FINAL WELL REPORT

2/7-24

Prepared by: L. De Boer
T. Knutson
R.A. Farnan
C.J. Kennedy
M.J. Scanlan
I. Tønne

Checked by: T.M. Croucher
R.A.P. Garnett

Approved by: N. Marshall
B. Sandstad

50.92.D\G00805

List of Contents

LIST OF FIGURES **Figure No.**

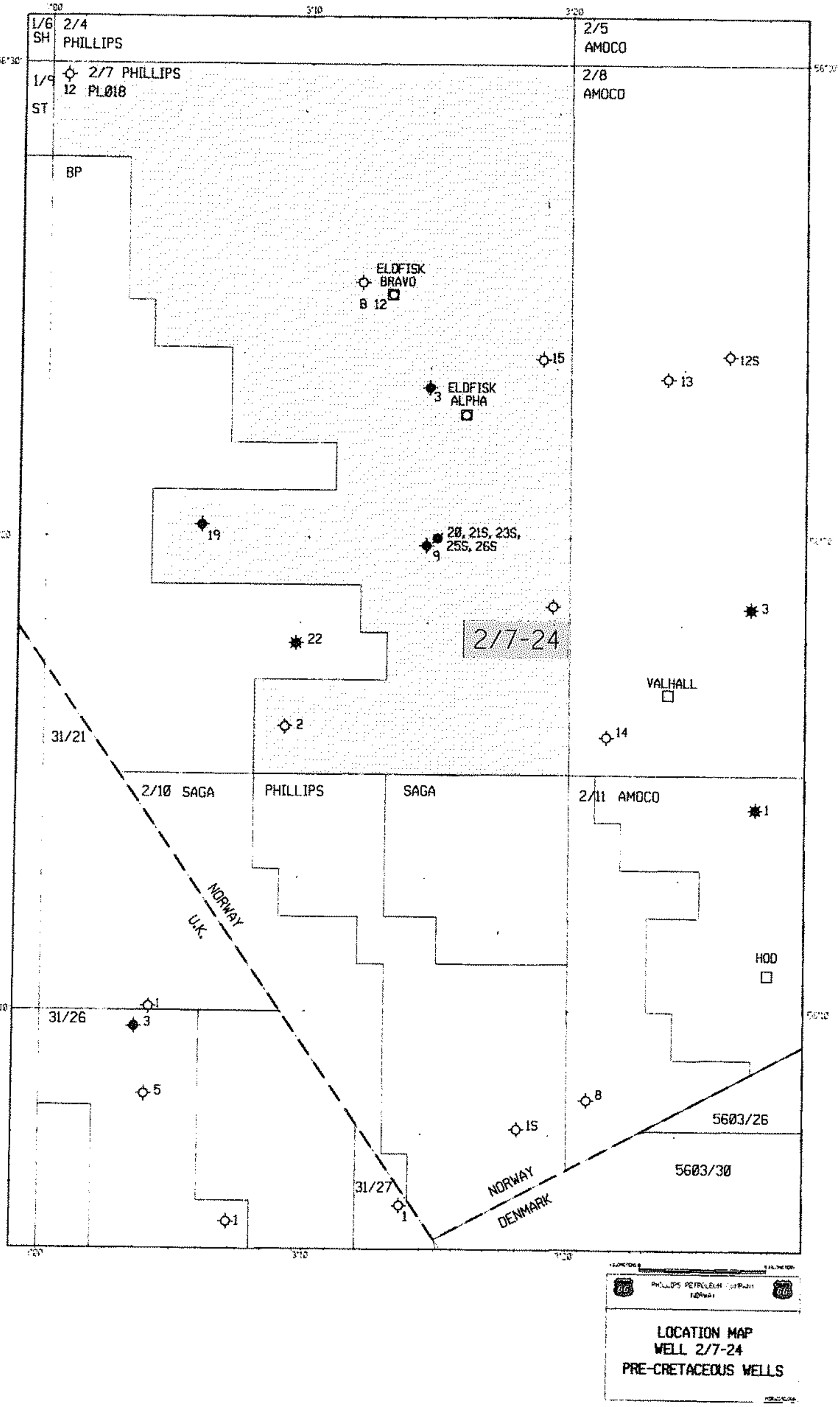
LIST OF TABLES **Table No.**

ENCLOSURES **Enclosure No.**

SECTION 1. SUMMARY

1. General Well Data Summary Sheet
2. Well Summary

Figure	Number
Location Map	1
Well Summary Log	2



1/6
SH
2/4
PHILLIPS
2/5
AMOCO
1/9
ST
2/7 PHILLIPS
12 PL018
2/8
AMOCO
BP
ELDFISK
BRAVO
B 12
15
12S
13
3
ELDFISK
ALPHA
19
20, 21S, 23S,
25S, 26S
9
3
2/7-24
22
VALHALL
2
14
31/21
2/10 SAGA
PHILLIPS
SAGA
2/11 AMOCO
1
NORWAY
U.K.
HOD
1
31/26
3
5
8
1S
5603/26
5603/30
31/27
1
NORWAY
DENMARK
1
LOCATION MAP
WELL 2/7-24
PRE-CRETACEOUS WELLS

Fig. 1

1. GENERAL WELL DATA SUMMARY

WELL NAME AND NUMBER:	West Valhall Prospect, Well 2/7-24
WELL TYPE:	Exploration
AFE NUMBER:	NW-6818
LOCATION GEOGRAPHICAL:	Latitude 56 deg 18 min 33.00 sec North Longitude 3 deg 19 min 23.56 sec East
LOCATION UTM:	Easting 519 997.7 Northing 6 240 675.3
RIG / RKB:	Ross Isle / 73' (22.3 m)
SPUD DATE:	7 November, 1990
STATUS/DATE:	Dry well, permanently plugged and abandoned, 13 April, 1991
WATER DEPTH:	229' (69.8 m)
TOTAL DEPTH:	16480' MD (5023 m)
AGE AT TD:	Upper Jurassic

INTERESTS:

Phillips Petroleum (Operator)	36.960%
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%

Casing Depths:

30"	at 417' MD RKB
20"	at 1504'
13 3/8"	at 5005'
9 5/8"	at 9979'
7"	at 12857'

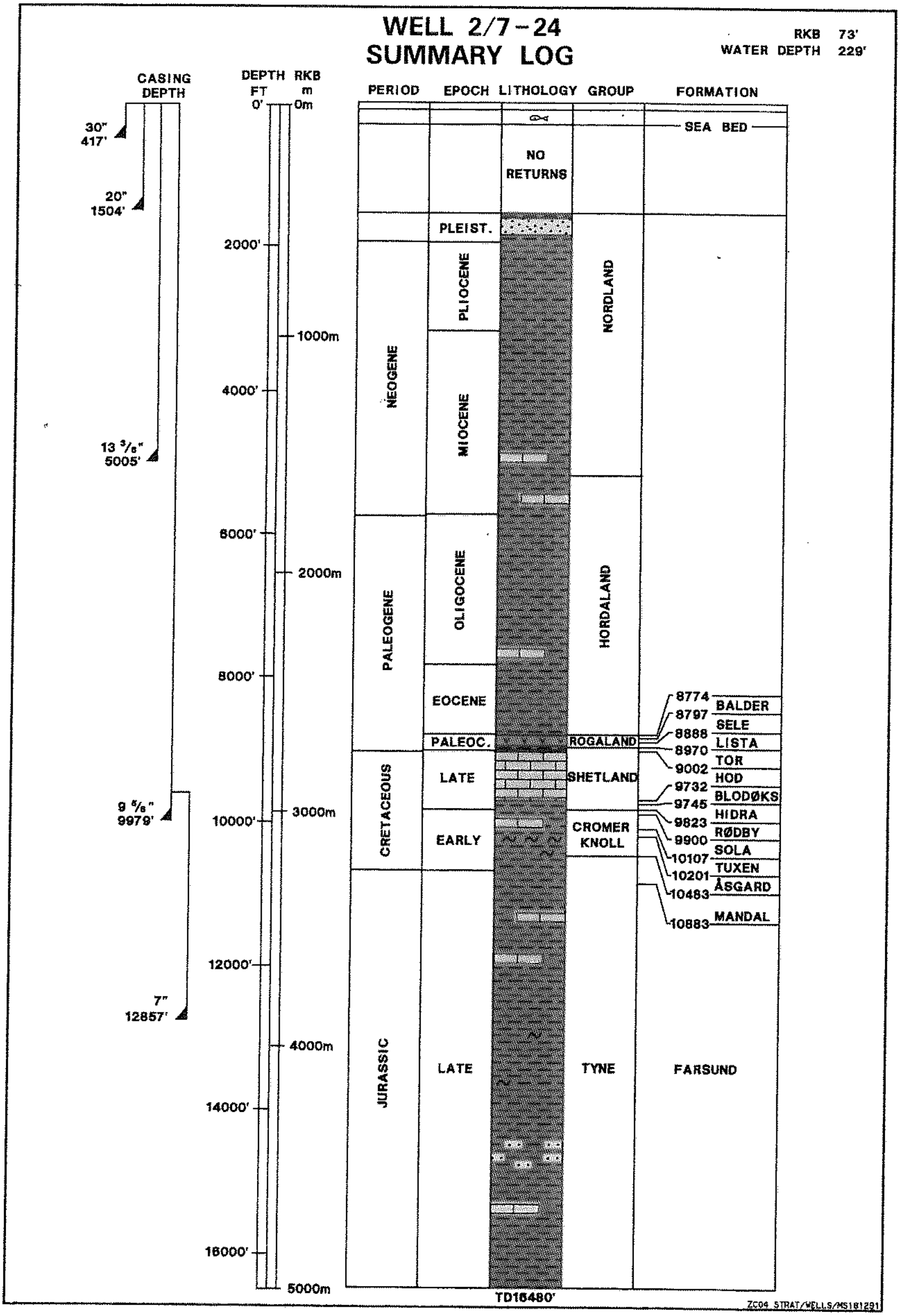
2. WELL SUMMARY

The 2/7-24 exploration well was drilled on the West Valhall Prospect, located in Production License 018. The well was spud on November 7, 1990, and drilled using the Ross Isle rig. The prospect is within the Central Trough on the west side of the Feda Graben, Norwegian North Sea. The objective of the well was a undrilled Upper Jurassic structure in Block 2/7. The well penetrated 5997' (1828m) measured depth of Upper Jurassic section, believed to be the thickest Upper Jurassic drilled to date in the Central Trough. Upper Jurassic lithology was primarily mudstone with subordinate amounts of thinly bedded sandstone and limestone.

One core was cut in the Upper Jurassic which consisted of mudstone and thin interbeds of sandstone. The sandstone represented the distal portion of a debris flow with a probable source area from the Grensen Nose to the west. Core data demonstrated the sandstone beds, which were bleeding gas with traces of oil, to be of low permeability. Anticipated reservoir quality sandstone was not encountered and after reaching a total depth of 16480' (5023m) measured depth, the well was permanently plugged and abandoned on April 13, 1991.

Studies performed on sample cuttings and cores indicate that the the well reached total depth in Upper Jurassic 'Late' - 'Middle' Kimmeridgian age rock. Geochemically, the encountered Upper Jurassic Mandal and upper part of the Farsund Formations displayed a good to rich potential for the generation of oil. Migrated hydrocarbons have occurred throughout the Lower Cretaceous and Upper Jurassic sections. The Upper Jurassic displayed increasing maturity ranging from early mature at the top of the section to late mature at total depth.

Below the 30" casing, the well was logged in its entirety using a combination of measurement while drilling (MWD, up-hole section), wireline, and tough logging condition (TLC, Upper Jurassic section) tools.



WELL 2/7-24
SUMMARY LOG
RKB 73'
WATER DEPTH 229'
CASING DEPTH
DEPTH RKB
FT
m
PERIOD
EPOCH
LITHOLOGY
GROUP
FORMATION
30" 417'
20" 1504'
13 3/8" 5005'
9 5/8" 9979'
7" 12857'
0'
2000'
4000'
6000'
8000'
10000'
12000'
14000'
16000'
0m
1000m
2000m
3000m
4000m
5000m
SEA BED
NO RETURNS
PLEIST.
NEOGENE
PLIOCENE
MIOCENE
NORDLAND
PALEOGENE
OLIGOCENE
EOCENE
PALEOC.
HORDALAND
ROGALAND
CRETACEOUS
LATE
EARLY
SHETLAND
CROMER KNOLL
JURASSIC
LATE
TYNE
FARSUND
8774
BALDER
8797
SELE
8888
LISTA
8970
TOR
9002
HOD
9732
BLODØKS
9745
HIDRA
9823
RØDBY
9900
SOLA
10107
TUXEN
10201
ÅSGARD
10483
MANDAL
10883
TD16480'
ZC04 STRAT/WELLS/MS181291

Fig. 2

SECTION 2 GEOLOGICAL SUMMARY

1. WELL OBJECTIVE/RESULTS

The primary objective of the West Valhall Prospect was Upper Jurassic Eldfisk Formation sandstone. The closest well control for the Eldfisk sandstone is ten kilometers northwest at the 2/7-3 well, which encountered (97') of net sandstone (40% volume shale, 5% porosity cutoff). The Eldfisk Formation was located approximately 250' above a seismic reflector called the Intra Upper Jurassic Marker (IUJM).

A secondary objective was sandstone associated with a seismic horizon called the Intra-Volgian Marker. This horizon was mapped in conjunction with negotiations regarding a possible joint License 018 and 006 West Valhall well near the Block 2/7-2/8 border. The horizon was interpreted to show the structural configuration of any sands which might have been encountered midway between the Base Cretaceous and the IUJM. Because of poor seismic quality, this marker was not mapped with confidence.

The primary objective Intra Upper Jurassic Marker was encountered at 13350' measured depth, 570' high to prognosis. The precise age of this seismic event is unknown. Biostratigraphy in the interval from 12967-16480' TD reflects a Late-Middle Kimmeridgian age. Structural dip at the level of the IUJM is 8 degrees east.

The 2/7-24 well has shown that a reservoir quality Upper Jurassic mass flow clastic deposit is not present at this location. The well did encounter thin Upper Jurassic shaly sandstones in the interval 14240-14830', approximately 850' true vertical depth below the Intra Upper Jurassic Marker. However, the sandstones were discontinuous and not of the reservoir quality that was anticipated.

The measured depth of the well is approximately the same as the true vertical depth down to 10000'. A maximum hole deviation of 20 degrees occurred at 14712' measured depth (14645' TVD). The deviation decreased to 12 degrees at the final TD of 16480' measured depth (16358' TVD).

2. STRUCTURE

The West Valhall Prospect is located in the Feda Graben near the Skrubbe (Lindesnes) Fault. The objective Upper Jurassic Eldfisk Formation sandstone was interpreted as a mass flow deposit located on the east side of the fault. The Skrubbe Fault was an eastward dipping normal fault during Upper Jurassic deposition. Sediments were interpreted to be sourced from a structurally high area near the Embla Field to the west, transported across the fault, and deposited in the Feda Graben to the east.

Structural inversion took place during the Late Cretaceous resulting in reverse movement along the Skrubbe Fault. The inversion was a result of a regional compressional stress regime with possible complications from salt related movements. The result of the inversion is the Lindesnes Ridge, a north-northwest south-southeast anticlinorium, located parallel to, and east of the Skrubbe Fault. The West Valhall Prospect was part of the Lindesnes Ridge System located between the Eldfisk Field to the northwest and the Valhall Field to the southeast. At the West Valhall Prospect, the inversion uplifted the objective Intra Upper Jurassic Marker Horizon and the anticipated Eldfisk Formation sandstone to a present day structural high position along the Lindesnes Ridge.

At the level of the primary objective Intra Upper Jurassic Marker the structure displays three way dip closure with fault closure on the western side against the Skrubbe Fault (Figures 3 and 4). Small four way dip closure occurs near the top of this structure. At the 2/7-24 location structural dip at the Intra Upper Jurassic Marker is approximately 8 degrees to the east.

Prior to drilling, the 3-D seismic interpretation delineated a structural basement high in the southeast part of the Embla Field. The high was interpreted to be located on the Grensen Nose, immediately west of the Skrubbe Fault and the proposed 2/7-24 location. The Base Cretaceous-Top Basement isochron showed a thin over the basement high area which was interpreted to be the result of erosion during Upper Jurassic extensional tectonics and associated footwall uplift at the Embla area. The area was thought to be a high during the Upper Jurassic and a source of clastic sediment for the Feda Graben and the West Valhall Prospect.

Recent development drilling at the Embla Field, has shown that the anticipated structurally high, clastic source area for the West Valhall Prospect was located further west than previously interpreted. Upper Jurassic sands shed off the Grensen Nose are not as well developed east of the Embla area as the sands found in the 2/7-3 Eldfisk Formation type well, northwest of the West Valhall Prospect area.

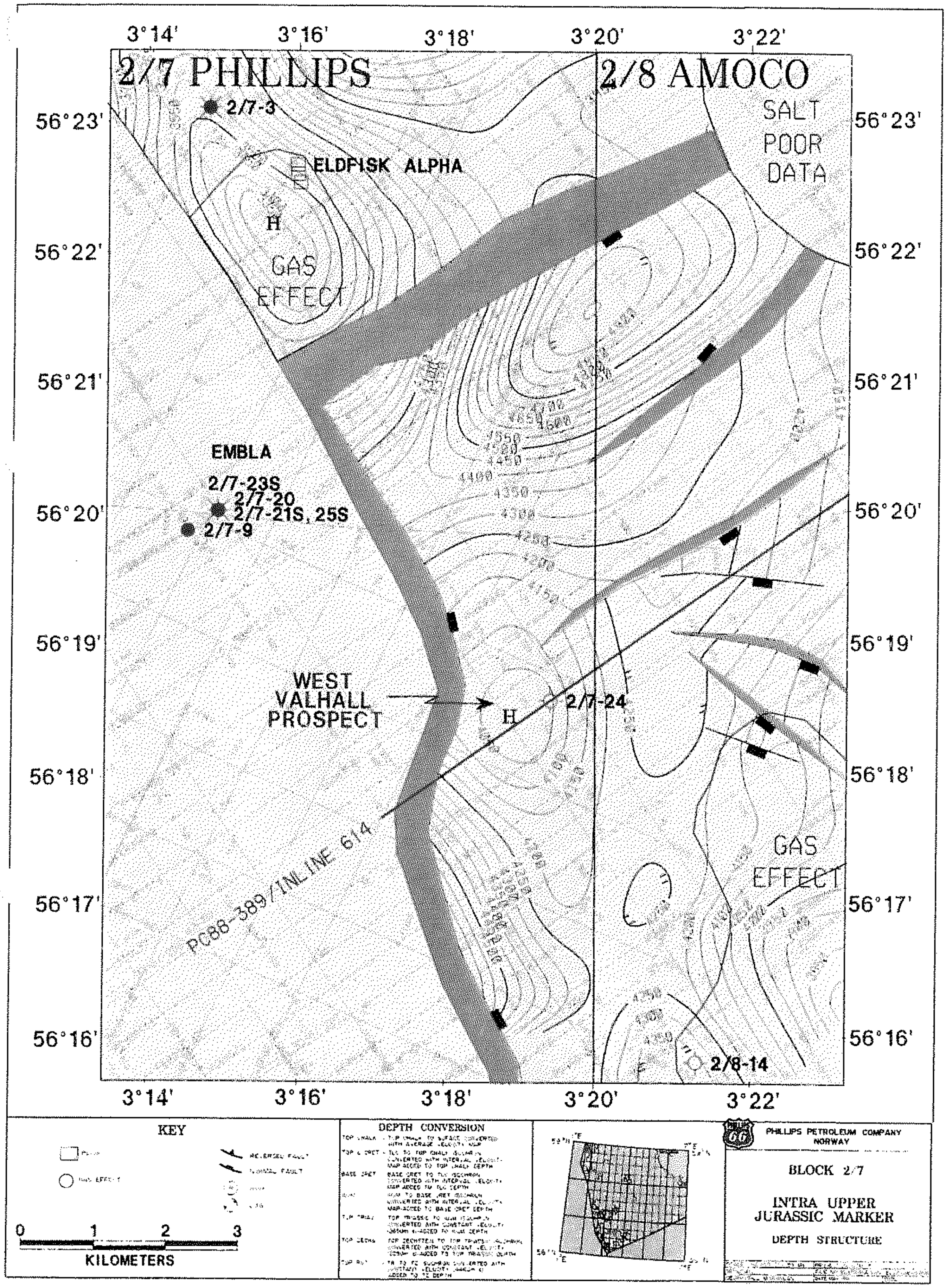
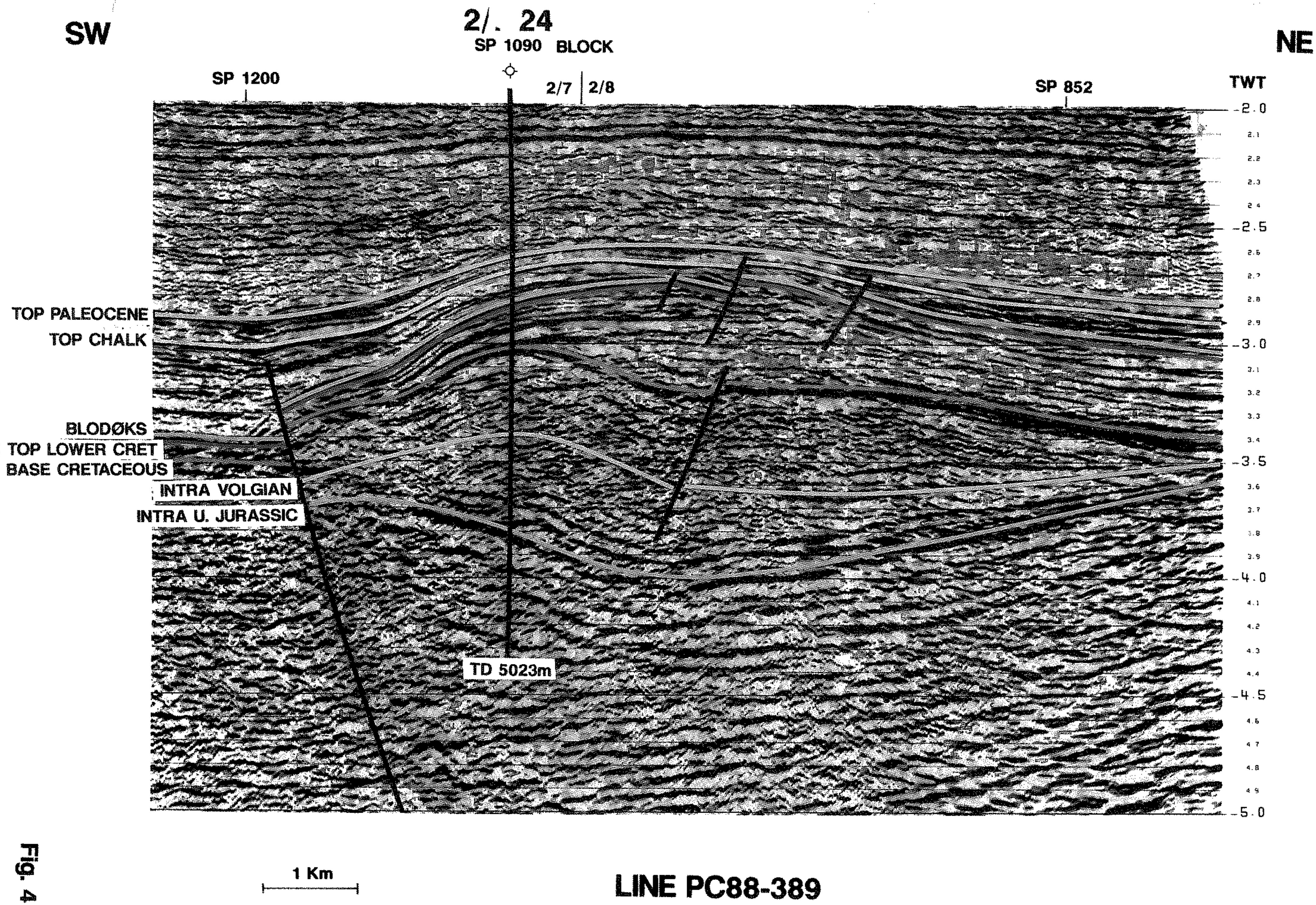

2/7 PHILLIPS
2/8 AMOCO
SALT POOR DATA
2/7-3
ELDFISK ALPHA
GAS EFFECT
EMBLA
2/7-23S
2/7-20
2/7-21S, 25S
2/7-9
WEST VALHALL PROSPECT
2/7-24
PC88-389/INLINE 614
GAS EFFECT
2/8-14
KEY
0 1 2 3
KILOMETERS
DEPTH CONVERSION
PHILLIPS PETROLEUM COMPANY NORWAY
BLOCK 2/7
INTRA UPPER JURASSIC MARKER
DEPTH STRUCTURE

Fig. 3



LINE PC88-389

Fig. 4

3. OPERATIONS SUMMARY

36" Hole Section: 302' - 420'

The 2/7-24 well was spudded on the 7th November, 1990. The hole was drilled with a 26" bit and a 36" hole opener to 420' without riser, BOP, or MWD. The hole was drilled with seawater, using high viscosity pills at every connection. The hole was displaced with 10.0 ppg high viscosity mud prior to running casing.

The 30" casing was run and cemented at 417'.

A total of two days were spent on this section.

26" Hole Section: 420' - 1525'

Three feet of 26" hole were made after drilling out the 30" casing shoe. As a precaution against a possible shallow gas accumulation, a 12 1/4" pilot hole was then drilled to 1525'. Drilling was again with seawater, with high viscosity pills pumped at every connection. After displacing the hole with 9.5 ppg mud the hole was opened up to 26".

Teleco MWD resistivity/gamma ray/directional (RGD) tools were run during the drilling of the 12 1/4" pilot hole.

The 20" casing was run and cemented at 1504' followed by the installation of the BOP and riser.

A total of 10 days were spent on this section; delays were caused by repairs to the BOP.

17 1/2" Hole Section: 1525' - 5025'

The hole was displaced to 10.0 ppg ester-based Petrofree mud prior to drilling out the 20" casing shoe. Ten feet of formation were drilled and a formation integrity test performed to 12.35 ppg equivalent mud weight (eqmw). The section was then drilled with one bit to 5025'. The mud weight was increased in stages from 10.0 ppg at 1525' to 12.0 ppg at 4900'.

No shallow gas was encountered. The background gas averaged around 45 units.

The section was logged while drilling with Teleco RGD tools. Schlumberger wireline logs DIL/SLS/GR/CAL/AMS were run from 4996 to the 20" shoe. The gamma ray was run to seabed but was of poor quality; hence, the MWD log is used for the 17 1/2", 26" and 36" hole sections on the completion log.

The 13 3/8" casing was run and cemented at 5005'

A total of 8 days were spent on this section.

12 1/4" Hole Section: 5025' - 9992'

Drilled 10' of new formation with a 12 1/4" bit to 5035' and performed a leak off test to 16.17 ppg eqmw.

The remaining 12 1/4" hole was drilled to 9992'. Mudweight was gradually increased from 12.1 ppg to 14.4 ppg throughout this section.

Teleco MWD Dual Propagation Resistivity/Gamma Ray (DPR) tools were run while drilling this section. The resistivity failed at 7753' as the result of problems with power supply. Schlumberger wireline logs DITE/SLS/GR (run 1) and LDL/CNL/GR (run 2) were run from total depth to the 13 3/8" casing shoe. The gamma ray was run to seabed. OBDT/GR (run 3) was run in the interval from 10006' up to 8700'.

The 9 5/8" casing was run and cemented at 9979'.

A total of 10 days were spent on this section.

8 1/2" Hole Section: 9992' - 12873'

The hole was displaced with oil based mud (15.5 ppg) followed by drilling ten feet of new formation. A formation integrity test was performed at 10002' to 17.5 ppg eqmw.

Drilling proceeded to 10046' when returns were circulated following a gas peak of 4050 units. After drilling to 10469' there was a gain of 6 barrels in 30 minutes and the mudweight was raised to 16.2 ppg. Losses of 7 barrels were seen when drilling resumed. Lost circulation material (LCM) pills were pumped in order to prevent further losses. Although connection gases and pump off gases were still present, continuing losses made it necessary to reduce the mud weight to 16.0 ppg.

At 10,639' a 10 barrel gain was noticed on pulling out on a wiper trip. In response to increasing pore pressure, the mud weight was again increased to 16.1 ppg and drilling continued to 10731' when poor weather conditions led to hanging off the drill string and unlatching the riser. After running back in the hole to the 9 5/8" casing shoe, a loss of 3 barrels in 20 minutes occurred and a circulated gas peak of 4020 units was recorded. A balanced cement plug was set to 9725' so that the BOP stack could be pulled for repair work. Mud weight was reduced to 15.8 ppg prior to drilling out the cement in order to prevent mud losses to the formation. The mud weight was gradually raised to 16.1 ppg in response to increasing connection gases.

At 10852', five barrels of mud were lost in 10 minutes followed by a gain. During a flow check a gain of 13 barrels in 39 minutes occurred and the hole was shut in. A pressure build up of 43 psi was recorded. Mudweight was raised to 16.4 ppg before hanging off due to poor weather conditions. When the well was opened up the pump rates were varied to establish a rate where no losses occurred. 92 barrels were lost suggesting the formation had been fractured. LCM pills were pumped and hesitation squeezes performed but mud losses persisted.

A Schlumberger intermediate wireline run of DITE/LSS/GR/CAL/AMS (run 1) and RFT/GR (run 2) were recorded. Run 1 was from 10846' to the 9 5/8" casing shoe. The RFT run indicated a formation pressure of 7813 psi at 10121', one test had a seal failure, and 22 tests indicated a tight formation.

After squeezing cement to reduce the high gas levels, drilling resumed. The Teleco MWD tool failed at the start of the run. As drilling proceeded a swab test was made at each connection, with resultant gas peaks ranging between 670 units and 1255 units. The background gas level increased to 3145 units by 10860' and the mudweight was raised to 16.5 ppg. At 10990', a flow check recorded a 10 barrel increase and a gas peak of 3070 units. LCM and cement were squeezed into the formation. The mud weight was decreased to 16.4 ppg due to continuing losses.

Drilling continued ahead to 11038', when 36 barrels were lost to the formation. The mud weight was subsequently cut back to 16.2 ppg. Simulated connections and flow checks indicated high gas levels and mud gains.

At 11082' the well was shut in after a 4 barrel gain and 200 psi back-pressure. Drilling continued and at 11114', gases were circulated out via the choke and poor boy degasser. The mud weight was raised to 16.4 ppg and a 17.5 ppg slurry was pumped before pulling out to change the mud system.

Two cement plugs were pumped prior to displacing the hole with a water based mud. New formation was drilled from 11114' to 11214'. A flow check was made and 180 barrels of 17.5 ppg mud were pumped before pulling out of hole to pick up a MWD tool. While running back in the hole, a flow check at 10800' gained 18 barrels of mud and the well was shut in. Returns were via the choke and a gas peak of 4705 units was recorded. Mud weight was raised to 16.3 ppg and drilling proceeded to 11645' with the hole in relatively stable condition; However, connection gases ranged up to 1155 units. A leak off test of 17.5 ppg eqmw was carried out at 11645'.

Drilling resumed with a 16.4 ppg mud weight. The problems throughout most of the remaining section were pit gains and the increasing levels of connection, swab, and pumps off gas. When gas values rose above 500 units the drill string was picked up to circulate out the bubble. This in turn would produce a gas peak at bottoms up. Each connection was flow checked with gains of between 4 and 6 barrels.

Background and connection gas increased at 12350'. However, after weighing up the mud system to 16.6 ppg, connection gases remained high (250-900 units). Carbides were run throughout the bit run and showed that the hole became progressively washed out with depth, particularly below 12350'. After drilling to 12873', the decision was made to set 7" liner. At this point the average hole diameter was calculated to be 10.9".

A total of eight Teleco MWD tools were used in this hole section, (seven DPR, one RGD). MWD was not used while drilling from 10995' to 11214' (the data was later obtained while reaming). Due to MWD tool failure, no data was obtained from 11362' to 11647'.

Schlumberger wireline log DITE/MSFL/BHC/GR could not pass below 10517' and the run was therefore logged from 10517' up to the 9 5/8" shoe at 9979'. The tool was shortened to DLL/MSFL/GR only but was still unable to pass 10517'. Only the caliper was logged in this run. In the third attempt to reach to drilled depth of 12873', the tool string was changed to DLL/MSFL/SDT/CNL, without a radioactive source. When the tools could not pass 10517', a wiper trip was run. After the trip, DLL/MSFL/BHC/GR (run 1), LDL/CNL/NGL (run 2), and FMS/GR (run 3) were then successfully logged from 12884' up to the 9 5/8" casing shoe. RFT/GR (runs 4 and 5) recorded 1 tool failure and four tight tests and four seal failures. A VSP (run 6) was run from total depth up to 3500'. CST/GR (run 7) consisted of three bullets, all of which were lost in the hole.

The hole inclination remained relatively constant at 1-2 degree in this section until around 11500' when it began to increase. At 11647' the inclination was 5.4 degrees; at 12019' inclination was 8.5 degrees. The MWD survey tool failed at 12375'.

The 7" liner was set and cemented at 12857'.

A total of 82 days were spent on this hole section. Most of the delays were related to hole problems and bad weather conditions.

5 7/8 Hole Section: 12873' 16480' TD

Ten feet of new formation was drilled with 16.2 ppg mud followed by a formation integrity test of 18.0 ppg eqmw at 12883'.

The 5 7/8" hole section was drilled to total depth of 16480'. Mud weight varied from 16.2 ppg at the top of the section to 16.4 ppg at total depth. A turbine assembly was used from 12980' to 15967'. This section was drilled without MWD due to the small hole size and high temperature.

Connection gases in the upper part of this section were still present but the magnitude was somewhat less than in the previous hole section. At 14134' maximum connection gas was 307 units Background gas levels varying between 50 and 200 units.

At 14711' a survey was dropped. The drill string became stuck at 14490' while pulling to the shoe to retrieve the survey. The string could not be rotated but was jarred free with 145000 pounds overpull.

A 55' conventional core was cut from driller's depth 14711' to 14766'. Recovery was 56'.

The remainder of this section was drilled without any major difficulties. Connection gases increased in the lower part of this section (below 14766'). A maximum connection gas of 1625 units was recorded at 16130'. At total depth the mud weight was raised to 16.8 ppg prior to the final logging program.

Schlumberger ran wireline logs DLL/MSFL/GPIT/BHC/GR (run 1), but were unable to pass below 15100'. Run 1 was logged from 14986' up to the 7" liner at 12857'. The logging tool was then shortened but was still unable to pass below 15100'. A wiper trip washed and reamed to total depth. Logs were rerun but could not reach the liner shoe, probably because the mud had gelled due to high temperature and over treatment with lime. Another wiper treatment was made and the mud was replaced. Trip gas reached 3535 units.

The next logging attempt (run 2) was run on drill pipe (Tough Logging Conditions, TLC). Logging tools for run 2 were combined as DIL/MSFL/LDL/CNL/NGL. The tools were logged going down from the 7" casing shoe to the total depth of 16472'. Communication with the tool was lost at total depth and no logs were acquired coming back up the hole. The communication failure was attributed to a short circuit in the wet connector. While running TLC, the hole was displaced with fresh low solid mud and no gelling problems occurred. The remaining Schlumberger logs were run on wireline.

Schlumberger wireline VSP (run 3) was logged from 16200' up to 12750'. SHDT/NGL (run 4) was logged from 16240' to up to the 7" casing shoe. A total of 42 sidewall cores were shot on CST/GR (run 5); 11 shots were recovered, 1 misfired, 4 were empty, and 26 bullets were lost. An additional 42 shots were fired on CST/GR (run 6); 24 were recovered, 8 misfired, 9 were empty, and 1 was lost.

The hole inclination in this section gradually increased from an inclination of 6.7 degrees, azimuth 232 degrees at 12958', to 8.1 degrees, azimuth 227 degrees at 13462', to 20.0 degrees, azimuth 202 degrees, at 14712'. From 14712', the inclination gradually decreased to 12.2 degrees, azimuth 215 degrees at the total measured depth of 16480' (16358' TVD).

No testing took place and the well was plugged and abandoned on April 13, 1991.

A total of 46 days were spent on this last hole section.

4. BIOSTRATIGRAPHY

The biostratigraphical evaluation using ditch cuttings, sidewall cores and conventional core was performed by The Robertson Group, plc, Llandudno, United Kingdom. Samples were analyzed over the interval from 1530' - 16480' TD.

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

Lithology	: 369 ditch cutting samples, 18 sidewall cores, and 3 core piece samples.
Micropaleontology	: 274 ditch cutting samples from the intervals 1530'-8970' and 9780'-16480', 17 sidewall cores, and three core pieces.
Palynology	: 110 ditch cuttings, 17 sidewall cores, and two core pieces from the interval 9860'-16480'.
Nannofossils	: 25 ditch cutting samples from the interval 9030'-10140'.
'Hot Shots'	: 6 batches of samples were analyzed as 'hot shots'.

5. CHRONOSTRATIGRAPHIC SUCCESSION

AGE		TOPS (RKB)	
Pleistocene		1530 ft (top not seen)	466.3 m
Pliocene		1890 ft	576.1 m
------------------ Stratigraphic Break ------------------------			
Late Miocene		3150 ft	960.1 m
Middle Miocene		4770 ft	1453.9 m
------------------ Stratigraphic Break ------------------------			
Early Miocene		5580 ft	1700.8 m
Late Oligocene		5760 ft	1755.7 m
Early Oligocene		7380 ft	2249.5 m
------------------ Stratigraphic Break ------------------------			
Middle Eocene		7819 ft(1)	2383.3 m
Early Eocene		8640 ft	2633.5 m
------------------ Stratigraphic Break ------------------------			
Late Paleocene		8774 ft(1)	2674.3 m
------------------ Stratigraphic Break ------------------------			
Early Paleocene		8970 ft(2)	2734.1 m
------------------ Stratigraphic Break ------------------------			
Late Cretaceous	Coniacian	9002 ft(1)	2743.8 m
	Late Turonian	9090 ft	2770.7 m
	Early Turonian	9630 ft	2935.3 m
	Late Cenomanian	9732 ft(1)	2966.3 m
------------------ Stratigraphic Break ------------------------			
Early Cretaceous	Late Albian	9823 ft(1)	2994.1 m
	Basal Late Albian - ?Late Aptian	9870 ft	3008.4 m

	------ Stratigraphic Break --------------------		
	Late Aptian	9900 ft	3017.6 m
	------ Stratigraphic Break --------------------		
Early Cretaceous (continued)	Late Barremian	10080 ft	3072.4 m
	Early Barremian	10110 ft	3081.6 m
	Late Hauterivian	10200 ft	3109.0 m
	Early Hauterivian	10260 ft	3127.3 m
	Late Valanginian - ?Latest Ryazanian	10380 ft	3163.9 m
	------ Stratigraphic Break --------------------		
	Late Ryazanian	10483 ft(1)	3195.3 m
	Early Ryazanian	10610 ft	3234.0 m
Late Jurassic(3)	Late - Middle Volgian	10660 ft	3249.2 m
	Middle Volgian	10860 ft	3310.2 m
	Early Volgian	12390 ft	3776.5 m
	'Late' - 'Middle'? Kimmeridgian	12967(swc)- 16480 ft TD	3952.4 m 5023.2 m TD

Notes: (1) Refers to wireline measured depth.

(2) Poor sample quality and preservation. Reported by Robertson as Early Paleocene (reworked Upper Maastrichtian) on biostratigraphy. Interpreted by Phillips as Maastrichtian (Tor Formation) based on regional geology.

(3) Late Jurassic: poor micropaleontology preservation and recovery/sample quality. Generally moderate to good palynology preservation and recovery/sample quality down to 14893; poor-very poor from 14893-TD.

6. LITHOSTRATIGRAPHIC SUCCESSION

RKB 73' (22.3m)

Units	MD-RKB FT	MD-RKB M	TVD-SS FT	TVD-SS M	TWT SECS.
Nordland Group	Sea Bed				
Hordaland Group	5222	1591.7	5149	1569.4	1.593
Rogaland Group					
Balder Formation	8774	2674.3	8701	2552.1	2.651
Sele Formation	8797	2681.4	8724	2659.1	2.660
Lista Formation	8888	2709.1	8815	2686.8	2.684
Shetland Group					
Tor Formation	8970	2734.1	8897	2711.8	2.706
Hod Formation	9002	2743.8	8929	2721.6	2.712
Blodøks Formation	9732	2966.3	9659	2944.1	2.845
Hidra Formation	9745	2970.3	9672	2948.1	2.848
Cromer Knoll Group					
Rødby Formation	9823	2994.1	9750	2971.8	2.862
Sola Formation	9900	3017.6	9827	2995.3	2.879
Tuxen Formation	10107	3080.7	10033	3058.1	2.930
Åsgard Formation	10201	3109.3	10127	3086.7	2.953
Tyne Group					
Mandal Formation	10483	3195.3	10409	3172.7	3.019
Farsund Formation	10883	3317.2	10809	3294.6	3.132
TD, Tyne Group	16480	5023.2	16285	4963.7	4.344

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.

NORDLAND GROUP: 1530-5222' md (First returns at 1525'; actual top Nordland at seabed, 302'md).

Thickness: 4920' md from seabed.

Age: Pleistocene to Middle Miocene.

Description and Lithology: The Nordland Group in this well consists of a thick sequence of clay and mudstone with subordinate sand, bioclastic debris, and limestone. From the MWD log, the interval from 420' to 1670' has been interpreted as predominantly sand with interbedded clay. From 1670' to the top of the Hordaland Group at 5222', the lithology is predominantly mudstone with occasional interbeds of sand, bioclastic debris, and limestone. The mudstone is grey to grey brown, soft to firm, and slightly calcareous. Occasional sand stringers, found primarily in the upper part of this interval, occur as very fine to fine grained loose quartz grains. Occasional limestone stringers, occurring in the lower part of this interval, are white to yellow brown, firm to hard, and argillaceous. Traces of pyrite and carbonaceous debris are also present.

Depositional Environment: The upper part of the Nordland Group from 1530-3150' (sampling started at 1530') yielded coarse tested calcareous benthonic foraminifera which, with the 'poorly' sorted nature of the sand over this interval, indicated a relatively high energy environment within the inner shelf. The appearance of planktonic foraminifera together with the increased representation of deeper water species within the interval 3150-4770' indicates deeper water conditions within the outer shelf. The interval 4770-5220' contains an increased representation of agglutinated foraminifera and the diverse calcareous benthonic and planktonic assemblages suggest an open marine, outer shelf to upper bathyal environment.

HORDALAND GROUP: 5222-8774' md.

Thickness: 3552' md

Age: Middle Miocene to Lower Eocene.

Description and Lithology: The top of the Hordaland Group is marked by a downhole decrease of the gamma ray curve at 5222'. The predominant lithology is grey to grey brown claystone, with increasing amounts of thin bedded limestone similar to that in the basal part of the Nordland Group. The claystone is generally firm, silty, non to slightly calcareous, and often pyritic. At 7750', the color of the claystone changes to greenish grey - medium grey, and occasionally reddish brown.

Depositional Environment: The interval contains well preserved assemblages dominated by calcareous benthonic and planktonic foraminifera with subsidiary agglutinated foraminifera. The association present is consistent with a well oxygenated outer shelf to upper bathyal environment of deposition. Based upon the presence of agglutinated foraminifera and the poor diversity, calcareous benthonic forms, often exhibiting dissolution, a subsidiary dysaerobic middle to lower bathyal environment is indicated at depths of 5760' and 7830'.

ROGALAND GROUP: 8774-8970' md.

Thickness: 196' md.

Age: Upper Paleocene.

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

Balder Formation: 8774-8797' md.

Description and Lithology: The top of the Balder Formation is marked by the characteristic downhole increase in resistivity and sharp decrease in gamma ray readings. Lithologically, the Balder is predominantly claystone, similar to that of the basal Hordaland Group. Interbedded with the claystone are traces of tuffaceous claystone, speckled blue-grey, green-grey, and purple, firm.

Sele Formation: 8797-8888' md.

Description and Lithology: The top of the Sele Formation is marked by a sharp downhole increase in gamma ray readings. Lithologies are dominated by claystones which are medium grey to green grey, trace reddish brown, firm, blocky, and calcareous.

Lista Formation: 8888-8970' md.

Description and Lithology: The top of the Lista Formation is noted by a downhole decrease in gamma ray readings of approximately 15 API units. Lithologies are dominated by claystone which is medium grey to green grey, soft to firm, silty, and non-calcareous. The claystone becomes reddish brown towards the base of the formation.

Depositional Environment: The interval 8790-8850' of the Rogaland Group contains an extremely poor diversity benthonic assemblage. An absence of benthos indicates bottom water conditions during this time were probably anoxic. The planktonic component is dominated by diatoms. Surface waters were periodically enriched by nutrients possibly from the volcanic activity and the diatom "bloom" would have led to oxygen depletion in the bottom waters. The appearance of a diverse flysch type agglutinated assemblage at 8850' indicates and improvement in bottom water conditions although the absence of calcareous benthonic foraminifera is indicative of a dysaerobic environment within an enclosed basin.

SHETLAND GROUP: 8970-9823' md.

Thickness: 853' md.

Age: Upper Cretaceous; Maastrichtian to Upper Cenomanian.

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

Tor Formation: 8970-9002' md.

AGE: Upper Cretaceous; Maastrichtian.

Description and Lithology: The top of the Tor Formation is marked by the characteristic sharp downhole decrease in gamma ray readings to around 10 API units a corresponding increase in resistivity values, and a sharp decrease in sonic travel time. The lithology from this thin formation is limestone, white to cream, firm, blocky, and cryptocrystalline.

Hod Formation: 9002-9732' md.

Age: Upper Cretaceous; Coniacian to Lower Turonian.

Description and Lithology: The top of the Hod is noted by a slight downhole increase in gamma ray readings of about 15 API units and a corresponding increase in sonic transit time. Chalky limestones which dominate this thick sequence are white, cream and pale grey, firm, locally hard, blocky, cryptocrystalline, and become argillaceous toward the base of the formation.

Blodøks Formation: 9732-9745' md.

Age: Upper Cretaceous; Upper Cenomanian.

Description and Lithology: The thin Blodøks Formation is marked by a characteristic downhole increase in gamma ray values and sonic travel time readings. The lithology is claystone, medium to dark grey, soft, blocky, slightly calcareous, with traces of finely disseminated pyrite.

Hidra Formation: 9745-9823' md.

Age: Upper Cretaceous; Upper Cenomanian.

Description and Lithology: The top of the Hidra Formation occurs where downhole gamma ray values and sonic travel times decrease sharply. The lithology is limestone, white, cream, occasionally brownish grey, firm to hard, chalky, cryptocrystalline, occasionally interbedded with claystone, medium to dark grey, brown, firm, blocky, calcareous. The basal part of the formation becomes increasingly argillaceous grading to a marl, white to light olive grey, locally blue grey, firm to hard, blocky.

Depositional Environment: The presence of a chalk lithology and rich nannofossil assemblages in the Shetland Group indicates an open marine, outer shelf to upper bathyal environment. The Blodøks Formation represents a period when anoxic conditions inhibited the production of organic carbonates and allowed the normal background clay deposition to become the dominant lithotype.

CROMER KNOLL GROUP: 9823-10483' md.

Thickness: 660' md.

Age: Lower Cretaceous; Upper Albian to Upper Valanginian - ?Uppermost Ryazanian.

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

Rødby Formation: 9823-9900' md.

Age: Lower Cretaceous; Upper Albian to Basal Upper Albian - ?Upper Aptian.

Description and Lithology: The top of the Cromer Knoll Group is marked by a gradual downhole increase in gamma ray values and a corresponding increase in sonic transit time. The Rødby Formation consists of gradational/interbedded mudstone, marl, and occasional limestone. The mudstone is medium to dark grey, locally brownish black, firm, silty, calcareous, occasionally very calcareous grading to a marl. The marl is light olive grey, blue grey, with dark grey lamination, soft to firm, very calcareous, grading to a firm limestone.

Depositional Environment:
The large number of planktonic forms present indicates an open marine outer shelf to upper bathyal environment.

Sola Formation: 9900-10107' md.

Age: Lower Cretaceous; Upper Aptian to Upper Barremian.

Description and Lithology: The top of the Sola Formation is marked by a slight downhole increase in the sonic transit time. The lithology of the upper part of the formation is similar to the mudstone, marl, and limestone of the overlying Rødby Formation. However, the lower part of the Sola Formation is marked by a color change in the mudstone to reddish brown, light to medium grey brown, and light medium grey blue. Texturally, the mudstone is soft, locally sticky, and non to slightly calcareous. After setting 9 5/8" casing at 9979' the mudstone description becomes medium to dark brown black, light brown, firm to hard, calcareous, sandy, fine grain quartz, silty, grading to a siltstone.

Depositional Environment:

The presence of planktonic foraminifera suggests an outer shelf to upper bathyal, open marine environment.

Tuxen Formation: 10107-10201' md.

Age: Lower Cretaceous; Upper Barremian to Upper Hauterivian.

Description and Lithology: The Tuxen Formation is interpreted from wireline logs as a downhole decrease in gamma ray values. The Tuxen Formation lithology is similar to the overlying Rødby and Sola Formations but with an increase in carbonate content compared to the overlying Sola Formation. Marl and limestone are the predominant lithologies.

Depositional Environment:
The presence of mixed foraminiferal assemblages and ostracods suggests a general inner to outer shelf environment. The occurrence of an influx of planktonic forms at the top of the formation indicates a stronger open marine influence at this level.

Åsgard Formation: 10201-10483' md.

Age: Lower Cretaceous; Upper Hauterivian to Upper Valanginian - ?Uppermost Ryazanian.

Description and Lithology: The top of the Åsgard Formation is represented by a downhole increase in gamma ray values and a decrease in sonic transit time. The lithology is predominantly mudstone with subordinate amount of marl and limestone. The mudstone is light to medium brown, yellow brown, hard, blocky, brittle, micaceous, occasionally very silty, non to very calcareous, grading to marl. The limestone is white, cream, grey, firm to hard, blocky, argillaceous. Traces of sand, quartz, medium to coarse, well rounded occur at 10300'.

Depositional Environment:
The occurrence of mixed microfaunal assemblages dominated by benthonic forms suggests an inner to outer shelf environment. The consistent occurrence of ostracods supports this suggestion.

TYNE GROUP: 10483-16480' md.

Thickness: 5997' md.

Age: Lower Cretaceous, Upper Ryazanian to Upper Jurassic, 'Upper' -'Middle'? Kimmeridgian.

The Tyne Group is represented by the Mandal and Farsund Formations:

Mandal Formation: 10483-10883' md

Age: Lower Cretaceous, Upper Ryazanian to Upper Jurassic, Middle Volgian.

Description and Lithology: The top of the Mandal Formation is marked by the characteristic sharp downhole increase in gamma ray values from approximately 50 API units in the Åsgard Formation to 100-120 API units in the Mandal Formation; an increase in sonic values also occurs. The formation is primarily mudstone, medium to dark brown grey, brown black, olive black, firm to hard, blocky, subfissile, silty, carbonaceous, non to slightly calcareous, trace pyrite, occasionally grading to siltstone. Occasional limestone stringers, light to medium olive grey, hard, brittle, microcrystalline, also occur.

Depositional Environment:
Microfaunal recovery consists predominantly of radiolaria with benthonic foraminifera being very rare. This type of assemblage indicates a deep water, outer shelf to upper bathyal environment with restricted water circulation.

Farsund Formation: 10883-16480' (TD) md.

Age: Upper Jurassic, Middle Volgian to 'Upper' - 'Middle'? Kimmeridgian.

Description and Lithology: The top of the Farsund Formation is represented by a decrease in gamma ray values to approximately 75 API units. The upper part of the Farsund Formation (10883-

11300') is dominated by mudstone, medium to dark grey, firm, blocky, non to occasionally slightly calcareous. Occasional stringers of limestone, light grey, green grey, hard, microcrystalline, dolomitic, and argillaceous also occur. From 11300-11750', the gamma ray decreases to approximately 60 API units. Lithologically, this interval is predominantly mudstone, dark black to olive black, hard, blocky, brittle, subfissile, micaceous, non to slightly calcareous, occasionally pyritic. Occasional dolomitic limestone stringers also occur. From 11750-14240' background gamma ray values increase in the general range of 90-120 API units. The lithology is predominantly mudstone, dark grey, dark brown grey, olive black, firm to hard, subfissile to fissile, non to slightly calcareous in upper part becoming moderately calcareous with depth, trace pyrite. This interval also displays subordinate limestone stringers, cream, medium grey, and grey brown, hard, blocky, pyritic, often argillaceous grading to a soft to firm marl, and minor sandstone stringers, grey to grey brown, very fine to fine quartz, generally hard, occasionally friable, subangular to subround, well sorted, generally well cemented with calcite, argillaceous, often grading to a coarse siltstone.

The interval 14240-14830' is primarily mudstone as above with an increase in the amount of clastic material. Pulses of decreased gamma ray values in the 30-75 API unit range occur which have been interpreted as thin sandstone beds which are interbedded with mudstone. The interval displays a number of coarsening and fining upward sequences which are isolated from one another by thick, mudstone dominated sequences. The coarsening upward sequences are occasionally overlain by a fining upward sequence. One of these sandstone/mudstone packages is described in Core Number 1, from 14711-14766' drillers depth (see CONVENTIONAL CORE DESCRIPTION). Sandstone descriptions from the well site are limited. Sandstone is described as white, light grey quartz, generally fine to medium grain, occasional coarse to pebble size, hard, angular to subround, moderately to poorly sorted, argillaceous, matrix supported, and calcareous. The reservoir quality of the sandstone is poor, reflecting textural characteristics such as poor sorting, high detrital clay content, and commonly fine grain sizes.

From 14830-15970' mudstone is the predominant lithology with subordinate stringers of limestone and sandstone. Mudstone gamma ray values typically range from 90-105 API units. The mudstone is dark grey, dark brown grey, firm to hard, subfissile, slightly calcareous, becoming increasingly dark black grey, very silty, and carbonaceous below 15600'. The limestone is light grey to white, soft to firm, argillaceous, trace calcite. Sandstone stringers are light grey, quartz, fine to medium, subangular, moderate to well sorted, well cemented with calcite, pyritic.

From 15970'-16480'(TD) mudstone continues to predominate the lithology. The mudstone is medium dark grey brown, brown black, hard, brittle, subfissile, carbonaceous, non to very calcareous. Also occurring is subordinate marl, light medium grey, grey brown, moderately hard, blocky, grading to limestone and occasional stringers of limestone, cream, white, hard, blocky, cryptocrystalline, occasionally crystalline.

Depositional Environment:
The microfaunas consist almost entirely of radiolaria together with sponge spicules indicating a deep water open marine environment with limited water circulation. The sandstones represent subaqueous debris flows into a deep water basin.

8. PORE PRESSURE SUMMARY

Pressure evaluation provided by EXLOG commenced at 302'. A plot of the mud weight and estimated pore pressures demonstrates that the well can be divided into separate pressure regimes which are primarily lithology based. A Phillips plot of the estimated pore pressure and mudweight is shown in Figure 5. A fracture gradient has not been interpreted as there were no leak off tests below the 9 5/8" or 7" shoe. Refer to Exlog End of Well Report for more details on pore pressure.

Section 1: 302' to 1525'

The lithology of this section was predominantly sand and sandstone with subordinate clay and claystone.

A wide scatter of drilling exponent values was the result of the poorly consolidated lithologies which caused variances in ROP, WOB, RPM, and other drilling parameters. A normal pore pressure trend of 8.7 ppg was established for this section. Gas, temperature, and cuttings data were unavailable as the returns were to the sea bed.

A formation integrity test of 12.35 ppg equivalent was recorded at 1535'.

Section 2: 1525' to 5025'

This section consisted mainly of clay and mudstone with subordinate amounts of sand and limestone.

The drilling exponent and gas data were the most useful tools in the interpretation of the pore pressure regime. They indicated an increase in the pore pressure gradient from 8.7 ppg to 9.5 ppg between 1525' and 3800'. By 5025' the pressure was estimated to have increased to 11.6 ppg.

Background gas levels increased from 10 units at the top of the section up to 45 units around 2600'. The level remained steady down to 3500' where it started to increase again. By the end of the section the average background gas increased to 55 units.

A leak off test of 16.17 ppg equivalent was recorded at 5035'.

Section 3: 5025' to 9992'

The upper part of this section, down to 8970', is primarily claystone with subordinate limestone stringers. Limestone occurs from 8970' to 9823' (Shetland Group), while the lower part of the section (Cromer Knoll Group) consists of gradational/interbedded claystone, marl, and occasional limestone.

Due to variable drilling parameters, the drilling exponent values were erratic. Interpretation of pore pressure was mainly based upon gas values and wireline logs and to some extent, temperature data.

From the 13 3/8" casing shoe (5005') to 8400', the pore pressure increased gradually from 11.6 to 13.6 ppg. Background gas values increased from 15 units at the top of the section, to 40 units at the top of the Hordaland Group at 5222'. The average fell to 35 units when the mudweight was increased from 12.0 to 14.0 ppg. From 8400' to 8800' (top Balder Formation at 8774') the gas values increased rapidly to around 70 units. Pore pressure at the top Shetland Group (8970') is estimated at 13.8 ppg. The average background gas level through the Shetland Group limestone section was 45 units. Pore pressure at the base of the Shetland (top Rødby Formation, 9823') had increased to 14.0 ppg. At 9975' a formation gas peak of 202 units was recorded and the pore pressure was estimated around 14.1 ppg.

Delta temperature displayed a constant trend of 0.4 degree F throughout the section with minor variations from this trend caused by mud additions.

A formation integrity test of 17.50 ppg equivalent was recorded at 10002'.

Section 4: 9992' to 10483'

This section consists mainly of mudstone and marl with occasional limestone stringers.

The drilling exponent was greatly affected by changes in mudweight and the use of PDC bits. Consequently, the best indicators used for pore pressure estimation were gas readings, one RFT point, and to some extent, wireline logs and temperature data.

From the 9 5/8" casing shoe (9979') to the top of the Upper Jurassic Mandal Formation (10483'), the estimated pore pressure increased rapidly from 14.1 ppg to 15.6 ppg. Average gas values for this interval increased from 35 units to 80-100 units even though the mud weight was raised from 15.5 to 16.2 ppg. The highest background gas readings occurred in a predominantly marly section from 10040' to 10180'. Maximum formation gas was 4050 units at 10046', probably from marl. High gas readings were also recorded from fractured limestone stringers.

An RFT formation pressure of 7813 psi (14.9 ppg eqmw) was obtained from the Tuxen Formation at a measured depth of 10121' **(see Formation Evaluation)**.

Table 1 displays the formation, trip, connection, flow check gas readings for Pore Pressure Sections 4, 5, and 6.

Temperature data from the 9 5/8" casing shoe to total depth was affected by continual additions to the mud system.

Section 5: 10483' to 12873'

The lithology of this interval is mudstone with occasional interbeds of limestone.

The drilling exponent was greatly affected by changes in mudweight and the use of PDC bits. Consequently, the best indicators used for pore pressure estimation were gas readings, pit gains and losses, and to some extent, wireline logs.

Pore pressure estimates by Exlog range from 15.7 ppg at the top of the section (Upper Jurassic Mandal Formation 10483') to 16.4 ppg at the base of the section. Phillips interprets that the pore pressure in the lower part of this section may be more in the range of 16.0 ppg and that the higher estimated pore pressure is due to borehole ballooning effects noted below.

Losses and gains to the formation occurred from 10450' down to 12873'. Losses varied from 1-11 barrels/hour and mud gained at flow checks varied from 8 to 25 barrels. The losses and gains were due to possible fracturing/ballooning of the formation (Gill, J.A., 1987, 1989, see footnote). Following increases in mudweight it was noted that background gas levels and gas peaks also increased. The higher equivalent circulating density caused increased pressuring of the formation. When the pumps were turned off the mud was returned from the formation along with the high gas readings.

Connection, flow check, and pumps off gases recurred from the top of the Mandal Formation to the base of the section. The maximum peak connection gas was 5900 units at 11101'. Maximum formation gas was 3145 units recorded at 10860'. High connection gases were in some cases swab induced, and may be partly due to the effects of borehole ballooning from the elevated equivalent circulating density.

A formation integrity test of 18.0 ppg equivalent was recorded at 12,883'.

Section 6: 12873' to 16480'

The lithology in this section is primarily mudstone, with subordinate sandstone, marl, and limestone.

The pore pressure evaluation was primarily based upon gas readings and changes in mud volumes. No drilling exponent trends could be established with any degree of accuracy. The drilling exponent data proved unreliable during the turbine drilling (12980'-15967') of this section. Changes in estimated pore pressure were much less pronounced than higher up in the well bore. At the top of the section Exlog calculated the pore pressure at 16.3 ppg and at total depth the pressure was estimated to be 16.4 ppg. Exlog concluded that the final figure may be a slight underestimation because large trip gases were swabbed (4435 units at TD) even when the mud weight was increased to 16.8 ppg to stabilize the hole for the logging program. However, as noted in Figure 5, the pore pressure at TD has been interpreted around 16.0 ppg (lower than the Exlog estimated 16.4 ppg) due to the ballooning effect on the borehole. No RFT's were recorded on this hole section.

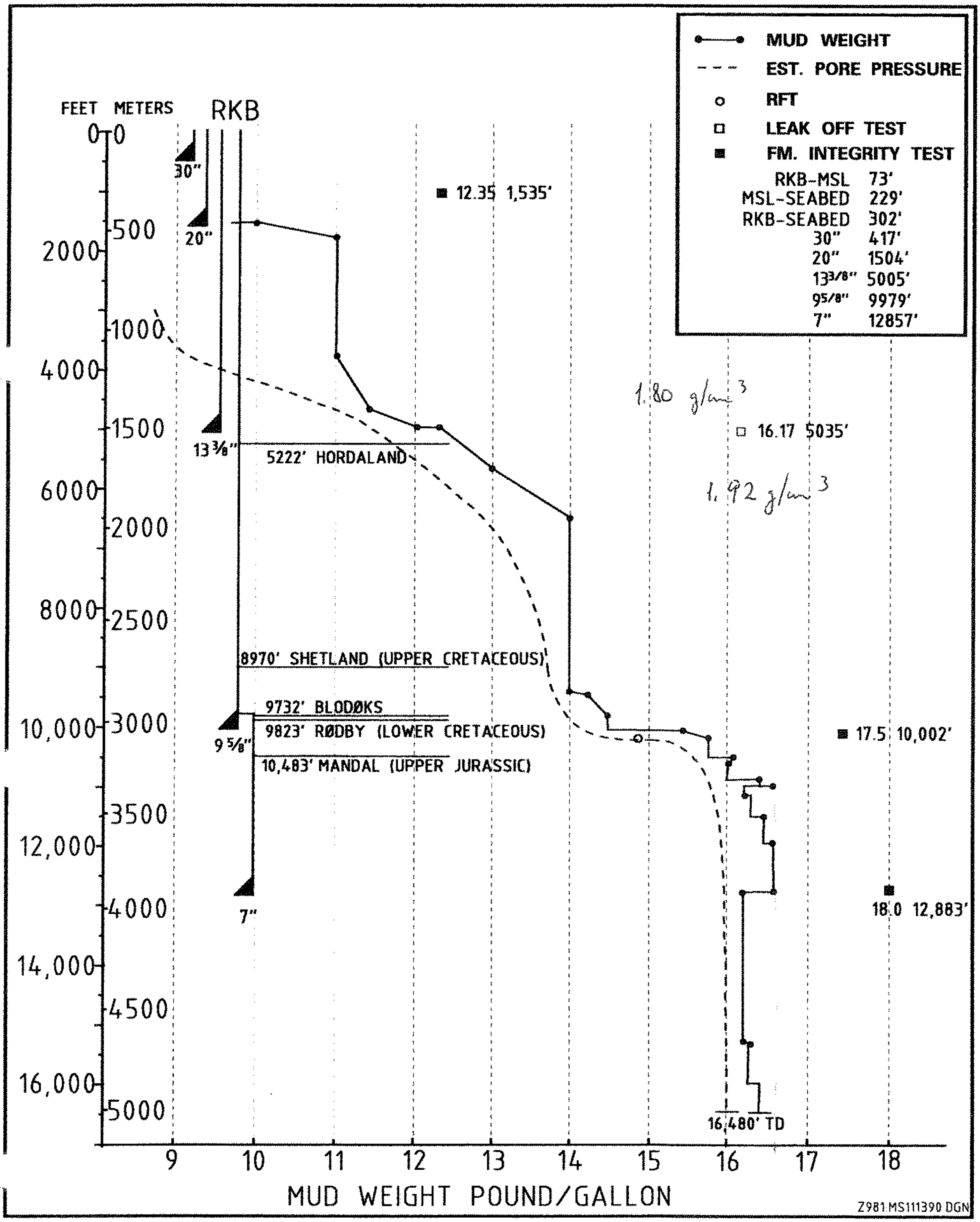
Gas values were quite variable ranging from 6 units near the top of the section to over 800 units at 15150'; the average value being 120 units. There were two notable high formation gas areas: from 13350' to 13660' and from 14850' to 15430'. Trip, connection, and flow check gas peaks were present throughout. However, their magnitude showed a notable increase below 15350'.

Footnote:

Gill, J.A., How borehole ballooning alters drilling responses, Oil and Gas Journal, March 13, 1989, p. 43-48.

Gill, J.A., Well logs reveal true pressures where drilling responses fail, Oil and Gas Journal, March 16, 1987, p. 41-45.

8,3554



MUD WEIGHT
EST. PORE PRESSURE
RFT
LEAK OFF TEST
FM. INTEGRITY TEST
RKB-MSL 73'
MSL-SEABED 229'
RKB-SEABED 302'
30" 417'
20" 1504'
13 3/8" 5005'
9 5/8" 9979'
7" 12857'
FEET METERS
RKB
0 0
500
2000
1000
4000
1500
6000
2000
8000
2500
10,000
3000
3500
12,000
4000
14,000
4500
16,000
5000
30"
20"
13 3/8"
9 5/8"
7"
12.35 1,535'
1.80 g/cm3
16.17 5035'
1.92 g/cm3
5222' HORDALAND
8970' SHETLAND (UPPER CRETACEOUS)
9732' BLODØKS
9823' RØDBY (LOWER CRETACEOUS)
10,483' MANDAL (UPPER JURASSIC)
17.5 10,002'
18.0 12,883'
16,480' TD
9
10
11
12
13
14
15
16
17
18
MUD WEIGHT POUND/GALLON
Z981 MS111390 DGN

Fig. 5

<u>Table 1 Formation, Trip, Connection and Flow Check Gas</u>

Depth (ft)	Formation (u)	Trip (u)	Connection (u)	Flow Check (u)
10000	-	376	-	-
10008	39	-	-	-
10010	38	-	-	-
10025	65	-	-	-
10028	44	-	-	-
10033	135	-	-	-
10039	635	-	-	-
10046	4050	-	-	-
10088	-	-	-	845
10193	200	-	-	-
10201	88	-	-	-
10253	135	-	-	-
10277	-	-	-	391
10305	-	-	-	750
10310	150	-	-	-
10321	60	-	-	-
10344	-	-	-	1828
10368	248	-	-	-
10390	555	-	-	-
10400	-	-	-	-3420
10401	102	-	-	-
10448	87	-	-	-
10449	-	-	-	1315
10452	-	3095	-	1860
10460	-	-	-	165
10466	167	-	-	-
10467	442	-	-	-
10472	-	-	-	377
10490	-	-	520	-
10496	-	-	-	326
10503	-	-	-	5418
10526	-	-	-	1100
10552	-	-	-	2960
10585			1350	-
10616	-	-	1775	-
10617	190	-	-	-
10621	240	-	-	-
10639	-	2095	-	-
10640	-	-	-	322
10643	-	-	-	454
10644	-	-	-	279
10649	-	-	605	-
10678	-	-	1230	-
10700	-	-	-	1690
10710	-	-	638	-
10731	-	4020	-	878
10751	-	-	1745	-
10782	207	-	-	-
10786	-	-	2465	-
10800	-	-	-	1635
10814	-	-	2465	-
10840	-	-	-	2250
10852	-	1870	-	2925
10860	3145	-	-	-
10867	-	-	1255	-
10880	-	-	-	-510
10884	758	-	-	-
10897	-	-	672	-
10928	-	-	1675	-
10959	-	-	1205	-
10978	2315	-	-	-
10990	-	-	-	3070
10995	-	-	-	3330
10999	209	-	-	-
11008	-	-	949	-
11038	-	-	-	2885
11071	-	-	2140	-

Depth (ft)	Formation (u)	Trip (u)	Connection (u)	Flow Check (u)
11081	-	-	-	2730
11101	-	-	5900	-
11113	-	-	-	3620
11114	-	-	-	733
11130	-	-	2130	-
11164	-	-	770	-
11171	1305	-	-	-
11195	-	-	1075	-
11210	-	660	-	-
11214	-	3965	-	-
11270	-	-	595	-
11303	-	-	-	555
11308	-	-	435	-
11365	-	-	1155	-
11385	308	-	-	-
11428	-	-	985	-
11452	133	-	-	-
11490	-	-	1150	-
11492	150	-	-	-
11533	-	-	915	-
11615	-	-	1090	-
11623	120	-	-	-
11647		1910	-	-
11684	-	-	1245	-
11684	-	-	-	1140
11716	-	-	1108	-
11747	-	-	1705	-
11755	-	-	-	1385
11779	-	-	-	1290
11809	-	-	1070	-
11840	-	-	1160	-
11871	-	-	1280	-
11878	-	-	-	1015
11902	-	-	1170	-
11934	-	-	1360	-
11945	120	-	-	-
11962	-	-	1395	-
11994	-	-	1395	-
12027	-	-	1105	-
12058	-	-	1015	-
12089	-	-	845	-
12120	-	-	-	-
12120	-	-	-	540
12120	-	1130	-	-
12156	-	-	117	-
12161	-	112	-	-
12186	-	120	-	-
12188	-	-	139	-
12240	-	116	-	-
12250	-	-	160	-
12253	-	157	-	-
12281	-	-	123	-
12312	-	-	135	-
12344	-	-	132	-
12356	115	-	-	-
12368	235	-	-	-
12376	-	-	846	-
12381	247	-	-	-
12407	-	-	571	-
12438	-	-	900	-
12469	-	-	361	-
12498	-	-	759	-
12531	-	-	562	-
12562	-	-	669	-
12593	-	-	620	-
12624	-	-	458	-
12655	-	-	397	-

Depth (ft)	Formation (u)	Trip (u)	Connection (u)	Flow Check (u)
12669	-	-	-	-
12686	-	-	411	-
12718	-	-	383	-
12746	-	-	-	522
12749	-	-	-	592
12780	-	-	1125	-
12811	-	-	3470	-
12842	-	-	2170	-
12873	-	-	-	246
12873	-	1630	-	-
12983	-	130	-	-
12994	-	45	-	-
13113	-	-	60	-
13143	-	-	62	-
13269	-	-	50	-
13332	-	-	127	-
13363	-	-	218	-
13365	302	-	-	-
13393	-	-	336	-
13456	-	-	147	-
13463	328	-	-	-
13473	356	-	-	-
13482	-	-	-	420
13488	-	-	149	-
13535	-	-	-	535
13553	-	-	157	-
13630	312	-	-	-
13646	-	-	151	-
13655	259	-	-	-
13707	-	-	162	-
13740	-	-	170	-
13800	-	-	153	-
13862	-	-	134	-
13925	-	-	147	-
13993	-	-	228	-
14050	-	-	140	-
14134	-	-	307	-
14197	-	-	282	-
14274	-	-	-	216
14295	-	-	220	-
14322	-	-	260	-
14384	-	-	194	-
14441	163	-	-	-
14447	-	-	219	-
14510	-	-	280	-
14571	-	-	185	-
14634	-	-	232	-
14665	-	-	-	1635
14669	179	-	-	-
14697	-	-	264	-
14711	-	3040	-	-
14766	-	2275	-	-
14788	-	-	551	-
14853	-	-	455	-
14877	365	-	-	-
14915	-	-	290	-
14977	-	-	332	-
15041	-	-	500	-
15092	395	-	-	-
15012	-	-	415	-
15150	830	-	-	-
15165	-	-	250	-
15222	628	-	-	-
15238	743	-	-	-
15243	592	-	-	-
15290	-	-	380	-

50.92.ki\MS0701

Depth (ft)	Formation (u)	Trip (u)	Connection (u)	Flow Check (u)
15315	421	-	-	-
15353	-	-	640	-
15417	-	-	345	-
15430	460	-	-	-
15477	-	-	755	-
15516	-	2715	-	-
15602	-	-	491	-
15643	-	-	-	249
15665	-	-	242	-
15728	-	-	373	-
15793	-	-	711	-
15853	-	-	697	-
15855	218	-	-	-
15876	-	-	-	464
15883	-	-	855	-
15888	270	-	-	-
15946	-	-	277	-
15963	-	4805	-	-
15967	-	1640	-	-
16005	-	-	807	-
16067	-	-	1340	-
16130	-	-	1625	-
16162	-	-	-	-
16179	447	-	-	-
16193	-	-	1205	-
16202	-	-	-	1270
16209	155	-	-	-
16222	-	-	-	670
16255	-	-	626	-
16275	-	-	-	681
16279	-	-	-	865
16302	-	-	-	724
16306	156	-	-	-
16317	-	-	827	-
16338	183	-	-	-
16347	-	-	-	178
16380	-	-	1225	-
16410	-	-	-	394
16515	-	-	-	377
16440	-	-	738	-
16445	163	-	-	-
16459	140	-	-	-
16480	-	-	-	-

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 9930' - 16480'(TD). Oil-based drill mud was used down to 11114' and caused problems in the geochemical interpretation on samples above this depth. The interval between 12980' - 15967' was turbo drilled and only core and sidewall core samples from this interval were analyzed.

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

Sample preparation and lithologic description	201
Total organic carbon determination	51
Rock-Eval pyrolysis	51
Thermal extraction-pyrolysis gas chromatography	46
Vitrinite reflectance	35
Spore color index and visual kerogen microscopy	20
Solvent extraction of organic matter	15
Asphaltene separation	15
Hydrocarbon fractionation	15
Gas chromatography-mass spectrometry of saturated hydrocarbon fraction	15

Source Rock Potential

Samples from the Upper Jurassic Mandal Formation have very rich TOC content (3.1 - 8.5%), organic material classified as type II kerogen and are thought to have rich potentials for the generation of oil. However, the samples are highly contaminated by the oil-based drilling mud and the petroleum potential data are thought to be spurious.

The upper 2000' of the Farsund Formation have rich TOC content (2.3 -7.6%) generally decreasing with depth. The organic matter of this interval is classified as type II kerogen with a good to rich potential for generation of oil.

A deeper part of the Farsund Formation in the interval 12983' - 14716' displays good to rich TOC content (1.0 - 9.4%). The predominant organic matter is type II kerogen with generally rich potential for oil generation, and locally type II/III and III kerogen, which are thought to have fair to rich potential for generation of mixed gas and oil.

Below 14,726', the samples have good to rich TOC contents (1.0 - 3.9%) and organic material classified as residual inert kerogen or at best, type III and IV kerogen, with fair potential for gas generation.

Generation and Migration

Migrated hydrocarbons are suggested to occur throughout the analyzed section. In the Rødby and Mandal Formations, the migrated hydrocarbons are masked by compounds from the oil-based drilling mud, incurring problems in interpretation. The Farsund Formation contains migrated oil that is thought to have migrated form a more mature (more deeply buried) Mandal Formation into the Farsund Formation. The upper part of the Farsund Formation contains mainly migrated oil, while the samples in the range 12983' - 14716' contain both migrated and in-situ generated oil. From samples in the cored section, 14726' -14767', the migrated oil is thought to be mixed with in-situ generated condensate. Below 16000', the samples show the presence of small amounts of in-situ generated gaseous compounds in addition to small amounts of migrated oil.

Maturity

The three 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. Comparison of the three parameters with the pyrolysis - gas chromatography and gas chromatography - mass spectrometry suggest that Tmax gives the most reliable maturity measurements.

Tmax suggests the well to be early mature above 10000' - 10500' where it enters the oil window (corresponding to 0.6% Ro for type II kerogen). Peak oil generation (0.8% Ro) appears to occur at 13500' -14000' and the base of the oil window (1.0% Ro) is considered to occur at approximately 14500' - 15000'. Samples are in the condensate window from approximately 15000' - 16480' TD.

Vitrinite reflectance data show a shallower oil window, indicating the top of the oil window is approximately 12050', peak oil generation around 13600', and the base of the oil window around 16000'.

The spore color index suggest the onset of the oil window around 8100', and the base of the oil window at approximately 12800'.

10. GEOTHERMAL GRADIENT

The geothermal gradient from a well can be calculated if the true bottom hole temperature is known. The true bottom hole temperature can be calculated by correcting wireline log temperatures for the cooling effects of the drilling mud. Bottom hole temperatures from at least two wireline logs and the time since mud circulation stopped are necessary for the calculation.

Corrected bottom hole temperatures from the 2/7-24 well are not possible because of logging difficulties in the 5 7/8" hole section (see **Formation Evaluation**). The deepest Schlumberger logs were run on drill pipe to a depth of 16469' (340 F maximum temperature) and not on wireline. The deepest wireline log was at a depth of 16225' where a maximum temperature of 350 F was recorded from the CST log. An accurate estimate of time since circulation stopped is not possible because periodic mud circulation occurred during the previous TLC logging run.

Phillips purchased a 1989 regional study from The Robertson Group plc. entitled the 'Geothermal Database of Offshore Northwest Europe'. The study concluded that the geothermal gradient of the Feda Graben in the area of the 2/7-24 well location was approximately 1.98 F/100'. The geothermal gradient of the nearby 2/7-20 well located on the Grensen Nose has been estimated by Phillips at 2.0 F/100'. Based on the above information it is assumed that the geothermal gradient for the 2/7-24 well is approximately 1.99 F/100'. Assuming an average seabed temperature of 43 F, a gradient of 1.99 F/100' would give a 'corrected' bottom hole temperature at 16225' of 360 F.

11. WELLSITE SAMPLE DESCRIPTION

This section summarizes the wellsite ditch cutting sample descriptions.

SECTION 1: 1525' to 5025'

This section consisted largely of siltstone and claystone with minor limestone/dolomite stringers.

The siltstone was generally medium to dark grey, becoming olive grey in the lower part of the section. Cuttings were soft to firm, crumbly, blocky, and predominantly slightly calcareous though ranging from non to very calcareous. In places the siltstone was micromicaceous and occasionally speckled with black carbonaceous material. The rock was often very argillaceous, grading to claystone, and contained traces of loose quartz and pyrite in the upper part of the section.

The claystone occurred at approximately 1750 ft and 2200 ft. It was dark grey, soft, plastic, blocky, slightly calcareous and micromicaceous in part.

The limestone was grey white to greenish white, firm to moderately hard with the cuttings being blocky to sub-blocky in appearance. The rock varied from a micro to cryptocrystalline matrix. The dolomite that was present in trace amounts was pale grey, hard, blocky and microcrystalline.

SECTION 2: 5025' to 8954'

This section consisted of a silty claystone interspersed with limestone stringers, occasionally dolomitic.

The claystone was dark to medium grey, often olive grey and occasionally becoming brownish grey with depth. The cuttings were predominantly firm throughout although rarely moderately hard in upper parts of the section. In appearance they were amorphous, blocky, often slightly calcareous and generally silty. Rarely trace amounts of glauconite were observed.

The limestone stringers were similar to those in section one in appearance being an off white to pale grey white color, firm to moderately hard, cryptocrystalline and having occasional fine carbonaceous and rarely argillaceous lamellae.

SECTION 3: 8954' to 9950'

This section consisted of limestone with minor amounts of claystone becoming more abundant nearer the base of the section.

The limestone was white to light grey, occasionally light brown, firm to moderately hard and brittle in places. The cuttings were sub-blocky and amorphous, having occasional dark argillaceous microlaminae near the base of the section. Limestone was predominantly cryptocrystalline although microcrystalline in places, often having a chalky appearance.

The claystone was medium to dark grey, firm, blocky and slightly calcareous.

SECTION 4: 9950' to 10467'

This section consisted of claystones, marls and limestones.

Claystone was dominant in the start of the section and was medium to dark grey, grey black and greenish grey becoming increasingly red brown down section. It was soft to firm, crumbly or fissile with a blocky cuttings morphology. The texture was generally amorphous but occasionally the claystone became slightly silty and speckled. The fluorescence was dull yellow and a slow to moderately fast blooming cut was obtained. The claystone became increasingly calcareous down section grading to marl. At 9950 ft marls dominated.

The marl was yellow brown, medium brown, light buff grey and occasionally olive grey. At their first appearance the marls were predominantly soft and sticky but became harder down section and consequently more brittle. The texture was generally amorphous but occasionally there were microlaminations of dark claystone and the marl became slightly silty. There was often nodular pyrite and abundant disseminated pyrite. These marls frequently graded to argillaceous limestone and had a dull yellow orange fluorescence with a poor slow yellow blooming cut.

The limestone in this section showed some variety. The top of the section was heavily contaminated with cavings from the chalky limestone above. The limestone was white to off white, firm to hard with a blocky cuttings morphology. It was also cryptocrystalline and often showed microlaminations of dark claystone. The fluorescence was dull yellow orange with a slow yellow streaming cut.

The marls described above frequently graded to a very argillaceous limestone which was light grey to buff, predominantly firm, microcrystalline and showed abundant nodular and disseminated pyrite.

At 10000 ft clear, opaque sand was seen. The loose, fine quartz sand was sub-rounded to sub-angular, with poor to moderate sorting and some cherty quartz inclusions. Elsewhere in the section occasional trace amounts of similar loose quartz sand were seen.

SECTION 5: 10467' to 12870'

This section consisted of claystones with a series of limestone/dolomite stringers. There were also siltstones at the top of the section (10590 ft to 10800 ft), and minor traces of sandstone.

The claystone was olive black, olive brown/grey, sometimes speckled white, soft to firm and was sub-blocky to blocky. It became more fissile from 11310 ft onward grading to a shale and was slightly silty, calcareous and occasionally contained glauconite specks. Occasionally the claystone showed a dull yellow fluorescence and a slow streaming white cut.

The limestone was light to medium grey, cream to buff, firm to hard brittle and cuttings were generally blocky, though occasionally amorphous. It was cryptocrystalline and rarely microcrystalline with no visual porosity, containing argillaceous material, often as dark grey mottling, and dark green glauconite specks in parts. Occasionally it had a dull yellow mineral fluorescence and a slow streaming pale yellow cut.

Dolomite occurred as traces throughout the section often grading to limestone. It was light grey, green grey, and occasionally light brown, firm to hard, with blocky cuttings. It also occurred as opaque angular crystals as veins within the claystone. It showed pale orange brown to dull yellow fluorescence with no cut.

The siltstone was dusky brown, occasionally grey, soft to firm, blocky, micromicaceous, carbonaceous and calcareous with traces of pyrite.

The trace sandstone was most common between 11680 ft and 12000 ft and was light grey, brown, with translucent grains and no visual porosity. Grains are sub-angular to sub-rounded, hard and moderate to well sorted with a calcareous cement. It showed a good dull yellow white fluorescence and occasionally a bright yellow gold fluorescence, with a slow to moderately fast yellow white milky cut.

SECTION 6: 12870' to 13900'

This section consisted of claystones and marls with limestone stringers appearing at 13600 ft. Traces of sandstone were seen at 13650 ft.

The claystone was the predominant rock type in this section and was black, olive black, olive brown, brown black and dark grey. It was moderately firm to firm, becoming soft to very soft further down the section. The cuttings were sub-blocky to sub-rounded, occasionally amorphous, brittle, sub-fissile, slightly to moderately calcareous and slightly silty in parts, often grading to marl. The claystone often showed a dull orange fluorescence, occasionally with a bright blue white blooming or very slow streaming cut.

The marl was most abundant in the upper part of the section. It was medium to light grey, olive grey, brown grey, slightly silty in parts and graded to limestone within the lower part of the section. The cuttings were soft to moderately firm, sub-rounded to sub-blocky and occasionally amorphous. A rare pale yellow gold fluorescence with an occasionally slow blue white streaming cut was seen.

The limestone was white, off-white, off-white to brown, pale yellow and brown and light to medium grey. The cuttings were moderately firm to firm, occasionally amorphous, brittle, blocky, slightly silty in places grading to marl. They occasionally showed a yellow orange fluorescence accompanied by a slow blooming or a very slow to moderately fast streaming cut.

The trace sandstone was light red to orange brown, firm to hard and consisted of well sorted, translucent, sub-angular quartz grains. The fluorescence was dull yellow gold in color with a slow blue white blooming/streaming cut.

SECTION 7: 13900' to 14610'

This section consisted of claystone with interbeds of limestone.

The claystone was grey to dark grey, black, brown black and olive black. The cuttings were soft to firm, sub-blocky to blocky, elongate, occasionally amorphous and rounded, brittle, slightly silty in parts and fissile with traces of mica at the base of the section. The claystone had no fluorescence, but gave a slow blue white blooming cut and a weak pale white crush cut.

The interbedded limestone was white, light grey to buff, occasionally with dark grey mottling. The cuttings were soft to moderately firm, occasionally very soft and amorphous, less commonly brittle and blocky. The limestone was cryptocrystalline with slightly silty laminations in part and showed an orange yellow fluorescence. It gave a very fast blue white diffuse cut, a slow blooming cut and occasionally a weak pale white crush cut.

SECTION 8: 14610' to 15890'

This section consisted of claystone interbedded with limestone and sandstone. A 55 ft core was cut from driller's depth 14711 ft to 14766 ft, 56 ft were recovered.

The claystone was dark grey to black, dark grey brown, light to medium grey, firm to moderately hard, with a sub-blocky to blocky, occasionally sub-angular cuttings morphology. In addition they were amorphous, elongate, sub-fissile to fissile, moderately calcareous to calcareous, occasionally with calcite veins and traces of nodular pyrite. The claystone was slightly silty to silty, in places grading to siltstone. It displayed a dull yellow to light yellow fluorescence with a slow crush cut giving a weak pale yellow fluorescence.

The marl was dark brown, brown black, moderately firm, occasionally sub-fissile with a sub-blocky to sub-rounded cuttings morphology. It was also slightly silty in parts with no fluorescence or cut.

The limestone was white to creamy white, light grey and soft to firm. The cuttings were sub-blocky to blocky, occasionally amorphous, sub-rounded, brittle, cryptocrystalline grading in parts to marl and in others to claystone. The fluorescence was pale yellow to dull gold orange and where a cut was found it was very weak milky white and both blooming and crush.

The sandstone was translucent to white, light to medium grey, light grey brown, moderately hard to hard, occasionally very hard, fine to medium grained with a slightly calcareous cement and a slightly argillaceous matrix. The grains were predominantly quartz, translucent to white, sub-angular to sub-rounded with the degree of roundness and sorting increasing with depth. There was no visual porosity and accessory minerals were pyrite only. The sandstone showed dull yellow fluorescence and occasionally bright yellow fast streaming cut.

Descriptions from conventional Core No. 1 noted traces of dark brown oil bleeding from a sandstone bed at 14735'. Bleeding gas was noted throughout the core.

SECTION 9: 15890' to TD at 16480'

This section consisted of interbedded claystones, marls and limestones.

The claystone was light to medium brown, brown black, dark grey to black, soft to moderately firm and occasionally firm to moderately hard. The cuttings were sub-blocky, sub-rounded, occasionally rounded, occasionally brittle with rare accessory pyrite. The claystone was also slightly silty to silty in parts, moderately to very calcareous with the calcium carbonate content increasing down section. No fluorescence was observed but a very slow, occasionally moderately fast, streaming cut was obtained.

The marl cuttings were medium grey, brown grey, dark brown to brown black, moderately firm to firm, occasionally soft, sub-rounded to sub-blocky with occasional calcareous laminae and calcite veins. The marl was also occasionally slightly silty with inclusions of crystalline magnetite (?). The fluorescence was brown and a crush cut was obtained with a pale yellow mineral fluorescence.

The limestone cuttings were white to cream, buff, firm to hard, brittle, cryptocrystalline and blocky. Calcite veins were present and there was no visual porosity. A yellow brown fluorescence was seen along with a crush cut with a pale yellow fluorescence.

12. LITHOLOGICAL DESCRIPTIONS OF SIDEWALL CORES

Depth (ft)	Core No.	Recovery (mm)	Quality	Type of Analysis(1)	Lithology
12894	42	18	Good	B	MUDSTONE: dark grey to olive-black, moderately hard, subfissile, micro-micaceous, weakly to moderately calcareous with traces of carbonaceous material and pyrite.
12954	41	15		G	MUDSTONE: dark grey, patchy moderately bright yellow fluorescence on mud.
12967	40	16	Good	B	MUDSTONE: olive-black, moderately hard, blocky to subfissile, micromicaceous, locally silty, moderately calcareous with scattered carbonaceous material and finely disseminated pyrite.
13019	38	15		G	MUDSTONE: dark grey.
13032	37	20	Fair	B	MUDSTONE: dark grey to olive-black, moderately hard to hard, blocky, micro-to-micaceous, weakly to moderately calcareous with traces of pyrite.
13084	36	20		G	MUDSTONE: dark grey.
13134	35	11	Fair	B	MUDSTONE: as 13032'.
13169	34	15		G	MUDSTONE: dark grey.
13184	33	5			MUDSTONE: dark grey, patchy dull yellow fluorescence on mud.

(1): B = Biostratigraphical
G = Geochemical

50.92.ki\MS0701

Depth (ft)	Core No.	Recovery (mm)	Quality	Type of Analysis(1)	Lithology
13224	32	15	Good	B	MUDSTONE: olive-grey to olive-black, moderately hard, subfissile, micromicaceous to micaceous, locally silty, moderately to strongly calcareous with scattered pyrite and carbonaceous material.
13334	29	12	Fair		MUDSTONE: medium dark grey to olive-grey, firm to moderately hard, micromicaceous to micaceous, moderately to strongly calcareous with scattered pyrite and carbonaceous material.
13358	29	20	Good	B	MUDSTONE: dark grey to olive-black, moderately hard to hard, subfissile, micromicaceous, locally silty, moderately calcareous with pyrite and carbonaceous material.
13384	26	10		G	MUDSTONE: dark grey, bleeding gas.
13414	25	20	Good	B	MUDSTONE: olive-black, hard, blocky, micromicaceous to micaceous, weakly calcareous with scattered pyrite and carbonaceous material.
13494	23	15		G	MUDSTONE: dark grey.
13554	22	14	Good	B	MUDSTONE: dark grey, moderately hard to hard, blocky, micromicaceous, weakly calcareous with locally abundant pyrite.
13561	21	10		G	MUDSTONE: dark grey, bleeding gas.

Depth (ft)	Core No.	Recovery (mm)	Quality	Type of Analysis(1)	Lithology
13614	20	20	Good	B	MUDSTONE: medium dark grey to dark grey, moderately hard to hard, blocky, micromicaceous to micaceous,locally silty, weakly to moderately calcareous with scattered pyrite and traces of carbonaceous material.
13684	18	5		G	MUDSTONE: medium grey, patchy dull yellow fluorescence on mud.
13738	17	15	Fair	B	MUDSTONE: as 13614' (fragments). Contaminated with drilling mud.
13854	15	5		G	MUDSTONE: medium grey, bleeding gas, patchy bright yellow fluorescence on mud.
13995	12	20	Good	B	MUDSTONE: olive-black, moderately hard, subfissile to fissile, micromicaceous, weakly calcareous.
14031	11	15		G	MUDSTONE: dark grey, silty, bleeding gas, patchy bright yellow fluorescence on mud.
14334	6	14	Fair	B	MUDSTONE: dark grey, moderately hard to hard, blocky to subfissile, micromicaceous, weakly calcareous with scattered pyrite.
14711	39	10			Interlaminated mudstone and sandstone: MUDSTONE: dark grey. SANDSTONE: grey, fine to medium grained, poor sorting, calcareous and argillaceous cement, very poor visible porosity, speckled dull orange fluorescence.

Depth (ft)	Core No.	Recovery (mm)	Quality	Type of Analysis(1)	Lithology
14716	37	10			<u>SANDSTONE:</u> grey, fine to coarse, angular, poor sorting, calcareous and argillaceous cement, very poor visible porosity, speckled moderately bright orange fluorescence.
14721	35	10			<u>MUDSTONE:</u> dark grey, sandy in part, some bleeding gas.
14893	31	9	Fair	B	<u>MUDSTONE:</u> dark grey to olive- grey, moderately hard, subfissile, micromicaceous, locally silty, weakly calcareous with scattered pyrite and traces of carbonaceous material.
15174	26	10		G	<u>MUDSTONE:</u> dark grey, trace mica.
15248	25	17	Fair	B	<u>MUDSTONE:</u> olive-grey to olive-black, moderately hard to hard, blocky micromicaceous, moderately to strongly calcareous with pyrite, scattered and as laminations.
15274	24	5			<u>MUDSTONE:</u> dark grey, some laminae of very fine grained sandstone.
15333	23	5			<u>MUDSTONE:</u> dark grey, shot through with calcite veining.
15345	22	17	Good	B	<u>MUDSTONE:</u> as 15248'.
15756	13	12	Fair	B	<u>MUDSTONE:</u> dark grey, moderately hard, subfissile, micromicaceous, weakly to moderately calcareous with scattered pyrite.

16104	5	10	Fair	B	MUDSTONE: medium dark grey to olive-grey, moderately hard to hard, blocky, micromicaceous, weakly to moderately calcareous with scattered pyrite and carbonaceous material.

13. CONVENTIONAL CORE DESCRIPTION

Detailed sedimentological and petrographic analyses on Core No. 1 have been performed by The Robertson Group, plc. The core study has been integrated with log data to produce a characterization of the stratigraphic interval above and below the cored interval. The following section is a summary of their observations.

The conventional core description (scale 1:50) and legend is shown in Enclosure 1. A data summary chart at 1:200 scale displaying logs, facies, core description, etc., is included as Enclosure 2.

Facies Analysis

Four facies have been recognized in core, ranging from mudstones to conglomerates. The stratigraphic position of these facies is shown on the 1:200 data summary chart attached.

Over the cored interval the four facies listed below occur intimately interbedded and all units are relatively thin, with a relatively low sandstone/mudstone ratio.

Facies S1 comprises thicker (generally >1'), commonly pebbly sandstones which range from fine to coarse grained and locally grade into conglomerate. Individual units commonly have sharp bases and may either coarsen or fine upwards. Pebbles are generally matrix supported and comprise quartzitic and volcanic extraclasts. Mudstone intraclasts and shell fragments (bivalves, brachiopods, echinoderms, belemnites) also occur. The matrix is generally poorly sorted and variably argillaceous. Commonly, the sandstones are structureless, although locally cross-bedding, planar lamination and current ripples are present.

Facies S1 represents deposits of high density turbidity currents or possibly sandy debris flows. Rapid flow inception and deceleration results in sharply defined bases and tops. Rapid deposition results in poor sorting and generally structureless appearance.

Facies S2 comprises thin (<6"), very fine to fine and locally medium grained sandstones. The sandstones are usually sharply defined, although locally they fine upwards into silty mudstones. Slight deformation of these thin sandstones is common. Generally they are planar laminated to structureless and locally current rippled. Small shell fragments are locally present.

Facies S2 is interpreted as deposits of distal, low density, sandy turbidity currents. The sharply bounded to locally fining-upward nature of the sand units indicates rapid flow inception and deceleration. Rapid deposition is indicated by the generally structureless nature of the sands.

Facies DC comprises poorly sorted, poorly structured to chaotic, generally matrix supported, granule and pebble conglomerates. Clasts comprise quartzitic and basic volcanic extraclasts, mudclasts, sandstone intraclasts and shell fragments.

The poor sorting, chaotic nature and matrix-supported texture of these conglomerates are typical features of debris flow conglomerates.

Facies M consists of silty, locally sandy, laminated mudstones. Locally, large slump features are present.

The mudstones are the suspension deposits of basinal and slope sedimentation. The lack of bioturbation indicates anaerobic bottom conditions. Slumping indicates the presence of steep depositional gradients.

DEPOSITIONAL ENVIRONMENT

The presence of thick, mudstone dominated intervals, the interbedded nature of more sand-rich intervals and the thin, discrete nature of sandy and conglomerate beds demonstrates that clastic supply to the area was relatively restricted. As such these samples are considered to represent a basinal setting.

The highly interbedded association of distal turbidites, debris flow conglomerates and basinal mudstones is a rather unusual assemblage. However, because subaqueous debris flows require relatively steep gradients in order to flow, they are most abundant at the foot of a slope into a basin (Walker, 1984). The presence of a relatively steep depositional gradient is supported by the presence of slumping. Large scale coarsening and fining sequences seen on wireline logs (see **LITHOSTRATIGRAPHIC UNITS**, interval 14240'-14830') are considered to represent the progradation and retrogradation of the distal portion of a subaqueously accumulated set of slope facies interacting with basinal mudstones.

FRACTURE ANALYSIS

The intensity of fracturing is low within the cored interval, the majority being concentrated around a fault which intersects the core at 14739-14740' (driller's depth). Sigmoidal tension gashes associated with this zone have reverse sense of movement. The fault zone dips at 40 degrees.

The preferred fracture orientation trends ENE-WSW with subsidiary NNE-SSW and NW-SE trends.

Both shear fractures and cemented dilational fractures are present in the core. Cemented dilational fractures are the most common form present, with cements including dolomite, calcite, quartz, and pyrite.

PETROGRAPHY and DIAGENESIS

Petrographic results are based upon the study of 13 thin sections from the cored interval.

The sandstones range from lithic arenites to lithic wackes, are generally moderately to poorly sorted, with matrix supported grains, and locally straight grain contacts. Detrital grains generally dominate, with monocrystalline quartz and polycrystalline quartz the main components. Basic volcanic clasts and skeletal grains are locally common. Feldspar occurs in amounts ranging from trace to 3%.

The poorly sorted conglomerates, matrix supported, have a similar detrital grain population.

Mudstones are variably silty and sandy, poorly to moderately sorted with monocrystalline quartz the main grain type.

Authigenic cements include calcite, non-ferroan and ferroan dolomite, pyrite, and silica. Most of these phases are associated with fracturing although early calcite and pyrite probably represent eogenetic cements associated with the degradation and dissolution of biogenic material in a reducing environment. Illite is the only petrographically resolvable authigenic clay, occurring as a replacement of detrital clay.

Reservoir quality is extremely poor, reflecting textural characteristics such as poor sorting, high detrital clay content, and commonly fine modal grain sizes. Authigenic cements are common and occlude most macroporosity. Most of the porosity present is mircroporosity associated with detrital clay and leached unstable grains.

HYDROCARBON SHOWS

Hydrocarbon shows from the wellsite description (every 3') consisted of:

Gas:	Bleeding throughout the core.
Oil:	Traces of dark brown oil bleeding in vicinity of sandstone bed at 14735', moderately bright light yellow fluorescence.
Mudstone:	No direct fluorescence. Slow cut with pale yellow cut fluorescence.

References:

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

Walker, R. G., 1984, Turbidites and associated coarse clastic deposits, in Walker, R. G., (ed.), Facies Models, Publ. Geoscience Canada, Toronto, p.171-188.

14. CONVENTIONAL CORE ANALYSIS

Conventional core analysis and core photography of Core Number 1 was performed by Norcore A/S, Tananger, Norway. The analysis included a core gamma log, and cutting and cleaning of 14 plugs for porosity and permeability determinations.

A summary of the core analysis is shown in Table 2 and a plot of the core gamma log versus the Natural Gamma Tool Ratios wireline log is shown in Figure 6.

NORCORE A/S

COMPANY :PHILLIPS PETROLEUM

CONVENTIONAL CORE ANALYSIS

APRIL 1991

WELL NO : 2/7-24

FINAL REPORT

JOB NO : 88131

SAMPLE REF	DEPTH FEET	PERMEABILITY Ka HOR mD	PERMEABILITY KL HOR mD	GRAIN DENSITY gm/cc	HELIUM POROSITY %	REMARKS	LITHOLOGICAL DESCRIPTION
						CORE 1 INTERVAL 14711.00 FEET - 14767.00 FEET	
1	14712.30	0.06	0.03	2.71	7.9		SHST/SLST,LT GY/BN/DK GY,HD-V.HD,W.CMT,SILC CMT,TR CARB/MICA
2	14714.15	0.17	0.10	2.70	7.4		SHST/SLST,A/A,W/NUM SILC VC.GR
3	14714.70	0.71	0.46	2.69	8.6		SHST/SLST,LT GY/BN/DK GY,HD-V.HD,W.CMT,SILC CMT,TR CARB/MICA
4	14717.15	0.02	0.01	2.72	7		SLST,DK GY,V.HD,W.CMT,SILC CMT,MOD CARB,TR MICA/SHST
5	14719.90	0.02	0.01	2.69	2.2		SST/LST/SLST,GY,CG,M.STD,V.HD,W.CMT,CALC CMT,DIS PY/PY NODS
6	14720.80	0.02	0.01	2.71	2.5		SST/LST/SLST,GY,CG,M.STD,V.HD,W.CMT,CALC CMT,DIS PY/PY NODS
7	14722.00	0.02	0.01	2.71	2.0		SLST,GY,V.HD,W.CMT,CALC CMT,NUM SILC GR,DIS PY
8	14733.00	0.04	0.02	2.75	2.7		SST/SLST,DK GY,VCG,M.STD,V.HD,W.CMT,SIL/CAL CMT,AB DIS PY
9	14733.10	0.02	0.01	2.77	2.0		SST/SLST,DK GY,VCG,M.STD,V.HD,W.CMT,SIL/CAL CMT,AB DIS PY
10	14754.50	0.03	0.01	2.69	5.2		SLST,OCC VCG SST,DK GY,V.HD,W.CMT,SIL/CAL CMT,AB DIS PY
11	14757.10	0.02	0.01	2.83	3.7		SLST/SHST/OCC VC.SILC GR,V.HD,W.CMT,SIL/OCC CALC CMT,AB DIS PY

Table 2

NORCORE A/S

COMPANY :PHILLIPS PETROLEUM

CONVENTIONAL CORE ANALYSIS

APRIL 1991

WELL NO : 2/7-24

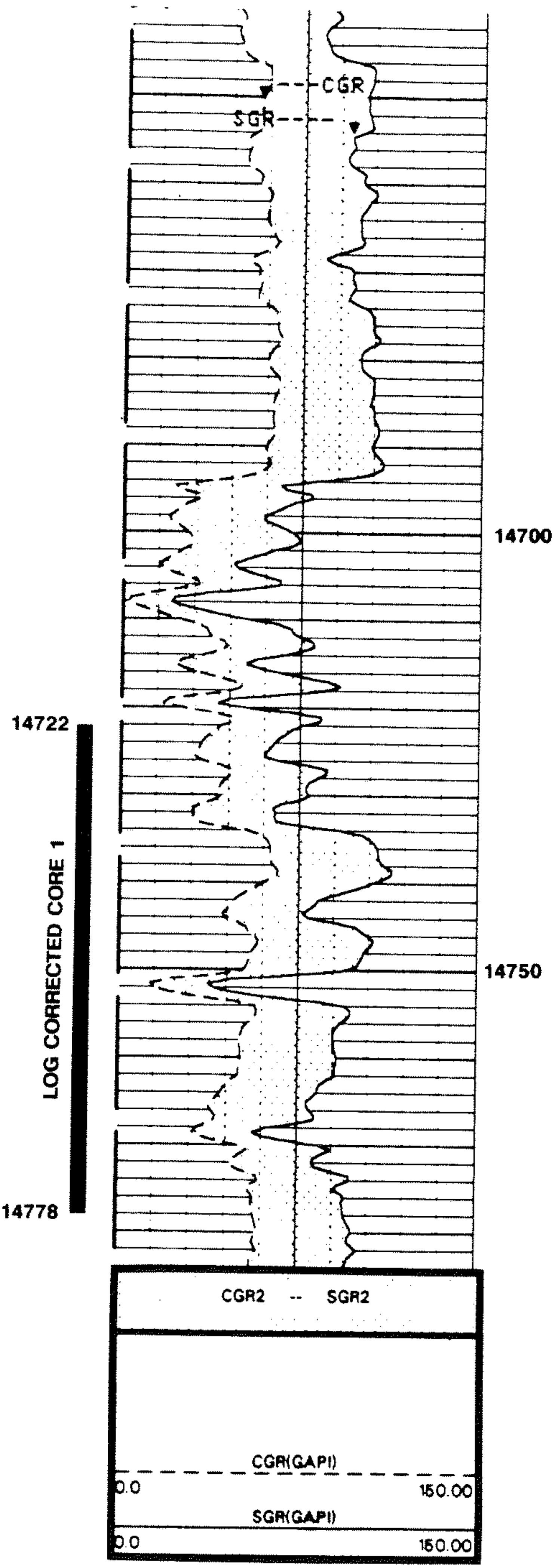
FINAL REPORT

JOB NO : 88131

SAMPLE REF	DEPTH FEET	PERMEABILITY Ka HOR mD	KL HOR mD	GRAIN DENSITY gm/cc	HELIUM POROSITY %	REMARKS	LITHOLOGICAL DESCRIPTION
12	14757.80	0.03	0.01	2.73	3.9		SLST/OCC VCG SST,DK GY,V.HD,W.CMT,CALC CMT,OCC SHST/MICA
13	14758.40	0.02	0.01	2.75	4.0		SLST/SHST/OCC VC.SILC GR,LT-DK GY,V.HD,W.CMT,SIL/CAL CMT,CARB
14	14760.15	0.02	0.01	2.73	2.9		SLST/FG SST,DK GY,V.HD,W.CMT,CALC CMT,TR SHST,AB DIS PY

Table 2
Continued

NGT RATIOS LOG



CORE GAMMA LOG

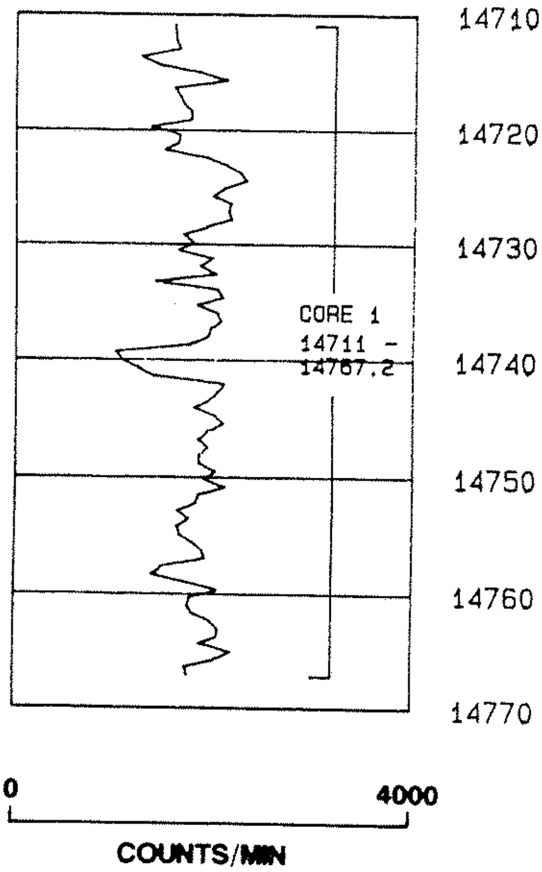


Fig. 6

15. BOREHOLE PROFILE

A zero offset VSP was acquired by Schlumberger during two runs. The first run was acquired from 12,850 ft to 4,550 ft at 50 ft intervals on 19th February, 1991. The interval 12850-9979 ft was run in open hole and the interval 9979-4550 was run in casing. The second run was acquired in open hole, from 16,200 ft to 12,750 ft at 50 ft intervals on 6 April, 1991.

The energy source was a bolt air gun (500 cu. in. capacity at 1900 psi) suspended 13 feet below mean sea level. The first run was recorded using the Combinable Seismic Imager (CSI), while the second run was recorded with the Well Seismic Tool (WST.A). The recorded data was of good quality and no instrument problems were encountered.

The VSP displays were processed by Schlumberger using a standard processing sequence. The final displays are included in Schlumberger's VSP report dated 6 April, 1991.

16. LISTING OF AVAILABLE REPORTS

Biostratigraphy, 1530-16480', The Robertson Group, August, 1991.

Conventional Core Analysis and Core Photos, Norcore, March, 1991.

Geochemical Report, 9830-16480', Geolab Nor, July, 1991.

Mean Square Dip (MDS) Dipmeter Processing Report, 10500-12883', Schlumberger, December, 1990.

Mean Square Dip (MSD) Dipmeter Processing Report, 12873-16239', Schlumberger, April, 1991.

Mudlog End of Well Report, Exlog, March, 1991.

MWD End of Well Report, Teleco Oil Services Ltd., March, 1991.

Navigation and Positioning of Drilling Rig "Ross Isle", Racal Survey, November, 1990.

Oil Based Dipmeter Report, 8557-10006', Schlumberger, December, 1990.

PRENGT Environmental Corrections, 12870-16250, Schlumberger, April, 1991.

Sedimentology, Petrography, and Fracture Analysis of Core 1, The Robertson Group, July, 1991.

Site Survey and Report June 7-20, Racal, November, 1990.

VSP/WSC/GEO 3500-16200', Schlumberger, April, 1991.

SECTION 3 FORMATION EVALUATION

Table	**Number**
Open Hole Wireline Logging Summary	3
Repeat Formation Tester Data, January 8, 1991	4
Repeat Formation Tester Data, February 17, 1991	5

Appendices	**Number**
Schlumberger NGT Environmental Corrections Report	1
Schlumberger OBDT Report, 8657-10006 Ft.	2
Schlumberger MSD Report, 10500-12883 Ft.	3
Schlumberger MSD Report, 12873-16239 Ft.	4

2/7–24 OPEN HOLE 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
DIL/SLS/CAL/GR	1	21 Nov 90	302'	4981'	17 1/2"	122	8.3	12.0	Ester based	"Petrofree" mud.
DITE/SLS/CAL/GR	1	01 Dec 90	5010'	9998'	12 1/4"	209	10.8	14.5	Ester based	"Petrofree" mud.
LDL/CNL/GR	1	02 Dec 90	5010'	10005'	12 1/4"	214	17.0	14.5	Ester based	CNL not decentralised. Log uninterpretable. "Petrofree" mud.
OBDT/GR	1	02 Dec 90	8700'	10006'	12 1/4"	216	24.5	14.5	Ester based	"Petrofree" mud.
DITE/LSS/CAL/GR	2	08 Jan 91	9988'	10846'	8 1/2"	227	19.6	16.4	Oil based	
RFT/GR	1	08 Jan 91	10121'	10791'	8 1/2"	250	25.3	16.4	Oil based	22 tight tests; 1 good test; 1 seal failure.
DLL/MSFL/BHC/GR	1	16 Feb 91	9988'	12869'	8 1/2"	263	15.0	16.8	Water based	
LDL/CNL/NGL	2	16 Feb 91	9988'	12880'	8 1/2"	263	22.6	16.8	Water based	
FMS/GR	1	16 Feb 91	9988'	12884'	8 1/2"	266	31.2	16.8	Water based	
RFT/GR	2	17 Feb 91	10792'	12381'	8 1/2"	–	–	16.8	Water based	4 tight tests, 4 no seals.
CST/GR	1	18 Feb 91	–	–	8 1/2"	–	–	16.8	Water based	No recovery.
VSP	1	18 Feb 91	3500'	12850'	8 1/2"	265	48.8	16.8	Water based	
DLL/MSFL/BHC/GR	2	31 Mar 91	12870'	14986'	5 7/8"	313	15.0	16.7	Water based	Did not reach TD.
DIL/BHC/LDL/CNL/NGL	2	05 Apr 91	12870'	16472'	5 7/8"	340	N/A	N/A	Water based	Down log run on drillpipe.
VSP	2	06 Apr 91	12750'	16200'	5 7/8"				Water based	

continued ....

Table 3

2/7–24 OPEN HOLE WIRELINE LOGGING SUMMARY – continued ....

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
SHDT/NGL	1	07 Apr 91	12857'	16240'	5 7/8"	341	N/A	N/A	Water based	Sticking problems. Caliper closed over two intervals.
CST	2	07 Apr 91	14635'	16180'	5 7/8"				Water based	11 recovered, 4 empty, 1 misfire, 26 left in hole.
CST	3	08 Apr 91	12953'	14584'	5 7/8"				Water based	24 recovered, 9 empty, 8 misfire, 1 left in hole.

* **RUN NUMBER REFERS TO NUMBER OF TIMES A PARTICULAR TOOL WAS RUN.**

Table 3
Continued

2. WIRELINE DATA QUALITY SUMMARY

There were five separate wireline logging runs in this well. The wireline contractor for all logging runs was Schlumberger. A summary of the logging runs plus a copy of log headings is provided in Table 3.

Run 1: November 21, 1990 Pleistocene/Pliocene/Miocene

Acquisition Objective: Correlation

Driller TD	5025
Bit Size	17.5 inches
Mud Weight	12.0 lbs/gal
Mud type	Ester based (Petrofree)
Hole deviation	0

Logging Runs:

	Top (ft)	Bottom (ft)	Temperature (deg f)
DIL/SLS/CAL/GR	302	4981	122

Data Quality Discussion:

The wireline gamma ray shows a cyclic nature through a great deal of the interval. This does not seem to correlate with any borehole of lithologic effects and therefore appears to reflect a tool malfunctioning problem. It was therefore decided to use the MWD GR as being representative of the gamma ray response in this interval.

DIL - Because of the ester-based mud (Petrofree) the SFL and SP measurements are invalid. Both the ILM and ILD are of good quality.

SLS - The DT and DTL both show appropriate response and overlay each other with the exception of places where the caliper shows the hole to be washed out. Each of these intervals were compared with the down run of the log. There was no apparent difference in quality. Therefore the poor response was attributed to borehole conditions.

Run 2: December 1-2, 1990 Miocene to Lower Cretaceous

Acquisition Objective: Structure, lithology determination and correlation.

Driller TD	9992 feet
Bit Size	12.25 inches
Mud Weight	14.5 lbs/gal
Mud type	Ester based (Petrofree)
Hole deviation	2.2 degrees

Logging Runs:

	Top (ft)	Bottom (ft)	Temperature (deg f)
DITE/SLS/CAL/GR	5010	9998	209
LDL/CNL/GR	5010	10005	214
OBDT/GR	8700	10006	216

Data Quality Discussion:

In general the LDL/CNL caliper shows in gauge hole for most of the interval.

DITE - Because of the ester-based mud the SFL and SP measurements are invalid. Both the IMPH and IDPH are of good quality.

SLS - The DT and DTL both show appropriate response and overlay each other with the exception of places where the caliper shows the hole to be washed out. Each of these intervals were compared with the down run of the log. There was no apparent difference in quality. Therefore the poor response was attributed to borehole conditions.

LDL/CNL - Because the CNL was run without the eccentering bowspring the data proved to be unusable. The RHOB, DRHO and PEF curves respond as expected in this interval.

OBDT/GR - All pad data responds as expected. The calipers show some ovality but in general indicate a good borehole.

Run 3: January 8, 1991 Lower Cretaceous/Upper Jurassic

Acquisition Objective: Special logging run for pressure and hydrocarbon evaluation in interval where numerous mud losses and gains occurred.

Driller TD	10852 feet
Bit Size	8.5 inches
Mud Weight	16.4 lb/gal
Mud type	Oil based (Note:461 lbs/bbl barite in system)
Hole deviation	1.4 degrees

Logging Runs:

	Top (ft)	Bottom (ft)	Temperature (deg f)
DITE/LSS/CAL/GR	9988	10846	227
RFT/GR	10121	10791	250

Data Quality Discussion:

In the interval from 9988 to 10480 ft the caliper shows that the hole is up to 2 inches out of gauge in some places and also appears to be quite rugose.

DITE - Because of the oil-based mud the SFL and SP measurements are invalid. Both the IMPH and IDPH are of good quality.

LSS - The DT and DTL both show appropriate response and overlay each other with the exception of the interval where the caliper show the hole as being washed out.

RFT - The tool was used to acquire formation pressure data. No fluid samples were taken. Refer to interpretation section for discussion of results.

Results:	Good	Dry	Seal Failure	Total
	1	22	1	24

Run 4: February 16-18, 1991 Lower Cretaceous/Upper Jurassic

Acquisition Objective: Hydrocarbon evaluation, structure lithology, pressure determination and correlation.

Driller TD	12673 feet
Bit Size	8.5 inches
Mud Weight	16.8 lbs/gal
Mud type	Water based changed to oil based at 11,114 ft
Hole deviation:	7 degrees

Logging Runs:

	Top (ft)	Bottom (ft)	Temperature (deg f)
DLL/MSFL/BHC/GR	9988	12869	263
LDL/CNL/NGL	9988	12880	263
FMS/GR	9988	12884	266
RFT/GR	10792	12381	
CST/GR			
VSP	3500	12850	265

Data Quality Discussion:

From 9988 to 10500 ft the hole is out of gauge with the caliper showing a hole 20 inches in diameter in some places. The hole is slightly out of gauge (1" to 2") for the remainder of the interval. However, after 10500 ft the hole does not appear to be particularly rugose and the condition of the hole does not appear to be affecting the logs in most of these intervals. The DLL tool was tied into the DITE log over the upper interval (9988 -10846 ft) from the previous logging for depth control.

DLL/MSFL - In general both the LLD and LLS respond appropriately through the entire interval. It should be noted however that there are washed out intervals where the LLS reading is being affected by borehole signal. Also there is an interval from 12636-12646 ft where the MSFL reading is flat lining. This response does not appear to be due to any particular borehole or formation condition.

BHC - The DT and DTL both show appropriate response and overlay each other with the exception of the interval where the caliper show the hole as being washed out.

LDL/CNL - The tool was run in a high resolution sampling mode at an average logging speed of 900 ft/hr. A review of the long spacing and short spacing quality curves (QLS and QSS) shows that they are outside acceptable tolerances in the interval from 9988 feet to 10540 feet. This response is attributed primarily to borehole conditions.

NGL - The tool responds appropriately throughout the logging interval. However, due to the presence of barite in the mud the reliability of the measurement of the components of the gamma ray spectrum (uranium, potassium and thorium) is questionable.

BHC - From 10680-10720 ft the BHC caliper is reading under gauge. This is probably caused by the orientation (i.e., tool eccentralized) of the tool in the borehole. During the rest of the interval the tool response is as expected.

FMS - Calipers show one axis of the hole to be in gauge whereas the other axis is overgauge through most intervals. The hole shows on the average less than five degrees of deviation.

RFT - The tool was used to acquire formation pressure data.

Results:	Good	Dry	Seal Failure	Total
	0	4	4	8

CST - Three bullets were shot. No bullets were recovered.

VSP - Low frequency noise disturbed the signal at several levels. Source of this noise was not located.

Run 5: March 31 - April 8, 1991 Upper Jurassic

Acquisition Objective: Hydrocarbon evaluation, structure, lithology, pressure determination and correlation.

Driller TD	16480 feet
Bit Size	5.875 inches
Mud Weight	16.7 - 16.8 lbs/gal
Mud type	Water based (28% barite)
Hole deviation	Maximum 20 deg. at 14712 ft, 12 deg. at TD

Logging Runs:

	Top (ft)	Bottom (ft)	Temperature (deg f)	Acquisition Mode
DLL/MSFL/BHC/GR	12870	14986	313	Wireline
DIL/BHC/LDL/CNL/ /NGL	12870	16472	340	Drillpipe (TLC)
VSP	12750	16200		Wireline
SHDT/NGL	12857	16240	341	Wireline
CST1	14635	16180		Wireline
CST2	12953	14584		Wireline

Data Quality Discussion:

The first wireline logging run (DLL/MSFL/BHC/GR) did not reach the total depth of the well (tool stopped at 15001 ft) and was logged from 14986 ft up to 7" casing. The well was circulated and conditioned for several days prior to the next logging attempt. It was decided that due to potential sticking problems to use drill pipe conveyed logging (TLC) rather than the conventional wireline method. The TLC log was depth correlated to the SHDT/NGL which was run using the conventional wireline unit later. On the TLC run the entire tool string failed after reaching the bottom of the hole. From the first logging run the caliper appears to be nominally in gauge except for the interval from 13920-14040 ft. The hole appears to be slightly sticky just off bottom but there is no evidence of sticking elsewhere.

DLL/MSFL- In general the LLD, LLS and MSFL respond appropriately through the entire interval.

BHC - The acoustic data is of good quality.

Note: The following discussion on the TLC logging measurements is in reference to a down pass:

DIL (TLC)- The ILD,ILM and SFL are of good quality throughout the interval.

BHC (TLC)- The BHC responds properly throughout the interval.

LDL (TLC) - Data was acquired logging down without the caliper open. PEF data is not useful for lithologic interpretation due to the high barite content of the mud. Due to the problem of pad contact the LDL QLS and QSS curves are out of tolerance for most of the logged interval.

CNL (TLC) - The neutron measurement responds properly throughout the interval.

NGL (TLC) - Readings are affected by the formation activation caused by the Neutron/Density sources. The prints show a large CGR to SGR separation. The reading from this tool should be ignored in preference to the NGL reading from the SHDT logging run.

After TLC, the following logs were run on wireline:

VSP - Several levels close to TD were disturbed by noise.

SHDT - Due to sticky hole the caliper was closed over two intervals 13942-13934 and 13374-13370 ft. With the exception of overpull, as indicated by the tension curve, the tool responds normally over the entire interval.

NGL - The SGR responds appropriately over most of the interval with the exception of 13950-14000 ft where it is affected by hole washout. The high content of barite in the mud is affecting the spectral stripping of the uranium, potassium and thorium content. This is discussed more fully in the report in the appendix of this section.

CST1 - 11 recovered, 4 empty, 1 misfire, 26 left in hole.

CST2 - 24 recovered, 9 empty, 8 misfire, 1 left in hole.

3. INTERPRETATION SUMMARY

Run 5: Upper Jurassic Interval (12870 - 16480 TD)

Data Splicing and Shifting

Due to the difficulties associated logging this interval, several depth shifts had to be performed on the data in order to arrive at an interpretable data set. Data from the TLC run form the bulk of the input to the volumetric interpretation. From the top of the logged interval (12870 ft) to 14900 ft this data was shifted to match the incomplete DLL/MSFL of March 31. Below 14,900 ft the TLC run is tied into the SHDT/NGL wireline run.

GR - The final GR used in the interpretation is a merge of SGR from SHDT/NGL to the depth of 16240 ft, and the SGR from the TLC NGL logging from 16240 ft to 16480 ft TD.

All other measurements used in the interpretation are from the TLC logging pass, depth shifted as discussed above.

Environmental Corrections Applied to Data

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

Resistivity measurements (DIL) corrected for:

Hole size	:	5.875 inches
Temperature	:	340 deg°f at 16450 feet
Standoff size	:	.5 inches
Mud resistivity	:	.738 ohm
Mud temperature	:	58 deg°f

True resistivity was derived using corrected ILD, ILM and SFL curves and the RINT-2C Schlumberger "tornado" chart.

Gamma Ray measurements (as mentioned, the final GR is a composite of the NGT measurements from the dipmeter/NGT combination and the GR from the TLC run of the final section) were corrected as follows:

For the upper section (12870-16240 ft) NGT corrections were applied by Schlumberger and the report is included. In the lower section the uncorrected TLC NGL SGR was used.

Shale/Clay Volume Determination
Although several combinations of logs were reviewed for determination of clay volume from log, the most consistent interpretation resulted from the use of corrected gamma ray.

The gamma ray corrected as described above was used as input for the shale volume evaluation. A linear response algorithm was assumed in calculating shale volume from gamma ray. A value of 40 API units was used for GR clean and a value of 100 API units for GR shale. The results of the interpretation were compared to core shale volumes to determine the appropriateness of the endpoints chosen.

Effective Porosity Determination
After review of Neutron, Acoustic, and cross-plot Neutron/Acoustic porosities, it was decided that the acoustic data reflected the most consistent response with porosity. Porosity from the acoustic log was calculated using the following formula:

$$\text{Porosity} = .625 * (DT-55)/DT) - .65*VSH$$

This is a modified Raymer-Hunt correlation. A Delta-T matrix of 55 is used to reflect the predominantly sand-shale environment. The acoustic correction factor (.625) was chosen based on a fit with the other porosity information acquired in the well.

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

The Rw (.03 ohm at 245 deg f) used in the interpretation is based on values of similar Jurassic intervals in this area of the North Sea.

As no core of a representative reservoir interval was acquired and no apparent water zone was present through this interval in this well, standard values of 1, 1.81, 2 were chosen for a, m, and n, respectively.

<u>List of Key Parameters Used in the Evaluation</u>

Parameter / Zone	Upper Jurassic
Zone Top (ft)	12780
Zone Base (ft)	16450
Bit Size (ft)	5.875
Total Depth (ft)	16450
BHT (deg f)	340
Gamma Ray Clean (api)	40
Gamma Ray Shale (api)	100
DT Matrix (us/ft)	55
Rw (ohm)	.03
Temperature Rw (deg f)	245
Resistivity Shale (ohm)	2.5
a	1
m	1.81
n	2

50.92.ki\MS0701

Summary Discussion

No commercial quantities of hydrocarbons were encountered in the Upper Jurassic. Throughout the interval there are some sandstone and limestone stringers which compute water saturations less than 50%. However, these stringers showed very low porosity values.

The interval from 14230-14830 ft is primarily mudstone but with an increase in the amount of clastic material relative to the rest of the Upper Jurassic section. Using a shale volume of less than 40% and porosity greater than 5% this 600 foot gross interval contains 68 feet net (11% net/gross ratio). The following summary values were calculated:

Upper Jurassic Interval: 14230 - 14830 ft

Discriminators:	Shale Volume	0-40
	Porosity	5-100

Gross Interval:	600 ft
Net Interval:	68 ft
Net/Gross:	11 %

4. REPEAT FORMATION TESTER

Results and Conclusions

The pressure testing for this well (drill stem testing) was canceled due to the poor reservoir rock quality and lack of hydrocarbons indicated by logs. Only scattered hydrocarbons were indicated from the CPI log and both RFT logs indicated very tight formations. From the initial RFT run, only one point was obtained from 24 attempts. This point indicated a mobility of 0.05 mD/cp. The remaining points were not obtained due to tight conditions or seal failures. The formation pressure at 10,121 ft measured depth (10,120 ft TVD-RKB) indicated 7,813.4 psig (531.7 atm). No valid RFT pressure points were obtained in the second run.

Pressures from Repeat Formation Tester Tool (RFT)

RFT data was collected in the 8 1/2" section and are given in Table 4. The data were collected January 8, 1991.

The initial RFT log covered measured depths from 10,121 ft to 10,791 ft, corresponding to the Tuxen, Åsgard and Mandal Formations (Lower Cretaceous and Upper Jurassic).

Even when many points were attempted retaken, only one valid point was obtained from a total of 24 attempts. This was due to an extremely tight formation. The mobility measured from the valid RFT point was estimated at 0.05 mD/cp. The final formation pressure was 7,813.3 psig (531.7 atm).

The second RFT log was run in the 8 1/2" section February 17, 1991 and the data are listed in Table 5. No valid RFT formation pressures were obtained from this run due to tight reservoir rock and log seal failures. The logged depths covered 10,792 ft to 12,381 ft MD, corresponding to Upper Jurassic Mandal and Farsund Formations.

The RFT depths are listed versus true vertical depth. The sequence column indicates the sequence in which the points were actually logged.

Table 4

Repeat Formation Tester Data
8 1/2" hole section, January 8, 1991

Measured Depth, ft (RKB)	Vertical Depth, ft (RKB)	Sequence	Formation press., psig *	Hydrostatic press., psig.	Mobility k/μ, mD/cp	Notes
10,121	**10,120**	**20**	**7,813.3**	**8,515.9**	**0.05**	**4 resets, incr. press at end**
10,166	10,165	1	41.5	8,582.1	-	tight
10,197	10,196	19	305.9	8,579.5	-	tight
10,198	10,197	18	-	-	-	seal fail
10,317	10,316	17	384.6	8,674.2	-	tight
10,373	10,372	2	44.1	8,725.0	-	tight
10,400	10,399	16	431.1	8,739.3	-	tight
10,426	10,425	15	458.3	8,760.8	-	tight
10,438	10,437	14	404.4	8,769.2	-	tight
10,470	10,469	13	499.4	8,788.8	-	tight
10,479	10,478	3	78.4	8,789.1	-	tight
10,508	10,507	12	533.4	8,818.4	-	tight
10,575	10,574	4	251.3	8,884.9	-	tight
10,607	10,606	21	277.2	8,912.2	-	tight
10,608	10,607	22	318.2	8,911.2	-	tight
10,608.5	10,607.5	23	385.5	8,912.0	-	tight
10,609	10,608	10	1,928.4	8,897.8	-	3 resets, form. breakdown
10,609	10,608	11	1,389.0	8,897.9	-	tight
10,609.5	10,608.5	24	369.0	8,907.8	-	tight
10,693	10,692	7	484.3	8,942.7	-	tight
10,694	10,693	5	8,824.8	8,944.2	-	seal fail, gas in tool
10,694	10,693	9	460.4	8,962.7	-	tight
10,694.5	10,693.5	8	587.1	8,967.4	-	tight
10,791	10,790	6	628.1	9,004.5	-	tight

* Formation pressure column does not necessarily indicate true formation pressure.

50.92.ki\MS0701

Table 5

Repeat Formation Tester Data
8 1/2" hole section, February 17, 1991

Measured Depth, ft (RKB)	Vertical Depth, ft (RKB)	Sequence	Formation press., psig *	Hydrostatic press., psig.	Mobility k/μ, mD/cp	Notes
10,792	10,791	2	-	9,492.0	-	tight
10,792	10,791	1	-	9,494.9	-	no seal
10,856	10,855	3	-	8,579.5	-	tight
10,868	10,867	4	-	9,555.3	-	tight
10,988	10,985	5	-	9,662.7	-	no seal
12,354	12,321	7	-	10,817	-	no seal
12,354	12,321	6	-	10,822	-	no seal
12,381	12,348	8	-	10,839	-	tight

* Formation pressure column does not necessarily indicate true formation pressures.

PRENGT ENVIRONMENTAL CORRECTIONS

PPCON

WELL : 2/7-24

FIELD : West Valhall

DATE LOGGED: 6-APR-91

RUN NO: 1

Log analyst
B. Myking
April 1991

Reference : S20191

Appendix 1

Contents

1 Objectives

The objective is to correct the NGT for the presence of barite in the mud in order to produce a normalized NGT log.

2 Method used

In the PRENGT program an Alpha filter was used to make the estimation of the contents of Thorium, Uranium and Potassium, and to search for the Barite content in the mud.

3 Results

The processing gave a barite factor of 0.899. A factor of 1 means no barite in the mud. No negative levels of either Uranium, Thorium or Potassium were detected of a total of 4136 samples. A Kalman filter was also tried, but did not give as goos results as the Aplha filter. For explanation of the Alpha filtering technique, see the appendix.

4 Appendix A

Alpha filter:
The "Alpha" filter is a very simple filter which assumes that the variations of individual window countrates are strongly correlated with each other and thus, the total countrate (SGR). The filter starts with heavily averaged individual window counts and modulates them by the unaveraged total countrate. This results in window rates with vertical resolution of the raw gamma-ray with statistics of the gammaray, but with relative proportions driven by the original individual window rates. The validity of the filter results relies on the assumption that the relative proportions of TUK are slowly varying, while absolute values can change dramatically. It is also valid in clean zones with high Uranium activity and low K and Th. The only time the filter is not valid is if in the middle of a zone of high T, U and K activity only one of the elements undergoes a sudden dramatic change. However, such an occurence is not geologically likely.

Schlumberger

OBDT Processing Report
WELL 2/7-24
PHILLIPS PETROLEUM CO. Norway

The Oil Based mud Dipmeter Tool (OBDT) was used to log the interval 10006 - 8657 ft in the Cretaceous and Tertiary sequences on the West Valhall field.

OBDDIP Processing Parameters :

Interval logged	10006 - 8657 ft
Correlation Interval	4.00 ft
Step Ratio	50%
Search Angle	35° × 2
Focusing Option	Horizontal fixed plane
Magnetic Declination	3.7359° East
Speed correction	Yes
Emex correction	No

Comments

Data Quality :

The data quality is very good.
The borehole deviation is 2° and generaly to southeastly and east direction.

Borehole Conditions :

Borehole conditions are good.

Structural features :

The structural dip vary from 14° in the lower section to 10° in upper part of Cretaceous and 11° in the Tertiary shale.
Possible several faults can be interpreted in the interval 9650 - 9380 ft, where the major fault dipping to westly direction is interpreted at 9455 ft.

K.Mandziuch

Ref. no.: SKJ.50350

Date: 21 Dec. 90

Appendix 2

Schlumberger

MSD Processing Report
WELL 2/7-24
PHILLIPS PETROLEUM CO. Norway

The Formation MicroScanner Tool (FMS) was used to log the interval 12886 - 9988 ft in the Jurassic clay sequence on the West Valhall field.

MSD Processing Parameters :

Interval processed	12883 - 10500 ft
Correlation Interval	4.00 ft
Step Ratio	50%
Search Angle	35° × 2
Focusing Option	Horizontal fixed plane
Magnetic Declination	3.8648° East
Speed correction	Yes
Emex correction	Yes

Comments

Data Quality :

The data quality is very good. The maximum borehole deviation is 8° and deviation azimuth is to the southwest in the lower part, and above 11350 ft bore hole deviation is in a northeast direction.

Borehole Conditions :

Borehole conditions are of variable quality from poor to very poor. A large washout was reported (above 10500 ft) and the processing was stopped at client request.

Structural features :

From the MSD data, only the structural trend within the Jurassic sediments can be determined. The structural trend varies from 8° to the north in the lower section, to 10° to northwest and 7-8° to the west in the upper part of the Jurassic shale.

Several tectonic features can be observed in the interval but more detailed faults orientation and structural analysis of the data requires FMS image processing and use of the SUN workstation.

K.Mandziuch

Ref. no.: SKJ.50351

Date: 05 Mar 91

Appendix 3

Schlumberger

MSD Processing Report
WELL 2/7-24
PHILLIPS PETROLEUM CO. Norway

The Stratigraphic High Resolution Dipmeter Tool (SHDT) was used to log the interval 16239 - 12873 ft in the Jurassic shaly sequences on the West Valhall field.

MSD Processing Parameters :

Interval logged	16239 - 12873 ft
Correlation Interval	4.00 ft
Step Ratio	50%
Search Angle	35° × 2
Focusing Option	Horizontal fixed plane
Magnetic Declination	3.7359° East
Speed correction	Yes
Emex correction	No

Comments

Data Quality :

The data quality are relatively good but the button D3A is dead over the intervals: 16239 - 16140 ft and 13243 - 12872 ft, this does not reduce the overall dip quality.

In the intervals 13963-13935 ft and 13382-13368 ft the tool got close and the MSD result is incorrect.

The borehole deviation is 11° at the bottom, 20° at 14936 ft and 7° at the top of interval. The borehole azimuth is generally to SSW (199°-225°) direction.

Borehole Conditions :

The borehole elongation is to the SSW-NNE direction which can indicate the minimum stress direction.

Structural features :

In the lower part of the borehole the structural dip is 29° to south (up to 15960 ft) and the drag zone (15960-15795 ft) with possiblly two faults can be interpreted. In the interval above 15795 ft, the structural trend is 14° to SSE direction.

At 14510 ft an unconformity or major fault can be interpreted. In interval 14510-14230 ft the structural trend is 8-10° to eastly and southesterly directions where a several finingupward sequences can be recognised.

At 14230 ft the structural trend changes to a southeasterly direction with the dip magnitude of 14°.

From 13550 ft the structural trend change to an easterly direction and dip magnitude is 8°.

From 13030 ft to 12872 ft the dip azimuth varies between SE, E and NE directions and various dip magnitudes, from 6° to 14°.

K.Mandziuch

Ref. no.: SKJ.50350

Date: 22 April 1991