.00000    OHMM
   MXE2 29.4100      MM/M              DXE2 77.4500     MM/M
   MRE2 20.2100      MM/M              DRE2 14.2700     MM/M
   MPH2 -.810500   DEG                DPH2 .154500     DEG
   MGF2 1.03800                     DGF2 1.00800
   DESP DISA                        SFLE ALLO
   DCAS 601.000    M                  ITEN ALLO
   DEVI 0.0        DEG              DSES H412
   IPRO PHAS                         IPHA NORM
   TOCA ALLO                         MODE BHC
   DETE E2                         MGAI 4000.00
   AGC  ALLO                         SLEV 5000.00    MV
   GAI  40.0000                     SFAF 0.0        DB/M
   SGAD ALLO                          SGW  80         US
   NMSG 180         US                 SGDT 50        US/F
   DTCM NORM                           SLC  C
   SLS  WA                         SPLE 0          IN
```

RATE 15 HZ SOAD AUTO
DDEL 0 US DSIN 10 US
DWCO 600 RMOD 8
WMOD BHC WAGC ALLO
WX07 787.401 US/M WGAI 20.0000
ITTS DT SPSO DT
SPFG 9-H DTM 183.727 US/M
SVS DT NCUT GSRV
DTSB TEMP BHT 0.00000 DEGC
BHT 0.00000 DEGC SPAE DISA
BS 222.000 MM BHS OPEN

ACCUMULATED INTEGRATION VALUES SUMMARY:

Integrated Hole Volume: 35.3095 M3 FROM 1537.40 M TO 601.000 M
Integrated Cement Volume: 10.0633 M3 FROM 1537.40 M TO 601.000 M
(ASSUMING 177.800 MM O.D. CASING)
Integrated Transit Time: .264305 S FROM 1537.40 M TO 601.000 M

EVENT MARK SUMMARY:

OUTPUT INTERVAL DEPTH TRACK
BETWEEN PIPS EDGE

Integrated Hole Volume .100000 M3 LEFT EDGE
Integrated Transit Time .00100000 S RIGHT EDGE

TENS(LBF)
4000.0 0.0
BS(MM)
125.00 375.00
CALI(MM)
125.00 375.00
GR(GAPI)
0.0 150.00
DT(US/M)
500.00 100.00

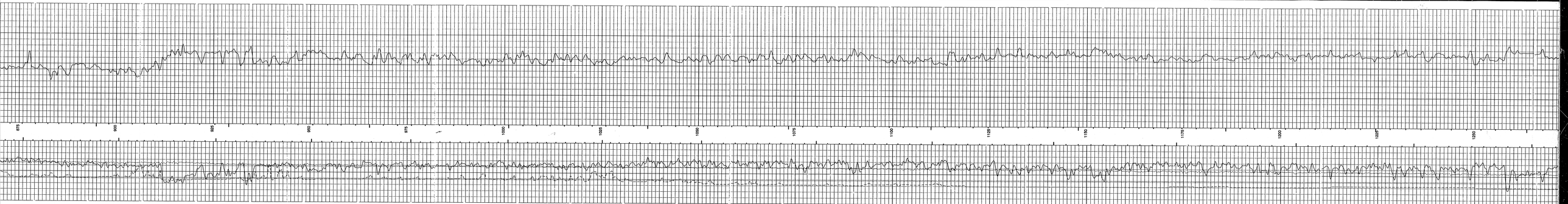
CP 43.007 FILE 15 15-MAR-1998 05:55

INPUT FILE(S) CREATION DATE
12 15-MAR-1998 04:54
11 15-MAR-1998 04:05

1/240

525
550
575
600
625
650
675
700
725
750
775
800
825
850

TENS
BS
CALI
GR
DT
CASING CHECK
DT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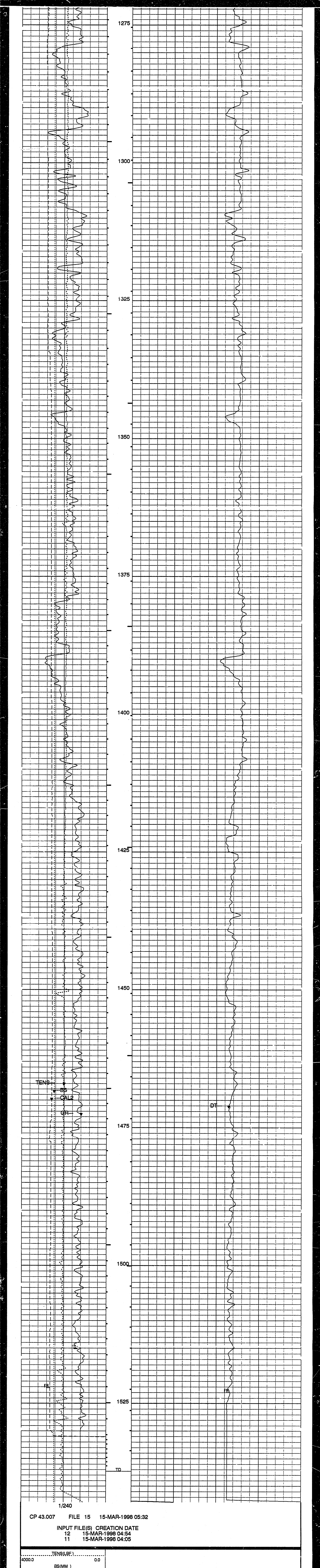



CP 43.007 FILE 15 15-MAR-1998 05:32

INPUT FILE(S) CREATION DATE
12 15-MAR-1998 04:54
11 15-MAR-1998 04:05

| | |
|---|---|
| TENS(LBF) 4000.0 — 0.0 | |
| BS(MM) 125.00 — 375.00 | |
| CAL2(MM) 125.00 — 375.00 | |
| GR(GAPI) 0.0 — 150.00 | DT(US/M) 500.00 — 100.00 |

PARAMETERS

| NAME | VALUE | UNIT | NAME | VALUE | UNIT |
|---|---|---|---|---|---|
| SMB | DISA | | VDLR | 2IN | |
| PP | NORM | | DO | 0.0 | M |
| DO2 | 0.0 | M | WMUD | 1135.00 | K/M3 |
| TD | 1537.40 | M | FCD | 177.800 | MM |
| IFRS | 20 | KHZ | SBR | 1.00000 | OHMM |
| MXE2 | 29.4100 | MM/M | DXE2 | 77.4500 | MM/M |
| MRE2 | 20.2100 | MM/M | DRE2 | 14.2700 | MM/M |
| MPH2 | -.810500 | DEG | DPH2 | .154500 | DEG |
| MGF2 | 1.03800 | | DGF2 | 1.00800 | |
| DESP | DISA | | SFLE | ALLO | |
| DCAS | 601.000 | M | ITEN | ALLO | |
| DEVI | 0.0 | DEG | DSES | H412 | |
| IPRO | PHAS | | IPHA | NORM | |
| T0CA | ALLO | | MODE | BHC | |
| DETE | E2 | | MGAI | 4000.00 | |
| AGC | ALLO | | SLEV | 5000.00 | MV |
| GAI | 40.0000 | | SFAF | 0.0 | DB/M |
| SGAD | ALLO | | SGW | 80 | US |
| NMSG | 180 | US | SGDT | 50 | US/F |
| DTCM | NORM | | SLC | C | |
| SLS | WA | | SPLE | 0 | IN |
| RATE | 15 | HZ | SOAD | AUTO | |
| DDEL | 0 | US | DSIN | 10 | US |
| DWCO | 500 | | RMOD | B | |
| WMOD | BHC | | WAGC | ALLO | |
| WGDT | 787.401 | US/M | WGAI | 20.0000 | |
| ITTS | DT | | SPSO | DT | |
| SPFS | R-H | | DTM | 183.727 | US/M |
| SVS | DT | | NCJT | GSRY | |
| GTSE | TEMP | | SHT | 5.00000 | DEGC |
| BHT | 58.0000 | DEGC | SPAE | DISA | |
| BS | 222.000 | MM | BHS | OPEN | |

ACCUMULATED INTEGRATION VALUES SUMMARY:

Integrated Hole Volume: 4.86730 M3 FROM 1537.40 M TO 1443.38 M
Integrated Cement Volume: 2.53642 M3 FROM 1537.40 M TO 1443.38 M
(ASSUMING 177.800 MM O.D. CASING)
Integrated Transit Time: .0249793 S FROM 1537.40 M TO 1443.38 M

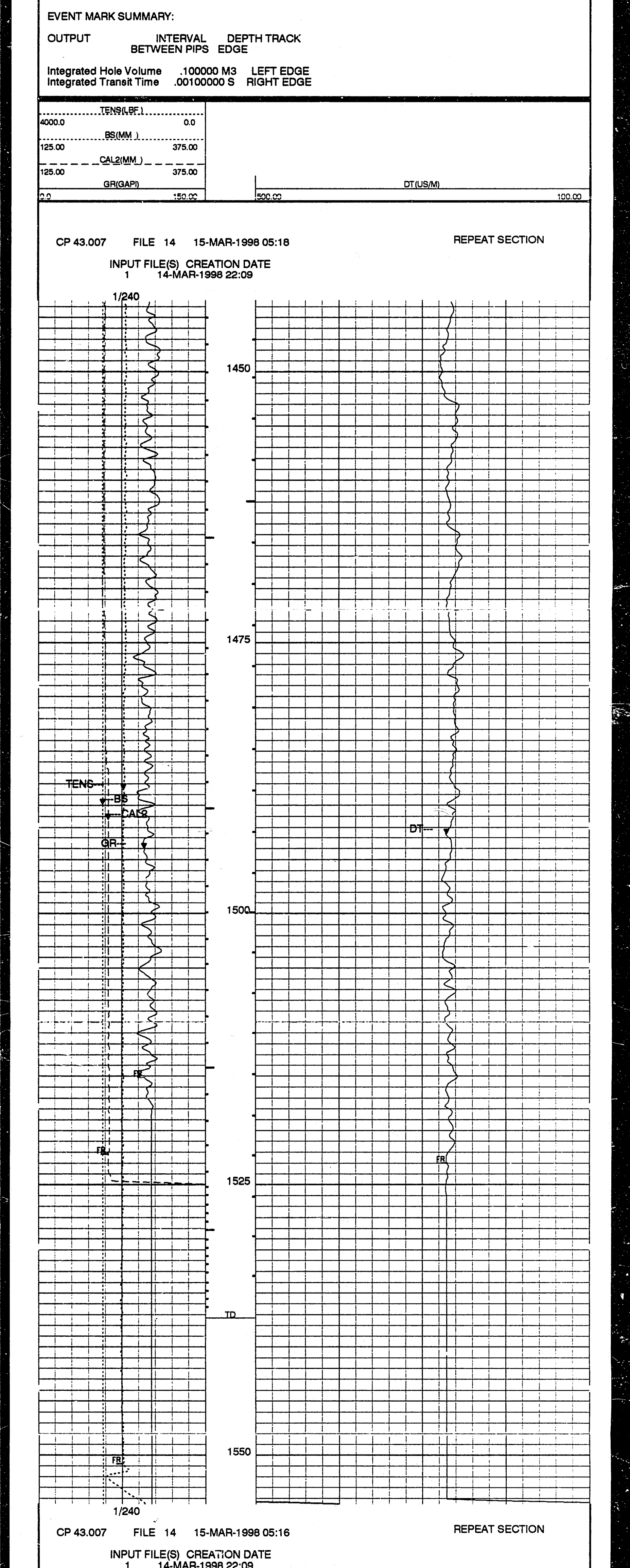
EVENT MARK SUMMARY:

| OUTPUT | INTERVAL BETWEEN PIPS | DEPTH TRACK EDGE |
|---|---|---|
| Integrated Hole Volume | .100000 M3 | LEFT EDGE |
| Integrated Transit Time | .00100000 S | RIGHT EDGE |

| | |
|---|---|
| TENS(LBF) 4000.0 — 0.0 | |
| BS(MM) 125.00 — 375.00 | |
| CAL2(MM) 125.00 — 375.00 | |
| GR(GAPI) 0.0 — 150.00 | DT(US/M) 500.00 — 100.00 |

CP 43.007 FILE 14 15-MAR-1998 05:18 REPEAT SECTION

INPUT FILE(S) CREATION DATE
1 14-MAR-1998 22:09




CP 43.007 FILE 14 15-MAR-1998 05:16 REPEAT SECTION

INPUT FILE(S) CREATION DATE
1 14-MAR-1998 22:09

| | |
|---|---|
| TENS(LBF) 4000.0 — 0.0 | |
| BS(MM) 125.00 — 375.00 | |
| CAL2(MM) 125.00 — 375.00 | |
| GR(GAPI) 0.0 — 150.00 | DT(US/M) 500.00 — 100.00 |

SENSOR MEASURE POINT TO TOOL ZERO

SDT 15.85 METER SGTL 22.28 METER
DTT -13.4 METER DITE 3.15 METER
PCDB 15.21 METER

PARAMETERS

| NAME | VALUE | UNIT | NAME | VALUE | UNIT |
|---|---|---|---|---|---|
| SMB | DISA | | VDLR | 2IN | |
| PP | NORM | | DO | .500000 | M |
| WMUD | 1135.00 | K/M3 | TD | 1537.40 | M |
| FCD | 177.800 | MM | IFRS | 20 | KHZ |
| SBR | 1.00000 | OHMM | MXE2 | 29.4100 | MM/M |
| DXE2 | 77.4500 | MM/M | MRE2 | 20.2100 | MM/M |
| DRE2 | 14.2700 | MM/M | MPH2 | -.810500 | DEG |
| DPH2 | .154500 | DEG | MGF2 | 1.03800 | |
| DGF2 | 1.00800 | | DESP | DISA | |
| SFLE | ALLO | | DCAS | 601.000 | M |
| ITEN | ALLO | | DEVI | 0.0 | DEG |
| DSES | H412 | | IPRO | PHAS | |
| IPHA | NORM | | T0CA | ALLO | |
| MODE | BHC | | DETE | E2 | |
| MGAI | 4000.00 | | AGC | ALLO | |
| SLEV | 5000.00 | MV | GAI | 40.0000 | |
| SFAF | 0.0 | DB/M | SGAD | ALLO | |
| SGW | 80 | US | NMSG | 180 | US |
| SGDT | 50 | US/F | DTCM | NORM | |
| SLC | C | | SLS | WA | |
| SPLE | 0 | IN | RATE | 15 | HZ |
| SOAD | AUTO | | DDEL | 0 | US |
| DSIN | 10 | US | DWCO | 500 | |
| RMOD | B | | WMOD | BHC | |
| WAGC | ALLO | | WGDT | 787.401 | US/M |
| WGAI | 20.0000 | | ITTS | DT | |
| SPSO | DT | | SPFS | R-H | |
| DTM | 183.727 | US/M | SVS | DT | |
| NCJT | GSRY | | GTSE | TEMP | |
| SHT | 5.00000 | DEGC | BHT | 58.0000 | DEGC |
| SPAE | DISA | | BS | 222.000 | MM |
| BHS | OPEN | | | | |

BEFORE SURVEY CALIBRATION Summary

Performed: 14-MAR-1998 22:08
Program File: TOH (Version 43.007 95/05/03 95/05/03)

SGTL Detector Calibration Summary

| | MEASURED BKGD | MEASURED JIG | CALIBRATED | UNITS |
|---|---|---|---|---|
| GR | 5 | 177 | 165 | GAPI |

Back: 14-MAR-1998 21:33 Jig: 14-MAR-1998 21:40 Comp: 14-MAR-1998 21:40

DITE Electronics Calibration Summary

Sonde SN#: 81
Cartridge SN#: 83
Induction Freq: 20 KHz

Induction Electronics:

| | Offset (MM/M) | Valid Range (MM/M) | Gain (--) | Valid Range (---) | Phase (DEG.) | Valid Range (DEG.) |
|---|---|---|---|---|---|---|
| IRD | 9.9 | -115. => 135. | .946 | .81 => 1.14 | | |
| IXD | 12.7 | -114. => 136. | .955 | .81 => 1.15 | 4.37 | -11.25 => 18.75 |
| IRM | 15.1 | -210. => 240. | .939 | .80 => 1.13 | | |
| IXM | 35.2 | -190. => 260. | .962 | .82 => 1.16 | 7.71 | -7.91 => 22.09 |

SFL Electronics:

| | Offset | Valid Range | Units | Gain | Valid Range |
|---|---|---|---|---|---|
| SFV | 1.3 | -13.9 => 16.1 | MV | .99 | .84 => 1.18 |
| SFC | .0 | -.0 => .0 | AMPS | .99 | .84 => 1.18 |

Plus Measurement performed at: 14-MAR-1998 22:07

PCDB Electronics Calibration Summary

| | MEASURED ZERO | MEASURED PLUS | CALIBRATED ZERO | CALIBRATED PLUS | UNITS |
|---|---|---|---|---|---|
| MINV | 0.0 | 0.0 | 0.0 | 0.0 | OHMM |
| MNOR | 0.0 | 0.0 | 0.0 | 0.0 | OHMM |

Zero: 14-MAR-1998 21:43 Plus: 14-MAR-1998 21:42 Comp: 14-MAR-1998 21:44

PCDB Caliper Calibration Summary

| | MEASURED Small | MEASURED Large | CALIBRATED Small | CALIBRATED Large | UNITS |
|---|---|---|---|---|---|
| CAL2 | 191.10 | 284.76 | 214.29 | 315.89 | MM |
| SA | 0.0 | 0.0 | 0.0 | 0.0 | MM |

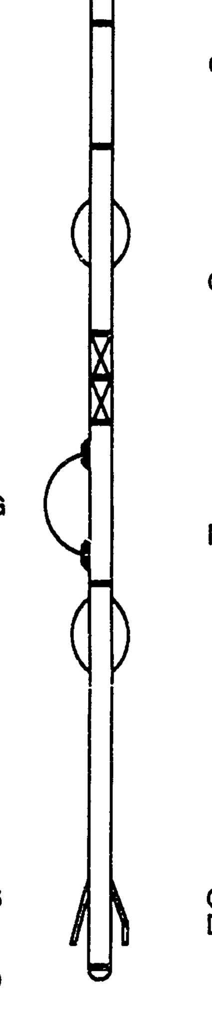
Small: 14-MAR-1998 21:43 Large: 14-MAR-1998 21:42 Comp: 14-MAR-1998 21:44

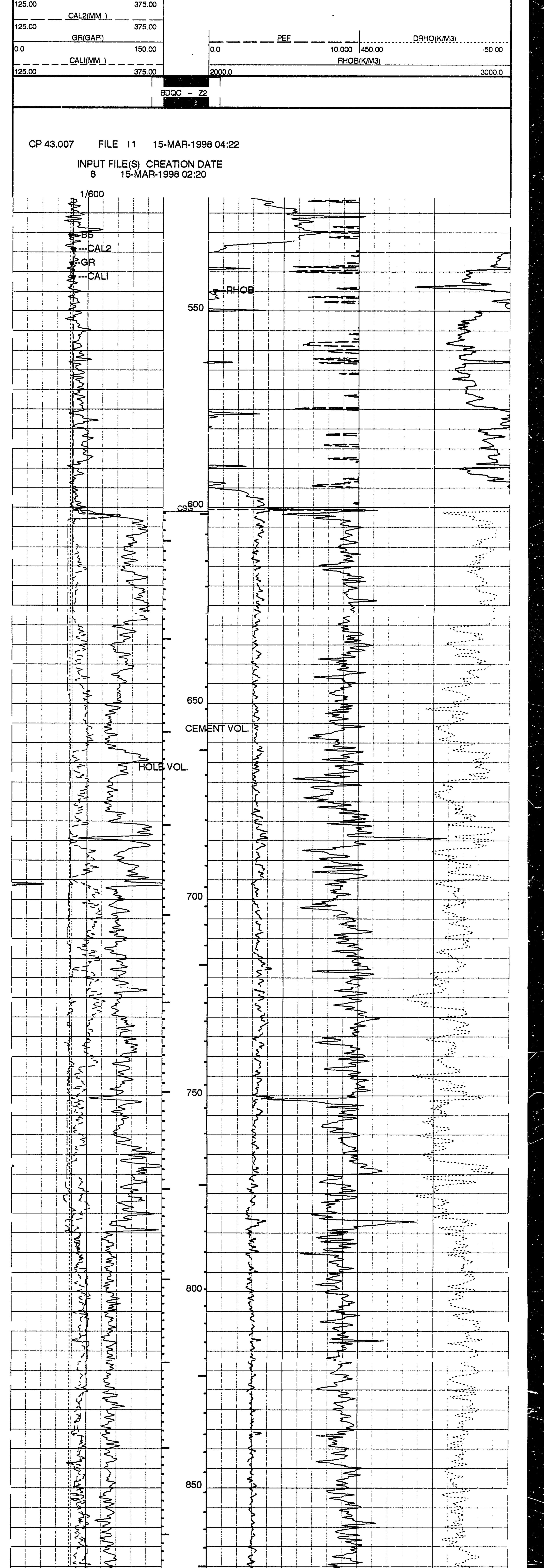
CP 43.007 FILE 0 14-MAR-1998 22:08

| | | | | |
|---|---|---|---|---|
| COMPANY | RANGER OIL LIMITED | SCHL. | FR | 1521.5 M |
| | | SCHL. | TD | 1540.0 M |
| WELL | RANGER ET AL LITTLE BEAR M-39 | DRLR. | TD | 1550.0 M |
| | | Elev: | KB | 259.2 M |
| FIELD | LITTLE BEAR | | DF | 258.9 M |
| TERRITORY | N.W.T. | | GL | 253.9 M |

Schlumberger

BOREHOLE COMPENSATED SONIC LOG





N.E.B. COPY NEB 1838

9211-R36-2-3

Schlumberger

"SIMULTANEOUS"
COMPENSATED NEUTRON-LITHO-DENSITY

TERRITORY	N.W.T.
FIELD	LITTLE BEAR
LOCATION	
WELL	RANGER ET AL LITTLE BEAR M-39
COMPANY	RANGER OIL LIMITED

COMPANY RANGER OIL LIMITED

WELL RANGER ET AL LITTLE BEAR M-39

FIELD LITTLE BEAR

TERRITORY N.W.T.

LOCATION 69-49-58-129

Other Services:
PHSFL
BHC SONIC
LOGNET

API SERIAL NO.	SECT.	TWP.	RANGE

Permanent Datum	GROUND LEVEL	Elev. 253.9 M		Elev.: K.B.259.2 M
Log Measured From	KELLY BUSHING	5.4 M	above Perm. Datum	D.F.258.9 M
Drilling Measured From	KELLY BUSHING			G.L.253.9 M

Date	15-MARCH-1998			
Run No.	TWO			
Depth Driller	1550.0 M			
Depth Logger (Schl.)	1540.0 M			
Btm. Log Interval	1539.7 M			
Top Log Interval	601.0 M			
Casing-Driller	244.5 MM @ 602.6 M	@	@	
Casing-Logger	601.0 M			
Bit Size	311 MM @ 602.6 M	222 @ 1550.0 M	@	
Type Fluid in Hole	GEL CHEM			
Dens. | Visc.	1135. K/M3	77.0 S		
pH | Fld. Loss	9.0	8.0 C3		
Source of Sample	FLOWLINE			
Rm @ Meas. Temp.	4.850 OHMM @ 18.0 DEGC		@	
Rmf @ Meas. Temp.	4.810 OHMM @ 10.0 DEGC		@	
Rmc @ Meas. Temp.	3.390 OHMM @ 10.0 DEGC		@	
Source: Rmf | Rmc	PRESS	PRESS		
Rm @ BHT	2.299 OHMM @ 62.0 DEGC		@	
TIME Circulation Ended	09:00/14TH			
TIME Logger on Bottom	02:00/15TH			
Max. Rec. Temp.	62.0 DEGC			
Equip. | Location	8416	NORMAN WELLS		
Recorded By	G. MCISAAC			
Witnessed By	HENRI WENNEKERS			

The well name, location and borehole reference data were furnished by the customer.

All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretations made by any of our officers, agents or employees. These interpretations are also subject to Clause 4 of our General Terms and Conditions as set out in our current Price Schedule.

Run No.	TWO	
Service Order No.	1210887	
Drilling Fluid Level		
Salinity		
Rmf @ BHT	1.821 OHMM @ 62.0 DEGC	@
Rmc @ BHT	1.283 OHMM @ 62.0 DEGC	@
Logging Speed	1000.0 M/HR	
EQUIPMENT DATA		
Tool Number 1	TCC-B 319	
Tool Number 2	SGC-SA 1048	
Tool Number 3	DAC-CA 1077	
Tool Number 4	CNT-HA 1257	
Tool Number 5	NSC-E 1868	
Tool Number 6	DRS-E 723	
Tool Number 7	GSR-JA 2043	
Tool Number 8	NSR-FA 1491	
Tool Number 9		
Tool Number 10		
Tool Number 11		
Tool Number 12		

REMARKS:
CORRELATED TO SOC DITE DATED 5-MARCH-1998
CNT BOWSPRING USED
90 DEG OFFSETS USED ON LDT
CEMENT VOL BASED ON 177.8 MM PRODUCTION CASING

LOGGING TOOL STRING SKETCH

LOGGING HEAD
TCCB
13.89 M
SGTL
12.98 M
GR
12.70 M
PCDB
11.30 M
CAL2
CAL2
9.63 M
FLEX2
8.71 M
FLEX1
8.10 M
CNTH
7.49 M
BOWSPRING
NPOR
6.15 M
LDTD
5.28 M
90 DEG OFFSETS
CALIPER DETECTORS
CALI
0.81 M
DPHI DRHO RHOB PEF
0.79 M
TOOL ZERO
TOOL ZERO

TOTAL TOOL STRING LENGTH IS 14.91 M.
TOTAL TOOL STRING WEIGHT IS 518.9 KG IN AIR.

ACCUMULATED INTEGRATION VALUES SUMMARY:

Integrated Hole Volume: 37.3280 M3 FROM 1540.00 M TO 601.000 M
Integrated Cement Volume: 14.0192 M3 FROM 1540.00 M TO 601.000 M
(ASSUMING 177.800 MM O.D. CASING)

EVENT MARK SUMMARY:

OUTPUT INTERVAL BETWEEN PIPS DEPTH TRACK EDGE

Integrated Hole Volume .100000 M3 LEFT EDGE
Integrated Cement Volume .100000 M3 RIGHT EDGE

BDQC
10.000 0.0

BS(MM)
125.00 375.00
CAL2(MM)
125.00 375.00
GR(GAPI)
0.0 150.00
CALI(MM)
125.00 375.00

PEF
0.0 10.000

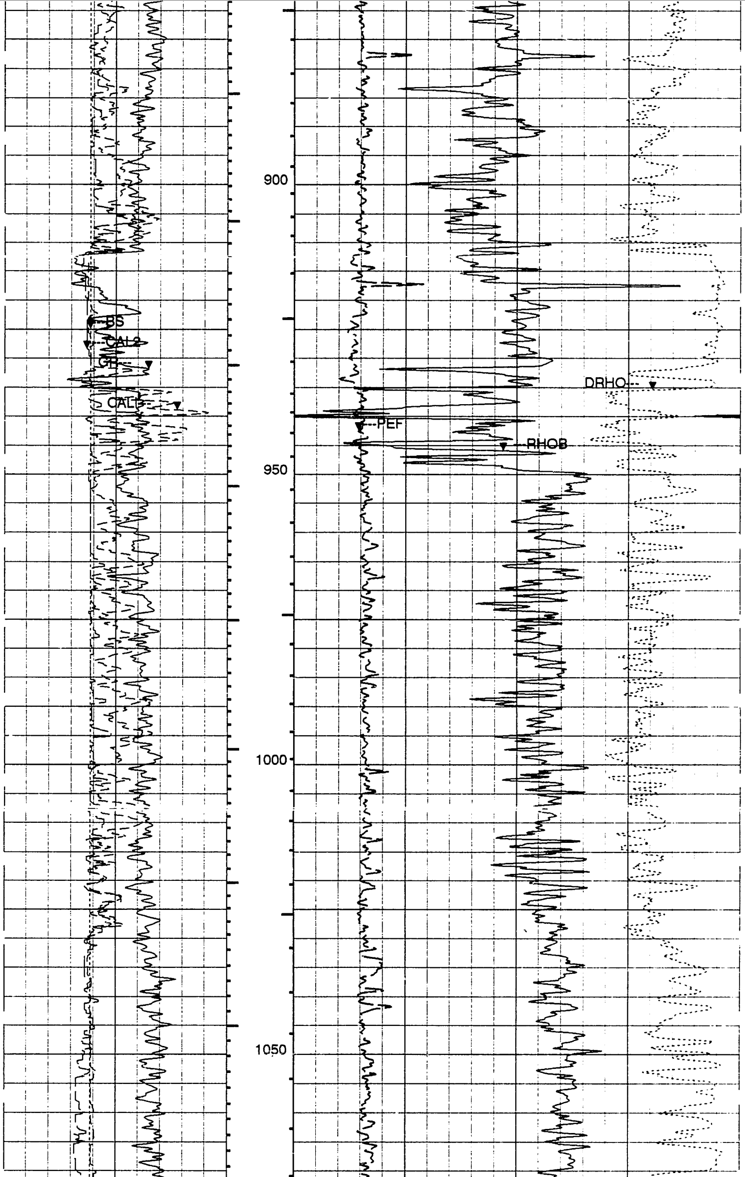
DRHO(K/M3)
450.00 -50 00

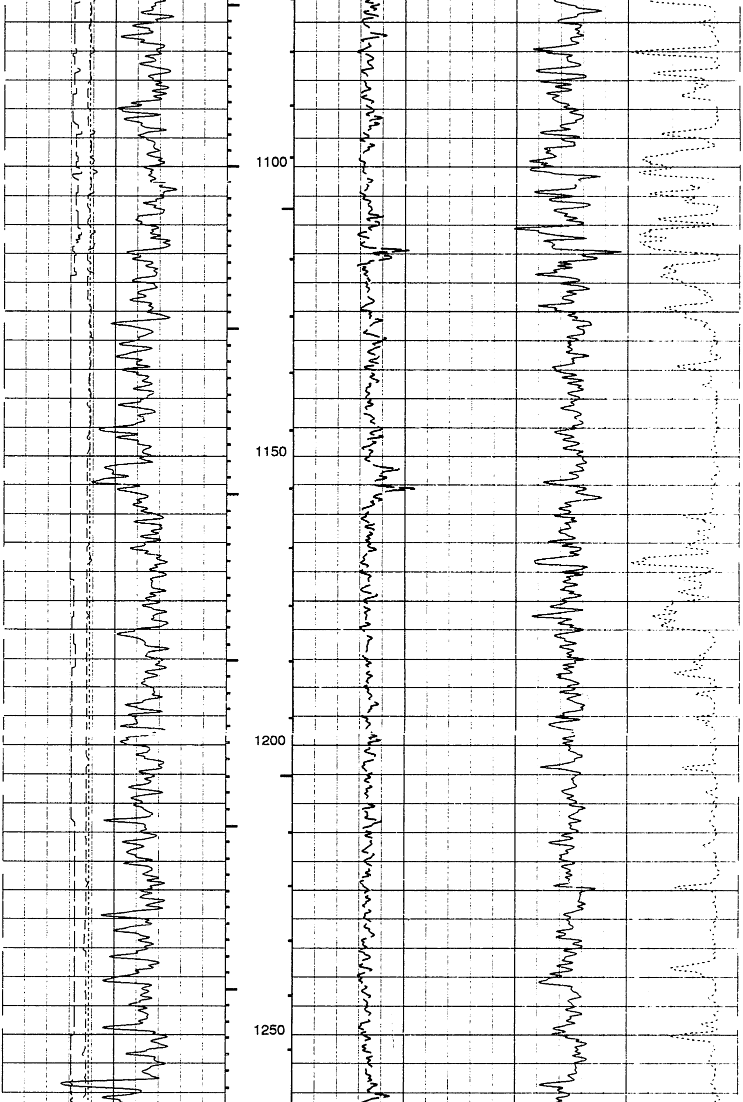
RHOB(K/M3)
2000.0 3000.0

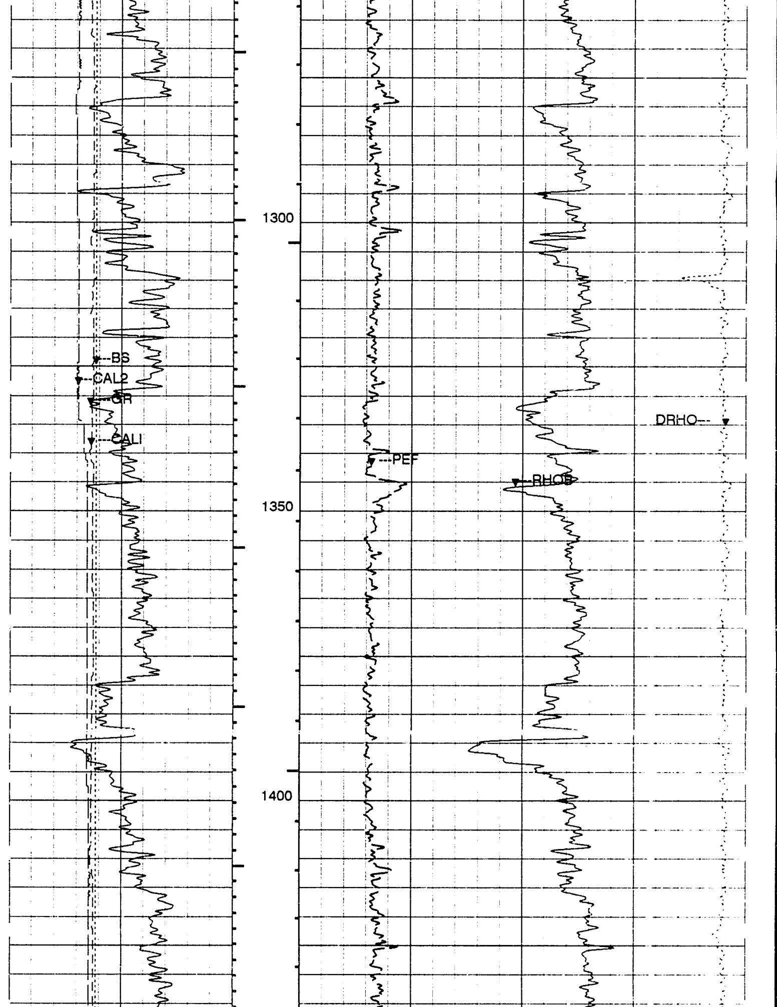
BDQC -- Z2

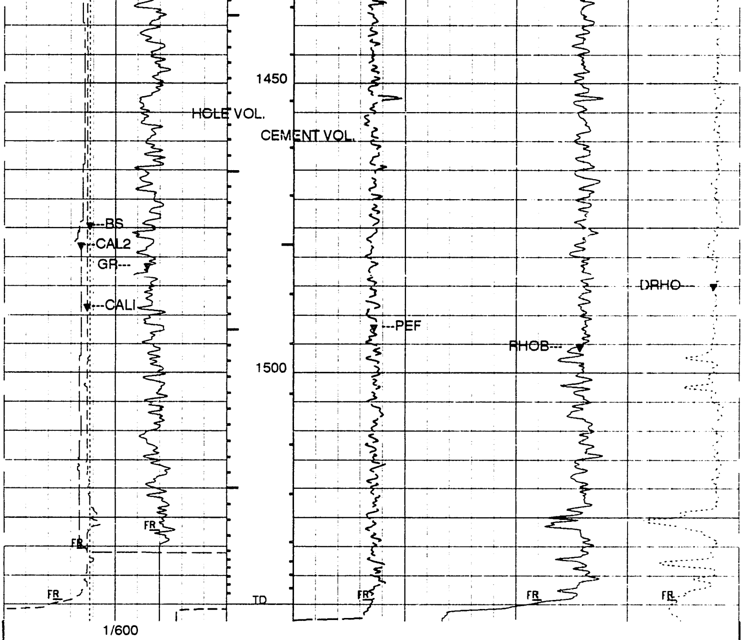
CP 43.007 FILE 11 15-MAR-1998 04:22

INPUT FILE(S) CREATION DATE
8 15-MAR-1998 02:20









CP 43.007 FILE 11 15-MAR-1998 04:05

INPUT FILE(S) CREATION DATE
8 15-MAR-1998 02:20

BDQC -- Z2

BDQC
10.000 0.0

BS(MM)
125.00 375.00

CAL2(MM)
125.00 375.00

GR(GAPI)
0.0 150.00

CALI(MM)
125.00 375.00

PEF
0.0 10.000

DRHO(K/M3)
450.00 -50.00

RHOB(K/M3)
2000.0 3000.0

SENSOR MEASURE POINT TO TOOL ZERO

LDTD .81 METER
PCDB 13.16 METER
CNTH 6.30 METER

SGTL 12.70 METER
DTT -.28 METER

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
PP	RECO		DO	.500000	M
WMUD	1135.00	K/M3	TD	1540.00	M
FCD	177.800	MM	DHC	BS	
BFM	LIQU		MDEN	2650.00	K/M3
FD	1000.00	K/M3	DPPM	STAN	
MATR	SAND		HC	CALI	
NPDC	0		HSCO	YES	
SOCO	NO		MCCO	NO	
BSCO	NO		FSCO	NO	
MWCO	NO		PTCO	NO	
CCCO	NO		SDAT	SOCN	
MCOR	NATU		SOCN	12.7000	MM
FSAL	-50000.0	PPM	ANGL	0.0	DEG
GGRD	.0182270	DC/M	BHFL	WATE	
CDSE	RHOB		CNPS	NPHI	
NCJT	GSRY		GTSE	TEMP	
SHT	5.00000	DEGC	BHT	62.0000	DEGC
TDL	1540.00	M	MRT	62.0000	DEGC
DFD	1135.00	K/M3	RMFS	4.81000	OHMM
RMS	4.85000	OHMM	MST	18.0000	DEGC
MFST	10.0000	DEGC	BS	222.000	MM
BHS	OPEN				

ACCUMULATED INTEGRATION VALUES SUMMARY:

Integrated Hole Volume: 37.3280 M3 FROM 1540.00 M TO 601.000 M
Integrated Cement Volume: 14.0192 M3 FROM 1540.00 M TO 601.000 M
(ASSUMING 177.800 MM O.D. CASING)

EVENT MARK SUMMARY:

OUTPUT	INTERVAL BETWEEN PIPS	DEPTH TRACK EDGE
Integrated Hole Volume	.100000 M3	LEFT EDGE
Integrated Cement Volume	.100000 M3	RIGHT EDGE

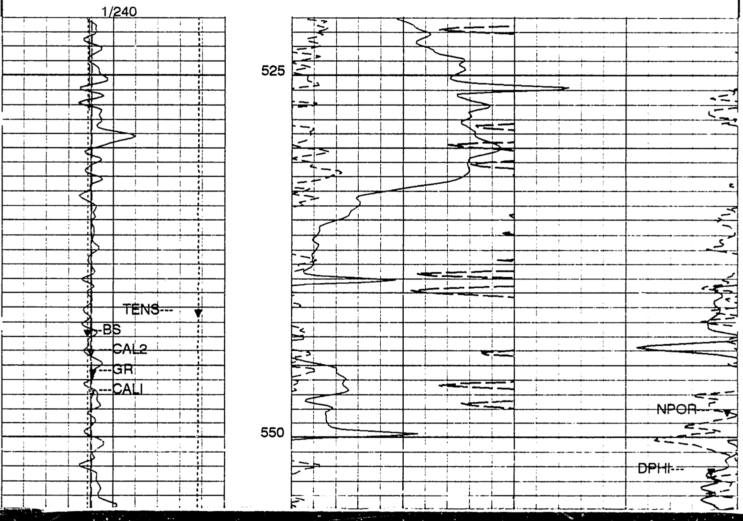
TENS(LBF)
10000. 0.0
BS(MM)
125.00 375.00
CAL2(MM)
125.00 375.00
GR(GAPI)
0.0 150.00
CALI(MM)
125.00 375.00

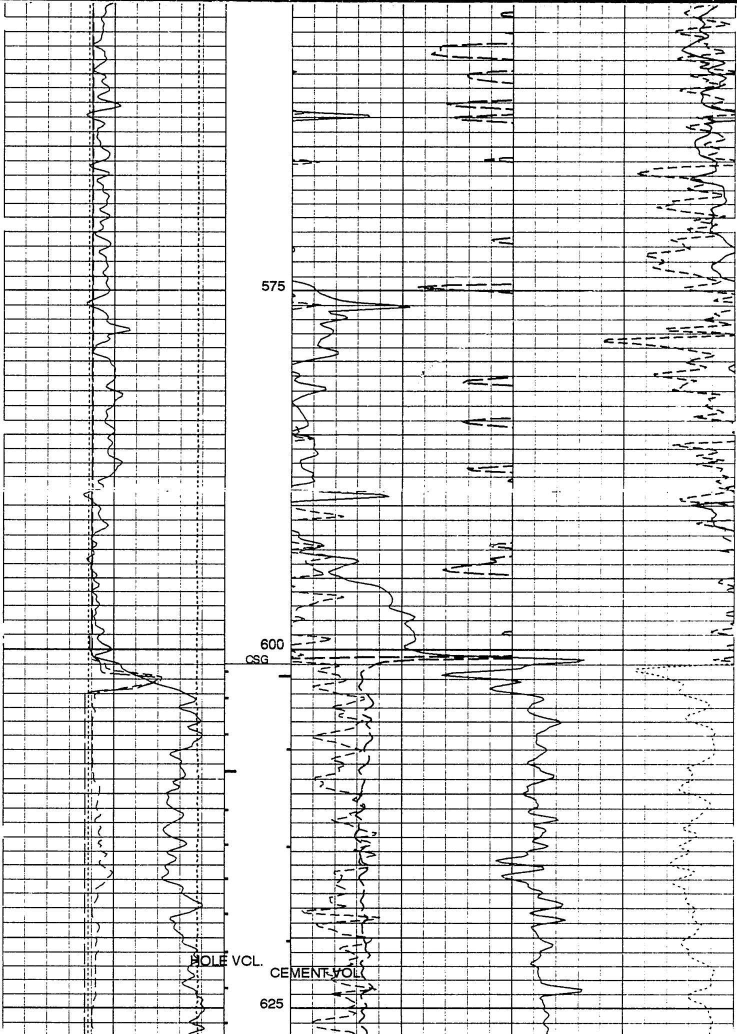
PEF
0.0 10.000
DRHO(K/M3)
450.00 -50.00
NPOR(V/V)
.45000 -.1500
DPHI(V/V)
.45000 -.1500

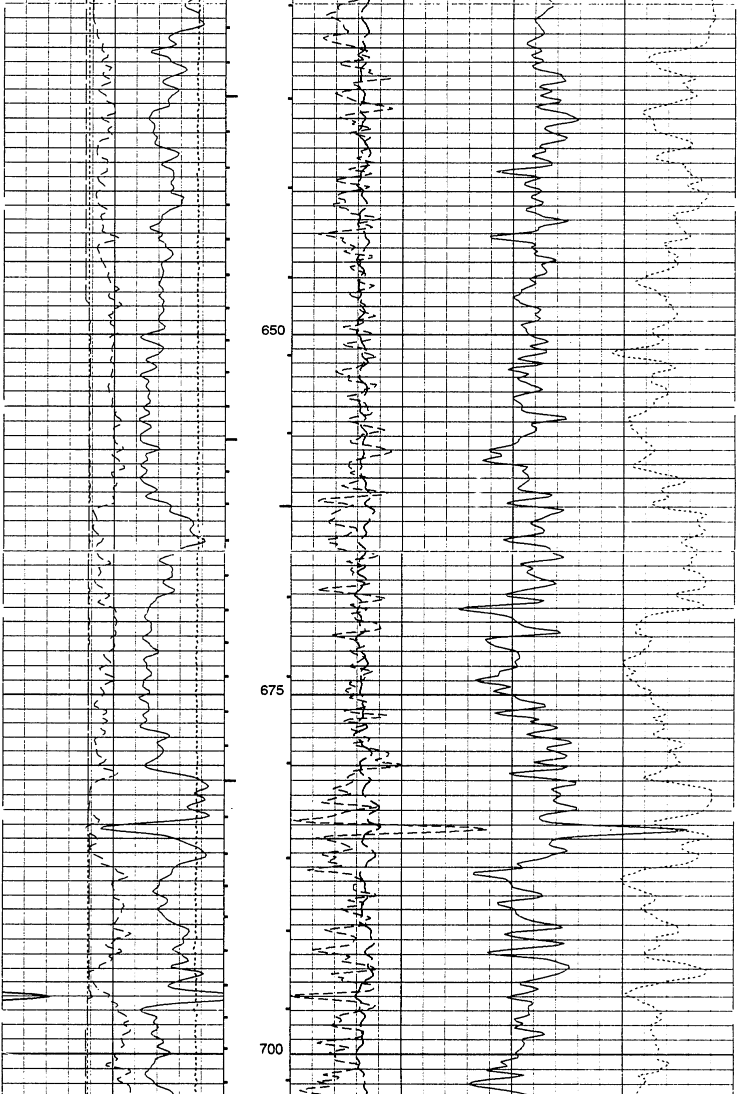
CP 43.007 FILE 11 15-MAR-1998 04:22

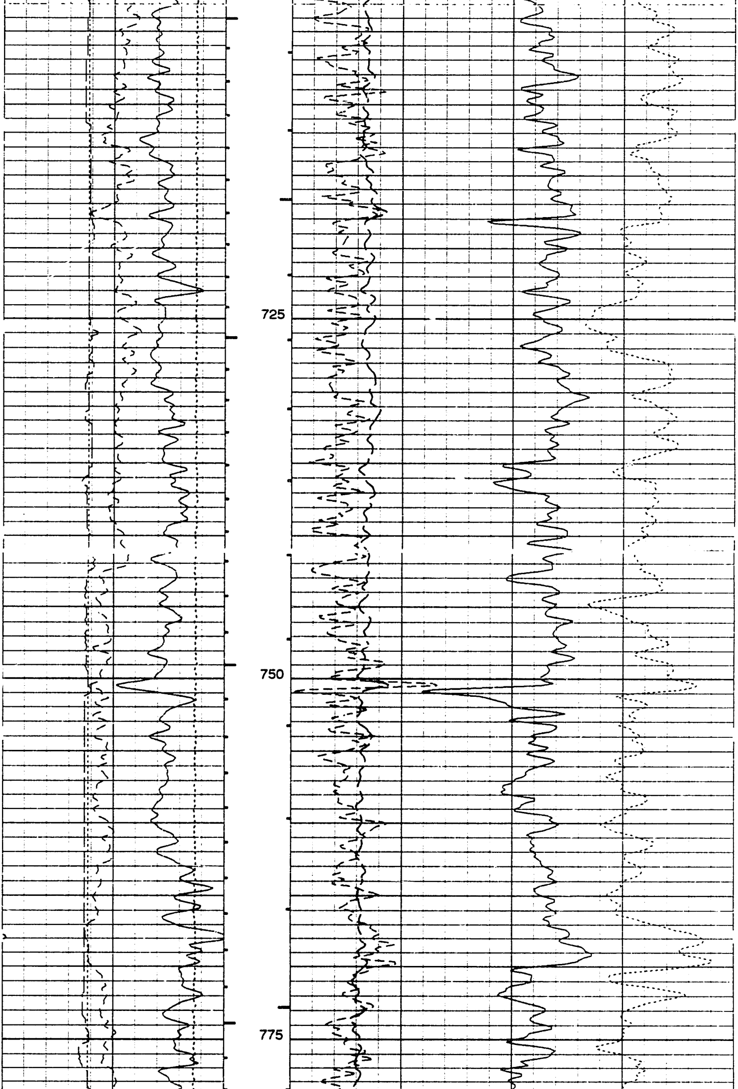
INPUT FILE(S) CREATION DATE
8 15-MAR-1998 02:20

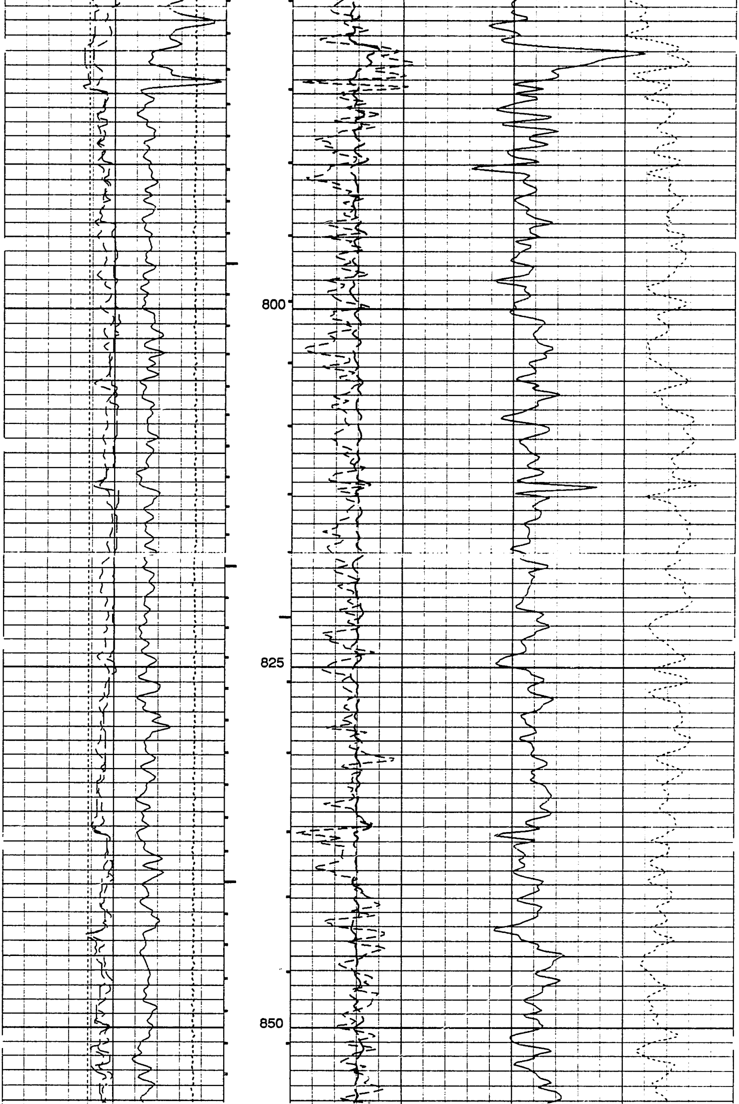
SANDSTONE MDEN=2650 KG/M3




575
600
CSG
HOLE VCL.
CEMENT VOL
625


650
675
700


725
750
775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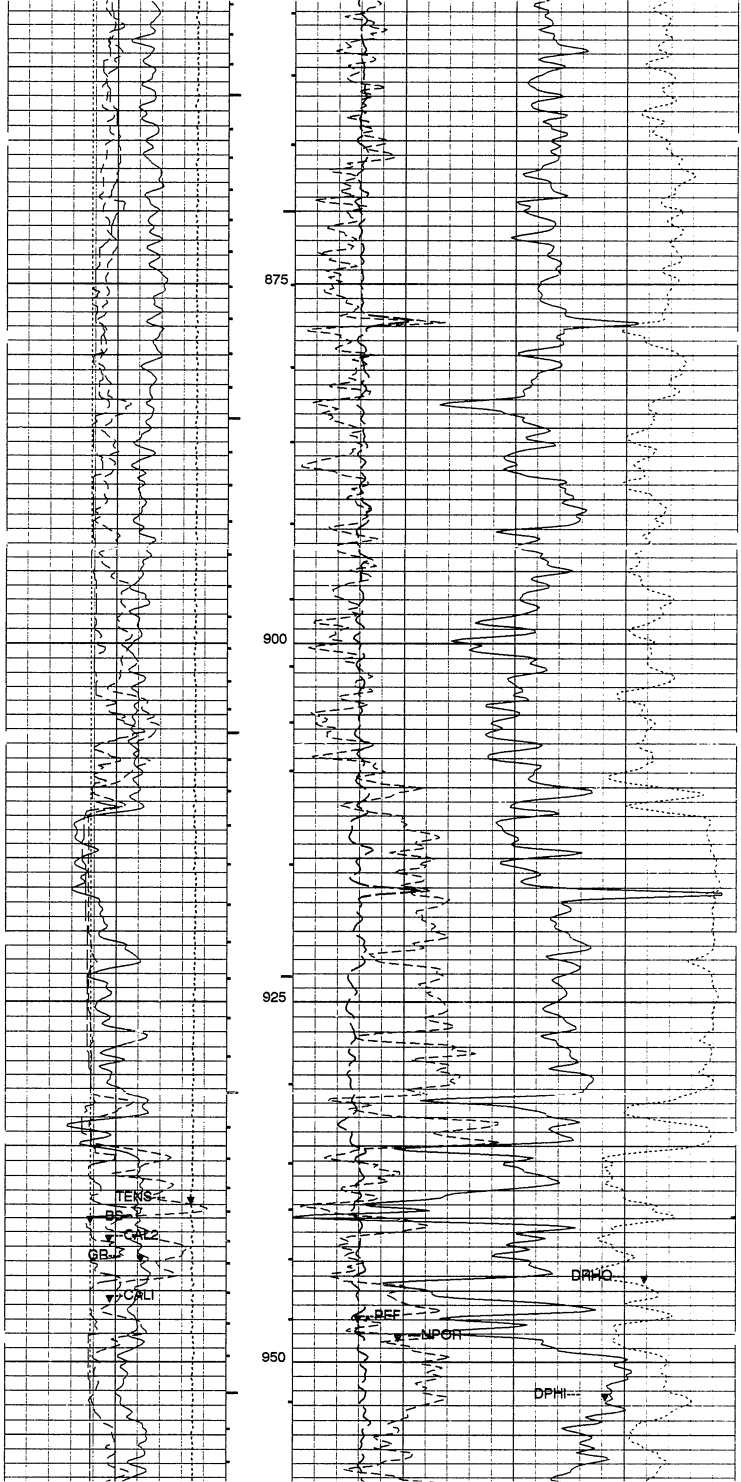
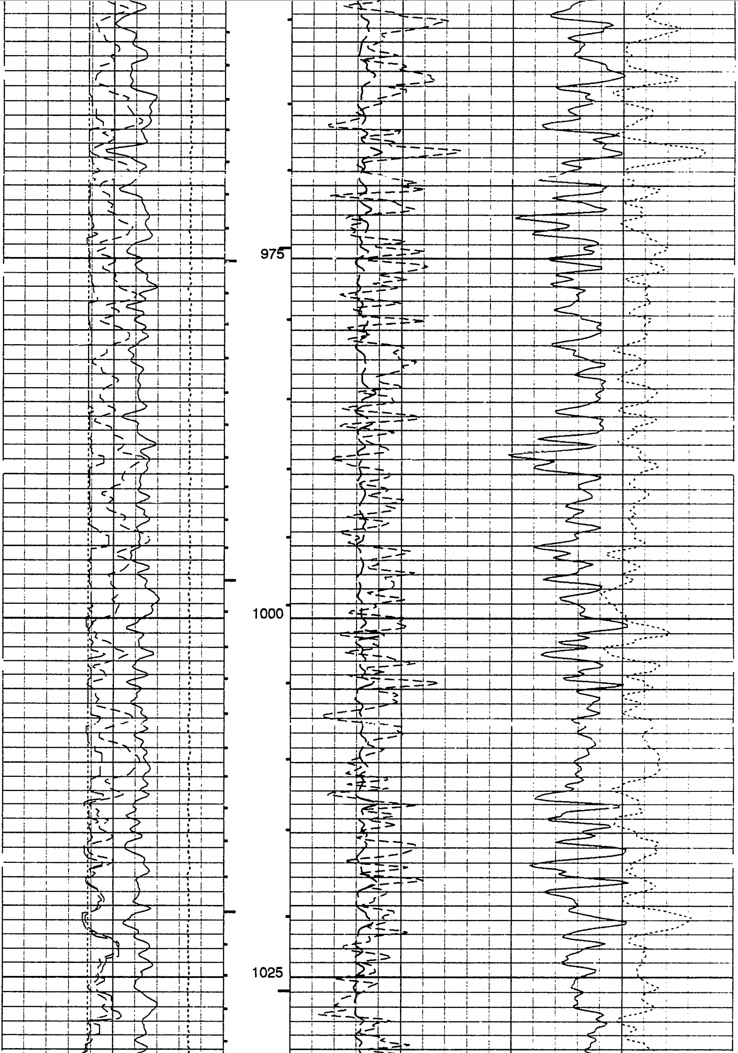
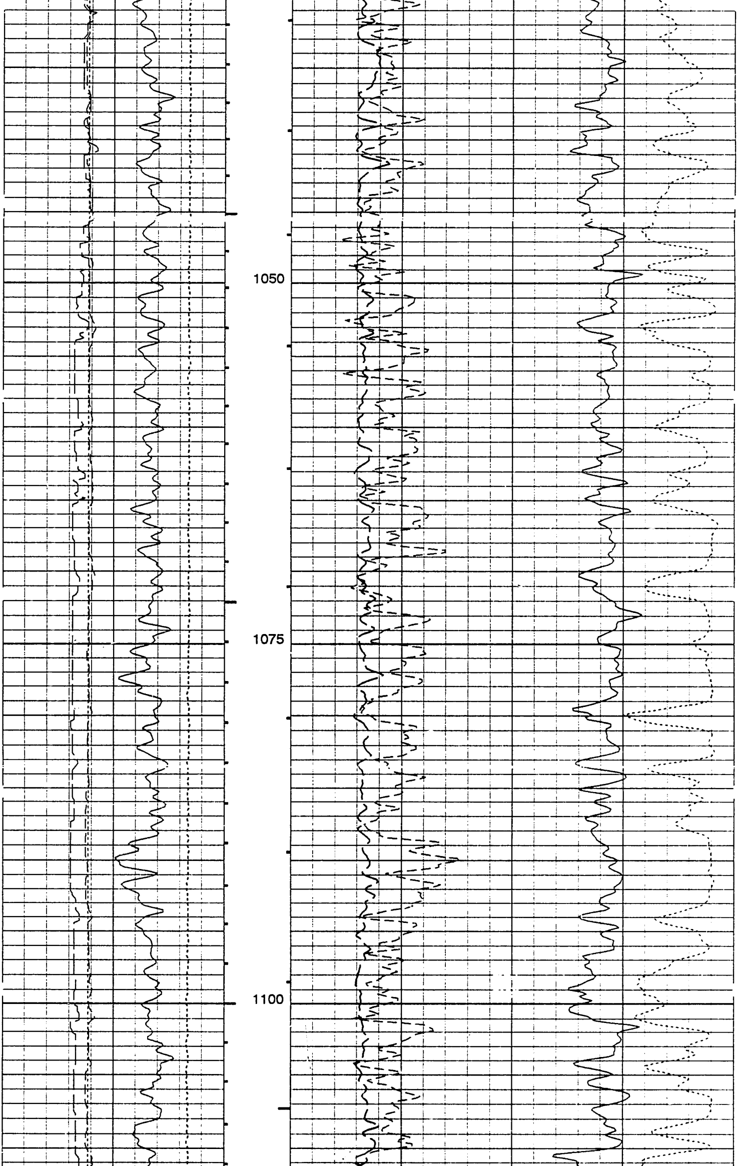
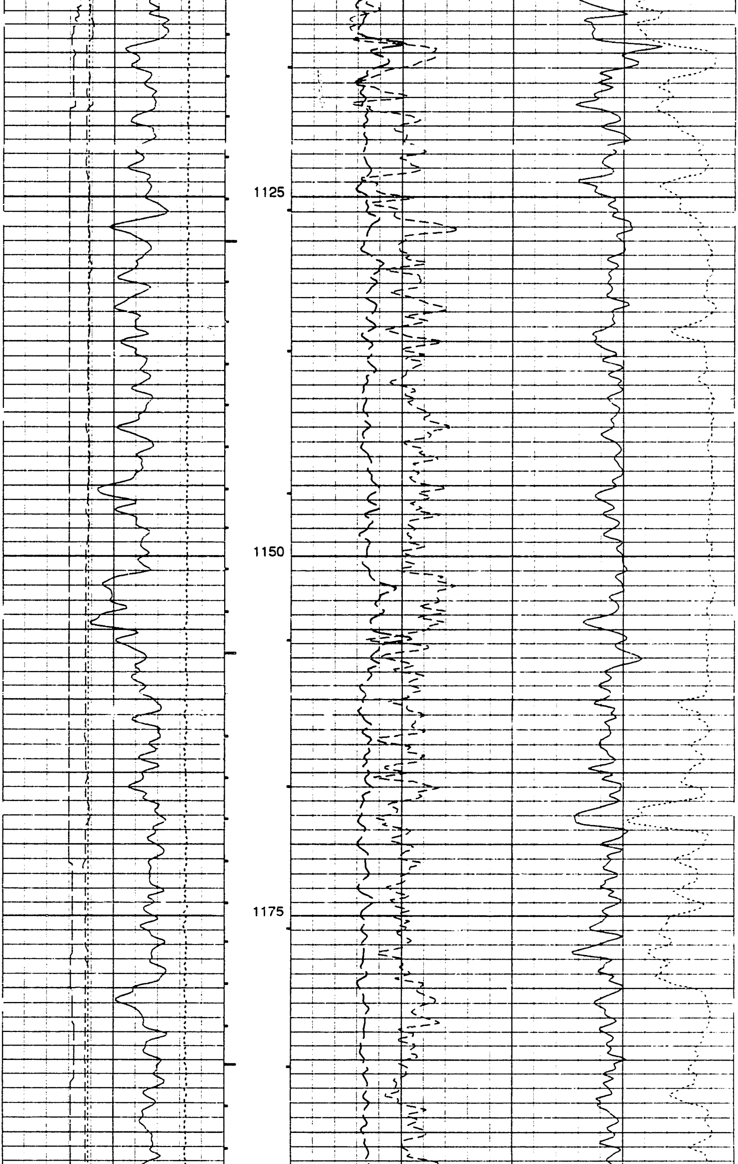
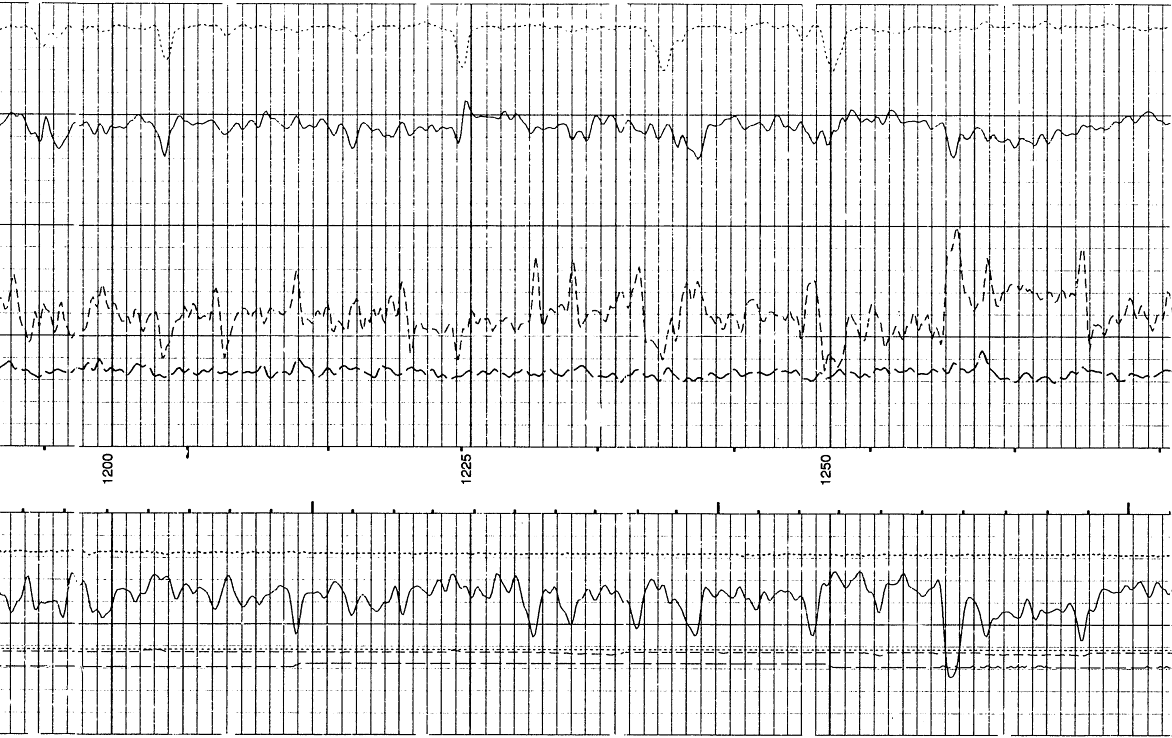
825
850

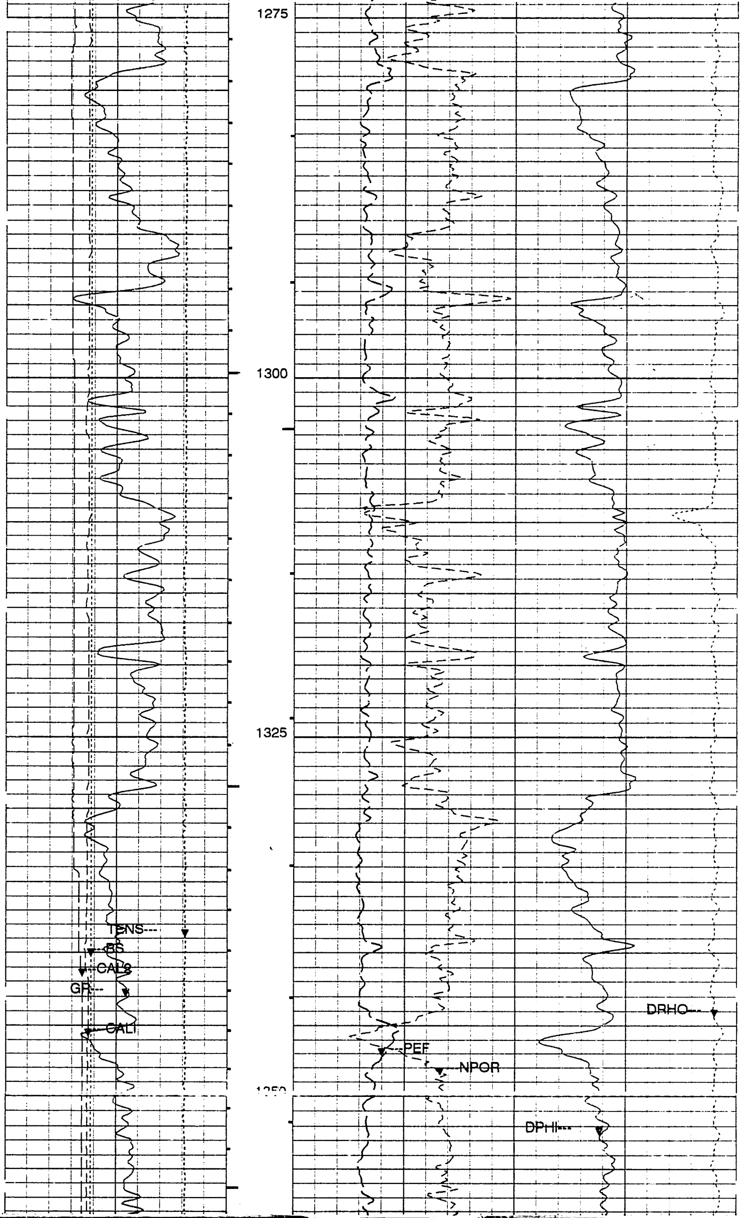

875
900
925
TENS
BS
CAL2
GB
CALI
DRHO
REF
NPOR
950
DPHI

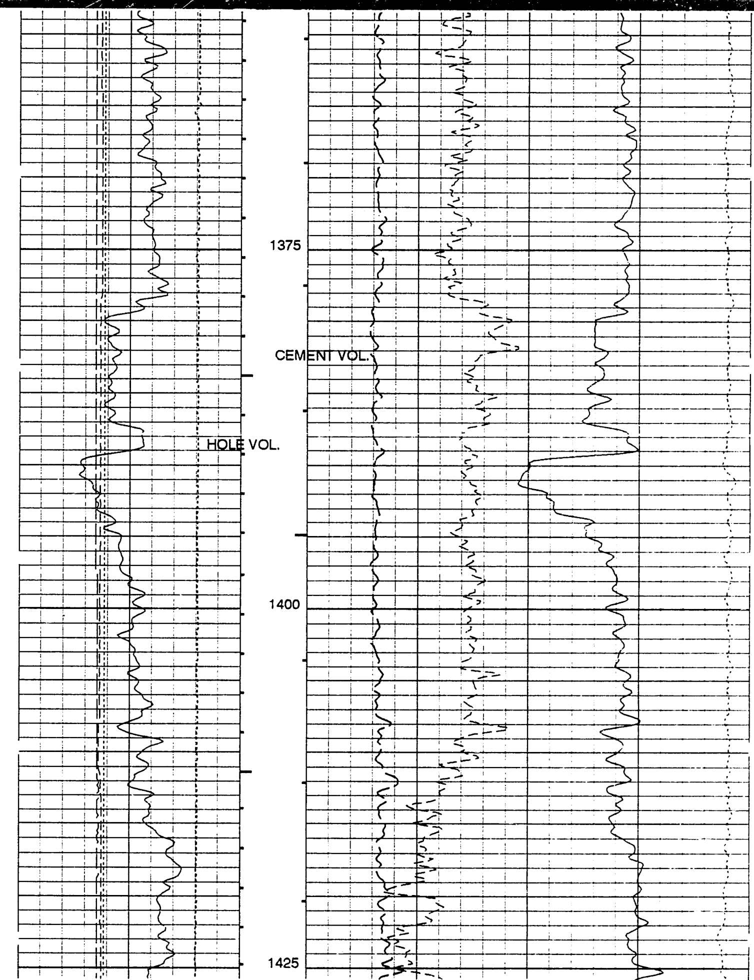

975
1000
1025

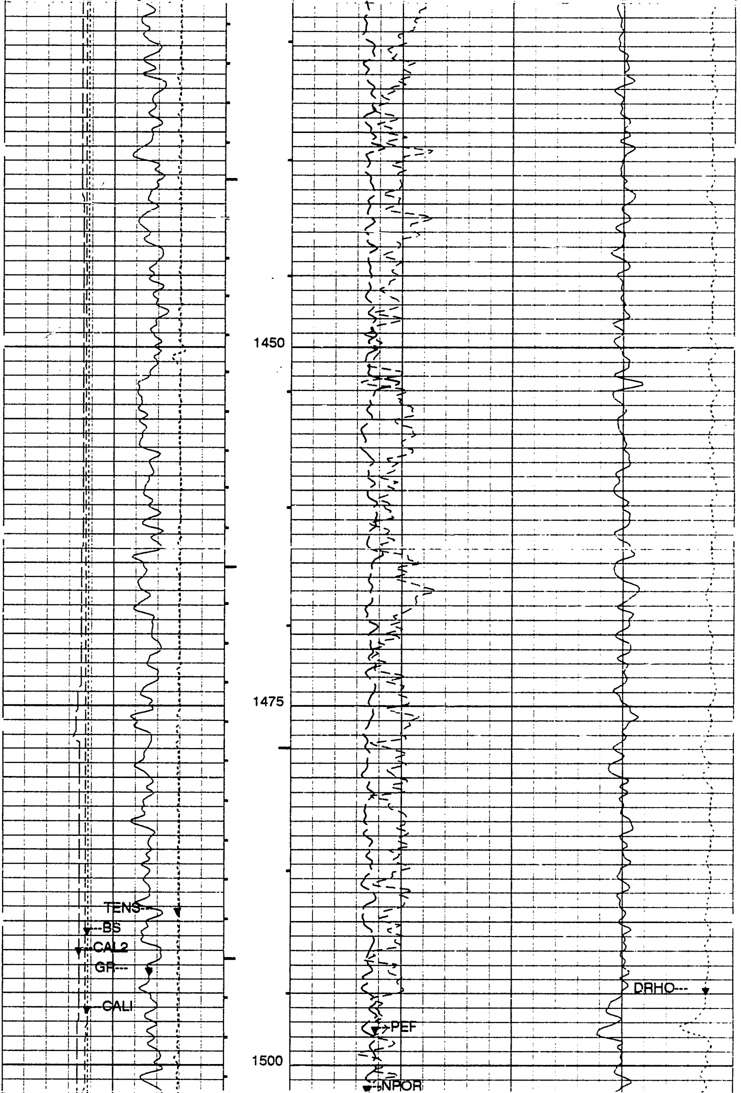

1050
1075
1100

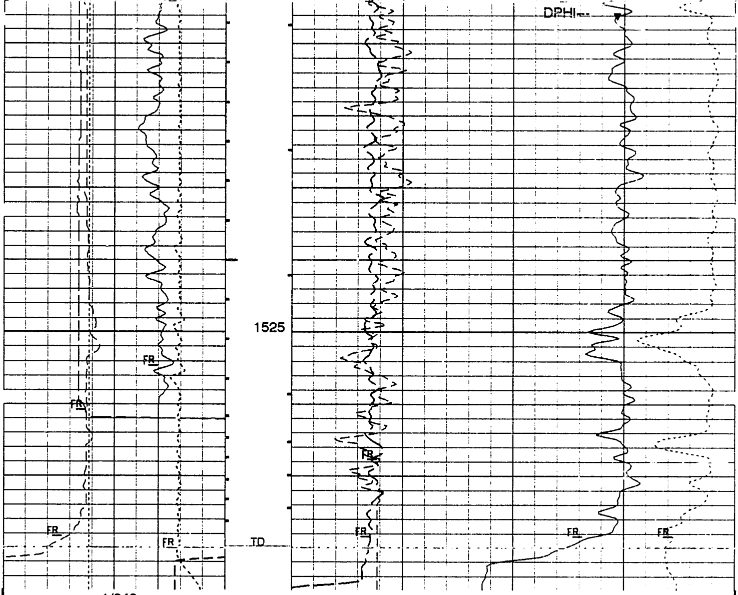

1125
1150
1175


1200
1225
1250


1275
1300
1325
TENS
BS
CAL2
GR
CALI
PEF
NPOR
DPHI
DRHO







1/240

SANDSTONE MDEN=2650 KG/M3

CP 43.007 FILE 11 15-MAR-1998 04:05

INPUT FILE(S) CREATION DATE
8 15-MAR-1998 02:20

TENS(LBF)	
10000.	0.0
BS(MM)	
125.00	375.00
CAL2(MM)	
125.00	375.00
GR(GAPI)	
0.0	150.00
CALI(MM)	
125.00	375.00

PEF		DRHO(K/M3)	
0.0	10.000	450.00	-50.00
NPOR(V/V)			
.45000			-.1500
DPHI(V/V)			
.45000			-.1500

SENSOR MEASURE POINT TO TOOL ZERO

LDTD .81 METER
PCDB 13.16 METER
CNTH 6.30 METER

SGTL 12.70 METER
DTT -.28 METER

PARAMETERS

NAME	VALUE	UNIT	NAME	VALUE	UNIT
PP	RECO		DO	.500000	M
WMUD	1135.00	K/M3	TD	1540.00	M
FCD	177.800	MM	DHC	BS	
BFM	LIQU		MDEN	2650.00	K/M3
FD	1000.00	K/M3	DPPM	STAN	
MATR	SAND		HC	CALI	
NPDC	0		HSCO	YES	
SOCO	NO		MCCO	NO	
BSCO	NO		FSCO	NO	
MWCO	NO		PTCO	NO	
CCCO	NO		SDAT	SOCN	
MCOR	NATU		SOCN	12.7000	MM
FSAL	-50000.0	PPM	ANGL	0.0	DEG
GGRD	.0182270	DC/M	BHFL	WATE	
CDSE	RHOB		CNPS	NPHI	
NCJT	GSRY		GTSE	TEMP	
SHT	5.00000	DEGC	BHT	62.0000	DEGC
TDL	1540.00	M	MRT	62.0000	DEGC
DFD	1135.00	K/M3	RMFS	4.81000	OHMM
RMS	4.85000	OHMM	MST	18.0000	DEGC
MFST	10.0000	DEGC	BS	222.000	MM
BHS	OPEN				

ACCUMULATED INTEGRATION VALUES SUMMARY:

Integrated Hole Volume: 6.38024 M3 FROM 1540.00 M TO 1372.66 M
Integrated Cement Volume: 2.22926 M3 FROM 1540.00 M TO 1372.66 M
(ASSUMING 177.800 MM O.D. CASING)

EVENT MARK SUMMARY:

OUTPUT	INTERVAL BETWEEN PIPS	DEPTH TRACK EDGE
Integrated Hole Volume	.100000 M3	LEFT EDGE
Integrated Cement Volume	.100000 M3	RIGHT EDGE

CHANGED PARAMETERS

NAME	VALUE	UNIT	DEPTH (M)	NAME	VALUE	UNIT	DEPTH (M)
TD	1540.00	M	1542.4				

TENS(LBF)
10000. 0.0
BS(MM)
125.00 375.00
CAL2(MM)
125.00 375.00
GR(GAPI)
0.0 150.00
CALI(MM)
125.00 375.00

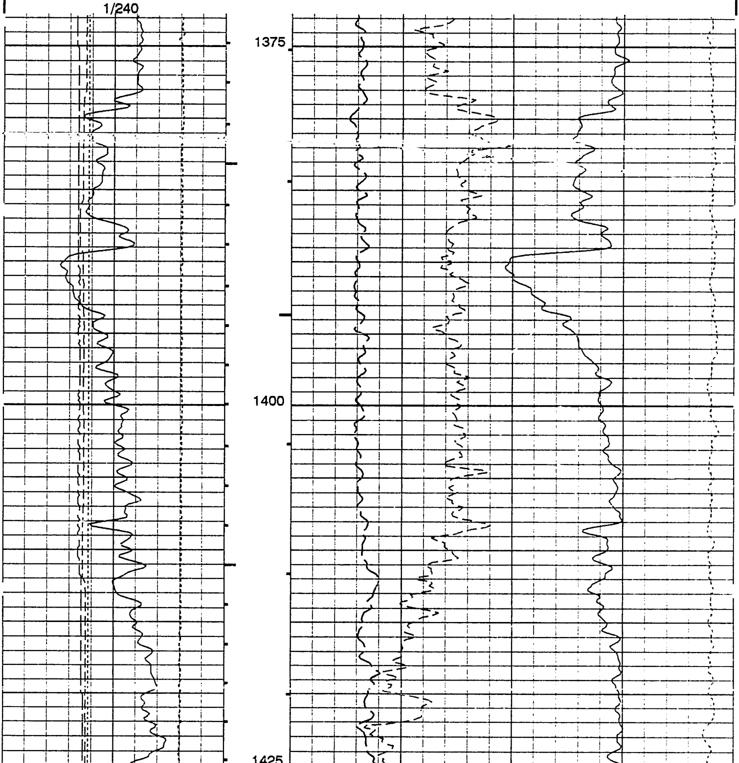
PEF
0.0 10.000
DRHO(K/M3)
450.00 -50.00
NPOR(V/V)
.45000 -.1500
DPHI(V/V)
.45000 -.1500

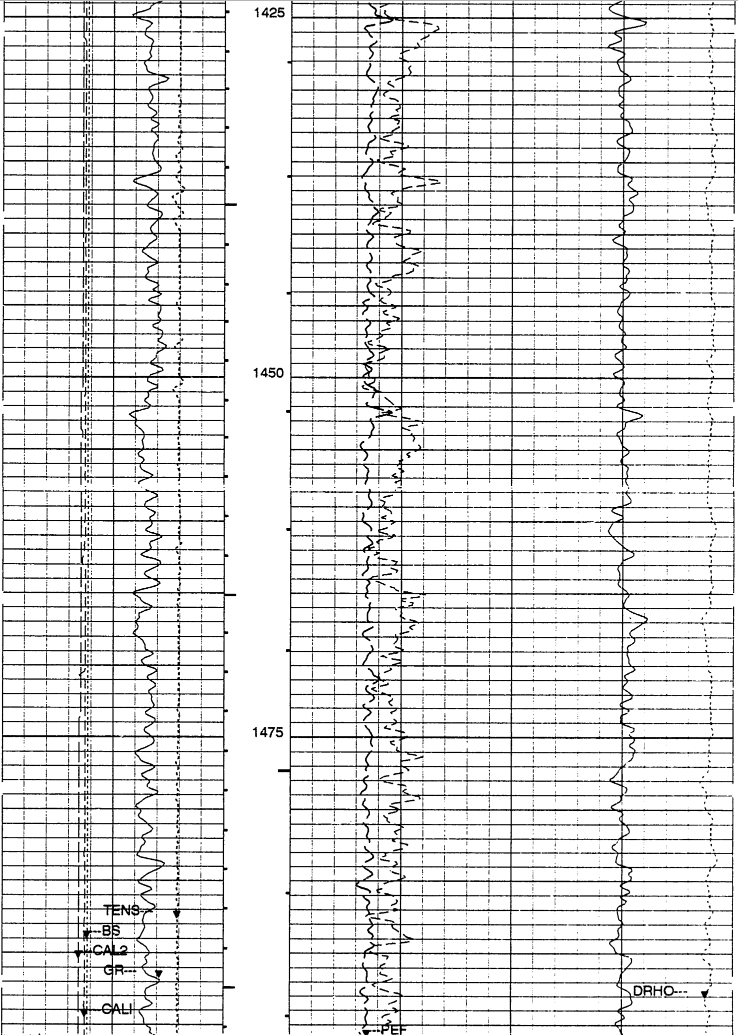
CP 43.007 FILE 10 15-MAR-1998 03:46

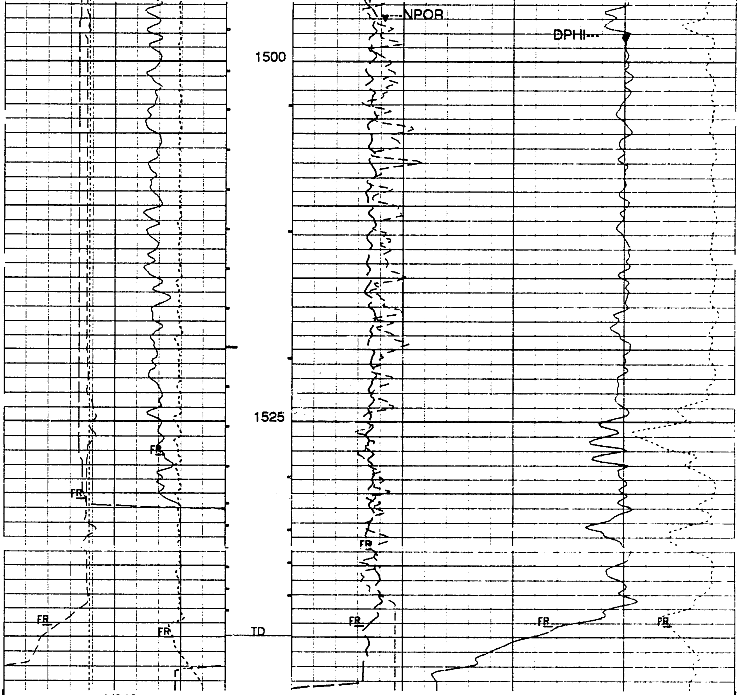
INPUT FILE(S) CREATION DATE
7 15-MAR-1998 02:00

SANDSTONE MDEN=2650 KG/M3

REPEAT SECTION







1/240

CP 43.007 FILE 10 15-MAR-1998 03:43

INPUT FILE(S) CREATION DATE
7 15-MAR-1998 02:00

REPEAT SECTION

SANDSTONE MDEN=2650 KG/M3

10000.	TENS(LBF)	0.0
125.00	BS(MM)	375.00
125.00	CAL2(MM)	375.00
0.0	GR(GAPI)	150.00
125.00	CALI(MM)	375.00

0.0	PEF	10.000
450.00	DRHO(K/M3)	-50.00
.45000	NPOR(V/V)	-.1500
.45000	DPHI(V/V)	-.1500

```
SENSOR MEASURE POINT TO TOOL ZERO

LDTD  .81 METER          SGTL 12.70 METER
PCDB 13.16 METER          DTT  -.28 METER
CNTH  6.30 METER
```

```
            PARAMETERS

NAME  VALUE     UNIT           NAME  VALUE     UNIT

PP   RECO                   DO  .500000    M
WMUD 1135.00    K/M3          TD  1537.40    M
FCD  177.800    MM             DHC  BS
BFM  LIQU                   MDEN 2650.00    K/M3
FD   1000.00    K/M3            DPPM STAN
MATR SAND                     HC   CALI
NPDC 0                       HSCO YES
SOCO NO                        MCCO NO
BSCO NO                       FSCO NO
MWCO NO                        PTCO NO
CCCO NO                       SDAT SOCN
MCOR NATU                        SOCN 12.7000     MM
FSAL -50000.0   PPM               ANGL 0.0        DEG
GGRD .0182270   DC/M                BHFL WATE
CDSE RHOB                        CNPS NPHI
NCJT GSRY                        GTSE TEMP
SHT  5.00000    DEGC              BHT  62.0000    DEGC
TDL  1540.00    M               MRT  62.0000    DEGC
DFD  1135.00    K/M3              RMFS 4.81000    OHMM
RMS  4.85000    OHMM                MST  18.0000    DEGC
MFST 10.0000    DEGC                BS   222.000    MM
BHS  OPEN
```

```
        BEFORE SURVEY CALIBRATION Summary


 Performed:   15-MAR-1998 01:15
 Program File: TOH   (Version   43.007  95/05/03  95/05/03)


CNTH          Detector Calibration Summary

    Neutron Cartridge Number    : 1257
    Neutron Source Number        : 1491
    Thermal Housing Number      : 4465
    Alpha detectors             : Yes

      Input   Plus     Shop   Gain   Shop     Before    Tol.
          Reference   Tank           Bkg       Bkg      Bkg
            Counts    Counts        Counts    Counts   Counts

      CNTC   6031.00  5704.00  1.057   26.730    26.761    4.010
      CFTC   2793.00  2462.00  1.134   36.020    30.795    5.403

      Ratio    2.159    2.317


Before Survey Calibrations done: 15-MAR-1998 01:06


SGTL        Detector Calibration Summary

       MEASURED
     BKGD   JIG      CALIBRATED       UNITS
  GR    5    177        165          GAPI

Back: 14-MAR-1998 21:33   Jig: 14-MAR-1998 21:40  Comp: 14-MAR-1998 21:40
```

```
LDTD        Detector Calibration Summary

     Density Resistivity Sonde Number   :  723
     Nuclear Services Cartridge Number  :  1868
     Powered Detector Housing Number    :  2980
     Powered Gamma-Gamma Detector Number :  2721
     LDT Logging Source Number          :  2043
     LDT Calibration Mode               :  WATE

          Measured     Shop  Values
          Bkgd      Al+Fe   Al    Units
     LL    15.5      91.4  97.6    CPS
     LU    56.5     137.3 146.1    CPS
     LS    43.7     160.0 170.6    CPS
     LITH   4.3      40.0  59.7    CPS
     SS1   12.8     184.4 194.2    CPS
     SS2    8.9     263.5 277.6    CPS

      HV Settings        Detector Resolutions
      HV LS:  1340.4 V      LS:  8.4 %
      HV SS:  1340.8 V      SS:  8.7 %

Wellsite Calibration done: 15-MAR-1998 01:10


PCDB        Electronics Calibration Summary

        MEASURED              CALIBRATED
      ZERO   PLUS           ZERO    PLUS     UNITS
 MINV   0.0   0.0           0.0     0.0     OHMM
 MNOR   0.0   0.0           0.0     0.0     OHMM

Zero: 14-MAR-1998 21:43  Plus: 14-MAR-1998 21:42  Comp: 14-MAR-1998 21:44


PCDB        Caliper Calibration Summary

        MEASURED              CALIBRATED
      Small  Large          Small   Large    UNITS
 CAL2  191.10 284.76         214.29  315.89    MM
  SA   0.0    0.0           0.0     0.0       MM

Small: 14-MAR-1998 21:43 Large: 14-MAR-1998 21:42 Comp: 14-MAR-1998 21:44


LDTD        Caliper Calibration Summary

        MEASURED              CALIBRATED
      Small  Large          Small   Large    UNITS
 CALI  158.45 272.89         203.20  304.80    MM

Small: 15-MAR-1998 01:13 Large: 15-MAR-1998 01:12 Comp: 15-MAR-1998 01:14

  CP 43.007     FILE   0    15-MAR-1998 01:14


         AFTER SURVEY TOOL CHECK Summary


 Performed:   15-MAR-1998 04:03
 Program File: TOH    (Version   43.007  95/05/03  95/05/03)


CNTH             Tool  Check


     Input   Before   After   Tolerance on
              Bkg      Bkg    Before-After
             Counts   Counts     Counts


     CNTC    26.8     26.9       4.0
     CFTC    30.8     32.5       4.6
```

After Survey Calibrations done: 15-MAR-1998 03:59

Before Survey Calibrations done: 15-MAR-1998 01:06

LDTD Tool Check

Density Resistivity Sonde Number : 723
Nuclear Services Cartridge Number : 1868
Powered Detector Housing Number : 2980
Powered Gamma-Gamma Detector Number : 2721
LDT Logging Source Number : 2043
LDT Calibration Mode : WATE

	Measured Background			Tolerance on
	Before	After	Units	Before-After
LL	15.5	15.5	CPS	+/- 1.0
LU	56.5	57.1	CPS	+/- 1.0
LS	43.7	44.1	CPS	+/- 1.0
LITH	4.3	4.3	CPS	+/- 0.3
SS1	12.8	12.9	CPS	+/- 0.5
SS2	8.9	8.9	CPS	+/- 0.5

HV Settings	Detector Resolutions
HV LS: 1335.5 V	LS: 8.5 %
HV SS: 1331.7 V	SS: 8.7 %

Wellsite Calibration Before Survey: 15-MAR-1998 01:10
Wellsite Calibration After Survey: 15-MAR-1998 04:03

CP 43.007 FILE 10 15-MAR-1998 04:03

COMPANY	RANGER OIL LIMITED	**SCHL.**	**FR**	1539.7 M
		SCHL.	**TD**	1540.0 M
WELL	RANGER ET AL LITTLE BEAR M-39	**DRLR.**	**TD**	1550.0 M
FIELD	LITTLE BEAR	**Elev:**	**KB**	259.2 M
			DF	258.9 M
TERRITORY	N.W.T.		**GL**	253.9 M

Schlumberger

SIMULTANEOUS
COMPENSATED NEUTRON
LITHO-DENSITY

1838

N.E.B. COPY

# Little Bear M-39 Petrophysical Study

**Prepared for:**
**Ranger Oil Limited**
**March 19, '98**

RANGER OIL

OAKROCK Ltd.

NATIONAL ENERGY BOARD
REGULATORY CHECK
MAR 3 1 1998

OAKROCK Ltd.

Box 92, Irricana, Alberta T0M 1B0 Telephone: (403) 935-4641 Fax: (403) 935-2354

March 19, 1998

Dr. Peter Goetz,
Ranger Oil Limited
1600, 321 - 6th Avenue SW
Calgary, Alberta T2P 3H3

Dear Peter,

***Re: Little Bear Petrophysical Analysis***

Enclosed is my interpretation of Ranger et al. Little Bear M-39. I have interpreted the section from 600m to total depth at 1540m. The primary objective of this study was to evaluate the potential of this well, and in particular the sand at 1390m.

***Summary of Results***

Most of the section encountered by this well is shale. Three porous sands were identified: 912m to 935m, 1330m to 1335m, and 1389m to 1394m. Of these it is likely that only the lower sand would produce hydrocarbons.

A range of Rw values were determined from the CWLS Rw maps for this area. The more pessimistic value, 0.10 Ωm at 25°C, would suggest that more than 90 percent of the hydrocarbons in this well were in the lower sand, with a small portion in the middle sand. Using the more optimistic Rw value of 0.05 Ωm at 25°C would reduce water saturations sufficiently to indicate additional pay in the upper sand.

***Interpretation Methods***

A shaly sand model was used in the interpretation of these sands. The model parameters were determined from cross-plots of the log data for each interval. These parameters are listed on the analysis summary sheet attached.

Water saturations were calculated using the Modified Simandoux water saturation equation. This equation, which is also known as the Total Shale Model, has the form:

$$\frac{1}{Rt} = \frac{\phi^m \times Sw^n}{a \times Rw \times (1 - Vshale)} + \frac{Vshale \times Sw}{Rshale}$$

When the shale volume (Vshale) is zero, as in a clean sand or carbonate, this equation reduces to the basic Archie equation. This is the case with most water saturation equations.

Formation water resistivities (Rw) were obtained from the CWLS Formation Water Resistivity Catalogue maps. Representative values of Rw were found to range between 0.10 Ωm at 25°C, equivalent to 70,000 ppm NaCl, and 0.05 Ωm at 25°C, or the equivalent to 160,000 ppm NaCl. An interpretation was completed for each of these values.

*....Continued on Page 2*

Dr. Peter Goetz.
Ranger Oil Limited

**Re: Little Bear Petrophysical Analysis**

March 19, 1998

Using the reported Rmf value, and the shallow resistivity curve, the water saturation in the invaded zone was calculated. The difference between this saturation and the water saturation calculated previously has been shown as moved hydrocarbon on the analysis plots. The presence of moved hydrocarbons is an additional indication that the zone is permeable, and could produce fluids or gas.

Permeability was calculated as a function of porosity and water saturation. The equation used was based upon two assumptions. The first was that an intergranular or intercrystaline pore system exists. The second assumption was that the formation was at irreducible water saturation. Both of these assumptions are valid for shaly sand formations.

This quantitatively derived permeability equation is as follows:

$$\log K = \frac{\ln(\phi \times (1 - Sw))}{0.59} + 5.0$$

where: K is the permeability,
$\phi$ is the effective (non-shale) porosity, and
Sw is the water saturation.

The theoretical model upon which this equation is based states that, given the condition of irreducible water saturation, the smaller the pore size, the greater the portion of the pore that will be occupied by water.

If we accept the limitations imposed by these assumptions, it is possible to obtain meaningful permeability data from well logs. This form of permeability equation has been tested and compared to core permeability data in shaly sand and carbonate reservoirs in many areas of the world. It has consistently provided reliable results.

A number of factors combine to define hydrocarbon pay. The calculation of net pay for a formation is the simple sum of the hydrocarbon volumes present.

$$NetPay = \sum \phi \times (1 - Sw) \times thickness$$

To determine the hydrocarbon volume that could contribute to production requires that limits, or cut-offs be applied. These include a minimum porosity limit, and a maximum water saturation limit. Since the relative shaliness of sand may also be a limiting factor in production, a maximum vshale limit was also applied.

The water saturation cut-off was intuitively defined as 50 percent. After reviewing the porosities and lithologies determined in this study, three porosity cut-off values were chosen: 8, 10, and 12 percent. A shale volume cut-off of 60 percent was chosen for the sands. Changing these parameters will have a corresponding effect upon the net pay calculated.

Dr. Peter Goetz,
Ranger Oil Limited

**Re: Little Bear Petrophysical Analysis**

March 19, 1998

A summary of the net pay results is attached in Tables 1 and 2.

***Discussion of Results***

In the nearly 1000m of section in this interpretation, most is shale. There are a few thin and shaly sands above the Basal Slater River (912m). However, these sands do not have significant porosity.

In the top 4m of sand in the Basal Slater River formation, porosities average 13 percent. Water saturations in this sand range from 60 percent, if an Rw of 0.10 Ωm were used, to 42 percent based upon an Rw of 0.05 Ωm.

There is nothing significant from 935m to 1330m. Then from 1330m to 1335m there are 2m of sand where porosity approaches 10 percent. This sand is quite shaly. If an Rw of 0.10 Ωm were used, the water saturations in this sand would be approximately 47 percent. Reducing Rw to 0.05 Ωm would reduce average water saturations to 32 percent.

The primary sand of interest in this well is from 1389m to 1394m. This is the cleanest sand in this section, and has porosities approaching 17 percent. The average porosity of this sand is nearly 14 percent. In the first case considered, Rw = 0.10 Ωm, the average water saturation was 43 percent. When Rw was changed to 0.05 Ωm, average water saturations decreased to 31 percent.

In summary, the lower sand from 1389m to 1394m is the only sand with apparent potential in this well. The other sands might contain limited hydrocarbons, but not likely in commercial quantities.

I have enclosed for this well: a well summary report, an analysis summary, analysis plots of the two interpretations, and a composite plot of the data. Thank you for this opportunity to be of service to you. I would be glad to answer any further questions you might have.

Sincerely,
OAKROCK Ltd.

K Heslop

Kenneth Heslop, P.Eng.

OAKROCK Ltd.

Dr. Peter Goetz.
Ranger Oil Limited

**Re: Little Bear Petrophysical Analysis**

March 19, 1998

***Table #1: Ranger et al Little Bear Net Pay Summary – Rw = 0.05 Ωm at 25°C***

| Cut off Values | | | | Average Values | | | | | Net Pay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sw | PhiE | Vsh | Perm | Sw | PhiE | Vsh | Perm | PhiSw | h | Phih | Hc |
| Interval Top = 912.0, | | | | Interval Base = 935.0 | | | | | | | |
| 0.50 | 0.08 | 0.60 | 0.00 | 42.1 | 13.0 | 48.4 | 3.73 | 5.5 | 2.50 | 0.33 | 0.19 |
| 0.50 | 0.10 | 0.60 | 0.00 | 42.0 | 13.5 | 47.1 | 4.41 | 5.7 | 2.25 | 0.30 | 0.18 |
| 0.50 | 0.12 | 0.60 | 0.00 | 40.6 | 15.1 | 43.2 | 7.95 | 6.1 | 1.38 | 0.21 | 0.12 |
| 1.00 | 0.10 | 0.60 | 0.00 | 43.7 | 12.9 | 47.9 | 3.21 | 5.6 | 2.88 | 0.37 | 0.21 |
| Interval Top = 1330.0, | | | | Interval Base = 1335.0 | | | | | | | |
| 0.50 | 0.08 | 0.60 | 0.00 | 34.1 | 9.8 | 54.8 | 2.21 | 3.3 | 1.00 | 0.10 | 0.06 |
| 0.50 | 0.10 | 0.60 | 0.00 | 32.5 | 10.6 | 54.1 | 3.37 | 3.4 | 0.63 | 0.07 | 0.04 |
| 0.50 | 0.12 | 0.60 | 0.00 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.00 | 0.00 |
| 1.00 | 0.10 | 0.60 | 0.00 | 32.5 | 10.6 | 54.1 | 3.37 | 3.4 | 0.63 | 0.07 | 0.04 |
| Interval Top = 1388.0, | | | | Interval Base = 1394.0 | | | | | | | |
| 0.50 | 0.08 | 0.60 | 0.00 | 31.3 | 13.6 | 43.5 | 8.79 | 4.3 | 3.75 | 0.51 | 0.35 |
| 0.50 | 0.10 | 0.60 | 0.00 | 31.0 | 13.9 | 42.3 | 10.16 | 4.3 | 3.50 | 0.49 | 0.34 |
| 0.50 | 0.12 | 0.60 | 0.00 | 30.7 | 14.4 | 40.9 | 11.88 | 4.4 | 3.00 | 0.43 | 0.30 |
| 1.00 | 0.10 | 0.60 | 0.00 | 31.0 | 13.9 | 42.3 | 10.16 | 4.3 | 3.50 | 0.49 | 0.34 |

OAKROCK Ltd.

Dr. Peter Goetz,
Ranger Oil Limited

**Re: Little Bear Petrophysical Analysis**

March 19, 1998

***Table #2: Ranger et al Little Bear Net Pay Summary -- Rw = 0.10 Ωm at 25°C***

| Cut off Values | | | | Average Values | | | | | Net Pay | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sw | PhiE | Vsh | Perm | Sw | PhiE | Vsh | Perm | PhiSw | h | Phih | Hc |
| Interval Top = 912.0, | | | | Interval Base = 935.0 | | | | | | | |
| 0.50 | 0.08 | 0.60 | 0.00 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.00 | 0.00 |
| 0.50 | 0.10 | 0.60 | 0.00 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.00 | 0.00 |
| 0.50 | 0.12 | 0.60 | 0.00 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.00 | 0.00 |
| 1.00 | 0.10 | 0.60 | 0.00 | 60.3 | 12.7 | 47.7 | 0.73 | 7.6 | 2.00 | 0.25 | 0.10 |
| Interval Top = 1330.0, | | | | Interval Base = 1335.0 | | | | | | | |
| 0.50 | 0.08 | 0.60 | 0.00 | 47.0 | 9.7 | 55.0 | 0.90 | 4.5 | 1.25 | 0.12 | 0.06 |
| 0.50 | 0.10 | 0.60 | 0.00 | 46.6 | 10.5 | 52.4 | 1.30 | 4.9 | 0.50 | 0.05 | 0.03 |
| 0.50 | 0.12 | 0.60 | 0.00 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 | 0.00 | 0.00 |
| 1.00 | 0.10 | 0.60 | 0.00 | 46.6 | 10.5 | 52.4 | 1.30 | 4.9 | 0.50 | 0.05 | 0.03 |
| Interval Top = 1388.0, | | | | Interval Base = 1394.0 | | | | | | | |
| 0.50 | 0.08 | 0.60 | 0.00 | 43.2 | 13.7 | 43.0 | 4.39 | 5.9 | 3.88 | 0.53 | 0.30 |
| 0.50 | 0.10 | 0.60 | 0.00 | 43.2 | 13.7 | 43.0 | 4.39 | 5.9 | 3.88 | 0.53 | 0.30 |
| 0.50 | 0.12 | 0.60 | 0.00 | 43.0 | 13.9 | 42.2 | 4.80 | 6.0 | 3.50 | 0.49 | 0.28 |
| 1.00 | 0.10 | 0.60 | 0.00 | 43.2 | 13.7 | 43.0 | 4.39 | 5.9 | 3.88 | 0.53 | 0.30 |

OAKROCK Ltd.

# RANGER ET AL LITTLE BEAR
# M-39

COMPANY: RANGER OIL (CANADA) LTD FIELD: LITTLE BEAR PROV: N.W.T
Data Top: 600 Base: 1540 Data Increment: 0.1250 Metres
KB: 259.2200 Ground Level: 253.8700

| Run # | Run Depth | Rmf | Rmf Temp. | Mud Weight | Bit Size | Neutron Type | Matrix | Resist. Type | Service Co. | Logging Date |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1540.000 | 4.810 | 10.00 | 1135 | 222 | CNL/TNPH | Sand | IND. | Schlumberger | 15-MAR-98 |

## Formation Tops and Tests

| | |
|---|---|
| 912.00 | FM Top: Basal Slater River |
| 1278.50 | FM Top: Imperial |

## Log Curves

| | | | |
|---|---|---|---|
| 0 | Acoustic | 600.00 | 1540.00 |
| 1 | Neutron - (SS) | 600.00 | 1540.00 |
| 2 | Bulk Density | 600.00 | 1540.00 |
| 3 | PE | 600.00 | 1540.00 |
| 4 | Caliper | 600.00 | 1540.00 |
| 5 | Gamma Ray | 600.00 | 1540.00 |
| 6 | S.P. | 600.00 | 1540.00 |
| 7 | Deep Resistivity | 600.00 | 1540.00 |
| 8 | Medium Resistivity | 600.00 | 1540.00 |
| 9 | Shallow Resistivity | 600.00 | 1540.00 |
| 15 | PhiD | 600.00 | 1540.00 |
| 49 | Delta Rho | 600.00 | 1540.00 |

M-39

# RANGER ET AL LITTLE BEAR
# M-39

## Analysis Parameters

| | | | | |
|---|---|---|---|---|
| Interval Top | 600 | 900 | 1050 | 1275 |
| Interval Base | 900 | 1050 | 1275 | 1540 |
| Lithology | Sandstone | Sandstone | Sandstone | Sandstone |
| Porosity Method | SS-N/D | SS-N/D | SS-N/D | SS-N/D |
| Vshale Method | Linear | Linear | Linear | Linear |
| Sw Method | Mod. Sim. | Mod. Sim. | Mod. Sim. | Mod. Sim. |
| Permeability Method | Heslop | Heslop | Heslop | Heslop |
| a | 1.00 | 1.00 | 1.00 | 1.00 |
| m | 2.00 | 2.00 | 2.00 | 2.00 |
| 'm' Method | Constant | Constant | Constant | Constant |
| n | 2.00 | 2.00 | 2.00 | 2.00 |
| Rw @ 25C/77F | 0.100 | 0.100 | 0.100 | 0.100 |
| Formation Temp. | 30.30 | 40.00 | 45.00 | 52.00 |
| Temp. Gradient | 0.0338 | 0.0338 | 0.0338 | 0.0338 |
| R Shale | 6 | 8 | 8 | 9 |
| R Clean | -- | -- | -- | -- |
| dT Shale | 320 | 250 | 250 | 240 |
| dT Clean | -- | -- | -- | -- |
| dT Matrix | -- | -- | -- | -- |
| dT Fluid | -- | -- | -- | -- |
| Rho Shale | 2566 | 2620 | 2680 | 2660 |
| Rho Grain | 2650 | 2650 | 2650 | 2650 |
| Rho Carbonate | 2710 | 2710 | 2710 | 2710 |
| Rho Clean | -- | -- | -- | -- |
| Rho Matrix | -- | -- | -- | -- |
| Rho Clay | 2850 | 2850 | 2850 | 2850 |
| Rho Fluid | 1000 | 1000 | 1000 | 1000 |
| Phi Shale | 30.00 | 24.00 | 23.00 | 21.00 |
| Phi Clean | -- | -- | -- | -- |
| Phi Matrix | -- | -- | -- | -- |
| Phi Clay | 29.00 | 29.00 | 29.00 | 29.00 |
| Phi Fluid | 100.00 | 100.00 | 100.00 | 100.00 |
| PE Shale | -- | -- | -- | -- |
| PE Clean | -- | -- | -- | -- |
| Gamma Ray Shale | 105 | 75 | 90 | 80 |
| Gamma Ray Clean | 50 | 25 | 20 | 20 |
| SP Shale | -- | -- | -- | -- |
| SP Clean | -- | -- | -- | -- |
| Corrections Applied | None | None | None | None |
| COAL PARAMETERS: | | | | |
| Coal Acoustic | -- | -- | -- | -- |
| Coal Neutron | -- | -- | -- | -- |
| Coal Density | -- | -- | -- | -- |
| Coal Gamma Ray | -- | -- | -- | -- |
| Coal Resistivity | -- | -- | -- | -- |

Correction Options:
HCC - Hydrocarbon Density Correction
INV - Invasion Correction
ACC - Acoustic Compaction Correction
XSND - Exclude Sands from Solution
MIX - Mixed Matrix Shaly Sand Solution
BIAS - Bias Porosity Towards Density
BHC-G - Gamma Ray Borehole Corrections
BHC-N - Neutron Borehole Corrections
BHC-D - Density Borehole Corrections

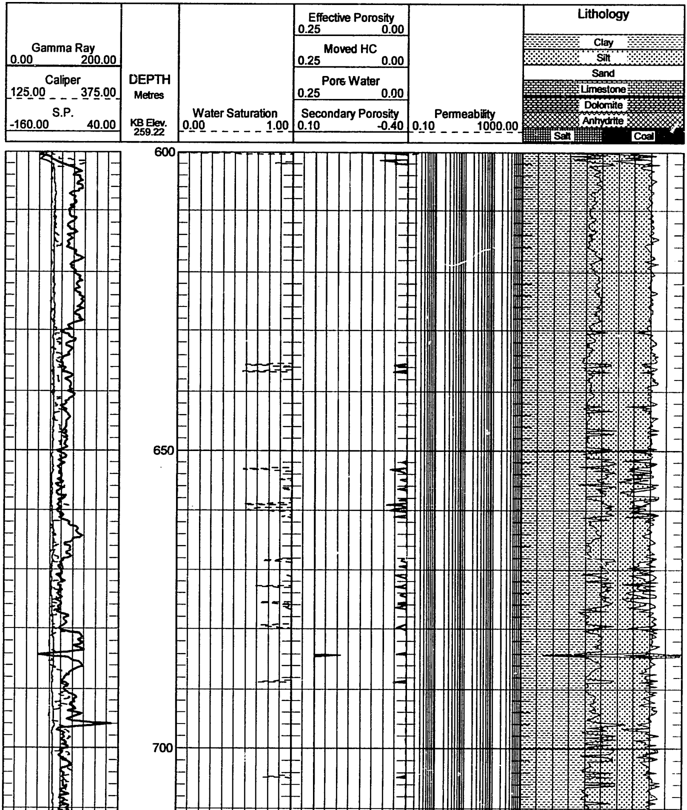
RANGER ET AL LITTLE BEAR

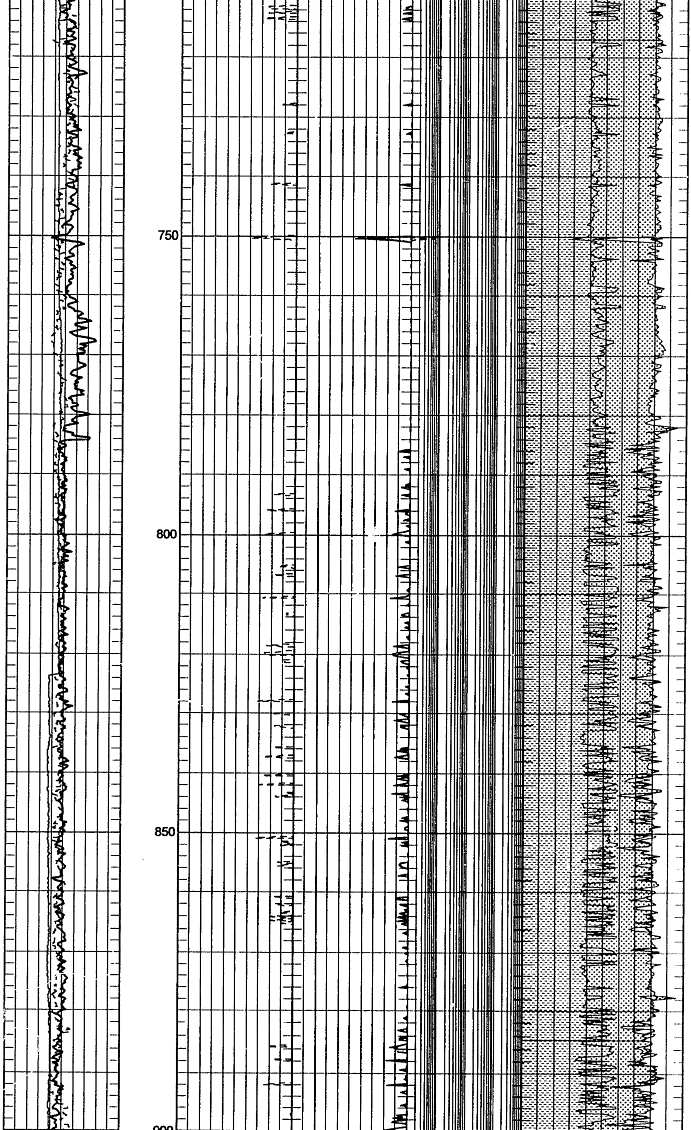
M-39

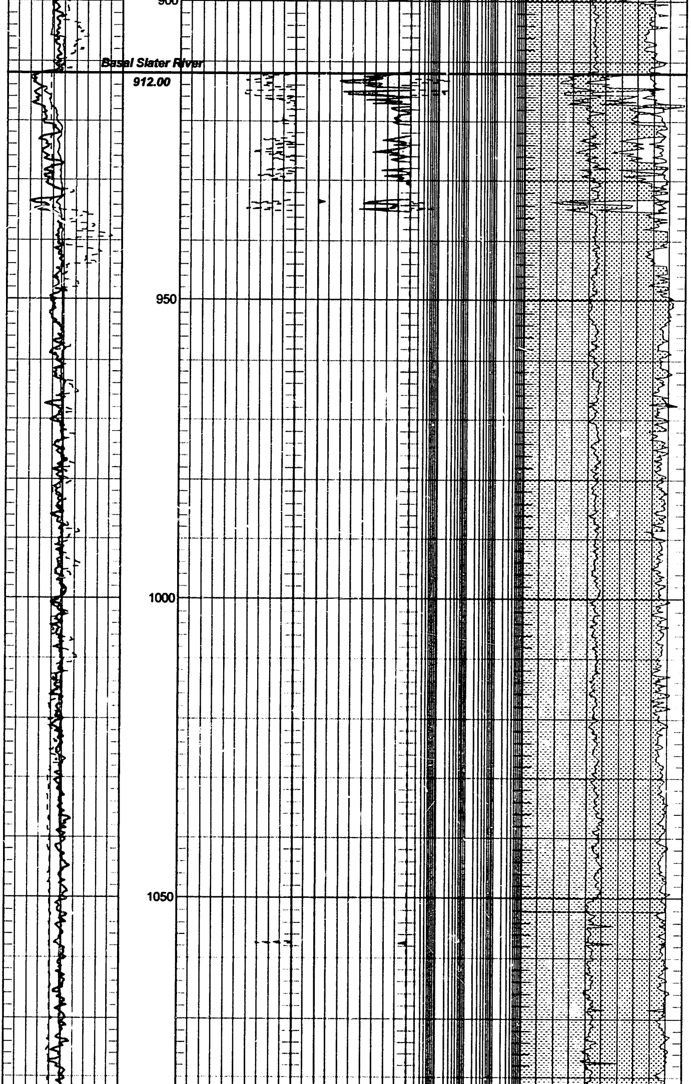
Rw = 0.10 @ 25C

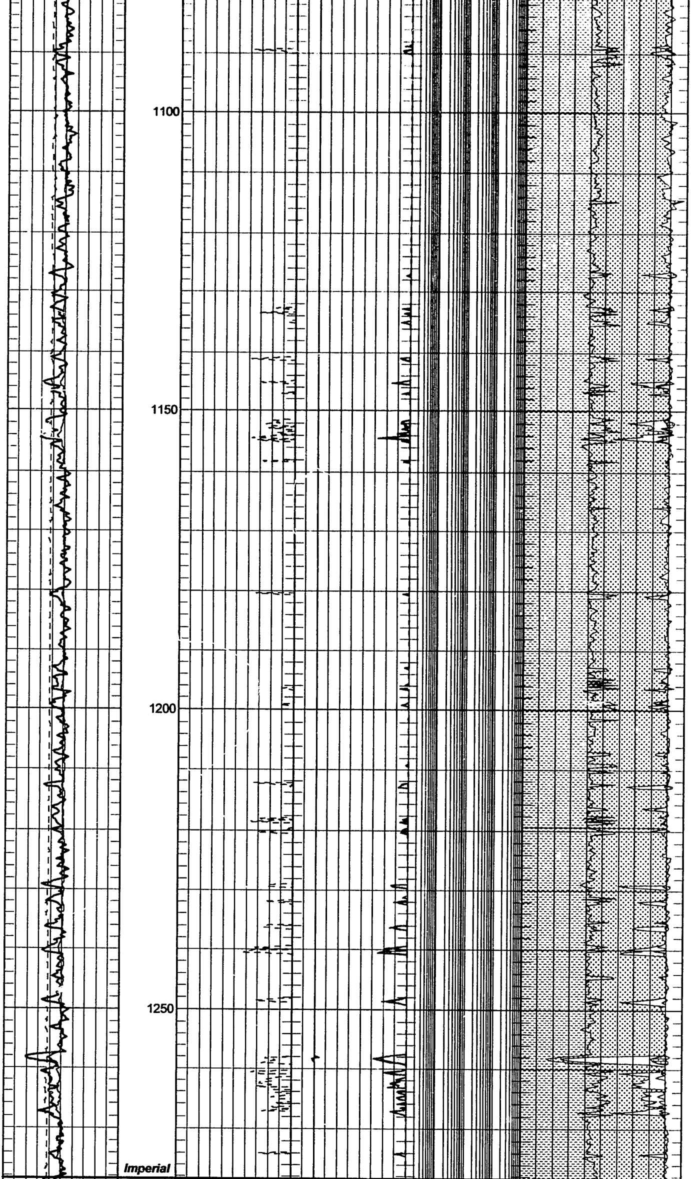
Interpreted by: Kenneth Heslop, P.Eng
Multiple Models Used In This Interpretation
4 Interpretive Intervals Defined

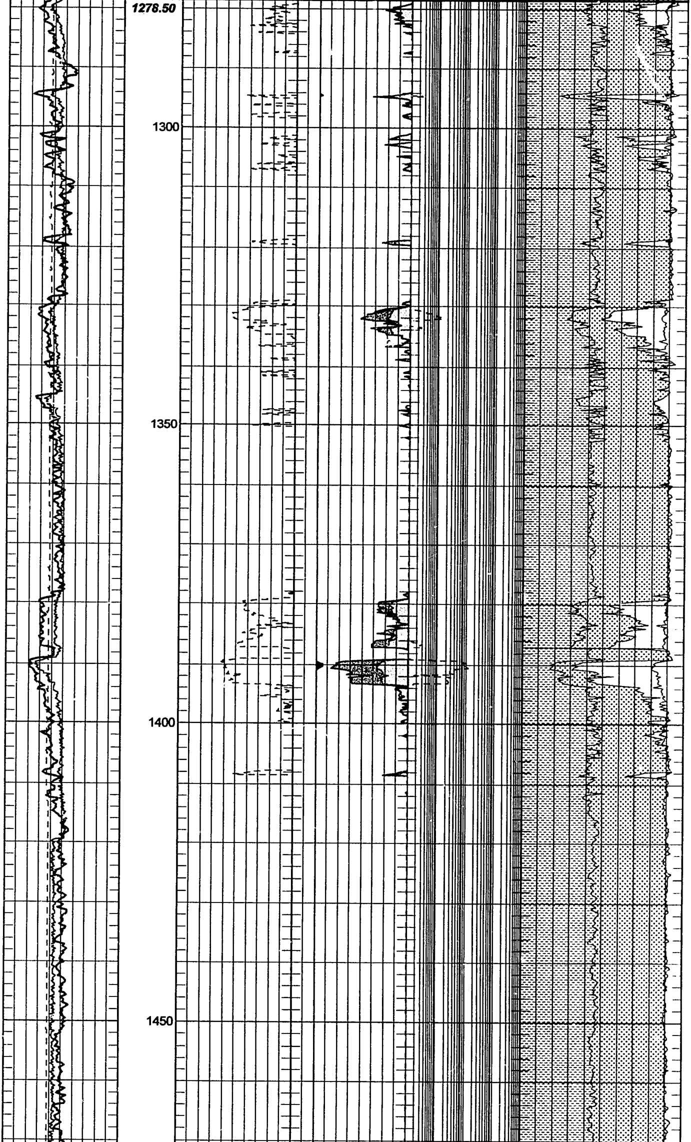
OAKROCK Ltd. (403)935-4641

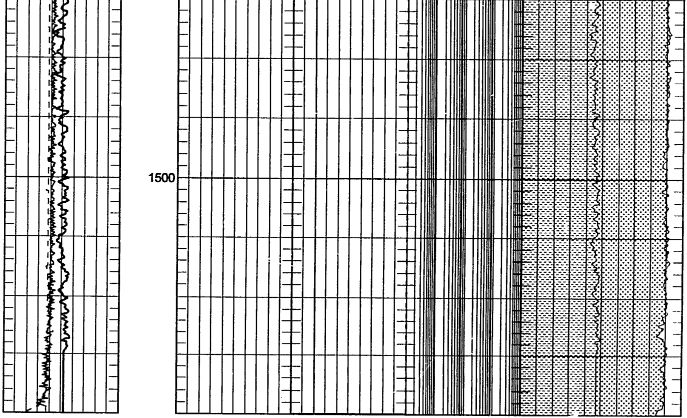




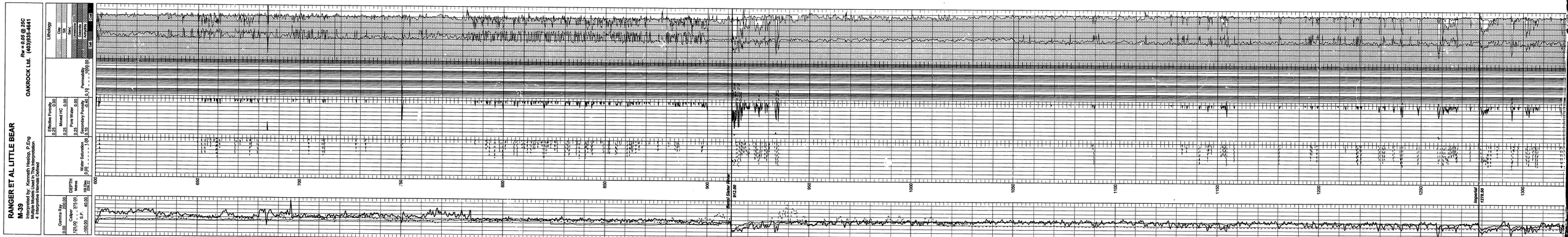


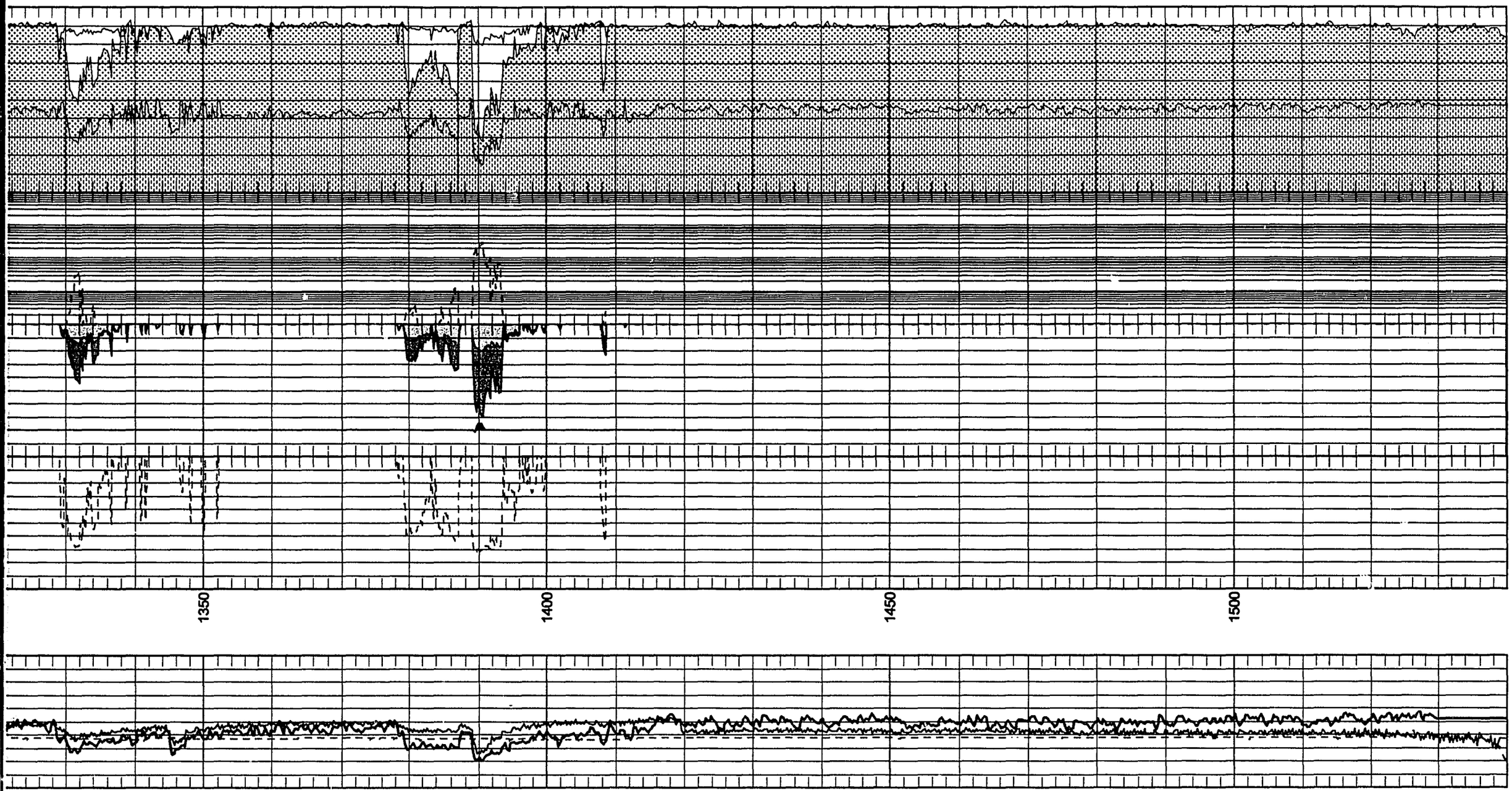






LEGIBILITY
OF LOG
COULD VARY
DUE TO
COLOR
CONTENT


RANGER ET AL LITTLE BEAR
M-39
OAKROCK Ltd. 1(403)264-4641
Rw = 0.05 @ 25C
Interpreted by: Kenneth Hesby, P.Eng
Multiple Models Used In This Interpretation
4 Hydrocarbon Intervals Zoned
Lithology
Clay
Silt
Sand
Limestone
Dolomite
Coal
Effective Porosity
0.25
Moved HC
0.25
Bulk Water
0.25
Secondary Porosity
0.25
Permeability
0.01
100,000
Water Saturation
100
0.00
DEPTH
Metres
Gamma Ray
0.00
200.00
Caliper
125.00
275.00
-160.00
40.00
600
650
700
750
800
850
900
Base Slave River
972.00
950
1000
1050
1100
1150
1200
1250
Reported
1272.00
1300


1350
1400
1450
1500

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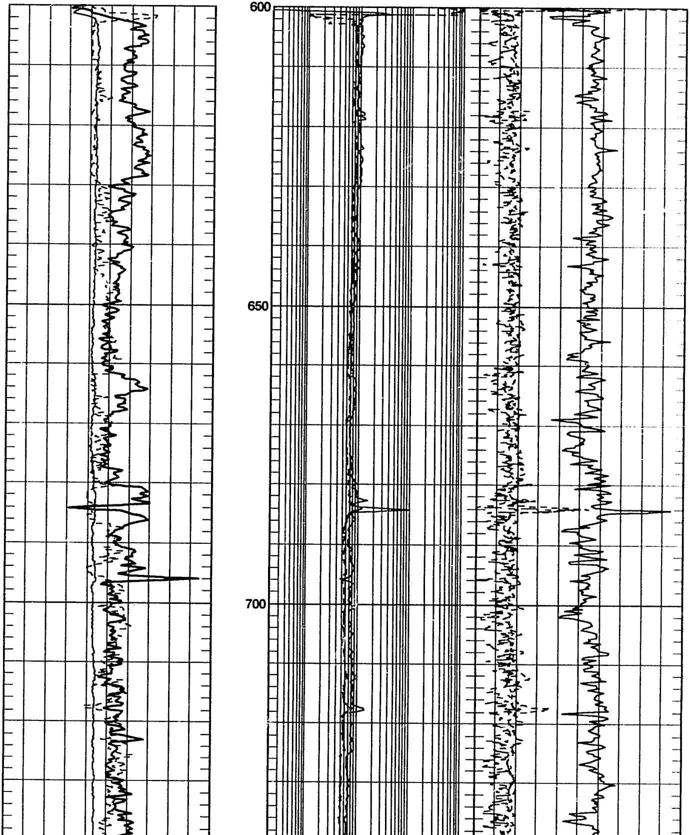
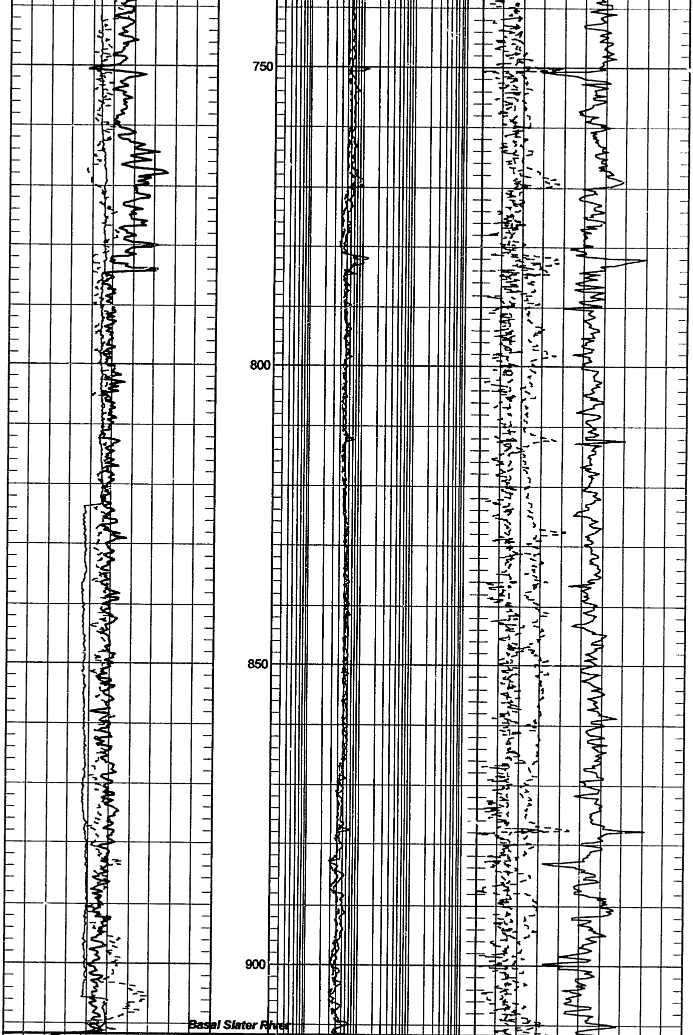
RANGER ET AL LITTLE BEAR
M-39

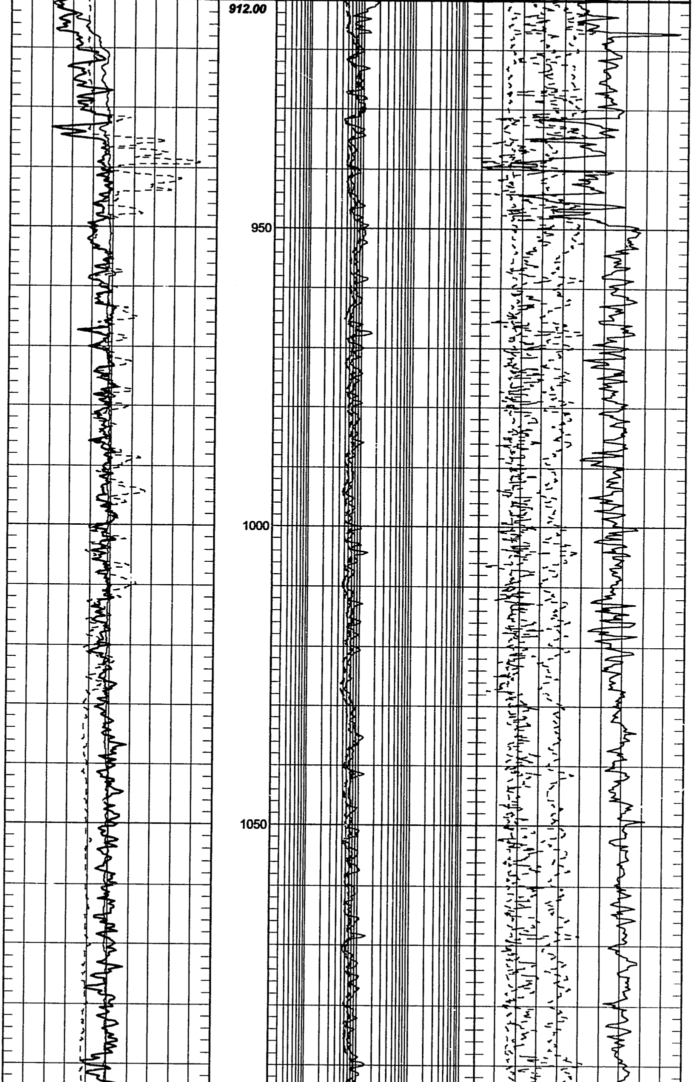
Prepared by: Kenneth Heslop, P.Eng
LogX Data Plot

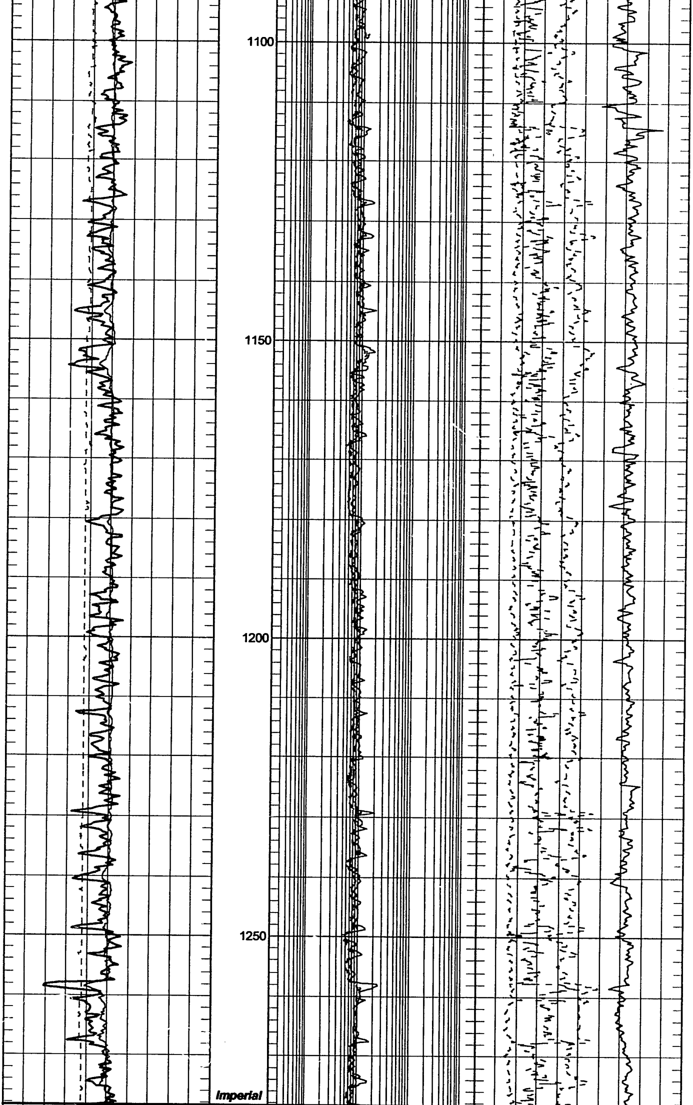
OAKROCK Ltd. **(403)935-4641**

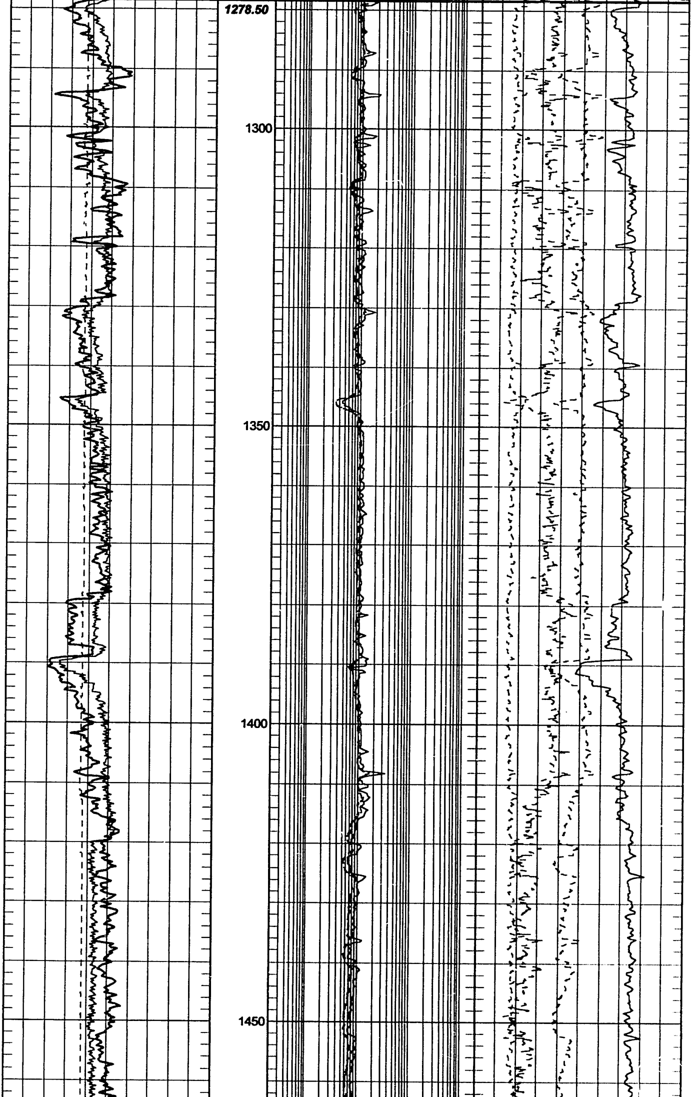
Track 1	Depth	Track 2	Track 3
Gamma Ray 0.00 – 200.00	DEPTH Metres	Deep Resistivity 0.20 – 2000.00	Acoustic 378.00 – 115.00
Caliper 125.00 – 375.00		Medium Resistivity 0.20 – 2000.00	Neutron - (SS) 0.45 – -0.15
S.P. -160.00 – 40.00	KB Elev. 259.22	Shallow Resistivity 0.20 – 2000.00	Bulk Density 1908.00 – 2898.00
			PE 0.00 – 20.00

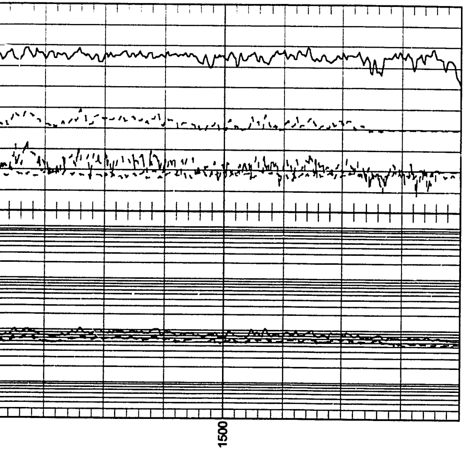


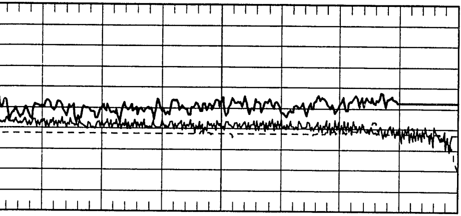












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