BP AMOCO NORGE AS
16/4-3
WEST DELTA

# GEOLOGICAL AND PETROLEUM ENGINEERING COMPLETION REPORT

16/4-3

**NORTH SEA**

**NORWAY**

Neil Hanley

- CONFIDENTIAL -

**June 2001**

GCR APPROVAL

PROSPECT: FLUORITT

TARGET: PALAEOCENE FORTIES SANDSTONE EQUIVALENT.

LOCATION ID:

DATE: NOVEMBER - DECEMBER 2000

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**Indexing Information**

| | |
|---|---|
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| **Well name(s):** | 16/4-3 |

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**Subjects:**

Well Summary

Geology/Lithology

Pore Pressure/Fracture Gradient

Wireline Operations

Appendices

# SUMMARY

Block 16/4 was previously awarded to Norsk Hydro as PL087 in 1984. Two exploration wells were drilled; 16/4-1 in 1984 and 16/4-2 in 1990. Both wells were targeted at Eocene prospects, however neither well was successful due to the inability of hydrocarbons to successfully migrate through thick Palaeocene mudstones into the targeted Eocene prospects. Subsequently, PL087 was relinquished on 1st January 1995.

BP, in partnership with Norsk Hydro, was awarded Block 16/4 as the PL243 license as part of the North Sea Awards in 1999. The 16/4-3 well is the first well drilled in the license since the award and was targeted to penetrate Palaeocene turbidite sands in the Fluoritt Prospect.

The Fluoritt Prospect was located at the western edge of the Utsira High in the South Viking Graben of the North Sea and has been mapped using the UP96 3D survey. However, full prospect evaluation was completed using a further five 3D survey and several 2D surveys to map the area in the surrounding blocks.

The prospect was defined as a combined stratigraphic and structural trap with closure formed by curvature of the Forties turbidite sandstone channel against the regional dip of the western flank of the Utsira High. To the north and south the trap was formed by dip closure. The prospect was oriented N-S and stretches approximately 15 km.

The reservoir was thought to have been composed of Palaeocene sandstones deposited from tightly constrained turbidity channels that flowed from the East Shetland Platform. The depositional limits of the channel sands were controlled by the pre-existing basin floor topography, which is, itself, controlled by buried Mesozoic grabens.

The 16/4-3 well was designed to determine the hydrocarbon type and properties in the Fluoritt Prospect by acquiring the data necessary to understand the reservoir characteristics and fluid distribution.

BP took over the semi-submersible rig; West Delta, from Norsk Hydro at 03:00 hrs on 28th November 2000. After a weather affected rig move and anchor handling, the 16/4-3 well was spudded at 20:45 hrs on the 5th December 2000.

Top Forties was encountered 27m low to prognosis at 2196.3 mBRT. Hydrocarbon fluorescence was observed in cuttings from the Forties and also from a short interval in the Middle Heimdal, however, the Forties sandstones were poorly developed at the well location and are considered uneconomic.

Drilling continued and the well TD'd at 2425 mBRT in the Ekofisk Formation.

16/4-3 was plugged and abandoned with oil shows at 08:00 on 24th December 2000 and the rig released to Norsk Hydro.

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**Enclosures**

1/500 Measured Depth Composite Log

# 1 WELL DATA SUMMARY

## 1.1 GENERAL DATA

| | | |
|---|---|---|
| **Well Name** | 16/4-3 | |
| **Status** | P&A with oil shows | |
| **Licence** | PL 243 | |
| **Operator** | **BP Amoco Norge AS** | **30.00%** |
| **Partners** | Norsk Hydro | 30.00% |
| | SDØE/Statoil | 25.00% |

| | | | |
|---|---|---|---|
| **Surface Location** | | **TD Location** | |
| **Latitude** | 58° 42' 18.718" N | **Latitude** | 58° 42' 17.650" N |
| **Longitude** | 02° 03' 51.456" E | **Longitude** | 02° 03' 50.411" E |
| **Grid** | 6 507 754.30 mN | **Grid** | 6 507 721.79 mN |
| | 445 781.10 mE | | 445 763.83 mE |

| | |
|---|---|
| **Projection** | UTM 31N; Common Meridian 03° E |
| **Spheroid** | ED 50, 1924 International Spheroid |

| | |
|---|---|
| **Seismic Location** (Survey UP96 3D) | Inline: 2922, Xline: 497 (Surface location) |

| | | | |
|---|---|---|---|
| **Offset from Nearest Wells** | Esso well 16/1-3: 12.1 kms North | Statoil well 16/1-5: 11.6 kms North-east | Hydro well 16/4-1: 8.6 kms South-east |

| | | | |
|---|---|---|---|
| **Drilling Rig:** | West Delta | **Rig Type:** | Semi-submersible |
| **RTE** | 29 mAMSL | **Total Depth** | 2425.0 mBRT |
| **Depth Datum** | RT | **Loggers Depth** | 2425.0 mBRT |
| **Water Depth** | 102 m | **Maximum Inclination** | 1.70° @ 1784.0 mBRT |
| **Rig on Contract** | 28th November 2000 | **Spud Date** | 5th December 2000 |
| **TD Date** | 18th December 2000 | **Rig Released:** | 24th December 2000 |

| | |
|---|---|
| **Report Number** | W28. |
| **Authors** | Hanley, Neil |

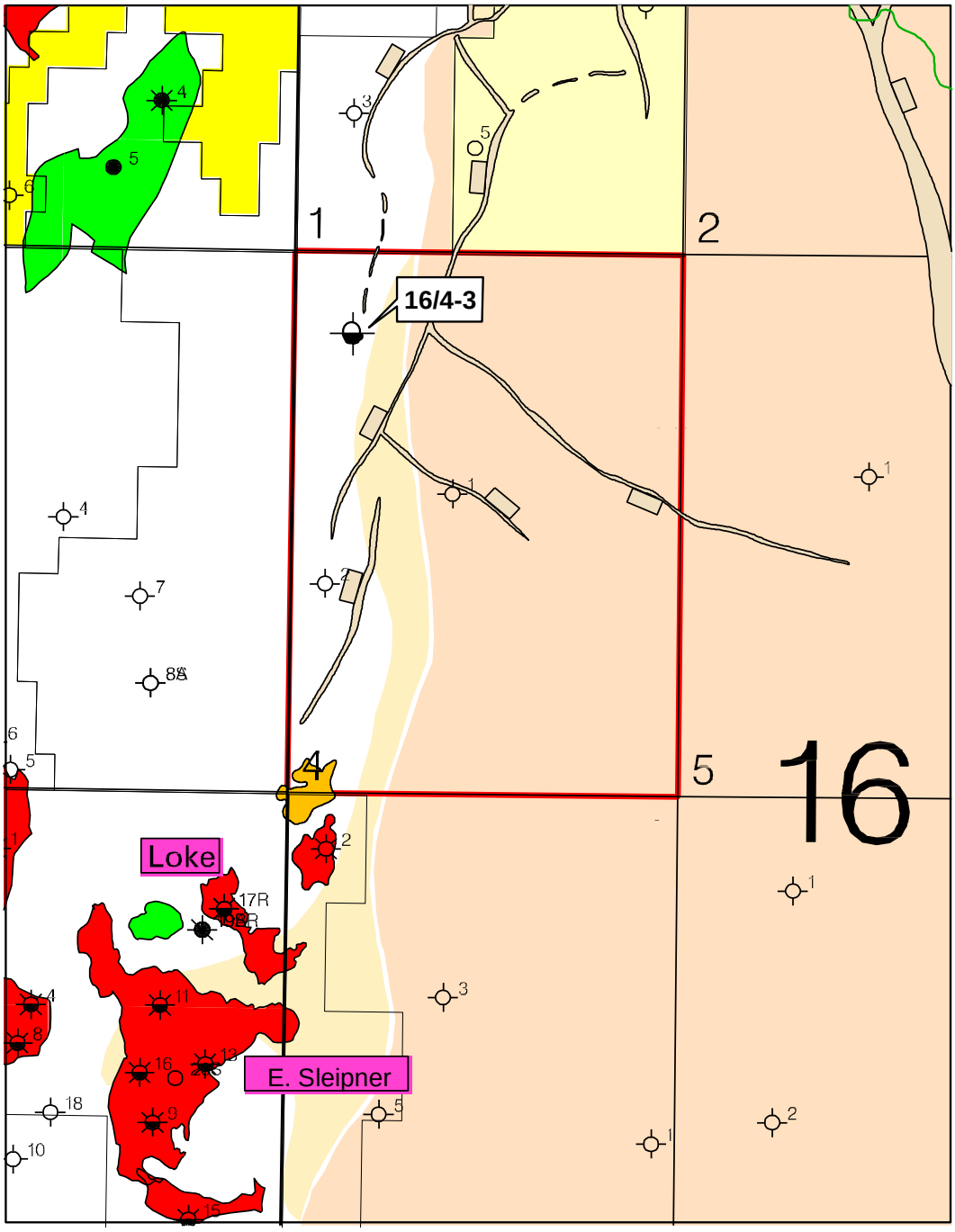


Figure 1: Location Map

## 1.2 STRATIGRAPHY

| Chrono/Lithostratigraphy | | Tops | | | |
|---|---|---|---|---|---|
| | | **Depth** | **Depth** | **Depth** | **Thick ness** |
| | | mBRT | mTVDBRT | mTVDSS | m |
| | | | | | |
| Middle Micoene – Recent | **Nordland Group** | | | | |
| | Undifferentiated | 131.00 | 131.00 | 102.00 | 613.50 |
| | Utsira Fm | 744.50 | 744.49 | 715.49 | 286.94 |
| | Base Utsira Fm | 1031.47 | 1031.43 | 1002.43 | |
| | | | | | |
| Eocene – Early Miocene | **Hordaland Group** | | | | |
| | Undifferentiated | 1031.47 | 1031.43 | 1002.43 | 154.68 |
| | Skade Fm | 1176.15 | 1176.08 | 1147.08 | 172.54 |
| | Base Skade Fm | 1348.72 | 1348.62 | 1319.62 | |
| | Grid Fm | 1822.70 | 1822.44 | 1793.44 | 57.28 |
| | Base Grid Fm | 1880.00 | 1879.72 | 1850.72 | |
| | | | | | |
| L. Palaeocene – E. Eocene | **Rogaland Group** | | | | |
| | Balder Fm | 2075.20 | 2074.86 | 2045.86 | 56.68 |
| | Sele Fm | 2131.90 | 2131.54 | 2102.54 | 64.37 |
| | Forties Fm | 2196.28 | 2195.91 | 2166.91 | 48.96 |
| | Lista Fm | 2245.25 | 2244.87 | 2215.87 | 31.90 |
| | Heimdal Fm | 2277.16 | 2276.77 | 2247.77 | 134.51 |
| | Middle Heimdal Mbr | 2277.16 | 2276.77 | 2247.77 | 56.40 |
| | Lower Heimdal Mbr | 2333.56 | 2333.16 | 2304.16 | 78.11 |
| | | | | | |
| Early Palaeocene | **Shetland Group** | | | | |
| | Ekofisk Fm | 2411.67 | 2411.24 | 2382.24 | >13.33 |
| | | | | | |

# WELL SUMMARY DIAGRAM

## 1.3 CASING

| Casing Size | Section TD mBRT | Casing Depth mBRT | Test Depth mBRT | Lithology | Formation | Comments |
|---|---|---|---|---|---|---|
| | | | | | | |
| 30” | 204.5 | 203.9 | - | Mudstone | Undifferentiated Quaternary | Surface conductor. No LOT |
| 20” | 400.0 | 396.4 | 403.0 | Mudstone | Undifferentiated Quaternary | LOT: 1.70sg EMW<br>Tested with 1.03sg mud (seawater) and 400 psi applied surface pressure. |
| 9 5/8” | 1700.0 | 1695.3 | 1703.0 | Mudstone | Undifferentiated Hordaland Gp | LOT: 1.72sg EMW.<br>Tested with 1.30sg mud and 1040 psi applied surface pressure. |

# 1.4 CORES

1.4.1 SUMMARY

No cores were obtained in this well

# 1.5 SIDEWALL CORES

1.5.1 SUMMARY

No sidewall cores were obtained in this well

## 1.6 SHOWS

| Interval (mBRT) | Lithology | Formation | Background Gas | Gas Show | Hydrocarbon Show Description |
|---|---|---|---|---|---|
| 2195 – 2220 | Sandstone | Forties | 0.15 % | 0.15 % | Drilled cuttings. Bright, locally dull yellow to yellow brown fluorescence, fast to instant blooming to streaming bright yellow white cut fluorescence, dull yellow residual ring, no oil stain. |
| 2277 – 2282 | Sandstone | Middle Heimdal | 0.15% | 0.15% | Drilled cuttings. Moderate bright yellow to yellow brown fluorescence, poor slow yellow to yellow white cut, slow blooming yellow to yellow white crush cut. |
| | | | | | |

# 1.7 TESTS

## 1.7.1 MDT PRESSURE TEST DATA

| Test | Depth mMDBRT | Depth mTVDSS | Mud Hydrostatic (psia) | | Formation Pressure (psia) | Comment |
|---|---|---|---|---|---|---|
| | | | Before | After | | |
| Run 1 | | | | | | |
| 1 | 2196.0 | 2166.6 | 4218.1 | 4217.5 | 3343.3 | Tight. |
| 2 | 2200.5 | 2171.1 | 4227.5 | 4225.7 | | Tight. |
| 3 | 2206.5 | 2177.1 | 4237.8 | 4237.6 | 3454.04 | Tight. |
| 4 | 2211.5 | 2182.1 | 4248.3 | | | Tight. |
| 5 | 2213.5 | 2184.1 | 4251.4 | 4250.3 | | Tight. |
| 6 | 2211.1 | 2181.7 | | | | Tight |
| 7 | 2215.5 | 2186.1 | 4255.5 | | | Tight. |
| 8 | 2217.5 | 2188.1 | 4258.8 | | | Tight. |
| 9 | 2258.5 | 2229.1 | 4342.0 | | | Tight. |
| 10 | 2282.5 | 2253.1 | 4383.0 | 4378.0 | 3268.4 | Good test. |
| 11 | 2281.0 | 2251.6 | 4379.5 | | | Tight. |
| 12 | 2278.0 | 2248.6 | | | | Tight. |
| 13 | 2342.5 | 2313.1 | 4500.0 | 4492.0 | 3351.6 | Good test. |
| 14 | 2349.0 | 2319.6 | 4507.0 | | 3361.1 | Good test. |
| 15 | 2354.0 | 2324.6 | 4517.0 | | 3368.5 | Good test. |
| | | | | | | |

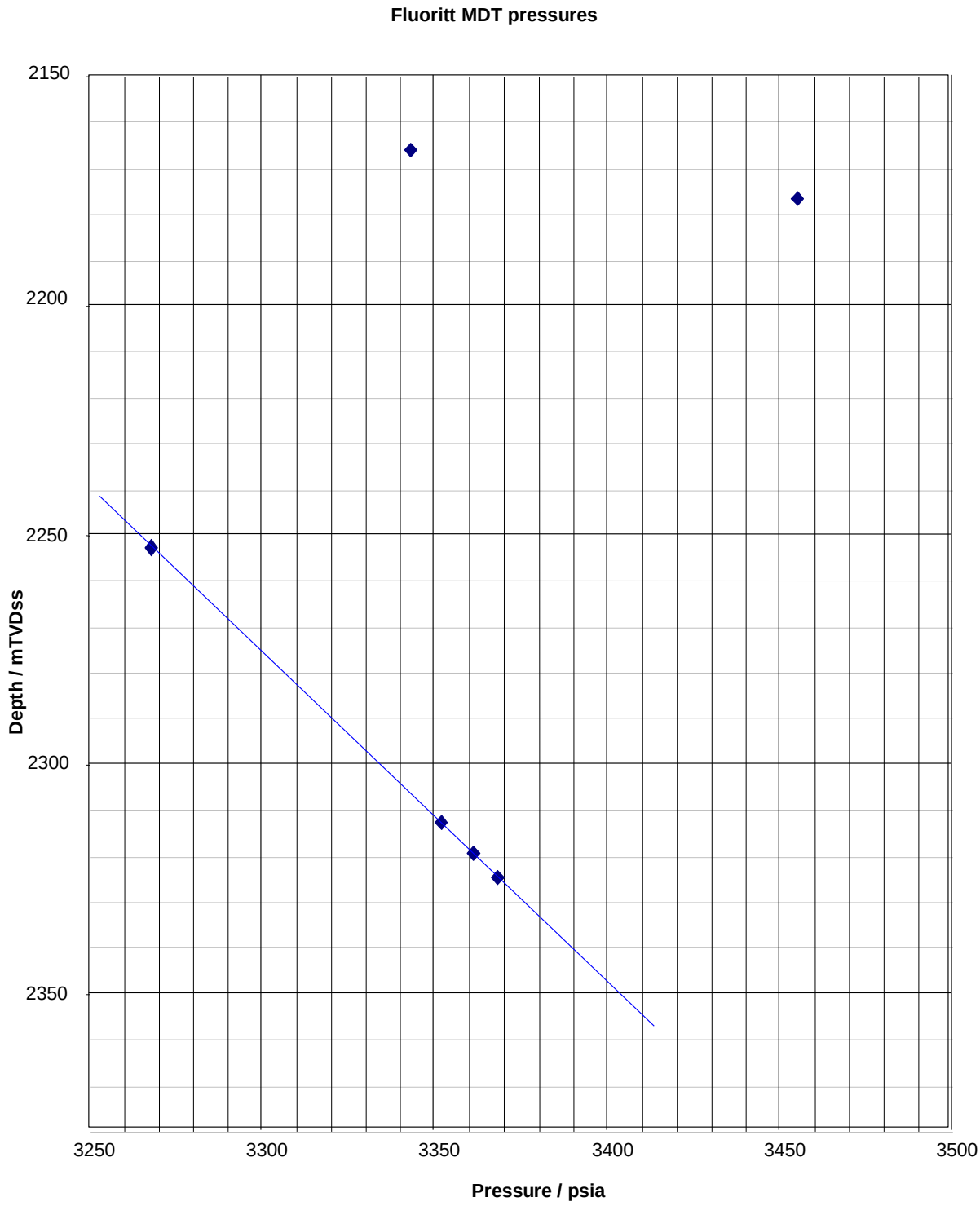


Figure 3: MDT Pressure Data

### 1.7.2 MDT SAMPLING DATA

No MDT samples were obtained from the well.

### 1.7.3 DST PRESSURE TEST DATA

No drill stem tests were conducted in the well.

## 1.8 TEMPERATURE PLOT

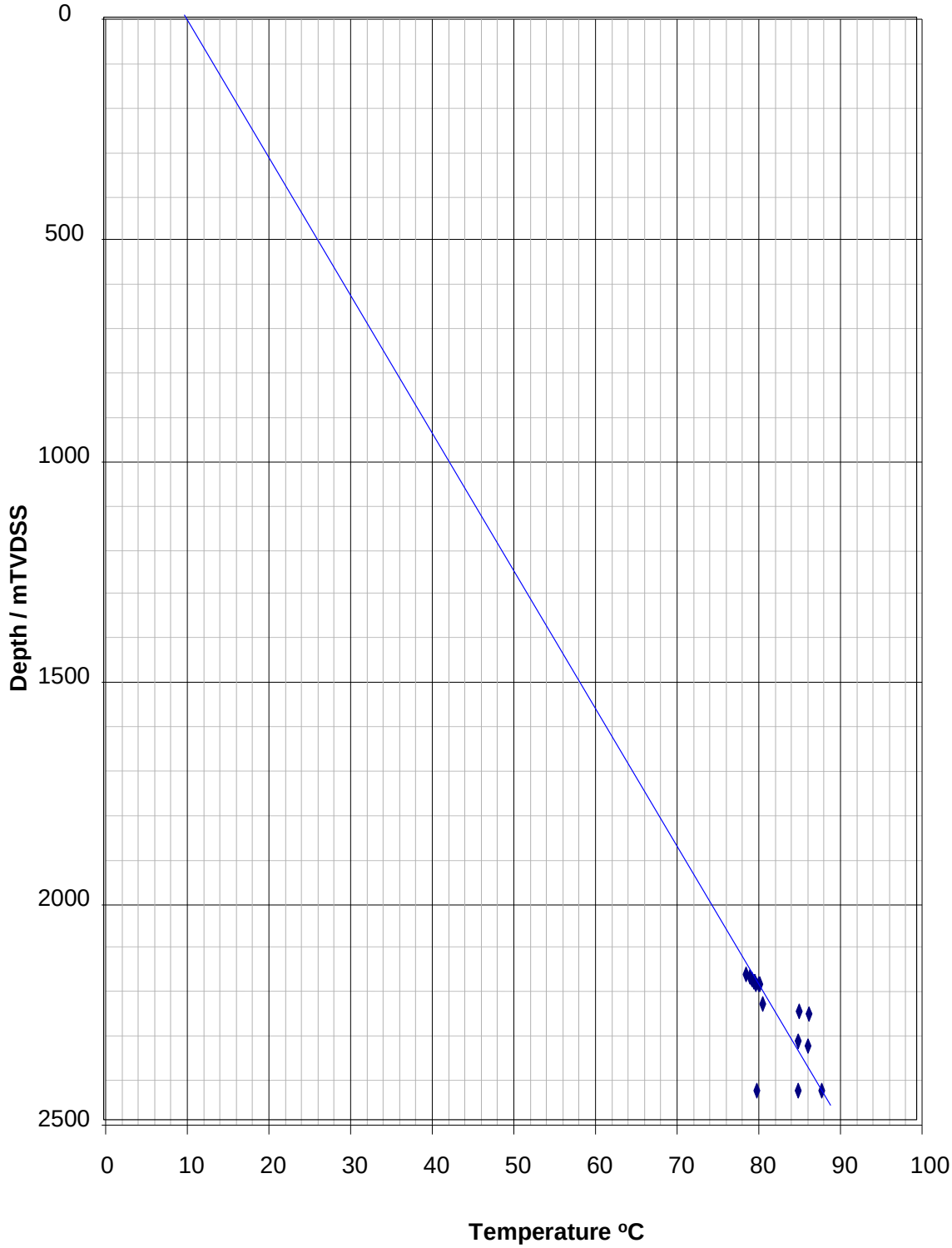


Figure 4: Temperature plot

## 1.9 VSP & CHECKSHOT

1.9.1 SUMMARY

| DEPTH | T/TIME | SHOT | FIX | STK | FILE | TIME | REMARKS |
|---|---|---|---|---|---|---|---|
| 1037.0 | 526.93 | 74-78 | | 1 | 10 | 07:32 | RIH Checkshot |
| 1414.0 | 701.36 | 80-82 | | 2 | 10 | 07:48 | RIH Checkshot |
| 2080.0 | 1003.38 | | | 3 | 10 | 08:10 | RIH Checkshot |
| | | | | | | | Correlation 2m deep (Subtract 2m) |
| 2417.0 | 1128.18 | 87 –91 | | 4 | 15 | 08:41 | Main checkshots |
| 2328.0 | 1100.88 | 92 –94 | | 5 | 15 | 08:49 | |
| 2282.0 | 1084.28 | 95 –99 | | 6 | 15 | 08:54 | |
| 2250.0 | 1071.86 | 100–102 | | 7 | 15 | 08:59 | |
| 2200.0 | 1053.22 | 103-105 | | 8 | 15 | 09:04 | |
| 2137.0 | 1026.8 | 106–108 | | 9 | 15 | 09:09 | |
| 2080.0 | 1004.09 | 109–111 | | 10 | 15 | 09:16 | |
| 2000.0 | 967.76 | 115–117 | | 11 | 15 | 09:24 | |
| 1900.0 | 920.56 | 118–122 | | 12 | 15 | 09:30 | |
| 1827.0 | 892.19 | 124–126 | | 13 | 15 | 09:37 | |
| 1800.0 | 880.11 | 127–129 | | 14 | 15 | 09:42 | |
| 1715.0 | 841.30 | 130-132 | | 15 | 15 | 09:48 | Casing shoe @ 1695m |
| 1600.0 | 786.36 | 133-135 | | 16 | 15 | 09:57 | |
| 1500.0 | 742.52 | 136-138 | | 17 | 15 | 10:03 | |
| 1414.0 | 701.53 | 144-148 | | 18 | 15 | 10:11 | |
| 1300.0 | 650.67 | 150-152 | | 19 | 15 | 10:16 | |
| 1182.0 | 596.05 | 155-157 | | 20 | 15 | 10:22 | |
| 1100.0 | 557.17 | 158-160 | | 21 | 15 | 10:28 | |
| 1037.0 | 528.09 | 163-167 | | 22 | 15 | 10:34 | |
| 1000.0 | 510.54 | 168-171 | | 23 | 15 | 10:37 | |
| 900.0 | 463.06 | 172-174 | | 24 | 15 | 10:42 | |
| 800.0 | 407.78 | 178-182 | | 25 | 15 | 10:50 | Very noisy (sonic data stopped at 860m) |
| 700.0 | 363.84 | 184-188 | | 26 | 15 | 10:56 | Very Noisy |
| 600.0 | | | | | | | POOH |

# 2 GEOLOGY

## 2.1 NORDLAND GROUP (131.0 – 1031.7 mBRT)

### 2.1.1 UNDIFFERENTIATED (131.0 – 744.5 mBRT)

| | |
|---|---|
| Top | 131.0 mBRT |
| Age | Middle Miocene to Recent |
| Upper boundary pick | Seabed |
| Lithology and shows | Returns to seabed from 131.0m to 403.0 mBRT.<br><br>From drilling characteristics and logging response this section is interpreted to be composed of interbedded sands and mudstones. A layer of pebbles/cobbles is interpreted to occur between 196 mBRT and 200 mBRT<br><br>From 403.0 mBRT, the Nordland Group consists of mudstone with minor sand lenses.<br><br>The mudstones are light to medium grey, soft, carbonaceous and non to calcareous in places. Loose, disseminated sand was found throughout the Nordland Group mudstones. The sand grains were generally fine to very fine, colourless, angular to sub rounded with traces of pyrite. |
| Logging character | LWD gamma and resistivity data was collected in the 9 7/8" pilot hole to aid shallow gas detection and in selecting a competent lithology for setting 20" casing. No signs of shallow gas were observed in the LWD data from the pilot hole.<br><br>Above the 20" at 396.4 mBRT, wireleine gamma reads between 45 API and 50 API, with the LWD resistivity log showing values of between 2.0 ohm.ms and 3.0 ohm.ms. A sand unit is interpreted to occur between 248 mBRT and 269 mBRT. Resistivity decreases to approximately 1.0 ohm.m suggesting the unit is water wet.<br><br>Below the 20" casing the gamma log is relatively characterless and varies between 60 API and 75 API, resisitivity is between 1.0 ohm.m and 2.5 ohm.ms. Sonic data was acquired below the 20" shoe and averaged 150 μsec/ft, but varied between 140 μsec/ft and 165μsec/ft. |
| Drilling characteristics | A moderate to high shallow gas warning had been raised for the Fluoritt well between 466 mBRT and 582 mBRT. To enable the section to be drilled with the BOP's installed a 9 7/8" pilot hole was first drilled to 400 mBRT. As per the Data Acquisition Plan, ROP was held at 50 m/hr to allow the collection of 3 LWD data points per meter of realtime data to identify shallow gas zones and to pick a competent formation for cementing the 20" casing shoe.<br><br>During hole opening a layer of pebbles/cobbles was encountered between 196 and 200 mBRT which lead to a reduction in ROP and stalling of the 36" bit. Section TD for the 36" hole was 204.5 mBRT. To allow running of the 20" casing, the hole was opened to 26" to a depth of 400 mBRT.<br><br>Drilled gas levels were low at 0.3% with no evidence of gas from the predicted shallow gas zones.<br><br>The section to 400 mBRT was drilled riserless using seawater and hi-vis sweeps. The rest of the Nordland Group was drilled with a 1.22sg KCl polymer waterbased mud system. |

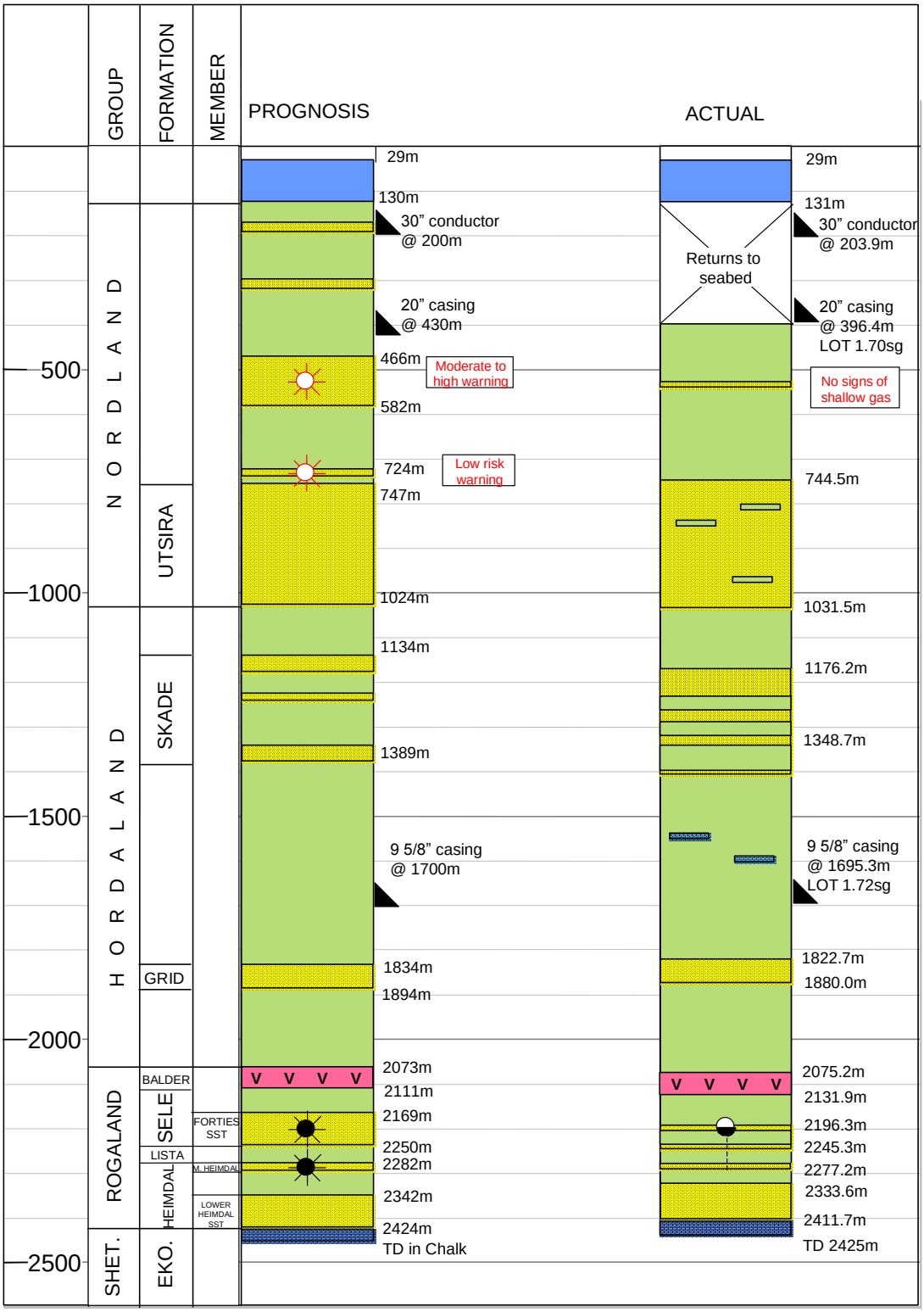


Figure 4: Prognosed versus Actual.

## 2.1.1 UTSIRA FORMATION (744.5 – 1031.5 MBRT)

| | |
|---|---|
| Top | 744.5 mBRT |
| Age | Middle Miocene |
| Upper boundary pick | Decrease in gamma ray from 70 to 45 API, change in lithology from mudstone to loose sand. |
| Lithology and shows | Predominantly loose sands with minor interbedded mudstone units.<br><br>The Utsira sands are loose, predominantly fine grained, varying very fine to coarse, clear to translucent, rarely pink, subangular to well rounded, moderate sphericity, occasional shell fragments, rare pyrite, rare glauconite.<br><br>The mudstones are light grey, locally light green grey, slightly to moderately calcareous.<br><br>No hydrocarbon shows were observed in the Utsira Formation. |
| Logging character | From 744.5 mBRT to 853 mBRT, sandstone gamma ray averages 45 API. Resitivity is approximately 0.8 ohm.ms and sonic 150 μsec/ft.<br><br>From 853 mBRT gamma varies between 35 API and 40 API. Resitivity and sonic remain at similar levels to those recorded in the upper Utsira.<br><br>Mudstones occur throughout with gamma increasing to approximately 60 API, resistivity increasing to over 1.0 ohm.m and sonic decreasing to 140 μsec/ft. |
| Drilling characteristics | The Utsira Formation was drilled with rates of penetration controlled to 40 m/hr to ensure good surface volume control as per programme. From 900 mBRT the rate of penetration was allowed to increase to approximately 80 m/hr.<br><br>Drilled gas was relatively uniform at 0.2%, with a maximum drilled gas of 1.0% recorded at 965 mBRT.<br><br>The Utsira Formation was drilled with 1.22sg mud. |

## 2.2 HORDALAND GROUP (1031.7 – 2075.2 mBRT)

### 2.2.1 UNDIFFERENTIATED (1031.7 – 2075.2 mBRT)

| | |
|---|---|
| Top | 1031.5 mBRT |
| Age | Early Eocene to Early Miocene |
| Upper boundary pick | Change in lithology from sand to mudstone, corresponding increase in gamma ray from 45 API to 60 API. |
| Lithology and shows | The Hordaland Group comprises a thick sequence of mudstones with interbedded sandstones. The sandstones are distributed over a wide area and are distinct enough to be raised to formation level. They are therefore discussed separately.<br><br>The musdtones are light to medium grey becoming light to medium brown with depth. In general they are firm, locally micaceous with traces of glauconite and pyrite, and are calcareous becoming non to slightly calcareous below 1590 mBRT. On drilling out of the 9 5/8" casing shoe, the mudstones are described as medium dark grey to grey brown occasionally blue grey, becoming light to medium grey, grey green to blue grey, moderately firm. Below the Grid sands the mudstones become medium to medium dark grey, occasionally grey green, firm and occasionally soft<br><br>Thin limestone are stingers occur, they are light buff brown to cream, occasionally medium brown, firm to hard, locally argillaceous. |
| Logging character | In the 12 ¼" hole, gamma ray averages 60 API in the mudstones of the Hordaland Group, with sonic ranging between 130 μsec/ft and 150 μsec/ft. LWD resistivity data was collected over the upper mudstone unit and decreased from approximately 1.8 ohm.ms at 1031.7 mBRT to 1.0 ohm.ms at 1176.2 mBRT.<br><br>In the 8 ½" hole gamma varies between 80 API and 135 API, with resistivity less than 1.0 ohm.m throughout. Density averages 2.15 g/cc and increases to 2.35 g/cc at the base of the Hordaland Group. Densities of up to 2.95 g/cc were recorded in the (dolomitic) limestone stringers. Neutron porosity exceeded 0.45 PU, with sonic averaging 140 μsec/ft in the mudstones. |
| Drilling characteristics | As per plan, the rate of penetration was held at 80 m/hr to allow collection of data for the LWD Bipolar Acoustic Tool.<br><br>Between 1409 mBRT and 1695.3 mBRT, drilled gas averaged 0.4%. Occasional peaks associated with limestone stringers were recorded of approximately 1.5%. Below 1550 mBRT, $C_2$ and $C_3$ were recorded. Mudweight was 1.22sg.<br><br>9 5/8" casing was set at 1695.3 mBRT. After drilling out of the casing mudweight was increased to 1.31sg, drilled gas averaged 0.4% and was composed of $C_1$. |

### 2.2.2 SKADE FORMATION (1176.2 – 1348.7 mBRT)

| | |
|---|---|
| Top | 1176.2 mBRT |
| Age | Late Oligocene – Early Miocene |
| Upper boundary pick | Change in lithology from mudstone to sandstone. |
| Lithology and shows | The Skade Formation consists of a sequence of interbedded sandstones and mudstones with occasional limestones.<br><br>The sands are predominantly colourless to pale pink, very fine to fine grained, with trace to abundant glauconite.<br><br>Mudstones up to 15m thick are recognised. They are generally dark grey brown, occasionally light grey, green grey, non to slightly calcareous with trace shell fragments and are glauconitic in places.<br><br>Rare, thin limestone stringers are present. The limestones being pale pink to pale orange, moderately hard, subblocky to blocky, microcrystalline to cryptocrystalline.<br><br>No hydrocarbon shows were observed in the Skade Formation sandstones. |
| Logging character | LWD resistivity and gamma ray failed 33m into the top of the Skade Formation.<br><br>Wireline gamma values in the sands are approximately 35 API to 40 API, with recordings of 60 API in the mudstones. Sonic log is approximately 140 μsec/ft. |
| Drilling characteristics | The Skade Formation was drilled with a 12 ¼" assembly with average rates of penetration of 80 m/hr.<br><br>Drilled gas was low, averaging 0.4%.<br><br>The Skade Formation was drilled with 1.22sg mud. |

### 2.2.3 GRID FORMATION (1822.7 - 1880.0 mBRT)

| | |
|---|---|
| Top | 1822.7 mBRT |
| Age | Middle Eocene |
| Upper boundary pick | The Grid Formation is picked on the change in lithology from mudstone to loose sands with corresponding decrease in gamma ray from 90 API to 55 API. |
| Lithology and shows | The Grid Formation consists of a sequence of loose sands with interbedded mudstone stringers.<br><br>The sand is predominantly colourless, transparent to translucent, very fine to fine with sub-rounded to sub-spherical grains.<br><br>Light to medium grey, non to slightly calcareous mudstones were found within the Grid.<br><br>No hydrocarbon shows were observed in the Grid sandstones. |

| | |
|---|---|
| Logging character | Logs indicate that the Grid Formation comprises two sandstone packages separated by a 5m thick mudstone unit.<br><br>The upper 17m displays a gamma of 55 API, density of 2.05 g/cc, neutron of 0.33 PU and sonic of 110 μsec/ft. The lower sand package shows a gamma of 70 API, density of 2.03 g/cc, neutron of 0.39 PU and sonic of 115 μsec/ft. Resistivity measurements are low in both sandstone units at between 0.3 and 0.4 ohm.ms. |
| Drilling characteristics | As per plan, rates of penetration were controlled to no more than 100 m/hr and averaged 80 m/hr.<br><br>On penetration of the Grid Formation, drilled gas decreased to approximately 0.15%, and was composed of $C_1$ with traces of $C_2$.<br><br>Mudweight was maintained at 1.31sg. |

## 2.3 ROGALAND GROUP (2075.2 - 2211.7 mBRT)

### 2.3.1 BALDER FORMATION (2075.2 - 2131.9 mBRT)

| | |
|---|---|
| Top | 2075.2 mBRT |
| Age | Early Eocene |
| Upper boundary pick | The Balder Formation is picked at a decrease in interval transit time which corresponds to a high gamma reading at the base of the Hordaland Group. |
| Lithology and shows | The Balder Formation consists of mudstones which become tuffaceous towards the base. Minor limestone stringers are recognised.<br><br>The mudstones are predominantly medium grey to light blue grey, occasionally red brown, rare purple grey, locally abundant, often crystalline pyrite.<br><br>Occasional limestone stringers were penetrated. The limestones are white to off white, firm to moderately hard and grades to dolomitic limestone in places. |
| Logging character | Gamma and sonic logs display the characteristic bell-shaped profiles of the Balder Formation.<br><br>Gamma log varies between 90 API and 135 API with the lower values associated with thin limestone stringers.<br><br>Resistivity measures less than 1.0 ohm.m, with density averaging 2.25 g/cc and average neutron porosity values of 0.45 PU recorded.<br><br>On penetration of the Balder Formation, sonic log values of 120 μsec/ft were recorded, these increased to 140 μsec/ft near the base. |
| Drilling characteristics | As per the drilling programme ROP was controlled to 20 m/hr on penetration of the top Balder Formation.<br><br>Due to the high overbalance employed to drill the 8 ½" section, drilled gas was less than 0.2% and composed of $C_1$ and $C_2$ with traces of $C_3$ recorded.<br><br>The Balder Formation was drilled with 1.31sg mud. |

## 2.3.2 SELE FORMATION (2131.9 – 2196.3 mBRT)

| | |
|---|---|
| Top | 2131.9 mBRT |
| Age | Late Palaeocene – Early Eocene |
| Upper boundary pick | The Sele Formation is picked at the sharp increase in interval transit time below the Balder Formation. |
| Lithology and shows | A sequence of mudstones with occasional limestone stringers.<br><br>In general, the mudstones are medium to medium dark grey, with rare traces of micropyrite. They are occasionally calcareous in places, becoming non calcareous with depth. Off white limestone stringers are present throughout. |
| Logging character | Gamma log averages 120 API for the top 80m of the Sele Formation. The lowermost 15m averages 150 API gamma, with sonic log values of 130 μsec/ft recorded in the top 35m which decrease to 120 μsec/ft 30m above the base.<br><br>Resistivity log measures less than 1.0 ohm.m, with values exceeding 1.0 ohm.m in the below 2170 mBRT.<br><br>Density log averages 2.25 g/cc and shows a slight increase over the bottom 15m. Average neutron porosity values of between 0.3 and 0.45 PU were recorded. |
| Drilling characteristics | Rates of penetration were held to 20 m/hr to aid core point selection.<br><br>Average drilled gas remained low at less than 0.3% with alkanes up to $C_3$ recorded.<br><br>Mudweight was maintained at 1.31sg. |

## 2.3.3 FORTIES FORMATION (2196.3 – 2245.3 mBRT)

| | |
|---|---|
| Top | 2196.3 mBRT |
| Age | Late Palaeocene |
| Upper boundary pick | The Forties Formation is picked at the change in lithology from mudstone to sandstone with a corresponding decrease in gamma ray and increase in interval velocity. |
| Lithology and shows | The Forties consists of thin sandstones interbedded with mudstones. The basal 23m of the Forties comprises mudstones.<br><br>The sandstones are predominantly made up of loose, colourless, very fine to fine grained quartz rarely cemented with silica.<br><br>The mudstones are medium dark grey to medium blue grey and non calcareous.<br><br>Shows were observed in drilled cuttings. In general they are bright, locally dull yellow to yellow brown fluorescence, fast to instant blooming to streaming bright yellow white cut fluorescence, dull yellow residual ring, no oil stain. |

| | |
|---|---|
| Logging character | Gamma log shows a decrease in values from the overlying Sele Formation. In general the sandstones have a value of 105 API, with the cleaner sandstones recording 90 API. Mudstone gamma ray is generally above 120 API.<br><br>Resistivity values are less than 2.0 ohm.ms suggesting the Forties Formation is not hydrocarbon bearing at the 16/4-3 well location.<br><br>Density/neutron confirms that the sandstones are poorly developed with no cross-over of the logs observed.<br><br>Sonic values vary between 100 μsec/ft and 120 μsec/ft with 130 μsec/ft recorded in the basal 5m. |
| Drilling characteristics | As per plan, rates of penetration were held at 20 m/hr looking for core point.<br><br>Drilled gas remained low at less than 0.2% with chromatographic breakdown recording traces of up to $nC_4$.<br><br>Mudweight was maintained at 1.31sg. |

### 2.3.4 LISTA FORMATION (2245.3 – 2277.2 mBRT)

| | |
|---|---|
| Top | 2245.3 mBRT |
| Age | Late Palaeocene |
| Upper boundary pick | The Lista Formation is picked at the sharp decrease in gamma values below the Forties Formation mudstones. |
| Lithology and shows | The Lista comprises mudstone with rare limestone stringers.<br><br>The mudstones are generally non to rarely calcareous, grey to grey green and silty in places.<br><br>Firm to moderately hard stringers of off white limestone were penetrated. |
| Logging character | Gamma log values are generally between 90 API and 100 API.<br><br>Resistivity measures less than 1.0 ohm.m, with density averaging 2.35 g/cc and average neutron porosity values of between 0.3 and 0.4 PU recorded.<br><br>Sonic values are approximately 115 μsec/ft. |
| Drilling characteristics | Rates of penetration were controlled to 20 m/hr.<br><br>Drilled gas remained low at less than 0.2% with alkanes up to $C_4$ recorded. An increase in drilled gas levels of up to 0.7% was recorded on drilling out of a thin limestone stringer at 2271 mBRT.<br><br>Mudweight was maintained at 1.31sg. |

### 2.3.5 MIDDLE HEIMDAL MEMBER (2277.2 – 2333.6 mBRT)

| | |
|---|---|
| Top | 2277.2 mBRT |
| Age | Late Palaeocene |
| Upper boundary pick | The Middle Heimdal Member was picked on the first occurrence of sandstone beneath the Lista Formation and corresponding decrease in gamma ray values. |
| Lithology and shows | Interbedded sequence of mudstone limestone and sandstones.<br><br>The mudstones are generally light to medium grey, firm and slightly silty and non calcareous.<br><br>White to off white, soft to firm limestones occur throughout.<br><br>A five meter thick sandstone unit was penetrated at the top of the Middle Heimdal Member. These sands are predominantly loose, colourless, predominantly fine grained quartz.<br><br>Shows were observed in moderately cemented sandstone cuttings. They are described as moderate bright yellow to yellow brown fluorescence, poor slow yellow to yellow white cut, slow blooming yellow to yellow white crush cut. |
| Logging character | The variable lithology penetrated in the Middle Heimdal is reflected in the responses of the wireline logs.<br><br>Gamma log shows values from 75 API to 135 API with resistivity remaining low at less than 1.0 ohm.m.<br><br>Sonic velocities are generally over 120 μsec/ft and reaches 140 μsec/ft in some of the mudstone units.<br><br>Density varies between 2.35 g/cc and 2.25 g/cc, with neutron remaining high at 0.40 PU. |
| Drilling characteristics | As there was no requirement for controlled drilling, rate of penetration was allowed to increase. Up to 114 m/hr was recorded in the Middle Heimdal with an average ROP of 45 m/hr<br><br>Drilled gas remained low at less than 0.4% with traces of $nC_4$ recorded.<br><br>Mudweight was maintained at 1.31sg. |

### 2.3.6 LOWER HEIMDAL MEMBER (2333.6 - 2411.7 mBRT)

| | |
|---|---|
| Top | 2333.6 mBRT |
| Age | Late Palaeocene |
| Upper boundary pick | The Lower Heimdal Member is picked on the first occurrence of sand below the overlying mudstone and limestones of the Middle Heimdal Member. |

| | |
|---|---|
| Lithology and shows | Predominantly sandstone with occasional limestones and mudstones.<br><br>The sandstones are primarily loose, off white to very pale brown, fine to rarely very fine and are weakly cemented. No shows were seen in the Lower Heimdal sandstones.<br><br>The limestones are white, soft to moderately hard with a mudstone texture.<br><br>Non calcareous mudstones were also penetrated. They are generally medium dark grey to medium green grey, firm and occasionally micromicaceous. |
| Logging character | In the sandstones and limestones the gamma log has values of 70 API, with the mudstones recording values of up to 135 API.<br><br>Sonic values are over 80 μsec/ft to 160 μsec/ft were recorded in the Lower Heimdal Member.<br><br>Resistivity measures less than 0.5 ohm.ms in the sandstones, with density averaging 2.15 g/cc to 2.25 g/cc. High densities are recorded at 2380 mBRT, these have been attributed to barite fallout from the mud system. Average neutron porosity values of between 0.33 PU and 0.21 PU were recorded. |
| Drilling characteristics | Rates of penetration of up to 110 m/hr were recorded in the Lower Heimdal. Average ROP was approximately 50 m/hr.<br><br>Maximum gas of 0.79% was recorded at 2361 mBRT, average drilled gas remained low at less than 0.5% with alkanes upto of $C_4$ recorded.<br><br>Mudweight was maintained at 1.31sg. |

## 2.4 SHETLAND GROUP (2411.7 – 2425.0 mBRT)

### 2.4.1 EKOFISK FORMATION (2411.7 - 2425.0 mBRT)

| | |
|---|---|
| Top | 2411.7 mBRT |
| Age | Early Palaeocene |
| Upper boundary pick | The Ekofisk Formation is picked on the change in lithology from the mudstones and sandstones to massive limestone. This corresponds to a decrease in gamma and increase in resistivity log values. |
| Lithology and shows | The Ekofisk Formation comprises white to off white crumbly to sub blocky limestone. |
| Logging character | Only gamma and resistivity logs were recorded in the Ekofisk. Gamma values are between 40 API and 60 API, reflecting the argillaceous nature of the formation.<br><br>Resistivity logs gradually increase from 0.6 ohm.ms to over 3.0 ohm.ms at 2425 mBRT. |
| Drilling characteristics | ROP decreased as the Ekofisk was penetrated.<br><br>Drilled gas was low at below 0.2%, with traces of $nC_4$ recorded in the upper part of the Ekofisk.<br><br>The interval was drilled with a mudweight of 1.31sg. |

# 3.0 PORE PRESSURE AND FRACTURE GRADIENT

## 3.1 INTRODUCTION

A pore pressure evaluation has been undertaken for the 16/4-3 well. DxC Exponent, realtime LWD, formation gases and hole conditions were reviewed to provide information on formation pressure variations while drilling. Post well analysis has been carried out using wireline logs and information acquired from pressure tests using MDT to refine the pore pressure estimation.

## 3.2 NORDLAND GROUP

A 9 7/8" pilot hole was drilled from seabed to 400 mBRT and a normal compaction trend was established using the DxC Exponent. Hole conditions were good and no evidence for hole instability were observed.

After opening the hole to 36" and 26", 20" casing was set at 396.4 mBRT and the BOPs installed. A 12 ¼" assembly was used to drill ahead with cuttings and gas circulated to surface. After drilling 3m of new formation a leak-off test was performed giving a value of 1.70sg with 1.03sg mud and 400psi applied surface pressure.

A 1.20sg water-based mud was used to drill the mudstones of the Nordland Group. Gas expulsion from the cuttings was suppressed due to the high overbalance with drilled gas averaging 0.5%. DxC Exponent, drilled gas, LWD resistivty and sonic and the lack of pressure cavings or tight hole suggests that the mudstones of the Nordland Group are normally pressured throughout.

As per programme, mudweight was increased to 1.22sg before the sands Utsira Formation were penetrated. Pore pressure evaluation techniques are not applicable in sandstones and no direct pressure measurements were taken.

The Nordland Group has a normal pore pressure of 1.03sg.

## 3.3 HORDALAND GROUP

The top of the Hordaland Group is corresponds to the base of the Utsira Formation. Drilled gas was variable through the Hordaland from 0.1% to a peak of 2.2% at 1100 mBRT, but was generally 0.5%. Due to a failure of the LWD string, no resistivity data was collected below 1210 mBRT. Sonic log and DxC Exponent both indicate a normal compaction trend. From 1300 mBRT mudweight had increased to 1.24sg and was maintained to section TD at 1700 mBRT.

A 9 5/8" casing was run and set at 1695.3 mBRT. After drilling 3m of new formation a leak-off test to 1.72sg was performed using 1.30sg mud and 1040psi applied surface pressure. The remainder of the Hordaland Group was drilled with 1.31sg mud in 8 ½" hole. Drilled gas remained low and logging responses plotted on a normal compaction trend.

No indications of abnormal pressure were observed in the Hordaland Group and pore pressure was estimated to remain at 1.03sg.

## 3.4 ROGALAND - SHETLAND GROUPS

Evaluation of the available data indicates that pore pressure remained 1.03sg through the Rogaland and Shetland Groups.

In accordance with the drilling programme, rates of penetration were controlled to allow adequate data transmission rates from the LWD tools for core point selection. This negates the use of DxC exponent as a tool for pore pressure estimation. MDT measurements in the sandstones of the Forties and Heimdal Formations indicated that these formations were normally pressured.

Mudweight was maintained at 1.31sg throughout.

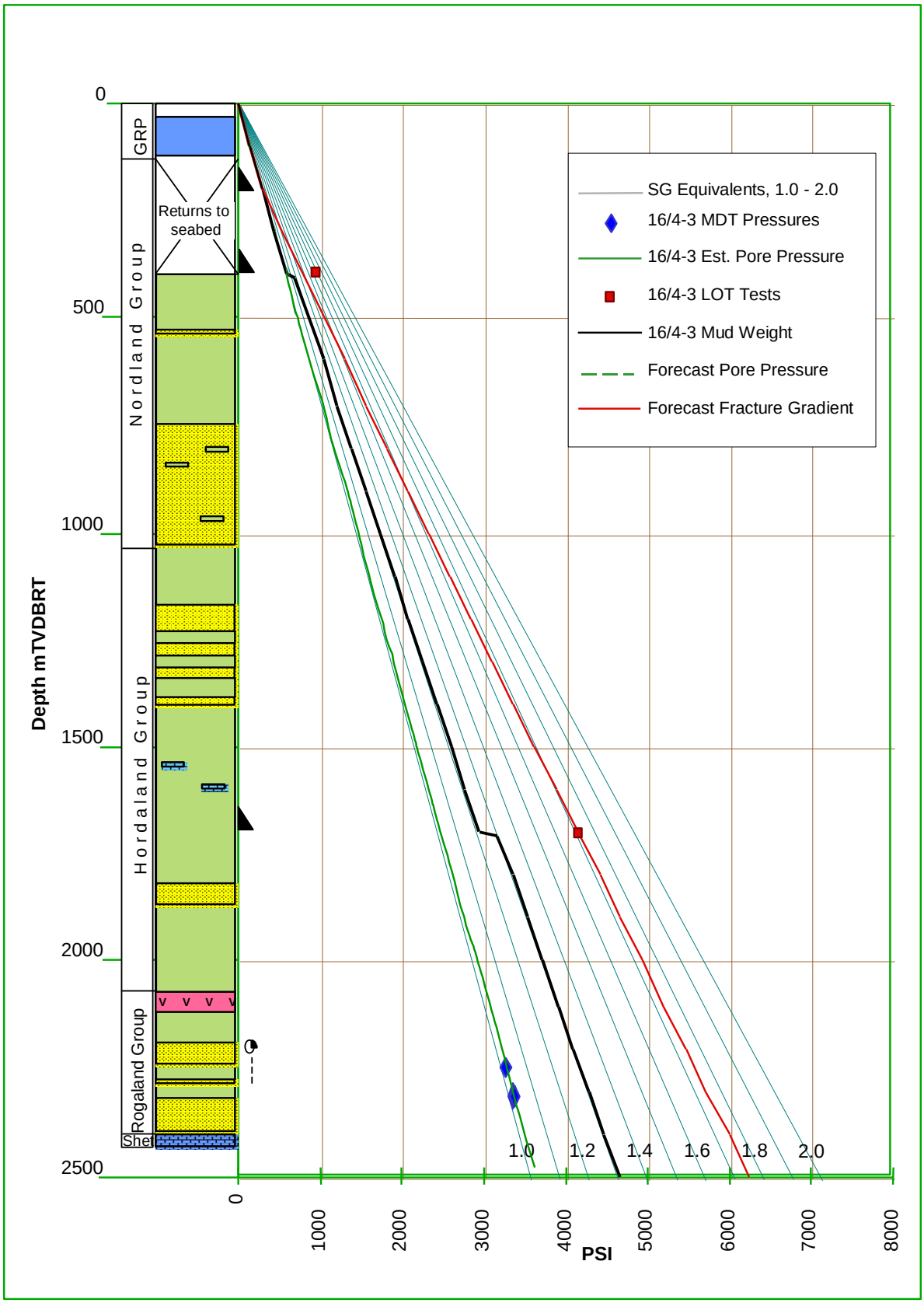


Figure 5: Formation Pressure Evaluation

# 4.0 FORMATION EVALUATION

## 4.1 WIRELINE LOGS RUN

| Run No. | Date | Tool String | Hole Size ins | Max Temp (°C) | Time since circ. (hrs:min) | Logged interval | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | mBRT | mBRT | |
| 1A1 | 19/12/00 | Pex / GR / HRLA / DSI / SP | 8 ½" | 80 | 12:45 | 2421.0 | 131.0 | ACTS head tension failed intermittently below 2190m. |
| 1B1 | 19/12/00 | MDT / GR | 8 ½" | 85 | 27:00 | 2354.0 | 2196.0 | Large diameter probe and packer used |
| 1C1 | 20/12/00 | CSAT / GR | 8 ½" | 88 | 32:23 | 2417.0 | 700.0 | |
| | | | | | | | | |

## 4.2 TD LOGGING, WIRELINE OPERATIONS SUMMARY

- No downtime
- Good hole conditions – no tool sticking
- Late change to MDT sampling programme lead to delay in running MDT tool

## 4.3 COMPARISION LOGGERS AND DRILLERS DEPTHS

| Casing | Driller's Depth mBRT | Logger's depth mBRT |
|---|---|---|
| | | |
| 30" Conductor | 203.9 | Not recorded |
| 20" Casing | 396.4 | Not recorded |
| 9 5/8" Casing | 1695.3 | 1696.0 |
| TD | 2425.0 | 2425.0 |
| | | |

## 4.4 TIME BREAKDOWN

| Run No. | Date | Tool String | Logged interval | | Opr. Time | Lost time |
|---|---|---|---|---|---|---|
| | | | mBRT | mBRT | (hrs:min) | (hrs:min) |
| 1A1 | 19/12/00 | Pex / GR / HRLA / DSI / SP | 2421.0 | 130.0 | 9:10 | 0:00 |
| 1B1 | 19/12/00 | MDT / GR | 2354.0 | 2196.0 | 11:20 | 0:00 |
| 1C1 | 20/12/00 | CSAT / GR | 2417.0 | 700.0 | 6:45 | 0:00 |
| | | | | | | |

## 4.5 LWD LOGS RUN

| Run No. | Tool String | Hole Size ins | Logged interval | | Remarks |
|---|---|---|---|---|---|
| | | | mBRT | mBRT | |
| | | | | | |
| 1 | MPR/GR | 9 7/8" | 130.0 | 400.0 | Realtime and memory MPR/GR data was collected in 9 7/8" pilot hole for shallow gas evaluation and casing point selection. As per the Data Acquisition Plan, ROP was held at 50 m/hr to allow the collection of 3 data points per metre of realtime data. Consequently data quality was very good. Downloaded memory data was also of good quality. |
| 2 | MPR/GR | 17 ½" | 400.0 | 403.0 | If the leak-off test at 403m was below 1.35sg then 17 ½" hole was to be drilled to 1100 mBRT where 13 3/8" casing would be set. To evaluate the gas zone from 466m to 582m and at 724m, LWD resistivity and gamma were included in the clean-out assembly. A good leak-off at the 20" shoe resulted in the 17 ½" bit being pulled to allow a 12 ¼" drilling assembly to be run. |
| 3 | MPR/GR/BAT | 12 ¼" | 403.0 | 1700.0 | There was a critical requirement to have working resistivity and gamma tools through the gas zones identified on the shallow survey. Rate of penetration was held to below 50 m/hr to facilitate the collection of good realtime data. Below the base Utsira, ROP was allowed to increase. However, due to the data recording capabilities of the BAT tool ROP was maintained at below 100 m/hr. Both realtime and memory MPR/GR failed at 1210 mBRT. As per programme there was no need to pull for a working LWD tool and drilling continued to section TD at 1700 mBRT. |
| 4 | MPR/GR/BAT | 8 ½" | 1700.0 | 2425.0 | Critical requirement to have working resistivity and gamma tools for core point selection. On drilling out of the 9 5/8" casing the MPR tool lost the attenuated (deep) resistivity signal. This was regained at 1750 mBRT. Between 1750 and 1803 mBRT the signal was recorded intermittently. Below 1803 mBRT the MPR/GR tool appeared to regain full functionality, consequently there was no need to pull for a new tool. |
| | | | | | |

# REFERENCES


| | |
|---|---|
| 16/4-3 Drilling Programme | BP Amoco Norge AS, September 2000 |
| 16/4-3 Data Acquisition Plan | BP Amoco Norge AS, August 2000 |
| Shallow Geoharzard Assessment | BP, September 2000 |
| Wellbore Stability Assessment For Well 16/4-3, Fluoritt, Norway | GeoScience Limited, August 2000 |
| N.O.C.S. Well 16/4-3 Biostratigraphy of the Interval 1140 – 2425m TD | Cornick, P. and Gregory, J., March 2001. |
| A Revised Cretaceous and Tertiary lithostratigraphic nomenclature for the Norwegian North Sea | NPD Bulletin No 5, Edited by Isaksen D. and Tonstad K., December 1989 |

# APPENDIX 1: FORECAST VERSUS ACTUAL

| Marker Horizon | Forecast | | | Actual | | |
|---|---|---|---|---|---|---|
| | Depth | Seismic | Error Bar | Depth | Checkshot | Error |
| | | TWT | | | TWT | |
| | mTVDSS | msec | m | mTVDSS | msec | m |
| | | | | | | |
| Nordland Group | 101.5 | 134.0 | +/- 0.5 | 102.00 | | +0.5 |
| Utsira Fm | 718.0 | 764.0 | +/- 12 | 715.49 | | -2.51 |
| Base Utsira Fm | 995.0 | 1082.0 | +/- 20 | 1002.43 | | +7.43 |
| | | | | | | |
| Hordaland Group | 995.0 | 1082.0 | +/- 20 | 1002.43 | | +7.43 |
| Skade Fm | 1105.0 | 1188.0 | +/- 50 | 1147.08 | | +42.08 |
| Base Skade Fm | 1360.0 | 1426.0 | +/ 40 | 1319.62 | | -40.38 |
| Grid Fm | 1805.0 | 1826.0 | +/ 40 | 1793.44 | 1815.0 | -11.56 |
| Base Grid Fm | 1865.0 | 1884.0 | +/- 40 | 1850.72 | 1857.0 | -14.28 |
| | | | | | | |
| Rogaland Group | 2044.0 | 2047.0 | +/- 25 | 2045.86 | 2038.0 | +1.86 |
| Balder Fm | 2044.0 | 2047.0 | +/- 25 | 2045.86 | 2038.0 | +1.86 |
| Sele Fm | 2082.0 | 2075.0 | +/- 25 | 2102.54 | 2084.0 | +20.54 |
| Forties Fm | 2140.0 | 2116.0 | +/- 25 | 2166.91 | 2137.0 | +26.91 |
| Lista Fm | 2221.0 | 2173.0 | +/- 25 | 2215.87 | 2173.0 | -5.13 |
| Middle Heimdal Mbr | 2253.0 | 2197.0 | +/- 40 | 2247.77 | 2198.0 | -5.23 |
| Lower Heimdal Mbr | 2313.0 | 2236.0 | +/- 30 | 2304.16 | 2233.0 | -8.84 |
| | | | | | | |
| Shetland Group | 2395.0 | 2286.0 | +/- 30 | 2382.24 | 2289.0 | -12.76 |
| Ekofisk Fm | 2395.0 | 2286.0 | +/- 30 | 2382.24 | 2289.0 | -12.76 |
| | | | | | | |

# APPENDIX 2: BIOSTRATIGRAPHY

| AGE | DEPTH |
|---|---|
| Early Miocene | 1140 – 1230 m |
| Late Oligocene | 1300 – 1390 m |
| Early Oligocene | 1410 – 1720 m |
| Late Eocene | 1730 – 1740 m |
| Middle Eocene | 1760 – 2000 m |
| Early Eocene | 2010 – 2173 m |
| Late Palaeocene | 2176 – 2398 m |
| Early Palaeocene | 2410 – 2425 m |

For a detailed breakdown of the biostratigraphy see report: Biostratigraphy of the Interval 1140 – 2425m TD; Cornick, P. and Gregory, J. March 2001.

# APPENDIX 3: WIRELINE OPERATIONS ACTIVITY SUMMARY

## Wireline Sequence of Events

| Run Number | Time/Date | Comments/Activities |
|---|---|---|
| **Run 1A1** | **19/12/00** | **Pex-SP-GR-HRLA-DSI** |
| | 09:00 | Hand rigfloor to Schlumberger |
| | 09:00 | Hold rig Floor safety meeting. |
| | 09:15 | Start rig up Pex-SP-GR-HRLA-DSI. |
| | 10:10 | Tools connected, function test same. Pulled string up to check Dipole transmitter cavities (OK) |
| | 10:30 | Install radioactive sources. |
| | 10:50 | RIH to 100m and activate heave compensation. |
| | 11:10 | Wait for rig crew to tie-back top drive hoses. |
| | 11:20 | RIH . |
| | 11:55 | At 1625m, prepare for down log. |
| | 12:00 | RIH (caliper closed) for downlog, DSI in monopole (lower dipole). Shoe recorded at 1697m. |
| | 12:50 | Stop downlog @ 2410. Pull up slowly while resetting files prior to uplog. Add 1m stretch correction to depth. |
| | 12:55 | RIH slowly to tag bottom. TD recorded at 2425 m. |
| | 13:00 | Pull up slowly from TD, open calipers and commence uplog. DSI in upper and lower dipole mode. Caliper reading 7.5" in open hole. CHT sensor giving erratic reading in places (sensor problem, NOT due to hole conditions). |
| | 14:15 | At shoe. Check caliper inside casing (reading 8.13" inside casing of ID 8.535"). |
| | 14:20 | Stop uplog @ 1635m. Close caliper. Apply depth correction (subtract 0.5m) to uplog. RIH for repeat section. |
| | 14:45 | Open caliper and start repeat section uplog from 2330m. DSI in upper and lower dipole mode. Apply correction to caliper calibration (add 0.4"). |
| | 15:05 | Finish repeat @ 2200m, close caliper and pull up to shoe. |
| | 15:20 | At shoe. Start uplog through casing for DSI and GR. |
| | 16:30 | DSI readings deteriorate to below acceptable level @ 860m, continue uplog through casing for GR at approx. 4000 ft/hr. |
| | 17:00 | Complete logging GR at 130m and POOH to surface. |
| | 17:15 | Tool at surface, remove sources and start rig down run 1a1. |
| | 18:25 | Rig down complete |
| | | |
| | | Total time run 1A1 = 9 hours 10 minutes |
| | | |
| **Run 1B1** | | **MDT-GR** |
| | 18:25 | Changed logging head to ECRD, while waiting on Oilphase MDT bottle preparation. |
| | 20:00 | Start rigging up. |
| | 21:15 | Tool string powered up, calibrations and surface check made. |
| | 21:30 | RIH to 75m and activate heave compensation. |
| | 21:45 | Continue to RIH. |
| | 22:20 | At 1675m just inside shoe. Wait for tool temperature and pressure to stabilize. |
| | 22:35 | Noticed winch slipping very slowly, checked winch and tightened brake |
| | 23:00 | RIH to 2270m |
| | 23:15 | Make correlation pass on depth, no depth correction. Move down to first pretest depth. |
| | 23:25 | On station at Pretest 1 2196 mMD Forties Fm. (23:31-23:58) Tight. |
| | 00:00 | On station at Pretest 2 2200.5 mMD Forties Fm. (00:03-00:15) Tight. |
| **1B1** | **20/12/00** | **MDT-GR (continued)** |
| | 00:16 | On station at Pretest 3 2206.5 mMD Forties Fm. (00:18-00:32) Tight. |
| | 00:35 | On station at Pretest 4 2211.5 mMD Forties Fm. (00:37-00:44) Tight. |

| Run Number | Time/Date | Comments/Activities |
|---|---|---|
| | 00:45 | On station at Pretest 5 2213.5 mMD Forties Fm. (00:47-00:54) Tight. |
| | 00:59 | On station at Pretest 6 2211.5 mMD Forties Fm. (01:00-01:02) This was done as a check for the tool, using probe 2 instead of probe 1 – same result, tight. |
| | 01:02 | On station at Pretest 7 2215.5 mMD Forties Fm. (01:03-01:08) Tight. |
| | 01:10 | On station at Pretest 8 2217.5 mMD Forties Fm. (01:12-01:17) Tight. |
| | 01:22 | On station at Pretest 9 2258.5 mMD Lista Fm. (01:25-01:29) Tight |
| | 01:30 | RIH to 2400m |
| | 01:40 | Make correlation pass, depth correction of +0.8m. RIH to 2400m and check correlation – OK. |
| | 02:01 | On station at Pretest 10 2282.5 mMD Middle Heimdal (02:06-02:12) Good test, mobility 1.4md. |
| | 02:17 | On station at Pretest 11 2281 mMD Middle Heimdal (02:21-02:23) Tight. |
| | 02:26 | On station at Pretest 12 2278 mMD Middle Heimdal (02:28-02:36) Tight. |
| | 02:42 | On station at Pretest 13 2342.5 mMD Lower Heimdal (02:45-02:50) Good test, mobility 1275.7md. |
| | 02:52 | On station at Pretest 11 2349 mMD Lower Heimdal (02:55-03:02) Good test, mobility 835.9md. |
| | 03:04 | On station at Pretest 11 2354 mMD Lower Heimdal (03:06-03:12) Good test, mobility 665.6md. |
| | 03:15 | POOH to surface with run 1B1 MDT-GR |
| | 04:20 | Tool at surface |
| | 04:30 | Start Rig down |
| | 05:45 | Rig down complete |
| | | |
| | | Total time run 1B1 = 11 hours 20 minutes |
| | | |
| **Run 1C1** | | **ZO-VSP-GR (depths refer to geophone depth)** |
| | 05:45 | Start Rigging up |
| | 06:30 | Power up tools and do surface checks. |
| | 06:50 | RIH, taking checkshots at 1037, 1414m and 2080m |
| | 08:25 | Start GR correlation log from 2350-2275m. 2m deep, to reference log (subtract 2m) |
| | 08:30 | RIH to 2421m |
| | 08:40 | Start shooting checkshots as per programme (see checkshot list) |
| | 11:00 | At 600m signal noise too great to continue. POOH |
| | 11:25 | At surface, start rig down |
| | 12:00 | Rig down complete. |
| | | |
| | | Total time run 1C1 = 6 hours 45 minutes |
| | | |
| | | Total time logging 27 hours15 minutes |
| | | |