FINAL WELL REPORT

2/7-28

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1. SUMMARY

1. GENERAL WELL DATA SUMMARY

WELL NUMBER:	2/7-28	
PROSPECT NAME:	Eldfisk Jurassic	
WELL TYPE:	Exploration	
LICENSE:	PL018	
OPERATOR:	Phillips Petroleum (Operator)	36.960%
COVENTURERS:	Norske Fina A/S	30.000%
	Norsk Agip A/S	13.040%
	Elf Aquitaine Norge A/S	7.594%
	Norsk Hydro Produksjon A/S	6.700%
	Total Norge A/S	3.547%
	Den Norske Stats Oljeselskap A/S	1.000%
	Elf Rep Norge A/S	0.456%
	Elf Rex Norge A/S	0.399%
	Confranord A/S	0.304%
LOCATION GEOGRAPHICAL:	Latitude 56 deg 22 min 52.1563 sec North Longitude 03 deg 14 min 19.2881 sec East	
LOCATION UTM:	Northing 6248666.67 Easting 514740.51	
RIG:	Mærsk Guardian	
RKB:	135 ft / 41.2 m	
WATER DEPTH:	234 ft / 71.3 m	
SPUD DATE:	8 March, 1992	
STATUS/DATE:	Dry well, permanently plugged and abandoned, 7 August, 1992	
TOTAL DEPTH:	12772 ft MD (3893.0 m) 12754 ft TVD (3887.5 m)	
FORMATION AT TD:	Zechstein, Upper Permian	
CASING DEPTH:	30"	at 718 ft (218.8 m) MD
	20"	at 1754 ft (534.6 m)
	13 3/8"	at 4904 ft (1494.8 m)
	11 3/4"	at 9220 ft (2810.3 m)
	9 7/8"	at 9305 ft (2836.2 m)
	8 3/8"	at 9907 ft (3019.7 m)
	7"	at 10930 ft (3331.5 m)

2. WELL SUMMARY

Exploration well 2/7-28 was drilled on the Eldfisk Jurassic Prospect, located in Production License 018. The prospect is within the Central Trough on the west side of the Feda Graben, Norwegian North Sea. With a targeted Upper Jurassic reservoir objective located below existing production at the Eldfisk Chalk Field, the well was positioned 1.8 kilometers west of the Eldfisk Alpha Platform (Figure 1). Well 2/7-28 was spud on March 8, 1992 and drilled using the Mærsk Guardian jack-up. The encountered reservoir objective Upper Jurassic Eldfisk Formation sandstone was thinner than expected displaying traces of hydrocarbons. After reaching the Upper Permian Zechstein Group, the well was permanently plugged and abandoned without testing on August 7, 1992.

Drilling to the Upper Paleocene section proceeded without major difficulty. The 11 3/4" liner was set higher than prognosed because of a combination of lost circulation in the Lower Paleocene Våle Formation and instability in the previously drilled uphole Tertiary section. A prognosed depleted chalk reservoir horizon necessitated setting 9 7/8" casing at the top of the Ekofisk Formation. Drilling progressed to 10008 ft (3050.4 m) with good shows encountered in the Ekofisk and Tor Formations and trace shows in the Hod Formation. This depth, below the depleted Eldfisk Field Chalk reservoir in the lower part of the Hod Formation, was the proposed setting depth for the 8 3/4" liner. While under-reaming before running the liner, an under-reamer arm was lost in the hole. The liner was set above the junk at 9907 ft (3019.7 m). A successful sidetrack hole was made below the liner. After drilling continued the bottom hole assembly twisted-off at 10043 ft (3061.1 m). The hole was sidetracked again and drilling continued to the base of the Lower Cretaceous where 7" liner was set.

The Upper Jurassic section, 10954-12457 ft (3338.8-3796.9 m), was drilled without difficulty. Two conventional cores were cut at driller depths 11202-11264 ft (3414.4-3433.3 m) and 11529-11547 ft (3514.1-3519.6 m), respectively. The first core recovered claystone and subordinate thin sandstone and the second core recovered an Eldfisk Formation conglomeratic sandstone overlying claystone. Wireline logs demonstrated the best developed sandstone was a 30 ft (9.1 m) zone from 11511-11541 ft (3508.6-3517.7 m) which was water wet.

Below the Upper Jurassic, a 138 ft (42.1 m) thick Triassic(?) section was drilled with a top at 12456 ft (3796.6 m). Below the Triassic(?), the Upper Permian Zechstein Group was encountered at 12594 ft (3838.7 m). After penetrating 178 ft (54.3 m) of Zechstein salt, the well reached a total depth of 12772 ft (3893.0 m), and was subsequently wireline logged, plugged, and abandoned. Figure 2 displays casing depths and a generalized stratigraphic summary.

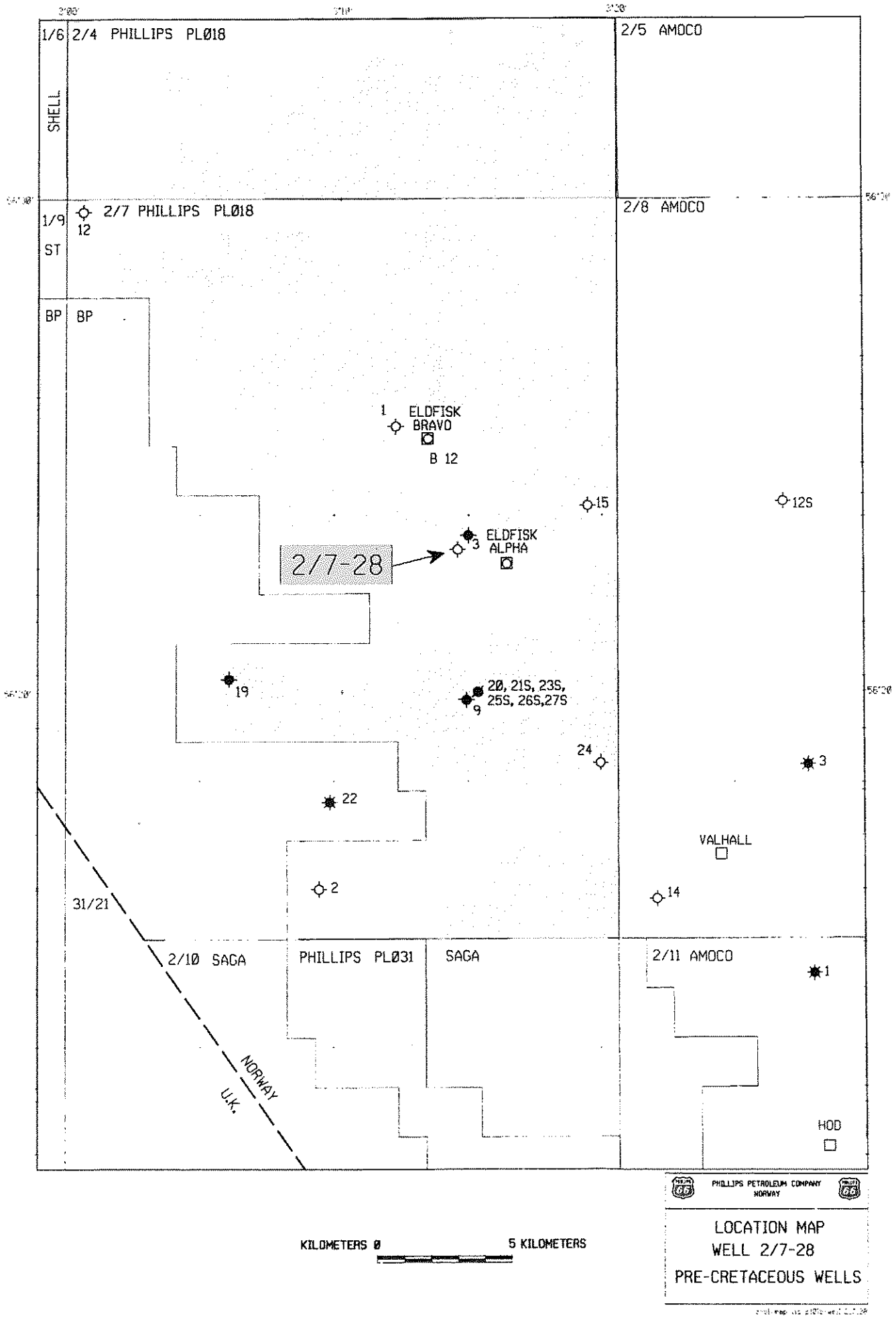
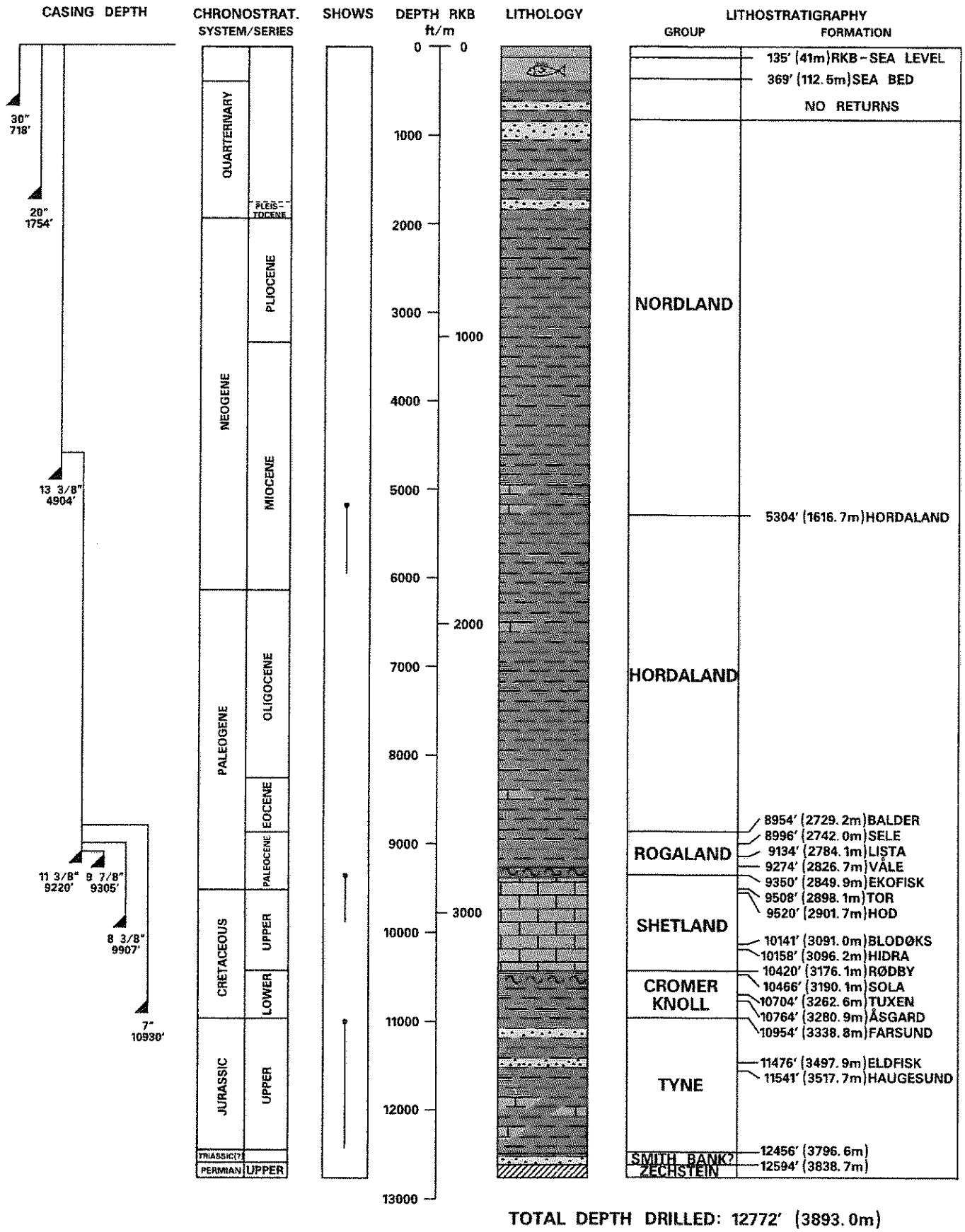

1/6 2/4 PHILLIPS PLØ18
2/5 AMOCO
SHELL
1/9 2/7 PHILLIPS PLØ18
12
ST
2/8 AMOCO
BP BP
1 ELDFISK
BRAVO
B 12
15
12S
ELDFISK
ALPHA
3
2/7-28
19
20, 21S, 23S,
25S, 26S,27S
9
24
3
22
VALHALL
2
14
31/21
2/10 SAGA
PHILLIPS PLØ31
SAGA
2/11 AMOCO
1
NORWAY
U.K.
HOD
KILOMETERS Ø
5 KILOMETERS
PHILLIPS PETROLEUM COMPANY
NORWAY
LOCATION MAP
WELL 2/7-28
PRE-CRETACEOUS WELLS

FIG. 1

WELL 2/7-28
SUMMARY LOG



TOTAL DEPTH DRILLED: 12772' (3893.0m)

ZB44/STRAT/WELL/2728gohm

FIG. 2

2. GEOLOGICAL SUMMARY

Figure

Table	Page No.

Attachment	Number

1. WELL OBJECTIVE / RESULTS

The primary reservoir objective of the prospect was Upper Jurassic Eldfisk Formation sandstone. The closest well control for the Eldfisk Formation is well 2/7-3, 600 meters northeast of the 2/7-28 location, comprising 97 net ft (29.6 m) of water-wet sandstone (40% volume shale, 5% porosity cutoff). The nearest seismically mappable event to the Eldfisk Formation is an Early Volgian reflector called the Intra Upper Jurassic Marker (IUJM). In well 2/7-3, the IUJM is located approximately 250 ft (76.2 m) above the Eldfisk Formation. The primary objective of well 2/7-28 was to drill updip of the mapped IUJM, updip of the water wet Eldfisk sandstone discovered in well 2/7-3.

In well 2/7-28, the top of the Upper Jurassic was represented by the Middle Volgian Farsund Formation at 10954 ft (2228.8 m). The stratigraphically younger Mandal Formation was not present in the wellbore probably due to a normal fault cutting the top of the Upper Jurassic section.

The mapped Early Volgian IUJM was encountered at 11835 ft (3470.2 m), 91 ft (27.7 m) above the Eldfisk Formation. The top of the Early Volgian Eldfisk Formation sandstone was at 11476 ft (3497.9 m), 486 ft (148.1 m) high to the water-wet 2/7-3 well. Wireline logs demonstrated the best developed sandstone was a 30 ft (9.1 m) zone from 11511-11541 ft (3508.6-3517.7 m). The upper part of this sandstone displayed up to 20% porosity but was water wet (20% hydrocarbon saturation). The lower part of the sandstone was tight.

Additional Upper Jurassic sandstones include a 10 ft (3.0 m) Middle to Early Volgian Farsund Formation argillaceous sandstone at 11022 ft (3359.5 m), with interpreted 50% wireline log oil saturation; and occasional thin bedded, Early Volgian Farsund Formation sandstones slightly above and below the IUJM which were occasionally porous but predominantly tight.

The lack of a significant volume of trapped hydrocarbons is interpreted to be due to a fracturing of the overlying Upper Jurassic/Lower Cretaceous claystone seal. The seal was probably fractured during inversion tectonics associated with the creation of the Lindesnes Ridge.

Two Upper Jurassic conventional cores were cut at driller depths 11202-11264 ft (3414.4-3433.3 m) and 11529-11547 ft (3514.1-3519.6 m), respectively. The first core recovered Farsund Formation claystone with subordinate sandstone, and the second core recovered basal Eldfisk Formation conglomeratic sandstone with traces of bleeding oil and gas, overlying Haugesund Formation claystone. Sedimentological core interpretation indicates the Eldfisk sandstone was deposited as a high density turbidite and/or a sandy debris flow. Although paleo-transport direction determination from the Formation Microscanner (FMS) was inconclusive, based on regional geology, the likely source area for the sandstone was from the Grensen Nose area to the southwest.

The basal Upper Jurassic section consisted of 'mid' Kimmeridgian claystone overlying unconformably a questionable age Triassic section drilled from 12456-12594 ft (3796.6-3838.7 m). The Triassic (?) section consisted of claystone with interbeds of anhydrite and sandstone. Upper Permian Zechstein Group salt was encountered from 12594-12772 ft (3838.7-3893.0 m) total depth.

Hydrocarbon source rocks occur in the Upper Jurassic Farsund and Haugesund Formations. These formations contain type II kerogen source rocks with a rich to very rich potential for generating hydrocarbons. The source rocks, currently in the oil mature window, have generated and expelled hydrocarbons in significant amounts. Migrated hydrocarbons are found in the Upper Cretaceous Shetland Group and in the Upper Jurassic Eldfisk Formation.

The final measured depth of the well, 12772 ft (3893.0 m), was similar to the final true vertical depth, 12754 ft (3887.5 m). The maximum hole deviation down to 9900 ft (3017.8 m) was 1 degree. The deviation increased to 5 degrees at approximately 11700 ft (3566.2 m), reaching a maximum deviation of 12 degrees at total depth.

2. REGIONAL / LOCAL STRUCTURE

The Eldfisk Jurassic Prospect is located in the Feda Graben on the western side of the Norwegian Central Trough. The objective Upper Jurassic Eldfisk Formation sandstone is interpreted as a high density turbidite/debris flow deposit located on the east side of the major northwest-southeast trending Skrubbe fault. The Skrubbe Fault was an eastward dipping normal fault during Upper Jurassic extensional tectonics. Clastic sediments were interpreted to be sourced from a structurally high area on the Grensen Nose to the southwest, transported across the fault, and deposited in the Feda Graben to the east. Total Upper Jurassic thickness values in the area vary from 0 ft on the Grensen Nose to greater than 5800 ft (1767.9 m) in the Feda Graben.

Structural inversion took place during the Late Cretaceous resulting in reverse movement along the Skrubbe Fault Zone. The inversion was a result of a complex regional compressional stress regime, the interpretation of which has been complicated by Zechstein salt related movements as shown by wells 2/7-28 and 2/7-3. The structural inversion created the Lindesnes Ridge, a north-northwest south-southeast anticlinorium, located parallel to, and east of the Skrubbe Fault. The Eldfisk Jurassic Prospect is part of the Lindesnes Ridge System with a bottom hole well location below the Eldfisk Upper Cretaceous Chalk Field. At the Eldfisk Jurassic Prospect, the inversion uplifted the seismically mapped Intra Upper Jurassic Marker Horizon (IUJM) and the slightly older Eldfisk Formation sandstone to a present day structural high position along the Lindesnes Ridge. The IUJM horizon has been seismically mapped as a northwest-southeast trending anticline, partially fault bounded to the southeast (Figure 3).

Seismic data over the Eldfisk area delineates two gas affected areas located to the north and south of the 2/7-28 location. Data quality in both of these areas is poor. Away from the gas affected areas the interpreted horizons have fair to good reflection quality except for the top Zechstein event which is difficult to interpret.

The top of the Upper Jurassic in well 2/7-28, the Farsund Formation, was 51 ft (15.5 m) high to prognosis, 293 ft (89.3 m) high to well 2/7-3. The Mandal Formation which is present in the nearby well 2/7-3, was absent in well 2/7-28 probably due to a westward dipping normal fault not previously interpreted on seismic data. The mapped IUJM horizon was 44 ft (13.4 m) low to prognosis. Reservoir objective Eldfisk Formation was encountered 124 ft (37.8 m) high to prognosis, 486 ft (148.1 m) high to well 2/7-3. As there is no seismic reflector to associate with the top Zechstein in the prospect area, this horizon came in 855 ft (260.6 m) high to prognosis, 1215 ft (370.3 m) high to well 2/7-3.

Structural data was acquired from the Formation Micro-Scanner (FMS) tool which was run across most of the Paleocene/Upper Cretaceous Shetland Group, the Upper Jurassic Tyne Group, and the Triassic(?) Smith Bank Formation. Processing of the Shetland Group interval has not been initiated at the time of compilation of the completion report. The structural interpretation of the Upper Jurassic interval delineates three separate zones with varying structural dip. The interval 10940-11320 ft (3334.6-3450.4 m) displays structural dip of 7-15 degrees, in an easterly direction, with dips increasing with depth. The second interval, 11320-11875 ft (3450.4-3619.5 m), displays dip scatter in the upper part and good dip continuity in the lower part. Structural dip in the interval is interpreted as 40-50 degrees in an east-northeasterly direction. This zone may represent a major tilted fault block. The third interval, 11875-12605 ft (3619.5-3842.1 m), displays high dip scatter due to very high occurrence of fractures, with a structural dip interpreted as approximately 15-20 degrees in an easterly direction.

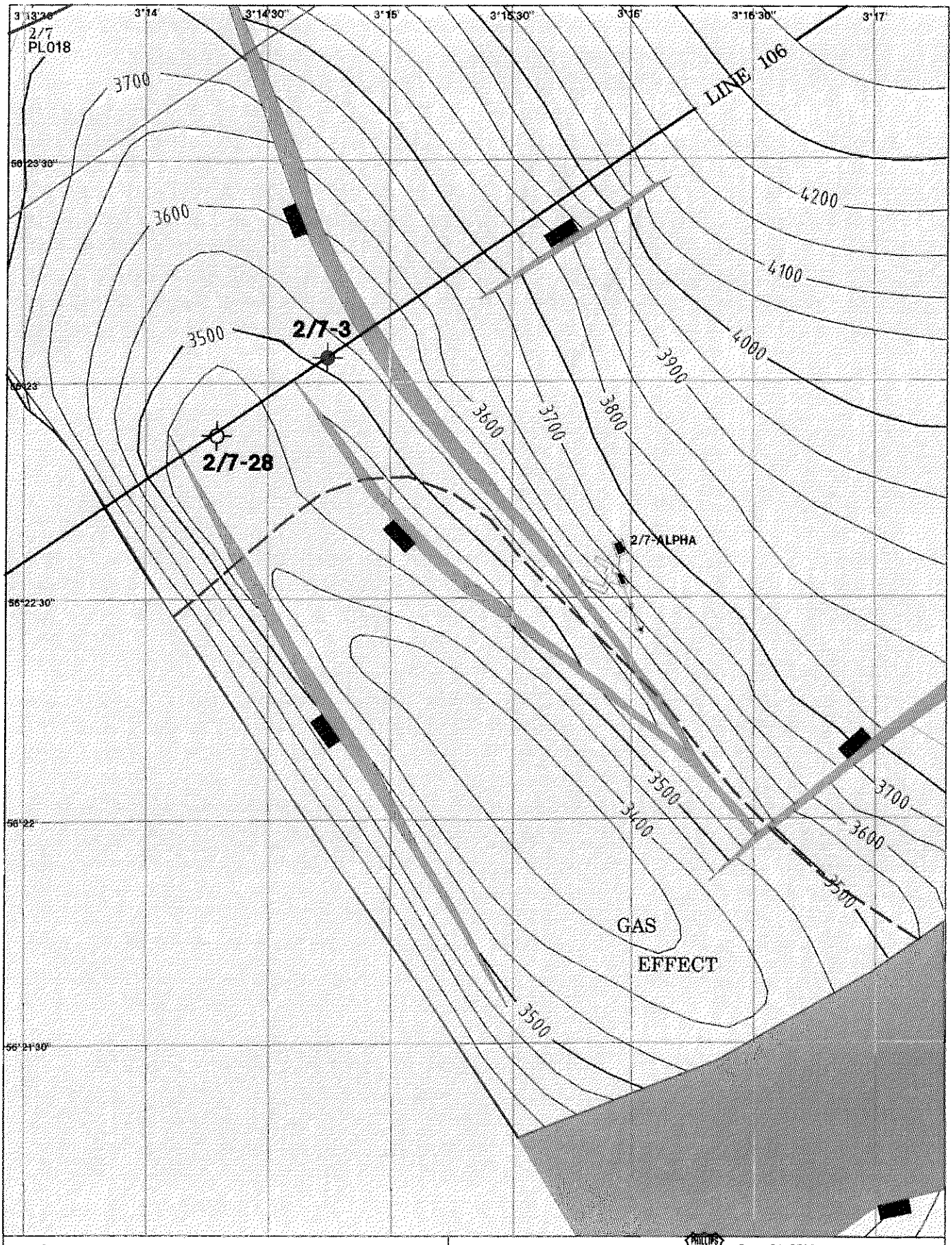


FIG. 3

KEY

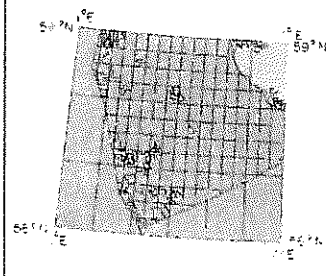
PLAY

REVERSED FAULT

NORMAL FAULT

DATA POOR DUE TO GAS EFFECT

0 0.5
KILOMETERS



PHILLIPS PETROLEUM COMPANY NORWAY

ELDFISK JURASSIC

INTRA UPPER JURASSIC MARKER

DEPTH STRUCTURE

Z981/MAP/LIC/PL018/BL2_7. BL27EMBL4

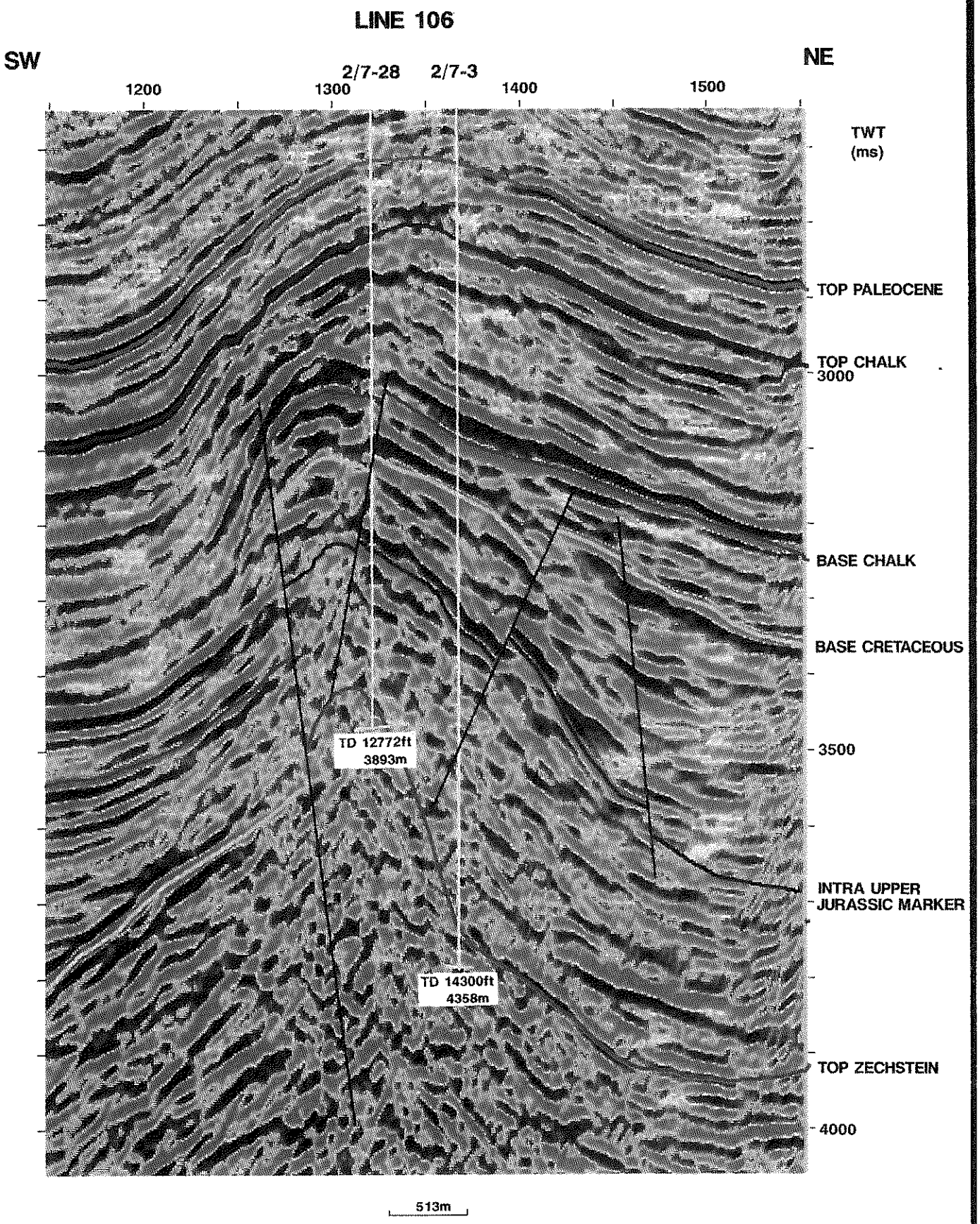

LINE 106
SW
NE
2/7-28
2/7-3
1200
1300
1400
1500
TWT
(ms)
TOP PALEOCENE
TOP CHALK
3000
BASE CHALK
BASE CRETACEOUS
3500
INTRA UPPER
JURASSIC MARKER
TOP ZECHSTEIN
4000
TD 12772ft
3893m
TD 14300ft
4358m
513m

FIG. 4

3. OPERATIONS SUMMARY

36" HOLE SECTION: 369-745 ft (112.5-227.1 m)

The well was spudded on March 8th, 1992.

The interval from 369 ft to 662 ft (112.5-201.8 m) was drilled with a 26" bit and a 36" hole opener, while the interval from 662 ft to 745 ft (201.8-227.1 m) was drilled as a 17.5" pilot hole and opened to 36". The section was drilled without riser or MWD. Tight hole problems and poor weather conditions caused the 30" conductor string to be retrieved three times before it was successfully landed at 718 ft (218.8 m) on the fourth attempt.

10 days were used for this section.

26" HOLE SECTION: 745-1780 ft (227.1-542.5 m)

A 26" bit was used to drill the cement, casing shoe and new formation before the hole was displaced to 9.5 ppg (1.14 g/cc) mud. The bit was then pulled to pick up a 12 1/4" assembly. This assembly was used to drill to 1780 ft (542.5 m). The 12 1/4" pilot hole was drilled in anticipation of possible shallow gas at 1250 ft (381 m) and 2013 ft (613.6 m). A 26" hole opener was used to open up the 12 1/4" pilot hole.

The anticipated shallow gas in this section was not encountered. Formation gas values ranged from traces to 3.5 units (0.07%) and averaged 0.5 to 2 units (0.01-0.04%)

The pilot hole was successfully logged with an Anadrill CDR memory tool providing gamma ray and resistivity data. No wireline logs were run in this section.

An initial attempt to run the 20" casing failed to pass 1060 ft (323 m) because of tight hole. The hole was reamed using a 26" bit before the casing was re-run without problems. The 20" casing shoe was set at 1754 ft (534.6 m).

A total of 6 days were used for this section.

17 1/2" SECTION: 1780-4925 ft (542.5-1501.1 m)

The BOP was installed and 10 ft (3 m) of new formation drilled before a leak off test (LOT) was performed. This yielded 15.0 ppg (1.8 g/cc) EMW.

The mud weight was increased progressively from 11.0 ppg (1.32 g/cc) at the start of the section to 13.0 ppg (1.56 g/cc) by the end.

The background gas generally ranged from 10 to 50 units (0.2-1%). A maximum peak of 232 units (4.6%) was recorded at 2209 ft (673.3 m). This shallow gas peak was anticipated.

Problems with gumbo plugging were encountered while drilling the lower part of the section from 4283 ft to section TD. Gumbo also caused problems while backreaming on a wiper trip before running the casing.

The section was logged while drilling with Anadrill's CDR memory tool providing gamma ray and resistivity data. No wireline logs were run.

The 13 3/8" casing was run and cemented at 4904 ft (1494.7 m).

A total of 9 days were used on this section.

14" HOLE SECTION: 4925-9305 ft (1501.1-2836.2 m)

This hole section was drilled with two 14" bi-centre bits in three runs to a depth of 9266 ft (2824.3 m). Two 12 1/4" bits were used to drill the rest of the section.

A (LOT) was performed after drilling to 4936 ft (1504.5 m). This yielded 16.8 ppg (2.02 g/cc) EMW with 12.9 ppg (1.55 g/cc) mud in the hole.

The section was drilled with a mud weight of 14.5 ppg. The weight was later reduced to 14.0 ppg after several attempts to stop the mud losses at 9285 ft (2830.1 m).

After setting the 11 3/4" liner at 9220 ft (2810.3 m) a mudweight of 13.2 ppg was used when drilling the cement plug and 1 ft of new formation.

The background gas level was in the range 10-30 units (0.2-0.6%) to 6250 ft (1905 m), reducing gradually to 5 units (0.1%) or less by 7000 ft (2133.6 m). The gas increased abruptly to 20-30 units (0.4-0.6%) below 7400 ft (2255.5 m), sometimes reaching over 50 units (1%). Connection gases were particularly evident between 6000 and 8200 ft (1828.8-2499.4 m) and a maximum connection gas of 200 units (4%) was recorded at 7982 ft (2432.9 m). A trip gas of 1250 units (25%) was recorded after changing the bit at 9119 ft (2779.5 m) and a short trip gas of 2178 units (43.6%) was recorded at 9266 ft (2824.7 m). Pump off gases were also recorded in this section, with a maximum of 147 units (2.94%) recorded at 8946 ft (2726.7 m).

Below 9264 ft (2823.7 m) lost circulation and the resulting reduction in hydrostatic head, caused high gas levels associated with oil shows. These oil shows were believed to have originated from the interval 5300-5400 ft (1615.4-1645.9 m). Oil content of the mud reached 6% and the gas reached a maximum of 4180 units (83.6%) with presence of C5 and heavier volatile hydrocarbons.

There were few drilling problems until 9264 ft (2823.7 m) although lost circulation of up to 50 bbls/hr (7.9 m^3/hr) was experienced between 8940 and 8975 ft (2724.9-2735.6 m; Hordaland Grp.-Balder Fm.). These losses were cured by circulating "liquid casing".

Severe lost circulation occurred between 9264 and 9285 ft (2823.7-2830 m; Lista Fm.-Våle Fm.). Frequent LCM pills were pumped in order to maintain circulation. At 9285 ft (2830 m) lost circulation was eventually cured with a calcium chloride/econolite and cement pill, and by reducing the mud weight to 14.0 ppg (1.68 g/cc). Wireline logs were run and another 13 ft (4 m) drilled. A further 6 ft (1.8 m), to 9304 ft (2835.9 m), was unintentionally drilled during reaming operations. The mud weight was reduced from 14.5 ppg (1.74 g/cc) to 14.3 ppg (1.72 g/cc) after this operation because of lost returns.

A 15" underreamer was run from 7863 ft to 9295 ft (2396.6-2833.1 m) with full returns. Circulation was lost while POOH, but was cured by pumping an LCM pill. The mudweight was 14.4 ppg (1.73 g/cc) during this operation. The hole started to pack off while running in to TD and tight hole was experienced when POOH again.

It was concluded that the hole had deteriorated considerably since drilling of the section began. A mudweight higher than 14.5 ppg (1.74 g/cc) would be needed when running a liner, and this would in turn lead to further losses at TD. Because of this the hole was plugged back to 9220 ft (2810.3 m) with the intention to set the 11 3/4" liner higher than prognosed. The mudweight was raised to 15.0 ppg (1.80 g/cc) after setting a cement plug. No losses were experienced. The hole was again underreamed to 15" from the 13 3/8" casing shoe to bottom at 9220 ft (2810.3 m). Several tight spots were encountered between 5385-5580 ft (1641.3-1700.8 m) and 8805-9150 ft (2683.8-2788.9 m). Abundant cavings were seen and the hole packed off while POOH. Tight hole sections were encountered on all wiper trips within the interval from 8000 ft (2438.4 m) to TD. Fill was commonly experienced when running back to bottom. This situation continued despite raising the mudweight to 15.6 ppg (1.87 g/cc). A high viscosity pill at this stage indicated, based on the volume pumped, an average hole size of 21". This caused problems cleaning the hole with the limited flow rate possible using the 15" underreamer. A 12 1/4" bit was run to enable a higher flow rate. The hole was swept with frequent high viscosity pills. It was then logged before the 11 3/4" liner was run.

A Teleco DPR MWD tool acquired gamma and dual resistivity data from 7920 to 9260 ft (2414-2822.5 m). The tool was removed from the string at 9266 ft (2824.3 m) to reduce chances of plugging when pumping LCM. The missing 25 ft (7.6 m) interval from this section was subsequently logged by Teleco after setting the 11 3/4" liner.

Schlumberger conducted three logging runs at 9285 ft (2830 m):

Run #1.1, DLL/MSFL/GR/SP. This suite of tools was run from 9281 ft (2828.8 m) WLM to 4904 ft (1494.7 m) WLM. The BHC was not included in this suite and run separately because of the hole conditions and the requirement to achieve the deepest possible readings for the MSFL and GR logs for correlation purposes at the top Våle Fm. No problems were encountered when running this suite.

Run #1.1, BHC/GR. The interval from 9285 ft (2830 m) WLM to 8700 ft (2651.8 m) WLM was logged. The Gamma ray log was run 350 ft (106.7 m) into the casing in order to allow overlay with the MWD log in the 17 1/2" hole.

Run #1.1, BGT/GR. This suite was logged from 9283 ft (2829.5 m) WLM to 4904 ft (1494.7 m) WLM with no problems.

No further open hole logs were run in this section. After interpreting the results from the logging operations it was decided to drill another 13 ft (4 m) before running the 11 3/4" liner.

The 11 3/4" liner was run without difficulties, and set on top of the cement plug at 9220 ft (2810.3 m). Two squeeze jobs were necessitated before the liner was successfully tested. The mud weight was reduced to 13.2 ppg (1.59 g/cc) before drilling out the 11 3/4" liner using a 10 5/8" bit. The cement plug from 9220 to 9304 ft (2810.3-2835.9 m) was drilled and the hole deepened to 9305 ft (2836.2 m). No mud losses were observed. The hole was opened to 13 1/2" and a 9 7/8" liner was run and set on bottom at 9305 ft (2836.2 m).

46 days were used on this section.

8 1/2" HOLE SECTION: 9305-10008 ft (2836.2-3050.4 m)

This section was drilled with an 8 1/2" diameter bit. The hole was later underreamed to 15" from 9350-9400 ft (2849.9-2865.1 m), 9450-9510 ft (2880.4-2898.6 m) and 9560-9610 ft (2913.9-2929.1 m). It was finally underreamed to 12 1/4" from 9320 to 10000 ft (2840.7-3048 m).

No formation integrity test (FIT) or leak off test was performed after drilling out the 9 7/8" liner shoe.

The pilot hole was drilled with a seawater/polymer mud with a weight of 8.7 ppg (1.04 g/cc). The mudweight was gradually increased to 11.8 ppg (1.42 g/cc) after reaching TD of the section. This was done to ensure safe tripping.

The background gas level was generally in the range 400-600 units (8-12%) except for the first 50 ft (15.2 m) where the gas was 10-20 units (0.2-0.4%). The gas level increased with depth and several peaks were recorded. A maximum drill gas of 1850 units (37%) was seen at 9795 ft (2985.5 m). A connection gas peak of 1951 units (39%) was observed at 9820 ft (2993.1 m). The maximum gas of 3790 units (75.8%) was recorded when pumping out of the hole after a wiper trip at section TD. No problems were encountered while drilling the pilot hole in this section.

A wiper trip was performed after reaching the proposed section TD at 10000 ft (3048 m). No drag or fill was encountered on this trip. When circulating bottoms up at TD a gas peak of 1837 units (36.7%) was recorded. The well started flowing and was shut in. The gas was circulated out and the pipe pumped out of hole to the 9 7/8" liner shoe. A maximum of 3790 units (75.8 %) of gas was recorded when circulating at this depth. The pipe was run to section TD again and the mudweight increased from 8.7 ppg to 9.2 ppg (1.04-1.10 g/cc) because of continuously high gas values. A new wiper trip was made to the 11 3/4" liner lap at 9072 ft (2765.1 m) where it was discovered that the well was flowing 4 BPH (0.6 m^3/h).

The bit was run to bottom and the mudweight increased in increments to 11.8 ppg (1.42 g/cc). The gas level and flow were reduced by doing this and it was possible to POOH. A 15" underreamer was RIH to open up the intervals that were thought to be tight. The intervals 9350-9400 ft (2849.9-2865.1 m) and 9560-9610 ft (2913.9-2929.1 m) were opened. When pulling back for a third interval the pipe became stuck at 9495 ft (2894.1 m). It was worked back to 9421 ft (2871.5 m) where an acid pill was pumped to free the string. Several hours were required to work the underreamer into the casing, and back on surface it was found to be missing one arm.

Two 8 1/2" junk mill runs were made, recovering a total of 56 lbs, mainly composed of damaged casing. An extra foot of formation was drilled during this operation, and therefore the new section TD is 10001 ft (3048.3 m).

Another 15" underreamer was run in an attempt to open the section from 9450 ft to 9507 ft (2880.4-2897.7 m). Circulation was lost completely and the mudweight was reduced to 10.5 ppg (1.26 g/cc) before POOH. Another 8 1/2" junk mill was run to 10001 ft (3048.3 m). The hole was stable while milling on junk. Only 1/2 lb of junk was retrieved, but the wear on the mill suggested that the underreamer arm was lying at an angle across the 8 1/2" hole at TD. A 12 1/4" underreamer was run but would not pass through the 9 7/8" liner at 9082 ft (2768.2 m). An 8 1/2" junk mill could not pass 9135 ft (2784.3 m) on the next run. When POOH with this mill the well started flowing at a rate of 1.75 BPH (0.3 m^3/h). The mill was run to TD and the mud weight increased to 10.7 ppg (1.28 g/cc). Another 8 1/2" junk mill run was made to 10001 ft (3048.3 m). A Teleco MWD/DPR tool was run together with this mill to obtain a GR/RES memory log over the interval 9305-10001 ft (2836.2-3048.3 m). A flow of 1.9 BPH (0.3 m^3/h) was observed when pulling out of hole, and the mudweight was increased to 11.8 ppg (1.42 g/cc) after running to TD. A slight flow was observed when flow checking at 9005 ft (2744.7 m).

The hole was then opened from 9305 ft to 10001 ft (2836.2-3048.3 m) using a 12 1/4" underreamer. The mudweight was reduced to 11.0 ppg (1.32 g/cc) before reaming began, as a loss of 30 BPH (4.8 m^3/h) was seen. Wear on the cutter arms indicated that another underreamer run would be needed.

To reduce the cutter arm at TD to small millable pieces, a charge of 10 lbs (4.5 kg) of explosives was applied on the end of 5" drillpipe. The following two junk mill runs recovered 20 lbs (9 kg) of junk and 7 ft (2.1 m) of new formation was drilled (10001-10008 ft/3048.3-3050.4 m). The junk consisted mainly of pieces from the bomb, but some pieces of casing were recovered. A run with a junk retriever recovered 10 lbs (4.5 kg) of junk from the 9 7/8" casing.

Since it seemed likely that the underreamer arm had been pushed into the side of the hole at or near TD, no further recovery attempts were made. A 12 1/4" underreamer assembly was made up and the hole opened up between 9320 ft and 9930 ft (2840.7-3026.7 m). During this operation the mud weight was reduced from 11.8 ppg (1.42 g/cc) to 11.0 ppg (1.32 g/cc).

The mudweight was increased again to 11.8 ppg (1.42 g/cc) when POOH. As the underreamer proved to be damaged, another was RIH and the interval reamed again. Back on surface the arms on this underreamer were found to be bent. A caliper log was run to decide the effectiveness of the underreaming operation. This provided an opportunity to run a FMS/GR log (Run #2.1). No further logs were run as the setting of the 8 3/8" liner was a priority at this point.

Teleco performed well on all four tool runs in this section. On the first run the tool failed at 9272 ft (2826.1 m -resistivity depth) because of damage to insulation and electrodes. This was believed to have occurred when the drill string was rotated inside at the base of the liner. Because there was no shoe, the end of the liner was suspected to be damaged and probably under gauge with sharp projections. The failure did not affect the GR log or telemetry, which continued to function to TD at 9295 ft (2833.1 m). A memory log was successfully recovered after the tool was at surface.

The third run was made with a GR MWD only tool with the intention to establish the tops of the Ekofisk and Hod Formations. The tool functioned well to a GR depth of 9810 ft (2990.1 m) where it failed. The failure was accompanied by a 150 psi (10.3 bars) pressure drop as the tool ceased to pulse signals. The tool failure caused only minor inconvenience, since the important formation top picks had already been made.

On the fourth run a 6 3/4" DPR tool was run in the 8 1/2" hole to obtain Gamma Ray/Resistivity data in memory mode from 9305 ft to 10001 ft (2836.2-3048.3 m). Although three 15" sections occurred in the hole, Teleco was only able to apply one borehole correction factor to the log at the wellsite (used 8 1/2"). Despite this, a reference to Teleco's chart indicated very little difference between the correction factors at low resistivities for boreholes of 8 1/2" and 13 1/2". It was believed that a correction for a 15" hole would probably also be close to these values. A gap in the log in the interval 9365-9380 ft (2854.5-2859 m) was not explained although a larger gap, 9759-9800 ft (2971.8-2987 m), was attributed to the tool reading zeros, caused by too slow a pump rate immediately after a connection. It took eight minutes to address the problem and alert the driller to stop and restart the pumps. With a logging speed of 400 ft/hr (122 m/hr) this represented 50 ft (15.2 m) of lost data.

Unable to supply slim hole tools for the next hole section, Teleco rigged down.

Because of the difficulties encountered when drilling this hole section, the open hole wireline logging programme was cancelled. The Teleco DPR MWD log replaced the planned wireline logs.

Due to the problems with the underreaming in this section, it was decided to run a caliper log to check the hole size before running the 8 3/8" casing. This provided the opportunity to run an FMS/GR (Run #2.1) log without additional runs and with minimal extra time involved. The tools were not run to bottom because of the junk near the bottom of the hole, and the caliper was closed well before entering the 9 7/8" liner due to damage at the liner bottom. The logging interval was thus from 9970 ft to 9333 ft WLM (3038.9-2844.7 m WLM). No problems were encountered during the logging operations.

The 8 3/8" liner was run and the shoe set at 9907 ft (3019.7 m) MD. A 9 7/8" tie back string was run. A total of 220 bbls (35 m^3) of mud were lost during cementing of the tie-back string.

A total of 34 days were used on this hole section.

7 3/8" HOLE SECTION: 9917-10950 ft (3022.7-3337.6 m)

The 8 3/8" casing set in the previous hole section and 15 ft (4.6 m) of rathole was cleaned out before a leak off test was performed. It had been decided to sidetrack around the junk at the bottom of the hole. Drilling in the rathole continued to 10006 ft (3049.8 m) before pulling out for the cement stinger. A kick off plug was set from 9857 ft to 10006 ft (3004.4-3049.8 m).

A LOT was performed at 9922 ft (3024.2 m) after cleaning out the casing. This yielded 14.5 ppg (1.74 g/cc) EMW with 12.0 ppg (1.44 g/cc) mud in the hole. A FIT was performed after dressing off the first kick-off plug to 9917 ft (3022.7 m). This yielded 17.0 ppg EMW (2.04 g/cc) with 12.0 ppg (1.44 g/cc) mud in the hole. After having drilled to 10028 ft (3056.5 m) another FIT was conducted. This yielded 14.3 ppg (1.72 g/cc) EMW with 12.1 ppg (1.45 g/cc) mud in the hole. A third FIT was performed at the shoe after having pulled back from 10038 ft (3059.6 m). This gave a value of 15.0 ppg (1.8 g/cc) without fracturing the formation. A 13.0 ppg (1.56 g/cc) mud was used.

After the kick-off at 9917 ft (3022.7 m) the inclination reached a maximum of 5.3 degrees with an azimuth of 230 degrees at 9993 ft (3045.9 m). The hole angle had dropped to 2.5 degrees with an azimuth of 147.2 degrees at section TD.

The section was drilled with a Thermadrill high temperature mud system with a weight of 13.0 - 14.0 ppg (1.56 - 1.68 g/cc).

The background gas was generally low from 10008 ft (3050.4 m) to 10060 ft (4480.6 m) with values ranging from 3 to 15 units (0.06-0.3%). At 10060 ft (3066.3 m) the gas increased and reached a maximum of 180 units (3.6%) at 10095 ft (3077 m). It remained high to 10220 ft (3115.1 m). The background gas then typically varied between 12 and 60 units (0.2-1.2%) for the remainder of the section. A maximum formation gas peak of 241 units (4.8%) was recorded at 10134 ft (3088.8 m). A maximum trip gas of 599 units (12%) was recorded after a trip at 10154 ft (3094.9 m). Connection gases in the order of 30-130 units (0.6-2.6%) were seen from 10773 ft (3283.6 m) to section TD.

A first attempt to sidetrack was made at 9917 ft (3022.7 m) with a 1.5 deg bent-sub and a mud motor. Approximately 5% of limestone in the samples at 10018 ft (3053.5 m), together with metal shards and excess torque, suggested the sidetrack had failed and that the bit had drilled into the junk. The hole was re-plugged with cement and dressed off again to 9917 ft (3022.7 m).

A successful sidetrack was performed using a 6" bit and a 2 deg bent-sub. Drilling halted at 9988 ft (3044.3 m) when the MWD gave an inclination of 2.9 deg at 9943 ft (3030.6 m) with a risk of a dogleg. The 6" hole was opened to 8 1/2" with an underreamer to a depth of 9977 ft (3041 m). The hole was displaced to 13.0 ppg (1.56 g/cc) mud before it was drilled to 10038 ft (3059.6 m) where the MWD-tool failed. This failure was probably caused by a "pump down" effect of the pulser where it turned itself off when reaming/washing down to bottom using a too high flow rate. It was not possible to re-set the tool and another 50 ft (15.2 m) were drilled before POOH. On surface the string was found to have parted and a 42.57 ft (12.9 m) fish was left down hole. The fish was retrieved using an overshot. Drilling of the 7 3/8" hole continued to 10043 ft (3061.1 m) where a new twist off occurred. Two unsuccessful attempts were made to retrieve the 6.47 ft (1.97 m) fish before cementing back to 9766 ft (2976.7 m).

The hole was sidetracked again at 9917 ft (3022.7 m) using a 6" bit, a 1.5 deg bent-sub and mud motor. The 6" hole was drilled to 10015 ft and underreamed to 8 1/2". When drilling ahead using a 7 3/8" assembly, a 300 psi (20.7 bars) pressure drop was recorded at 10154 ft (3094.9 m). On surface a total of 4 washouts were found in drill collar connections. In addition, the connection between the turbine motor and bearing sections was found to have partially backed out. No further problems were encountered when drilling to section TD at 10950 ft (3337.6 m). The section was underreamed to 9" in two runs.

After pulling out of the hole at 10154 ft (3094.9 m) on the sixth run, the inner probe insert in the MWD-tool was changed out as a precaution. The tool test failed and the pulser unit was replaced. A second test also failed and the probe was tested via a cable link. This test confirmed the probe was working, and the fault was isolated as a connection problem between the pulser and the probe. The bad connection was caused by wear attributed to excessive vibration.

On the last run in this section severe interference from pressure pulses created inside the drill string caused the pulses from the MWD-tool to be decoded incorrectly. This run was performed using a turbine. The result of these problems was a log with large data gaps and the remaining data of uncertain quality. The bottom 300 ft (91.4 m) of the section was re-logged on a wiper trip. The pulsed signals were clearly received at surface, but no GR data was transmitted. This fault was caused by mud invasion into the GR sensor.

Schlumberger performed 2 logging runs in this interval separated by the underreaming of the section:

Run #3.2, DLL/MSFL/SDT/GR. The logged interval was from 10955 ft 9915 ft WLM (3339.1 - 3022.1 m WLM). The caliper was closed and the MSFL abandoned at 10505 ft (3201.9 m) WLM because of overpull.

Run #3.1, LDL/CNL/GR. This combination could not reach section TD, and the log was commenced from 10920 ft (3328.4 m). The caliper log on the LDL was used to check the hole before running the 7" liner.

The 7" liner was run to 10935 ft (3333 m) where it encountered an obstruction. The liner was then pulled back and set at 10930 ft (3331.4 m) with the liner lap at 8839 ft (2694.1 m).

A total of 25 days were used to complete this hole section.

6 1/2" HOLE SECTION: 10950-12772 ft (3337.6-3892.9 m)

This section was drilled using four runs with 5 7/8" bi-center bits cutting a 6 1/2" hole. Two cores were also cut in this section.

An FIT was performed after cleaning out the rat hole and having drilled 10 ft (3 m) of new formation. This achieved the required integrity of 17.5 ppg (2.10 g/cc) EMW using a mudweight of 14.0 ppg (1.68 g/cc).

The hole angle increased from 2.5 deg with an azimuth of 139.1 deg in the beginning of the section to a maximum of 12.0 deg with an azimuth of 260.0 deg at 12772 ft (3893 m).

Thermadrill mud was used throughout this section. Before commencing drilling the mud weight was increased from 14.0 ppg (1.68 g/cc) to 16.5 ppg (1.98 g/cc). This was further increased to 16.9 ppg (2.03 g/cc) at 11524 ft (3512.5 m) to counteract an increase in pore pressure.

The background gas in this section generally varied between 30 and 110 units (0.6-2.2%). A maximum formation gas peak of 450 units (9%) was recorded at 12294 ft (3747.2 m). Connection gases were seen throughout the section varying between 10 and 436 units (0.2-8.7%). A wiper trip gas of 1010 units (20.2%) and a trip gas of 505 units (10.1%) were both recorded from 11524 ft (3512.5 m).

The section was drilled with no operational problems to 11202 ft (3414.4 m). A decision to cut a conventional core was then made based on good MWD gamma ray correlation and a fair mudlog gas correlation to the top of the thin 15 ft (4.6 m) sandstone which tested oil in well 2/7-3. Core #1 was cut from 11202 ft to 11264 ft (3414.4-3433.3 m) with a recovery of 97%. The core was predominantly claystone with thin interbeds of sandstone. Drilling recommenced and the hole was drilled to 11514 ft (3509.5 m) where a drill break occurred. The samples proved to be sandstone, and another 10 ft (3 m) was drilled before it was decided to POOH to core again. The well started flowing when observing at the 7" liner shoe, and the bit was run in to bottom. The mudweight was increased to 16.7 ppg (2.00 g/cc) at this point. The mudweight had to be further increased to 16.9 ppg (2.03 g/cc) after another short trip to the 7" shoe where the well started flowing again.

Core #2 was nominally cut from 11524 ft to 11547 (3512.5-3519.6 m), but coring parameters indicated that the top 5 ft (1.5 m) had been washed away and that the top of the core thus was at 11529 ft (3514.1 m). The core recovery of 18 ft (5.5 m) appeared to represent 100% of what was really cored, and the core was marked accordingly. The depth shift using the core gamma supports this depth theory.

Drilling recommenced and the hole was drilled to 12332 ft (3758.8 m) where a MWD-failure necessitated a trip. The well was finally drilled to TD at 12772 ft (3892.9 m). This depth was reached on the 28th July, 1992. The mudweight was increased to 17.0 ppg (2.04 g/cc) after reaching TD.

The Smith MWD-tool failed on the third bit run at 11985 ft (3653 m). Recovery of the tool revealed a damaged battery module, attributed by Smith to high vibration.

On the fourth run the MWD-tool failed at 12396 ft (3778.3 m) with the pulsation-sub stuck in "on" mode. After drilling to 12427 ft (3787.7 m) a survey was obtained. This restarted the tool and the interval from 12396 ft to 12427 ft (3778.3-3787.7 m) was re-logged. The tool stopped working again at 12427 ft (3787.7 m). No further data were obtained until the interval 12470-12590 ft (3800.9-3837.4 m), but the data were of poor quality. Smith said this was caused by excessive vibration. No GR log was therefore obtained from 12470 ft (3800.9 m) to TD at 12772 ft (3892.9 m).

Schlumberger performed 6 logging runs in this hole section. Hole quality was generally good, except for being unable to log to TD because of the salt flow bridging the hole:

Run #4.3, DLL/MSFL/GR. These tools where run without problems over the interval 12632 ft-10939 ft (3850.2-3334.2 m) WLM.

Run #4.2, LDL/CNL/NGL. This combination was run from 12624 ft to 10939 ft (3847.8-3334.2 m) WLM. The NGL failed intermittently in the intervals 11920-11760 ft WLM and 11490-10939 ft WLM (3633.2-3584.4 m and 3502.2-3334.2 m WLM).

Run #4.3, SDT/GR. The sonic log failed after only 70 ft (21.3 m) of the main log. A down log had been recorded and was used to create a reasonable DT-curve. The tool was not re-run.

Run #4.2, FMS/GR. A full log was obtained over the interval 12596-10939 ft (3839.3-3334.2 m) WLM, although equipment problems were encountered with the FMS. The azimuth readings were 180 degrees different to the MWD, but Schlumberger managed to extract correct azimuth readings from the RELATIVE BEARING data.

Run #4.1 and #4.2, VSP. The VSP survey was performed without problems and was split into Open Hole (12600-3600 ft/3840.5-1097.3 m WLM) and Cased Hole (10850-3600 ft/3307.1-1097.3 m WLM) surveys because of the use of different geophones.

Run #4.1, CST. Equipment problems were experienced during this run as the GR failed. No backup GR was available and SP for correlation was used instead. A total of 59 shots were taken, of which 23 were recovered (39%), 32 lost and 4 empty.

A total of 17 days were used on this hole section.

With no hydrocarbon reservoirs encountered, the well was permanently plugged and abandoned. This work was completed 5th August, 1992. The rig left the location 7th August, 1992.

4. BIOSTRATIGRAPHY

The biostratigraphical evaluation using ditch cuttings, sidewall and conventional cores was performed by Geostrat Biostratigraphic Consultants, United Kingdom. Samples were analyzed over the interval 1840-12730 ft (560.8-3880.2 m).

The type and number of analyses carried out are listed below:

Lithology : 199 ditch cutting samples, 18 sidewall cores, and 10 conventional core piece samples over the entire interval.

Micropaleontology : 158 ditch cutting samples and 4 conventional core samples over the intervals 1840-9340 ft (560.8-2846.9 m) and 10420-12470 ft (3176.1-3800.0 m).

Palynology : 80 ditch cutting samples, 17 sidewall cores, and 7 conventional core samples over the interval 10420-12730 (3176.1-3880.2 m).

Nannofossils : 35 ditch cutting samples over the interval 9370-10390 ft (2856.0-3166.9 m).

Samples were analyzed at an average interval of 90 ft (27.4 m) for the Tertiary and 30 ft (9.1 m) for the Late Cretaceous, Early Cretaceous, and Late Jurassic.

Ages and depths noted on the Chronostratigraphic Succession (Section 5) are based on Geostrat evaluation.

5. CHRONOSTRATIGRAPHIC SUCCESSION

AGE		Depth (RKB) Feet	Meters	
Pleistocene (top not seen)		1840	560.8	
Late Pliocene		1930	588.3	
Early Pliocene		2650	807.7	
Late Miocene		3370	1027.2	
Middle Miocene		4960	1511.8	
Early Miocene		5500	1676.4	
Late Oligocene		6130	1868.4	
Early Oligocene		7930	2417.1	
---------- unconformity ----------				
Middle Eocene		8248	2514.0	*
Early Eocene		8920	2718.8	
Late Paleocene		8954	2729.2	*
Early Paleocene		9340	2846.9	
Late Cretaceous	Late Maastrichtian	9508	2898.1	*
---------- unconformity ----------				
	Campanian	9520	2901.7	
	Late Santonian	9580	2920.0	
	Late Coniacian-Early Santonian	9670	2947.5	
	Late Turonian-Early Coniacian	9970	3038.9	
	Late Turonian	10040	3060.2	
	Early-Mid Turonian	10060	3066.3	
	Early-Late Cenomanian	10158	3096.2	*
Early Cretaceous	Late Albian	10420	3176.1	*
	Middle Albian	10466	3190.1	*
	?Late Aptian-Early Albian	10628	3239.5	*
---------- unconformity ----------				
	Early Aptian	10681	3255.6	*
---------- unconformity ----------				

AGE		Depth (RKB)	
	?Hauterivian-Early Barremian	10732	3271.2 *
	Late Valanginian-Early Hauterivian	10840	3304.1
	Early Valanginian	10931	3331.8 *
	unconformity		
Late Jurassic	Middle Volgian	10954	3338.8 *
	Early Volgian	11027	3361.1
	'late' Kimmeridgian	11600	3535.7
	'mid' Kimmeridgian	12445	3793.3 *
	unconformity		
Triassic		12456	3796.6 * **
	unconformity		
Late Permian		12594 - TD	3838.7 * **

Note: * refers to wireline depth.

** Triassic and Late Permian based on logs and lithology only.

6. LITHOSTRATIGRAPHIC SUCCESSION

RKB 135 ft / 41.1 m

UNIT	MD ft	MD m	TVD SS ft	TVD SS m	TWT sec.
NORDLAND GROUP	369	112.5	234	71.3	
HORDALAND GROUP	5304	1616.7	5169	1575.5	1.588
ROGALAND GROUP					
Balder Formation	8954	2729.2	8819	2688.1	2.714
Sele Formation	8996	2742.0	8861	2700.9	
Lista Formation	9134	2784.1	8999	2742.9	
Våle Formation	9274	2826.7	9138	2785.3	
SHETLAND GROUP					
Ekofisk Formation	9350	2849.9	9214	2808.5	2.815
Tor Formation	9508	2898.1	9372	2856.6	
Hod Formation	9520	2901.7	9384	2860.3	
Blodøks Formation	10141	3091.0	10005	3049.6	
Hidra Formation	10158	3096.2	10022	3054.7	
CROMER KNOLL GROUP					
Rødby Formation	10420	3176.1	10284	3134.6	3.001
Sola Formation	10466	3190.1	10330	3148.6	
Tuxen Formation	10704	3262.6	10567	3220.9	
Åsgard Formation	10764	3280.9	10627	3239.1	
TYNE GROUP					
Farsund Formation	10954	3338.8	10817	3297.1	3.108
Eldfisk Formation	11476	3497.9	11339	3456.2	
Haugesund Formation	11541	3517.7	11403	3475.7	
SMITH BANK ?	12456	3796.6	12310	3752.1	3.430
ZECHSTEIN GROUP	12594	3838.7	12445	3793.3	3.452
TOTAL DEPTH (1) (Driller, Zechstein)	12772	3893.0	12619	3846.3	

Note: (1) No TWT at driller TD. Deepest wireline log 12647 ft (3854.9 m).

7. LITHOSTRATIGRAPHIC UNITS

The results presented are based on the analysis of ditch cuttings, selected core pieces, sidewall cores, and wireline logs. Actual tops are from wireline measured depths. Lithostratigraphic terminology is from Isaksen and Tonstad (1989) and Vollset and Dore (1984).

NORDLAND GROUP: 369-5304 ft (112.5-1616.7 m). First sample returns at 735 ft (224.0 m).

Thickness: 4935 ft (1504.2 m).

Age: Middle Miocene to Present.

Description and Lithology: The Nordland Group in this well consists of a thick sequence of clay, claystone, and sand, with subordinate limestone, boulders, carbonaceous material, and shell fragments. From the slow and erratic (drilling) rate of penetration, occasional boulder beds are inferred in the approximate interval 385-670 ft (117.4-204.2 m).

The interval 735-1910 ft (224.0-582.2 m) consists of interbedded clay and sand. Clay beds are olive grey, medium grey, soft, sticky, sandy, carbonaceous, and non to slightly calcareous. Sand beds are clear quartz, very fine-coarse, predominantly very fine-fine, subround, and carbonaceous.

The interval 1910-5304 ft (582.2-1616.7 m) is predominantly clay and claystone with occasional interbeds of sand and carbonaceous material and, near the base of the section, limestone stringers. The clay and claystone are medium grey, dark grey, becoming olive grey at 3500 ft (1066.8 m), soft, silty, sandy, carbonaceous, fossiliferous, non to slightly calcareous. The sand is clear quartz, very fine-medium, and subrounded. Limestone stringers are white, firm-hard, micritic, and argillaceous.

Hydrocarbon Shows: Local, trace oil shows indicated by dull grey to gold fluorescence and slow, yellow streaming cut fluorescence were observed from claystones at 4950 ft (1508.8 m) to the base of the Nordland Group.

Depositional Environment: The upper part of the Nordland Group consists of stacked periglacial to glacio-marine sands interbedded with normal marine clay. From 1840 ft (560.8), where biostratigraphical sampling began, to 3370 ft (1027.2 m) calcareous benthonic foraminifera indicated a marine, inner shelf environment. The interval from 3370 ft (1027.2 m) to the base of the Nordland Group represents a marine, outer to mid shelf environment as indicated by abundant and diverse microfaunas consisting of calcareous benthonic, planktonic, and agglutinating foraminifera.

HORDALAND GROUP: 5304-8954 ft (1616.7-2729.2 m).

Thickness: 3650 ft (1112.5 m).

Age: Early Eocene to Middle Miocene.

Description and Lithology: The top of the Hordaland Group is marked by a downhole decrease of the gamma ray and an increase in the resistivity curve. The predominant lithology is claystone, olive grey, yellow brown, firm, blocky, silty, generally non-calcareous, locally micaceous and pyritic. Limestone stringers are usually yellow brown, occasionally light grey, pale orange, and off-white, soft to firm, crypto-microcrystalline.

Hydrocarbon Shows: Good oil shows occurred near the top of the Hordaland Group claystone from 5380-5425 ft (1639.8-1653.6 m): dull grey green fluorescence, slow-fast bright yellow-white steaming cut fluorescence, gold-amber visible residual, and locally a strong oil smell. Trace oil shows occurred throughout much of the interval from 5304-6400 ft (1616.7-1950.7 m). The shows were from claystones: yellowish to green fluorescence, slow streaming yellow cut fluorescence, and pale straw visible residual ring.

Depositional Environment: A marine, outer shelf to upper bathyal environment with dysaerobic sea floor conditions is interpreted. Diverse and abundant agglutinating foraminifera dominate the microfaunas, with subordinate calcareous benthonic foraminifera, and in the lower part of the section, subordinate planktonic foraminifera and radiolaria.

ROGALAND GROUP: 8954-9350 ft (2729.2-2849.9 m).

Thickness: 396 ft (120.7 m).

Age: Early to Late Paleocene.

This group is represented by the Balder, Sele, Lista, and Vâle Formations:

Balder Formation: 8954-8996 ft (2729.2-2742.0 m).

Thickness: 42 ft (12.8 m).

Age: Late Paleocene.

Description and Lithology: The top of the Balder Formation is marked by a characteristic downhole increase in resistivity and decrease in gamma ray readings. Lithologically, the Balder is predominantly claystone, varicolored, grey to dark grey, olive-grey, green-grey, purplish-grey, blue-grey, firm, blocky, and non-calcareous. Interbedded with the claystone are traces of tuffaceous claystone, speckled, medium grey, blue-grey, green, cream, firm, non-calcareous, locally pyritic, crumbly.

Hydrocarbon Shows: Poor oil show were encountered in the lower part of the formation. They consisted of bright gold-yellow fluorescence, slow gold-yellow cut fluorescence, and pale straw visible residual ring.

Sele Formation: 8996-9134 ft (2742.0-2784.1 m).

Thickness: 138 ft (42.1 m).

Age: Late Paleocene.

Description and Lithology: The top of the Sele Formation is marked by a sharp downhole increase in gamma ray and a decrease in resistivity readings. Lithologies are dominated by claystone, olive-grey, dark grey green, dark grey, and brown black, firm, non-calcareous, locally greasy, pyritic.

Hydrocarbon Shows: None.

Lista Formation: 9134-9274 ft (2784.1-2826.7 m).

Thickness: 140 ft (42.7 m).

Age: Late Paleocene.

Description and Lithology: The top of the Lista Formation is noted by a downhole decrease in gamma ray (approximately 15 API units) and resistivity readings. Lithologies are dominated by claystone, dominantly light grey, occasionally greenish-grey, brownish-grey, dark grey, firm, subfissile, and non-calcareous. The claystone becomes reddish-grey toward the base.

Hydrocarbon Shows: None.

Våle Formation: 9274-9350 ft (2826.7-2849.9 m).

Thickness: 76 ft (23.2 m).

Age: Early Paleocene.

Description and Lithology: The top Våle Formation is based upon a decrease in gamma ray and a corresponding increase in resistivity values. Because of hole problems, approximately 20 ft (6.1 m) of section was not wireline logged near the upper part of the formation. The lithology is predominantly marl, light grey, off-white, soft, crumbly, very calcareous, locally argillaceous, grading to claystone in the upper part of the Våle, varicolored, soft to firm, non to slightly calcareous.

Hydrocarbon Shows: None.

Depositional Environment: The Rogaland Group Våle and Lista Formations are considered to have accumulated primarily in a marine, outer shelf environment with dysaerobic sea floor conditions. The Sele and Balder Formations accumulated in marine, mid shelf environments with anaerobic sea floor conditions. Volcanic activity is noted by the presence of tuffaceous claystones near the top of the Rogaland Group. Agglutinating foraminifera comprise the Lista and lower Sele Formations, while diatoms represent the microfaunas of the upper Sele and Balder Formations.

SHETLAND GROUP: 9350-10420 ft (2849.9-3176.1 m).

Thickness: 1070 ft (326.1 m).

Age: Early-Late Cenomanian to Early Paleocene.

The Shetland Group is represented by the Ekofisk, Tor, Hod, Blodøks, and Hidra Formations.

The Ekofisk, Tor, and Hod Formation tops were picked from the MWD gamma ray-resistivity log. The picks were adjusted down 8 ft (2.4 m) when tied to the only open hole wireline log in this section, the FMS/GR.

Ekofisk Formation: 9350-9508 ft (2849.9-2898.1 m).

Thickness: 158 ft (48.2 m).

Age: Early Paleocene.

Description and Lithology: The top of the Ekofisk Formation is marked by a decrease in gamma ray and corresponding increase in resistivity readings. The lithology is predominantly limestone, light grey, pink grey, and pale yellow brown, soft-firm, subblocky-blocky, slightly argillaceous, calcitic, with a trace of chert near the base of the formation.

Hydrocarbon Shows: Good oil shows, dull-bright yellow-white fluorescence, blue milky-white moderately streaming cut fluorescence, pale green-yellow-brown visible residual.

Tor Formation: 9508-9520 ft (2898.1-2901.7 m).

Thickness: 12 ft (3.7 m).

Age: Late Maastrichtian.

Description and Lithology: The top of the Tor Formation is marked by a downhole increase in resistivity and a slight decrease in gamma ray values. The lithology from this thin formation is limestone, white, light grey, pink grey, predominantly firm, and subblocky-subangular.

Hydrocarbon Shows: Good oil shows similar to the Ekofisk Formation were observed.

Hod Formation: 9520-10141 ft (2901.7-3091.0 m).

Thickness: 621 ft (189.3 m).

Age: Early-Mid Turonian to Campanian.

Description and Lithology: The top of the Hod is noted by a downhole decrease in resistivity and a slight increase in gamma ray readings. The lithology is limestone, predominantly white to light grey, firm-hard, blocky, micro- to occasionally crypto-crystalline, argillaceous in part, and calcitic.

Hydrocarbon Shows: The uppermost Hod, down to 9560 ft (2913.9 m), displays good oil shows, similar to the overlying Tor and Ekofisk Formations. Fair oil shows were present from 9560-9850 ft (2913.9-3002.3 m) yielding, moderate yellow fluorescence, slow streaming-bloom blue-white cut fluorescence, pale green-yellow-brown visible residual ring. Poor oil shows were observed from 9850-9965 ft (3002.3-3037.4 m): dull yellow-brown fluorescence with weak diffuse cut fluorescence. Trace oil show occurred from 9965-10000 ft (3037.4-3048.0 m) with, trace fluorescence and very pale blue-white cut.

Blodøks Formation: 10141-10158 ft (3091.0-3096.2 m).

Thickness: 17 ft (5.2 m).

Age: Early-Mid Turonian.

Description and Lithology: The top of the thin Blodøks Formation is marked by a characteristic downhole increase in gamma ray and sonic travel time readings. The lithology is claystone, grey to dark grey, soft-firm, subblocky-blocky, non-moderately calcareous, trace pyrite and calcite.

Hydrocarbon Shows: None.

Hidra Formation: 10158-10420 ft (3096.2-3176.1 m).

Thickness: 262 ft (79.9 m).

Age: Early-Late Cenomanian.

Description and Lithology: The top of the Hidra Formation occurs where downhole gamma ray and sonic travel time values decrease sharply. The lithology is limestone, off-white, light grey, occasionally grey-brown, firm, subblocky-blocky, argillaceous in part, and trace chert. The basal part of the formation becomes increasingly argillaceous, grading to marl, brown to dark reddish brown, soft-firm, and subblocky.

Hydrocarbon Shows: None.

Depositional Environment: The Shetland Group was deposited in a marine, outer shelf to upper bathyal environment. A low to moderately abundant and diverse nannofossil assemblage is present throughout most of the upper 300 ft (91 m) of the section. Nannofossil assemblage preservation is poor to moderate in the remainder of the section.

CROMER KNOLL GROUP: 10420-10954 ft (3176.1-3338.8 m).

Thickness: 534 ft (162.8 m).

Age: Early Valanginian to Late Albian.

The Cromer Knoll Group is represented by the Rødby, Sola, Tuxen, and Åsgard Formations:

Rødby Formation: 10420-10466 ft (3176.1-3190.1 m).

Thickness: 46 ft (14.0 m).

Age: Late Albian.

Description and Lithology: The top Rødby Formation is marked by a gradual downhole increase in gamma ray and sonic transit time values, and a decrease in resistivity values. The lithology consists of marl, medium light grey, greyish-red, soft-firm, subblocky, slightly sticky, grading to claystone, and very calcareous.

Hydrocarbon Shows: None.

Depositional Environment: A marine, mid to outer shelf environment was interpreted from micropaleontology assemblages dominated by planktonic foraminifera with low diversity benthonic species.

Sola Formation: 10466-10704 ft (3190.1-3262.6 m).

Thickness: 238 ft (72.5 m).

Age: Early Valanginian to ?Hauterivian-Early Barremian

Description and Lithology: The top of the Sola Formation is marked by gamma ray, sonic, and resistivity log breaks at 10466 ft (3190.1 m), below which values are relatively constant. The lithology is claystone, medium dark grey, grey-black, dark grey-red, firm, blocky, subfissile, and slightly-moderately calcareous. Below around 10550 ft (3215.7 m), the claystone is light grey, occasionally brown, reddish-brown, and green-grey and less calcareous. The mudlog indicated a possible thin tuff(?) bed, light grey, translucent, firm, brittle at 10675 ft (3253.8 m).

Hydrocarbon Shows: None.

Depositional Environment: Marine, mid to outer shelf environment was interpreted from micropaleontology microfaunas dominated by planktonic foraminifera with an increase in benthonic agglutinated taxa which indicate partially dysaerobic conditions.

Tuxen Formation: 10704-10764 ft (3262.6-3280.9 m).

Thickness: 60 ft (18.3 m).

Age: ?Hauterivian-Early Barremian to Early Aptian.

According to NPD Bulletin No.5, 1989, the age of the Tuxen Formation is Late Hauterivian to Late Barremian. In well 2/7-28, the Phillips picked top of the Tuxen is dated as Early Aptian and the lower part is ?Hauterivian-Early Barremian. Geostrat interpreted the top of the Tuxen slightly deeper at 10732 ft (3271.2 m) based on wireline log break and a ?Hauterivian-Early Barremian biostratigraphy age at 10750 ft (3276.6 m).

Description and Lithology: The top Tuxen Formation is noted by a downhole decrease in gamma ray and a corresponding increase in resistivity values. Lithologically, the Tuxen is predominantly marl, dark to pale yellow-brown, light grey, soft-firm, subblocky-blocky, and calcareous.

Hydrocarbon Shows: Trace to good oil shows from the marl were described as, dull yellow fluorescence, slow to blooming pale violet cut fluorescence, very light greenish-yellow visible residual ring.

Depositional Environment: The abundance of planktonic foraminifera in the upper part of the formation indicates a marine, outer shelf environment. In the lower part of the Tuxen, the presence of diverse benthonic foraminifera dominated by nodosariids with ostracods, indicates an aerobic, inner to mid shelf setting.

Åsgard Formation: 10764-10954 ft (3280.9-3338.8 m).

Thickness: 190 ft (57.9 m).

Age: Early Valanginian to ?Hauterivian-Early Barremian.

Description and Lithology: The top of the Åsgard Formation is represented by a downward increase in gamma ray and decrease in resistivity values. The lithology is claystone, light to dark grey, light olive grey, occasionally reddish-brown, firm to very firm, blocky, subfissile, non to very calcareous (olive grey), with a trace pyrite. From wireline logs, the basal 23 ft (7.0 m) of the Åsgard Fm appears to be slightly more calcareous than the overlying Åsgard claystone, with thin limestone beds. This section has been called the Leek Formation by Geostrat.

Hydrocarbon Shows: None.

Depositional Environment: A marine, inner to mid shelf environment is interpreted from the diverse benthonic dominated micropaleontological microfaunas.

TYNE GROUP: 10954-12456 ft (3338.8-3796.6 m).

Thickness: 1502 ft (457.8 m).

Age: 'Mid' Kimmeridgian to Middle Volgian.

The Tyne Group is represented by the Farsund, Eldfisk, and Haugesund Formations:

Farsund Formation: 10954-11476 ft (3338.8-3497.9 m).

Thickness: 522 ft (159.1 m).

Age: Early to Middle Volgian.

Description and Lithology: The top of the Upper Jurassic, the Farsund Formation, is marked by a sharp downhole increase in gamma ray and an overall increase in sonic transit time values relative to the overlying unconformable Lower Cretaceous Cromer Knoll Group. The Farsund lithology is predominantly claystone with interbeds of sandstone near the top and lower parts of the formation and occasional limestone stringers. Claystone is predominantly brownish-black, greyish-black, and medium to dark grey, firm to hard, subblocky to fissile, earthy, slightly to moderately calcareous, carbonaceous, micaceous, trace pyrite. Sandstone from 11018-11032 ft (3358.3-3362.6 m) is yellow-brown and clear quartz, very fine to fine, angular-subangular, moderately sorted, argillaceous matrix, variably friable to clay/silica cemented. From 11276 ft (3437.0 m) to the base of the Farsund, increased amounts of sandstone and sandy claystone beds are apparent. The sandstone is clear, light to medium grey, white, fine to coarse, trace very coarse, angular-subangular, poor-moderate sorting, variably loose to well cemented with calcite, trace pyrite.

Conventional Core No. 1 was cut in the Farsund Formation from driller depth 11202-11264 ft (3414.4-3433.3 m). The lithology is predominantly claystone with thinly bedded sandstone, very fine to medium grained, and locally pebbly in the lower part of the core (See Section 12, Conventional Core Description).

The IUJM seismic horizon occurs at 11385 ft (3470.2 m) and is of Early Volgian age.

Hydrocarbon Shows: Trace oil shows were present from 11000-11476 ft (3352.8-3497.9 m) in both claystone and sandstone. Sandstone show at 11020-11030 (3358.9-3362.0 m) was dull yellow-brown fluorescence, good cream-yellow streaming cut fluorescence, dark yellow-amber visible residual ring. Sandstone shows below 11276 ft (3437.0 m) were dull pale yellow fluorescence, weak yellow-white streaming cut fluorescence and brown visual residual ring.

Depositional Environment: Marine, mid to outer shelf. No *insitu* micropaleontological assemblages were recovered in the upper 73 ft (22.3 m) of the formation (Middle Volgian) due to heavy cement contamination in the cuttings. Below 11027 ft (3361.1 m), samples from the upper part of the Early Volgian are dominated by mono-specific agglutinated assemblages and subordinate radiolaria. This microfauna attests to deep water, dysaerobic shelf sedimentation. Below 11190 ft (3410.8 m), diverse radiolaria assemblages predominate reflecting less restricted, mid to outer shelf conditions, with anaerobic benthonic conditions. The sandstones represent distal, low density turbidite and sandy debris flow deposits in a basinal environment.

Eldfisk Formation: 11476-11541 ft (3497.9-3517.7 m).

Thickness: 65 ft (19.8 m).

Age: Early Volgian.

Description and Lithology: The top of the Eldfisk Formation is marked by a downward decrease in gamma ray values from the overlying Farsund Formation. The upper part of the Eldfisk consists of interbedded sandstone and claystone while the lower part is sandstone.

The claystone is grey-black, black, dark grey, firm-hard, blocky, earthy, carbonaceous, and calcareous. The sandstone is white to light grey, fine to coarse grained, predominantly quartz, poorly sorted, with floating pebbles and granules, angular to subangular, occasionally subround to round, variably loose sand to well cemented calcitic sandstone with porosity generally decreasing with depth. Clasts of mudstone and broken shell fragments are also present.

Conventional Core No. 2 was cut in the basal Eldfisk - top Haugesund Formation from driller depth 11529-11547 ft (3514.1-3519.6 m) (See Section 12, Conventional Core Description).

Hydrocarbon Shows: Trace to poor oil shows with patchy, moderately bright to dominantly dull yellow fluorescence, a pale bright white streaming cut fluorescence and a medium brown visible residual ring. Conventional Core No. 2 displayed traces of bleeding oil and gas.

Depositional Environment: High density turbidite sandstone possibly forming a channel fill sequence, and/or a sandy debris flow is interpreted for this formation. The sandstone overlies a predominantly basinal claystone sequence interbedded with thin, distal, low density, sandy turbidity current deposits.

Haugesund Formation: 11541-12456 ft (3517.7-3796.6 m).

Thickness: 915 ft (278.9 m).

Age: 'Mid' Kimmeridgian to Early Volgian.

This interval contains lithologies dated as 'late' and 'mid' Kimmeridgian by Geostrat. These are informal intervals considered to be equivalent to the *autissiodorensis* and *eudoxus* ammonite zones, and the *mutabilis* and *cymodoce* ammonite zones, respectively.

Description and Lithology: Definition of the top of the Haugesund Formation follows Vollset and Dore (1984) i.e., the contact with the overlying Eldfisk Formation. Top Haugesund is marked by an increase in gamma ray values. The lithology is predominantly claystone, brownish-black, black, olive-black, very firm, blocky, silty, micaceous, carboniferous, earthy, calcareous, locally pyritic, with very fine, sandy, in part and, occasionally grading to marl. Subordinate limestone stringers, white, cream, firm-hard, microcrystalline, with calcite veins also occur.

Hydrocarbon Shows: Trace oil shows occur throughout the Haugesund Formation, no direct fluorescence was observed. However a fairly slow streaming-blooming milky white cut fluorescence and a, faint amber visible residual ring were noted.

Depositional Environment: Marine, mid to outer shelf. The interval is characterized by low diversity, calcareous benthonic foraminifera and sponge microfossils. These assemblages are likely to be of shallow shelf origin and may have been transported into deeper water facies. A return of radiolaria suggests the return to predominantly hemipelagic sedimentation.

Smith Bank Formation (?): 12456-12594 ft (3796.6-3838.7 m).

Thickness: 138 ft (42.1 m).

Age: No *insitu* micropaleontological or palynological taxa were recovered from this interval. A Triassic age determination is based on the lithology of cutting samples and change in wireline log character. A major unconformity is defined at the base of the 'mid' Kimmeridgian interval where Early Kimmeridgian age lithologies are absent.

Assuming a Triassic age for the predominant claystone lithology, the name of the interval in the Phillips completion report and on the composite log is questionably assigned to the Smith Bank Formation. To date, the NPD has not assigned the Smith Bank Formation to a particular lithostratigraphic group.

Note: Geostrat interprets this section as Triassic Skagerrak Formation. However, a brownish to greyish black claystone sidewall core at 12534 ft (3820.4 m), below previously penetrated anhydrite, indicates a 'mid' Kimmeridgian age. Geostrat interprets the sidewall as ?mudcake with cuttings contamination form the overlying Tyne Group sediments. If the sidewall is *insitu* a 'mid' Kimmeridgian age at this depth is still possible.

Description and Lithology: The top of the Triassic is marked by a downhole decrease in sonic transit time and neutron porosity and a corresponding increase in density values. Overall, Triassic gamma ray values are lower than in the overlying Haugesund Formation. The lithology can be divided into three general units consisting of an upper varicolored claystone, a middle interbedded anhydrite and varicolored claystone, and a predominantly sandstone unit near the base.

The upper claystone is grey-red, dark red-brown, and light grey, cream, soft to firm, crumbly, non-slightly calcareous, anhydritic, waxy in part, locally very fine sand. The middle unit consists of interbedded anhydrite, clear, opaque, cream-white, soft to firm, elongate, tabular, good-perfect cleavage and two types of claystone: 1) greyish-red, reddish-brown, firm, waxy, non-calcareous; and 2) light-medium grey brown-black, grey black, soft-firm, crumbly, earthy, micaceous, non-slightly calcareous. The bottom unit is sandstone, clear, opaque, quartz, fine to medium grained, subangular, poor-moderately sorted, loose to well cemented with silica. The sandstone overlies a thin siltstone, which is brown-black, grey-black, firm, very argillaceous, carbonaceous, non-calcareous, with anhydritic laminations.

Anhydrite, sandstone, and claystone lithologies are verified from the interpretation of wireline neutron, density, gamma ray, and to a limited extent, resistivity logs.

Hydrocarbon Shows: None.

Depositional Environment: Terrestrial.

Zechstein Group: 12594-12772 ft (3838.7-3893.0 m).

Thickness: 178 ft (54.3 m). Zechstein Group at total depth.

Age: No *insitu* palynological taxa were recovered from this interval.

Description and Lithology: The top of the Zechstein is marked by a downhole increase in resistivity, a corresponding decrease in neutron porosity, and a washout by the caliper log. The deepest wireline logged interval was 12632 ft (3850.3 m) by the DLL/MSFL/GR. There were limited returns from the top of the Zechstein to total depth. Halite is in the inferred lithology as mud chlorides increased dramatically from 7500 ppm at 12350 ft (3764.3 m), to 15000 ppm at 12620 ft (3846.6 m), to 52000 ppm at 12690 ft (3868.0 m) driller depths.

Hydrocarbon Shows: None.

Depositional Environment: Marine, hypersaline.

8. FORMATION PRESSURE SUMMARY

Pressure evaluation was provided by EXLOG. A Phillips Pressure Summary Plot is shown in Figure 5. The fracture and overburden interpretation has not been included because of complexity involving the depleted chalk reservoir and the absence of reliable leak off test data below the 13 3/8" shoe. Direct formation pressure measurements from RFT or DST were not attempted. Refer to the EXLOG Final Well Report for further details on pressure interpretation.

26" Hole Section: 745 ft (227.1 m) to 1780 ft (542.6 m)

Summary	:	Pore pressure was estimated to be normal at 8.6 ppg (1.03 g/cc) throughout this section.
Lithology	:	Nordland Group interbedded clay and sand.
Dxc	:	Erratic values due to interbedded clay and sand.
Gas	:	Values very low, generally less than 4 units.
Temperature:		Flowline temperatures very steady, no abnormal trends observed.
Shale Density	:	Ditch cuttings too soft to obtain reliable values.
Mud Weight	:	Water based mud of 9.5 ppg (1.14 g/cc) throughout the interval.
LOT/FIT	:	None.

17 1/2" Hole Section: 1780 ft (542.6 m) to 4925 ft (1501.1 m)

Summary	:	Normal pore pressure at the start of the interval increasing steadily to around 11.6 ppg (1.39 g/cc) at the end of the section.
Lithology	:	Nordland Group clay and claystone, with occasional interbeds of sand and carbonaceous material.
Dxc	:	A good trend was established. A slight decrease in values indicated increased pore pressure around 2250 ft (670.6 m).
Gas	:	Background gas generally ranged from 10 to 50 units. A maximum reading of 232 units in the Nordland Group was recorded at 2209 ft (673.3 m).

Temperature:		Values were unreliable due to sensor by-pass and new mud being constantly added to the system.
Shale Density	:	Ditch cuttings were too soft to obtain reliable values.
Mud Weight	:	The mudweight gradually increased from 10.2 ppg (1.22 g/cc) to 13.0 ppg (1.56 g/cc).
LOT/FIT	:	Leak off test of 15.0 ppg (1.80 g/cc) EMW was achieved at 1790 ft (545.6 m).

14" Hole Section: 4925 ft (1501.1 m) to 9305 ft (2836.2 m)

Summary	:	An estimated pore pressure at the top of the section of 11.6 ppg (1.39 g/cc) increased to around 14.4 ppg (1.73 g/cc) near the top Hordaland Group. The pore pressure began to decrease in the Rogaland Group Lista Formation. Lost circulation occurred in the lower Lista at 9264 ft (2823.7 m). The pore pressure decreased to approximately 13.0 ppg (1.56 g/cc) by 9305 ft (2836.2 m) in the Våle Formation. The interval was drilled with 8.6 ppg (1.03 g/cc) mud weight, after the 9 7/8" liner had been set at 9305 ft (2836.2 m), without hole problems.
Lithology	:	The Hordaland Group consists of claystone with occasional limestone stringers, and the Rogaland Group consists of claystone, grading to marl at the base of the section.
Dxc	:	In the upper part of the section, several shifts of decreasing values indicated an increasing pore pressure near the top of the Hordaland Group.
Gas	:	Background gas levels was less than 5 units to 5145 ft (1568.2 m) then increased, just above the Hordaland Group, to approximately 30 units down to a depth of 5450 ft (1661.2 m). Gas levels decreased to 10-30 units to 6250 ft (1905 m), further reducing to 5 units or less by 7000 ft (2133.6). Levels increased abruptly to 20-40 units below 7400 ft (2255.5 m). At 9129 ft (2782.6 m), near the top of the Lista Formation, trip gas of 1200 units was recorded. After losing circulation in the Lista Formation at 9264 ft (2823.7), a reduced hydrostatic head caused increased gas levels, (4180 units trip gas) probably from uphole near the Hordaland Group where gas and oil shows were encountered previously. Connection gases were evident throughout the 14" hole section, with a maximum of 200 units at 7982 ft (2432.9 m). Maximum formation gas of 132 units occurred at 7409 ft (2258.3 m).

Temperature : As in the previous section, flowline temperature was unreliable as the flowline sensor was regularly by-passed and numerous transfers of mud occurred into the active system.

Shale Density : Values generally increased with depth, ranging from 2.3 g/cc at 5350 ft (1630.7 m), near the top of the Hordaland Group, to 2.4 g/cc at 9200 ft (2804.2 m) in the Rogaland Group.

Mud Weight : 14.5 ppg (1.74 g/cc).

LOT/FIT : Leak off test of 16.8 ppg (2.02 g/cc) EMW at 4936 ft (1504.5 m).

8 1/2" Hole Section: 9305 ft (2836.2 m) to 10008 ft (3050.4 m)

Summary : At the top of the section, the Rogaland Group Våle Formation was in pressure communication with the depleted Shetland Group chalk reservoir which includes the Ekofisk, Tor, and the upper part of the Hod Formations. Pore pressure in this interval was estimated at 8.0-8.7 ppg (0.96-1.04 g/cc). No losses were observed using 8.7 ppg (1.04 g/cc) mud.

The pore pressure was interpreted to increase rapidly around 9570 ft (2917.0 m) in the Hod Formation below the depleted reservoir. The interpreted increase was based on an increase in the background gas and drill rate, and a decrease in Dxc and temperature values (no RFT data attempted). In the remaining section, pore pressure gradually increased to 11.8 ppg (1.42 g/cc). This estimate was based on mud gains after reaching total depth, the use of 11.7 ppg (1.40 g/cc) mud to control the well and subsequent lost circulation using 11.8 ppg (1.42 g/cc) mud.

Lithology : Rogaland Group marl at the top of the section, Shetland Group limestone from 9350 ft (2849.9 m) to base of section.

Dxc : Decreasing values around 9575 ft (2918.5 m) indicated a possible increase in pore pressure.

Gas : The gas ranged from 10-20 units in the Våle Formation, increasing with depth in the general range of 400-700 units in the Shetland Group. At 9575 ft (2918.5 m), background increased from 500 to 700 units. A gas peak of 1850 units occurred in Hod Formation, at 9795 ft (2985.5 m). Maximum gas of 3790 unit was recorded when pumping out of hole at total depth in the Hod Formation.

Temperature : There was a slight decrease in values near the base of the depleted zone. Generally, the data were of minimal use as the sensor was frequently buried in cavings.

Shale Density : No shale lithology.

Mud Weight : 8.7 ppg (1.04 g/cc) was recorded while drilling the pilot hole. The mudweight was increased to 11.8 (1.42 g/cc) after TD due to the well flowing and an increase in gas.

LOT/FIT : None.

7 3/8" Hole Section: 9917 ft (3022.7 m) to 10950 ft (3337.6 m)

Summary : The pore pressure at the top of the section was estimated at 11.8 ppg (1.42 g/cc). A slight increase in pore pressure was interpreted at 10350 ft (3154.7 m) in the Hidra Formation, based on gas and temperature data, and a further increase at 10675 ft (3253.8 m) near the top of the Tuxen Formation, based on gas, temperature, and Dxc data. Pore pressure at the base of the section in the Lower Cretaceous Cromer Knoll Group was estimated at 13.0+ ppg (1.56+ g/cc). Generally Lower Cretaceous pore pressure was less than anticipated based on offset wells.

Lithology : Limestone of the Shetland Group grades into claystone, marl, and occasional limestone beds of the Cromer Knoll Group.

Dxc : A decreased trend from 10675-10750 ft (3253.8-3276.6 m) was indicated by an increased pore pressure. Other possible trends were masked by bit changes and increases in mud weight.

Gas : In the Shetland Group, background gas levels generally decreased from 300-400 units at the top of the section in the Hod Formation, to 20 units at the base of the section, the Hidra Formation, 10420 ft (3176.1 m). A gas increase to 150 units was recorded within the Hidra around 10350 ft (3154.7 m). Maximum formation gas was 241 units, Hod Formation, 10134 ft (3088.8 m). Maximum trip gas was 599 units at 10154, in the Blodøks Formation.

In the Lower Cretaceous Cromer Knoll Group, background gas was generally 10-20 units, increasing to 50-175 units in the Tuxen Formation. Maximum connection gas of 129 units was recorded at 10773 ft (3283.7 m) and the maximum formation gas of 222 units was recorded at 10739 ft (3273.3 m). Increased gas levels in the Tuxen supported the suggestion of increased pore pressure indicated by Dxc data.

Temperature : A slight decrease in trends around 10300 ft (3139.5 m) and 10650 ft (3246.2 m) indicated a possible increase in pore pressure.

Shale Density : Lower Cretaceous claystone values of 2.15 g/cc at 10420 ft (3176.1 m) generally increased to 2.55 g/cc at the base of the section. A decrease in values was evident from 10625-10675 ft (3238.5-3253.8 m).

Mud Weight : 13.0 ppg (1.56 g/cc) increasing to 13.5 ppg (1.62 g/cc) at 10240 ft (3121.2 m) and to 14.0 ppg (1.68 g/cc) at 10410 ft (3173.0 m) (near base of Shetland Group) to the base of the section.

LOT/FIT : After drilling to 10008 ft (3050.5 m), a 8 3/8" liner was set at 9907 ft (3019.7 m). A leak off test of 14.5 ppg (1.74 g/cc) EMW was taken at 9922 ft (3024.3 m). The low value was probably the result of a bad cement job around the shoe. After setting the cement plug and redrilling down to 9917 ft (3022.7 m), a formation integrity test of 17.0 ppg (2.04 g/cc) was obtained.

6 1/2" Hole Section: 10950 ft (3337.6 m) to 12772 ft (3892.9 m)

Summary : The estimated pore pressure at the top of this section was approximately 13.0+ ppg (1.56+ g/cc). After penetrating the top of the Jurassic, the pressure increased rapidly to 16.0 ppg (1.92 g/cc) by 11000 ft (3352.8 m). A maximum pore pressure of 16.5 ppg (1.98 g/cc) was estimated near the top of the Eldfisk Formation around 11450 ft (3490.0 m). Pore pressure was estimated to have decreased to 9 ppg (1.03 g/cc) in the Zechstein salt.

Lithology : The Jurassic Tyne Group (top at 10954 ft, 3338.8 m) is predominantly claystone with interbeds of sandstone and occasional limestone stringers. Eldfisk Formation 11476 ft (3497.9 m) is dominantly sandstone with interbeds of claystone.

The Triassic (?) (12456 ft, 3796.6 m) section is interbedded claystone, sandstone, anhydrite, and siltstone.

Permian Zechstein Group (12594 ft,-TD, 3838.7 m-TD) is interpreted as salt.

Dxc : A trend is difficult to interpret in the upper part of the section although decreasing values are apparent on the Dxc log. Decreasing trends indicative of increasing pore pressure are interpreted around 11150 ft (3398.6 m), Farsund Formation; 11450 ft (3490.0 m), near top Eldfisk Formation; 11575 ft (3528.1 m), near top Haugesund Formation; and 12100 ft (3688.1 m), Haugesund Formation.

Gas : After increasing the mud weight to 16.5 ppg (1.98 g/cc) at the top of the Jurassic, the background gas was around 10-50 units. Connection and formation gas peaks of 159 and 229 units were recorded at 10983 ft (3347.7 m) and 11020 ft (3358.9 m), respectively, indicating that the pore pressure had increased to around 16.0 ppg (1.92 g/cc). Connection gases over 100 units were recorded at 11139 ft (3395.2 m) increasing to 173 units at 11203 ft (3414.7 m) and to 302 units at 11450 ft (3490.0 m) where pore pressure was then estimated at 16.3 ppg (1.96 g/cc). In the Eldfisk Formation, a 436 unit connection gas measurement was recorded at 11504 ft (3506.5 m) and 1010 units of wiper trip gas at 11524 ft (3512.6 m). By this depth, pore pressure was estimated at 16.5 ppg (1.98 g/cc). After increasing mud weight to 16.9 ppg (2.03 g/cc), background gas varied in the remaining Jurassic section from 30 to 110 units, with a maximum formation gas of 450 units at 12294 ft (3747.2 m) and a maximum connection gas of 50-130 units.

Background gas in the Triassic section was around 20 units with a maximum formation gas of 63 units and a maximum connection gas of 47 units. There was a suspicion that the connection gases were not from the bottom part of the hole but from intervals uphole, and that the Triassic pore pressure was less than in the Jurassic.

Temperature : Delta temperature values reflected increases in estimated pore pressure at 11020 ft (3358.9 m), 11150 ft (3398.6 m), and 11425 ft (3482.4 m).

Shale Density : Initial Jurassic values of 2.55 g/cc decreased to 2.3 g/cc around 11000 ft (3352.8 m). Further reduction in the range of 2.1-2.3 g/cc were recorded from 11200-11550 ft (3413.8-3467.1 m). From 11550 ft (3520.5 m) to the base Jurassic values were approximately 2.3 g/cc.

Mud Weight : The mudweight was 16.5 ppg (1.98 g/cc) and was increased to 16.9 ppg (2.03 g/cc) at 11524 ft (3512.6 m) (Eldfisk Formation) and then maintained at this weight to the total depth of the well.

LOT/FIT: A formation integrity test of 17.5 ppg (2.10 g/cc) EMW was obtained at 10960 ft (3340.7 m).

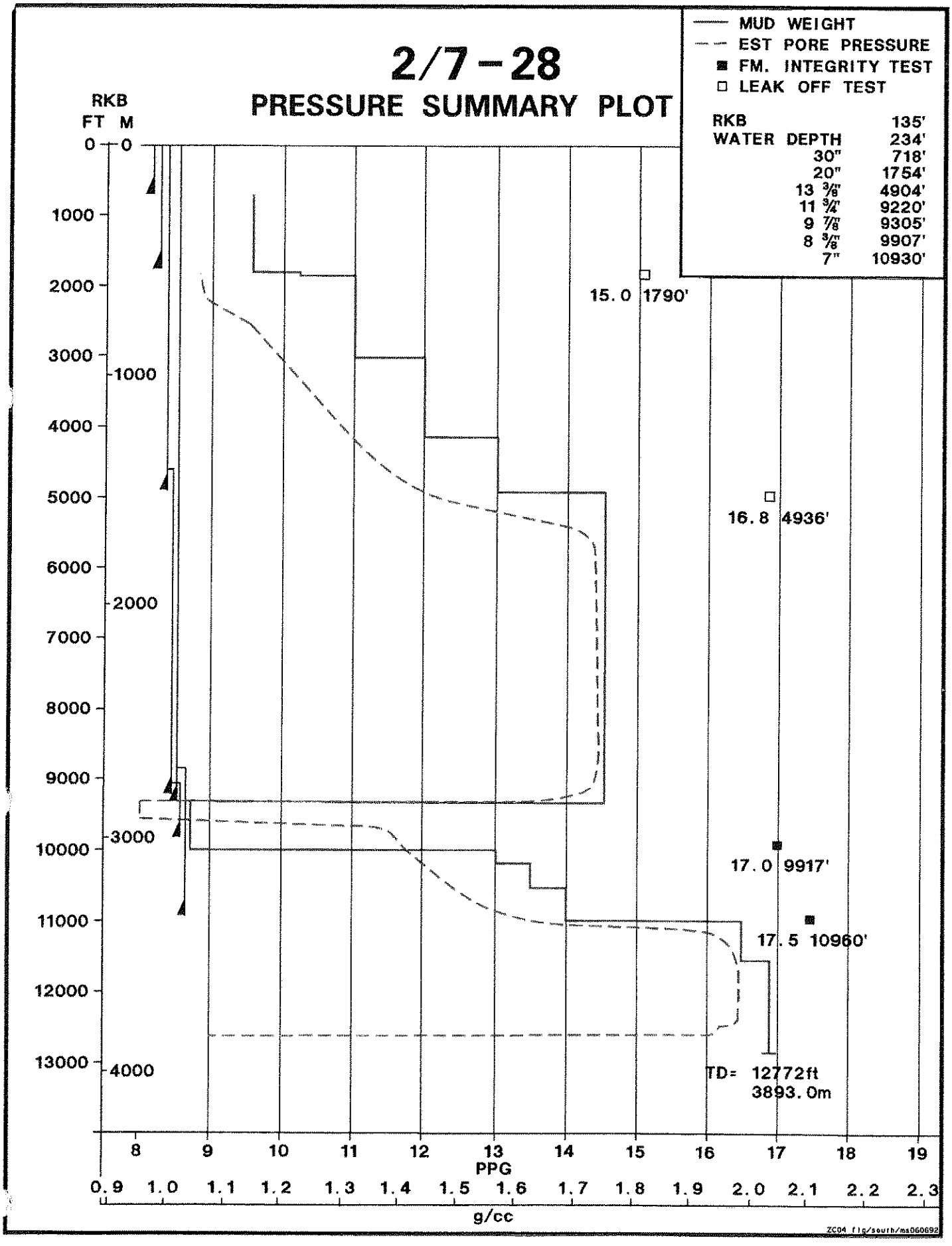

2/7-28
PRESSURE SUMMARY PLOT
MUD WEIGHT
EST PORE PRESSURE
FM. INTEGRITY TEST
LEAK OFF TEST
RKB 135'
WATER DEPTH 234'
30" 718'
20" 1754'
13 3/8" 4904'
11 3/4" 9220'
9 7/8" 9305'
8 3/8" 9907'
7" 10930'
RKB
FT M
15.0 1790'
16.8 4936'
17.0 9917'
17.5 10960'
TD= 12772ft
3893.0m
PPG
g/cc
ZC04 fig/south/ms060692

FIG. 5

9. GEOCHEMICAL SUMMARY

A full geochemical evaluation of ditch cuttings, sidewall cores and conventional core samples was performed by Geolab Nor, Trondheim, Norway. Samples were analyzed over the interval from 10030-12772 ft (3057.2-3893.0 m).

The type and number of analyses carried out are listed below:

Analysis Type	No. of Samples
Washing	91
Lithology Description	104
Rock-Eval/TOC	37
Vitrinite reflectance	39
Visual kerogen microscopy	27
Thermal extraction (GHM,S1)	36
Pyrolysis GC (GHM,S2)	36
Soxhlet extraction of organic matter	20
Saturated hydrocarbon GC	20
Aromatic hydrocarbon GC	20
GC/MS of saturated HC	8

Source Rock Potential

The Upper Jurassic Tyne Group 10954-12456 ft (3338.8-3796.6 m) is an oil prone marine type II kerogen source rock. The intervals from 10954-11200 ft (2228.8-3413.8 m) (upper Farsund Formation) and 11558-12466 (3522.9-3799.7 m) (Haugesund Formation) are classified as a normal marine type II kerogen source rocks with rich source rock potential. An intermediate interval from 11200-11476 ft (3413.8-3522.9 m) (lower Farsund Formation) is an algal influenced type II kerogen with a very rich source rock potential.

The upper Farsund Formation displays a total organic carbon (TOC) content ranging from 5.3-7.8% with a rich potential for generating oil. The lower Farsund Formation displays very high total organic carbon values ranging from 10.3-22.4% TOC. The lower Farsund has a very rich potential for generating oil. The Haugesund Formation has total organic carbon content values ranging from 3.5-11.1% TOC, giving a rich potential for generating oil and to a lesser extent gas.

Maturity

The maturity parameters applied on samples from the well, Tmax, vitrinite reflectance, and spore color index, give differing depths for the onset and base of the oil window. The heavy staining of several samples used for vitrinite reflectance probably reduced the Ro values and therefore the Tmax values are preferred for the overall maturity assessment.

Rock Eval Tmax demonstrated the top of the oil window around 10500 ft (3200.4 m) and peak oil generation around 11250 ft (3429.0 m). The bottom of the oil window is believed to be close to the total depth of the well, 12772 ft (3893.0 m). The Farsund Formation has started to generate hydrocarbons indicated by the free hydrocarbon yields (S1) from Rock-Eval as well as the amounts of solvent extractable organic matter. The Haugesund Formation has generated and most likely expelled hydrocarbons in significant amounts at the present maturity level, with a rich generation potential left.

Migration

Migrated hydrocarbons are found in trace amounts in the Upper Cretaceous Shetland Group and in the Upper Jurassic Eldfisk Formation. The hydrocarbons encountered in both sections are considered to have been generated from mature marine source rocks, possibly the Farsund and Haugesund Formations as they appear in the well. Although unresolved at present, the aromatic hydrocarbon maturity parameters indicate that the hydrocarbons present in the analyzed interval samples from the Shetland Group were generated from a source rock past peak oil generation, whereas the Eldfisk Formation hydrocarbons were generated from a source rock at peak oil generation.

10. GEOTHERMAL GRADIENT

The geothermal gradient was evaluated using temperature data from wireline log runs. Average temperatures measured with maximum wireline thermometers were corrected to account for the cooling influence of the drilling mud (Zielinski - Pirkle correction). The gradient was interpreted using the data from the log runs at total depths 9290 ft (2831.6 m) and 12633 ft (3850.6 m) (Figure 6). Additional log runs were not utilized because insufficient data were available to calculate the corrected bottom hole temperatures using this method. An average annual seabed temperature of 43 deg F (6.1 deg C) was used in the gradient calculation.

The calculation demonstrates an increasing geothermal gradient with depth. A gradient of 1.61 deg F/100 ft (29.4 deg C/km) was calculated at log depth 9290 ft (2831.6 m), 60 ft (18.3 m) above the top of the Shetland Group. The gradient increases to 2.19 deg F/100 ft (39.9 deg C/km) at log depth 12633 ft (3850.6 m), 39 ft (11.9 m) below the top of the Zechstein Group.

A similar increasing gradient with depth trend occurs in nearby well 2/7-3 which also penetrated the Zechstein Group. Empirically calculated geothermal gradients for well 2/7-3 demonstrate an increase from 1.75 deg F/100 ft (31.9 deg C/km) in the Tertiary to 2.19 deg F/100 ft (39.9 deg C/km) in the Zechstein Group.

Logging run at 9290 ft (2831.6 m):

Circulation stopped on 17 April at 22:30 hours.
Seabed temperature 43 deg F (6.1 deg C).

Log	T2 Time Since Last Circulation (Hours)	1/T2	T max (F / C)
DLL/MSFL/GR	10.08	0.099	158 / 70.0
BHC/GR	16.33	0.061	168 / 75.6
BGT/GR	19.17	0.052	173 / 78.3

Corrected Temperature = 187 deg F (86.1 deg C)
Gradient = 1.61 deg F/100 ft (29.4 deg C/km)

Logging run at 12633 ft (3850.6 m):

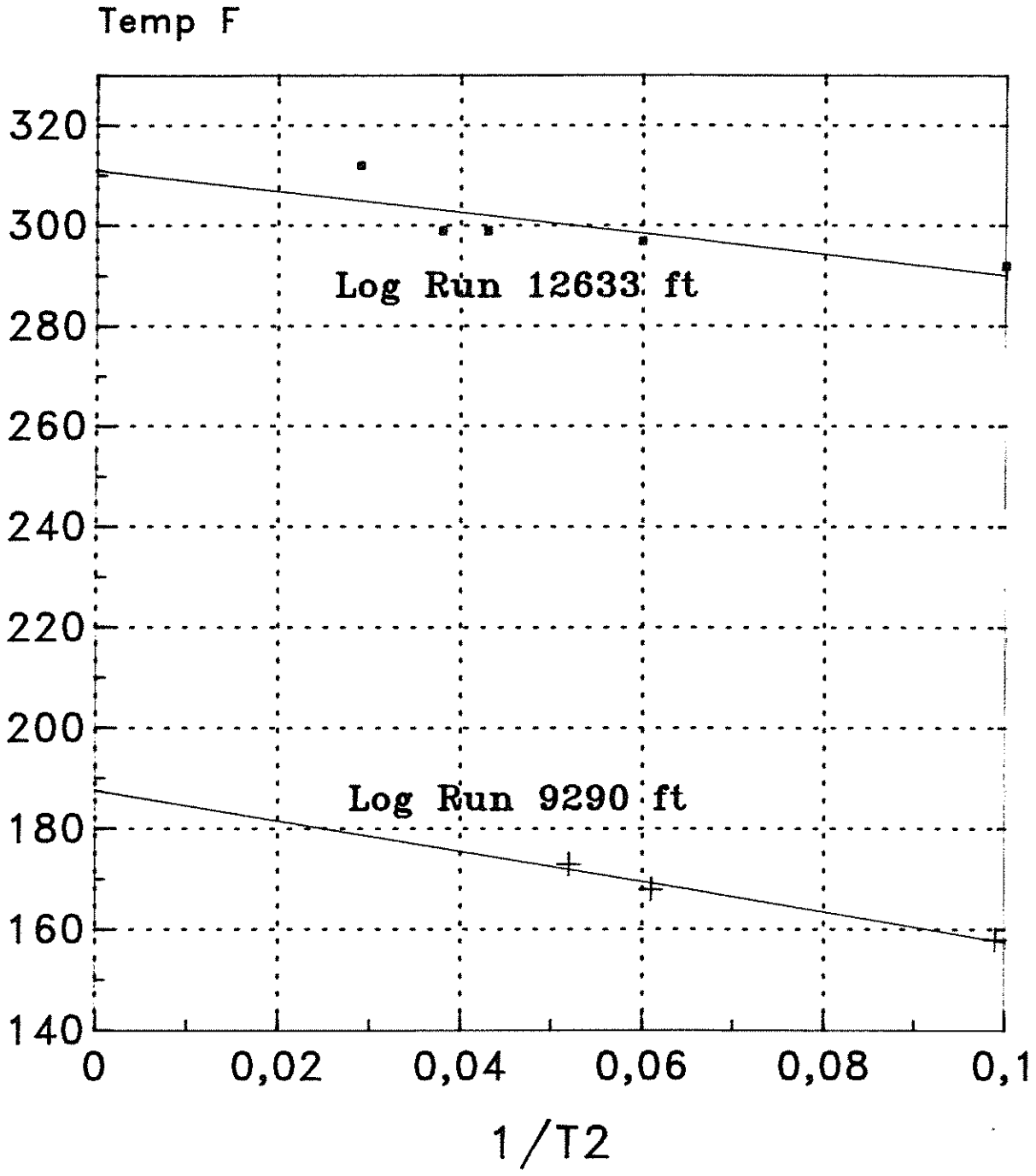
Circulation stopped on 28 July at 17:15 hours.
Seabed temperature 43 deg F (6.1 deg C).

Log	T2 Time Since Last Circulation (Hours)	1/T2	T max (F / C)
DLL/MSFL/GR	9.98	0.100	292 / 144.4
LDL/CNL/NGL	16.60	0.060	297 / 147.2
SDT/GR	23.05	0.043	299 / 148.3
FMS/GR	26.12	0.038	299 / 148.3
VSP/GR	34.30	0.029	312 / 155.6

Corrected Temperature = 311 deg F (155.0 deg C)
Gradient = 2.19 deg F/100 ft (39.9 deg C/km)

Well 2/7-28

BHT Correction



Corrected Temperature at 9290 ft = 187 deg F
Corrected Temperature at 12633 ft = 311 deg F

FIG. 6

11. LITHOLOGICAL DESCRIPTION OF CONVENTIONAL SIDEWALL CORES

A total of 59 conventional sidewall cores were attempted. From this total, 23 were recovered, 32 were lost, and 4 were empty. Various parameters, including lithological descriptions and type of analysis later performed on the cores (biostratigraphical, geochemical), are listed below:

Table I

SHOT	DEPTH Feet (m)	STATUS	SIZE Inch (mm)	ANALYSIS	LITHOLOGY
59	10964 (3341.9)	Empty			Trace of Claystone, brnsh-blk, frm, earthy, micropyr, sl slty, sl calc, no show.
58	10960 (3340.6)	Lost			
57	10966 (3342.5)	Recvrd	3/4 (19)	Biostrt	Claystone, brnsh-blk, firm, sl stky, earthy, micro pyr, sl calc, no show.
56	10974 (3344.9)	Lost			
55	10984 (3348.0)	Recvrd	1/2 (13)	Biostrt	Claystone, brnsh-blk, mod frm-frm, loc stky, plas, earthy, micropyr, sl-mod calc. Show: v poor, no flu, no cut, v poor blu-wh crush cut.
54	11013 (3356.8)	Empty			
53	11025 (3360.5)	Lost			
52	11030 (3362.0)	Recvrd	1/2 (13)	Geochem	Sandstone, dusky-yellsh-brn, qtz, vf, clr, ang-sbang, well srtd, fri, poor silica/clyst cement, abund brn-blk clyst mtx. Show: v poor, no flu, strong crm-yell strmng cut flu, amber brn res.

51	11043 (3365.9)	Lost			
50	11053 (3369.0)	Recvrd	1/2 (13)	Biostrt	Claystone, brnsh-blk, frm, musc, sb- blky, v micropyr, sl calc. Show: v poor, no flu, strong blu-wh strmng cut flu, yell-brn res.
49	11078 (3376.6)	Recvrd	1/2 (13)	Biostrt	Claystone, brnsh-blk, frm, sl wxy, sl stky, sl plas, v micropyr, sl calc. Show: v poor, no flu, yell-wh strmng cut flu, yell-ambr res.
48	11093 (3381.2)	Lost			
47	11130 (3392.5)	Empty			
46	11158 (3401.0)	Recvrd	3/4 (19)	Biostrt	Claystone, brnsh-blk, v frm, micromica, v micropyr, sb blky, non-sl calc. Show: v poor, no flu, yell-wh strmng cut flu, yell-amber res.
45	11183 (3408.3)	Recvrd	1 (25)	Biostrt	Claystone: brnsh-blk, v frm-frm, carb, v micromusc, sbfiss, mod calc. Show: v poor, no flu, yell-wh + blue-wh strmg cut flu, faint yell res.
44	11291 (3441.5)	Lost			
43	11356 (3461.4)	Lost			

42	11370 (3465.6)	Recvrd	1/4 (7)	Biostrt	Claystone: brnsh-blk, hd, v brit, v earthy, v carb, sl micropyr, sl-mod calc. Show: v poor no flu, blu-wh strmng cut flu, yell res.
41	11387 (3470.8)	Lost			
40	11405 (3476.3)	Lost			
39	11424 (3482.1)	Lost			
38	11461 (3493.4)	Recvrd	1/2 (13)	Biostrt	Claystone: brnsh-blk, v frm-hd, brit, v earthy, v carb, comm pyr incls, sl-mod calc. Show: v poor, no flu, bri yell-wh + blu wh strmg cut flu, yell res.
37	11472 (3496.7)	Lost			
36	11492 (3502.8)	Lost			
35	11496 (3504.0)	Lost			
34	11502 (3505.9)	Lost			
33	11508 (3507.7)	Lost			
32	11516 (3510.1)	Lost			
31	11520 (3511.3)	Lost			

30	11572 (3527.2)	Lost			
29	11590 (3532.7)	Recvrd	1/2 (13)	Biostrt	Claystone: brnsh-blk, v frm-hd, brit, ang, micromusc, sl micropyr, sl calc. Show: v poor, no flu, bri yell-wh + blu-wh cut flu, yell res.
28	11610 (3538.8)	Recvrd	1/2 (13)	Geochem	Claystone: blk, v firm, brit, blky, ang, v earthy, v carb, with abund nod pyr, sl-mod calc. Show: v poor, no flu, brt yell-wh + blu-wh cut flu, yell-gld res.
27	11633 (3545.8)	Recvrd	1/2 (13)	Biostrt	Claystone: blk, v firm, blky, v carb, v earthy, rr nod pyr, occ musc, sl-mod calc. Show: v poor, no flu, strmg yell-wh blom+ strmng cut flu, yell-gold res. With 2 mm Limestone horizon, wh, xtln, hd, brit, v clean, loc yell-wh min flu, no show.
26	11710 (3569.3)	Lost			
25	11797 (3595.8)	Lost			
24	11837 (3608.0)	Lost			
23	11877 (3620.2)	Recvrd	1/2 (13)	Biostrt	Claystone: blk, v firm, blky, v carb, v earthy, v fine, clr, ang, qtz incls, sl-mod calc. Show: v poor, no flu, yell-wh strmg cut flu, yell-gold res.

22	11916 (3632.0)	Recvrd	1/4 (7)	Geochem	Claystone: blk, v frm, blky, brit, v carb, v earthy, sl-mod calc. Show: v poor, no flu, slow blu-wh bloom cut flu, pale yel-amber res.
21	11992 (3655.2)	Lost			
20	12049 (3672.6)	Lost			
19	12142 (3700.9)	Lost			
18	12256 (3735.7)	Lost			
17	12305 (3750.6)	Lost			
16	12327 (3757.3)	Lost			
15	12363 (3768.3)	Recvrd	1/4 (7)	Biostrt	Claystone: brnsh-blk, olv-blk, v frm, brit, blky, v carb, v earthy, sl calc. Show: v poor, no flu, slow blu-wh bloom cut flu, pale yell-wh res.
14	12428 (3788.1)	Recvrd	1/2 (13)	Biostrt	Claystone: blk, v frm-hd, brit, blky, v carb, v earthy, comm clr, ang, fine qtz incls, sl-mod calc. Show: v poor, no flu, slow blu-wh blom + strm cut flu, no res.
13	12451 (3795.1)	Lost			
12	12457 (3796.9)	Lost			

11	12465 (3799.4)	Recvrd	3/4 (19)	Biostrt	Claystone: lt grey, lt bluish-grey, sft, plas. stky, sl calc, no show.
10	12475 (3802.4)	Recvrd	1/2 (13)	Biostrt	Claystone: v lt grey, soft, plas, cmbly, loc microxsln anhydrite, non calc to calc, no show.
9	12479 (3803.6)	Recvrd	1/2 (13)	Biostrt	Claystone: lt brnsh-grey, sft-mod frm, v cmbly, wxy, amorph, non calc to calc, no show.
8	12485 (3805.5)	Recvrd	1/8 (3)		Claystone, grysh-brn, sft, v plas, amorph, v stky, sl calc, no show.
7	12494 (3808.2)	Empty			Trace of Claystone: dk grey, hd, brit, blky, occ musc, sbfiss, sl carb, sl calc. Show: v poor, no flu, poor blu-wh cut flu, no res.
6	12505 (3811.6)	Lost			
5	12524 (3817.4)	Recvrd	1/2 (13)		Claystone: med lt gry, sft, sticky, plas, anhydritic, amph, loc hd mod calc clyst incls, non calc-calc, no show.

4	12534 (3820.4)	Recvrd	1/2 (13)	Biostrt	Claystone: brnsh-blk, grysh-blk, firm, cmbly, earthy, loc musc flakes, carb, sl calc. Show: v poor, flu, sl cut flu, no res.
3	12556 (3827.1)	Lost	1/2 (13)	Biostrt	
2	12582 (3835.0)	Recvrd			Siltstone: brnsh-blk, grysh-blk, firm, v arg, carb, non calc-calc, with Anhydrite bands and inclusions, wh, clear, crystalline, friable. Show: v poor, no flu, bright+blue-wh diffusive and slow bloom cut flu, yell-wh res.
1	12586 (3836.3)	Lost			

12. CONVENTIONAL CORE DESCRIPTION

The following section summarizes data obtained from Conventional Cores No. 1 and 2. Sedimentological and petrographic analyses have been performed by Simon Petroleum Technology. For further details, refer to Sedimentology and Petrography of Well 2/7-28, Simon Petroleum Technology, January, 1993. The core description is shown in Enclosure 1.

Description and Depositional Environment

Core No. 1 was taken from the Farsund Formation at driller depth 11202-11264 ft (3414.4-3433.3 m). A comparison of core gamma ray with wireline gamma ray (DLL/GR run) indicates that a corrected downward shift of 5 ft (1.5 m) should be applied to the driller depth.

Lithologically, the upper 36 ft (11.0 m) of Core No. 1 is predominantly claystone with thin silty and sandy lenses commonly developed. The claystone is dark grey to black, firm, silty, slightly-moderately carbonaceous, micaceous, slightly calcareous, pyritic, and well laminated with dips from 11-15 degrees, locally steepening to 21 degrees where slumping is developed. The lower 26 ft (7.9 m) shows increasing amounts of thinly bedded sandstones, light to medium grey, very fine to medium, locally coarse to pebbly, trace cobble, argillaceous, poor to moderately sorted, well cemented with calcite. The sandstones form thin (< 1 ft 0.3 m) chaotic units associated with slumped and contorted claystone sequences with matrix supported large floating cobble size clasts. Broken bivalve and belemnite shell debris are locally present.

The depositional environment of the upper part of Core No. 1 has been interpreted as basinal claystone with thin interbedded sandstone deposits of distal, low density, sandy turbidity currents. The lack of bioturbation indicates anaerobic bottom conditions. Slumping indicates the presence of a steep depositional setting. The poor sorting, chaotic nature and matrix supported texture of the lower part of the core is common of a debris flow environment.

Core No. 2 was taken from the basal Eldfisk and top Haugesund Formations at driller depth 11529-11547 ft (3514.1-3519.6 m). Comparison of the core gamma ray with wireline gamma ray (DLL/GR run) indicates that a corrected downward shift of 4 ft (1.2 m) should be applied to the drillers depth.

Lithostratigraphically, the upper 8 ft (2.4 m) of Core No. 2 is the basal part of the Eldfisk Formation. The lithology is sandstone, white to light grey, very fine to coarse, predominantly quartz, poorly sorted, with floating granules and pebbles, angular to subangular, occasionally subround to round, and well cemented with calcite. The lower 10 ft (3.0 m) of Core No. 2 is the upper part of the Haugesund Formation. The lithology is predominantly claystone, dark grey to black, hard, silty, slightly calcareous, micaceous, with thin interbeds of sandstone, light grey, very fine to medium, locally pebbly, poorly sorted, well cemented, with clasts of mudstone and broken shell fragments also present. Beds display dips of approximately 50 degrees.

Calcite cemented fractures are common in the sandstone interval. The fractures are generally sub-vertical but display a wide variety of dips varying from 30-85 degrees.

Core No. 2 is interpreted as a thicker bedded, high density turbidite sandstone possibly forming a channel fill sequence, and/or a sandy debris flow. The sandstone overlies a predominant basinal claystone sequence interbedded with thin, distal, low density, sandy turbidity current deposits.

Petrography

Six thin sections from the cored intervals were prepared for petrographic examination.

Sandstones range in detrital mineralogy from lithic arenites to lithic wackes (Dott, 1964, modified by Pettijohn, 1975). The sandstones are moderately to poorly sorted, with matrix supported grains, and locally, straight to concavo-convex grain contacts. Detrital grains are predominantly mono-crystalline quartz, with subordinate poly-crystalline quartz and rock fragments. Carbonate replaced mudclasts are occasionally common, with local skeletal fragments and traces of mica.

Authigenic cement, primarily calcite, is locally extensive. Trace to subordinate cements include dolomite, pyrite, bitumen, and quartz overgrowths. Much of the authigenic mineralogy is interpreted to have occurred prior to incorporation into the present sedimentary unit, such as mudstone clasts which are almost completely replaced by carbonate.

Reservoir quality of the sandstone is poor, reflecting textural characteristics such as poor sorting, locally high detrital clay content, and the presence of authigenic cements which occlude most macroporosity.

HYDROCARBON SHOW

Wellsite show description, from core pieces every 3 ft (1 m):

Core No. 1:

Claystone: No fluorescence, very weak streaming, moderately bright white cut fluorescence, trace brown ring residue.

Core No. 2:

Sandstone: Dull to moderately bright pale yellow fluorescence, weak streaming, moderately poor bright white cut fluorescence, poor brown ring residue.

Claystone: No Fluorescence, poor streaming, moderately bright white cut fluorescence, trace brown ring residue.

Onshore, traces of bleeding oil and gas were noted from Core No. 2 when the core was removed from inner core barrel.

Reference:

Dott, R. H., 1964, Wacke, greywacke, and matrix - what approach to immature sandstone classification?, Journal Sedimentary Petrology, vol. 34, p.625-632.

13. CONVENTIONAL CORE ANALYSIS

Conventional core analysis and core photography of Cores 1 and 2 were performed by Geco-Prakla Petroleum Laboratory, Stavanger, Norway. The analysis included the generation of gamma logs for Cores 1 and 2, and the cutting and cleaning of nine plugs from Core 2 for the determination of porosity and permeability.

A comparison of the core gamma logs to the gamma ray wireline log indicated depth shifts of 5 ft (1.5 m) and 4 ft (1.2 m) were necessary to the driller depth for Cores 1 and 2, respectively (See: Section 12, Conventional Core Description).

A summary of conventional Core 2 porosity/permeability/grain density data is shown in Table 2.

Table II

Company : PHILLIPS
Well : 2/7-28
Field :
Core no. : 2

CONVENTIONAL CORE ANALYSIS

Country : NORWAY
Date : AUGUST 1992
Page : 1

GECO PRAKLA
Petroleum Laboratory

Plug no.	Depth (feet) RKB MD	Permeability (mD) Horizontal K_g	Horizontal $1/P_m$	Horizontal K_a	Horizontal K_{el}	Vertical K_g	Vertical $1/P_m$	Vertical K_a	Vertical K_{el}	Porosity (%) He	Porosity (%) Fluid sum.	Pore saturation (%) S_o	Pore saturation (%) S_w	Grain density (g/cm³)	Lithological description.
	11529'0"														
1	11529'1"	0.054	0.342	0.081	0.040					3.9				2.69	
2	11530'1"	0.028	0.343	0.042	0.020					4.2				2.68	
3	11531'2"	0.090	0.343	0.134	0.067					3.7				2.68	
4	11532'3"	0.086	0.343	0.128	0.064					8.1				2.68	
5	11532'11"	<0.04		<0.04	<0.02					3.9				2.68	
6	11533'11"	0.037	0.343	0.056	0.027					5.0				2.67	
7	11534'10"	<0.04		<0.04	<0.02					3.6				2.70	
8	11535'8"	nhpp				<0.04		<0.04	<0.02	3.5				2.69	
9	11536'1"	0.038	0.343	0.057	0.027					3.6				2.69	
	11547'0"														

14. BOREHOLE PROFILE

A zero offset VSP was acquired by Schlumberger during 30 July, 1992, covering a depth interval from 3600-12600 ft (1097.3-3840.5 m). The survey was recorded using a three component, gimballed Combinable Seismic Imager (CSI) tool for the open hole interval below the 7" liner. The interval above the 7" liner was recorded using an eight level single component Downhole Seismic Array (DSA-A) tool.

The energy source consisted of two 200 cubic inch air guns suspended 4 m below mean sea level. The acquired data were generally good; however, some levels suffered from casing ringing due to poor cementation of overlapping casing strings. These intervals were not included in processing of the vertical seismic profile.

The vertical seismic profile was processed by Schlumberger using a standard processing sequence. The final displays are included in Schlumberger's vertical seismic profile report dated 30 July, 1992.

15. LISTING OF AVAILABLE REPORTS

Array Sonic Processing, interval 8980-9952 ft., Schlumberger, July, 1992.

Biostratigraphy of the Interval 1840-12730 ft., Geostrat, October, 1992.Conventional Core Analysis, Cores 1 and 2, Geco-Prakla, October, 1992.

Core Fracture Evaluation of the Jurassic Section (Cores 1 and 2), Intera Information Technologies Limited, September, 1992.

Core Photographs, Cores 1 and 2, Geco-Prakla, 1992.

Drilling Program, Phillips Petroleum Company Norway, November, 1991.

Exlog Final Well Report (Mudlog), Exlog, July, 1992.

FMS Processing Report, interval 10940-12605 ft., Schlumberger, July, 1992.

FMS Structural and Sedimentological Interpretation, interval 10940-12605., Schlumberger, October, 1992.

Geochemical Report for Well 2/7-28, Geolab Nor, January, 1993.

MWD, End of Well Report, interval 738-4925 ft., Anadrill, March, 1992.

MWD, End of Well Report, interval 4925-10010 ft., Teleco Oilfield Company Ltd U/A, July, 1992.

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Sedimentology and Petrography of well 2/7-28, Norwegian North Sea, (Convention Core No. 1 and 2), Report No.7262/Id, Simon Petroleum Technology, January, 1993.

Zero Offset VSP Processing Report, 3600-12600 ft, Schlumberger, 30 July, 1992.

3. FORMATION EVALUATION

Table

1. INTRODUCTION

This section deals with the acquisition and interpretation of the basic openhole wireline log data. Specialist interpretation of the data from the FMS-tool is covered in separate FMS processing and interpretation reports **(See Geological Section, List of Reports)**. A total of four separate wireline logging runs were made in this well. A computer-processed interpretation - for shale volume, porosity and water saturation - was carried out on Run#4, Jurassic to TD.

No significant quantities of hydrocarbon were observed in the interval covered by this CPI.

Table III

2/7–28 WIRELINE LOGGING SUMMARY

Tool String	Run No.	Log Date	Top Logged Interval	Bottom Logged Interval	Bit Size	BHT degF	Hrs. Since Circ.	Mud Weight lbs/gal	Mud Type	Remarks
DLL/MSFL/GR	1:1	17 Apr 92	4904'	9281'	14"	158	10.1	14.0	S'water Drispac	
BHC/GR	1:1	17 Apr 92	8700'	9285'	14"	168	16.3	14.0	S'water Drispac	
BGT/GR	1:1	17 Apr 92	4904'	9283'	14"	173	19.2	14.0	S'water Drispac	
FMS/GR	2:1	08 Jun 92	9333'	9970'	12 1/4" 15"	164	9.1	11.8	S'water Polymer	TD not reached due to junk in hole.
SDT/GR	2:1	10 Jul 92	9040'	9915'	casing	NA	NA	14.0	Therma–drill	Waveforms recorded through casing for determination of formation delta T.
DLL/MSFL/SDT/GR	3:2	10 Jul 92	9915'	10955'	9"	233	10.3	14.0	Therma–drill	Caliper closed during main log due to overpull. MSFL recorded only on repeat section.
LDL/CNL/GR	3:1	13 Jul 92	9915'	10920'	9"	233	21.3	14.0	Therma–drill	Did not reach total depth due to hole condition.
DLL/MSFL/GR *	4:3	29 Jul 92	10939'	12632'	6 1/2"	292	10.0	17.0	Therma–drill	
LDL/CNL/NGL *	4:2	29 Jul 92	10939'	12624'	6 1/2"	297	16.7	17.0	Therma–drill	NGL tool had intermittant failure.
SDT/GR *	4:3	29 Jul 92	10971'	12605'	6 1/2"	299	23.0	17.0	Therma–drill	Delta–T from down log. Tool failed at TD.
FMS/GR *	4:2	29 Jul 92	10939'	12596	6 1/2"	299	26.1	17.0	Therma–drill	
VSP *	4:1 4:2	30 Jul 92 30 Jul 92	3600' 3600'	12600' 10850'	6 1/2" casing	312 300	34.3 41.3	17.0 17.0	Therma–drill	
CST/GR *	4:1	30 Jul 92	10964'	12586'	6 1/2"	NA	NA	17.0	Therma–drill	59 attempted, 23 recovered, 4 empty, 32 lost.
* None of these logs reached total depth, probably due to the mud becoming saturated as the salt was drilled and then gelling.										

2. WIRELINE DATA QUALITY DISCUSSION

There were four separate wireline logging runs in this well. The contractor for all logging runs was Schlumberger. A summary of the logging runs is provided in Table 3.

Run 1: 17th April, 1992 Hordaland and Rogaland Groups

Acquisition objective: Hydrocarbon accumulation and correlation.

Driller TD	9285 ft (2830.1 m)
Bit size	14.0/12.25 inches
Mud weight	14.0 lbs/gal (1.68 g/cc)
Mud type	Seawater / Soltex
Hole deviation	< 1.0 deg.

Logging runs:

Run #	Tool	Top		Base		Temperature	
		ft	m	ft	m	deg F	deg C
1:1	DLL/MSFL/GR	4904	1494.7	9281	2828.8	158	70
1:1	BHC/GR	8700	2651.8	9285	2830.1	168	76
1:1	BGT/GR	4904	1494.7	9283	2829.5	173	78

Data quality discussion:

The quality of the logs was acceptable, meaning that the objectives for the logging were met. The hole was generally rugose, but this did not result in any significant degradation of the logging tool responses. The sonic showed some intervals of cycle skipping, particularly in the interval below 9225 ft (2811.8 m). The logging operation itself went smoothly with no tool sticking or delays.

1.5" stand offs were used with the DLL/MSFL.

The BGT, run to record the performance of the bi-centred bit used to drill this section, functioned satisfactorily. Maximum recorded temperature was 173 deg F (78 deg C) at 9283 ft (2829.5 m).

Run 2: 8th June, 1992 Rogaland and Shetland Groups

Acquisition objectives: Structure, correlation, lithology and hole geometry.

Driller TD	10008 ft (3050.4 m)
Bit size	12.25/15 inches
Mud weight	11.8 lbs/gal (1.41 g/cc)
Mud type	Seawater/Polymer
Hole deviation	1.1 deg

Logging runs:

Run #	Tool	Top		Base		Temperature	
		ft	m	ft	m	deg F	deg C
2:1	FMS/GR	9334	2845.0	9970	3040.7	164	73
2:1	SDT/GR	9040	2755.4	9915	3022.1		

Data quality discussion:

These logs have all been assigned Run No. 2, according to the Phillips Norway standard run numbering procedure. The FMS/GR was run in open hole, on 8th June, 1992, the SDT/GR was run in cased hole on the 10th July.

FMS/GR - Drillers total depth was not reached due to junk in the hole. In order to avoid hanging up on a damaged casing shoe at 9305 ft (2836.2 m), the caliper was closed before entering the casing. Because of this risk of hanging up, and the poor hole conditions generally, no repeat section was made.

In view of the severe hole conditions, it was decided not to run any further openhole logs in this section. There is therefore a gap between the depths of 9283 ft and 9914 ft (2829.5 - 3021.8 m) in this well with no openhole wireline log data, other than this FMS.

SDT/GR - This log was recorded in casing to 9040 ft (2755.4 m). Subsequent processing of the sonic waveforms by Schlumberger at their computer centre resulted in an acceptable DT curve being obtained behind casing, in an interval where the only openhole log obtained was the FMS described above.

Maximum recorded temperature was 164 deg F (73 deg C) at 9976 ft (3040.7 m).

Run 3: 10th/13th, July 1992 Shetland Group and Cromer Knoll Groups

Acquisition objectives: Structure, correlation and lithology.

Driller TD	10950 ft (3337.6 m)
Bit size	7.375 inches
Mud weight	14.0 lbs/gal (1.68 g/cc)
Mud type	Therma-Drill
Hole deviation	5.3 deg

Logging runs:

Run #	Tool	Top		Base		Temperature	
		ft	m	ft	m	deg F	deg C
3:1	GR/DLL/SDT/MSFL	9915	3022.1	10955	3339.1	233	112
3:1	LDL/CNL/GR	9914	3021.8	10920	3328.4	233	112

Data quality discussion:

Conditions generally were not favourable to data acquisition, despite which, some valuable data were acquired.

GR/DLL/SDT/MSFL - Severe sticking and over pulls were encountered after logging off bottom with this combination. The MSFL log was abandoned, and the caliper closed at 10505 ft (3201.9 m). The tools were then run back to TD and the openhole section logged without the MSFL. The sonic waveform log was recorded in casing to 9040 ft (2755.4 m).

LDL/CNL/GR - This log was run in a separate rig-up, after the hole had been under-reamed from 7.375 inches to 9.0 inches. This procedure was adopted: a) so that the stratigraphic location could be determined with the DLL/MSFL/SDT before final commitment was made to running the liner and b) to obviate the need for a separate caliper run before running the 7.0 inch liner.

Run 4: 29th July, 1992 Tyne, Triassic (?) and Zechstein Groups

Acquisition objectives: Hydrocarbon evaluation, structure, lithology and correlation.

Driller TD	12772 ft (3892.9 m)
Bit size	5.875/6.50 inches
Mud weight	17.0 lbs/gal (2.04 g/cc)
Mud type	Therma-Drill
Hole deviation	11.4 deg at 12490 ft (3806.9 m)

Logging runs:

Run #	Tool	Top ft	Top m	Base ft	Base m	Temperature deg F	Temperature deg C
4:3	DLL/MSFL/GR	10939	3334.2	12632	3850.2	292	144
4:2	LDL/CNL/NGL	10939	3334.2	12624	3847.8	297	147
4:3	SDT/GR	10971	3343.9	12605	3842.0	299	148
4:2	FMS/GR	10939	3334.2	12596	3839.3	299	148
4:1	VSP(open hole)	3600	1097.3	12600	3840.5	312	156
4:2	VSP(casing)	3600	1097.3	10850	3307.1	300	149
4:1	CST	10964	3341.8	12586	3836.2		

Data quality discussion:

DLL/MSFL/GR - The tool would not go below 12647.5 ft (3854.9 m). This depth is 53.5 ft (16.3 m) below where the top of the Zechstein is interpreted to occur, and the tool may have stood up on a ledge of halite swelling into the hole. Otherwise, hole conditions were generally good, and satisfactory data were acquired.

LDL/CNL/NGL - As with the DLL/MSFL combination, it was impossible to get to TD. The SGR gamma ray reads typically 20 API units higher than the gamma ray recorded with the DLL/MSFL combination. The NGL failed intermittently in the intervals 11920-11760 ft and 11490-10939 ft (3633.2-3584.4 m and 3502.2-3334.2 m), but otherwise the log quality is good.

SDT/GR - The tool failed at 12540 ft (3822.2 m), shortly after coming off bottom. However, a down log had been recorded from which an acceptable DT curve was later extracted, despite severe cycle-skipping. It was therefore decide not to re-run the sonic log.

FMS/GR - This log was run at speeds varying between 1300 and 1800 ft/hr (396 - 549 m/hr) in order to minimise uneven tool movement. The PAD1 AZIMUTH output was not working during the log, but Schlumberger were subsequently able to extract PAD1 AZIMUTH from the RELATIVE BEARING, in combination with the hole azimuth reading from the MWD directional tool.

VSP - See **GEOLOGICAL SUMMARY** for a discussion of the data quality of this tool.

CST - Some lost time was incurred on this run, due to the use of incorrect software. The recoveries are summarised below:

Recovered	Lost	Empty	Total fired
23 (39%)	32	4	59

3. INTERPRETATION SUMMARY

Tyne, Triassic (?), and Zechstein Groups, 10945 - 12600 ft (3336.0 - 3840.5 m)

Data splicing and shifting:

The log quality is generally good over this interval, and no splices, depth shifts, calibration shifts or edits were necessary.

Environmental corrections:

Standard borehole environmental corrections were applied to the raw log data as follows:

Resistivity measurements (DLL/MSFL) were corrected for:

Hole size	:	caliper
Temperature	:	292 deg F (144 deg C) @ 12600 ft (3840.5 m)
Standoff size	:	1.5"
Mud resistivity	:	0.277 ohmm @ 66 deg F (19 deg C)
Mudcake resistivity	:	0.777 ohmm @ 64 deg F (18 deg C)
Mud filtrate resistivity	:	0.135 ohmm @ 68 deg F (20 deg C)

True resistivity was derived using corrected MSFL, LLS and LLD curves in the RINT-9b Schlumberger "Tornado" chart.

The Gamma Ray was corrected for hole size and a mud weight of 17.0 lb/gal (2.04 g/cc).

Neutron (CNL) measurements were corrected for:

Dead time		
Hole size	:	caliper
Mudcake	:	caliper
Borehole salinity	:	mud resistivity
Formation salinity	:	mud filtrate resistivity
Mud weight	:	17.0 lb/gal (2.04 g/cc)
Stand-off	:	0.5"
Temperature	:	292 deg F (144 deg C) @ 12600 ft (3840.5 m)

Shale/clay volume determination:

Although several combinations of logs were reviewed for the determination of shale volume, the most consistent interpretation resulted from the use of the density-neutron crossplot method. This was therefore used as input for the shale volume calculation. A density of 2.42 g/cc and an apparent neutron porosity of 39 % were used for the shale parameters.

Effective porosity determination:

As noted above in "wireline data quality discussion", the sonic log in this section is not wholly satisfactory, being derived from a down log with heavy cycle-skipping. Hence, it was decided to derive the effective porosity from the density and neutron logs, using a complex-lithology algorithm. This algorithm corrects the porosity for the effects of shale and, iteratively, for hydrocarbons.

Water saturation determination:

Water saturation was computed using a modified version of the Poupon equation which takes into account the effect of clay on the resistivity measurements.

The Archie saturation parameters; 'a', 'm', 'n' and also Rw, the formation water resistivity, were selected on the basis of regional knowledge. These, and other key parameters are listed in the table below.

List of key parameters used in the analysis:

Zone top	10945 ft (3336.0 m)
Zone base	12600 ft (3840.5 m)
Bit size	5.875/6.50 inch (bi-centred)
Total depth	12600 ft (3840.5 m)
BHT	293 deg F (145 deg C)
Dens. shle	2.42 g/cc
Density ma	2.68 g/cc
Neutron por shale	39%
DT matrix	n/a
Rmf	0.135 ohmm
Temp, Rmf	68 deg F (20 deg C)
Rw	0.053 ohmm
Temp, Rw	245 deg F (118 deg C)
R shale	3.0 ohmm
a	1.00
m	2.00
n	2.00
Density fl	1.00 g/cc
Density HC	0.60 g/cc
GR-cl/sh	n/a

Summary Discussion:

Most of the Jurassic section consists of a fairly uniform shale with limited sand development near the top and bottom of the Farsund Formation and in the Eldfisk Formation. The thickest developed sandstone occurs in the Eldfisk Formation between 11511-11541 ft (3508.6-3517.7 m). The upper part of this interval, around 11515 ft (3509.8 m) has the best developed porosity in the entire section, up to 20%, with associated 20% hydrocarbon saturation. The lower part of this sandstone was tight.

A 10 ft (3.1 m) argillaceous sandstone in the Farsund Formation at 11022 ft(3359.5 m) displayed 10% porosity and 50% hydrocarbon saturation. Thin bedded sandstones in the gross interval 11390-11507 ft (3471.7-3507.4 m) were occasionally porous but predominantly tight.

In the interval 11200-11240 ft (3413.8-3426.0 m) the log exhibits an unusual combination of responses. The density reads around 2.0 g/cc, the neutron shows 45% or more porosity, and gamma ray reads consistently around 100 API units. Resistivity readings are high, up to 1000 ohms, but there is not the degree of separation that might be expected between resistivity curves in a porous, hydrocarbon-bearing rock. Geochemical analysis indicates this section is extremely rich in organic carbon (10-22% TOC) with values two to three times larger relative to the shales above and below. Conventional Core No. 2 recovered predominantly claystone with thin interbeds of sandstone. The interval is not of any commercial significance.

In the Haugesund Formation below 11600 ft (3535.7 m), the shale is regularly interrupted by high density, low gamma ray streaks, typically less than 3 ft (1.0 m) in thickness. These are interpreted as non-porous limestone stringers which occur on the order of 20-50 ft (6.1-15.2 m).

In the Triassic (?) section below 12470 ft (3800.9 m), anhydrite was observed in cuttings and sidewall cores. The presence of this mineral is also confirmed by wireline log response (density values around 2.98 g/cc). At 12594 ft (3838.7 m), the density decreases sharply to values around 2.10 g/cc, while the neutron also decreases to an apparent porosity of close to zero. This response is interpreted as the onset of a halite bed at the top of the Zechstein Group.