# Geological Report

NORTH
## *RANGER ~~FORT~~ LIARD P66A*

P66 LAT 60 40'/LONG 123 30'

**File No: 96NB-1666**

C L Consultants Limited

CONTINENTAL LABORATORIES

CL CONSULTANTS LIMITED

**1958 - 1998**

***"Logging the Past 40 Years"***

# *RANGER ~~FORT~~ NORTH LIARD P66A*

P66 LAT 60 40'/LONG 123 30'

**File No: 96NB-1666**

Prepared By:

**H. WENNEKERS/ D. FERGUSON/ F. RICHARDSON**
**Geological Wellsite Consultants**
CL Consultants Limited

Prepared for:

Peter Goetz
RANGER OIL LIMITED

PERMIT TO PRACTICE
CL CONSULTANTS LIMITED
Signature: _____
Date: March 16, 1998
PERMIT NUMBER: P2911
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

PROFESSIONAL GEOLOGIST ALBERTA
PATRICK J. BISS





C L Consultants Limited

# INDEX

## SYNOPSIS

| | | |
|---|---|---|
| **OPERATOR:** | RANGER OIL LIMITED | |
| **WELL NAME:** | RANGER FORT LIARD P66-A | |
| **LOCATION:** | LAT 60 30' / LONG 123 30' | |
| **FIELD:** | UNDEFINED | |
| **PROVINCE:** | Alberta | |
| **ELEVATIONS:** | G.L. - 449.49 m | K.B. - 459.89 m |
| **SPUD DATE:** | January 12, 1997 | 0900 hrs |
| **T.D. DATE:** | February 04, 1998 | 04:00 hrs |
| **CONTRACTOR:** | PRECISION DRILLING | Rig: 426 E |
| **HOLE SIZE:** | 311 mm | |
| **COLLARS:** | MONEL 228 mm | |
| **MUD COMPANY:** | DOWELL | |
| **MUD TYPE:** | INVERT | |
| **WIRELINE LOGGING CO.:** | COMPUTALOG | |
| **LOG RECORD:** | Run #1 | |

| | | | |
|---|---|---|---|
| 1) XY-GR | 3118.0 m - 1005.0 m | | |
| 2) STI-BCS-GR | 3116.4 m - 1006.0 m | | |
| 1) STI-SONIC | 3500M TD - 3112 CSG | RUN #1 | FEB 9/98 |
| 2) DENSITY | 3500M TD - 3112 CSG | RUN #2 | FEB 9/98 |
| 3) NEUTRON | 3500M TD - 3112 CSG | RUN #3 | FEB 9/98 |
| 4) EMI | 3500M TD - 3112 CSG | RUN #4 | FEB 9/98 |

| | |
|---|---|
| **DRILLING SUPERVISION:** | JOHN FAULKNER / ART SCHRITT |
| **GEOLOGICAL SUPERVISION:** | HENRI WENNEKERS / D FERGUSON |
| **TOTAL DEPTH:** | 3501 meters |

## FORMATION TOPS (m)

| FORMATION | PROGNOSIS (MD) | PROGNOSIS (TVD) | SAMPLES (MD) | SAMPLES (TVD) | LOGS (MD) | LOGS (TVD) |
|---|---|---|---|---|---|---|
| KICKOFF POINT | 1327 | 1327 | | | | |
| DEVONIAN 2ND BLACK SH | 2256 | 2085 | | | | |
| FT SIMPSON | 2387 | 2180 | 2054m / 1944m | | | |
| FAULT | 2431 | 2210 | | | | |
| FT SIMPSON SEIS MKR | 2612 | 2340 | | | | |
| HORN R | 2812 | 2480 | 2796m / 2461m | | | |
| **NAHANNI TOP** | **3025** | **2630** | 3116m / 2690m | | | |
| NAHANNI TOP[WHIP 4] | 3128 | 2699.8 | | | | |
| TD | 3501 | | 3500m / 3000.62m | | | |

-2170.1

-2239.91

seismic – 2230

## DEVIATION SURVEY RECORD

| Depth (m) | Incl | Azimuth | TVD | Vert Sect | Rectangular Offsets | |
|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 N | 0.00 E |
| 199.00 | 0.50 | 36.40 | 199.00 | -0.86 | 0.70 N | 0.52 E |
| 226.00 | 1.75 | 25.00 | 225.99 | -1.36 | 1.17 N | 0.76 E |
| 253.00 | 1.50 | 20.40 | 252.98 | -2.07 | 1.87 N | 1.06 E |
| 262.50 | 1.46 | 36.51 | 262.48 | -2.30 | 2.09 N | 1.17 E |
| 283.00 | 1.75 | 67.40 | 282.97 | -2.85 | 2.42 N | 1.62 E |
| 312.00 | 1.90 | 70.40 | 311.96 | -3.70 | 2.75 N | 2.48 E |
| 343.00 | 2.00 | 70.40 | 342.94 | -4.65 | 3.10 N | 3.47 E |
| 374.00 | 2.25 | 59.40 | 373.92 | -5.73 | 3.59 N | 4.51 E |
| 403.00 | 3.00 | 68.40 | 402.89 | -6.97 | 4.16 N | 5.70 E |
| 433.00 | 3.30 | 70.90 | 432.84 | -8.47 | 4.73 N | 7.25 E |
| 451.00 | 4.40 | 71.30 | 450.80 | -9.56 | 5.12 N | 8.39 E |
| 460.00 | 4.30 | 71.10 | 459.77 | -10.17 | 5.34 N | 9.04 E |
| 470.00 | 4.30 | 74.20 | 469.75 | -10.83 | 5.57 N | 9.75 E |
| 480.00 | 4.30 | 79.10 | 479.72 | -11.47 | 5.74 N | 10.48 E |
| 490.00 | 4.20 | 87.40 | 489.69 | -12.05 | 5.83 N | 11.21 E |
| 499.00 | 4.10 | 93.10 | 498.67 | -12.51 | 5.83 N | 11.87 E |
| 509.00 | 4.10 | 99.30 | 508.64 | -12.96 | 5.75 N | 12.58 E |
| 518.00 | 4.00 | 107.10 | 517.62 | -13.29 | 5.60 N | 13.19 E |
| 528.00 | 3.80 | 114.70 | 527.60 | -13.57 | 5.36 N | 13.83 E |
| 538.00 | 3.50 | 123.60 | 537.58 | -13.75 | 5.06 N | 14.38 E |
| 547.00 | 3.20 | 129.50 | 546.56 | -13.82 | 4.74 N | 14.81 E |
| 557.00 | 2.80 | 129.60 | 556.55 | -13.87 | 4.41 N | 15.21 E |
| 566.00 | 2.40 | 130.80 | 565.54 | -13.91 | 4.15 N | 15.52 E |
| 576.00 | 2.10 | 128.60 | 575.53 | -13.94 | 3.90 N | 15.82 E |
| 586.00 | 1.90 | 122.80 | 585.52 | -14.00 | 3.69 N | 16.10 E |
| 596.00 | 1.70 | 107.60 | 595.52 | -14.10 | 3.56 N | 16.39 E |
| 605.00 | 1.90 | 97.90 | 604.51 | -14.25 | 3.50 N | 16.66 E |
| 614.00 | 2.00 | 92.80 | 613.51 | -14.45 | 3.47 N | 16.97 E |
| 624.00 | 2.20 | 88.10 | 623.50 | -14.71 | 3.47 N | 17.33 E |
| 634.00 | 2.20 | 92.00 | 633.49 | -14.98 | 3.47 N | 17.72 E |
| 644.00 | 2.20 | 101.00 | 643.49 | -15.22 | 3.42 N | 18.10 E |
| 654.00 | 2.30 | 103.80 | 653.48 | -15.43 | 3.34 N | 18.48 E |
| 663.00 | 2.40 | 113.60 | 662.47 | -15.59 | 3.22 N | 18.83 E |
| 673.00 | 2.50 | 124.30 | 672.46 | -15.71 | 3.01 N | 19.20 E |
| 683.00 | 2.40 | 130.50 | 682.45 | -15.76 | 2.75 N | 19.54 E |
| 693.00 | 2.20 | 136.30 | 692.45 | -15.78 | 2.48 N | 19.83 E |
| 702.00 | 1.90 | 144.50 | 701.44 | -15.75 | 2.23 N | 20.04 E |
| 712.00 | 1.60 | 151.30 | 711.43 | -15.68 | 1.98 N | 20.20 E |
| 722.00 | 1.20 | 151.40 | 721.43 | -15.61 | 1.76 N | 20.32 E |
| 731.00 | 0.80 | 165.00 | 730.43 | -15.55 | 1.62 N | 20.38 E |
| 741.00 | 0.40 | 183.40 | 740.43 | -15.49 | 1.52 N | 20.39 E |
| 751.00 | 0.10 | 158.00 | 750.43 | -15.46 | 1.47 N | 20.39 E |
| 760.00 | 0.30 | 45.00 | 759.43 | -15.48 | 1.48 N | 20.41 E |
| 770.00 | 0.70 | 53.90 | 769.43 | -15.57 | 1.54 N | 20.48 E |

## DEVIATION SURVEY RECORD

| Depth (m) | Incl | Azimuth | TVD | Vert Sect | Rectangular Offsets |
|---|---|---|---|---|---|
| 780.00 | 0.90 | 64.60 | 779.43 | -15.70 | 1.61 N 20.60 E |
| 789.00 | 1.00 | 79.60 | 788.43 | -15.84 | 1.65 N 20.74 E |
| 799.00 | 1.10 | 111.10 | 798.43 | -15.95 | 1.63 N 20.92 E |
| 808.00 | 1.30 | 135.40 | 807.42 | -15.98 | 1.53 N 21.07 E |
| 818.00 | 1.40 | 155.00 | 817.42 | -15.94 | 1.34 N 21.20 E |
| 827.00 | 2.00 | 182.50 | 826.42 | -15.78 | 1.08 N 21.24 E |
| 837.00 | 2.50 | 208.80 | 836.41 | -15.45 | 0.71 N 21.13 E |
| 847.00 | 2.80 | 220.10 | 846.40 | -14.99 | 0.34 N 20.87 E |
| 857.00 | 2.90 | 219.60 | 856.39 | -14.50 | 0.04 S 20.55 E |
| 866.00 | 2.40 | 211.50 | 865.38 | -14.09 | 0.38 S 20.31 E |
| 876.00 | 2.10 | 185.40 | 875.37 | -13.74 | 0.74 S 20.18 E |
| 886.00 | 2.00 | 153.30 | 885.36 | -13.55 | 1.08 S 20.24 E |
| 896.00 | 2.20 | 123.50 | 895.36 | -13.53 | 1.34 S 20.48 E |
| 905.00 | 2.70 | 118.00 | 904.35 | -13.63 | 1.54 S 20.81 E |
| 914.00 | 2.70 | 110.50 | 913.34 | -13.78 | 1.71 S 21.20 E |
| 924.00 | 2.70 | 111.50 | 923.33 | -13.97 | 1.88 S 21.63 E |
| 934.00 | 2.50 | 130.60 | 933.32 | -14.08 | 2.11 S 22.02 E |
| 944.00 | 3.20 | 153.20 | 943.31 | -14.01 | 2.50 S 22.31 E |
| 954.00 | 3.60 | 163.70 | 953.29 | -13.77 | 3.05 S 22.53 E |
| 963.00 | 4.40 | 164.20 | 962.27 | -13.47 | 3.65 S 22.70 E |
| 973.00 | 5.30 | 170.50 | 972.23 | -13.01 | 4.48 S 22.88 E |
| 983.00 | 5.60 | 176.90 | 982.19 | -12.42 | 5.42 S 22.98 E |
| 989.00 | 5.50 | 178.70 | 988.16 | -12.02 | 6.00 S 23.00 E |
| 1007.00 | 5.39 | 179.13 | 1006.08 | -10.84 | 7.71 S 23.04 E |
| 1019.00 | 4.80 | 179.30 | 1018.03 | -10.10 | 8.77 S 23.05 E |
| 1029.00 | 4.40 | 176.80 | 1028.00 | -9.55 | 9.57 S 23.08 E |
| 1039.00 | 4.00 | 174.50 | 1037.97 | -9.07 | 10.30 S 23.13 E |
| 1048.00 | 3.50 | 170.40 | 1046.95 | -8.71 | 10.89 S 23.21 E |
| 1058.00 | 3.00 | 169.30 | 1056.93 | -8.39 | 11.45 S 23.31 E |
| 1068.00 | 2.60 | 166.80 | 1066.92 | -8.12 | 11.92 S 23.41 E |
| 1077.00 | 2.00 | 160.40 | 1075.91 | -7.95 | 12.27 S 23.51 E |
| 1087.00 | 1.60 | 144.50 | 1085.91 | -7.85 | 12.55 S 23.65 E |
| 1097.00 | 1.20 | 128.50 | 1095.91 | -7.84 | 12.73 S 23.81 E |
| 1106.00 | 1.20 | 115.70 | 1104.90 | -7.88 | 12.83 S 23.97 E |
| 1116.00 | 1.10 | 106.10 | 1114.90 | -7.96 | 12.90 S 24.16 E |
| 1126.00 | 1.20 | 105.30 | 1124.90 | -8.06 | 12.95 S 24.35 E |
| 1136.00 | 1.20 | 114.10 | 1134.90 | -8.15 | 13.02 S 24.55 E |
| 1146.00 | 1.20 | 108.80 | 1144.90 | -8.23 | 13.10 S 24.74 E |
| 1156.00 | 1.30 | 109.60 | 1154.89 | -8.33 | 13.17 S 24.95 E |
| 1165.00 | 1.30 | 101.40 | 1163.89 | -8.43 | 13.23 S 25.14 E |
| 1175.00 | 1.60 | 98.00 | 1173.89 | -8.57 | 13.27 S 25.39 E |
| 1185.00 | 1.60 | 95.40 | 1183.88 | -8.75 | 13.30 S 25.67 E |
| 1193.00 | 1.30 | 97.90 | 1191.88 | -8.87 | 13.32 S 25.87 E |
| 1203.00 | 1.20 | 94.50 | 1201.88 | -9.01 | 13.35 S 26.09 E |
| 1233.00 | 1.30 | 94.10 | 1231.87 | -9.43 | 13.40 S 26.74 E |
| 1262.00 | 1.40 | 107.80 | 1260.86 | -9.81 | 13.53 S 27.40 E |

## DEVIATION SURVEY RECORD

| Depth (m) | Incl | Azimuth | TVD | Vert Sect | Rectangular Offsets | |
|---|---|---|---|---|---|---|
| 1291.00 | 1.10 | 112.40 | 1289.86 | -10.08 | 13.74 S | 28.00 E |
| 1310.00 | 0.40 | 110.50 | 1308.86 | -10.18 | 13.84 S | 28.23 E |
| 1320.00 | 1.20 | 117.10 | 1318.85 | -10.23 | 13.90 S | 28.36 E |
| 1327.00 | 1.66 | 125.42 | 1325.85 | -10.26 | 13.99 S | 28.50 E |
| 1329.00 | 1.80 | 127.00 | 1327.85 | -10.27 | 14.02 S | 28.55 E |
| 1339.00 | 2.50 | 120.40 | 1337.84 | -10.35 | 14.23 S | 28.87 E |
| 1349.00 | 2.90 | 115.50 | 1347.83 | -10.49 | 14.45 S | 29.28 E |
| 1358.00 | 3.10 | 114.40 | 1356.82 | -10.65 | 14.65 S | 29.71 E |
| 1368.00 | 3.20 | 118.40 | 1366.81 | -10.83 | 14.89 S | 30.20 E |
| 1378.00 | 3.00 | 123.50 | 1376.79 | -10.96 | 15.17 S | 30.67 E |
| 1388.00 | 3.20 | 136.50 | 1386.78 | -11.00 | 15.51 S | 31.08 E |
| 1398.00 | 3.60 | 151.50 | 1396.76 | -10.91 | 15.99 S | 31.42 E |
| 1408.00 | 4.40 | 169.70 | 1406.73 | -10.60 | 16.65 S | 31.64 E |
| 1417.00 | 5.20 | 182.00 | 1415.70 | -10.10 | 17.39 S | 31.68 E |
| 1427.00 | 6.20 | 190.40 | 1425.65 | -9.33 | 18.38 S | 31.57 E |
| 1436.00 | 6.90 | 197.40 | 1434.60 | -8.45 | 19.37 S | 31.32 E |
| 1446.00 | 8.00 | 205.30 | 1444.51 | -7.26 | 20.57 S | 30.84 E |
| 1456.00 | 9.30 | 211.40 | 1454.40 | -5.82 | 21.89 S | 30.13 E |
| 1465.00 | 10.70 | 214.80 | 1463.26 | -4.29 | 23.20 S | 29.27 E |
| 1474.00 | 11.60 | 217.20 | 1472.09 | -2.57 | 24.61 S | 28.25 E |
| 1484.00 | 12.40 | 218.80 | 1481.87 | -0.51 | 26.24 S | 26.96 E |
| 1494.00 | 12.60 | 219.30 | 1491.63 | 1.64 | 27.93 S | 25.60 E |
| 1503.00 | 12.80 | 220.00 | 1500.41 | 3.61 | 29.45 S | 24.34 E |
| 1513.00 | 12.90 | 220.20 | 1510.16 | 5.83 | 31.15 S | 22.91 E |
| 1523.00 | 13.30 | 219.40 | 1519.90 | 8.09 | 32.89 S | 21.46 E |
| 1533.00 | 13.70 | 219.60 | 1529.63 | 10.41 | 34.69 S | 19.97 E |
| 1543.00 | 14.50 | 220.60 | 1539.33 | 12.84 | 36.56 S | 18.40 E |
| 1553.00 | 15.10 | 221.00 | 1548.99 | 15.38 | 38.49 S | 16.73 E |
| 1562.00 | 15.80 | 223.20 | 1557.67 | 17.78 | 40.27 S | 15.12 E |
| 1572.00 | 16.70 | 222.30 | 1567.27 | 20.57 | 42.32 S | 13.22 E |
| 1582.00 | 17.50 | 222.80 | 1576.83 | 23.51 | 44.49 S | 11.24 E |
| 1592.00 | 17.90 | 224.70 | 1586.35 | 26.55 | 46.68 S | 9.13 E |
| 1602.00 | 18.10 | 225.30 | 1595.86 | 29.64 | 48.87 S | 6.95 E |
| 1612.00 | 18.10 | 225.60 | 1605.37 | 32.75 | 51.05 S | 4.73 E |
| 1621.00 | 18.60 | 225.00 | 1613.91 | 35.58 | 53.04 S | 2.72 E |
| 1631.00 | 19.70 | 225.60 | 1623.36 | 38.86 | 55.35 S | 0.39 E |
| 1640.00 | 20.60 | 226.80 | 1631.81 | 41.96 | 57.49 S | 1.85 W |
| 1650.00 | 21.40 | 226.00 | 1641.14 | 45.54 | 59.96 S | 4.44 W |
| 1659.00 | 22.70 | 226.00 | 1649.49 | 48.92 | 62.31 S | 6.87 W |
| 1668.00 | 24.10 | 225.80 | 1657.74 | 52.50 | 64.80 S | 9.44 W |
| 1677.00 | 25.90 | 226.70 | 1665.90 | 56.30 | 67.43 S | 12.19 W |
| 1687.00 | 27.60 | 226.80 | 1674.83 | 60.80 | 70.51 S | 15.47 W |
| 1697.00 | 28.80 | 226.80 | 1683.64 | 65.52 | 73.75 S | 18.91 W |
| 1707.00 | 29.60 | 227.20 | 1692.37 | 70.40 | 77.07 S | 22.48 W |
| 1717.00 | 30.50 | 226.90 | 1701.03 | 75.40 | 80.49 S | 26.15 W |
| 1727.00 | 31.20 | 226.50 | 1709.61 | 80.53 | 84.00 S | 29.88 W |

## DEVIATION SURVEY RECORD

| Depth (m) | Incl | Azimuth | TVD | Vert Sect | Rectangular Offsets | |
|---|---|---|---|---|---|---|
| 1736.00 | 32.50 | 226.60 | 1717.26 | 85.27 | 87.27 S | 33.32 W |
| 1746.00 | 33.80 | 226.70 | 1725.63 | 90.74 | 91.02 S | 37.30 W |
| 1755.00 | 35.10 | 226.20 | 1733.05 | 95.83 | 94.53 S | 40.99 W |
| 1764.00 | 36.10 | 225.50 | 1740.37 | 101.07 | 98.18 S | 44.75 W |
| 1774.00 | 37.20 | 224.00 | 1748.39 | 107.04 | 102.42 S | 48.95 W |
| 1784.00 | 38.40 | 223.50 | 1756.29 | 113.16 | 106.85 S | 53.19 W |
| 1793.00 | 39.60 | 223.80 | 1763.29 | 118.83 | 110.95 S | 57.10 W |
| 1803.00 | 40.80 | 225.00 | 1770.93 | 125.28 | 115.56 S | 61.61 W |
| 1813.00 | 41.60 | 223.90 | 1778.45 | 131.87 | 120.26 S | 66.23 W |
| 1826.00 | 43.10 | 224.50 | 1788.06 | 140.62 | 126.54 S | 72.33 W |
| 1836.00 | 43.40 | 224.20 | 1795.34 | 147.47 | 131.44 S | 77.12 W |
| 1847.00 | 43.40 | 225.40 | 1803.33 | 155.03 | 136.80 S | 82.45 W |
| 1857.00 | 43.70 | 224.70 | 1810.58 | 161.92 | 141.67 S | 87.32 W |
| 1866.00 | 44.60 | 225.90 | 1817.04 | 168.19 | 146.08 S | 91.78 W |
| 1876.00 | 44.90 | 225.60 | 1824.14 | 175.23 | 150.99 S | 96.82 W |
| 1885.00 | 45.70 | 226.40 | 1830.47 | 181.62 | 155.43 S | 101.42 W |
| 1895.00 | 46.20 | 228.20 | 1837.42 | 188.81 | 160.30 S | 106.71 W |
| 1904.00 | 46.50 | 228.80 | 1843.64 | 195.31 | 164.62 S | 111.58 W |
| 1914.00 | 46.80 | 228.50 | 1850.50 | 202.56 | 169.42 S | 117.04 W |
| 1923.00 | 47.10 | 229.40 | 1856.65 | 209.12 | 173.74 S | 122.00 W |
| 1933.00 | 47.50 | 231.30 | 1863.43 | 216.44 | 178.43 S | 127.66 W |
| 1942.00 | 48.40 | 231.40 | 1869.46 | 223.08 | 182.61 S | 132.88 W |
| 1952.00 | 48.50 | 231.20 | 1876.09 | 230.52 | 187.28 S | 138.72 W |
| 1962.00 | 48.60 | 231.20 | 1882.71 | 237.97 | 191.98 S | 144.56 W |
| 1971.00 | 49.00 | 231.60 | 1888.64 | 244.70 | 196.21 S | 149.85 W |
| 1981.00 | 48.50 | 231.70 | 1895.23 | 252.17 | 200.87 S | 155.75 W |
| 1990.00 | 47.90 | 231.70 | 1901.23 | 258.83 | 205.03 S | 161.02 W |
| 2000.00 | 48.00 | 232.60 | 1907.93 | 266.20 | 209.58 S | 166.88 W |
| 2010.00 | 48.30 | 232.40 | 1914.60 | 273.59 | 214.12 S | 172.79 W |
| 2019.00 | 47.80 | 232.30 | 1920.61 | 280.22 | 218.21 S | 178.09 W |
| 2028.00 | 47.40 | 231.30 | 1926.68 | 286.82 | 222.32 S | 183.31 W |
| 2038.00 | 47.70 | 231.30 | 1933.43 | 294.16 | 226.93 S | 189.07 W |
| 2048.00 | 47.90 | 230.50 | 1940.15 | 301.53 | 231.60 S | 194.82 W |
| 2065.00 | 47.40 | 229.60 | 1951.60 | 314.04 | 239.67 S | 204.45 W |
| 2075.00 | 46.50 | 229.30 | 1958.43 | 321.33 | 244.42 S | 210.00 W |
| 2084.00 | 45.90 | 228.50 | 1964.66 | 327.81 | 248.69 S | 214.90 W |
| 2094.00 | 46.70 | 229.80 | 1971.57 | 335.02 | 253.42 S | 220.37 W |
| 2104.00 | 47.50 | 230.20 | 1978.37 | 342.31 | 258.13 S | 225.98 W |
| 2113.00 | 47.40 | 231.40 | 1984.46 | 348.91 | 262.32 S | 231.12 W |
| 2123.00 | 47.20 | 230.50 | 1991.24 | 356.22 | 266.95 S | 236.82 W |
| 2133.00 | 47.20 | 230.80 | 1998.04 | 363.52 | 271.60 S | 242.50 W |
| 2142.00 | 47.60 | 231.50 | 2004.13 | 370.11 | 275.76 S | 247.66 W |
| 2152.00 | 47.80 | 232.60 | 2010.86 | 377.45 | 280.30 S | 253.49 W |
| 2162.00 | 46.90 | 232.70 | 2017.63 | 384.74 | 284.77 S | 259.34 W |
| 2171.00 | 45.90 | 232.90 | 2023.84 | 391.19 | 288.71 S | 264.53 W |
| 2181.00 | 46.00 | 233.00 | 2030.79 | 398.31 | 293.04 S | 270.26 W |

## DEVIATION SURVEY RECORD

| Depth (m) | Incl | Azimuth | TVD | Vert Sect | Rectangular Offsets |
|---|---|---|---|---|---|
| 2191.00 | 46.40 | 233.90 | 2037.71 | 405.45 | 297.34 S 276.06 W |
| 2201.00 | 46.60 | 232.90 | 2044.60 | 412.63 | 301.66 S 281.88 W |
| 2211.00 | 46.20 | 233.00 | 2051.49 | 419.80 | 306.02 S 287.66 W |
| 2221.00 | 45.60 | 232.10 | 2058.45 | 426.92 | 310.39 S 293.37 W |
| 2231.00 | 45.00 | 231.60 | 2065.49 | 433.98 | 314.78 S 298.95 W |
| 2240.00 | 44.40 | 231.80 | 2071.88 | 440.26 | 318.70 S 303.92 W |
| 2249.00 | 43.90 | 230.20 | 2078.34 | 446.50 | 322.65 S 308.79 W |
| 2259.00 | 43.60 | 228.70 | 2085.57 | 453.39 | 327.14 S 314.05 W |
| 2269.00 | 43.90 | 227.90 | 2092.79 | 460.29 | 331.74 S 319.21 W |
| 2278.00 | 44.90 | 226.60 | 2099.22 | 466.59 | 336.02 S 323.83 W |
| 2288.00 | 46.10 | 226.00 | 2106.23 | 473.72 | 340.95 S 328.99 W |
| 2298.00 | 47.40 | 225.40 | 2113.08 | 481.00 | 346.03 S 334.20 W |
| 2307.00 | 48.00 | 225.70 | 2119.14 | 487.66 | 350.69 S 338.96 W |
| 2317.00 | 48.00 | 225.50 | 2125.83 | 495.09 | 355.89 S 344.27 W |
| 2327.00 | 47.70 | 226.00 | 2132.54 | 502.50 | 361.07 S 349.58 W |
| 2336.00 | 47.60 | 226.70 | 2138.60 | 509.15 | 365.66 S 354.39 W |
| 2346.00 | 47.10 | 227.50 | 2145.38 | 516.50 | 370.67 S 359.78 W |
| 2356.00 | 46.60 | 227.80 | 2152.22 | 523.79 | 375.58 S 365.17 W |
| 2365.00 | 46.10 | 228.60 | 2158.43 | 530.29 | 379.92 S 370.02 W |
| 2375.00 | 45.70 | 227.40 | 2165.39 | 537.46 | 384.73 S 375.36 W |
| 2384.00 | 45.20 | 226.70 | 2171.70 | 543.87 | 389.10 S 380.05 W |
| 2393.00 | 45.30 | 226.30 | 2178.04 | 550.26 | 393.50 S 384.69 W |
| 2403.00 | 45.70 | 224.50 | 2185.05 | 557.39 | 398.50 S 389.77 W |
| 2403.00 | 45.70 | 224.50 | 2185.05 | | 398.50 S 389.77 W |
| 2419.00 | 46.30 | 224.10 | 2196.16 | | 406.74 S 397.81 W |
| 2429.00 | 46.80 | 223.50 | 2203.04 | | 411.98 S 402.83 W |
| 2439.00 | 46.80 | 224.10 | 2209.89 | | 417.24 S 407.88 W |
| 2448.00 | 46.30 | 224.10 | 2216.07 | | 421.93 S 412.42 W |
| 2457.00 | 46.00 | 225.50 | 2222.31 | | 426.54 S 417.00 W |
| 2467.00 | 45.70 | 225.90 | 2229.28 | | 431.55 S 422.13 W |
| 2477.00 | 45.40 | 226.80 | 2236.28 | | 436.48 S 427.30 W |
| 2487.00 | 45.50 | 228.20 | 2243.29 | | 441.29 S 432.55 W |
| 2496.00 | 45.50 | 228.20 | 2249.60 | | 445.57 S 437.34 W |
| 2506.00 | 45.40 | 228.10 | 2256.62 | | 450.33 S 442.64 W |
| 2516.00 | 45.60 | 229.70 | 2263.63 | | 455.01 S 448.02 W |
| 2525.00 | 45.60 | 229.40 | 2269.92 | | 459.19 S 452.91 W |
| 2535.00 | 45.50 | 229.00 | 2276.93 | | 463.85 S 458.32 W |
| 2544.00 | 45.30 | 230.30 | 2283.25 | | 468.00 S 463.20 W |
| 2555.00 | 45.20 | 230.30 | 2290.99 | | 472.99 S 469.21 W |
| 2564.00 | 44.80 | 230.20 | 2297.35 | | 477.06 S 474.10 W |
| 2574.00 | 44.80 | 229.00 | 2304.45 | | 481.62 S 479.47 W |
| 2583.00 | 45.30 | 228.10 | 2310.81 | | 485.84 S 484.24 W |
| 2593.00 | 45.90 | 227.10 | 2317.80 | | 490.66 S 489.52 W |
| 2603.00 | 46.70 | 225.50 | 2324.71 | 700.32 | 495.74 S 494.74 W |
| 2612.00 | 46.70 | 224.10 | 2330.89 | 706.87 | 500.30 S 499.36 W |
| 2622.00 | 46.50 | 223.50 | 2337.76 | 714.13 | 505.55 S 504.39 W |

## DEVIATION SURVEY RECORD

| Depth (m) | Incl | Azimuth | TVD | Vert Sect | Rectangular Offsets | |
|---|---|---|---|---|---|---|
| 2632.00 | 46.60 | 224.10 | 2344.63 | 721.39 | 510.79 S | 509.41 W |
| 2641.00 | 46.30 | 224.50 | 2350.84 | 727.91 | 515.45 S | 513.97 W |
| 2651.00 | 45.70 | 223.80 | 2357.78 | 735.10 | 520.61 S | 518.98 W |
| 2660.00 | 44.90 | 223.40 | 2364.11 | 741.50 | 525.25 S | 523.39 W |
| 2670.00 | 44.30 | 223.30 | 2371.23 | 748.52 | 530.35 S | 528.21 W |
| 2680.00 | 44.30 | 224.70 | 2378.39 | 755.50 | 535.38 S | 533.06 W |
| 2689.00 | 44.30 | 224.70 | 2384.83 | 761.79 | 539.84 S | 537.48 W |
| 2699.00 | 44.50 | 225.30 | 2391.98 | 768.78 | 544.79 S | 542.43 W |
| 2709.00 | 44.60 | 225.80 | 2399.10 | 775.80 | 549.70 S | 547.44 W |
| 2718.00 | 44.70 | 225.40 | 2405.50 | 782.12 | 554.13 S | 551.96 W |
| 2728.00 | 44.80 | 226.60 | 2412.61 | 789.16 | 559.02 S | 557.02 W |
| 2738.00 | 45.10 | 227.60 | 2419.68 | 796.22 | 563.83 S | 562.20 W |
| 2747.00 | 45.40 | 228.00 | 2426.02 | 802.60 | 568.12 S | 566.93 W |
| 2756.00 | 45.40 | 229.30 | 2432.34 | 809.00 | 572.36 S | 571.74 W |
| 2766.00 | 44.80 | 230.00 | 2439.40 | 816.06 | 576.94 S | 577.14 W |
| 2776.00 | 43.80 | 229.30 | 2446.56 | 823.02 | 581.46 S | 582.46 W |
| 2785.00 | 43.00 | 229.80 | 2453.09 | 829.18 | 585.48 S | 587.17 W |
| 2795.00 | 42.50 | 227.90 | 2460.44 | 835.96 | 589.94 S | 592.28 W |
| 2804.00 | 42.20 | 228.20 | 2467.09 | | 593.99 S | 596.79 W |
| 2814.00 | 42.20 | 227.00 | 2474.50 | | 598.52 S | 601.75 W |
| 2827.00 | 42.40 | 226.80 | 2484.11 | | 604.50 S | 608.14 W |
| 2836.00 | 43.20 | 227.60 | 2490.72 | | 608.66 S | 612.62 W |
| 2845.00 | 43.40 | 226.90 | 2497.27 | | 612.85 S | 617.16 W |
| 2855.00 | 43.30 | 226.50 | 2504.54 | | 617.55 S | 622.15 W |
| 2864.00 | 43.10 | 226.10 | 2511.10 | | 621.81 S | 626.61 W |
| 2874.00 | 43.30 | 226.50 | 2518.39 | | 626.54 S | 631.56 W |
| 2883.00 | 43.40 | 226.40 | 2524.93 | | 630.80 S | 636.03 W |
| 2893.00 | 43.30 | 225.80 | 2532.20 | | 635.56 S | 640.98 W |
| 2903.00 | 43.70 | 224.80 | 2539.46 | | 640.40 S | 645.87 W |
| 2913.00 | 44.00 | 224.10 | 2546.67 | | 645.34 S | 650.72 W |
| 2921.00 | 44.80 | 222.40 | 2552.39 | | 649.42 S | 654.56 W |
| 2931.00 | 45.30 | 222.20 | 2559.45 | | 654.66 S | 659.32 W |
| 2940.00 | 45.80 | 223.80 | 2565.75 | | 659.35 S | 663.70 W |
| 2950.00 | 46.10 | 222.50 | 2572.71 | | 664.60 S | 668.62 W |
| 2959.00 | 46.40 | 222.10 | 2578.93 | | 669.41 S | 672.99 W |
| 2969.00 | 46.30 | 220.90 | 2585.83 | | 674.82 S | 677.79 W |
| 2978.00 | 45.40 | 220.60 | 2592.10 | | 679.72 S | 682.00 W |
| 2988.00 | 44.80 | 220.00 | 2599.16 | | 685.12 S | 686.58 W |
| 2998.00 | 44.80 | 220.10 | 2606.26 | | 690.51 S | 691.12 W |
| 3013.00 | 45.20 | 220.40 | 2616.86 | | 698.61 S | 697.97 W |
| 3023.00 | 45.20 | 220.60 | 2623.91 | | 704.00 S | 702.58 W |
| 3032.00 | 44.90 | 219.70 | 2630.27 | | 708.87 S | 706.69 W |
| 3036.00 | 44.80 | 219.70 | 2633.10 | | 711.04 S | 708.49 W |
| 3045.00 | 44.90 | 219.60 | 2639.48 | | 715.93 S | 712.54 W |
| 3054.00 | 44.60 | 219.50 | 2645.88 | | 720.81 S | 716.57 W |

## DEVIATION SURVEY RECORD

| Depth (m) | Incl | Azimuth | TVD | Vert Sect | Rectangular Offsets |
|---|---|---|---|---|---|
| 3064.00 | 44.50 | 219.20 | 2653.00 | | 726.24 S 721.02 W |
| 3073.00 | 44.30 | 219.40 | 2659.43 | | 731.11 S 725.01 W |
| 3085.00 | 44.30 | 219.60 | 2668.02 | | 737.58 S 730.34 W |
| 3095.00 | 43.90 | 219.80 | 2675.20 | | 742.93 S 734.79 W |
| 3122.00 | 40.40 | 214.70 | 2695.22 | | 757.33 S 745.77 W |
| 3138.00 | 36.90 | 208.80 | 2707.72 | | 765.81 S 751.03 W |
| 3157.00 | 37.00 | 208.70 | 2722.90 | | 775.82 S 756.53 W |
| 3185.00 | 37.80 | 209.50 | 2745.15 | | 790.68 S 764.80 W |
| 3195.00 | 38.10 | 209.90 | 2753.03 | | 796.02 S 767.85 W |
| 3204.00 | 38.10 | 207.60 | 2760.12 | | 800.89 S 770.52 W |
| 3214.00 | 38.40 | 207.70 | 2767.97 | | 806.37 S 773.39 W |
| 3224.00 | 38.50 | 208.10 | 2775.80 | | 811.87 S 776.30 W |
| 3253.00 | 34.70 | 206.30 | 2799.08 | | 827.24 S 784.21 W |
| 3282.00 | 33.40 | 202.80 | 2823.11 | | 842.00 S 790.96 W |
| 3311.00 | 34.60 | 204.90 | 2847.15 | | 856.82 S 797.52 W |
| 3340.00 | 35.30 | 204.80 | 2870.92 | | 871.90 S 804.51 W |
| 3369.00 | 35.40 | 205.00 | 2894.57 | | 887.12 S 811.57 W |
| 3397.00 | 35.60 | 205.30 | 2917.37 | | 901.84 S 818.48 W |
| 3416.00 | 35.60 | 204.80 | 2932.82 | | 911.86 S 823.16 W |
| 3426.00 | 35.50 | 203.90 | 2940.95 | | 917.15 S 825.56 W |
| 3436.00 | 35.50 | 204.50 | 2949.09 | | 922.45 S 827.94 W |
| 3445.00 | 35.70 | 205.70 | 2956.41 | | 927.19 S 830.16 W |
| 3455.00 | 36.00 | 204.50 | 2964.52 | | 932.50 S 832.65 W |
| 3465.00 | 36.30 | 204.30 | 2972.59 | | 937.87 S 835.08 W |
| 3474.00 | 36.60 | 205.20 | 2979.83 | | 942.72 S 837.32 W |
| 3482.00 | 36.80 | 204.70 | 2986.25 | | 947.06 S 839.34 W |
| 3500.00 | 37.26 | 203.59 | 3000.62 | | 956.95 S 843.77 W |

## BIT RECORD

| # | Type | Size (mm) | In | Out | Total (m) | Hrs drilled | FOB (daN) | RPM | Cond. T B G |
|---|---|---|---|---|---|---|---|---|---|
| RR28C | EHP51H | 311 | 1243 | 1327 | 84 | 16.00 | 10/16 | 60/70 | |
| 29C | EPH43H | 311 | 1327 | 1475 | 148 | 71.25 | 09/16 | 18/160 | 2-7-IN KICK OFF |
| 30C | FIPC | 311 | 1375 | 1541 | 66 | 49.25 | 15/25 | 20/100 | 4-2-IN |
| 31C | ERA13 | 311 | 1541 | 1613 | 72 | 56.75 | 15/21 | 20/130 | 4-7-IN |
| 32C | FDGH | 311 | 1613 | 1668 | 55 | 33.00 | 15/21 | 20/130 | 3-4-IN |
| 33C | HP13G | 311 | 1668 | 1801 | 133 | 68.50 | 15/25 | 20/100 | 4-2-IN |
| 34C | FDGH | 311 | 1801 | | 0 | | | | |
| 35C | GT-1 | 311 | 1801 | 1837 | 36 | 23.00 | 16/25 | 20/90 | 3-2-IN |
| 36C | HP43H | 311 | 1837 | 1863 | 11 | 10.50 | 19/27 | 20/90 | 2-2-IN |
| 37C | FM2844 | 311 | 1863 | 2070 | 207 | 70.25 | 12/17 | 20/90 | 1-IN |
| RR37C | FM2844 | 311 | 2070 | 2086 | 16 | 14.75 | 12/15 | 20/90 | 3-IN |
| 38C | GT18 | 311 | 2086 | 2156 | 70 | 61.00 | 23/35 | 20/90 | 8-7-5mm |
| 39C | GS83F | 311 | 2156 | 2203 | 47 | 41.00 | 22/34 | 20/90 | 6-6-3mm |
| 40C | F2 | 311 | 2203 | 2269 | 66 | 71.75 | 20/30 | 25/90 | 7-4-1mm |
| 41C | HP13G | 311 | 2269 | 2357 | 88 | 56.00 | 15/30 | 25/90 | 5-7-1mm |
| 42C | HP13G | 311 | 2357 | 2434 | 77 | 48.00 | 15/30 | 150 | 6-5-1mm |
| 43C | FM2943 | 311 | 2434 | 2567 | 133 | 95.75 | 08/22 | 20/90 | 2-1/16mm |
| 44C | EHP41H | 311 | 2567 | 2597 | 30 | 43.50 | 20/30 | 20/32 | 6-4-1/16 |
| 45C | JG4 | 311 | 2597 | 2646 | 49 | 58.50 | 20/32 | 30/90 | 5-8-IN |
| 46C | MSDGH | 311 | 2646 | 2697 | 51 | 52.00 | 20/33 | 35/90 | 3-8-IN |
| 47C | FM2944 | 311 | 2697 | 2827 | 130 | 84.50 | 06/19 | 31/150 | 8-4-1/16 |
| 48C | HP13G | 311 | 2827 | 2833 | 6 | 6.00 | 20 | 31/150 | 7-2-4 |
| 49C | S83F | 311 | 2833 | 2851 | 18 | 22.25 | 20/32 | 31/150 | 6-2-1/16 |
| 50C | GT18 | 311 | 2851 | 2902 | 51 | 40.25 | 32/90 | 20/90 | 8-8-IN |
| 51C | GT20 | 311 | 2902 | 2936 | 34 | 26.75 | 32/90 | 20/90 | 6-3-IN |
| 52C | F3P | 311 | 2936 | 2977 | 41 | 55.00 | 28/38 | 20/90 | 3-4-1/16 |
| 53C | GT18 | 311 | 2977 | 3017 | 40 | 30.25 | 20/18 | 30/90 | 7-4-1/4 |
| 54C | F2 | 311 | 3017 | 3053 | 36 | 42.25 | 20/24 | 30/90 | 6-7-1/4 |
| 55C | F27 | 311 | 3053 | 3072 | 19 | 30.00 | 24 | 30/90 | 2-4-1/8 |
| 56C | HP61A | 311 | 3072 | 3084 | 10 | | | | |
| 57C | | 311 | 3084 | 3098 | 14 | | | | |
| 58C | | 311 | 3098 | 3115 | 17 | | | | |
| RR59 | | 311 | 3115 | 3115 | 0 | | | | |
| 60C | | 311 | 3115 | 3115 | 0 | | | | |
| CASING | | | | | | | | | |

## BIT RECORD

| # | Type | Size (mm) | In | Out | Total (m) | Hrs drilled | FOB (daN) | RPM | Cond. T B G |
|---|---|---|---|---|---|---|---|---|---|
| 61 | S44G | 216 | 3115 | 3128 | 13 | 5.25 | 13/15 | 80 | 3-2-IN |
| 62 | F2 | 216 | 3128 | 3177 | 49 | 10.25 | 14/15 | 85 | |
| RR61 | S44G | 216 | 3071 | 3116 | 45 | 2.5 | 13/15 | 65 | 4-4-IN |
| 63 | D12ST | 216 | 3116 | 3140 | 26 | 29.25 | 13/14 | 350 | |
| 64 | EPH51a | 216 | 3140 | 3246 | 106 | 28.50 | 13/14 | 120 | 4-4-IN |
| 65 | SS86F | 216 | 3246 | 3500 | 254 | 67.25 | 13/15 | 125 | |
| RR61 | S44G | 216 | | 3500 | | | | | |

| BIT CONDITION | | SCALE |
|---|---|---|
| Tooth Wear | (T) | 0 - 8 |
| Bearing Wear | (B) | 0 - 8 |
| Gauge | (G) | in or (mm) under |

New Bit T=0 B=0 G=in

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-07-09 | 3121 | 0 | -- | Inspect BHA; Lay out and replace 3 cracked drill collars; Pick up pipe and run in hole open ended to 1700m; Slip and cut line, run in with rig service and BIOP drills; Finish in to bottom; No fill; Circulate with one pump at 98 strokes; Back ground gas -75 units; Trip gas 119 units; No mud lost. |
| 97-07-10 | 3121 | 0 | -- | Circulate and wait on orders; Hoist into casing; Repair oil leak on the top drive; Wait on orders; Run in hole; Moved 2 400 bbl storage tanks from river to the airstrip and stored 60000 liters of diesel in them; Hole drag down 10/15000 dan; Hole drag up 15/25000 dan; Torque on bottom - 1050/1130 p.s.i.; Back ground gas -102 units; Mud lost last 24 Hr5s -0m3. |
| 97-07-11 | 3121 | 0 | -- | Run in hole and wash 3m to bottom; Circulate and work pipe, rig service and function BOP; Hole drag down 10/15 dan; Hole drag up -15/25 dan; Torque on bottom -950/1050 p.s.i.; Background gas -57 units; Trip gas -468 units; Mud lost last 24 Hrs -1.0m3; Total water hauled to end of June -7125m3 or 498 loads; Total mud cost to condition present mud system and drill from 1400m to 2800m, no allowance for a mud cleaner or diesel, to build volume -$280,360.00. |
| 97-07-12 | Plug back depth 1765m | | -- | Wait on orders; Hoist to 2825m, circulate, and rig to run abandonment plugs; Plug #1 2825m -2750m ran with 30% excess; Plug down at 15:15 Hrs; Hoist and circulate; W.O.C.; Run in and felt plug at 2734m; Hoist to 1840m and run plug #2 1840m - 1765m ran with 30% excess; Plug down at 00:15 Hrts 07/12/97; Hoist and circulate; W.O.C. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-07-13 | Plug back depth | | | Run in to 1787m; Did not feel any cement; Hoist to 1757m and circulate; W.O.C.; Circulate and W.O.C.; Felt plug at 1784m; Circulate; Rig to and top up plug 1784m - 1765m; Hoist 10 stands to 1497m; Circulate and rig to run plug #3 1500m -1375m; Ran with 26.9m3 G with 1%d65 + 0.6%D800; Slurry weight 2100kg/m3; Plug down at 13;30Hrs; Hoist 6 stands and circulate; W.O.C.; Run in and felt plug at 1410m; Circulate and rig to top up plug; Top up with 18m3 "G" + 0.5%D800; Slurry weight 2100kg/m3; Plug down at 02:30Hrs July 13; Hoist 5 stands and circulate pipe and hole clean; Back ground gas -56 units; Trip gas -56 units. |
| 97-07-14 | 1325 | 0 | 14.5 | Hoist openended pipe; Lay out 25 joints of E pipe; Work on pipe stripper; Make up and run BHA; check caliper and strap in to 1243.5m; Tagged good cement and drill out cement; Strap tally 0.26m difference; Condition mud while running plugs and drilling cement ; Reduce mud weight to 1280 kg/m3 with centrifuge and increase weight back to 1360kg/m3. Hole drg 5 dan; Hole drag up - 10 dan; Torque on bottom - 1040 psi.; Background gas -20 units; Trip gas - 20 units. |
| 97-07-15 | 1339 | 12 | 8 | Drill cement to 1327m; Circulate and hoist directional tools; Work tight hole at 1300m; Circulate and clean shale; Hoist to casing shoe, pump trip pill and hoist; Change out hydraulic mud valve on top drive; Pick up and make up Halliburton directional tools; Low speed motor set at 1.5 degrees; Repair hydraulic hose for torque ram; Run in hole to 1075m, test MWD; Finish in and wash to bottom; Survey and orient motor; Drill ahead with survey; Slide 1327m-1334m, 1337m-1339m; Rotate 1334m-1337m; Hole drag down 5 dan; Hole |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-07-16 | 1388 | 49 | 21.75 | Drill with Dyna drill medium speed motor set at 1.5 degrees; Rig service, surveys and BOP drills; Hole has been good on connections; Slide 1339m-1342, 1342m-1350m, 1357m-1388m; Rotate 1343m-1346m; Hole drag down 5dan; Hole drag up 5 dan; Torque on bottom -750/850 psi.; Back ground gas 15 units; Mud lost last 24 Hrs -1.8m3. |
| 97-07-17 | 1429 | 41 | 21.25 | Drill 311mm hole with rig service and surveys; Worked pipe at 1405m prior to connection; Slide 1388m-1424m, 1427m-1429m; Rotate 1424m-1427m; Hole drag down 3/7 dan; Hole drag up 5/10 dan; Back ground gas 15 units; Mud lost last 24 Hrts 4.8m3; Unloaded PE BEN truck at barge landing; Did not send out core bbls and 63/4 tools; Returned one Smith F27#LG2472 to PE BEN yard at Fort Saint John with PE BEN. |
| 97-07-18 | 1467 | 38 | 16.75 | Drill to 1433m; Circulate sample and work pipe; Dummy trip to casing, hole was good; Work on Tesco motor; Changed two fuel injectors; Run in and wash to bottom; Drill with surveys and rig service; Slide 1429m-1451m, 1453m-1461m, 1463m-1467m; Rotate 1451m-1453m, 1461m-1463m; Hole drag down 5/9dan; Hole drag up 5/10dan; Torque on bottom 900/975 psi.; Background gas 18 units; Trip gas 20 units; Mud lost last 24 Hrs -7.5m3. |
| 97-07-19 | 1483 | 16 | 11.25 | Drill 311mm hole to 1475m; Circulate and mix trip pill; Circulate pipe out to 1316m; Pump trip pill and hoist; Change out motor and jars, make up new bit and run in; Shallow test MWD; Wash 2 stands to bottom; 1m fill; Drill with Trudril slow speed 1.5 degrees motor; Hole drag down 5dan; Hole drag up 5 dan; Torque on bottom 950/1050 psi; Background gas 13 units;Trip gas 213 units; Mud lost last 24 Hrs 8.0m3. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-07-20 | 1511 | 28 | 22.50 | Drill 311mm hole with rig service and surveys; Slide 1480-1488, 1492-1497, 1503-1508m; Rotate 1488-1492, 1497-1503, 1508-1511m; Hole drag down 5/10dan; Hole drag up 5/10 dan; Torque on bottom 900/950 psi.; Background gas 15 units; Mud lost last 24 Hrs 4m3. |
| 97-07-21 | 1541 | 30 | 22.25 | Drill directional 311mm hole with Trudrill slow speed 1.5 degrees motor with rig service and MWD surveys from 1511m -1541m; Slide 12m; Rotate 18m; etc. etc |
| 97-07-22 | 1552 | 11 | 10.00 | Trip for bit and mud motor; Pump out 6 stands; Pump pill; Trip out; Change mud motor and bit, service MWD;Trip in BHA; Slip and cut drilling line; Trip in test MWD at 1100m and 1495m; Wash and ream to bottom 1495m-1541m; 10m fill; Work pipe, survey, and orient tool; Directional drill 311mm hole with 197mm 1.83 degrees Halliburton mud motor and survey with MWD 1541m-1552m; Slide 7.0m; Rotate 4.0m; Hole drag down 8/10; Hole drag up 7/10 dan; Torque on bottom 930/1050 psi.; Background gas 14 units; Trip gas 104 units; Mud lost last 24 Hrs 2.0m3. |
| 97-07-23 | 1582 | 30 | 21.50 | Directional drill 311mm hole with 197mm 1.83 degrees Halliburton mud motor and survey with MWD 1552m-1582m; Repair air union rubber on #1 pump suction; Sipped out 171mm Halliburton directional tools; 2 197mm mud motors for repair; DBS core barrels and accessories; 171mm Faster jars and shock tool; 2 228mm jars for repair; Dowell division 200 mud pallets; Slide 25m; Rotate 5m; Hole drag down 5/7dan; Hole drag up 5/8dan;Torque on bottom 930/970 p.s.i.; Background gas 18 units; Mud lost last 24 Hrs 5.0m3. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-07-24 | 1611 | 29 | 22.00 | Directional drill 311mm hole with 197mm 1.83 degrees Halliburton mud motor and survey with MWD 1582m-1611m; Change suction valve on #2 pump; Slide 26m; Rotate 3.0m; Hole drag down 5/7dan; Hole drag up 5/10dan; Torque on bottom 930/970psi.; Back ground gas 25 units; Mud lost last 24 Hrs 2.4m3. |
| 97-07-25 | 1627 | 16 | 10.50 | Directional drill 311mm hole with 197mm 1.83 degrees Halliburton mud motor and survey with MWD 1611m-1613m; Trip for bit, pump out 2 stands; Pump pill trip out; Change bit and service MWD; Trip in to 987m; Change seals and saver sub on Tesco top drive; Trip in test MWD at 1125m; Wash and ream to bottom 1554m-1613m 4.0m fill; Orient tool; Directional drill 311mm hole with 197mm 1.83 degrees Halliburton mud motor and survey with MWD 1613m-1627m; Slide 15.0m; Rotate 1.0m; Hole drag down 5/7dan; Hole drag up 5/10dan; Torque on bottom 930/970 psi.; Background gas 18 units; Trip gas 259 units; Mud lost last 24 Hrs 3.5m3. |
| 97-07-26 | 1667 | 40 | 22.25 | Drill directional 311mm hole with 197mm 1.83 degrees Halliburton mud motor and survey with MWD 1627m-1667m; Slide 39.0m; Rotate 1.0m; Hole drag down 3/6dan; Hole drag up 5/10dan; Torque on bottom 975/1000 psi.; Background gas 20 units; Mud lost in last 24 Hrs 1.0m3. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-07-27 | 1681 | 14 | 10.50 | Directional drill 311mm hole with 197mm 1.83 degrees Halliburton mud motor and survey with MWD 1167m-1668m; Mud motor stalling stator rubber failed; Circulate out 2 stands; Pump pill; Trip out to change mud motor and bit, service MWD; Trip in to 1003m; Repair #2 pump and service Tesco top drive; Trip in and test MWD at 1125m; Wash and ream 1648m-1668m; 3m fill; Directional drill 311mm hole with 197mm 2.12 degrees Vector mud motor and survey with MWD 1668m-1681m; Slide 11.0m; Rotate 2.0m; Hole drag down 5/7dan; Hole drag up 8/15dan; Torque on bottom 980/1050 psi.; Background gas 15 units; Trip gas 111 units; Mud lost last 24 Hrs 1.0m3. |
| 97-07-28 | 1723 | 42 | 21.25 | Directional drill 311mm hole with 197mm 2.12 degrees Vector mud motor and survey with MWD 1681m-1723m; Pulsar failed on MWD; Prepare to trip out; Slide 16.0m; Rotate 26.0m; Hole drag down 5/10dan; Hole drag up 10/15dan; Torque on bottom 1100/1125 p.s.i.; Background gas 11 units; Mud lost last 24 Hrs 1.5m3. |
| 97-07-29 | 1746 | 23 | 11.00 | Directional drill 311mm hole with 197mm 2.12 degree Vector mud motor and survey with MWD 1723m-1724m; Circulate out 2 stands; Pump pill; Trip out; Tight hole 1665m; Set mud motor to 1.83 degrees, change out MWD and jars; Trip in BHA; Repair Tesco top drive; Trip in test MWD at 1126m; Trip to 1640m;; Wash and ream 1640m-1724m; Survey at 1697m and 1706m; Orient tool; Directional drill 311mm hole with 197mm 1.83 degrees Vector mud motor and survey MWD 1724m-1746m; Change valve and seat on #2 pump; Slide 16.0m; Rotate 7.0m; Hole drag down 5/10 dan; Hole drag up 10/18dan; Torque om bottom 1080/1110 psi.; Background gas 10; Trip gas 41; Mud lost last 24 Hrs 3.5m3. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-07-30 | 1790 | 44 | 22.0 | Directional drill 311mm hole w/ 197mm 1.83 Vector mud motor and survey w/ MWD 1746m-1790m; change suction on #1 pump; sample quality poor to fair; |
| 97-07-31 | 1801 | 16 | 5.75 | Directional drill 311mm hole with 197mm Vector mud motor and survey with MWD 1790-1801m; pump out 13 stds -pump pill - trip out -change out mud motor and bit, service MWD -trip in BHA slip and cut line -trip in to 1126m - test MWD -trip in to 1449m -work tight hole 1445-1432m - wash and ream 1432m-1520m - hole sloughing. |
| 97-08-01 | 1801 | 0m | 0 | Wash and ream 1510-1512m - pump out to 1404m - pump pill trip out - lay down directional tools -trip in with bit -wash and ream 1426-1801m -hole sloughing 1510-1523m - circ and condition hole and mud -circ out 13 stds - pump pill -trip out to csg shoe -repair Tesco top drive and #2 pump. |
| 97-08-02 | 1801 | 0m | 0 | Repair Tesco top drive - trip in to 1393m - wash 1393m-1605m - wash and ream 1605m - 1801m -hard reaming 1770 -1801m -Circ and work pipe -pump out 1801m-1604m -pump pill - trip ot and make up directional tools -trip in - shallow test MWD at 1086m -trip in to 1485m -wash 1485m-1634m |
| 97-08-03 | 1833 | 32 | 20.25 | Wash and ream 1634-1801m - 8m fill - directional drill w/ 196mm low speed 1.83 deg Trudrill mud motor and survey with MWD 1801m-1833m - repair pop valve and #2 pump suction |
| 97-08-04 | 1837 | 04 | 2.75 | Repair pump #2 - directional drill 311mm hole with 196mm 1.83 deg Trudrill mud motor and survey with MWD 1833m-1837m -pump pill - pump out 6 stds -trip out lay down 3 dc's and mud motor -pull wear bushings -pressure test BOP's -pick up directional tools and BHA -Trip in to 1144m and shallow test MWD -trip in hole |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-08-05 | 1848 | 11 | 10.5 | Wash and ream 1147-1611m- circ hole clean - hole unloading - wash 1611 - 1731m - ream 1731-1738m, 1796m-1837m; directional drill 311mm hole and survey with MWD 1837m-1848m - repair #2 pump suction |
| 97-08-06 | 1863 | 15 | 20.25 | Drill ahead 311mm hole with directional tools - work on pumps and check screens for pump pressure increase. Hoist 5 stds with pump on, flow check and pump trip pill - POH |
| 97-08-07 | 1884 | 21 | 7 | Hoist with bit - service tools and change out motor -RIH with new PDC bit to casing shoe, slip and cut line -Service tesco top drive -RIH to 1048m -break circulation and clean bridge -Check MWD. Clean bridge at 1420m -RIH to 1670m -Wash to bottom -ream 1796-1831m and 1856 -1863m -drill ahead 311mm hole with directional tools 1863m-1884m |
| 97-08-08 | 1970 | 86 | 21.75 | Work on #1 Pump - Directional drill 311mm hole 1884-1970m and survey with MWD. |
| 97-08-09 | 2019 | 86m | 18.25 | Drill with directional tools 1970-1998m - Work on pumps - Wiper trip to 1690m -repair top drive - Hole pulled tight at 1864m - Directional drill ahead 311mm hole 1998m-2109m |
| 97-08-10 | 2068 | 49m | 21.75 | Directional drill 311mm hole 2019m-2068m with vector low speed mud motor and survey w/ MWD. Hole condition good and sample quality is fair. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-08-11 | 2070 | 2m | 1.75 | Drill 311mm hole with directional tools and survey w/ MWD 2068-2070m; pump pressure increased. Circ, mix trip pill and hoist 5 stds w/ one pump on the well. Pump trip pill and hoist into casing. BOP drill. Finish out. Change out jars and motor. Pick up new jars, motor and gamma tools. Rerun PDC. Strap in BHA, replace seals on top drive actuator valve. Finish in to 1850m Break circ and check MWD and GR tool. Log in to 1968m. |
| 97-08-12 | 2086 | 16 | | |
| 97-08-13 | 2100 | 14 | 7.75 | Circulate sample and mix trip pill; Lay out one single and circulate out 5 stands; Pump trip pill and hoist with required flow checks; Change out motors and bit; Service MWD tools and run in to 1311m, break circulation and test MWD; Change out suction valve on #1 pump; Run in (stage motor every 10 stands); Wash to bottom from 1925m; Check survey and drill ahead; Slide 2086m-2100m; Rotate 2090m-2100m; Hole drag down 10/12dan; Hole drag up 7-100 dan; Torque on bottom 1050-1200 psi.; Background gas 125 units; Mud lost last 24 Hrs 4m3. |
| 97-08-14 | 2126 | 26 | 22.75 | Drill 311mm hole with rig service and surveys; Slide 2113m-2118m and 2122m-2126m; Rotate 2100m-2118m and 2118m-2122m; Hole drag down 7/10 dan; Hole drag up 10/13 dan; Torque on bottom 100/1300 p.s.i.; Background gas 140 units; Mud lost last 24 Hrs 5.2m3. |
| 97-08-15 | 2147 | 21 | 20.75 | Drill 311mm hole with rig service and surveys; Slide 13m; Rotate 8m; Background gas 100, and 45 over last four meters. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-08-16 | 2156 | 9 | 9.25 | Drill 311mm hole with rig service and surveys from 2147m - 2156m; Change graber dies on top drive; Circulate out 5 stands; Mix and pump trip pill; Hoist with required flow checks; Change out motor, MWD, and bit; Run in, check MWD at 1150m; Stage motor in hole; Slide 2152m-2156m; Rotate 2147m-2152m; Hole drag up 10/15000 dan; Hole drag down 10/15000 dan; Torque on bottom Background gas 100 units; Mud lost last 24 Hrs 5.0m3. |
| 97-08-17 | 2160 | 4 | 2.00 | Run in, check MWD; Stage motor in hole; Wash from 2117m-2143m; Ream from 2143m-2155m; Drill 311mm hole with rig service and MWD survey; MWD tools failed; Circulate out 5 stands; Mix and pump trip pill: Hoist with required flow checks; Change out MWD tool; Run in, check MWD; Stage motor in hole; Slide 0m; Rotate 4m; |
| 97-08-18 | 2183 | 23 | 18.75 | Finish staging motor in to 2024m; Wash to bottom; Log to 2160m; Drill 311mm hole; Replace suction valve and seat on #2 pump; Drill with rig service and surveys to 2183m; Slide 2161m-2167m, 2174m-2177m, 2181m-2183m; Rotate 2167m-2181m; Hole drag up 210/12dan; Hole drag down 10/20 dan; Torque on bottom 1100/1300 psi.; Background gas 25 units; Mud lost last 24 Hrs 2.1m3. |
| 97-08-19 | 2203 | 20 | 20.00 | Drill 311mm hole; Change discharge valve and seat on pump #1; Drill ahead with rig service and surveys to 2203m; Pump trip pill and hoist for bit; Slide 2183m-2186m, 2-90m-2196m, 2200m-2203m; Rotate 2186m-2190m, 2196m-2200m; Hole drag up 10/15000 dan; Hole drag down 10/13 dan; Torque on bottom 1100/1350 p.s.i.; Background gas 5 units; Mud lost last 24 Hrs 2.2m3. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-08-20 | 2003 | 0 | 0.00 | Hoist for bit wirh required flow checks, rig service: Inspect B.H.A.; Repair break in torque line; Work on top drive; Handle directional tools; Change out bit; Run in; Finish staging motor in to 2082m; Break circulation; Wash to bottom. |
| 97-08-21 | 2222 | 19 | 22.00 | Directional drill 311mmm hole with low speed 1.83 degrees Trudrill mud motor and survey MWD, log GR 2203m-2222m; Held BOP drills with both crews; Slide 13m; Rotate 9m; Hole drag up 10/15 dan; Hole drag down 10/20 dan; Torque on bottom 1100/1350psi; Background gas 10 units; Mud lost last 24 Hrs 1.5m3. |
| 97-08-22 | 2243 | 21 | 22.00 | Directional drill 311mm hole with low speed 1.83 degrees Trudrill mud motor, MWD, rig service and Gamma ray log from 2222m -2243m; Slide 13m; Rotate 8m; |
| 97-08-23 | 2265 | 22 | 22.00 | Drill directional 311mm hole with low speed 1.83 degrees Trudrill mud motor, MWD surveys, Gamma ray log, and rig service from 2243m-2265m. |
| 97-08-24 | 2276 | 11 | 9.00 | Directional drill 311mm hole with low speed 1.83 degrees Trudrill mud motor, MWD surveys and Gamma ray log, and rig service from 2265m-2270m: Service top drive at 2268m; Trip for motor and bit; Pump out stands; Mix and pump trip pill: Hoist for bit with required flow checks; Change out motor and bit; Add junk basket; Run in hole; Finish staging motor at 1863m; Break circulation; Wash to bottom: Directional drill 311mm hole with low speed 19.mm 1.83 degrees mud motor, MWD surveys, Gamma ray log, and rig service from 2270m-2276m; Slide 6m; Rotate 5m. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-08-25 | 2310 | 34 | 19.50 | Directional drill 311mm hole with MWD log with GR 2276m-2310m; Repair pump #1 pony rod, head, and liner; Slide 2279m-2284m, 2289m-2302m, 2308m-2310m; Rotate 2284m-2289m; 2302m-2308m; Hole drag up 10/18 dan; Hole drag down 10/15 dan; Torque on bottom 1180/1350 psi; Mud lost last 24 Hrs 1.9m3. |
| 97-08-26 | 2343 | 33 | 22.50 | Directional drill 311mm hole with 196mm Vector low speed mud motor, MWD surveys, Gamma ray log, and rig service from 2310m-2343m. Slide 16m; Rotate 17m; |
| 97-08-27 | 2357 | 14 | 10.25 | Directional drill 311mm hole with 196mm low speed 1.83 deg mud motor and survey with MWD/GR 2343-2357m; repair #1 main electrical to pump traction motors; circ out 6 stds - pump pill -trip out -change out mud motor and bit service MWD -trip in and shallow test MWD -trip in |
| 97-08-28 | 2390 | 33 | 17.25 | Trip in - ream bridge @ 2154-2160 - Trip in - ream bridge at 2241m - wash and ream 2241-2357m -Directional drill with low speed mud motor and survey with MWD/GR 2357-2390m |
| 97-08-29 | 2424 | 34 | 22.5 | Directional drill 311mm hole 2390-2424m and survey with MWD/GR; sample quality fair-good with the addition of oil wetting agent to mud system; scattered cavings throughout. |
| 97-08-30 | 2434 | 10 | 8.5 | Directional drill 311mm hole 2424-2434m; Pump out 10 stds; pump pill POH; Change out BHA; Pressure test BOP's and pick up directional tools. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-08-31 | 2451 | 17 | 10.25 | Pick up directional tols - lay down 2 dc's - pick up 10 127mm HWDP - slip and cut line - trip in to 1128mm shallow test MWD - trip in to 2080m -wash and ream 2080-2434m - directional drill 311mm hole with 197mm 1.83 deg vector mud motor and survey with MWD log with GR 2434-2451m. |
| 97-09-01 | 2484 | 33 | 21.25 | drill 311mm hole with low speed mud motor and survey with MWD/GR 2451-2484m. |
| 97-09-02 | 2520 | 36 | 21.0 | drill 311mm hole with Vector low speed mud motor and survey with MWD/GR 2484-2520m. |
| 97-09-03 | 2547 | 27 | 21.75 | drill ahead 311mm hole with vector low speed mud motor and survey with MWD/GR 2521-2547m. |
| 97-09-04 | 2565 | 18 | 20.0 | Drill 311mm hole with 197mm 1.83deg vector mud motor and survey with MWD/GR; work on #1 pump, chnage discharge valve; work on #2 pump change out valves and pony rod. |
| 97-09-05 | 2567 | 2 | 2.75 | Drill 311mm directional hole and survey with MWD/GR 2565-2567m; Hoist for bit at 2567m.Hole pulled tight from 2407-2123m. Finish out. Lay down tools. Service top drive, change grabber dies, saver sub and hoses. Picked up new Trudrill 7/8 Lobe 1.83 deg motor and MWD. RIH. Repair hydraulic hoses, check MWD. Finish in to 2284m. Wash and ream from 2284m to 2459m. |
| 97-09-06 | 2586 | 18 | 22.0 | Ream and wash 2459-2567m; Drill 311mm hole with trudrill 1.83deg mud motor and survey w/ MWD/GR. |
| 97-09-07 | 2595 | 9 | 15.75 | Drill to 2592m with 1.83deg motor and survey with MWD/GR. Work tight hole and wiper trip to 2250m. Circulate out and back in to clean low side of well. Drill ahead 2592 - 2595m. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-09-08 | 2597 | 2 | 5.0 | Drill 311mm directional hole to 2597m. Trip for motor. Circulate out to 2425. Lay down washed drill pipe. Finish out, repair pipe spinner. Change out drilling jars and lay down directional tools. Make up bit and junk sub. Run in to 2250m. Circulate from 2250m to bottom, work junk sub to clean up broken inserts. |
| 97-09-09 | 2604 | 7 | 6.75 | Work junk sub and drill 1m new hole. Hoist. Circulate 5 stds out. Pump trip pill and finish out with junk sub. Clean and inspect junk sub. Pick up directional tools. Run in BHA. Slip and cut line. Service top drive. Run in hole and check MWD at 1167m. Stage motor in hole to 2450m. Circulate to bottom. Work junk sub. Drill 311mm hole with trudrill 203mm 7/81obe 1.83deg motor and survey with MWD/GR to 2604m. |
| 97-09-10 | 2621 | 17 | 22.25 | Drill 311mm hole with Tru Drill 1.83 degrees motor, MWD, Gamma ray log from 2604m-2621m.Rig service and surveys. Work on #2 mud pump (valve). Slide 9m; Rotate 8m; Hole drag up 20/25000 dan; Hole drag down 15/20 dan; Torque on bottom 1100/1400 psi; Background gas 22 units; Mud lost last 24 Hrs 4.5 m3. |
| 97-09-11 | 2638 | 17 | 20.50 | Drill 311mm hole with Tru Dril 1.8 degrees motor with MWD and Gamma ray logging; Rig service and surveys. Work on #2 mud pump (valves); Work pipre to clean up hole after survey. Slide 5m; Rotate 12m; Hole drag up 10/20 dan; Hole drag down 8/16 dan; Torque on bottom 100/1450 psi; Background gas 26 units; Mud lost last 24 Hrs 5.6m3 |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-09-12 | 2646 | 8 | 10.00 | Drill 311mm hole with Tru Drill 1.8 degfrees mud motor, MWD surveys, Gamma ray logging and rig service from 2638m-2646m; Circulate and work hole; Hoist for bit; Circulate clean hole to 2339m; Work on top drive (kelly cock); Circulate and clean hole to 2340m; Finish out; Check monel seals; Lay out tools and motor; Slide 2m; Rotate 6m; Dowell cementer and 20 tonne of G on location. Empty fuel truck stuck on road (towed with Hayes) Hole drag up 10/20 dan; Hole drag down 8/14 dan; Torque on bottom 1250/1550 p.s.i.; Mud lost last 24 Hrs 5.6m3; BOP drill and meeting with crew; Sent 1 tire for repair and 1 to be replaced with a new tire for the Ranger truck; Returned 1 Security DBS PDC FM2943 for rebuild to DBS Nisku. |
| 97-09-13 | 2655 | 9 | 9.50 | Lay out motor and MWD; Change out monel collars; Pick up tools and run in hole to casing shoe; Service and repair Tesco to drive (wiring for kelly cock valve. Tesco man replaced switch seemed to have put wires back the wrong way; he needed blue print from office to get wire scheme and repair); Check MWD finish in hole; Wash and clean from 2377m; Work junk sub and drill with a Tru Drill 1.8 degrees motor from 2646m-2655m; Survey, run Gamma ray log and rig service; Slide 4m; Rotate 5m; Hole drag up 15/20 dan; Hole drag down 10/17 dan; Torque on bottom 1200/1450 psi; Background gas 16 units; Mud lost last 24 Hrs 3.8m3; Lost 2.0m3 while tripping. |
| 97-09-14 | 2675 | 20 | 21.75 | Drill 311mm hole with Tru Drill 1.83 degrees mud motor with rig service, gamma ray logging and surveys. Work on #1 mud pump (suction valve); Repair leak on #1 pump suction; Slide 6m; Rotate 14m; Hole drag up 15/20 dan; Hole drag down 10/13 dan; Torque on bottom 1250/1500 psi; Background gas 12 units; Mud lost last 24 Hrs 2.5m3. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-09-15 | 2697 | 22 | 20.25 | Drill 311mm hole with Tru Drill 1.8 degrees motor; Rig service, gamma ray and surveys; Work on mud pumps (valves and suction); Slide 4m; Rotate 18m; Hole drag up 15/20 dan; Hole drag down 12/17 dan;Torque on bottom 1200/1450 psi; Background gas 15 units; Mud lost last 24 Hrs 4.2 m3. |
| 97-09-16 | 2702 | 5 | 2.75 | Drill 311mm hole to 2697.4m. Circulate and work pipe; Mix trip pill and circulate out 12 stands; Pump pill and hoist; Handle directional tools; Run in BHA and service Tesco top drive: Run in to 1150m and check MWD, run in to 1177m and ream bridge; Run in and ream bridge at 1426m; Finish in to 2350m and wash and clean to bottom; Drill 311mm Halliburton tandem motor set at 1.75 degrees; Rotate 5m; Hole drag up 15/20 dan; Hole drag down 15/30 dan; Torque on bottom 100/1650 psi; Background gas 25 units; Mud lost last 24 Hrs 2m3. |
| 97-09-17 | 2748 | 46 | 19.00 | Directional drill 311mm hole with 197mm 1.83 degrees tandem Halliburton mud motor and survey with MWD, log Gamma ray from 2702m-2748m. Change head s on #2 pump. Work pipe every 5m hole not cleaning properly. Slide 5m. Rotate 46m. |
| 97-09-18 | 2771 | 23 | 14.50 | Directional drill 311mm hole with 197mm 1.83 degrees tandem Halliburton mud motor and survey with MWD, log Gamma ray from 2748m-2751m. Wiper trip 20 stands, circulate out 10 stands. Tight hole at 2628m-2635m. Wash and ream in 2640m-2751m, 1.0m fill. Directional drill 311mm hole with 197mm 1.83 degrees tandem Halliburton mud motor with MWD surveys, and log Gamma ray from 2751m-2771m. Changed 3 heads and liners, valves and seats on #1 and #2 mud pumps. Slide 5m. Rotate 18m. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-09-19 | 2794 | 23 | 20.00 | Directional drill 311mm hole with 197mm 1.83 degrees tandem Halliburton mud motor with MWD surveys and log Gamma ray from 2771m-2794m. Slide 14m. Rotate 9m. |
| 97-09-20 | 2822 | 28 | 21.50 | Directional drill 311mm holke with 197mm 1.83 degrees Halliburton mud motor, MWD surveys and log Gamma ray from 2794m-2822m. Slide 10m. Rotate 18m. |
| 97-09-21 | 2828 | 6 | 7.50 | Directional drill 311mm hole with 197mm 1.83 degrees mud motor, MWD surveys, and Gamma ray from 2822m-2828m. Stator rubber over shale shaker. Drilling slowed down. Trip for motor and PDC bit. Bit worn. Buttons missing. Slide 2m. Rotate 4m. |
| 97-09-22 | 2833 | 5 | 6.50 | Run in hole without junk basket (missing bottons?) and with MWD check. Bridge at 1940m. Directional drill 311mm hole with mud motor, rig service, MWD, and log Gamma ray from 2828m-2833m. MWD tool failed. Drilling slowed down to 2 hours per meter. Trip for MWD tool, bit. Slide 0m. Rotate 5m. |
| 97-09-23 | 2848 | 15 | 18.50 | Change bit, broken teeth. Change BHA, add junk basket. Run in with MWD check and rig sevice. Work on pump and wash and clean to bottom. Directional drill 311mm hole with 197mm 1.75 degrees Halliburton mud motor, with MWD surveys, and Gamma ray logging from 2833m-2848m. Slide 8m. Rotate 7m. |
| 97-09-24 | 2851 | 3 | 4.5 | Drill 311mm directional hole 2848-2851m (3m), work junk sub and circ out 6 stds, pump pill and trip out to change mud motor and bit -service MWD -trip in BHA -shallow test MWD at 1162m -wash and ream to bottom 2734 - 2851m. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-09-25 | 2882 | 31 | 21.5 | Directional drill 311mm hole with 197mm 1.83deg Vector mud motor and survey with MWD/GR 2851-2882m -work tight hole 2858m - 2852m. |
| 97-09-26 | 2902 | 20 | 18.75 | Drill 311mm directional hole with 197mm 1.83deg mud motor and survey with MWD/GR 2882-2892m, pump pill and POH. |
| 97-09-27 | 2902 | 0 | 0 | Work on top drive - pump pill - trip out and lay down directional tools - pull wear bushings -Pressure test BOP's -Install wear bushing - Make up directional tools and bit Trip in and test MWD shallow at 1165m. |
| 97-09-28 | 2927 | 25 | 18.25 | Trip in to 2846m - wash and ream 2846m-2897m ream underguage hole 2897m- 2902m no fill - Survey - directional drill 311mm hole with 197mm 1.83deg Vector mud motor and survey with MWD/GR 2902m-2927m - change head on pump 2 |
| 97-09-29 | 2936 | 9 | 8.8 | Directional drill 311mm hole with 197mm 1.83deg vector mud motor and survey with MWD/GR 2927-2936m -work junk sub -circ out 6stds -pump pill - trip out -change mud motor and bit -service MWD -make up BHA - slip and cut drilling line -trip in with bit 54 and trudrill mud motor. |
| 97-09-30 | 2948 | 12 | 16 | Trip in with bit - wash to bottom 2919-2936m no fill -drill ahead 311mm directional hole with 197mm 1.83deg trudrill mud motor and survey with MWD/GR 2936-2938m -flow check - circulate out trip gas 3656 units - directional drill 311mm hole 2938-2948m bit torque and rough drilling 2947.7-2948m |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling Rig activity (hrs) | 00:00 - 24:00 |
|---|---|---|---|---|
| 97-10-01 | 2960 | 12 | 21.5 | Directional drill 311mm hole with trudrill 1.83deg mud motor and survey with MWD/GR 2948-2960m. Note: fracture at 2937m (3656unit gas show) is probable fault with last survey over this interval showing almost 2 deg right turn (4deg DL). Fracture with small rapidly depleting gas show (783 / 147) at 2948m. |
| 97-10-02 | 2976 | 16 | 19.25 | circ out gas cut mud at 2975m Max gas 2730m from fracture at 2973.6m. mix barite and cic out gas. drill ahead to 2976 |
| 97-10-03 | 2984 | 8 | 4.75 | Drill to 2977m Circulate sample and work junk sub. Circulate 6 stds out and pull 6 stds. BOP drill. Pump trip pill and hoist. Hole was good. Lay down junksub and motor. Service MWD and pick up Dynadrill and set to 1.83deg. RIH, Check MWD and stage motor in hole. Wash to bottom from 2935m. Drill ahead 311mm directional hole , circulate out trip gas 3300 units. drill ahead 311mm directional hole 2977-2984m |
| 97-10-04 | 3012 | 28 | 20 | Drill 311mm hole with rig service and survey with MWD/GR to 2999.77m. repair steel ring gasket on discharge tee #2 pump. Drill ahead 311mm directional hole to 3012m. |
| 97-10-05 | 3017 | 5 | 6 | Drill 311mm hole with rig service and survey with MWD/GRto 3017m Pressure and torque spikes. Circ bottoms up sample. Circulate and hoist to 2742m. Flow check and pump trip pill. Hoist and lay down 25 joints of XHE drill pipe. Change out motors, check MWD. Pick up new vector mud motor and bit. RIH with BHA. Pick up 25 jts of good hard band XHE pipe nad RIH. |
| 97-10-06 | 3032 | 15 | 14.25 | Finish in hole. Wash and ream 2 stds to bottom. Work Junk sub. Drill 311mm directional hole with vector low speed mud motor and survey with MWD/GR to 3032.5m. Circulate sample |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-10-07 | 3048 | 16 | 21.75 | Drill ahead 311mm directional hole with low speed vector mud motor and survey with MWD/GR 3032-3048m. |
| 97-10-08 | 3053 | 5 | 6.25 | Drill 311mm hole to 3053m. Circulate sample. Drill to 2053m and circulate sample. Bit torqued up. Mix pill and circulate out 6 stands. Pump pill and hoist. Lay out singles with worn hard band. Clean junk sub, and lay out motor. Check MWD. Pick up new motor and bit. Hole was good on trip out. Rotate 5m. Hole drag up 20/30 dan. Hole drag down 10/15 dan. Background gas 700 units. Mud lost last 24 Hrs 4.2m3. |
| 97-10-09 | 3055 | 2 | 3.25 | Run in hole. Pick up singles with good hard banding. Slip and cut line. Run in. Two screens down. Work on panels. Blown fuses and RLI relays. Finish in with MWD check and staging motor to 3020m. Ream to bnottom and work junk sub. Circulate out trip gas maximum 4050 units. Work on #2 pump. Drill 311mm hole. Survey. Circulate 3055m sample. Rotate 2m. Hole drag up 15/30 dan. Hole drag down 15/20dan. Torque on bottom 1350/1650 psi. Background gas 156 units. Mud lost last 24 hrs 2.7m3. |
| 97-10-10 | 3068 | 13 | 21.00 | Circulate 3055m sample. Drill 311mm hole with rig service and surv ey. Work on both pumps. Rotate 13m. Hole drag up 35/45 dan. Hole drag down 20/25 dan. Torque on bottom 1350/1600 psi. Background gas 120 units. Mud lost last 24hr 3m3. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-10-11 | 3072 | 4 | 5.75 | Drill 311mm hole with Vector 1.83 degrees slow speed mud motor. Rig service, MWD surveys, and Gamma ray logging. Circulate 3072m sample. Work on junk sub and hoist for bit. Circulate 6 stands out, pump trip pill and hoist to 2010m. Check Elmago, outside bearing was worn. Pull into casing. Circulate hole and work Elmago brake. Wait on bearing. Rotate 4m. Hole drag up 25/35 dan. Hole drag down 10/15 dan. Torque on bottom 1350/1500 psi. Back ground gas 125 units. Mud lost last 24 hrs 2.6m3. |
| 97-10-12 | 3072 | 0 | 0 | Wait on mechanic and repairs for Elmago (inertia hydromatic) brake. Change bearings. Finish out of hole. Lay down motor and junk sub. Pick up a new Tru drill motor set at 1.832 degrees. Run in hole. Shallow test MWD at 1124m. Stage in motor. Background gas 0 units. No mud lost last 24 hrs. |
| 97-10-13 | 3084 | 12 | 18.75 | Finish in hole with new bit. Wash and ream from 3014m. Drill 311mm hole with Tru Drill 1.83 degrees motor. Rig service and survey. Rotate 12m. Hole drag up 20/30 dan. Hole drag down 15/20 dan. Torque on bottom 1300/1500 p.s.i. Background gas 50. Mud lost last 24 hrs 3m3. |
| 97-10-14 | 3095 | 11 | 21.50 | Drill 311mm hole with Tru Drill 1.83 degrees slow speed motor. Rig service and MWD survey. Repair mud pumps. Rotate 11m. Hole drag up 20/30 dan. Hole drag down 10/15 dan. Torque on bottom 1400/1550 psi. Back ground gas 80 units. Mud lost last 24 hrs 1.5m3. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-10-15 | 3098 | 3 | 7.25 | Directional drill 311mm hole with Tru Drill 1.83 degrees motor, MWD survey, and Gamma ray logging from 3095m to 3098.68m. Trip for bit and/or motor. Hoist, mix pill and pump trip pill, trip with flow check and rig service. Handle directional tools. Run in hole with MWD check at 1128m. |
| 97-10-16 | 3115 | 17 | 13.50 | Run in hole, circulate, and ream. Finish staging motor, and tagged bottom at 3101m. This is 2.32m lower than measured at beginning of this trip. Directional drill 311mm hole with Dyna Drill 1.83 degrees mud motor, MWD surveys, Gamma ray logging, rig service, and circulating bottom samples from 3101m-3115m. |
| 97-10-17 | 3115 | 0 | 0 | Circulate 3115 m sample. Circulate. Mix trip pill. Hoist several stands. Pump pill. Handle and lay down directional tools. Change bit.Run in Slide 0m. Rotate 8m. Hole drag up 25/30dan. Hole drag down 15/20dan. Torque on bottom 1300/1550 p.s.i. Back ground gas 80 units. Trip gas 1080 units. Mud lost last 24 hrs 2.8m3. |
| 97-10-18 | 3115 | 0 | 0 | Circulate hole for logging. Circulate out 6 stands. Pump pill trip out. Rig to log with Computalog. Run in with XY-GR-DAR-STI tools. Tools failed except XY calipers at 2800m. Check tools and bridle on surface. Run log tools to 3000m. Tools failed, pull tools. Geologist changed logging program. Run in with STI -GR and wait on new DAR tool. Hole bridged at 1900m. Pull log tools out. Wire line damaged, birds nest at 700m, due repeated efforts to get tool through bridge. Rig down loggers. Hole drag up 25/30dan, Hole drag down 15/20dan. Torque on bottom 1325/1430 p.s.i. Background gas 80 units. Trip gas 1980 units (Was much higher estimated at 3200 units. This was not recorded because the high gas reading unit in Minipac 2100 failed.) Mud lost last |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| | | | | 24 hrs 4.2m3. Geologist proposed to rig out loggers and proposed changed logging program to collect needed data before jeapordizing hole. |
| 97-10-19 | 3115 | 0 | 0 | Rig out loggers. Trip with RR #59 bit. No hole problems to 3105m. Wash and ream 3105m-3115m. 1.5m fill. Drill on rubber bull nose loggers lost in hole. Work tight hole. Drill up rubber bull nose. Circulate condition hole. Circulate out 6 stands. Pump pill trip out. Rig to log and log with Computalog. Hole drag up 25/30 dan. Hole drag down 15/20dan. Torque on bottom 1325/1430 psi. Background gas 120 units. Trip gas 3240 units. Mud lost last 24 hrs 1.0m3. |
| 97-10-20 | 3115 | 0 | 0 | Log well with Computalog STI-BCS-GR 3116.4m-1006.4m. Tight hole at 1490m-1478m. Loggers pulled 400 psi. over normal weight to loosen tool. Geologist stopped logging operations. Wait on orders. Senior V.P. Ranger ordered rig out loggers, to condition hole for setting casing. Trip in with bit # 60 to 1250m. Circulate and work pipe, Hole condition good. Pump pill trip out. Pick up 3pt reamer. Trip in BHA. Slip and cut drill lie. Repair mud manifold valves. Trip in to 1326m. Strap hole. Wash and ream 1326m -1565m. Hole drag up 2/5000dan. Hole drag down 1/2dan. Torque on bottom 920/1270 psi. Background gas 20. Mud lost last 24 hrs 3.5m3. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-10-21 | 3115 | 0 | 0 | Pull up to 1485m. Circulate change to 84 mesh shaker screens. Ream with bit and 3 point reamer 1485m-1584m. Hole unloading shale 1485m-1548m. Work pipe circulate hole clean. Ream with bit and 3 point reamer 1548m-3115m. 2.5m fill on bottom. Circulate and work pipe condition for casing. Hole drag down 5/15dan. Hole drag up 2/8 dan. Torque on bottom 1450/1740 psi. Background gas 85 units. Trip gas 950 units. Mud lost last 24 hrs 4.5m3. |
| 97-10-22 | 3115 | 0 | 0 | Circulate condition hole for casing. Wiper trip out to 1300m. Hole tight 1468m-1395m. Wash and ream 1325m-1500m. Circulate and work pipe, hole unloading 1/8" -3/4" in size. Circulate out to 1293m. Wash and ream 1310m-1530m. Hole cleaned up. Trip in with bit and 3point reamer to bridge at 1675m. Wash and ream 1675m-1756m. Hole drag up 5/15dan. Hole drag down 1/5dan. Torque on bottom 1450/1740 psi. Background gas 25 units. Mud lost last 24 hrs 1.5m3. |
| 97-10-23 | 3115 | 0 | 0 | Wash and ream 1756m-1786m. Trip out. Tight hole at 1438m-1430m. Lay down 3 ppoint reamer. Trip in BHA. Slip and cut drill line. Trip in with RR #60 bit. Wash and ream bridges 1440m-1462m, 1662m-1842m, 1936m-1952m. Repair top drive. Trip in. Clean fill 3104m-3115m. Circulate condition hole and mud. Hole drag up 10/25dan. Hole drag down 2/5dan. Torque on bottom 1450/1740 psi. Background gas 180 units. Trip gas 3240 units. Mud lost last 24 hrs 2.1m3. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-10-24 | 3115 | 0 | 0 | Circulate condition hole and mud. Circulate out 1 stand. Trip out tight hole at 2518m-2522m & 1438m-1444m. Trip out to 1000m. Trip in. Wash and ream 3098m-3115m. 1.0m fill. Circulate condition hole for casing. Circulate out 1 stand. Pump pill trip out to run casing. Hole drag up 10/15 dan. Hole drag down 5dan. Torque off (??) bottom 1400/1650 p.s.i. Back ground gas 185 units. Trip gas 2220 units. Mud lost last 24 hrs 1.8m3 |
| 97-10-25 | 3115 | 0 | 0 | Trip out. Lay down 228mm DCS. Pull wear bushing. Change top pipe rams to 244.5mm and test gate seals to 1400 kpa and 15 kpa. Rig up to run 244.5mm casing. Safety meeting. Run 244.5 mm casing. Changed to 350 ton slips and elevators at casing shoe. Mud lost last 24 hrs 0.8m3. |
| 97-10-26 | 3115 | 0 | 0 | Run 51 joints 244.5mm 662.42m 79.62kg/m L-80 Butress - 180 joints 244.5mm 2460.04m 69.94 kg/m L-80 Butress Landed @ 3114.80m. Weatherford stage cementer landed @ 1300.40m. Circulate condition hole for cement. Unable to reciprocate casing. Drill line on dead line anchor slipped at 260 dan. Safety meeting. Rig to cement. Pump 3m3 Diesel -3m3 CW8 preflush. Pressure test lines to 21000 kpa. Cement with 17 tonnes "G" + 35% D66 + 1.25% D160 + 0.5% D65 + 0.5% D-28 displaced with 67.93m3 water, 3.0m3 Diesel, 46.97m3 Invert mud. Plug down at 06:45 hrs. Over displaced 0.5m3 with out bumping plug. Floats held. Drop dart opened stage cementer with 900kpa. Circulate W.O.C. Hole drag up with casing unknown. Hole drag down 32 dan. Back ground gas 84 units. Trip gas 1348 units. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-10-27 | 3115 | 0 | 0 | Circulate through stage cementer. Load plug in head. Safety meeting. Pump 3m3 Diesel, 3m3 CW8 preflush. Cement with 68 tonnes "G" + 0.3% B71 + 0.5% D65 displace with Weatherford plug and 49.97m3 water. Bump plug with 19000kpa closed stage cementer. Plug down at 16:00 hrs. Rig out Dowell. Rig down BOP to set slips. Centrifuge mud. 160m3 in mud tanks. 204m3 in tank farm. |
| 97-10-28 | 3115 | 0 | 0 | Rig down BOP. Set casing slipsa. Rig up BOP. Centrifuge mud and clean suction tank. |
| 97-10-29 | 3115 | 0 | 0 | Rig up BOP. Change top pipe rams to 127mm. Pressure test upper and lower pipe rams, blind rams, HCRs and BOP valves, manifold valves and lines, stabbing valve, kelly valves to 1400kpa low and 3400 kpa high for 10 minutes each. Pressure test annular BOP to 1400 kpa and 10500 kpa. Mud line manifold failed test. repair valves. Centrifuge invert mud. Strip down #2 mud pump for repair. Weld on suction tank and mixing system. |
| 97-10-30 | 3115 | 0 | 0 | Repair mud line manifold and stand-pipe valves. Pressure test mud lines and valves to 1500 kpa and 21000 kpa. Test annular BOP to 1500 kpa and 17500 kpa. Clean mud tanks and level same. Repair #2 mud pump. Function test accumulator start pressure 20500 kpa, open HCR, close annular BOP upper and lower rams, open lower pipe rams pressure remaining 11600 kpa. Recharge time 1 minute and 31 seconds. Recharge pressure 7500 kpa. |
| 97-10-31 | 3115 | 0 | 0 | Clean mud tanks. Make up BHA. Repair #2 mud pumps. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-11-01 | 3115 | 0 | 0 | Strap in to 1280m. Drill oout cement, plug andstage cementer. Stage cementer at 1300.4m. Circulate bottoms up. Pressure test casing to 27000 kpa. Strap in tag cement at 3070m. Float collar at 3101m. Drill out float and cement. Change swivel packing. Circulate mix mud and chemicals. Repair #2 mud pump. |
| 97-11-02 | 3115 | 0 | 0 | Mix and condition mud. Wait on #2 pump repairs. |
| 97-11-03 | 3115 | 0 | 0 | Mix and condition mud. Wait on #2 pump repairs. |
| 97-11-04 | 3128 | 13 | 7.50 | Mix and condition mud. Wait on #2 pump repairs. Drill out cement and shoe. Work on pumps. Work on the top drive. Circulate samples 3120m and 3125m. Work on pumps. Survey. Mix and pump pill. Trip out. |
| 97-11-05 | 3128 | 0 | 0 | Mix and condition mu. Repair #2 mud pump. Drill out cement and shoe. Work on pumps. Work on top drive. Drill 216mm hole 3115m-3120m. Circulate up sample. Poor sample. Drill 216mm hole 3120m-3125m. Circulate sample. Poor sample. Drill 216mm hole 3125m-3128m. Circulate and survey. Mix and pump pill. Trip out to pick up stabilization. Repair draworks low chain. Circulate sample. |
| 97-11-06 | 3128m | 0 | 0 | Tripped out, changed out BHA, pick up extra pipe. Run in hole. |
| 97-11-07 | 3128m | 0 | 0 | Wash and ream to bottom. Drill 216mm hole 3128m-3177m. Work on pipe every 9m. Stuck on bottom. Circulate and jar. Mix ID Free and Diesel 5.4m3. Spot pill 3177m -3140m. Pump 10 strokes every 1/2 hour. Jar pipe no movement. Max pull 23 dan. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 |
|---|---|---|---|---|
| 97-11-08 | 3128m | 0 | 0 | Jar stuck pipe unable to circulate. Jar stuck pipe wit on wire line personel and tools. Rig to and run free-point with Computalog. Free-point tool hanging up at 2960m. Pull out free-point tool. Rig to run sinker bars and driving tool. Damaged wire-line and rope-socket while picking up the tools. Wait on wire line tools from 19:40 hrs. |
| **NO GEOLOGIST ON LOCATION TILL 23 JANUARY 1998** | | | | |
| 98-01-23 | 3098m | 0 | 0 | 0000-0015 rig service<br>0015-0400 pooh laydown & change BHA<br>0400-0800 run in hole<br>0800-0815 BOP function<br>0815-0845 RIH break circ.<br>0845-1115 drill cmt from 3098-3144 (top fish)<br>1115-1230 circ.<br>1230-1600 pooh<br>1600-1615 rig service<br>1615-1915 pooh<br>1915-2045 make up BHA, run in hole<br>2045-2130 slip & cut line<br>2130-2400 run in hole |
| 98-01-24 | 3144 | 46 | 0 | 0000-0015 rig service<br>0015-0245 circ.<br>0245-0445 rig up cementers,plug back<br>0445-0600 pull out of plug<br>0600-0715 circ.<br>0715-0800 hoist out<br>0800-0815 bop drill<br>0815-1600 pick up bha & rih<br>1600-1615 rig service<br>1615-2130 break circ.<br>2130-2230 rih to 3048<br>2230-2400 circ. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 | |
|---|---|---|---|---|---|
| 98-01-25 | 3116 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0700 | circ. |
| | | | | 0700-0800 | tag cement @ 3069.52 to 3078 |
| | | | | 0800-0815 | rig service |
| | | | | 0815-1000 | drill cement 3078 to 3116 |
| | | | | 1000-1130 | circ. |
| | | | | 1130-1600 | poor & flow @ 1350 |
| | | | | 1600-1615 | rig service |
| | | | | 1615-1800 | pooh |
| | | | | 1800-2100 | pick up dir. drill tools |
| | | | | 2100-2115 | break circ. |
| | | | | 2115-2400 | rih |
| 98-01-26 | 3116 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0300 | rih break circ. every twelve stands |
| | | | | 0300-0500 | rih unable to break circ. |
| | | | | 0500-0800 | pooh |
| | | | | 0800-0815 | rig service |
| | | | | 0815-1345 | pooh |
| | | | | 1345-1600 | handle dir tools |
| | | | | 1600-1615 | rig service |
| | | | | 1615-1815 | handle dir drill tools test mwd |
| | | | | 1815-1845 | rih |
| | | | | 1845-1930 | slip & cut line |
| | | | | 1930-2300 | rih to 2459 |
| | | | | 2300-2400 | circ. & wash to bottom |
| 98-01-27 | 3128 | 12 | 22 3/4 | 0000-0015 | rig service |
| | | | | 0015-0800 | drill |
| | | | | 0800-0815 | rig service |
| | | | | 0815-2400 | drill and slide |
| 98-01-28 | 3140 | 6 | 6 1/2 | 0000-1600 | rig service, drill slide pooh |
| | | | | 1600-1845 | lay down mud motor pick up slow speed |
| | | | | 1845-1915 | shallow test mwd tool |
| | | | | 1915-2400 | rih |
| 98-01-29 | 3176 | 36 | 14 1/4 | 0000-0015 | rig service |
| | | | | 0015-0115 | break circ. wash to bottom |
| | | | | 0115-0230 | work on no.2 pump |
| | | | | 0230-2400 | drill, rotate, survey, work pipe |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 | |
|---|---|---|---|---|---|
| 98-01-30 | 3224 | 48 | 13 3/4 | 0000-0015 | rig service |
| | | | | 0015-2115 | drill, rotate, survey, work pipe |
| | | | | 2115-2400 | pump 5 std, pump pill, pooh |
| 98-01-31 | 3251 | 27 | 8 | 0000-0015 | rig service |
| | | | | 0015-0145 | pooh |
| | | | | 0145-0215 | held safety meeting |
| | | | | 0215-0545 | pooh |
| | | | | 0545-0745 | handle dir tools |
| | | | | 0745-0800 | rih |
| | | | | 0800-0815 | rig service |
| | | | | 0815-0830 | run in bha |
| | | | | 0830-0900 | shallow test mwd tool |
| | | | | 0900-0945 | slip and cut line |
| | | | | 0945-1345 | rih |
| | | | | 1345-1430 | wash to bottom |
| | | | | 1430-2400 | drill,survey,rotate |
| 98-02-01 | 3321 | 70 | 17 3/4 | 0000-0015 | rig service |
| | | | | 0015-0815 | drill,rotate,survey,work pipe |
| | | | | 0815-0830 | pump lost circ.material |
| | | | | 0830-1115 | wiper trip |
| | | | | 1115-2400 | drill,rotate,survey,work pipe |
| 98-02-02 | 3377 | 56 | 17 1/2 | 0000-0015 | rig service |
| | | | | 0015-2400 | drill,rotate,survey,work pipe |
| 98-02-03 | 3464 | 87 | 20 | 0000-0015 | rig service |
| | | | | 0015-2400 | drill,rotate,survey,work pipe |
| 98-02-04 | 3500 | 36 | 3 1/2 | 0000-0015 | rig service |
| | | | | 0015-0415 | drill,rotate,survey,work pipe |
| | | | | 0415-0530 | circ. sample |
| | | | | 0530-0700 | pump out 14 stands |
| | | | | 0700-0715 | flow check & pump pill |
| | | | | 0715-1415 | pooh, lay bown dir drill tools |
| | | | | 1415-2200 | rih,break circ. every 12 stands |
| | | | | 2200-2345 | wash to bottom |
| | | | | 2345-2400 | circ. |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 | |
|---|---|---|---|---|---|
| 98-02-05 | 3500 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0245 | circ. |
| | | | | 0245-0545 | wiper trip 15 stands |
| | | | | 0545-0800 | circ. |
| | | | | 0800-0815 | rig service |
| | | | | 0815-1015 | pump out 14 stds |
| | | | | 1015-1030 | flow & pump pill |
| | | | | 1030-1600 | pooh |
| | | | | 1600-1615 | rig service |
| | | | | 1615-1630 | rig up loggers |
| | | | | 1630-1830 | run log no.1 |
| | | | | 1830-1930 | pull out log no. 1 can't reach bottom |
| | | | | 1930-2030 | rig out loggers |
| | | | | 2030-2145 | run in hole |
| | | | | 2145-2400 | slip & cut line & rih |
| 98-02-06 | 3500 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0215 | rih break circ, 1800m & every 12 stds |
| | | | | 0215-0445 | wash to bottom from 3107 |
| | | | | 0445-0800 | circ. |
| | | | | 0800-1630 | circ. & wiper trip |
| | | | | 1630-2130 | pooh |
| | | | | 2130-2300 | rih to bot of csg. |
| | | | | 2300-2330 | circ. |
| | | | | 2330-2400 | shut in well Read & record |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 | |
|---|---|---|---|---|---|
| 98-02-07 | 3500 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0030 | circ. kick |
| | | | | 0030-0045 | shut well |
| | | | | 0045-0230 | circ. kick no mud returns |
| | | | | 0230-0800 | shut in well , mix mud |
| | | | | 0800-0815 | rig service |
| | | | | 0815-1100 | well shut in , mix mud |
| | | | | 1100-1330 | circ. gas |
| | | | | 1330-1345 | shut in well |
| | | | | 1345-1530 | open well & circ.,flow check |
| | | | | 1530-1545 | flow check |
| | | | | 1545-1600 | circ. |
| | | | | 1600-1615 | rig service |
| | | | | 1615-1700 | run in to 3280 |
| | | | | 1700-2030 | circ. through chock |
| | | | | 2030-2300 | circ. open well |
| | | | | 2300-2330 | run in 4 stnds |
| | | | | 2330-2400 | circ. @ 55 strokes/min |
| 98-02-08 | 3500 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0200 | circ 55 stroks/min till bottom up |
| | | | | 0200-0330 | circ 85 stroks/min till bottom up |
| | | | | 0330-0430 | rih tag bottom |
| | | | | 0430-0715 | circ 55 stroks/min till bottom up |
| | | | | 0715-0800 | circ 85 stroks/min till bottom up |
| | | | | 0800-0815 | rig service |
| | | | | 0815-1245 | circ. 85 stroks/min |
| | | | | 1245 1415 | wiper trip to csg 15 stds |
| | | | | 1415-1445 | flow check |
| | | | | 1445-1600 | rih to bottom |
| | | | | 1600-1615 | rig service |
| | | | | 1615-2030 | circ |
| | | | | 2030-2045 | pump pill |
| | | | | 2045-2400 | pooh to log |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 | |
|---|---|---|---|---|---|
| 98-02-09 | 3500 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0345 | pooh |
| | | | | 0345-0415 | rig up loggers |
| | | | | 0415-0515 | run in log no. 1 |
| | | | | 0515-0800 | pull out log no.1 STI & SONIC |
| | | | | 0800-0815 | rig service |
| | | | | 0815-0845 | pooh change tools |
| | | | | 0845-0945 | run in log no.2 |
| | | | | 0945-1300 | pooh & log density |
| | | | | 1300-1345 | run in to log no.3 |
| | | | | 1345-1600 | pooh and log no.3 |
| | | | | 1600-1615 | rig service |
| | | | | 1615-1800 | log no.3 |
| | | | | 1800-1945 | run in log no.4 |
| | | | | 1945-2200 | pooh with log no.4 |
| | | | | 2200-2230 | lay down logging tools |
| | | | | 2230-2400 | rih break circ. at 1200m & 2000m |
| 98-02-10 | 3500 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0445 | rih break circ at 1200 & 2000 |
| | | | | 0445-0615 | break circ at 3100 & circ bottom up |
| | | | | 0615-0800 | wash to bottom |
| | | | | 0800-0815 | rig service |
| | | | | 0815-1600 | circ cond mud |
| | | | | 1600-1615 | rig service & function chock |
| | | | | 1615-1815 | circ. mix pill, pump pill |
| | | | | 1845-2100 | slip & cut line, break circ. |
| | | | | 2100-2400 | circ. & cond mud |

## DAILY DRILLING CHRONOLOGY

| Date | Depth 24:00 | Progress (24 hrs) | Drilling (hrs) | Rig activity 00:00 - 24:00 | |
|---|---|---|---|---|---|
| 98-02-11 | 3500 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0030 | circ |
| | | | | 0030-0130 | run in hole break circ at 3270 |
| | | | | 0130-0315 | circ & monitor gas |
| | | | | 0315-0800 | circ & cond mud |
| | | | | 0800-0815 | rig service |
| | | | | 0815-1015 | circ & cond mud |
| | | | | 1015-1145 | pump pill pooh |
| | | | | 1145-1230 | hole gained 47m3 rih wash to |
| | | | | 1230-1600 | circ bottom up, circ cond mud |
| | | | | 1600-1615 | rig service |
| | | | | 1615-1845 | pump pill pooh |
| | | | | 1845-1945 | rih break circ wash to bottom |
| | | | | 1945-2400 | circ & cond mud |
| 98-02-12 | 3500 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0045 | circ. |
| | | | | 0045-0800 | pooh |
| | | | | 0800-0815 | rig service |
| | | | | 0815-0900 | rig up tong hand |
| | | | | 0900-0915 | held safety meeting |
| | | | | 0915-1315 | run in csg |
| | | | | 1315-1600 | run in pipe(strap in) |
| | | | | 1600-1615 | rig service |
| | | | | 1615 2400 | run in csg (strap in) |
| 98-02-13 | 3500 | 0 | 0 | 0000-0015 | rig service |
| | | | | 0015-0515 | run in csg. |
| | | | | 0515- | |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1325 - 1355 | **SHALE** - medium - dark gray, subfissile, blocky, trace slickensides in part, slightly dolomitic, trace calcite micro fracture fill; |
| 1355 - 1385 | **SHALE** - dark gray, medium gray in part, fissile, platy in part, blocky in part, trace slickensides, in part trace thin interbedded dark gray microcrystalline argillaceous **LIMESTONE**, no visual show, no visible porosity, thin interbedded medium gray **CLAYSTONE**, slightly calcareous in small part, slightly dolomitic, trace calcite sparry micro fracture fill, trace pyrite disseminated; |
| 1385 - 1410 | **SHALE** - medium gray - dark gray, fissile, platy, blocky in part, rare slickensides, slightly silty, rare dolomitic, rare pyrite; |
| 1410 - 1435 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded **CLAYSTONE**, **SHALE** medium gray - dark gray, platy, blocky, rare slickensides, slightly calcareous, abundant calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part; |
| 1435 - 1460 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded **CLAYSTONE**, **SHALE** medium gray - dark gray, platy, blocky, rare slickensides, slightly calcareous, abundant calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part; |
| 1460 - 1469 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded **CLAYSTONE**, **SHALE** medium gray - dark gray, platy, blocky, rare slickensides, slightly calcareous, abundant calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part; |
| 1469 - 1484 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded **CLAYSTONE**, **SHALE** medium gray - dark gray, platy, blocky, rare slickensides, slightly calcareous, abundant calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1484 - 1500 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, slightly calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill; |
| 1500 - 1512 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, slightly calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill; |
| 1512 - 1525 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; |
| 1525 - 1535 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; |
| 1535 - 1552 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1552 - 1570 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; **SHALE** - dark gray - black, irregular blocky, medium hard - hard, slickensides, wavy, lustre, mixed with parallel micro calcite lenses, slightly silty, rare pyrite, disseminated, rare fragments; |
| 1570 - 1580 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; **SHALE** - dark gray - black, irregular blocky, medium hard - hard, slickensides, wavy, lustre, mixed with parallel micro calcite lenses, slightly silty, rare pyrite, disseminated, rare fragments; |
| 1580 - 1598 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; **SHALE** - dark gray - black, irregular blocky, medium hard - hard, slickensides, wavy, lustre, mixed with parallel micro calcite lenses, slightly silty, rare pyrite, disseminated, rare fragments; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1598 - 1610 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; **SHALE** - dark gray - black, irregular blocky, medium hard - hard, slickensides, wavy, lustre, slightly silty, rare pyrite, disseminated, rare fragments; |
| 1610 - 1620 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; **SHALE** - dark gray - black, irregular blocky, medium hard - hard, slickensides, wavy, lustre, slightly silty, rare pyrite, disseminated, rare fragments; |
| 1620 - 1645 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; **SHALE** - dark gray - black, irregular blocky, medium hard - hard, slickensides, wavy, lustre, slightly silty, rare pyrite, disseminated, rare fragments; |
| 1645 - 1665 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; **SHALE** - dark gray - black, irregular blocky, medium hard - hard, slickensides, wavy, lustre, slightly silty, rare pyrite, disseminated, rare fragments; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1665 - 1680 | **SHALE** - medium gray - dark gray, fissile, blocky in part, thin interbedded light gray brown **CLAYSTONE, SHALE** medium gray - dark gray, platy, blocky, rare slickensides, moderately calcareous, common calcite micro fracture fill, scattered pyrite in part, minor micromicaceous, slightly silty in part, rare quartz micro fracture fill, euhedral crystals, abundant calcite micro fracture fill, multiple zoning; **SHALE** - dark gray - black, irregular blocky, medium hard - hard, slickensides, wavy, lustre, slightly silty, rare pyrite, disseminated, rare fragments; |
| 1680 - 1690 | **SHALE** - dark gray - black, irregular blocky, medium hard - hard, rare slickensides, wavy, lustre, slightly silty, minor calcite micro fracture fill, multiple zoned; |
| 1690 - 1695 | **SHALE** - dark gray - black, irregular blocky, medium hard - hard, rare slickensides, wavy, lustre, slightly silty, minor calcite micro fractures fill, multiple zoned; |
| 1695 - 1700 | **SHALE** - medium gray - dark gray, subfissile, blocky, medium hard, moderately calcareous, trace slickensides in part, rare dolomitic, moderately calcite micro fractures fill; **SHALE** - dark gray - black, irregular blocky, medium hard - hard, rare slickensides, slightly silty, minor calcite micro fracture fill, multiple zoned, rare pyrite thin beds and thin streaks of disseminated micro crystals, and in calcite micro fractures fill; |
| 1700 - 1705 | **SHALE** - dark gray - black, irregular blocky, medium hard - hard, rare slickensides, slightly silty, minor calcite micro fracture fill, multiple zoned, rare pyrite thin beds and thin streaks of disseminated micro crystals, and in calcite micro fractures fill; |
| 1705 - 1710 | **SHALE** - medium gray - dark gray, subfissile, blocky, medium hard, moderately calcareous, trace slickensides in part, rare dolomitic, moderately calcite micro fractures fill; |
| 1710 - 1715 | **SHALE** - dark gray - black, irregular blocky, medium hard - hard, rare slickensides, slightly silty, minor calcite micro fracture fill, multiple zoned, rare pyrite thin beds and thin streaks of disseminated micro crystals, and in calcite micro fractures fill; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1715 - 1720 | **SHALE** - dark gray - black, irregular blocky, medium hard - hard, rare slickensides, slightly silty, minor calcite micro fracture fill, multiple zoned, rare pyrite thin beds and thin streaks of disseminated micro crystals, and in calcite micro fractures fill; |
| 1725 - 1735 | **SHALE** - medium gray - dark gray, subfissile, blocky, medium hard, moderately calcareous, trace slickensides in part, rare dolomitic, moderately calcite micro fractures fill; |
| 1735 - 1740 | **SHALE** - medium gray - dark gray, subfissile, blocky, medium hard, moderately calcareous, trace slickensides in part, rare dolomitic, moderately calcite micro fractures fill; |
| 1740 - 1760 | **SHALE** - medium gray - dark gray, subfissile, blocky, medium hard, moderately calcareous, trace slickensides in part, rare dolomitic, moderately calcite micro fractures fill; |
| 1760 - 1780 | **SHALE** - medium gray - dark gray, subfissile, blocky, medium hard, moderately calcareous, trace slickensides in part, rare dolomitic, moderately calcite micro fractures fill; **SHALE** - dark gray - black, platy, irregular blocky, medium hard, slightly silty, some calcite micro fracture fill; |
| 1780 - 1795 | **SHALE** - medium gray - dark gray, subfissile, blocky in part, medium hard, slightly calcareous, trace slickensides in part, rare dolomitic streaks in part, scattered calcite micro fracture fill; |
| 1795 - 1800 | No sample - sample not circ'd; |
| 1800 - 1815 | **SHALE** - medium gray - dark gray, subfissile, blocky in part, medium hard, slightly calcareous, trace slickensides in part, rare dolomitic streaks in part, trace calcite micro fracture fill; |
| 1815 - 1825 | **SHALE** - medium gray - dark gray, subfissile, blocky in part, medium hard, slightly calcareous, trace slickensides in part, rare dolomitic streaks in part, trace calcite micro fracture fill; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 1825 - 1837 | **SHALE** - medium gray - dark gray, subfissile, blocky in part, medium hard, slightly calcareous, trace slickensides in part, rare dolomitic streaks in part, trace calcite micro fracture fill; |
| 1837 - 1840 | No sample - sample not circ'd; |
| 1840 - 1855 | **SHALE** - medium gray - dark gray, subfissile, blocky in part, medium consolidated, trace slickensides in part, slightly dolomitic, trace calcite micro fracture fill in small part; |
| 1855 - 1865 | **SHALE** - medium gray - dark gray, subfissile, blocky in part, medium consolidated, trace slickensides in part, slightly dolomitic, trace calcite micro fracture fill in small part; **SHALE** - dark gray - black, medium gray in part, subfissile, medium hard, trace micromicaceous; |
| 1865 - 1880 | **SHALE** - dark gray - black, medium gray in part, subfissile, medium hard, trace micromicaceous; |
| 1880 - 1900 | **SHALE** - dark gray - black, medium gray in part, subfissile, soft, trace micromicaceous, trace carbonaceous in part; |
| 1900 - 1920 | **SHALE** - dark gray - black, medium gray in part, subfissile, soft, trace micromicaceous, trace carbonaceous in part; |
| 1920 - 1940 | **SHALE** - dark gray - black, medium gray in part, subfissile, soft, trace micromicaceous, trace carbonaceous in part; |
| 1940 - 1960 | **SHALE** - dark gray - black, medium gray in part, subfissile, soft, trace siliceous micro fracture fill, trace carbonaceous in part; |
| 1960 - 1980 | **SHALE** - dark gray - black, medium gray in part, subfissile, soft, trace siliceous micro fracture fill, trace carbonaceous in part, trace pyrite in part; |
| 1980 - 2000 | **SHALE** - dark gray - black, medium gray in part, subfissile, soft, trace siliceous micro fracture fill, trace carbonaceous in part, trace pyrite in part; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2000 - 2020 | **SHALE** - dark gray - black, becoming brown in part, subfissile, soft, trace pyrite in small part, slightly dolomitic in part; |
| 2020 - 2040 | **SHALE** - dark gray - black, becoming brown in part, subfissile, soft, trace pyrite in small part, slightly dolomitic in part; |
| 2040 - 2050 | **SHALE** - dark gray - black, becoming brown in part, subfissile, soft, trace pyrite in small part, slightly dolomitic in part; |
| 2050 - 2068 | **SHALE** - dark gray - black, becoming brown in part, subfissile, soft, trace pyrite in small part, slightly dolomitic in part; |
| 2068 - 2080 | **SHALE** - dark gray - black, becoming brown in part, subfissile, soft, trace pyrite in small part, slightly dolomitic in part; |
| 2080 - 2101 | **SHALE** - dark gray - black, becoming brown in part, subfissile, soft, trace pyrite in small part, slightly dolomitic in part; |
| 2101 - 2118 | **SHALE** - medium gray - dark gray, subfissile, blocky in part, medium consolidated, trace slickensides in part, slightly dolomitic, trace calcite micro fracture fill in small part; **SHALE** - dark gray - black, becoming brown in part, subfissile, soft, trace pyrite in small part, slightly dolomitic in part; |
| 2118 - 2125 | **SHALE** - dark gray - black, becoming brown in part, subfissile, soft, trace pyrite in small part, slightly dolomitic in part; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2125 - 2140 | **SHALE** - medium gray - dark gray, subfissile, blocky in part, medium consolidated, trace slickensides in part, slightly dolomitic, trace calcite micro fracture fill in small part; **SHALE** - dark gray - black, becoming brown in part, subfissile, soft, trace pyrite in small part, slightly dolomitic in part; Note: There is an increasing percentage of 1) **SHALE** - dark gray, medium hard, irregularly blocky, rare opaque calcite micro fracture fill, occasional clear quartz micro fracture fill with common clear euhedral quartz crystals, occasional pyrite fragments, common disseminated pyrite, slightly micromicaceous, minor slickensides in part, and of 2) **SILTSTONE** - black, hard to very hard, irregularly blocky, common micromicaceous, common disseminated pyrite, common quartz micro fracture fill with common euhedral quartz crystals. |
| 2140 - 2145 | **SHALE** - dark gray - black, medium hard, irregularly blocky, medium slickensides in part, rare calcite opaque micro fracture fill, occasional quartz micro fracture fill with common clear euhedral crystals, occasional pyrite fragments, common pyrite disseminated, slightly micromicaceous; **SILTSTONE** - black, hard - very hard, irregular blocky, common micromicaceous, common pyrite disseminated, common quartz micro fracture fill with common euhedral clear quartz crystals; |
| 2145 - 2155 | **SHALE** - dark gray - black, medium hard, irregularly blocky, medium slickensides in part, rare calcite opaque micro fracture fill, occasional quartz micro fracture fill with common clear euhedral crystals, occasional pyrite fragments, common pyrite disseminated, slightly micromicaceous; **SILTSTONE** - black, hard - very hard, irregularly blocky, common micromicaceous, common pyrite disseminated, common quartz micro fracture fill with common euhedral clear quartz crystals; siliceous in part. |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2155 - 2160 | **SHALE** - dark gray - black, medium hard, irregularly blocky, medium slickensides in part, rare calcite opaque micro fracture fill, occasional quartz micro fracture fill with common clear euhedral crystals, occasional pyrite fragments, common pyrite disseminated, slightly micromicaceous; **SILTSTONE** - black, hard - very hard, irregularly blocky, common micromicaceous, common pyrite disseminated, common quartz micro fracture fill with common euhedral clear quartz crystals; |
| 2160 - 2170 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, occasional quartz micro fracture fill with rare clear euhedral crystals, rare pyrite disseminated, slightly micromicaceous; **SILTSTONE** - black, hard - very hard, irregular blocky, siliceous, common micromicaceous, occasional pyrite disseminated, common quartz micro fracture fill with rare euhedral clear quartz crystals; |
| 2170 - 2180 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, occasional quartz micro fracture fill with rare clear euhedral crystals, rare pyrite disseminated, slightly micromicaceous; **SILTSTONE** - black, hard - very hard, irregular blocky, siliceous, common micromicaceous, occasional pyrite disseminated, common quartz micro fracture fill with rare euhedral clear quartz crystals; |
| 2180 - 2185 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, occasional quartz micro fracture fill with rare clear euhedral crystals, rare pyrite disseminated, slightly micromicaceous; **SILTSTONE** - black, hard - very hard, irregular blocky, siliceous, common micromicaceous, occasional pyrite disseminated, common quartz micro fracture fill with rare euhedral clear quartz crystals; |
| 2185 - 2190 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, rare quartz micro fracture fill with rare clear euhedral crystals, rare pyrite diseminated slightly micromicaceous; **SILTSTONE** - black, hard -very hard, irregular blocky, siliceous, common micromicaceous, occasional pyrite disseminated, sparse quartz micro fracture fill with rare euhedral clear quartz crystals; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2185 - 2190 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, rare quartz micro fracture fill with rare clear euhedral crystals, slightly micromicaceous, rare pyrite disseminated; **SILTSTONE** - black, hard - very hard, irregular blocky, common micromicaceous, trace pyrite disseminated, some quartz micro fracture fill with clear euhedral crystals, common siliceous; |
| 2190 - 2195 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, rare quartz micro fracture fill with rare clear euhedral crystals, slightly micromicaceous, rare pyrite disseminated; **SILTSTONE** - black, hard - very hard, irregular blocky, common micromicaceous, trace pyrite disseminated, some quartz micro fracture fill with clear euhedral crystals, common siliceous; |
| 2195 - 2200 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, rare quartz micro fracture fill with rare clear euhedral crystals, slightly micromicaceous, rare pyrite disseminated; **SILTSTONE** - black, hard - very hard, irregular blocky, common micromicaceous, trace pyrite disseminated, some quartz micro fracture fill with clear euhedral crystals, common siliceous; |
| 2200 - 2205 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, rare quartz micro fracture fill with rare clear euhedral crystals, slightly micromicaceous, rare pyrite disseminated; **SILTSTONE** - black, hard - very hard, irregular blocky, common micromicaceous, trace pyrite disseminated, some quartz micro fracture fill with clear euhedral crystals, common siliceous; |
| 2205 - 2210 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, rare quartz micro fracture fill with rare clear euhedral crystals, slightly micromicaceous, rare pyrite disseminated; **SILTSTONE** - black, hard - very hard, irregular blocky, common micromicaceous, trace pyrite disseminated, some quartz micro fracture fill with clear euhedral crystals, common siliceous; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2210 - 2215 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, rare quartz micro fracture fill with rare clear euhedral crystals, slightly micromicaceous, rare pyrite disseminated; **SILTSTONE** - black, hard - very hard, irregular blocky, common micromicaceous, trace pyrite disseminated, some quartz micro fracture fill with clear euhedral crystals, common siliceous; |
| 2215 - 2220 | **SHALE** - dark gray - black in part, soft - medium hard, platy - blocky, rare slickensides in part, rare quartz micro fracture fill with rare clear euhedral crystals, slightly micromicaceous, abundant pyrite disseminated; **SILTSTONE** - black, hard - very hard, irregular blocky, common micromicaceous, trace pyrite fragments and disseminated, rare quartz micro fracture fill, some siliceous , common in part; |
| 2220 - 2225 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, slightly micromicaceous, rare pyrite disseminated, rare quartz micro fracture fill; **SILTSTONE** - black, hard - very hard, irregular blocky, some micromicaceous, rare quartz micro fracture fill, common siliceous, some pyrite disseminated; **SILTSTONE** - black, medium hard - hard, irregular blocky, rare quartz micro fracture fill, some siliceous in part, abundant pyrite disseminated, slightly micromicaceous; |
| 2225 - 2230 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, slightly micromicaceous, rare pyrite disseminated, rare quartz micro fracture fill; **SILTSTONE** - black, hard - very hard, irregular blocky, some micromicaceous, rare quartz micro fracture fill, common siliceous, some pyrite disseminated; |
| 2230 - 2235 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, slightly micromicaceous, rare pyrite disseminated, rare quartz micro fracture fill; **SILTSTONE** - black, hard - very hard, irregular blocky, some micromicaceous, rare quartz micro fracture fill, common siliceous, some pyrite disseminated; **SILTSTONE** - black, medium hard - hard, irregular blocky, rare quartz micro fracture fill, some siliceous in part, abundant pyrite disseminated, slightly micromicaceous; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2235 - 2240 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, slightly micromicaceous, rare pyrite disseminated, rare quartz micro fracture fill; **SILTSTONE** - black, medium hard - hard, irregular blocky, rare quartz micro fracture fill, some siliceous in part, abundant pyrite disseminated, slightly micromicaceous; |
| 2240 - 2255 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, slightly micromicaceous, rare pyrite disseminated, rare quartz micro fracture fill; **SILTSTONE** - black, hard - very hard, irregular blocky, some micromicaceous, rare quartz micro fracture fill, common siliceous, some pyrite disseminated; **SILTSTONE** - black, medium hard - hard, irregular blocky, rare quartz micro fracture fill, some siliceous in part, abundant pyrite disseminated, slightly micromicaceous; |
| 2255 - 2265 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, slightly micromicaceous, rare pyrite disseminated, rare quartz micro fracture fill; **SILTSTONE** - black, medium hard - hard, irregular blocky, rare quartz micro fracture fill, some siliceous in part, abundant pyrite disseminated, slightly micromicaceous; |
| 2265 - 2270 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, slightly micromicaceous, rare pyrite disseminated, rare quartz micro fracture fill; **SILTSTONE** - black, medium hard - hard, irregular blocky, rare quartz micro fracture fill, some siliceous in part, abundant pyrite disseminated, slightly micromicaceous; |
| 2270 - 2275 | **SHALE** - dark gray - black in part, medium hard, blocky, rare slickensides in part, slightly micromicaceous, rare pyrite disseminated, rare quartz micro fracture fill; **SILTSTONE** - black, medium hard - hard, irregular blocky, rare quartz micro fracture fill, some siliceous in part, abundant pyrite disseminated, slightly micromicaceous; |
| 2275 - 2285 | **SHALE** - medium gray - dark gray, platy, soft, rare slickensides, slightly calcareous, trace dolomitic, trace silty, moderately micromicaceous, rare pyrite disseminated; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2285 - 2295 | **SILTSTONE** - black, medium hard - hard, irregular blocky, slightly micromicaceous to common micromicaceous in part, some siliceous in part, common pyrite disseminated, rare pyrite fragments; **SHALE** - medium gray - dark gray, platy, soft, rare slickensides, slightly calcareous, trace dolomitic, trace silty, moderately micromicaceous, rare pyrite disseminated; |
| 2295 - 2310 | **SILTSTONE** - black, medium hard - hard, irregular blocky, slightly micromicaceous to common micromicaceous in part, some siliceous in part, common pyrite disseminated, rare pyrite fragments; **SHALE** - medium gray - dark gray, platy, soft, rare slickensides, slightly calcareous, trace dolomitic, trace silty, moderately micromicaceous, rare pyrite disseminated; |
| 2310 - 2315 | **SHALE** - medium gray - dark gray, platy, soft, rare slickensides, slightly calcareous, trace dolomitic, trace silty, moderately micromicaceous, rare pyrite disseminated; |
| 2315 - 2340 | **SHALE** - medium gray - dark gray, platy, soft, rare slickensides, slightly calcareous, trace dolomitic, trace silty, moderately micromicaceous, rare pyrite disseminated; |
| 2340 - 2360 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming slightly calcareous in part, trace micromicaceous, trace pyrite in part; |
| 2360 - 2380 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, becoming slightly calcareous in part, trace micromicaceous, rare pyrite in part; |
| 2380 - 2395 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, becoming slightly dolomitic in part, slightly micromicaceous, trace calcareous streaks in part; |
| 2395 - 2410 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, slightly micromicaceous, slightly dolomitic, rare pyrite; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2410 - 2415 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, occasionally slightly calcareous in part, moderately consolidated in part, slightly micromicaceous, slightly dolomitic, rare pyrite; |
| 2415 - 2425 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, occasionally slightly calcareous in part, moderately consolidated in part, slightly micromicaceous, slightly dolomitic, rare pyrite; |
| 2425 - 2430 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, occasionally slightly calcareous in part, moderately consolidated in part, slightly micromicaceous, slightly dolomitic, trace pyrite; |
| 2430 - 2440 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, occasionally slightly calcareous in part, moderately consolidated in part, slightly micromicaceous, slightly dolomitic, trace pyrite; |
| 2440 - 2450 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, occasionally slightly calcareous in part, moderately consolidated in part, slightly micromicaceous, slightly dolomitic, trace pyrite; |
| 2450 - 2470 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, occasionally slightly calcareous in part, moderately consolidated in part, slightly micromicaceous, slightly dolomitic, trace pyrite; |
| 2430 - 2440 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, occasionally slightly calcareous in part, moderately consolidated in part, slightly micromicaceous, slightly dolomitic, trace pyrite; |
| 2470 - 2495 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, occasionally slightly calcareous in part, moderately consolidated in part, slightly dolomitic; |
| 2495 - 2510 | **SHALE** - medium gray, dark gray in part, platy, soft, becoming black in part, occasionally slightly calcareous in part, moderately consolidated in part, slightly dolomitic; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2510 - 2535 | **SHALE** - medium gray, subfissile, becoming dark gray in part, soft, slightly dolomitic, trace micromicaceous in part; |
| 2535 - 2560 | **SHALE** - medium gray, subfissile, becoming dark gray in part, soft, slightly dolomitic, trace micromicaceous in part; |
| 2560 - 2575 | **SHALE** - medium gray, subfissile, becoming dark gray in part, soft, slightly dolomitic, trace micromicaceous in part; |
| 2575 - 2590 | **SHALE** - medium gray, dark gray in part, soft, subfissile, samples poor quality - heavy contamination by mud products, slightly dolomitic in part; |
| 2590 - 2595 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor - heavy contamination by unassimilated mud products, slightly dolomitic; |
| 2595 - 2600 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic; |
| 2600 - 2620 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic; |
| 2620 - 2635 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic; |
| 2635 - 2640 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic, abundant pyrite, fragments; |
| 2640 - 2645 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2645 - 2650 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic, occasional pyrite fragments and disseminated; |
| 2650 - 2660 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic, occasional pyrite fragments and disseminated; **SILTSTONE** - black, blocky, occasional pyrite disseminated and fragments, common siliceous, some calcite micro fracture fills; |
| 2660 - 2675 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic, occasional pyrite fragments and disseminated; **SILTSTONE** - black, blocky, occasional pyrite disseminated and fragments, common siliceous, some calcite micro fracture fills; |
| 2675 - 2690 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic, some pyrite fragments and disseminated; **SILTSTONE** - black, blocky, occasional pyrite disseminated and fragments, common siliceous, some calcite micro fracture fills, rare quartz micro fracture fill; |
| 2690 - 2695 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic, some pyrite fragments and disseminated; minor **SILTSTONE** - black, hard to very hard, blocky with sharp ribs, rare pyrite disseminated and fragments, some quartz micro fracture fill. |
| 2695 - 2700 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic, some pyrite fragments and disseminated; rare calcite micro fracture fill, rare clear calcite crystals; minor **SILTSTONE** - black, hard - very hard, blocky with sharp ribs, rare quartz micro fracture fill. |
| 2700 - 2710 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic, some pyrite fragments and disseminated; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2710 - 2715 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, sample quality poor, slightly dolomitic, some pyrite fragments and disseminated; **SILTSTONE** - black, blocky, occasional pyrite disseminated and fragments, common siliceous, some calcite micro fracture fills, rare quartz micro fracture fill; |
| 2715 - 2720 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, rare calcite micro fracture fill, rare pyrite disseminated and fragments; |
| 2720 - 2730 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, rare calcite micro fracture fill, rare pyrite disseminated and fragments; **SILTSTONE** - black, hard - very hard, blocky, rare pyrite disseminated and fragments, common siliceous, some calcite micro fracture fills, rare quartz micro fracture fill; |
| 2730 - 2740 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, rare calcite micro fracture fill, rare pyrite disseminated and fragments; **SILTSTONE** - black, hard - very hard, blocky, rare pyrite disseminated and fragments, common siliceous, some calcite micro fracture fills, rare quartz micro fracture fill; |
| 2740 - 2745 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, rare calcite micro fracture fill, rare pyrite disseminated and fragments; |
| 2745 - 2760 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, rare calcite micro fracture fill, rare pyrite disseminated and fragments; **SILTSTONE** - black, hard - very hard, blocky, rare pyrite disseminated and fragments, common siliceous, some calcite micro fracture fills, rare quartz micro fracture fill; |
| 2760 - 2770 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, rare calcite micro fracture fill, rare pyrite disseminated and fragments; **SILTSTONE** - black, hard - very hard, blocky, rare pyrite disseminated and fragments, common siliceous, some calcite micro fracture fill fills, rare quartz micro fracture fill; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2770 - 2780 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated; |
| 2780 - 2785 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, very poor quality sample; |
| 2785 - 2795 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, very poor quality sample; |
| 2795 - 2805 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, very poor quality sample; |
| 2805 - 2820 | **SHALE** - medium gray, dark gray in part, subfissile, soft to moderately consolidated, very poor quality sample; |
| 2820 - 2835 | **SHALE** - black, platy, soft - hard, common pyrite disseminated and thin streaks; |
| 2835 - 2848 | **SHALE** - black, platy, soft - hard, common pyrite disseminated and thin streaks; |
| 2848 - 2855 | **SHALE** - black, dark gray in part, fissile, brittle, hard - moderately consolidated, minor trace calcite fracture fill in part, scattered pyrite disseminated and thin streaks, trace siliceous streaks in part; |
| 2855 - 2865 | **SHALE** - black, fissile, brittle, hard - moderately consolidated, minor trace calcite fracture fill in part, scattered pyrite disseminated and thin streaks, trace siliceous streaks in part; |
| 2865 - 2870 | **SHALE** - black, occasionally dark gray in part, fissile, moderately consolidated, minor trace calcite fracture fill in part, scattered pyrite disseminated and thin streaks, trace siliceous streaks in part; |
| 2870 - 2885 | **SHALE** - black, fissile - subfissile, moderately consolidated, trace pyrite disseminated and thin streaks, slightly dolomitic; |
| 2885 - 2895 | **SHALE** - black, fissile - subfissile, moderately consolidated, trace pyrite disseminated and thin streaks, slightly dolomitic; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2895 - 2915 | **SHALE** - black, fissile, moderately consolidated, trace pyrite disseminated, moderately dolomitic; |
| 2915 - 2927 | **SHALE** - black, fissile, moderately consolidated to hard, trace pyrite disseminated, moderately dolomitic, slightly calcareous in part; |
| 2927 - 2935 | **SHALE** - black, fissile, moderately consolidated, brittle in part, trace pyrite disseminated, slightly dolomitic, moderately calcareous in part; |
| 2935 - 2940 | **SHALE** - black, fissile, moderately consolidated, brittle in part, trace pyrite disseminated, slightly dolomitic, moderately calcareous in part; **SHALE** - dark gray - black, subfissile, hard, brittle in part, trace fracture fill calcite in small part, trace pyrite, moderately calcareous in part; |
| 2940 - 2945 | **SHALE** - dark gray - black, subfissile, hard, brittle in part, trace fracture fill calcite in small part, trace pyrite, moderately calcareous in part; |
| 2945 - 2950 | **SHALE** - black, dark gray in part, blocky, subfissile in part, hard, trace fracture fill calcite in small part, trace pyrite disseminated, moderately calcareous in part; |
| 2950 - 2960 | **SHALE** - black, dark gray in part, blocky, subfissile in part, hard, trace fracture fill calcite in small part, trace pyrite disseminated, moderately calcareous in part; |
| 2960 - 2970 | **SHALE** - black, fissile, moderately consolidated, brittle in part, trace pyrite disseminated, slightly dolomitic, moderately calcareous in part; **SHALE** - black, dark gray in part, blocky, subfissile in part, hard, trace fracture fill calcite in small part, trace pyrite disseminated, moderately calcareous in part; |
| 2970 - 2975 | **SHALE** - black, dark gray in part, blocky, subfissile in part, hard, trace fracture fill calcite in small part, trace pyrite disseminated, moderately calcareous in part; **SHALE** - black, dark gray in part, blocky, subfissile in part, hard, fair fracture porosity, trace pyrite disseminated, moderately calcareous in part, scattered calcite fracture fill; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 2975 - 2980 | **SHALE** - black, dark gray in part, blocky, subfissile in part, hard, trace fracture fill calcite in small part, trace pyrite disseminated, moderately calcareous in part; |
| 2980 - 2995 | **SHALE** - black, dark gray in part, blocky, subfissile in part, hard, trace fracture fill calcite in small part, scattered pyrite disseminated, moderately calcareous in part; |
| 2995 - 3010 | **SHALE** - black, dark gray in part, blocky, subfissile in part, hard, trace fracture fill calcite in small part, trace pyrite disseminated, moderately calcareous in part; |
| 3010 - 3015 | **SHALE** - black, dark gray in part, blocky, subfissile in part, hard, trace fracture fill calcite in small part, trace pyrite disseminated, slightly calcareous in part; |
| 3015 - 3025 | **SHALE** - dark gray, black in part, blocky, moderately consolidated, trace fracture fill calcite in small part, trace pyrite disseminated, moderately calcareous; |
| 3025 - 3030 | **SHALE** - dark gray, black in part, blocky, moderately consolidated, scattered fracture fill calcite in small part, scattered pyrite disseminated, moderately calcareous; |
| 3030 - 3032 | **SHALE** - dark gray, black in part, blocky, moderately consolidated, scattered fracture fill calcite in small part, scattered pyrite disseminated, moderately calcareous; |
| 3032 - 3035 | **SHALE** - dark gray, black in part, blocky, moderately consolidated, trace pyrite disseminated, moderately calcareous, scattered calcite fracture fill in small part; |
| 3035 - 3040 | **SHALE** - dark gray, black in part, blocky, moderately consolidated, trace pyrite disseminated, moderately calcareous, scattered calcite fracture fill in small part; |
| 3040 - 3044 | **SHALE** - dark gray, mottled white calcareous streaks in part, black in part, blocky, moderately consolidated, trace pyrite disseminated, moderately calcareous, scattered calcite fracture fill in small part; |

## LITHOLOGY

Formation tops
Sample interval
(in meters) SAMPLE DESCRIPTION

The interval from 2833m to 3053m contains dark grey to black, blocky to irregular blocky, hard to very hard, siliceous, **SHALE**, silty in part. This lithology has been described as **SILTSTONE** by H. Wennekers. The cuttings are multi and irregularly faceted, with some cutting surfaces appearing as shell-like and even amygdaloidal; not uncommon for chert fracturing. Cuttings of this lithology may include cavings, which though seems unlikely with the slightly over gauge, clean, hole, and the high viscosity (117) and heavy (1430kg/m3) drilling mud. Drilling bits ware on this lithology. Drilling bit shanks wore and some of the bits were 1/2" under gauge. This lithology has been mistakenly been described as "chert" from this lowermost interval (the Horn River) of the Besa River in some wells in the region.

3044 - 3045 **SHALE** - dark gray, mottled white calcareous streaks in part, black in part, blocky, moderately consolidated, trace pyrite disseminated, moderately calcareous, scattered calcite fracture fill in small part;

3045 - 3055 **SHALE** - dark gray, mottled white calcareous streaks in part, black in part, blocky, moderately consolidated, trace pyrite disseminated, moderately calcareous, scattered calcite fracture fill in small part; **SHALE** - dark gray - black, hard - very hard, blocky, abundant siliceous, common calcareous, some calcite white micro fracture fill, rare quartz euhedral crystals, common pyrite disseminated and fragments;

3055 - 3065 **SHALE** - dark gray, mottled white calcareous streaks in part, black in part, blocky, moderately consolidated, trace pyrite disseminated, moderately calcareous, scattered calcite fracture fill in small part; **SHALE** - dark gray - black, hard - very hard, blocky, abundant siliceous, common calcareous, some calcite white micro fracture fill, common quartz micro fracture fill and euhedral crystals, common pyrite disseminated and fragments;

3065 - 3068 **SHALE** - black, hard - very hard, blocky, abundant siliceous, moderately calcareous, some calcite white micro fracture fill, common pyrite disseminated, streaks, and fragments;

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3068 - 3072 | **SHALE** - dark gray - black, hard - very hard, blocky, abundant siliceous, moderately calcareous, some calcite white micro fracture fill, trace quartz micro fracture fill, rare pyrite disseminated; |
| 3072 - 3080 | **SHALE** - dark gray, mottled white calcareous streaks in part, black in part, blocky, moderately consolidated, trace pyrite disseminated, moderately calcareous, scattered calcite fracture fill in small part; **SHALE** - dark gray - black, hard - very hard, blocky, abundant siliceous, moderately calcareous, some calcite white micro fracture fill, trace quartz micro fracture fill, rare pyrite disseminated; |
| 3080 - 3090 | **SHALE** - dark gray, mottled white calcareous streaks, black in part, blocky, moderately consolidated, trace pyrite disseminated, moderately calcareous, scattered calcite fracture fill in small part, rare dolomite clear euhedral crystals in calcite micro fracture fill; **SHALE** - black, hard - very hard, blocky, abundant siliceous, moderately calcareous, some calcite white micro fracture fill, common pyrite disseminated, streaks, and fragments; **LIMESTONE** - gray brown, platy, mottled, microcrystalline, calcite fossil mould, common argillaceous, some calcite white calcite micro fracture fill; |
| 3090 - 3095 | **SHALE** - dark gray, mottled white calcareous streaks in part, black in part, blocky, moderately consolidated, trace pyrite disseminated, moderately calcareous, scattered calcite fracture fill in small part; **SHALE** - black, hard - very hard, blocky, abundant siliceous, moderately calcareous, some calcite white micro fracture fill, common pyrite disseminated, streaks, and fragments; **LIMESTONE** - gray brown, platy, mottled, microcrystalline, calcite fossil, small angle top cone Tentaculites, common argillaceous, some calcite white calcite micro fracture fill; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3095 - 3098 | **SHALE** - black, hard - very hard, blocky, abundant siliceous, moderately calcareous, some calcite white micro fracture fill, common pyrite disseminated, streaks, and fragments; **LIMESTONE** - gray brown, platy, mottled, microcrystalline, calcite fossil, small angle top cone Tentaculites, common argillaceous, some calcite white calcite micro fracture fill; |
| 3098 - 3099 | **SHALE** - black, hard - very hard, blocky, abundant siliceous, moderately calcareous, some calcite white micro fracture fill, common pyrite disseminated, streaks, and fragments; |
| 3099 - 3102 | No sample; A 2.32m discrepancy in bottom hole depth. |
| 3102 - 3105 | **SHALE** - black, hard - very hard, blocky, abundant siliceous, moderately calcareous, some calcite white micro fracture fill, common pyrite disseminated, streaks, and fragments; **LIMESTONE** - gray brown (whitish-gray to dark gray speckled, platy, mottled, microcrystalline, calcite fossil, small angle top cone Tentaculites, common argillaceous, some calcite white calcite micro fracture fill. |
| 3105 - 3110 | **SHALE** - black, hard - very hard, blocky, abundant siliceous, moderately calcareous, some calcite white micro fracture fill, common pyrite disseminated, streaks, and fragments; **LIMESTONE** - gray brown (whitish - gray to dark gray speckled), platy, mottled, microcrystalline, calcite fossil, small angle top cone Tentaculites, common argillaceous, some calcite white calcite micro fracture fill; |
| 3110 - 3113 | **SHALE** - black, hard - very hard, blocky, abundant siliceous, moderately calcareous, some calcite white micro fracture fill, common pyrite disseminated, streaks, and fragments; **LIMESTONE** - gray brown - dark gray, mottled, hard, brittle, platy, microcrystalline, calcite fossil, small angle top cone Tentaculites, common argillaceous, some calcite white calcite micro fracture fill, rare bitumen black, high lustre, amygdaloidal fractures; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3113 - 3115 | **LIMESTONE** - gray brown - dark gray, mottled, hard, brittle, platy, microcrystalline, dried bitumen in microfracture lined with calcite crystals, calcite fossil, small angle top cone Tentaculites, common argillaceous, some calcite white calcite micro fracture fill, rare bitumen black, high lustre, amygdoidal fractures; |

Some notes on the lithology of the rocks drilled in P-66-A between 3080m and 3115m.

The rock encountered from 3080m to 3115m contains what appears two units with limestone separated by shale. This could be a repeat section, or it represents an undisturbed succession. The lowermost sample of this interval from 3112.50m to 3115.00m contains abundant pieces of opaque calcite, common pieces of quartz and small clear quartz crystals, and pieces of opaque to translucent dolomite. Also encountered were small pieces of brittle dried bitumen, black, high luster, with amygdaloidal-like fractures. A few pieces had already been found in sample 3112.50m, but then a decision as to its origin waivered between in-situ and/or a mud additive. This riddle was solved when, in circulated 3115.00m bottom hole sample, a cutting was found that contained limestone and part of a micro fracture almost filled with calcite crystals; not closed, but with space left between the two surfaces of crystal tops, indicating crystal growth was from the fracture walls towards the centre of the fracture. The open space between the two opposite surfaces studded with crystal tops, is filled with black shiny dried bitumen. This was a most wonderful discovery, since similar fractures filled with dried bitumen (Gilsonite) are characteristic of the Nahanni limestone and dolomite in wells drilled in the Pointed Mountain Field and in other wells that were drilled in the region. At this time, it is not known how far the 3115.00m bottom hole depth is from the top of the Nahanni dolomites. It might be concluded that the limestone we have seen in the last 35 meters of the P-66-A hole might include basal Horn River limestones and uppermost limestones of the Nahanni Formation.

The limestones encountered in the 3080m to 3098m interval are not sedimentary limestones. It appears that these Limestones are defined as Limiestones, because of their reaction with 0.1normal HCL acid, leaving some argillaceous residue. In places, the distinction between argillaceous Limestone and calcareous shale is very difficult; if not impossible. In addition, it is more than likely that these limestone are the result of a series of complex diagenitic events.

## LITHOLOGY

Formation tops
Sample interval
(in meters) SAMPLE DESCRIPTION

It appears, that a mainly argillaceous black rock, claystone to shale, containing abundant pyrite, went through a silicification cycle, changing the rock into a very hard siliceous claystone-shale, that I have described in many cases as a siltstone; gritty feel and hard. This "siltstone" then was subjected to a calcification process, which diagenetically converted the "siltstone" to varying degrees into a mottled rock, that reacts actively with 0.1 normal HCL acid, suggesting it is a limestone; very little residue is left after acid has removed all calcite. The limestone designation seems logic as the rock contains calcified fossils. Unfortunately, such calcified fossils are also present in siliceous shales/claystones. These fossils include, Tentaculites; three dimensional, suggesting that hardening of this rock, due silification, occurred somewhere prior to advanced induration. Or, as an alternative, local calcification of these fossils occurred early in the induration process.

It is noted here, that the calcification of the "siltstone" occurred as if it followed original very fine bedding in the "siltstone". A bedding that can not be detected when cuttings of non-calcified "siltstone" are examined in detail. Thus, calcification highlights that "bedding". Also, the calcification process, although appearing to follow original bedding, has the appearance, on a cross section surface, not of thin beds, but of a string of flattened beads. With more advanced calcification, the "partially calcified siltstone" is converted into a grayish brown coloured limestone. Following that, it appears that further calcification results in a grayish brown to whitish and dark gray "salt and pepper" microcrystalline limestone. Usually, the description "salt and pepper" is used for sandstone, but that is how it looks. Further calcification results in a microcrystalline whitish-blackish salt and pepper limestone.

Note: The content of the above two pages is based on visual observations on location P-66-A, and not on reviews of literature and other sources.

[An alternate interpretation might envision diagenetically changed original sedimentary argillaceous limestones and possibly calcareous shales of the Nahanni, between 3102m and 3115m?; silicification to varying degrees?]

3115 - 3125 **DOLOMITE** - light tan, light brown, microcrystalline, dried brittle black bitumen and soft black bitumen, abundant calcite, pieces of crystals, some blackish due to bitumen;

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| | Sample descriptions that follow [3115-3500] whipstock no.4 were logged by Fred Richardson January 27/98 to February 4/98 |
| 3115 - 3120 | Sample is 100% cement; |
| 3120 - 3125 | Sample is 100% cement; No sample - teflon beads; |
| 3125 - 3130 | Teflon beads; **DOLOMITE** - dark gray, fine crystalline to medium crystalline and some coarse crystalline; **DOLOMITE** - white, medium crystalline to coarse crystalline and some fine crystalline, fair intercrystalline porosity, fair vuggy porosity; |
| 3125 - 3130 | **DOLOMITE** - white, fine crystalline to medium crystalline, no gas show, sample ground very fine, and abundant cement, difficult to access porosity, occasional bitumen; 40-50% of sample is cement; |
| 3130 - 3135 | **DOLOMITE** - white, fine crystalline to medium crystalline, no gas show, sample ground very fine, and abundant cement, difficult to access porosity, occasional bitumen; |
| 3135 - 3140 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - dark gray, black, fine crystalline to medium crystalline, trace intercrystalline porosity; |
| 3140 - 3145 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - dark gray, black, fine crystalline to medium crystalline, trace intercrystalline porosity; |
| 3145 - 3150 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, fair intercrystalline porosity, fair vuggy porosity; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3150 - 3155 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, fair intercrystalline porosity, fair vuggy porosity; |
| 3155 - 3160 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, fair intercrystalline porosity, fair vuggy porosity; |
| 3160 - 3165 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, fair intercrystalline porosity, fair vuggy porosity; |
| 3165 - 3170 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, fair intercrystalline porosity, fair vuggy porosity; |
| 3170 - 3175 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, fair intercrystalline porosity, fair vuggy porosity; |
| 3175 - 3180 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, fair intercrystalline porosity, fair vuggy porosity; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3180 - 3185 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, fair intercrystalline porosity, fair vuggy porosity; |
| 3185 - 3190 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; |
| 3190 - 3195 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; |
| 3195 - 3200 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3200 - 3205 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; **DOLOMITE** - gray, gray - brown, fine crystalline to microcrystalline, rare intercrystalline porosity; |
| 3205 - 3210 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - gray, gray - brown, fine crystalline to microcrystalline, rare intercrystalline porosity; |
| 3210 - 3215 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; **DOLOMITE** - as above, fine crystalline to microcrystalline, rare intercrystalline porosity; |
| 3215 - 3220 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - brown, fine crystalline to cryptocrystalline, trace intercrystalline porosity, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3220 - 3225 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; **DOLOMITE** - brown, fine crystalline to cryptocrystalline, trace intercrystalline porosity, occasionally calcareous; |
| 3225 - 3230 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - brown, fine crystalline to cryptocrystalline, trace intercrystalline porosity, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3230 - 3235 | **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; **DOLOMITE** - gray, gray - brown, fine crystalline to microcrystalline, rare intercrystalline porosity; **DOLOMITE** - brown, fine crystalline to cryptocrystalline, trace intercrystalline porosity, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3235 - 3240 | **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; **DOLOMITE** - gray, gray - brown, fine crystalline to microcrystalline, rare intercrystalline porosity; **DOLOMITE** - brown, fine crystalline to cryptocrystalline, trace intercrystalline porosity, occasionally calcareous; |
| 3240 - 3245 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3245 - 3250 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3250 - 3255 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - brown, fine crystalline to cryptocrystalline, trace intercrystalline porosity, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3255 - 3260 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3260 - 3265 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3265 - 3270 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3270 - 3275 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3275 - 3280 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; **DOLOMITE** - brown, fine crystalline to cryptocrystalline, trace intercrystalline porosity, occasionally calcareous; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3280 - 3285 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; |
| 3285 - 3290 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3290 - 3295 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3295 - 3300 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3300 - 3305 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to medium crystalline, rare intercrystalline porosity; **DOLOMITE** - brown, fine crystalline to cryptocrystalline, trace intercrystalline porosity, occasionally calcareous; |
| 3305 - 3310 | **DOLOMITE** - gray, gray - brown, fine crystalline to microcrystalline, rare intercrystalline porosity; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3310 - 3315 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |
| 3315 - 3320 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, rare vuggy porosity, occasionally calcareous; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3320 - 3325 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace of intercrystalline porosity, trace of vuggy porosity, trace gas, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace porosity, trace of vuggy porosity, trace gas, occasionally calcareous; |
| 3325 - 3330 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair intercrystalline porosity, fair vuggy porosity, gas, some clear quartz crystals, occasionally calcareous; |
| 3325 - 3330 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, occasional clear quartz crystals; |
| 3330 - 3335 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, occasional clear quartz crystals; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; |
| 3335 - 3340 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, occasional clear quartz crystals; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3340 - 3345 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, light gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; |
| 3345 - 3350 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; |
| 3350 - 3355 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; |
| 3355 - 3360 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, occasional clear quartz crystals; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3360 - 3365 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |
| 3365 - 3370 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, occasional clear quartz crystals; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |
| 3370 - 3375 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |
| 3375 - 3380 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3380 - 3385 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; |
| 3385 - 3390 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; |
| 3390 - 3395 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; |
| 3395 - 3400 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; |
| 3395 - 3400 | **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace vuggy porosity, trace clear quartz crystal, trace calcareous; |
| 3400 - 3405 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3405 - 3410 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace vuggy porosity, trace clear quartz crystal, trace calcareous; |
| 3410 - 3415 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace vuggy porosity, trace clear quartz crystal, trace calcareous; |
| 3415 - 3420 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |
| 3420 - 3425 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, trace vuggy porosity, trace clear quartz crystal, trace calcareous; |
| 3425 - 3430 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |

## LITHOLOGY

| Formation tops<br>Sample interval<br>(in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3430 - 3435 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |
| 3435 - 3440 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |
| 3440 - 3445 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, fair vuggy porosity, slight trace of calcite, occasionally calcareous; **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, occasional clear quartz crystals; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, poor intercrystalline porosity; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |
| 3445 - 3450 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, slight trace of calcite, occasionally calcareous; **DOLOMITE** - gray, dark gray, black, fine crystalline to very fine crystalline, occasional clear quartz crystals; **DOLOMITE** - gray, fine crystalline to very fine crystalline, trace intercrystalline porosity, some intercrystalline bitumen; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3450 - 3455 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, poor vuggy porosity, occasional clear quartz crystal, occasionally calcareous; **DOLOMITE** - gray, dark gray, very fine crystalline to fine crystalline and some medium crystalline, fair fracture porosity; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; |
| 3455 - 3460 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, poor vuggy porosity, occasional clear quartz crystal, occasionally calcareous; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; **DOLOMITE** - gray, dark gray, fine crystalline to medium crystalline; |
| 3460 - 3465 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, poor vuggy porosity, occasional clear quartz crystal, occasionally calcareous; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; **DOLOMITE** - gray, dark gray, fine crystalline to medium crystalline; |
| 3465 - 3470 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, poor vuggy porosity, occasional clear quartz crystal, occasionally calcareous; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; **DOLOMITE** - gray, dark gray, fine crystalline to medium crystalline; |
| 3470 - 3475 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, poor vuggy porosity, occasional clear quartz crystal, occasionally calcareous; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; **DOLOMITE** - gray, dark gray, fine crystalline to medium crystalline; |
| 3475 - 3480 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, poor vuggy porosity, occasional clear quartz crystal, occasionally calcareous; |
| 3480 - 3485 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, poor vuggy porosity, occasional clear quartz crystal, occasionally calcareous; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; **DOLOMITE** - gray, dark gray, fine crystalline to medium crystalline; |

## LITHOLOGY

| Formation tops Sample interval (in meters) | SAMPLE DESCRIPTION |
|---|---|
| 3485 - 3490 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, poor vuggy porosity, occasional clear quartz crystal, occasionally calcareous; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; **DOLOMITE** - gray, dark gray, fine crystalline to medium crystalline; |
| 3490 - 3495 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, poor vuggy porosity, occasional clear quartz crystal, occasionally calcareous; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; **DOLOMITE** - gray, dark gray, fine crystalline to medium crystalline; |
| 3495 - 3500 | **DOLOMITE** - white, coarse crystalline to very coarse crystalline, poor vuggy porosity, occasional clear quartz crystal, occasionally calcareous; **DOLOMITE** - brown, cryptocrystalline to microcrystalline, tight; **DOLOMITE** - gray, dark gray, fine crystalline to medium crystalline; |
| **TOTAL DEPTH** | **3500m** |

## GEOLOGICAL SUMMARY AND CONCLUSIONS

Side track #3, Ranger Fort Liard P66A, kicked off at around 1400m. Directional drilling, building up to a 45 degrees angle was drilled to 3115m when intermediate casing was set. Hole conditions were excellent from around 1950m down to 3115m, but many tight hole intervals, unloading of shale, and large diameter hole caused considerable concern for the integrity of the hole until it was finally cased. The section drilled between 1400m and 1950m contains medium gray to dark gray to light brown to tan, soft, platy, sometimes blocky, shale, micromicaceous in places, calcareous to varying degrees, sometimes slightly dolomitic. This shale unloads easily when mud pressure is lowered or when there is much activity in the hole. While the directional drilling had build up to, and reached, the 45 degrees angle, the production of finely ground up rock so characteristic of drilling that interval, continued even when the harder more stable strata were drilled from 1950m to 3115m. Well cutting samples contained at times almost no cuttings, but were dominated by pieces of mud solids, scraped of the well bore wall and characterized by shiny black surfaces, almost resembling slickensides. In this case, they are recent slickensides; actual friction surfaces. With the high downhole temperatures and pressures, it is increasingly difficult to assess what actually took place at the bit. Not mechanically, but physically and chemically. From time to time the hole dragged and with a mud, containing irregular and sometimes very high percentages of mud solids, the hole drag increased. From time to time, efforts were made to decrease the hole drag and bottom torque. This was done by adding crushed wallnut shells to the mud. Interesting to note that the mud company does not carry tables and graphs that show that these wallnut shells at 1000 to 5000 psi are compacted to very small pieces indeed. In this hole it was clearly visible that below 1950m the real cuttings of the silicified shale were larger than the compressed crushed wallnut pieces. In effect a useless addition to the mud, that tended to pack off the MWD tool and caused problems in the mud pumps. The most important adaptation to the lithologies in this hole was the production of very clean mud that had no problems carrying sloughings and cuttings. That was all that there is to it.

Sidetrack no.4 was required because a fish was left in the hole and had to be cemented off and sidetracked around. Kick off point was 3115m [measured] and directional drilling started on January 27, 1998 and successful drilled past the fish and to TD of 3500m at 04:00 hrs February 4, 1998. Drilling was completed without any major problems.

The lithology consisted primarily of white Dolomite very course crystalline with some spotty vuggy porosity to 10 or 12 % . Forty to fifty per cent of the samples are dark grey to black Dolomite, very fine crystalline and tight. One good gas show was encountered at 3166m [2280] units. Smaller gas shows are as follows: 346 units at 3378m and 760 units at 3408m.

Logging operations began February 5, 1998 18:00 to 20:00 and could not reach bottom , Hole was bridged off at 3288m . A clean out trip followed and an

GEOLOGICAL SUMMARY AND CONCLUSIONS (cont.)

obstruction was felt at 3288m . While circulating on bottom at 3106m the well kicked gas in the early morning hours February 7, 1998. The gas kick was controlled, and 25m3 of mud was lost to the formation. After mud volume was rebuilt and all gas circulated out of mud we were ready to log again at 05:15 February 9, 1998. And all logs were completed at 20:00 hrs. Logs run were STI, Sonic, Density, Laterolog, & EMI.

The next ~~(October~~ Feb. 10, 1998) we receive orders to run 177.8 mm casing.