

1299

NORSK HYDRO a.s.
FINAL REPORT
WELL 15/5-1
LICENCE 048

ORIGINAL

OCTOBER 1978

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PREFACE

Licence 048 was awarded the Statoil/Petronord group February 18, 1977 with Norsk Hydro Produksjon a.s as operator. The licence includes the blocks 15/2 and 15/5 on the Norwegian continental shelf.

The group consists of the following companies:

Den norske stats oljeselskap a.s	50.0 %
Elf Aquitaine Norge a.s	21.8 %
Norsk Hydro Produksjon a.s	17.3 %
Total Marine Norsk a.s	10.9 %

The well 15/5-1 was drilled by Norsk Hydro Produksjon a.s on behalf of the Statoil/Petronord group.

Summary.

The main objective of the well was to:

- test a possible extension of the hydrocarbons present in the Jurassic sandstones of the Sleipner Field of blocks 15/9 and 15/6.
- test the additional Jurassic sandstones on the flank of the structure.

The 15/5-1 well was the first well drilled by the new s.s. rig "Treasure Seeker", which was outfitted in Stavanger.

Following extensive commission tests the rig was accepted in Stavanger harbour on November 15, 1977. Due to rough weather rig move and anchoring was delayed and the well was not spudded until November 26, 1977.

The 30" casing and the 20" casing were landed and cemented without problems. After running the BOP and during the installation of the slip joint, it was accidentally dropped on the deck and damaged. A spare joint was located and shipped to the rig site. However, rough weather prevented the slip joint from being loaded on the rig and several days were lost on this account.

During drilling at 2726 meter anchor No.1 slipped during a storm, causing the rig to drift slightly off location, which again caused one gooseneck to break against a rig beam in the moon pool. The drill pipe was sheared and hung off on a tool joint. In total four days were lost before drilling was resumed. The 13-3/8" casing was run and cemented without any problems.

During drilling at 3142 meter the 12-1/4" diamond bit parted in two, leaving the matrix in the hole. In total 2,5 days were spent in cleaning the hole. There were two subsequent drill string failures, one caused by the parting of a jar and one due to a failure in a drill collar tool joint. In both cases the string was immediately recovered without excessive lost time. The 12-1/4" hole was logged twice, at 3402 meter and at 3511 meter, before the 9-5/8" casing was run and cemented.

Three cores were cut from 3561 meter to 3601 meter, and the well was logged. Drilling continued, and another two cores were cut from 3611 meter to 3625 meter. The well was finally drilled to 3775 meter, and logged whereupon a 7" liner was successfully run and cemented for production testing.

Two zones were production tested with a maximum rate of 23.4 MMSCF/day gas and 3046 BOPD through a 48/64" choke, from the zone 3561 m to 3584 m. The well was plugged and abandoned on April 8, 1978.

LOCATION OF WELL 15/5-1

III

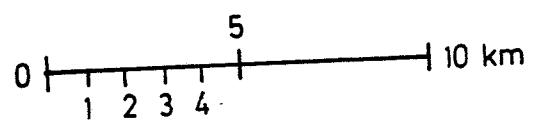
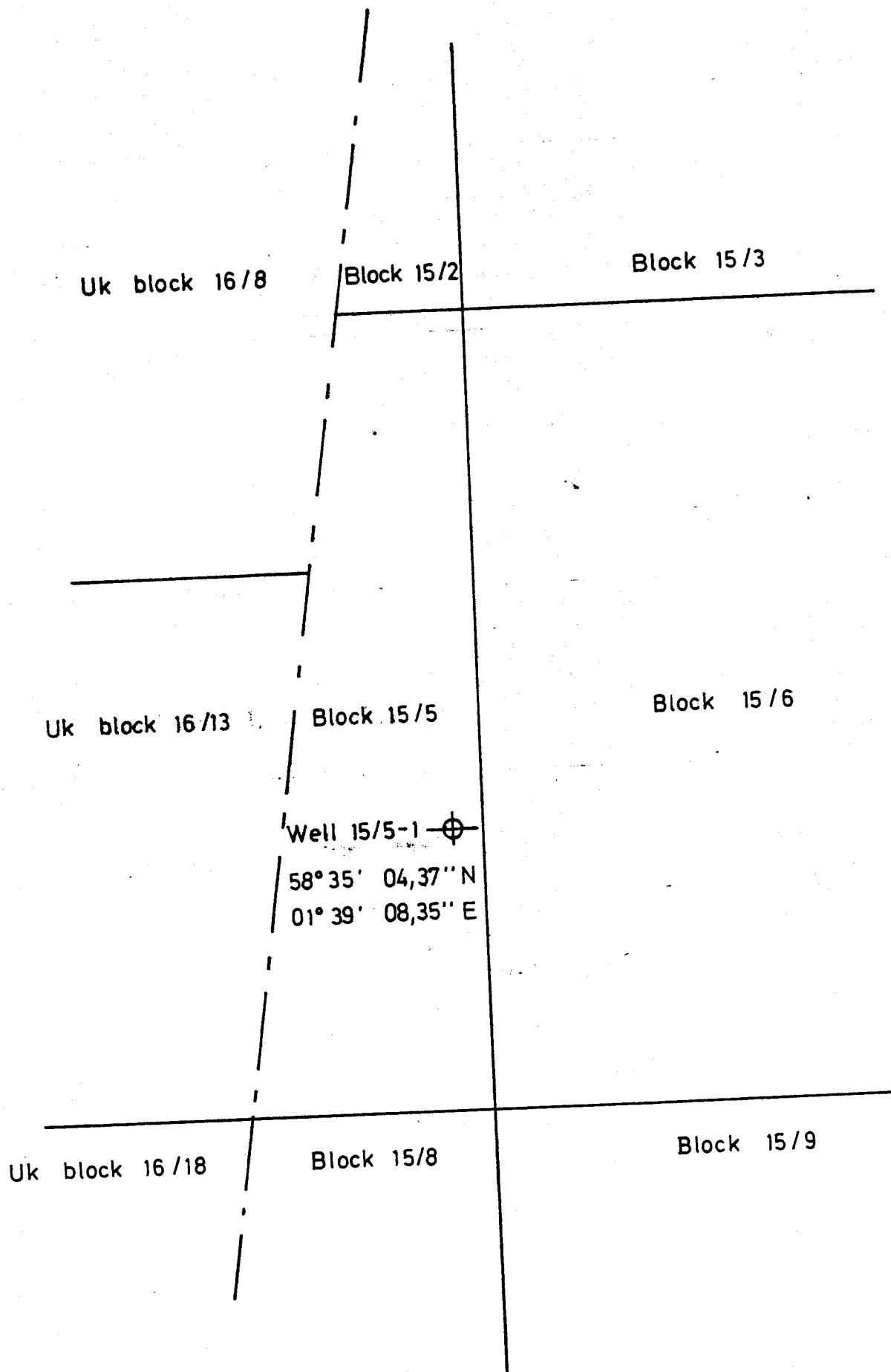


TABLE 1

SUMMARY OF WELL DATA

Location:	58°35'04.37" N 01°39'08.35" E
Operator	Norsk Hydro Produksjon a.s
Rig	Treasure Seeker
Contractor	Wilh. Wilhelmsen
RKB elevation (to MSL)	25 m
Water depth (RKB)	144 m
Start of operations	November 15, 1977
Well spudded	November 26, 1977
Well abandoned	April 8, 1978
<u>Well program</u>	
Hole record:	36" to 194.5 m 26" to 712.0 m 17½" to 2738.0 m 12-1/4" to 3511.0 m 8-3/8" to 3775.0 m
Casing record:	30" set at 194.0 m 20" set at 705.0 m 13-3/8" set at 2722.0 m 9-5/8" set at 3497.0 m 7" liner set at 3766.0 m

All depths are given in RKB.

SECTION A

OPERATIONS

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1. LOCATION SURVEY

Between August 31 and September 17, 1977 a site survey was carried out in area 15/5. The survey covered an area of 2 square kilometres and comprised side scan sonar, mud penetrater (pinger), boomer, multielectrode sparker, high energy sparker (analog and digital) and a echo sounder. Five gravity cores were also obtained.

The co-ordinates of the location as provided by Norsk Hydro a.s previous to the site survey were:

Latitude: $58^{\circ}35' 07.0''$ N
Longitude: $01^{\circ}39' 05.0''$ E

Decca survey was notified after the survey was completed of a revised location.

Latitude: $58^{\circ}35' 00.7''$ N
Longitude: $01^{\circ}39' 11.0''$ E

The echo sounder survey showed the sea bed undulating slightly through a range of 3.7 metres shoaling gradually to the East.

The water depth at the proposed location was found to be 119.4 m.

The side scan sonar survey indicated the presence of a wreck which was 2470 metres from the revised location on a bearing 317° true North.

The seismic records showed a sequence of up to 50 metres of finely laminated, alternating sands and clay-silts covering the whole survey area. Available evidence indicated that the main part of the sequence consisted of sand layers up to 2 meters thick with individual sand layers being separated by thinner bands of clay-silt. The sequence was expected to be well compacted or consolidated.

2. POSITIONING AND ANCHORING OF THE RIG

The location of Well 15/5-1 was defined as shot point No. 131 at time 210812 minus a layback of 209 m on line 602. The well should be spudded within a circle of radius 30 m from this position.

Due to the critical specifications for the operation, the navigation and positioning had to be carried out by the same positioning system as used in the shooting of the line, and with reference to the original Pulse /8 raw-data from "Goel Egede". Therefore a Decca Dual Pulse/8 receiver and minicomputer system was used to navigate and track the rig's position into the new location. In addition a real time satellite navigation system was used to confirm the position.

Some operational problems occurred with the Pulse/8 system during the "run-in" on November 17. The main reasons have been found to be passing of heavy rain showers and some technical problems with the equipment.

Final position of the derrick center (rotary table) based on J.M.R. Satelite Fix. system was found to be:

European datum: Latitude $58^{\circ}35'04.37''$ N
 Longitude $01^{\circ}39'08.35''$ E

During anchor handling the weather picked up rapidly and when the supply boat should lay out anchor No. 7, he got problems with the manouvring. To prevent collision between the boat and the rig, the pennant line was cut. As a result chain No. 7 crossed chain No. 8 and dropped on the port pontoon.

On November 23, all 8 anchors were set with direction and chain lengths as given in Fig. A.1. The results after the last pretension on November 24 were:

Chain No. 1: 712 kN

" " 2: 934 kN

" " 3: 1156 kN

" " 4: 712 kN

" " 5: 712 kN

" " 6: 889 kN

" " 7: 712 kN

" " 8: 778 kN

On December 3, prior to drilling out of the 20" casing shoe, all the 8 anchors were tested to 1112 kN.

Anchor No. 1 and No. 4 were later piggy-backed due to tension slipping and heavy weather.

3. OPERATION RESUME

3.1 Summary

Due to the weather forecasts the captain hesitated taking the rig out of Aamøyfjorden. One and a half day were lost waiting in the fjord.

When the rig arrived at the location there were difficulties with the pulse 8 positioning system caused by rainshowers. However, the decision was made to run anchors, but during the anchor handling the weather picked up. When handling anchor No. 7, the supply boat captain lost control for a second due to the heavy sea and to avoid collision between the supply boat and the rig the pennant wire was cut. As a result the anchor chain No. 7 was laid across both chain No. 8 and port pontoon.

Eleven and a half days after the rig was accepted, the well was spudded. The 36" hole was drilled to 194.5 m RKB. The 30" casing was set at 194 m RKB and cemented.

The riser was run and the 17½" pilot hole was drilled to 712 m with returns to the surface. The hole was logged and later underreamed to 26". The 20" casing was run to 705 m RKB and cemented back to the sea floor.

The BOP stack was tested and landed on the wellhead. When preparing to install the slip joint the slip joint was dropped on the deck and damaged. Because of heavy seas three rig-days were lost before the spare slip joint was loaded on board the rig. Another six rig-days were spent waiting on weather before drilling out of the 20" casing.

The obtained leak-off at the 20" shoe was 1.46 rd. After having drilled the 17½" hole to 1407 m the leak-off test was rerun and gave a leak-off pressure equal to 1.43 rd.

Down to 1407 m the 17½" hole was drilled with a stiff bottom hole assembly. Due to 400 kN overpull the stabilizers were left out. At 2360 m two stabilizers were reinstalled in the string but would not go to bottom. From then on the 17½" hole was drilled without stabilizers.

When drilling at 2726 m a heavy storm caused anchor No. 1 to slip. This, together with the rig's heave caused one of the goosenecks to break off the slip joint due to the slip joint hitting the cellar deck. The drill string was hung off in the BOP and the string was sheared as the heave was too excessive for backing off. The drilling was continued four days later.

The hole was drilled to 2738 m when anchor windlass No. 8 broke down. The bit was pulled as satisfactory tension could not be maintained on anchor No. 8. However, the windlass failure did not cause further delays as the 17½" hole was logged. A rollerreamer was used to straighten the hole before running casing. The 13-3/8" casing was landed at 2722 m and cemented in one stage.

When drilling out, a leak-off of 1.73 rd was obtained below the casing shoe.

The 12-1/4" hole was drilled to 3142 m with a diamond bit when the bottom section of the diamond bit was sheared off and 2.5 days were spent cleaning the hole. After having milled and drilled on the junk a trip was made with a reverse circulating junk basket, and 1 m core and 21 kg of diamond bit junk was recovered. The drilling was continued down to 3226 m when a drilling jar twisted off. The fish was recovered within 16 hours. When running in the hole with bit No. 21, the blind ram was not opened and the bit was junked. A drill collar was washed out on the following bit run and the drill string parted. About 30 hours were spent before this fish was retrieved. After reinspecting all the drill collars the drilling continued.

At 3402 m an intermediate log was run. Drilling was continued and the well was logged again at 3511 m. The 9-5/8" casing was landed at 3497 m and cemented.

The mud weight was increased to 1.38 rd before drilling out. The obtained leak-off, after having drilled out of the shoe was 2.11 rd. The hole was drilled to 3561 m and a new leak-off test was run giving a new value of 2.12 rd.

Three cores were cut between 3561 m and 3601 m. Before cutting core No. 3, the mud weight was increased to 1.44 rd.

The well was drilled to 3603 m and it was decided to make an intermediate log run but the logging tools did not reach bottom. The hole was conditioned and the mud weight was increased to 1.46 rd after which two log runs were then made without problems.

The hole was drilled to 3609 m and at which point Schlumberger RFT was run. Two formation fluid samples were gathered but unfortunately one sample was lost during transfer to the Core Lab bottles.

Another three cores were cut from 3609 m to 3625,5 m.

The well was drilled to 3775 m and logs were run. Three attempts were made to run the RFT. The tool got stuck twice and had to be fished by treading drill pipe over the logging wire. One sample was recovered from the second run.

The decision was taken to test the well. A 7" liner was hung off at 3284 m and cemented with the shoe at 3766 m.

The BOP stack was pulled and serviced. Due to two broken guide lines three rig-days were lost. Replacing the guide lines with the guide line replacement tool was not successful and divers had to reinstall the guide lines.

The liner was perforated from 3610 m to 3614 m for the first drill stem test. Half a day was lost because the perforating gun did not fire. The tubing was displaced with sea water. The well started flowing after the perforations had been unplugged by injecting sea water. Stabilized conditions were not reached. The perforations were squeeze cemented and the well was plugged back to 33596.5 m. Schlumberger perforated the liner from 3561 m to 3584 m for test No. 2. After the clean-up a three point flow after flow test was performed.

The well was killed and a Baker cement retainer was set at 3535 m. The perforations were squeeze cemented and a cement plug was set from 3330 m to 3230 m.

The well was plugged and abandoned on April 8, 1978 as described in chapter 4.

3.2 Diary Report

- 15th November Norsk Hydro accepted the rig Treasure Seeker on 15th of November 1977 at 00.00 hrs. The rig was then at anchor outside Stavanger, waiting on weather to move to location 15/5-1.
- 16th November Waited on weather. Pulled the anchors and started to move to location 15/5-1.
- 17th November Moved the rig to location.
Positioned the rig and ran anchors No. 1,2,3,4, 5, 6, and 8. Due to heavy weather the supply boat had manouvreability problems and anchor chain No. 7 was laid across both chain No. 8 and port pontoon. Waited on weather to rerun anchor No. 7.
- 18th November Waited on weather. Made preparations to start the drilling.
- 19th November Waited on weather. Prepared to start the drilling.
- 20th November Waited on weather
- 21st November Waited on weather
- 22nd November Waited on weather. Moved the rig 200 m north-east due to drift-off.
- 23rd November Set anchor No. 7, reset anchor No. 1 and 8.
- 24th November Checked the position with Decca - OK.
Waited on weather.
- 25th November Waited on weather. Ballasted the rig down to drilling draft.

- 26th November 184 m Run a 26" bit and 36" opener.
Measured depth to sea bed 144 m
RKB. Drilled 36" hole from 144 m
to 184 m.
- 27th November 194 m Drilled 36" hole from 184 m to 194 m.
Ran and cemented the 30" casing. POOH
with the casing running tool and started
to run the riser with 30" connector.
- 28th November 316 m Latched connector on the 30" wellhead
and tested with a pull of 220 kN.
Installed diverter. RIH with 17½" bit
and tagged cement at 188 m. Drilled
cement to 194 m. Drilled a 17½" pilot
hole from 194 m to 316 m.
- 29th November 712 m Drilled the 17½" pilot hole from 316 m
to 712 m.
- 30th November 712 m Made wiper trip and ran logs. RIH with a
17½" bit and 26" underreamer and reamed the
hole from 188 m to 215 m.
- 1st December 714 m Reamed the 17½" hole to 26" from 215 m to
712 m. Drilled a 26" hole from 712 m to
714 m. Pulled the diverter bag and POOH.
- 2nd December 714 m Pulled the riser. RIH with a 26" bit for
wiper trip. Started to run the 20"
casing.
- 3rd December 714 m Ran and cement the 20" casing. POOH with
the casing running tool and prepared to
run the BOP stack and the riser.
- 4th December 714 m Function tested the BOP stack on both pods.
Tested kill and choke line to 345 bar for
15 minutes. Ran BOP stack and riser.
When picking up the slip joint it was accidentally
dropped on the deck and damaged.

5th December 714 m Ran TV and adjusted guide line tension.
Tested the choke and stand pipe manifold.
Waited on weather to unload new slip joint
from supply boat.

6th December 714 m Waited on weather. Pulled the riser.

7th December 714 m Waited on weather. Unloaded the new
slip joint at 19.00 hrs. Ran the riser and
installed the diverter.

8th December 714 m Tested the kill and choke line and BOP
stack. Anchor No. 3 slipped. Disconnected
the riser. Waited on weather.

9th December 714 m Waited on weather.

10th December 714 m Waited on weather.

11th December 714 m Waited on weather.

12th December 714 m Ran the riser and function test the BOP
stack.

13th December 970 m RIH with a 17½" bit and tagged cement at
690 m. Drilled cement and float shoe.
Drilled a 17½" hole down to 724 m and ran
leak off test. Formation leak-off pressure
was equivalent with 1.46 rd mud. Drilled
from 724 m to 970 m.

14th December 1339 m Drilled from 970 m to 1339 m.

15th December 1407 m Drilled from 1339 m to 1407 m. Pulled
out to the 20" casing shoe and ran a
leak-off test. Leak-off pressure was
equivalent with 1.43 rd. mud. Changed bit.

16th December 1673 m Drilled from 1407 m to 1673 m.

17th December 1990 m Drilled from 1673 m to 1990 m.

- 18th December 2053 m Drilled from 1990 m to 2000 m.
Changed the bit and drilled from
2000 m to 2053 m.
- 19th December 2254 m Drilled from 2053 m to 2254 m.
Pulled out for bit change.
- 20th December 2254 m Retrieved the wear bushing and tested
the BOP stack with the test tool.
RIH with a new bit.
- 21st December 2360 m Drilled from 2254 m to 2360 m. Pulled
out for bit change.
- 22nd December 2360 m RIH with a new bit and reamed tight hole
from 2155 m to 2190 m. Was unable to get
deeper and POOH, the stabilizers were
badly balled up.
- 23rd December 2495 m RIH and drilled from 2360 m to 2495 m.
Pulled out with bit.
- 24th December 2495 m Repaired a damaged diverter flow line
seal. The pipe racker arm was damaged
when RIH and was repaired.
- 25th December 2595 m RIH with a new bit and drilled from
2495 m to 2595 m. POOH for bit change.
- 26th December 2633 m Repaired the BJ lifting head. Drilled
from 2595 m to 2633 m.
- 27th December 2655 m Drilled from 2633 m to 2646 m.
Pulled out for bit change. Retrieved
the wear bushing and tested the BOP
stack. Drilled from 2646 m to 2655 m.

- 28th December 2680 m Drilled from 2655 m to 2680 m.
Changed bit and RIH.
- 29th December 2703 m Drilled from 2680 m to 2703 m.
- 30th December 2726 m Repaired heave compensator hoses and
drilled from 2703 m to 2726 m.
Anchor No. 1 slipped while POOH.
Tried to hang off the drill string with
the hang off tool, but was unable to
release the tool. Spaced out and landed
the string in the BOP stack and cut the
string with the shear rams. The riser
was released and secured in the moon
pool. Waited on weather.
- 31st December 2726 m Waited on weather. Ran and connected
the riser to the BOP stack.
- 1st January 2726 m Waited on weather. Tested the kill and
choke line. Repaired DSC lock bar.
Waited on weather.
- 2nd January 2726 m Latched to top of the cut-off drill string
hanging in the BOP stack with an overshot
after having milled on top of the string.
- 3rd January 2738 m Pulled out with the drill string. RIH
and drilled from 2726 m to 2738 m.
- 4th January 2738 m Pulled out of the hole due to bad weather.
Displaced the riser with sea water.
Ran ISF/Sonic log.
- 5th January 2738 m Ran FDC/GR, HDT, and CST logs.
- 6th January 2738 m Finished logging. Repaired rig.

- 7th January 2738 m RIH with a new bit. Reamed down from 1630 m to 2107 m.
- 8th January 2738 m Reamed down from 2107 m to 2738 m. Pulled out with the bit.
- 9th January 2738 m Pulled the wear bushing and started to run the 13-3/8" casing.
- 10th January 2738 m Ran and cemented the 13-3/8" casing, casing shoe at 2722 m.
- 11th January 2738 m Laid down all casing tools and washed through the BOP stack and seal assembly with a wash tool. Waited on weather.
- 12th January 2738 m Waited on weather. Ran the riser and tested the kill and choke lines.
- 13th January 2738 m Tested the seal assembly and BOP stack and ran the wear bushing. Ran CBL log. Made up BHA with a 12½" bit and RIH.
- 14th January 2766 m Tagged top of cement at 2690 m. Drilled to 2751 m and ran a leak off test. Leak off pressure was equivalent with 1.73 rd mud. Drilled from 2751 m to 2766 m. Pulled out to change bit.
- 15th January 2802 m RIH with a 12-1/4" diamond bit and drilled from 2766 m to 2802 m.
- 16th January 2892 m Drilled from 2802 m to 2892 m.
- 17th January 2962 m Drilled from 2892 m to 2962 m.
- 18th January 3035 m Drilled from 2962 m to 3035 m.
- 19th January 3099 m Drilled from 3035 m to 3099 m.

- 20th January 3142 m Drilled from 3099 m to 3142 m.
POOH to change bit. 114 mm of the
12-1/4" diamond bit had sheared off
and was left in the hole.
- 21st January 3142 m RIH with a junk mill and milled on the
junk at 3142 m. POOH with the junk
mill and tested the BOP stack with the
test tool.
- 22nd January 3143 m RIH with a 12½" rock bit. Drilled on
the junk and worked the junk sub. POOH
to change bit.
- 23rd January 3145 m Drilling on the junk from 3143 m to 3145 m.
Pulled out with the bit. RIH with a
reverse circulating junk basket and cut
1 m core.
- 24th January 3152 m Pulled out and made up a new bit. Recovered
21 kg of diamond bit junk. RIH to 2487 m
and hung off the string in the BOP stack.
Waited on weather. RIH and drilled from
3145 m to 3152 m.
- 25th January 3198 m Drilled from 3152 m to 3198 m. POOH to
change bit.
- 26th January 3226 m RIH with a 12-1/4" diamond bit and drilled
from 3198 m to 3226 m. Lost the pump
pressure and torque and POOH. Found that
the jar in the drill string had parted.
RIH with an overshot.
- 27th January 3226 m Worked the overshot over the fish and POOH
with same. RIH with a new bit but hit the
closed shear rams. Tested the BOP stack
with the test tool.

- 28th January 3233 m RIH and drilled from 3226 m to 3233 m. Lost 102.3 kN from the original string weight. POOH and found that a drill collar was twisted off. RIH with an overshot, but pulled out as overshot would not latch onto the fish.
- 29th January 3233 m RIH with the overshot after it being repaired. Worked the overshot over the fish and POOH. Had thread inspection on the drill collars and subs.
- 30th January 3255 m RIH with a new bit while inspecting the drill collars. Drilled from 3233 m to 3255 m.
- 31st January 3291 m Pulled the bit due to increase in torque and found the sealing damaged on one of the cones. Changed bit and drilled from 3255 m to 3291 m.
- 1st February 3315 m Drilled from 3291 m to 3309 m. Pulled out to change bit. Drilled from 3309 m to 3315 m.
- 2nd February 3347 m Drilled from 3315 m to 3345 m. Pulled out to change bit. Drilled from 3345 m to 3347 m.
- 3rd February 3392 m Drilled from 3347 m to 3392 m.
- 4th February 3402 m Drilled from 3392 m to 3402 m. Pulled out for running logs. Ran ISF/Sonic/GR/SP logs and velocity survey.
- 5th February 3412 m Finished the logging and tested the BOP stack with the test tool. Tested the kelly valves and stand pipe manifold. RIH and drilled from 3402 m to 3412 m.

- 6th February 3471 m Drilled from 3412 m to 3471 m.
- 7th February 3508 m Drilled from 3471 m to 3511 m. Built the mud density to 1.34 rd.
- 8th February 3511 m Pulled out for logging. Ran ISF/SONIC/GR, FDC/CNL and HDT logs.
- 9th February 3511 m Ran CST. Made a wiper trip before running the 9-5/8" casing.
- 10th February 3511 m Ran the 9-5/8" casing.
- 11th February 3511 m Cemented the 9-5/8" casing, casing shoe at 3497 m. Washed inside the BOP stack and seal assembly with a wash tool. Ran a temperature log. Tested the seal assembly and BOP stack.
- 12th February 3511 m Lower pipe ram on BOP stack did not test. Changed the o-rings on the test tool and the pipe ram was then tested to the required pressure.
- 13th February 3514 m Ran a CBL log and tested the casing to 344 bar for 15 minutes. RIH with a 8-3/8" bit and tagged top of the cement at 3458 m. Drilled to 3514 m.
- 14th February 3529 m Ran a leak off test, and the leak off pressure was equivalent with 2,11 rd. mud. Changed bit and drilled from 3514 m to 3529 m.
- 15th February 3556 m Pull out for bit change. Drilled from 3529 m to 3556 m.

- 16th February 3561 m Drilled from 3556 m to 3561 m. Ran a leak off test, and the leak off pressure was equivalent with 2.12 rd. mud. Pulled out with the bit. RIH with a core barrel.
- 17th February 3593 m Took core No. 1 from 3561 m to 3578 m. Took core No. 2 from 3578 m to 3593 m. Built the mud density to 1.44 rd.
- 18th February 3593 m Tested the BOP stack with the test tool. RIH to take core No. 3.
- 19th February 3602 m Took core No. 3 from 3593 m to 3601 m. RIH with a new BHA and bit. Drilled from 3601 m to 3602 m.
- 20th February 3603 m Drilled from 3602 m to 3603 m. Pulled out to run logs. Ran ISF/SONIC/GR log, but could not get it past 3570 m. Pulled out to condition the hole. RIH with a new bit and reamed from 3546 m to 3603 m. Raised the mud density to 1.46 rd. and pulled out.
- 21st February 3603 m Ran ISF/SONIC/GR, FDC/CNL and DLL/MSFL logs. RIH with a new bit.
- 22nd February 3611 m Drilled from 3603 m to 3609 m. Pulled out and ran RFT logs. RIH with the core barrel and took core No. 4 from 3609 m to 3611 m.
- 23rd February 3623 m Continued taking core No. 4 from 3611 m to 3623 m, and retrieved core. Waited on weather. Released the riser from the BOP stack.
- 24th February 3623 m Waited on weather. Latched the riser to the BOP stack. Tested the BOP stack with the test tool.

- 25th February 3632 m Took core No. 5 from 3623 to 3625 m.
RIH with a new bit and drilled from
3625 m to 3632 m.
- 26th February 3684 m Drilled from 3632 m to 3684 m.
- 27th February 3754 m Drilled from 3684 m to 3754 m.
- 28th February 3775 m Drilled from 3754 m to 3760 m. Pulled
out to change bit. Drilled from 3760 m
to 3775 m.
- 1st March 3775 m Pull out to run logs. Ran DLL/MSFL, FDC/CNL,
HDT and ISF/SONIC/GR logs.
- 2nd March 3775 m Made a wiper trip and ran ISF/sonic logs.
RIH with the RFT log.
- 3rd March 3775 m During logging the RFT tool stuck at
3740 m. Prepared to fish the RFT tool by
threading the wire through the drill pipe.
- 4th March 3775 m While running down with the overshot, the
fish came loose and was pulled out.
- 5th March 3775 m Made wiper trip. Ran velocity survey,
ISF/Sonic and RFT logs.
- 6th March 3775 m Ran RFT log and velocity survey. Ran a
new RTF log, but the RFT tool stuck at
3605 m while running down.
- 7th March 3775 m RIH with an overshot, threading the wire
through the drill pipe. Pulled out of
hole with the the RFT tool.
- 8th March 3775 m Made a wiper trip and ran side wall coring
No. 1 and No. 2.

- 9th March 3775 m Made a new wiper trip and started to rig up for running the 7" liner.
- 10th March 3766 m Ran and cemented the 7" liner, with hang off point inside the 9-5/8" casing at 3284 m and liner shoe at 3766 m.
- 11th March 3766 m RIH with a new bit and tagged the top of the liner at 3284 m. POOH and made up a new BHA with 3½" drill pipe and a 6" bit.
- 12th March 3766 m RIH with the 6" bit to top of the liner hanger at 3284 m. Cleaned out stringers of cement down to the landing collar at 3741 m. Ran CBL log and tested the liner to 200 bar for 17 minutes.
- 13th March 3766 m Pulled the riser and BOP stack. Made ready to service the BOP stack.
- 14th March 3766 m Serviced and tested the BOP stack.
- 15th March 3766 m Finished servicing and testing the BOP stack. Guide line No. 2 broke. Ran down with the Reagan guide line running tool to run new guide line - negative.
- 16th March 3766 m Modified the guide frame for the guide line tool and made new attempts to cut the guide line on post No. 3 - negative.
- 17th March 3766 m Made new unsuccessful attempts to cut the guide line on post No. 3. Managed to cut the guide line on post No. 2. Made an attempt to replace the guide line - negative. Pulled all tools and made ready to replace the guide lines with the aid of divers.

- 18th March 3766 m Divers replaced the guide lines No. 2 and No. 3. Ran the BOP stack and riser and tested the kill and choke line. Started to test the BOP stack.
- 19th March 3766 m Finished testing the BOP stack. Waited on weather.
- 20th March 3766 m Waited on weather. RIH to 3741 m, conditioned the mud and built mud density to 1.46 rd. Spotted 3 bbls of diesel oil opposite the planned perforations.
- 21st March 3766 m Reached depth where the diesel oil was spotted and found it in wrong place. Spotted new 3 bbls of diesel oil at the correct depth. Had three misfires with the perforation gun. Stripped down the gun and rebuilt it.
- 22nd March 3766 m Perforated the 7" liner with 4 shots/ft from 3610 m to 3614 m. Started to make ready for the drill stem test.
- 23rd March 3766 m Ran a 3½" tubing test string while testing the connections to 524 bar.
- 24th March 3766 m Made up the surface test tree and landed the sub sea test tree in the 9-5/8" wellhead. Tested the choke manifold and all surface equipment to 689.5 bar.
- 25th March 3766 m Tested the tubing test string to 310,3 bar and started the drill stem test.
- 26th March 3766 m The tubing plugged while running the drill stem test, but was unplugged by injecting methanol in surface tree. Circulated 1.46 rd. mud and started to pull the test string.

- 27th March 3766 m Pulled out with the test string.
- 28th March 3766 m Serviced the test tools and ran junk basket. RIH with a cement retainer to 3596 m and squeezed the perforations with a final squeeze pressure of 207 bar. Pulled out to 3590 m and spotted 5 bbls of diesel oil. Pumped a mud slug to stabilize back-flow and pulled out with the string.
- 29th March Tested the BOP stack with the test tool.
Plugged back to Made ready to perforate.
3596 m
- 30th March RIH with open ended pipe and perforated the interval from 3584 m to 3561 m. Made ready to run the test string.
- 31st March Ran the test string and tested the surface equipment and the tubing connections.
Plugged back to Opened the test string and flowed the well for clean-up. Closed the well and pumped down 4.7 m³ of water as a cushion. Opened up the well for the drill stem test.
3596 m
- 1st April Ran the drill stem test. Closed the well in at the sub sea test tree due to difficulties in closing the ARP valve.
Plugged back to 3596 m
- 2nd April Ran final build up. Reverse circulated and conditioned the mud in the annulus to 1.46 rd and pulled out with the test string.
Plugged back to 3596 m
- 3rd April Set a cement retainer at 3535 m and squeezed the perforations. Set a balanced cement plug from 3330 m to 3230 m.
Plugged back to 3230 m
- 4th April Repaired the draw work and pulled out with the cementing string. Made ready to perforate at the 20" casing shoe.
Plugged back to 3230 m

5th April Perforated opposite the 20" casing shoe
Plugged back to and set the cement retainer at 702 m.
702 m Squeezed 14.3 m^3 cement slurry around the
 shoe. Spotted 30 m of cement on top of
 the cement retainer. A cement plug was set
 from 210 - 270 m with 2.1 m^3 class "G" neat
 cement. Perforated at 200 m and set a cement
 retainer at 190 m, but broke the setting
 tool and left it in the cement retainer.
Perforated at 188 m and set a new cement
retainer at 183 m.

6th April Squeezed the perforations at 188 m with
Plugged back to 11.3 m^3 cement slurry and pulled out of the
153 m retainer at 183 m with the cementing string.
 Spotted 30 m of cement on top of the cement
 retainer. Pulled the riser and BOP stack.
 Ran an explosive charge to 5 m below the
 sea bed and tried to shoot off the wellhead -
 which was not successful.

7th April Divers installed bull plugs in the wellhead,
Plugged back to but an attempt to circulate around the 30"
153 m and casing shoe failed. Fired the second
abandoned charge 5 m below sea bed, but was unable to
 pull wellhead. Fired the third charge 5m
 below sea bed and was then able to pull out
 with the wellhead and guide base. Jumped
 divers to remove junk on the sea bed. Started
 to deballast the rig.

8th April Finished deballasting the rig. Pulled the
Well abandoned anchors. Final abandonment of well 15/5-1
 was completed at 15.00 hrs on April 8, 1978.

3.3 Time Distribution

The total time used to move the rig to the location, to drill, complete, test and plug and abandon the Well 15/5-1 was 144.6 days. The time distribution is shown in Table A.1 and Figure A.2.

The operation can be divided into four main groups.

1. Underway and position the rig, 11.2 days.
2. Drilling of the well to TD, 102.8 days
3. Completion and testing of the well, 27 days.
4. Plug and abandon the well, 3.6 days.

Before spud, 85.2% of the time was lost due to WOW and anchoring problems.

A total of 7 days were lost when the slip joint dropped on the deck. This includes both waiting on the replacement slip joint and the following waiting on weather.

When the gooseneck was broken and the drill string was sheared and hung off, 2.4% of the total time was lost.

During the testing period 2.5 days were lost because of broken guide lines. This represented 1.8% of the total time.

- The lost time fishing was caused by the following incidents:
- Shearing off the diamond bit, parting the drilling jar, parting of the drill collar and the stuck RFT-tool.

The time used on formation evaluation was higher than planned. The main reason is the two extra intermediate logs runs and the coring of the pay zone.

TABLE A.1

TIME DISTRIBUTION

OPERATION	DAYS	PERCENTAGE OF TOTAL TIME
1. Under way	0.92	0.63
2. Mooring	1.40	0.97
3. Drilling	26.60	18.39
4. Tripping survey	11.14	7.70
5. Circulating and cond. mud	0.73	0.50
6. Run and cement casing	12.00	8.30
7. Formation evaluation	37.03	25.60
8. Subsea equipment	6.71	4.64
9. Lost time - drlg. equipment	6.97	4.82
10. Lost time - subsea equipment	6.07	4.20
11. Lost time - fishing	7.52	5.20
12. Lost time - hole problems	0.81	0.56
13. Lost time - mooring system	3.29	2.28
14. Lost time - wo weather	16.83	11.64
15. Lost time - wo equipment	0.42	0.29
16. Lost time - wo orders	0.09	0.06
17. Lost time - completion equipment	-	-
18. Lost time - others	1.83	1.27
19. Plug and abandon	4.28	2.96
SUM TOTAL	144.63 days	100%

Note: Formation evaluation includes the following:

Logging: 285 hrs = 8.2%

Completion and testing: 500.5 hrs = 14.4%

Coring : 103.3 hrs = 3.0%

TABLE A.2

HOLE DEVIATION - 15/5-1

Depth (m)	Inclination (degrees)	Direction (degrees)
194	0.50	236
288	0.50	236
357	0.13	308
<u>462</u>	<u>0.13</u>	<u>328</u>
554	0.25	299
650	0.50	288
712	0.25	293
<u>805</u>	<u>0.25</u>	<u>26</u>
901	0.50	336
996	0.25	275
1093	0.25	286
<u>1188</u>	<u>0.75</u>	<u>160</u>
1282	0.50	227
1377	0.75	239
1407	0.50	262
<u>1502</u>	<u>1.00</u>	<u>158</u>
1598	1.75	118
1698	0.75	153
1808	0.50	143
<u>1904</u>	<u>0.88</u>	<u>117</u>
2000	0.50	98
2092	1.50	156
2187	0.88	129
2358	1.00	137

Table A.2 cont.

-28-

Depth (m)	Inclination (degrees)	Direction (degrees)
2454	0.50	120
2495	0.50	250
2595	0.65	238
2646	0.50	223
2680	0.50	263
2800	1.25	193
2894	1.50	198
2988	1.75	193
3084	2.00	199
3171	3.75	231
3255	3.65	155
3344	1.50	353
3402	3.5	269
3511	3.8	228
3603	3.75	194
3775	0.25	131

4. FINAL ABANDONMENT OF THE WELL.

The approved abandonment program is shown in Fig. A-3 . Due to problems with the last cement retainer, the abandonment program had to be slightly modified.

The actual abandonment program is shown in Fig. A-4 . It was carried out as follows:

1. Baker cement retainer set at 3596 m. 20 sxs cement was squeezed into the perforations.
2. Baker cement retainer set at 3535 m. 50 sxs cement was squeezed into the perforations and 15 m. of cement was spotted on top of the retainer.
3. From 3330 m to 3230 m cement plug No. 3 was set with 90 sxs cement.
4. Perforated at 710 m. Set Baker cement retainer at 701.5 m squeezed 450 sxs class "G" neat cement into the perforations. 30 m of cement was spotted on top of the retainer.
5. Set a cement plug from 210-270 m with 66 sxs class "G" neat cement.
6. Perforated at 200 m. Set Baker cement retainer at 190 m. Due to broken setting tool it was perforated again at 188 m. An E-Z drill packer was set at 183 m. 350 sxs class "G" neat cement was squeezed into the perforations. Spotted 30 m with cement on top of packer.
7. Ran shaped charge on sandline. Ran three shots before managed to retrieve wellhead. Recovered 5 m of casing below guidebase.

8. The divers recovered the following from the sea bed:

- one steel ladder with back gage
- pieces of the rucker wire
- 2 guide-lines, each on 300 ft.

See letter to NPD and divers report enclosures A.1 and A.2.

5. PORE PRESSURE AND FORMATION INTEGRITY

5.1 Pore Pressure

Pore pressure detection was performed during drilling from 2000 m and down to final depth. Drilling parameters and electric logs were used in this work.

The results from different methods are as follows.
(All values are in rd.). (See Fig. A.5.)

Depth (m)	d_c -exp	Sonic log	Density log	Predicted before well was drilled
2400	1.07	1.07	1.07	1.10
2600	1.14	1.25	1.31	1.12
2800	1.15	1.08	1.19	1.13
3000	1.16	1.08	1.08	1.14
3200	1.16	1.08	1.08	1.14
3400	1.16	1.17	1.11	1.15
3470	1.21	1.25	1.26	1.20
2490	1.27	1.33	1.27	1.24
3500	1.28	-	1.32	1.26
3520	1.28	-	1.34	1.27
3545	1.31	1.35	1.31	1.30
3550	1.32	-	-	1.32

The RFT result showed that the pressure in the sand section was 1.34 rd.

5.2 Formation Integrity

The following formation integrity tests were run: (See Fig. A.5).

20" csg. shoe at 705 m: 1.46 rd.
 at 1407 m: 1.43 rd.
 13-3/8" csg. shoe at 2722 m: 1.73 rd.
 9-5/8" csg. shoe at 3497 m: 2.11 rd.
 at 3561 m: 2.12 rd.

6. MATERIALS REPORT

6.1 Casing and Wellhead

A Vetco SG-5 Wellhead system was used. This would have made it possible to use the 15 000 psi BOP Stack if higher formation pressure were encountered.

The 36" hole was spudded and drilled without any guidance system. The 30" casing was run with the 30" wellhead housing locked into the permanent guide structure. The extended posts would have facilitated guidance of the 15 000 psi BOP Stack.

The riser was run prior to drilling of the 17½" pilot hole and the 26" hole underreamed. The 20" casing was run with 18-3/4" wellhead housing to land in the 30" wellhead.

The 17½" hole was drilled with the 10 000 psi BOP Stack in place. The 13-3/8" casing was run, landed in 18-3/4" housing and cemented.

The 12-1/4" hole was drilled. The 9-5/8" casing was run, landed and cemented.

The 8-3/8" hole was drilled to T.D. The 7" liner was run and hung off inside 9-5/8" casing by using a Brown Oil Tool hydraulic liner hanger.

The well was production tested, plugged and abandoned.

The following types of casing were run:

Size	Grade	Weight lbs/ft	Length m	Threads	Setting depth m
30"	B	450	13	S.J	194
	B	310	38	S.J.	
20"	X-52	94	465	"L"	705
	K-55	94	85	Butt	
13-3/8"	N-80	72	1408,3	Butt.	2722
	J-55	68	1172,1	Butt.	
9-5/8"	Q-125	58,4	781,1	VAM	3497
	P-110	53,5	822,9	Butt.	
	P-110	47	1100,4	Butt.	
	RS-95	53,5	171,5	Butt.	
	N-80	47	479.5	Butt.	
7" liner	N-80	29	476.0	Butt.	3766

6.2 Drill Bit Record

The 36" hole was drilled with a 26" pilot bit and a 36" hole opener.

The 26" hole was drilled with a 17½" bit and a 26" underreamer with a 17½" pilot bit.

The 17½" hole was drilled with 9 bits:

3 bits	IADC code	111	from	712	to	2254	m
1 "	"	"	131		to	2360	m
3 "	"	"	132		to	2646	m
1 "	"	"	131		to	2680	m
1 "	"	"	515		to	2738	m

An additional bit IADC code 111 was used on a rollerreamer run to straighten the hole at several intervals.

The 12-1/4" hole was drilled with 11 bits:

1 bit	IADC code 214	from 2738 to 2766 m
1 diamond bit		to 3142 m
3 bits	IADC code 214	to 3198 m
1 diamond bit		to 3233 m
1 bit	IADC code 515	to 3255 m
1 "	" " 214	to 3309 m
1 "	" " 225	to 3346 m
1 "	" " 214	to 3402 m
1 "	" " 517	to 3511 m

A 12-1/4" diamond bit was damaged when it hit the shear/blind rams while being run in the hole.

The 8-3/8" hole was drilled with 5 bits:

3 bits	IADC code 224	from 3511 to 3561 m
1 "	" " 313	" 3601 to 3609 m
1 "	" " 627	" 3625 to 3760 m
1 Rerun	" " 313	" 3760 to 3775 m TD

Coring was carried out with 2 heads:

1 diamond head		from 3561 to 3593 m
1 "	"	" 3593 to 3601 m
	and	" 3609 to 3625 m

For complete bit report see Table A.3

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COUNTY	FIELD	STATE	SECTION	TOWNSHIP	RANGE	LOCATION	WELL NO.
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15/5-1

CONTRACTOR					RIG NO.	OPERATOR				TOOLPUSHER				SALESMAN									
Wilh. Wilhelmsen					Norsk Hydro																		
SPUD	UNDER SURF.	UNDER INTER.	SET SAND ST.	REACHED T.D.	PUMP NO. 1	LINER		PUMP NO. 2		LINER		PUMP POWER		TYPE MUD									
26/11-77						7"		7"		7"		FA - 1600											
DRILL PIPE	SIZE					TYPE	O.D.	NUMBER					O.D.	I.D.	LENGTH		DRAWWORKS POWER						
5" - 4 1/2 IF	TOOL JOINTS					DRILL COLLARS																	
NO.	SIZE (inch)	MAKE	TYPE	JET 32ND IN	SERIAL	DEPTH OUT	M	HOURS	M/ HR	ACCUM. DRLG. HRS.	WT KN	RPM	VERT. DEV.	PUMP PRESS. BAR	PUMP OPERATION	SPM	MUD		DULL. COND.		FORMATION REMARKS		
1	26	HTC	OSC 3AJ	3x22	TD 104	194.5	50	10.5	5	105	90	60	1/2°	36.4	1+2	76	76			1 1 I		CLAY W/ SAND	
HO	36	Servco	15000 SER	3x24	4170	"	"	"	"	"	"	"	"	"	"	"	"	"	"		1 1 I		
2	17 1/2	Smith	DSJ	3x20	VD 406	712	524	24 3/4	212	35 1/4	44	125	1/4°	200	1+2	120	120			2 2 I		CLAY W/SAND	
3	17 1/2	Reed	Y-11-J	3x22	-	714	(526)	21 1/4												INC			
UR	26	Servco	15000 SER	-	-	712	(524)	21 1/4	245	56 1/2	8.8	80/90	-	186	P	110	110			INC			
RR	1	26	HTC	OSC 3AJ	3x22	TD 104	712	Wiper trip															
4	17 1/2	Smith	DSJ	18-18-20	VD 462	1407	695	42	165	98 1/2	175	160	1/2°	225	P	90	90			6 6 I			
5	17 1/2	"	"	18-18-18	VD 456	2000	593	42 1/2	14	141	175	160	1/2°	225	P	85	85			7 6 I			
6	17 1/2	"	"	20-20-20	VD 459	2254	254	24 1/2	104	165 1/2	177	155	1°	220	P	82	82			8 7 I			
7	17 1/2	Reed	Y 13	20-20-20	526035	2360	106	16 1/2	6.4	182	200	150	1 1/4°	220	P	82	82			8 8 I			
8	17 1/2	Smith	2 JS	18-18-20	VD 746	-	-	-	-	-	-	-	-	-						INC		NOT ABLE TO GET TO BIM DUE STAB	
9	17 1/2	SEC	S4 TJ	18-18-20	515598	2495	135	13	105	195	150 220	120 125	1/2°	220	P	76	76	1.2	47	5.8	7 7	1	SD. ST. + CLAY / SH
10	17 1/2	SEC	S4 TJ	3x18	542444	2595	100	17.5	5.7	212.5	133	120	3/4°	220	P	73	73	1.2	45	6	6 8	1	CLAY / SH + SD. ST.
11	17 1/2	SEC	S4 TJ	3x18	515562	2646	51	14 1/4	3.6	226 3/4	133 220	120	1/2	212	P	77	77	1.2	47	6.2	5 6	1	SHALE
12	17 1/2	Reed	Y 13	3x18	233922	2680	34	16 1/4	2.1	243	133 222	120	1/2	220	P	75	75	1.26	47	6.5	3 4	I	IMST SAND, SHALE
13	17 1/2	Smith	2 JS	3x18	652 FA	2738	58	35 3/4	1.6	278 3/4	202	80	1/2	220	P	75	75	1.26	50	6	3 2	I	
14	17 1/2	Smith	DSJ	-	232044						45	100 120		167	P	60	60						
Rollerreamer																							
15	12 1/4	SEC	M44 NG	3x13	203947	2766	28	12 1/2	22.2	2914178	110	2 1/4	214	P	50	50	126	50	6.8	5 4	I	LIME- STONE CEMENT	
16	12 1/4	HYC	S-I-R	-	16883	3142	376	114 3/4	3.3	406290	200	13/4	207	P	52	52	126	50	6.5	Total	junk	LIMESTONE	
17	12 1/4	Hughs	XV	13-13-12	FL 676	3143	1	5	0.2	411178	20	-	213	P	50	50	126	45	6.6	8 4	T	LIMESTONE + JUNK	
18	12 1/4	Hughs	XV	13-13-12	83152	3144	1	4 1/2	20.2	415 1/2	178	80	-	213	P	50	50	126	45	6.6	7 8	I	LIMESTONE + JUNK

COUNTY	FIELD	STATE	SECTION	TOWNSHIP	RANGE	LOCATION	WELL NO.																		
CONTRACTOR			RIG NO.	OPERATOR	TOOLPUSHER			SALESMAN																	
SPUD	UNDER SURF.	UNDER INTER.	SET SAND ST.	REACHED T.D.	PUMP NO. 1	LINER	PUMP NO. 2	LINER	PUMP POWER	TYPE MUD															
									FA-1600																
DRILL PIPE	SIZE	TYPE	O.D.	NUMBER	O.D.	I.D.	LENGTH	DRAWWORKS POWER																	
5" - 4½" IF	TOOL JOINTS	DRILL COLLARS																							
NO.	SIZE	MAKE	TYPE	JET 32ND IN	SERIAL	DEPTH OUT	M	HOURS	N/HF	ACCUM DRILL HRS.	kN	RPM	VERT DEV.	PUMP PRESS BAR	PUMP OPERATION	S P M	2	WT.	VIS.	W.L.	T	B	G	OTHER	FORMATION REMARKS
Reverse circ.	junk basket					3145	1	1½	0.6	417	178	55	-	174	P	70	70	126	45	6.6					LIMESTONE + JUNK
19	12-1/4	HUGHS	XV	13-13-12	FL675	3198	53	18½	2.9	435.5	267	140	-	313	P	48	48	125	41	6.2	5	6	I	LIMESTONE + SHALE	
20	12-1/4	HYC	DIAMOND SN-1	-	6619	3233	35	13	2.7	448.5	289	200	-	190	P	47	47	126	48	6.1	"				
21	12-1/4	HYC	DIAMOND SN-1	-	6984	Damaged when hit blind																			
22	12-1/4	SMITH	2JS	14-14-14	903KL	3255	22	12 ¼	1.8	460.7		60	3												15 T
23	12-1/4	HUGHS	XV	13-13-13	FL885	3309	54	21½	2.5	482.1	240	140	3.7	218	P	50	50	126	45	6.0	4	2	T	Limestone MARL	
24	12-1/4	SMITH	SVH	13-13-13	610	3346	37	14 ¾	2.5	497	290	140	1.5	218	P	50	50	126	50	6.0	7	8	I	2 CONES LOCK-ED, 1 CONE SLACK	
25	12-1/4	HTC	XV	13-13-13	FL677	3402	56	25 ¼	2.2	522.7	290	100	110	3.5	218	P	50	50	125	43	6.0	7	6	I	
26	12-1/4	REED	FP52	13-13-13	735489	3511	109	31 ⅓	3.5	553.7	250	60	3.8	213	P	50	46	132	43	6.0	3	7	I		
27	8-3/8	SMITH	SV	-	956FT	3515	4	6-3/4	0.6	560.7	2050	50/90		105	S	80	138	45	5.0	7	7	T	Tag cmt. 3458 Drig. collar-sho		
28	8-3/8	SMITH	SV	9-9-9	970FT	3529	14	8½	1.6	568.7	180	80		207	S	52	138	44	5.0	7	6	I			
29	8-3/8	SMITH	SV	9-9-9	890FR	3561	32	11½	2.8	580.7	180	70		207	S	60	138	43	5.0	7	6	I			
Core 1	8-3/8	HYC	DG20R	-	16764	3593	32	8	4	584.7	110	110		87/99	S	50	56	140	43	5.0	4	0	% RUN I: 61-78 m		
Core 2	8-3/8	HYC	DG20R	-	16765	3601	8	3½	2.3	586.7	111	75		105	S	65	144	48	5.0	2	0	% RUN II: .78-.93 m			
30	8-3/8	SMITH	L4HJ	10-10-10	HE102	3603	2	1-1/4	1.6	587.7	111	80	3.7	198	S	65	146	50	4.8						
30RR	8-3/8	SMITH	L4HJ	-	HE102	3603	Condition trip before running logs																		
30RR	8-3/8	SMITH	L4HJ	10-10-10	HE102	3609	6	1-1/4	4.8	589	110	80		204	S	78	146	50	4.4						
RR2	8-3/8	HYC	DG-20R	-	16765	3623	14	4-3/4	2.9	593.7	110	100		117	S	60	146	50	4.4						
RR2	8-3/8	HYC	DG-20R	-	16765	3625	2	2	1	595.7	124	90		117	S	60	146	48	4.5						
31	8-3/8	REED	FP-62	11-11-11	117149	3760	135	50 ¾	2.7	646.7	175	70/110		207	S	77	646	50	4.4	8	8	3			
30RR	8-3/8	SMITH	L4HJ	-	HE102	3775	15	6-1/4	2.4	652.7	130	60	1/4	140	S	77	146	52	4.4	6	7	I			

6.3 Bottom Hole Assemblies

BIT NO.	BIT SIZE	BOTTOM HOLE ASSEMBLY
1	26"	36" holeopener - 9 x 9½" DC - 3 x HWDP
2	17½"	1 x 9½" Monel DC - 9 x 9½" DC - 15 x HWDP
3	17½"	26" underreamer - 9 x 9½" DC - 15 x HWDP
RRI	26"	9 x 9½" DC - 15 x HWDP
4	17½"	1 x 9½" Monel DC - 17½" stab - 2 x 9½" DC - 17½" stab - 11 x 9½" DC - 15 x HWDP
5	17½"	As bit No. 4
6	17½"	1 x 9½" Monel DC - 14 x 9½" DC - 15 x HWDP
7	17½"	As bit No. 6
8	17½"	As bit No. 4
9	17½"	As bit No. 6
10	17½"	" " " "
11	17½"	" " " "
12	17½"	" " " "
13	17½"	" " " "
Dressing Mill	15"	4 x 8" DC - 9 x 5" DP
Overshot	11-3/4"	4 x 8" DC - 9 x 5" DP
14	17½"	Junk sub - 1 x 9½" DC - Rollerreamer - 8 x 9½" DC - 15 x HWDP
15	12-1/4"	Junk sub - 12 x 8" DC-E.Q. jar - flex. jt. - 3 x 8" DC - 15 x HWDP
16	12-1/4"	12-1/4" stab - 1 x 8" Monel DC - 12-13/16" stab - 2 x 8" DC - 12-13/16" stab - 19 x 8" DC - jar - flex. jt. - 3 x 8" DC - 15 HWDP
Mill	12-1/8"	Junk sub - 16 x 8" DC - jar - flex. jt. - 3 x 8" DC - 15 x HWDP

BIT NO.	BIT SIZE	BOTTOM HOLE ASSEMBLY
17	12-1/4"	Junk sub - 12-1/4" stab. - 1 x 8" Monel DC - 12-3/16" stab - 19 x 8" DC - jar - flex. jt. - 15 x HWDP
18	12-1/4"	Same as bit No. 17, without junk sub
Rev.circ. junk basket		16 x 8" DC - jar - flex. jt. 3 x 8" DC - 15 x HWDP
19	12-1/4"	Same as bit No. 17
20	12-1/4"	Same as bit No. 17, without junk sub
Overshot		Jar - 6 x 8" DC - 15 x HWDP
21	12-1/4"	12-1/4" stab - 1 x 8" Monel DC - 12-3/16" stab - 3 x 8" DC 12-3/16" stab - 17 x 8" DC - 15 x HWDP
Overshot		Jar - 6 x 8" DC - 15 x HWDP
22	12-1/4"	1 x 8" Monel DC - 12-1/4" stab - 2 x 8" DC - 12-3/16" stab - 3 x 8" DC - 12-13/16" stab - 12 x 8" DC - 15 x HWDP
23	12-1/4"	As bit No. 22
24	12-1/4"	12-1/4" stab - 1 x 8" Monel DC - 12-13/16" stab - 2 x 8" DC - 12-13/16" stab - 18 x 8" DC - 15 x HWDP
25	12-1/4"	As bit No. 24
26	12-1/4"	As bit No. 24
27	8-3/8"	Junk sub - 24 x 6½" DC - 15 x HWDP
28	8-3/8"	Junk sub - NB - stab - 1 x 6½" DC - stab - 2 x 6½" DC - stab - 21 x 6½" DC - 15 x HWDP
29	8-3/8"	As bit No. 28
Core bit No.1	8-3/8"	Corebarrel - stab - 22 x 6½" DC - 15 x HWDP
Core bit No.2	8-3/8"	Corebarrel - stab - 15 x 6½" DC - 15 x HWDP
30	8-3/8"	NB - stab - 1 x 6½" DC - stab - 2 x 6½" DC - stab - 3 x 6½" DC - stab - 9 x 6½" DC - jars - 3 x 6½" DC - 15 x HWDP

BIT NO.	BIT SIZE	BOTTOM HOLE ASSEMBLY
30 RR	8-3/8"	As bit No. 30
Core bit No.2 RR	8-3/8"	Corebarrel - stab - 15 x 6½" DC - jar - 3 x 6½" DC - 14 x HWDP
31	8-3/8"	Junk sub - NB - stab - 1 x 6½" Monel DC - stab - 2 x 6½" DC - stab - 3 x 6½" DC-stab - 12 - 6½" DC - 15 x HWDP
30 RR	8-3/8"	As bit No. 31

6.4 Mud Report

Phases

36" hole, 30" csg.: The 36" hole was drilled with sea water with returns to the sea bed. A 1.08 rd spud mud with funnel viscosity of 100⁺ was mixed for spotting on connections and a 1.20 rd, 100⁺ spud mud was mixed for displacement of the hole before running the casing.

26" hole, 20" csg.: The riser was run before the 17½" pilot hole was drilled. A 1.03 rd sea water mud was used mixed of gel, soda ash, lime, caustic soda and barite.

During opening the hole to 26" prehydrated gel, sea water and caustic soda was added to the system continuously to maintain hole stability.

17½" hole, 13-3/8" csg.: Sea water mixed with gel, caustic soda, lime and barite was used when drilling out of 20" csg. shoe. At 1225 m CMC and Spersene was added to the system to reduce the fluid loss down to 15 ml/30 min and control flow properties.

At 1910 m the mud was gradually changed over to fresh water system by using drill water as treatment water. Due to the gumbo clay and shale being drilled, the fluid loss was reduced from 15 cc to 6 cc/30 min using CMC, Drispac and bentonite. Flow properties were controlled using Spersene and XP-20 (chrome lignosulfonate). Maximum mud density required for this interval was 1.26 rd.

12-1/4" hole, 9-5/8" csg.: When drilling the 12-1/4" hole from 2738 m to 3417 m the mud density was kept constant at 1.26 rd. From here and down to 3511 m the mud density was continuously increased to 1.34 rd. The mud was mixed with Spersene, gel XP-20, Drispac, lime, caustic soda. At 3145 m, Resinex was added to the system to reduce HT-HP fluid loss and stabilize the system for higher down hole temperature.

8-3/8" hole, 7" liner: The mud density was increased to 1.38 rd before the 9-5/8" csg. shoe was drilled out. It was kept constant down to 3593 m where it was increased to 1.45 rd. Final density at 3775 m was 1.46 rd. The fresh water, Spersene, XP-20 system was maintained to total depth utilizing Resinex and CMC for fluid loss control.

See Table A.4.

MUD SUMMARY

TABLE A.4

HOLE SIZE (inc)	DEPTH (m)	MUD DENSITY (rd)	FV (sec)	PV (mPa·s)	YP (Pa)	GEL STRENGTH (Pa)	FILTRATE ml/30 min.	CAKE mm	CL (ppm)	CALCIUM (ppm)	pH
36	194	1.08	100 ⁺	10	26	20/80	14	2	3 000	TR	9.5
17 ¹ ₂	251	1.07	50	8	14	4/10	20	2	10 000	40	9.5
"	468	1.08	50	7	20	6/20	30	2	15 000	40	9.5
"	712	1.08	50	8	20	6/15	35	2	15 000	40	9.5
26	196	1.08	45	6	15	3/12	40	2	16 000	40	9.0
"	714	1.09	40	5	24	5/9	40	2	16 000	40	9.0
17 ¹ ₂	901	1.08	40	7	11	4/10	40	2	16 000	800	9.0
"	1065	1.12	44	10	25	5/13	38	2	17 000	500	9.5
"	1177	1.10	43	7	16	4/11	40	2	17 000	600	9.5
"	1394	1.13	44	7	18	5/14	35	2	17 000	150	9.5
"	1475	1.12	42	8	11	4/11	15	2	15 000	250	10.0
"	1673	1.16	50	10	8	3/15	9	2	14 000	180	10.0
"	1904	1.18	50	27	6	4/20	6	2	9 000	0	9.5
"	2128	1.17	50	21	9	2/18	6	2	8 800	140	9.5
"	2183	1.20	55	20	7	2/21	7	2	8 000	NIL	9.5
"	2306	1.21	47	18	9	3/25	6	3	8 500	140	9
"	2495	1.20	45	20	7	3/9	6	2	7 000	100	9.5
"	2595	1.20	45	20	5	2/14	6	2	7 000	120	9.5
"	2670	1.26	50	23	8	4/15	6	2	7 000	80	9.5
"	2733	1.26	53	29	9	2/13	6	2	7 500	100	9.5
12-1/4	2800	1.26	52	30	7	1/14	7	2	8 000	50	11.0
"	2909	1.27	48	23	5	1/9	6	2	7 400	150	9.5
"	3035	1.27	55	22	6	1/12	6	2	7 500	150	9.5
"	3142	1.26	52	20	6	1/10	6	2	7 000	100	10.5
"	3227	1.25	50	20	6	2/12	6	2	6 500	80	10.5
"	3353	1.25	45	20	6	1/10	6	2	6 000	50	10.5
"	3489	1.28	46	17	6	2/13	6	2	6 000	50	10.5
"	3495	1.32	43	16	5	1/10	6	2	5 000	50	10.5
"	3508	1.34	43	16	5	1/10	6	2	5 000	50	10.5
8-3/8	3520	1.38	45	17	5	1/12	5	2	5 000	TR	11.0
"	3593	1.44	48	20	7	2/11	5	2	5 000	40	10.5
"	3609	1.46	50	18	11	1/13	4	2	8 000	80	11.0
"	3775	1.46	51	34	6	1/14	5	2	8 000	120	10.5

6.5 Cement Report

The 30" casing was set at 194 m and cemented with a lead slurry, followed by a tail in slurry.

Lead slurry: 17 tons class "G" cement with 0.908 m^3 of liquid Econolite and 1.226 m^3 of liquid CaCl_2 - slurry density: 1.5 rd.

Tail in slurry: 14 tons class "G" cement with 1.010 m^3 of liquid CaCl_2 - slurry density: 1.87 rd.

The 20" casing was set at 705 m and cemented with a lead slurry, followed by a tail in slurry.

Lead slurry: 128 tons class "G" cement with 6.8 m^3 of liquid Econolite - slurry density: 1.5 rd.

Tail in slurry: 17 tons class "G" cement with 0.4 m^3 liquid CaCl_2 - slurry density: 1.9 rd.

The 13-3/8" casing: was set at 2722 m and cemented with a lead slurry, followed by a tail in slurry:

Lead slurry: 72.5 tons class "G" cement with 4.63 m^3 of liquid Econolite, 0.79 m^3 CFR 2L and 0.08 m^3 HR 6L - slurry density: 1.5 rd.

Tail in slurry: 64.2 tons class "G" cement with 1.92 m^2 CFR 2L, 0.30 m^3 HR 6L and 2.64 m^3 FL 1 - slurry density: 1.87 rd.

The 9-5/8" casing was set at 3497 m and cemented in one stage.

Slurry: 80. tons class "G" cement with
 2.06 m^3 CFR 2L liquid additive
 2.86 m^3 FL 1 " "
 0.35 m^3 HR 6L " "

Slurry density: 1.89 rd.

The 7" liner, set at 3766 m and hung off at 3284 m and cemented in one stage.

Slurry: 14.25 tons class "G" cement with
 0.37 m^3 CFR 2L
 0.95 m^3 FL 1
 0.063 m^3 HR 6L

Slurry density: 1.89 rd.

Plug back after testing:

A BAKER cement Retainer was set at 3596.5 m and cement squeezed into formation:

Slurry: 0.85 tons class "G" cement with
 $.22 \text{ m}^3$ CFR 2L
 $.057 \text{ m}^3$ FL 1
 $.0076 \text{ m}^3$ HR 6L
 0.56 NF-1

Slurry density: 1.89 rd.

A BAKER Cement Retainer model K, was set at 3535 m and cement squeezed into formation (0.73 tons) and 1.4 tons left on top of Retainer

Slurry: 2.13 tons class "G" cement with
 $.055 \text{ m}^3$ CFR 2L
 0.14 m^3 FL 1
 0.019 m^3 HR 6L

Slurry density: 1.89 rd.

A Cement plug was set to overlap 7" liner top from 3330 m to 3230 m.

Slurry: 3.84 tons class "G" cement with 0.051 m^3 HR 6L.

Slurry density: 1.89 rd.

A BAKER Cement Retainer type K was set at 701.5 m and 19.2 tons class G NEAT cement squeezed into formation a 20" csg. shoe. 1.5 ton was left on top of the Retainer.

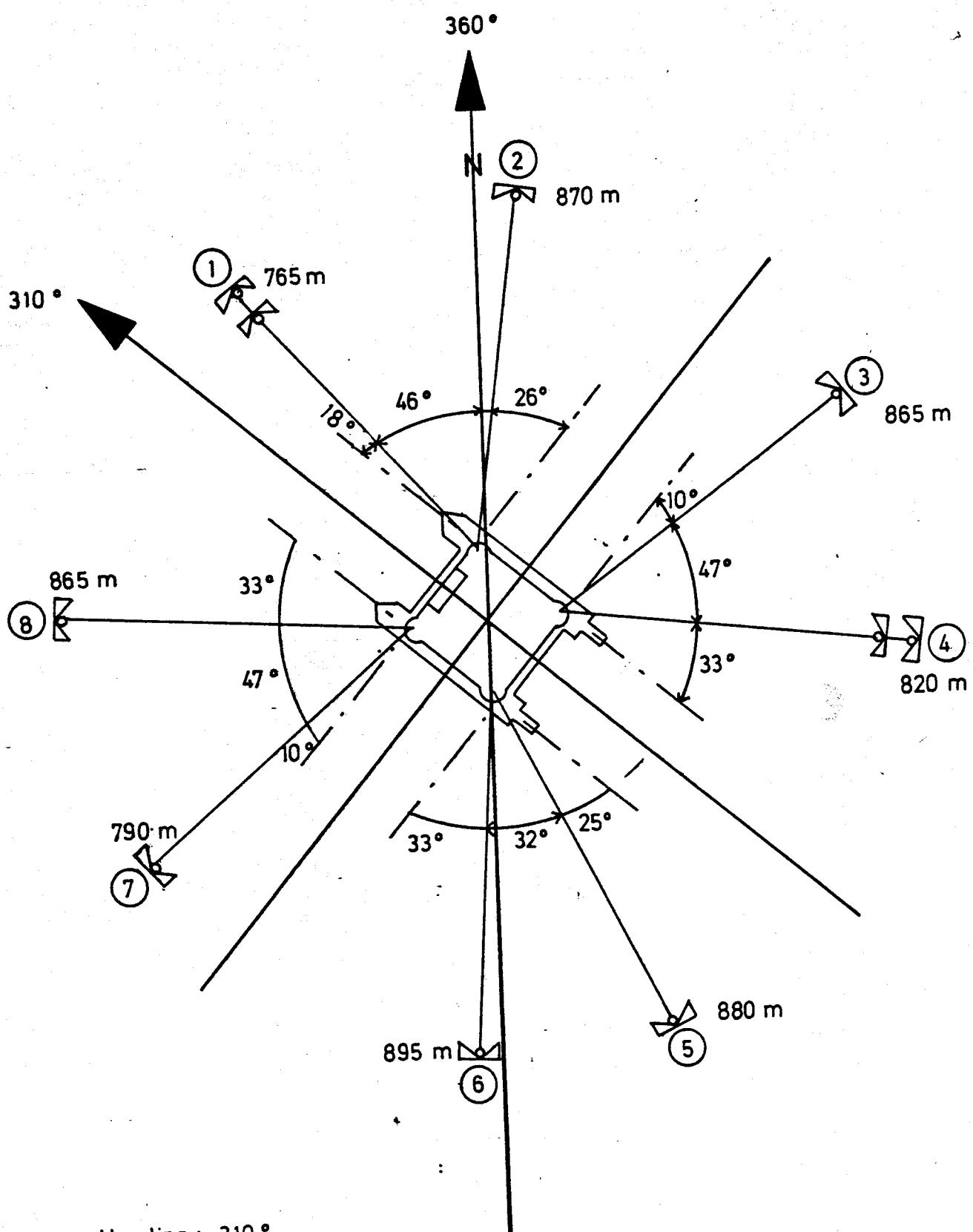
A cement plug of 2.82 tons class "G" NEAT cement was set from 270 m to 210 m.

A Baker cement retainer was set at 190 m. Due to material failure the setting mandrel was left in the packer and a squeeze job could not be carried out.

An additional Halliburton EZ-drill squeeze packer was set at 183 m and 14.94 tons class "G" NEAT cement squeezed into formation a 30" csg. shoe. 1.5 ton was left on top of the packer.

7. PRELIMINARY COST REPORT

Site survey, misc.	401.000
Rig Contract	16.457.000
Supplies	12.088.000
Services	22.837.000
Operator's cost	8.180.000
<hr/>	
Total	59.963.000

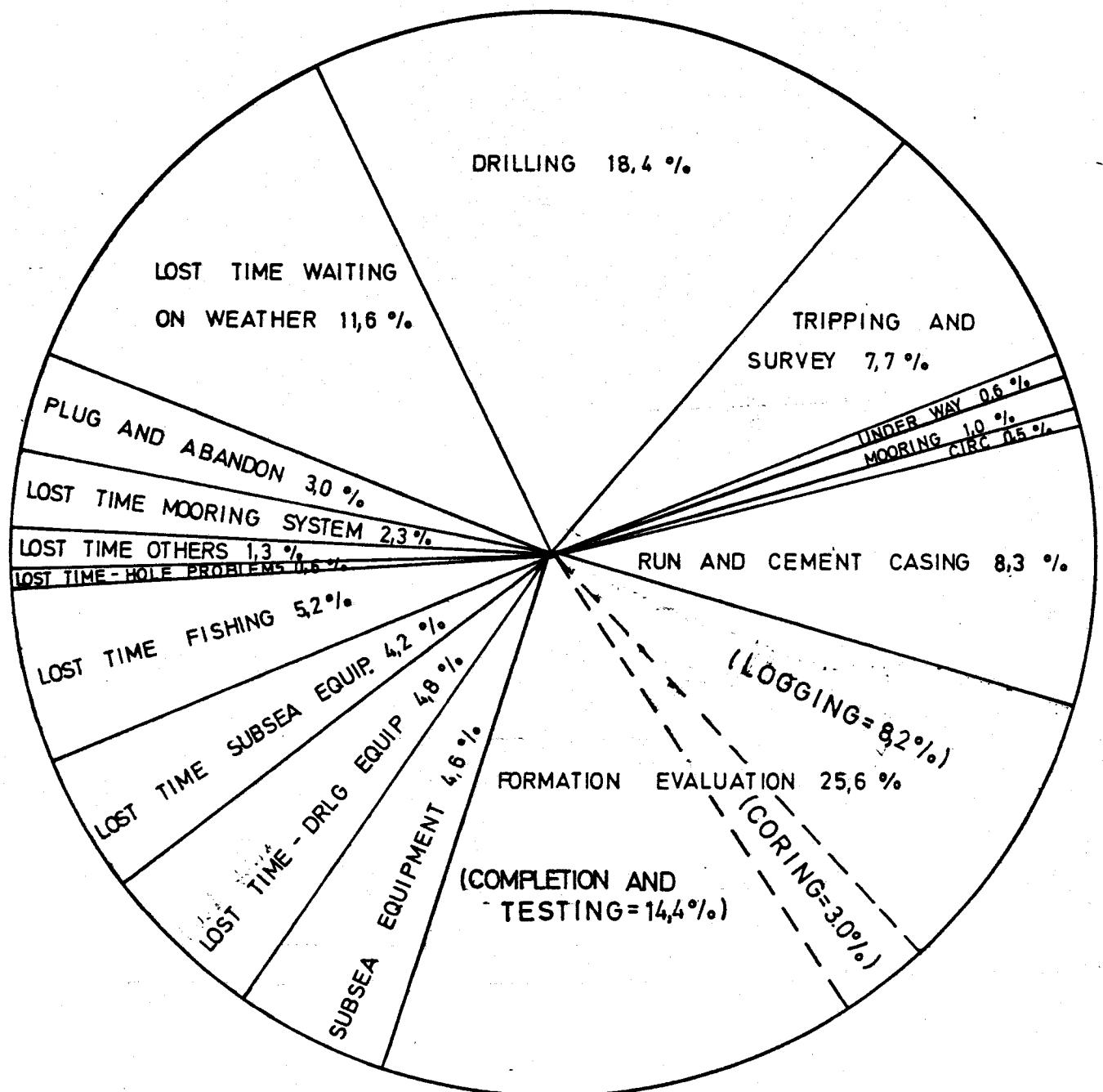


Heading : 310 °

Well coordinates : 58° 35' 04,37" N
01° 39' 08,35" E

Water depth (MSL) : 119,4 m

Norsk Hydro Drilling Depth	Mooring line pattern Treasure Seeker Well 15/5 - 1	Gr. no.	Fig. A1
		Date: 25/4 - 78 Sign: TSk / Hes	Dwg. no:



TOTAL TIME : 3471 HOURS

144,6 DAYS

NORSK HYDRO DRILLING DEPT	TOTAL TIME DISTRIBUTION WELL 15/5-1	GR. NO.	FIG
		DATE: 27/4-1978 SIGN: Tsk / Hes	A2 DWG. NO.

Water depth : 144 m.

- 49 -

- 30" csg shoe at 194 m
Perforate at 200 m

20 "csg shoe at 705 m
Perforate at 710 m

13 3/8 "csg shoe at 2722 m

7" liner hang off at 3284 m

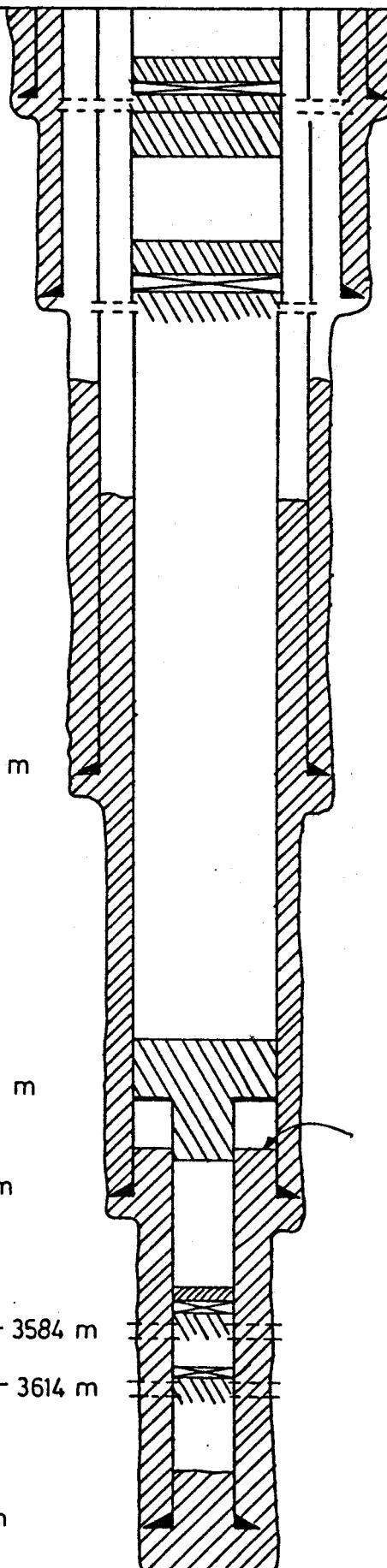
9 5/8 "csg shoe at 3497 m

Perforate test no.2: 3561-3584 m

Perforate test no.1: 3610-3614 m

7" liner shoe at 3766 m

TD at 3775 m



Top of cmt plug at 160 m
Packer set at 190 m
Cement plug 210 - 270 m

Top of cmt plug at 670 m.
Packer set at 700 m

Top of cement at approx 900 m

Top of cement at approx 1700 m.

Top of cement plug at 3230 m

Top of cement at approx 3320 m

Packer set at 3530 m

Packer set at 3596 m

Top at 7" collar at 3741 m

Norsk Hydro Drilling Dept	Abandonment of well 15 / 5 - 1 (proposed)	Gr. no	Fig. A3
		Date. 31/3-1978 Sign. TSK Hes	Dwg no

Water depth : 144 m.

- 50 -

Perforate at 188 m
30" csg shoe at 194 m
Perforate at 200 m

20 "csg shoe at 705 m
Perforate at 710 m

13 3/8 "csg shoe at 2722 m

7" liner hang off at 3284 m

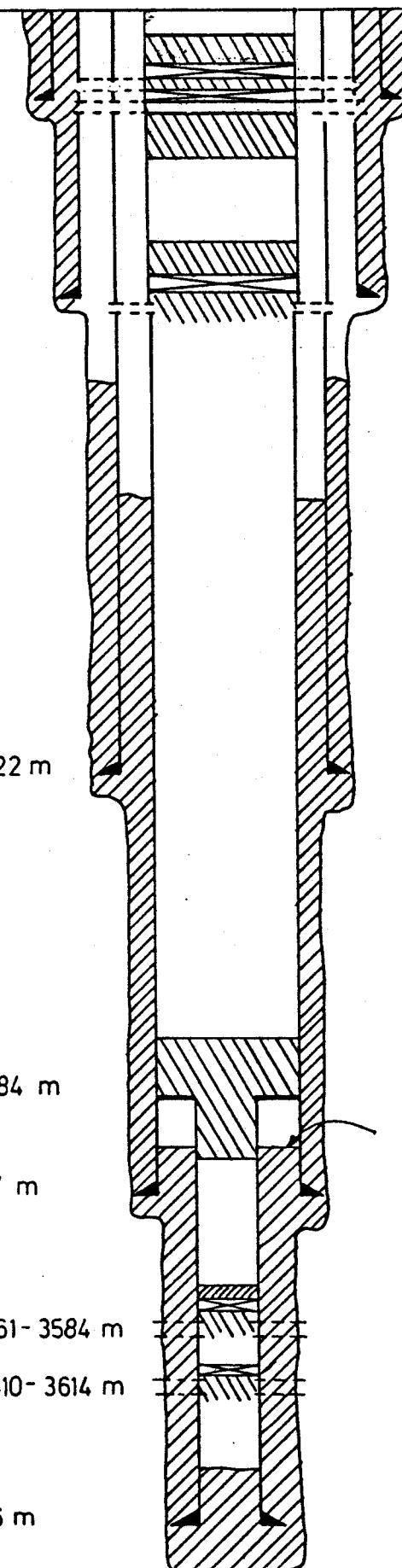
9 5/8 "csg shoe at 3497 m

Perforate test no. 2: 3561- 3584 m

Perforate test no. 1: 3610- 3614 m

7" liner shoe at 3766 m

TD at 3775 m



Top of cmt plug at 153 m
Packer set at 183 m
Packer set at 190 m
Cement plug 210 - 270 m
Top of cmt plug at 671,5 m
Packer set at 701,5 m

Top of cement at approx 900 m

Top of cement at approx 1700 m.

Top of cement plug at 3230 m

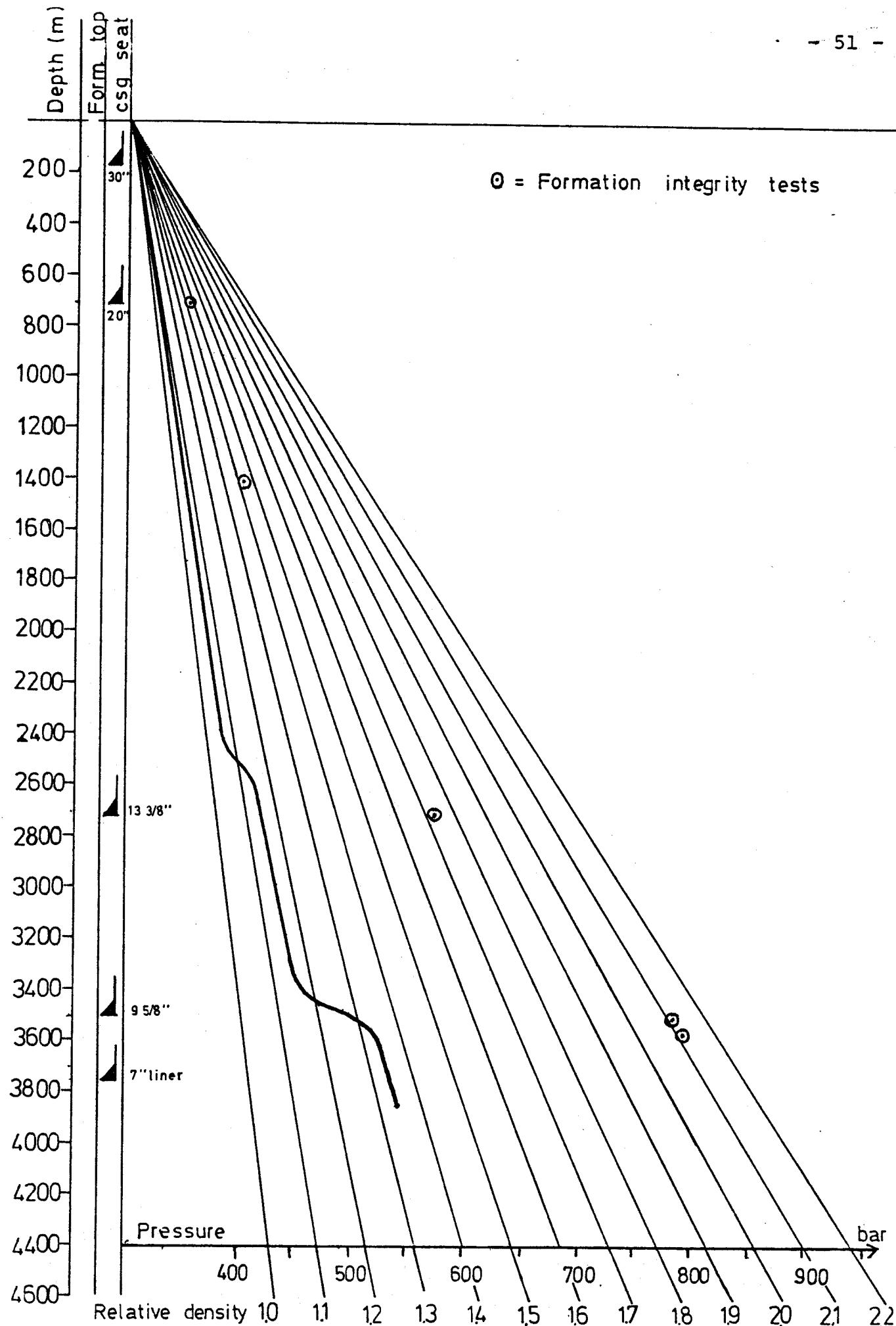
Top of cement at approx 3320 m

Packer set at 3535 m

Packer set at 3596 m

Top at 7" collar at 3741 m

Norsk Hydro Drilling Dept	Abandonment of well 15 / 5 - 1 as it was performed	Gr. no	Fig. A4
		Date: 31 / 3 - 1978	Dwg. no
		Sig: TSK / Hes	



Norsk Hydro Drilling Dept	Pore pressure and formation integrity test results on well 15/5-1	Gr no	Fig
		Date : 8/5 1978 Sign : TSK / Hes	Dwg. no.

OCEANEERING NORWAY A/S

ENCLOSURE A.1

DIVE INSPECTION REPORT

Nr 000152

Date: March 1st, 1978 Time: 1005 Client: Norsk Hydro

Depth: 400 ft

Vessel: Treasure Seeker

Divers: C. Pesticcio
M. Corsi

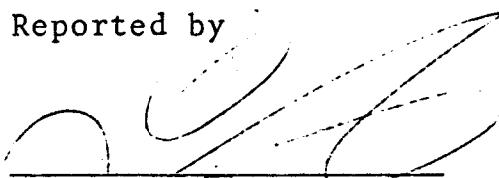
Location 15-5-1
Equipment: Bell, Rat Hat,
Hotwater suit

Purpose of Dive: Clear Broken No. 3 Guidewire from B.O.P. Stack

Remarks: Diver locked out from bell and proceeded to top of B.O.P. Stack to cut broken No. 3 guidewire from top of post. When wire was cut the diver contuned to remove loops of wire from around no. 3 guidepost, stck and rams.

When job was completed the diver returned to the bell and ascent/decompression commenced.

Reported by


Les Nielsen

OCEANEERING NORWAY A/S

ENCLOSURE A.1

DIVE INSPECTION REPORT

Nr. 000156

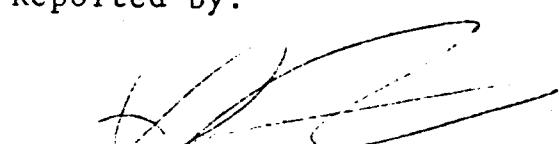
Date: 07.04.78 Time: 0125 & 1934 Client: Norsk Hydro A/S
Depth: 400 ft Vessel: Treasure Seeker
Divers: T. Bennett Location: 15/5-1
 B. Newport Equipment: Bell, Rat hats, Hotwater Suits

Purpose of Dive: Clear seabed of Debris observed on previous dive.
Search for and recover any other debris which may be found.

Remarks:

Diver locked out and proceeded to sling off the debris. Readied for lifting on a previous dive. A further search was carried out in the immediate vicinity of the wellhead - no more debris was observed. Divers returned to D.D.C. storage. A second dive was conducted on a location some 60 ft from the first. Some debris was found and recovered. A further search was carried out at a third location, no debris was observed there. Visibility poor.

Reported by:


Les Nielsen

ENCLOSURE A.2

Debris lost on sea bottom

From Well 15/5-1 the following items were reported lost on sea bottom and were not found before the rig mooved to new location.

1. One 3 m long steelladder with back cage (approx. 0.5x0.5x3m)
2. Two footmarkers (approx. 60 ft long)
3. 2 ea 20 ft rubberhose, ID = 4"
4. 26" bit breaker
5. Three empty oxygen bottles
6. Two empty acetylene bottles
7. 25 ft. of loading hose including end coupling.

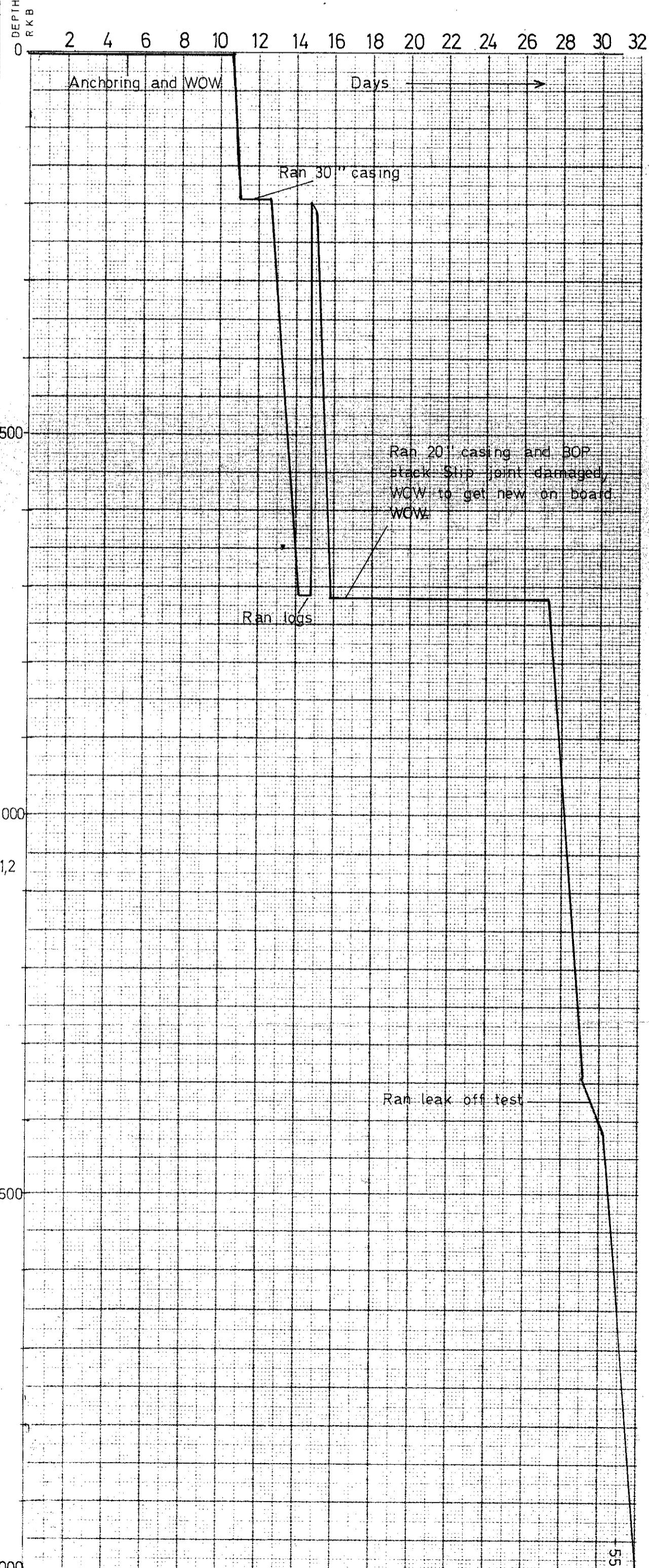
DRILLING PROGRESS, WELL 15/5-1

Operator: Norsk Hydro
 Coordinates: 58° 35' 04,37" N
 01° 39' 08,35" E

Spud in: November 26, 1977
 Well compl: April 8, 1978
 Rig: Treasure Seeker

Water depth: 119 m
 RKB to MSL: 25 m
 RKB to SeaBed: 144 m

DEPTHS m KB	LITHO SECTION	FORMATION	STAGES	SHOWS	DESCRIPTIONS, OBS	MUD MATERIALS	MUD WT. SP GR
-50					25 m SEA LEVEL		
-100							
-150					144 m SEA BOTTOM		
-200					Drilled with no returns.	1.0	1.1
-250					205		
-300					Cly, m - dk gy, sft - firm, slty, sl sticky w/intbd to 292 minor Sd, clr Qtz, vf - crs, occ 312 v crs, ang - subrnd, w/ abn lithic frags.		
-350					Tr shell frags and occ Lign beds		
-400					450		
-450							
-500							
-550							
-600							
-650							
-700					tr Pyr		
-750					20" 705m		
-800					720		
-850					276		
-900					Sd, clr, vf - f, ang - subang, mic w/thin layers of Cly. Tr shell frags, Glau.		
-950					C1		
-1000					372		
-1050					Cly, dk grn gy, sft - firm, sity, sl calc - calc Thin strg Lst, dk gy, hd, micro xln, sity, occ dol.		
-1100					C1		
-1150					Cly, dk brn - olive blk, sft - firm, occ inc indur, grdg Clyst, sity, sl calc, 1145 micro - mic.		
-1200					Thin beds of Sd, clr, vf, ang - subang, glau. Occ abn shell frags.		
-1250					C1		
-1300					Clyst, dk grn gy - olive blk, occ dk brn, firm, blky, occ subfrss, sl calc, sity, micro - mic, occ sl glau.		
-1350					Thin strgs of Lst, dk brn, crn, firm hd, occ v hd, micro xln, occ dol.		
-1400					C1		
-1450					Clyst a.a. inc indur bcn Sh.		
-1500					C1		
-1550					1555		
-1600					Clyst a.a. inc indur bcn Sh.		
-1650					C1		
-1700					1706		
-1750					Sd, clr, vf - m, ang - subang, occ arg mtx, no shows. intbd w/Sh, dk grn, minor dk brn, firm, blky, n. calc, occ glau. Tr Pyr.		
-1800					Thin strgs Lst, yel - crn, micro xln, hd, dol.		
-1850					1907		
-1900					Strgs of Sd/Sst, cir, wh - gy, vf - t, occ m, subang, tr. calc cmt.		
-1950							
-2000							

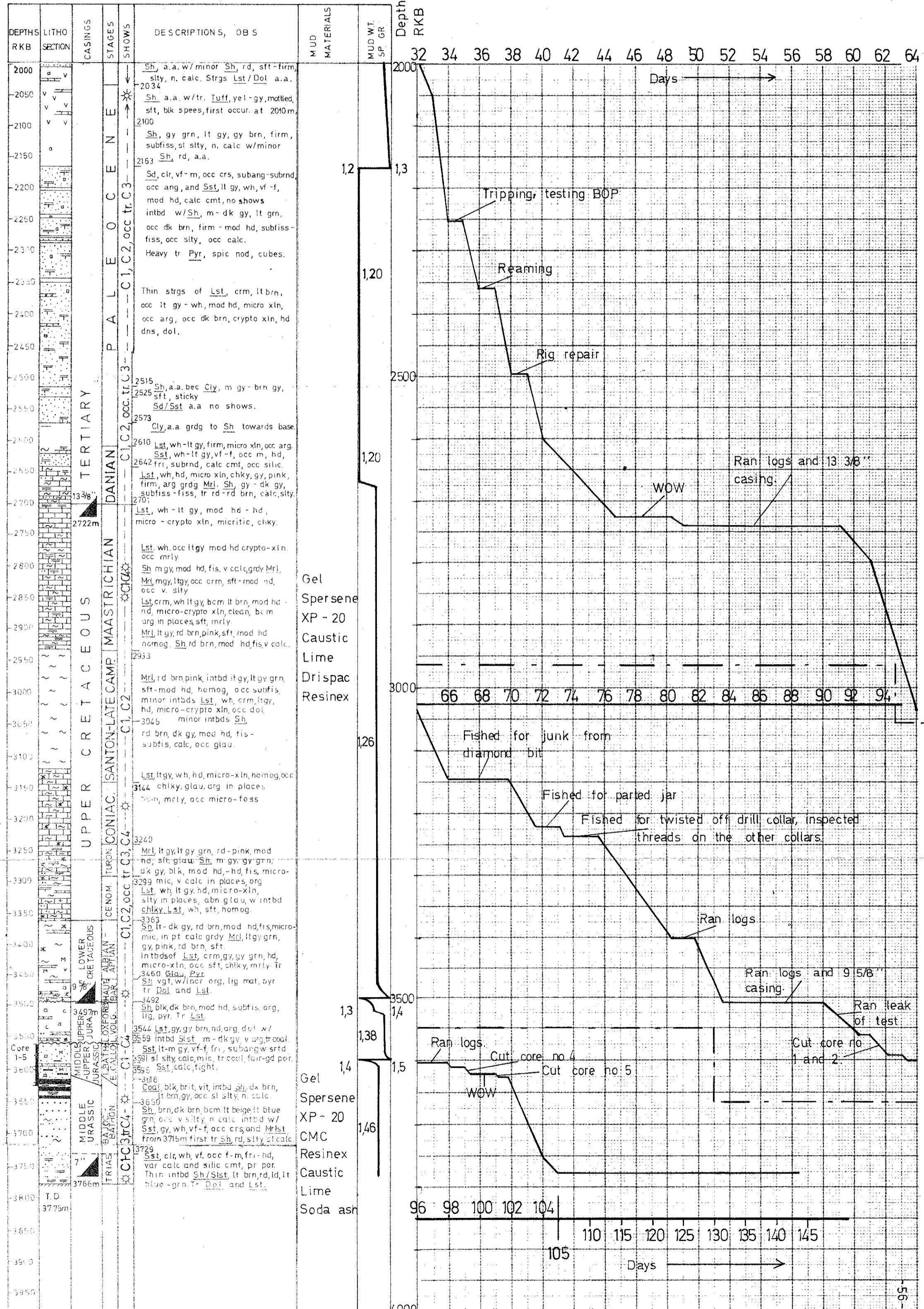


DRILLING PROGRESS, WELL 15/5-1

Operator: Norsk Hydro
 Coordinates: 58° 35' 04", 37" N
 01° 39' 08", 35" E

Spud in: November 26, 1977
 Well compl: April 8, 1978
 Rig: Treasure Seeker

Water depth: 119 m
 RKB to MSL: 25 m
 RKB to SeaBed: 144 m



SECTION B

GEOLOGY

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1. OBJECTIVES

The main objective of the well was to test sandstone reservoirs of Middle Jurassic age. In the nearby Sleipner field (in block 15/6 and 15/9) gas had been found previously in reservoirs of the same age. The well was located downflank on the structure at the Kimmerian level. This position was chosen to penetrate reservoirs believed to be wedging both above and below a strong seismic marker ("Red Marker").

2. RESULTS

The 15/5-1 well encountered gas condensate-bearing sandstones of Upper and Middle Jurassic age (Callovian and Bathonian). The expanded reservoir sequence which was hoped for was not found. The strong seismic marker ("Red Marker") is based on the results from the well, correlated to the top of the deltaic coaly sequence of Middle Jurassic age.

The top of the Callovian/Bathonian sandstones was encountered at 3558 m^x (KB) and continued down to 3614 m (KB) where a Bathonian/Bajocian deltaic series appeared. From wireline log evaluation the sandstone section with a gross thickness of 56 m, has been subdivided into four separate pay zones, each zone being separated by thin impermeable layers, resulting in a net sand pay of 42,1 m. Average porosity has been calculated to 14% and the average water-saturation to 14%.

RFTs were run and DSTs through casing were performed to evaluate the reservoirs. DST 2 (3561-3584 m) yielded a maximum flow rate for the well of $622.9 \cdot 10^3 \text{ Nm}^3/\text{d}$ gas and $474 \text{ STm}^3/\text{d}$ oil (43.4° API).

No hydrocarbon-water contact was identified in the well,

x) (The CPI log is used for depth ref. KB elevation: 25 m)

although sands were water wet below the coal beds at 3650 m.

The well was stopped at a total depth of 3775 m (KB) in a formation of Triassic age.

3. STRATIGRAPHY

A biostratigraphic evaluation of the well 15/5-1 has been performed by the laboratories of Robertson Research International Ltd, covering the interval 290-3775 m (KB).

The basic material for the analyses is ditch cutting samples, but also chips from conventional cores and side-wall core samples have been studied.

Well site micropalaeontology was carried out by the same laboratory during the drilling of the section from 2720 m to 3500 m, covering most of Cretaceous and the very top of the Upper Jurassic. The stratigraphic information hereby gained is considered to give important data for the operator during the drilling and the continuous planning of the well.

The final stratigraphic breakdown of the well has been obtained by comparing and adjusting the results of the biostratigraphy with wireline log correlations.

The stratigraphy of the well is shown on page 3 and 4. Included in this table is also a lithostratigraphic breakdown. The lithostratigraphic terminology applied is taken from Deegan and Scull: "A standard lithostratigraphic nomenclature for the Central and Northern North Sea" 1977.

DEPTH REF.: K.B.

ELEVATION K.B.: 25m

ALL DEPTH IN METERS (m)

CRONOSTRATIGRAPHY				LITHOSTRATIGRAPHY	
SYSTEM	SERIES / STAGE	DEPTH	THICKNESS	GROUP	FORMATION / MEMBER
QUATERNARY	RECENT- PLEISTOCENE	144	306	NORDLAND GROUP	144
	PLIOCENE	450	270		777
	MIocene	720	425		UTSIRA FM
	OLIGOCENE	1145	410	HORDALAND GROUP	1090
	EOCENE	1555	479		1706
	PALEOCENE	2034	576.5		FRIGG FM
	DANIAN	2610.5	90.5	ROGALAND GROUP	2057
	MAASTRICHTIAN	2701	232		BALDER FM
	LATE CAMPAN.	2933	72		SELE FM
CRETACEOUS	EARLY CAMP- SANTONIAN	3005	139	CHALK GROUP	2106
	CONIACIAN	3144	96		MAUREEN FM
	TURONIAN	3240	59		2164
	CENOMANIAN	3299	64		2573
		3363			LISTA FM
					2610.5
					MAUREEN FM
					2644
					EKOFISK FM
					2701
					TOR FM
					2904
					FLOUNDER / HOD FM
					3170
					HERRING FM
					3240
					PLENUS MRL FM
					3299
					HIDRA FM
					3363



DEPTH REF.: K.B.

ELEVATION K.B.: 25m

ALL DEPTH IN METERS (m)

CRONOSTRATIGRAPHY				LITHOSTRATIGRAPHY	
SYSTEM	SERIES / STAGE	DEPTH	THICKNESS	GROUP	FORMATION / MEMBER
CRE TACEOUS	LOWER	ALBIAN-APTIAN	3363	3363	3363 RØDBY FM
		BARREMIAN-LATE HAUTERIV.	3460	97	3431
JURASSIC	MIDDLE / UPPER	LATE VOLGIAN	3492	3492	VALL HALL FM
		MIDDLE VOLGIAN	3503	11	
		MIDDLE VOLGIAN-LATE OXFORDIAN	3535	32	HUMBER GROUP
		EARLY CALLOVIAN-LATE BATHONIAN	3558.5	23.5	KIMMERIDGE CLAY FM.
		BATHONIAN-BAJOCIAN	3610-3625	51.5 BOUNDARY UNIDENTIFIED	3558.5 3558.5
			3729	104	BRENT FM
TRIASSIC	UPPER?		3775 (T.D.)	46	3729 3775 3775

4. LITHOSTRATIGRAPHY

This summary is compiled predominantly from ditch cuttings descriptions. Wire line logs are used as assistance in the lithological interpretation and to place boundaries of rock formation.

Supplementary side wall core samples are available from Lower Tertiary, Cretaceous, Jurassic and Triassic.

I. QUATERNARY

Pleistocene (194 - 450 m)

The interval is comprised dominantly of clay, medium to dark grey, soft, moderately calcareous and frequently silty and sandy. Traces of shell fragments and pyrite occur throughout the section. Prominent sand beds are found between 212 and 226 m, and from 292 to 311 m. These sands are very fine to coarse, occasionally very coarse, angular to subrounded, with traces of shell fragments and glauconite. Beds of lignite occur within the sands at 297 and 305 m.

From the sea-bed and down to 1205 m, the beds are included in the Nordland Group.

II. TERTIARY

Pliocene (450 - 720 m)

The grey, in places medium to dark yellow brown, silty clays of the overlying Pleistocene, continue uninterrupted throughout the Pliocene.

Miocene (720 - 1145 m)

720 - 777 m

Clays similar to those of the overlying Pliocene continue down into this interval becoming slightly more micaceous.

777 - 971 m.

A sand body marking the top of the Utsira Formation is described over this interval. These sands are very fine to medium grained, angular and subrounded, poor to moderate sorted, and contain a number of clay interbeds, described as dark green grey, soft, silty and slightly calcareous. Traces of glauconite, pyrite, micas and shell fragments are recorded over the entire interval.

971 - 1145

A sharp break from the overlying sands is clearly evidenced at 971 m. Below this depth extends an interval of generally homogeneous clays, described as dark grey green to olive black, soft becoming firm, silty with minor sandy intervals, occasionally micro-micaceous and slightly calcareous.

Traces of glauconite and shell fragments are recorded, as are occasional stringers of dolomitic limestone, dark grey, hard, micro-crystalline and argillaceous.

Throughout the interval the clay becomes increasingly indurated grading downwards toward a dark brown to olive black claystone, representing the transition from the Utsira Formation (base at 1090 m) of the Nordland Group to the Hordaland Group.

Oligocene (1145-1555 m)

With the exception of sand beds between 1206 and 1214 m, and from 1290 to 1297 m, the lithology described in the overlying section continues throughout this interval. Below 1420 m the claystone becomes more indurated, appearing slightly fissile and shale-like.

The base of the Nordland Group is placed at 1205 m and the underlying Hordaland Group continues through the Tertiary section to 2057 m.

Eocene (1555 - 2034 m)

1555 - 1706 m

Claystones like those of the Oligocene continue down into this interval and remain as previously described. Between 1635 and 1680 m however, an increase in thin interbedded micro-crystalline and occasional dolomitic limestones occur.

1706 - 2015 m

A marked increase in sand characterizes this interval and distinguishes it as the Frigg Formation. The sand is interbedded with shales in more or less equal proportions above 1908 m. Below this depth, the sand becomes far less significant.

The sands consist of clear, fine to medium, occasional coarse quartz grains, angular or subrounded, generally loose, but also especially in the lower part, cemented with calcareous cement becoming sandstones.

The shales are dark green and dark brown grey, blocky and subfissile, occasionally silty and non calcareous. Occasional stringers of white, micro-crystalline dolomitic limestones are recorded and traces of glauconite and pyrite occur throughout the section.

2015 - 2034 m

Below 2015 m traces of tuff, yellow to bluish grey, soft and mottled appear in a sequence of grey green, grey brown or light green, subfissile, slightly silty and non calcareous shales.

Minor interbeds of red shale, firm, subfissile, silty and non calcareous are also recorded. Thin stringers of limestone, similar to those in the overlying section, occur in the upper part of this interval.

Paleocene (2034 - 2701 m)

2034 - 2164 m

The shales described in the lowermost interval of Eocene continue down into the underlying stage, where the tuff disappear in the basal part of this interval. This argillaceous interval down to 2164 m includes the Balder (upper boundary at 2057 m) and the Sele Formations within the Rogaland Group.

2164 - 2573 m

This interval is dominated by thick units of clear, light grey to white, very fine to medium grained, poorly to moderate sorted, calcareous cemented sandstones. In places the sandstones become argillaceous and contain traces of mica, glauconite and pyrite. The sandstone units are interbedded with light to dark grey, green grey and dark brown to dark grey brown, slightly calcareous shales and limestones, micro-crystalline, argillaceous and often dolomitic.

This sand and shale/limestone unit is considered to represent the Heimdal Formation within the Montrose Group.

2573 - 2610.5 m

Underlying the sandstone units is a light grey, grey brown, soft and occasional sandy clay. Towards the base of the interval the clay becomes indurated and shaly.

This interval represents the Lista Formation within the Rogaland Group.

Danian (2610.5 - 2701 m)

2610.5 - 2644 m

The dominant lithology is a white to light grey, very fine, occasional medium, calcareous cemented sandstone with traces of glauconite and pyrite. Thin interbeds of shale are also recorded, and at the top of the interval micro-crystalline and argillaceous limestone and marl are found.

This interval is interpreted to represent the Maureen Formation, the lowermost formation within the Rogaland Group.

2644 - 2701 m

Below the Maureen Formation the lithology becomes notably more calcareous. The top of this interval coincides with the top of the Chalk Group, which dominates the Cretaceous litho-stratigraphy.

The interval down to 2701 m consists of limestones, white, hard and chalky and light to medium grey, occasional pink, soft and argillaceous grading to marls. Occasional interbeds of dark grey, green, fissile, calcareous shale are found as well as stringers of very fine, occasional medium, calcareous cemented sandstones. Towards the base of the interval the formation becomes notably more pink, light grey green and argillaceous.

This interval is considered to represent the Ekofisk Formation.

III CRETACEOUS

Upper Cretaceous (2701 - 3363 m)

Maastrichtian (2701 - 2933 m)

This stage comprises the Tor and the uppermost 29 m of the Flounder/Hod Formations. It consists of limestone, cream, white, light grey, generally clean and chalky, in places argillaceous becoming marly. Minor thin interbeds of medium to dark grey, fissile, very calcareous shale occur over the interval.

In the lowermost 29 m of this interval the formation changes to a red brown, pink coloured marl with interbeds of an argillaceous limestone and minor shales. The limestone is white, cream, light grey, crypto to micro-crystalline and slightly dolomitic. The shales are predominantly red brown, dark grey, waxy and calcareous, but occasional black, non calcareous and carbonaceous shales occur.

Late Campanian (2933 - 3005m)

No marked change in the lithology is found on entering this stage. The marl becomes, however, more light grey green downwards into the interval where the limestone and the shaly interbeds get less significant.

This interval encompasses the Flounder/Hod Formation.

Early Campanian - Santonian (3005 - 3144 m)

Essentially a continuation of the overlying Late Campanian marls, with noteworthy limestone interbeds between 3053 and 3079 m. Below 3122 m a prominent lithological break is evidenced by the occurrence of cleaner limestones described as white, light grey and light grey green, hard, crypto to micro-crystalline, occasionally chalky and glauconitic, and often argillaceous grading to marl.

This interval is considered to represent a continuation of the Flounder/Hod Formation.

Coniacian (3144 - 3240 m)

The overlying often marly limestone continues down into this stage. Below 3170 m the limestone becomes increasingly pure and chalky with glauconite, notably in the lowermost 10 m.

This interval is believed to represent the lower part of the Flounder/Hod Formation and the Herring Formation.

Turonian (3240 - 3299m)

This interval is easily distinguishable from the overlying limestones by the marked increase in argillaceous material. Alternating marls and shales dominate the less significant interbedded limestones. The marls are light to medium grey, occasionally red, glauconitic and occasional silty. The shales are medium to dark grey, slightly micaceous, pyritic and moderate calcareous. In the lower part also black, soft, micaceous, non calcareous and carbonaceous shale was encountered. The interbedded limestones are, except for in places being silty and sandy, similar to those of the overlying interval.

From the appearance of this interval it is considered to represent the Plenus Marl Formation.

Cenomanian (3299 - 3363 m)

Coinciding with the Hidra Formation, this interval is divided into an uppermost marly section (3299 - 3321 m) and an underlying limestone which persists throughout the interval. The lithologies of each are generally similar to those already described in the Chalk Group.

LOWER CRETACEOUS (3363 - 3492 m)

The Lower Cretaceous comprises the Cromer Knoll Group, which is devided into the Rødby Formation overlying the Valhall Formation.

Albian - Aptian (3363 - 3460 m)

3363 - 3431 m

This interval describes the Rødby Formation and consists mainly of marls interbedded with limestones. The marls are pink, red brown, light grey and soft. In places they grade to shale which is light to dark grey, grey green, red brown, moderately hard, fissile, micro-micaceous and occasional silty and sandy. The interbedded limestones are described as cream, white and light grey, hard micro-crystalline and in places argillaceous becoming marly. Traces of a light green tuff with white and dark specks are recorded in the lower part of the interval, while traces of pyrite and glauconite occur throughout.

3431 - 3460 m

The top of this interval is noted by the occurrence of a more shaley lithology. The shale is light grey green, dark grey to grey black and red brown, micaceous, pyritic, slightly to non calcareous and occasional carbonaceous. Minor stringers of a white, light grey and medium brown, crypto to micro-crystalline, occasional dolomitic limestone are interbedded with the shale and traces of anhydrite, green, hard and dense are reported.

This interval represents the upper part of the Valhall Formation.

Barremian - Late Hauterivian (3460 - 3492 m)

The shaly lithology of the overlying interval continues into this section, but a considerable increase in the calcareous interbeds occurs. Towards the base the shales also more often appear dark coloured and carbonaceous with traces of lignite and pyrite.

This interval represent the lower part of the Vallhall Formation.

IV JURASSIC

UPPER JURASSIC (3492 - 3558.5m)

Late to Middle Volgian (3492 - 3535m)

The top of the Jurassic is distinguished by the appearance of conspicuous dark brown or black shales, which are highly organic, carbonaceous and slightly silty. Occasional stringers of dolomitic limestone are observed together with traces of pyrite.

This lithology is characteristic of the Kimmeridge Clay Formation, which is a subdivision of the Humber Group.

Middle Volgian to Late Oxfordian (3535 - 3558.5m)

The upper 10 m of this unit are a continuation of the overlying interval. Below 3543 m, however, the black shales are interbedded with increasingly significant beds of siltstone, very fine sandstone, and dolomitic limestones with traces throughout of coal and pyrite.

This interval is considered to be part of the Kimmeridge Clay Formation.

UPPER - MIDDLE JURASSIC/MIDDLE JURASSIC (3558.5-3729 m)

This entire section is described as the Brent Formation.

Early Callovian - Late Bathonian (3558.5 - 3616 m)

This interval comprises moderately consistent sandstones split into an upper and lower part by a conspicuous calcareous sandstone between 3591 and 3594.5 m. Above this the sandstone is light to medium grey, fine grained, well sorted, friable to moderately hard and in places calcareous. Varying amounts of mica, dispersed and laminated, and occasional thin laminae of coal, characterize the sandstone, which also contains traces of pyrite.

Fair to good porosity was encountered and good hydrocarbon shows were reported.

The intermediate, calcareous sandstone which grades to a sandy limestone, is tight with poor porosity and yielded poor hydrocarbon shows.

Below this tight section the lithology becomes more fine grained and argillaceous. The sandstone grades to siltstone containing frequent dispersed and laminated coal and mica, but also shows some medium to coarse grained bands. The porosity varies from fair to poor with good hydrocarbon shows in abundance to patchy quantities.

The base of this interval is clearly evidenced by the passage into the underlying coal measures.

Bathonian - Bajocian (3616 - 3729 m)

3616 - 3650 m

This is a conspicuous interval comprising multiple black, hard, vitreous coal seams with scattered lenses of pyrite, interbedded with light to dark brown occasional grey shale which often becomes silty grading to siltstone.

3650 - 3729 m

Generally this interval is an interbedded sequence of shales, sandstones and siltstones. The shales vary from light to dark brown, some light blue green and red, and are micaceous, non to slightly calcareous and silty. The sandstone is clear and white and mainly very fine to fine grained, although locally medium to coarse grains occur. Calcareous cement is common. In places also siliceous cement is recorded as is abundant white kaolin.

The siltstone is white to light grey, calcareous and grades to silty marlstone. Traces of limestone, pyrite and coal are also reported.

The sandstone porosity is generally poor in this interval, ranging occasional to fair. Fair hydrocarbon shows are reported in some sandstone stringers at the top of the interval.

V TRIASSIC

Upper Triassic (3729 - 3775 m T.D.)

Changes in lithology and log character delimit this interval. The section consists of sandstones similar to those of the overlying interval, interbedded with light brown, red and occasional light blue green shales. The shales are non to slightly calcareous and very silty grading to siltstone. Traces of white, micro-crystalline, silty or sandy and occasional dolomitic limestones are also recorded.

5.

HYDROCARBON SHOWS

Evaluation of hydrocarbon shows at the well site was carried out in a conventional manner.

Below 206 m, a complete hydrocarbon total gas detector (50 units = 1 %) and a gas chromatograph for automatic and continuous gas analysis, recorded as ppm by volume of C1 through C5, were operational.

Hydrocarbon shows on ditch cuttings were evaluated according to Norsk Hydro geologist's well site manual.

5.1

GAS RECORD

206 - 1320 m

With the exception of the interval 220 - 230 m, continuous

ditch gas recordings never exceed 1%, of which methane (C_1) is the only recorded component. Between 220 and 230 m the total gas peaks at just below 2% with a maximum methane recording of just over 10.000 ppm. Below this, the total gas curve exhibits a generally smooth and well rounded character of between 0.5 and 1% and the C_1 averages around 6.000 ppm.

In general, higher recordings correlate with sands or lignitic intervals.

1320 - 2040 m

The overlying interval has generally higher readings than this section, the continuous total gas readings tailing off to below 0.4%. No other gas components than methane (C_1) occur, and this average approximately 1.000 ppm.

2040 - 2276 m

The interval is delineated by the appearance in the chromatograph analysis of ethane (C_2) and traces of propane (C_3). Despite the appearance of these components however, continuous ditch gas readings remain low with only slight increase to an average between 0.06 and 0.5%. Only traces of cuttings gas are recorded.

2276 - 3483 m

With the exception of the two intervals 2800 - 2840 m and 3180 - 3187 m, this section is characterized by consistently low gas readings. Continuous ditch gas recordings never exceed 0.01% and virtually no cuttings gas is reported.

Methane (C_1) and ethane (C_2) are recorded throughout

(C₁ average approximately 200 ppm and C₂ approximately 40 ppm), and trace quantities of propane (C₃) are occasionally reported.

Between 2800 and 2840 m a zone is delineated by the appearance in chromatograph analyses of gas components methane through butane i.e. C₁, C₂, C₃ and C₄. A distinct peak at 2806 m reaches 1% total gas and comprises C₁, C₂, C₃ and both iso-butane (iC₄) and normal-butane (nC₄).

Between 3180 and 3187 m a gas peak coinciding with oil shows is recorded. The total gas peak reaches 0.03% and components C₁, C₂, C₃, iC₄ and nC₄ are reported, maximum values reaching 1000 ppm, 250 ppm, 200 ppm, 100 ppm and 10 ppm respectively.

Below 3363 m a small but distinct increase in the gas occurs, coinciding with the penetration of the Lower Cretaceous.

3483 - 3556 m

Below 3483 m a conspicuous gas increase is noted. The underlying interval is characterised by a variable ditch gas profile, which ranges between 0.2 and 1.5%. A corresponding increase in all chromatograph recordings is observed with maximum values reaching 6.000 ppm, 800 ppm, 600 ppm, 230 ppm and 70 ppm for C₁, C₂, C₃, nC₄ and iC₄ respectively. Of note is the sharp increase in cuttings gas, which exceeds 2% at maximum.

The gas increase correlates with the presence of the Kimmerian unconformity at 3492 m, below which the organic rich Kimmeridge Clay Formation occurs, which is commonly understood to be the principle source rock for the Jurassic reservoir sands of the North Sea. Some leakage across the unconformity can be expected, explaining the gas

increase in the limestones immediately above.

3556 - 3651 m

Gas recordings throughout this interval are incomplete and unrepresentatively low due to this section being cored. However, the prominent gas peak at 3556 m, correlates well with the change in the lithology from shales to sandstones with hydrocarbon shows. The ditch gas at this point records a total gas in excess of 2% and maximum C₁ exceeds 15.000 ppm. C₂ peaks at 2.000 ppm with C₃, nC₄ and iC₄ recording 800, 100 and 40 ppm respectively.

Apart from peaks at 3578 and 3605 m the gas profile in the sandstones is generally uniform. Below 3616 m, however, the gas becomes far more erratic in response to the penetration of the coal measures.

Gas ratios in the sandstones remain stable around 5, while below in the coal measures they increase to 8 or 9.

3651 - 3775 m

The base of the overlying interval is distinctly evidenced by a sudden sharp drop in gas recordings. The continuous ditch gas recording exhibits a more subdued character with most values below 0.2%. Between 3700 and 3736 m the gas increase slightly and the profile becomes slightly more ragged, with occasional peaks reaching 1%. C₁, C₂ and C₃ are recorded throughout the interval with iC₄ and nC₄ intermittently.

5.2

OIL STAINS AND FLUORESCENCE

2804 - 2904 m

The first signs of hydrocarbon shows on drill cuttings

occur within the Maastrichtian limestones and marls of the Upper Cretaceous Tor Formation. A dull to bright yellow fluorescence is recorded, having a white, slow streaming cut. This correlates well with a gas show and the first appearance of the heavier gases: iso-butane and normal-butane.

3180 - 3190 m

This interval occurs in the upper levels of the Herring Formation. These are Coniacian limestones which are relatively pure and hard. The fluorescence encountered is described as pale yellow to yellow white, with weak yellow white to pale blue, slow streaming, crush cut. A gas peak coinciding with this interval was recorded.

3363 - 3373 m

This interval directly underlies the top of the Lower Cretaceous. Within a series of marls a number of interbedded limestones display bright yellow fluorescence with none or a slow streaming crush cut.

While drilling this interval and down to approximately 3465 m, significant quantities of an apparently residual oil were observed in the drilling fluid at the shale shaker. From geochemical analysis of this material it has been suggested that the distributions found either represent a mixture of a heavy dead residual oil and a heavy gas condensate, or else the heavy oil and condensate are the product of a source rock in the earliest stage of maturity.

3492 - 3544 m

The Upper Jurassic Kimmeridge Clay Formation, which this interval describes, exhibited a dull yellow fluorescence with no cut.

3558.5-3591 m

These Jurassic sands, directly underlying the Kimmeridge shales, proved gas and oil condensate during drill-stem tests. From ditch cuttings and cores, abundant faint blue and white fluorescence was described together with a good streaming bluish white cut. Traces of bleeding oil was occasional seen on the cores. Correlation with the gas recordings previously described for this and the following interval, was excellent.

3594.5 - 3616 m

A continuation of the above section with similar good hydrocarbon shows. Abundant patchy bluish white to dull yellow, golden fluorescence, with a slow to moderately fast streaming blue white cut was recorded.

3650 - 3657 m

Sandstone stringers directly underlying the coal measures, showed a dull white to light yellow fluorescence with a slow to moderate fast, streaming white cut.

3725 - 3740 m

In this interval which describes the base of Middle Jurassic and the top of the Triassic, up to 5% of the sandstone ditch cuttings displayed a dull golden fluorescence with traces of a slow streaming white cut, improving when crushed. The possibility of these shows being reported on cavings is not dismissed, but in view of the gas peaks reported over this interval, they are considered most likely to be in situ.

6. CORING

6.1 CONVENTIONAL CORES

A total of 5 cores were cut in the Callovian-Bathonian sandstone reservoir sequence. Coring started at 3561 m, 3 m below the top of the pay zone, and continued with the exception of a 8.3 m interval drilled with a conventional bit between core 3 and 4 down to 3625.5 m into the underlying coal measures.

The recoveries of the cores from the sandstone intervals were excellent, better than 97%. The coal measures encountered below the sandstones were difficult to core and recover. Due to very low penetration only 2.5 m were cut in the last core and only 60% of this was recovered.

Descriptions of the cores are shown in Appendix. 1.

6.2 SIDE WALL CORES

Side wall cores were taken from 1535 m and down through the whole well, the last core being shot at 3768 m.

Six runs were made with a recovery varying from 17 to 28 out of 30 possible in each run. A total of 140 out of 180 cores were recovered.

A detailed description of the cores is given in Appendix 2.

7.

WIRELINE LOGGING

The following list contains a summary of the wireline logs run in the well 15/5-1, showing the dates, logged intervals and run numbers.

LOG	DATE	LOGGED INTERV.	RUN NO
BHC - GR	30.11.77	713.5- 192 m	1
ISF/MSFL/SONIC/GR	4.01.78	2739 - 705 m	1
ISF/SONIC/GR	4.02.78	3404.5-2718.5 m	2
"	8.02.78	3510.2-3345 m	3
"	21.02.78	3601 -3497.5 m	4
"	5.03.78	3775 -3497 m	5
FDC/GR	5.01.78	2739 - 705 m	1
FDC/CNL/GR	8.02.78	3510 -2718.5 m	1
"	21.02.78	3602 -3497.5 m	2
"	1.03.78	3570 -3773.5 m	3
DLL/MSFL/GR	21.02.78	3598 -3545 m	1
"	1.03.78	3773.5-3570 m	2
HDT	5.01.78	2739 -1700 m	1
"	8.02.78	3510 -2718.5 m	2
"	1.03.78	3773 -3498 m	3
VELOCITY SURVEY	5.02.78	3395 - 500 m	1
"	5.03.78	3772.6- 600 m	2
RFT	22.02.78	3597 -3560 m	1
"	2.03.78	3726 -3596 m	2
"	6.03.78	3611.8 m	3
CBL	13.01.78	2688 - 700 m	1
"	12.02.78	3295 -1650 m	2
"	12.03.78	3738.5-3280 m	3
CST	6.01.78	2730 -2337 m	1
"	6.01.78	2253 -1535 m	2
"	9.02.78	3500 -3157 m	3
"	9.02.78	3500 -2930 m	4
"	8.03.78	3753 -3513 m	5
"	9.03.78	3768 -3528 m	6

8. SPECIAL STUDIES

A biostratigraphic study of the well has been performed by Robertson Research International Ltd. The result are presented in the report:

"Norsk Hydro 15/5-1 well: Biostratigraphy of the interval 290 m - 3775 m."

A geochemical study of the well has been performed by Robertson Research International Ltd. Canned samples for this study were taken every 50 m from 1500 m to 3500 m and every 25 m from 3500 m to 3750 m. The results from this study are presented in the report:

"Report on a geochemical evaluation of the 15/5-1 well, Norwegian North Sea."

APPENDIX 1

CORE REPORTS, CORE NO. 1 - 5



Well no.	Core report			Core no's	
15/5-1				1	
Interval	Area	Cut	Date		
3561 - 3571 m	NORTH SEA	3561 - 3578.5 m	17-2-1978		
Scale	Well R.K.B.	Recovery	Geologist		
1:50	25m	3561 - 3577.9 m	NILS FAGERLAND		
Depth scale	Recovery	Lithological column	Depths	Lithological descriptions	Shows
3561				Sst, v homogenous for the whole section, lt-med gy, fri-mod hd, f, well srtd, subang, sl slty, sl-mod arg, mica dispersed and laminated, fair to good por where low in mica, generally fair por, mod cmt with calc cmt, dip on mica lam/bedding-planes generally 20-25°, occ v thin coal laminas associated with dk mica. Tr Pyr.	For whole section: Abundant faint blue-wh flu , 10% spotty wh flu , Extensive, fast-slow bluish wh cut.
3562		M			
3563		M			
3564		M			
3565		M			
3566		M			
3567					
3568		M	3568.5 m	Tr Crossbedding	
3569		M			
3570		M			
3571				Tr Loadcasts	
Well	15/5-1	Core report	1 / 1	Core no's	1

Norsk Hydro a.s

Oslo - Norway



Well no.	15/5-1	Core report			Core no's
Interval	3571 - 3578.5 m	Area	NORTH SEA	Cut	1
Scale	1 : 50	Well R.K.B.	25 m	Recovery	Date 17-2-1978
Depth scale	Re - recovery	Lithological column	Depths	Lithological descriptions	Shows
3571				Sst, a/a. Tr Loadcasts.	Shows a/a.
3572		M			
3573					
3574					
3575				occ Bioturbation.	
3576					Tr bleeding oil.
3577		M			
3578		M		incr mica lam.	
3578		NOT RECOVERED	3577.9		
3578.5					
3579					
3580					
Well	15/5-1	Core report	1/2	Core no's	1

Norsk Hydro a.s

Oslo - Norway



Well no.	Core report			Core no's
15/5-1				2
Interval	Area	Cut	Date	
3578,5 - 3587m	NORTH SEA	3578.5 - 3593.1m	18-2-1978	
Scale	Well R.K.B.	Recovery	Geologist	
1:50	25 m	3578.5 - 3590.2m	NILS FAGERLAND	
Depth scale	Re - recovery	Lithological column	Depths	Lithological descriptions
3578.5				Sst, lt - med gy, fri - mod hd, f, well srtd, subang, sl sly, mod arg, mica and coal dispersed and laminated, generally fair por, poor por in mica rich sections, rare calc cmt, occ silica cmt, general dip on lam bedding planes 25°, tr Pyr.
3579				
3580				
3581				
3582				Increase in Coal: From 3582, 4m to 3590 m, scattered irregular coal lamina occ with fibre - structure, extensive load - casts.
3583				
3584				
3585				
3586				
3587				
	cont'd following sheet			
Well	15 / 5 - 1	Core report	2/1	Core no's



Well no.	Core report			Core no's
15/5-1				2
Interval	Area		Cut	Date
3587 - 3593.1m	NORTH SEA		3578.5 - 3593.1 m	18-2-1978
Scale	Well R.K.B.	Recovery	Geologist	NILS FAGERLAND
Depth scale	Re - recovery	Lithological column	Depths	Lithological descriptions
3587				Down to 3588,6 m <u>Sst</u> , a/a.
3588				Shows a/a.
3589	M		3588,6 3588,8	From 3588,6 to 3588,8 m : <u>Sst</u> , highly micaceous, grdg <u>Shale</u> , finely lam, hd, non calc.
3590	M		3590,2	3588,8 to 3590m as down to 3588,6 m.
3591	M			From 3590m to bottom of core : <u>Sst</u> , lt gy, hd, dense, f, well srtd, v calc, grdg <u>Lst</u> , tight - v poor por.
3592				
3593		NOT RECOVERED	3593,1	
Well	Core report		Core no's	
15 / 5 - 1			2	2

Norsk Hydro a.s

Oslo - Norway



Well no.		Core report	Core no's		
15/5-1			3		
Interval	Area	Cut	Date		
3591.1 - 3600.7m	NORTH SEA	3593.1 - 3600.7 m	18-2-1978		
Scale	Well R.K.B.	Recovery	Geologist		
1:50	25 m	3591.1 - 3593.1m from core 2, 3593.1 - 3600.5m	NILS FAGERLAND		
Depth scale	Re - recovery	Lithological column	Depths	Lithological descriptions	Shows
3591.1				Sst, lt-m gy, hd-v hd, f, well srted, subang - ang, v calc grdg <u>Lst</u> occ coal lam, low in dispersed mica, calc mtx, v poor por, occ steep fracture partly calcite filled, poor bedding.	From 3591 to 3595.4m mainly calcite - mineral flu, slight tr bluish - dull - lt yel - wh flu, with slow milky bluish wh cut.
-3592					
-3593				Scattered vug por 0.5-3 mm.	
-3594				Coal with wood structure occ with vf <u>Pyr</u> lining.	
-3595			3594.8	④ 3cm Abn fossils on bedding plane.	
-3596		M	3595.4	From 3595.4 - 3599.6 m: Sst, m gy, mod hd, occ fri, f-vf, well srted, subang, sl-non calc, mod arg, mic, heavily wavy lam with mica and thin coal, occ coal accumulation as wood frags, fair-poor poor.	From 3595.4 to 3599.6 abn blue-wh flu with scattered pin point lt yel flu, slow blue-wh milky streaming cut, no residue.
-3597					
-3598		M			
-3599					
-3600		M M	3599.6	From 3599.6 - 3600.3 m: Sst, m gy, hd, vf grdg silt, arg, v mic, slightly calc, v poor por. From 3600.3 to 3600.5 m: Sst, lt-m gy, f, fri, well srted mod arg, sl calc, fair poor.	From 3599.6 to 3600.3: tr shows a/a.
		NOT RECOVERED	3600.3 3600.5 3600.7		
					From 3600.3 to 3600.5: abn flu and cut a/a cut is occ fast.
Well	Core report	3 / 1	Core nos		
15/5-1			3		



Well no.	Core report			Core no's
15/5-1				4
Interval	Area	Cut	Date	
3609 - 3619 m	NORTH SEA	3609 - 3623 m	23-2-1978	
Scale	Well R.K.B.	Recovery	Geologist	
1:50	25 m	3609 - 3620 m	NILS FAGERLAND	
Depth scale	Re - recovery	Lithological column	Depths	Lithological descriptions
3609		M		Sst, brn-gy, fri to mod hd, f, subang, well srted, mod arg, mic, tr Pyr, Coal mainly dispersed, non calc, fair por Dip of lam bedding 30° in most parts. Fairly homogenous.
3610				80% dull yellow-golden flu, with slow to mod fast bluish wh cut. This shows continues to 3615m.
3611			3611	a few scattered laminas with coarse ang grains, vf grains, tr mica, coal and Pyr. There are crs grain bands up to 15 cm thick, tr silica cmt. There are also m and crs grains scattered through most of the core floating in the f Sst.
3612			3611.4	
3613			3612.2	
3614				
3615		M	3614.9	
3616		M	3615.2	Sst / Siltstone, dk gy, carb, v arg, mic, pyritic, v poor por, 10-30° dip, v poor bedding.
3617		M		Patchy (20-30%) flu and cut a/a.
3618		M		
3619			3616.8	Coal, blk, hd, vitrious, sub conchoidal fractures.
				No shows.
Well	Core report		Core nos	
15 / 5 - 1		4 / 1		4

Norsk Hydro a.s

Oslo - Norway



Well no.	Core report			Core no's	
15/5-1				4	
Interval	Area	Cut	Date		
3619 - 3623m	NORTH SEA	3609 - 3623m	23-2-1978		
Scale	Well R.K.B.	Recovery	Geologist		
1:50	25 m	3609 - 3620m	NILS FAGERLAND		
Depth scale	Re - recovery	Lithological column	Depths	Lithological descriptions	Shows
3619				Coal, a/a.	
3620			3620		
3621					
3622					
3623			3623		
		NOT RECOVERED			
Well	Core report			Core nos	
15/5-1				4	



Well no.	Core report			Core no's
15/5-1				5
Interval	Area	Cut	Date	
3623 - 3625.5 m	NORTH SEA	3623 - 3625.5 m	24-2-1978	
Scale	Well R.K.B.	Recovery	Geologist	
1:50	25 m	3623 - 3624.5 m	NILS FAGERLAND	
Depth scale	Recovery	Lithological column	Depths	Lithological descriptions
				Shows
3623			3623	<u>Coal</u> blk, hd, vitrious, a few scattered pyr lenses 1-2cm at different levels, especially enriched at 3624.2 m.
3624			-3624,2	
3625			3624,5	The coal sequence shows no true bedding but is heavily fractured, the fracture planes are occ slickensided with dips 0-25°
		NOT RECOVERED	3625,5	
				Tr gas from fractures.
Well	Core report		Core nos	
15 / 5 - 1		5 / 1		5

APPENDIX 2

SIDE WALL CORE-DESCRIPTION

SIDE WALL CORES DESCRIPTION			SERVICE COMPANY Schlumb
WELL	15/5-1	RUN N°	30
LICENCE	048	PAGE N°	29
		DATE	30
			LOST 1
			FULL BULLET 27
			GEOLOGIST Nils Fagerland

tr - trace - M - medium - G - good

N°	DEPTH	REC %	LITHOLOGY	Fluorescence	CUT
				tr	
1	2730	45	Lst: lt gy, mod hd, micro xln, sl arg.	No show	
2	2723	45	Lst: m gy, mod hd, micro xln, arg grdg Mrlst.		
3	2714	45	Lst: wh, mod hd = hd, micro xln, Calcilutite.		
4	2708	95	Sh: m gy, mod hd, subfis, v calc, grdg Mrlst, firm-mod hd.		
5	2705	45	Lst: lt gy-wh, mod hd, micro xln, sl arg.		
6	2700	95	Mrlst: reddish brn, mod hd, mass.		
7	2698	98	Sh: m gy, mod hd, subfis, v calc.		
8	2693	55	Mrlst: m gy, mod hd, blky.		
9	2690	95	Mrlst: lt gy-m gy, mod hd.		
11	2678	90	Mrlst: reddish brn-purple, mod hd, subfis.		
12	2665	45	Lst: wh, mod hd, micro xln, fis - subfis, Calcilutite.		
13	2662	55	Lst: wh-lt gy, mod hd, micro xln, sl arg.		
14	2658	80	Mrlst: lt gy, mod hd, blky.		
16	2641	80	Sst: lt gy-wh, fri, f, mod-well srtd, subang, non calc sl arg, gd vis por.		
17	2637	98	Sh: m gy, mod hd, subfis, mod calc.		
18	2632	55	Sst: lt gy-wh, fri, f, subang, mod srtd, tr mica, sl calc, sl arg, gd por.		
19	2626	55	Sst: a/a calc.		
20	2621	45	Sst: lt gy-wh, fri, f, subang, mod srtd, sl - non calc, v arg, mod por.	▼	

SIDE WALL CORES DESCRIPTION		SERVICE COMPANY Schlumb.
WELL : 15/5-1	RUN N° : 1	ASKED : 30
LICENCE : 048	PAGE N° : 2	RECOVERED : 29
	DATE : 6/1-78	SHOT : 30
		LOST : 1
		FULL BULLET : 27
		GEOLOGIST : Nils Fagerland

tr : trace - M medium - G good

SERVICE COMPANY	Schlumberger
ASKED:	30
RECOVERED:	28
SHOT:	29
LOST:	1
FULL BULLET:	28
GEOLOGIST:	Nils Fagerland

SIDE WALL CORES DESCRIPTION

WELL : 15/5-1

RUN N° 2

LICENCE 048

PAGE N° 1

DATE : 6/1-78

tr : trace - M : medium - G : good

N°	DEPTH	REC %	LITHOLOGY	Fluorescence	
				CUT	EXC
1	2253	75	Sst: lt gy, fri, f-vf, subang, mod srted, mod arg, gd por.	No show	
2	2223	55	Sst: lt gy, fri, vf-f, sub ang, mod well srted, sl arg, gd por.		
3	2211	85	Sst: a/a.		
4	2204	55	Sst: a/a.		
5	2195	75	Sst: a/a.		
6	2188	85	Sh: m-dk gy, mod hd, aren with vf Sd a/a.		
7	2170	75	Sst: lt gy, fri, f, subang, well srted, clean, gd por.		
8	2142	100	Sh: dk gy, mod hd-firm, subfis.		
9	2120	96	Sh: a/a.		
10	2096	96	Sh: bluish gy, firm, blky, slty texture.		
11	2070	55	Sh: dk gy, firm - mod hd, subfis.		
12	2056	85	Sh: a/a, sl micromic.		
13	2048	95	Sh: bluish gy, firm, blky, v slty, grdg S1st, abd micro xln Pyr.		
14	2039	100	Sh: brownish rd, firm, blky, v calc.		
15	2034	100	Sh: a/a but sl - non calc.		
17	2020	75	Sh: brn, firm, blky, v calc		
18	2014	95	Sh: brn, firm, blky-subfis, sl - non calc		
19	2010	100	Sh: a/a with 1-6 mm lenses of Sh. brn, v hd, sl calc.		▼

SIDE WALL CORES DESCRIPTION				SERVICE COMPANY Schlub.
WELL	15/5-1	RUN N°	3	ASKED: 30
LICENCE	048	PAGE N°	1	RECOVERED: 17 (bought)
		DATE	9.2.78	SHOT: 30
				LOST: 7
				FULL BULLET: 4
				GEOLOGIST: Nicklin

tr trace - M medium - G good

N°	DEPTHs	REC	LITHOLOGY	Fluorescence	
				CUT	ESB
16	3500	1"	Sh: blk, mod hd, fis, crumbly, carb/org. Non mic, non calc, tr v. dull yel flu.		
17	3495	-	Empty		
18	3493	1 1/4"	Sh: blk, mod hd-hd, fis, carb/org, sl micro-mic, gen noncalc w/ some occ calc, tr dull flu a/a.		
1	3490	1 3/4"	Sh: a/a.		
19	3489	1"	Sh: a/a.		
2	3485	1 3/4"	Sh/Mrl: lt-m gy, firm-mod hd, sl sticky, vf, blky, v calc.	No show	
3	3482		Lost		
20	3474	1"	Sh: dk gy, mod hd-hd, subfis-fis, sl calc.		
21	3465	1 1/2"	Sh: m gy, mod hd, fis-subfis, calc, w/v thin grn-bright grn inter-lam.		
22	3455	1 1/2"	Sh: blk, firm-sft, subfis, crumbly, micro-mic, earthy text, calc.		
23	3451	1 1/2"	Sh: a/a but non calc.		
24	3445	2"	Sh: a/a.		
25	3437	1 3/4"	Sh: a/a bec more blky w/incl reworked Sh.		
26	3417	1 1/8"	Sh: red, brick red, sft-mod hd, blky-mass, bec amor, sl sticky, bec cly, sl calc, occ micro-mic, occ thin lt grn gy inter-lam.		
27	3407	1 1/4"	Sh: m gy-lt gygn, mod hd, fis, calc, micro-mic, w/small lenses of dk gy-blk Sh (reworked?).		
28	3379	3/8"	Sh/Mrl: m gy, sft-firm, crumbly-subfis, v calc, sl slty text w/ reworked dk gy Sh lenses a/a.		
29	3366	3/4"	Mrl:m gy,lt gy, sft, sticky, sltv, sl subfis. v calc grdg to Lst, w/ thin interbd Lst: gy, v hd, brit, crypto-xln, arg.		
4	3359	3/4"	Mrl/Lst:v lt gy-off wh,sft, crumbly, mass, w/reworked. Sh, occ vf slt (poss micro-foss) occ v f glag, thin inter-lam/frag arg streaks.		

SIDE WALL-CORES DESCRIPTION		SERVICE COMPANY Schlumb.
	ASKED:	30
	RECOVERED:	17 (bough
	SHOT:	30
	LOST:	7
	FULL BULLET:	4
WELL : 15/5-1	RUN N°: 3	
LICENCE 048	PAGE N°: 2	
	DATE 9.2.78	GEOLOGIST: Nicklin

tr : trace - M medium - G good

SIDE WALL CORES DESCRIPTION				SERVICE COMPANY Schlumb.
WELL	15/5-1	RUN N°	4	ASKED: 30
LICENCE	048	PAGE N°	1	RECOVERED: 20(bought)
		DATE	9.2.78	SHOT: 30
				LOST: 7(+2 bro)
				FULL BULLET: 3
				GEOLOGIST: Nicklin

tr : trace - M : medium - G : good

N°	DEPTH	REC	LITHOLOGY	Fluorescence	
				CUT	EXPO
16	3500	1 1/4"	Sh: blk, mod hd-hd, fis. org/carb, sl-mod calc, v dull yel flu.		
17	3495	3/4"	Sh: blk a/a, non calc, w pyr nod.		
18	3493	1 1/4"	Sh: blk, mic, ind.		
19	3490	1 3/4"	Sh: blk, carb a/a.		
20	3489		Lost	No show	
1	3485	3/4"	Mrl: gy, v calc.		
21	3482	1 1/2"	Sh: dk red brn-gy, mod hd-hd, blky, sl sticky, crumbly, calc bcc mrly, tr micro-mic w/ thin reworked dk gy Sh, occ micro-pyr.		
22	3474	1 3/4"	Mrl/Sh: gy, gy grn, v f spec, mod hd-crumbly, fis, occ vf micro- mic, v calc, pos grdg to arg Lst.		
23	3465	1 3/4"	Sh: blk.		
29	3451	1 1/2"	Sh: blk sl calc.		
25	3445	1 1/2"	Sh: gy, calc.		
26	3407	1"	Sh: gy, lt gy, v calc.		
27	3366	3/4"	Mrl: lt gy.		
2	3319	1 1/2"	Mrl: lt gy, v f spec, mod hd, crumbly, subfis, blky, w/v thin, minor reworked Sh, sl micro-mic.		
3	3302		Broken		
28	3250		Lost		
4	3200	1"	Sh/Mrl: lt gy - gy grn, mod hd-sft, blky, crumbly, v f, occ tr micro-pyr, calc bcc mrly.		
5	3135		Lost		

SIDE WALL CORES DESCRIPTION			SERVICE COMPANY Schl.
WELL	15/5-1	RUN N°	30
LICENCE	048	PAGE N°	RECOVERED 28
		DATE	SHOT 30
			LOST 2
			FULL BULLET 23
			GEOLOGIST: Nils Fagerland

tr : trace - M : medium - G : good

N°	DEPTHS	REC %	LITHOLOGY	Fluorescence	
				CUT	ESD
30	3513	40	Sh: dk grn-blk, hd, carb.	No show	
28	3520	60	Sh: blk, hd, carb, sl slty.		
27	3525	80	Sh: a/a.		
26	3530	40	Sh: a/a.		
25	3535	25	Sh: a/a.		
24	3537	50	Sh: a/a, fracture plane? bedding? dip 30-40°.		
23	3540	40	Sh: a/a.		
22	3542	30	Sh: blk, hd, mod calc, carb, slty, heavily fractured.		
21	3545	90	Sh: blk, mod hd, sl calc, carb, sl slty, fractured.		
19	3549	80	Sh: blk, hd, carb, fractured.		
17	3554	80	Slst: m gy, firm, v arg, calc.		
16	3557	80	Slst: a/a.		
15	3559	40	Sst: lt gy, f, fri-lse, ang, well srted, sl arg, calc, good por, 90° wh fluor, instant wh-blue-lt vel cut.		
14	3604	40	Sst: a/a but mod hd, abd arg mtx, sl calc poor por, no show.		
13	3608	80	Sst: m gy, f, firm, ang, mod srted, v arg, poor por, with interlam Sh/ clst, no show.		
12	3683	40	Mrlst; wh-lt gy, firm, sl slty.		
11	3687	50	Slst/Clyst: lt gy, firm, calc.		
10	3696	80	Cly: lt brn-beige, v sft, sl calc.		

		SERVICE COMPANY Schl.
		ASKED 30
		RECOVERED 28
		SHOT 30
		LOST 2
		FULL BULLET 23
WELL : 15/5-1	RUN N° 5	GEOLOGIST:
LICENCE 048	PAGE N° 2	Nils Fagerland
	DATE 8/3-78	

tr : trace - M medium - G good

SERVICE COMPANY Schlumb.	
ASKED:	30
RECOVERED:	27
SHOT:	29
LOST:	2
FULL BULLET:	25
GEOLOGIST:	Nils Fagerland

SIDE WALL CORES DESCRIPTION

WELL : 15/5-1

RUN N° 6

LICENCE: 048

PAGE N°: 1

DATE: 9/3-78

tr : trace - M medium - G good

N°	DEPTH	REC	LITHOLOGY	Fluorescence	
				CUT	EXPL
60	3528	50	Sh: blk, hd, fis, carb, fractured, non calc.	No show	
59	3551	50	Sh: a/a but sl sly, sl calc, tr pvr.		
57	3557,5	50	Slst: m-dk gy, firm-mod hd, wavy lam with coal and pyr, v arg grdg Sh, sl-non calc.		
56	3569	50	Sst: lt gy, v f, fri, ang, mod srtd, arg, calc, fair por, 80% pale wh fluor, with fast wh str cut.		
54	3595	40	Sst: lt gy, f, fri-mod hd, ang, well srtd, arg, calc, fair-good por, 90% pale wh fluor, slow streaming wh cut.		
53	3605	50	Slst: brn, firm-mod hd, v arg grdg Sh, non calc, tr mica, tr Sst a/a, no vis por, no show.	No show	
52	3625	50	Coal: blk, mod hd, vitrious, fractured.		
51	3628	50	Sh: dk brn, firm, blky, fractured, non calc.		
50	3632	40	Sh: lt brn gy, hd, sl sly, non calc, blky, sl tr v coal frags.		
49	3637	95	Sh: gy-lt brn, firm-stky, calc, occ sl tr coar i, tr v sly parts, sl calc, hd.		
48	3652	50	Sh: lt gy-it beige, firm, non calc.		
47	3656	40	Sst: gy-lt brn, f, fri, ang, well srtd, arg, sl calc, fair por, 70% dull wh-lt vel fluor, slow wh cut.		
45	3669	95	Sh: chocolate brn, firm, non calc.	No show	
44	3681,5	40	Sh: whitish-blue, firm, v calc, sl sly.		
43	3686,5	40	Sh/Slst: wh, firm, v calc, abd wh mineral fluor, no cut, sl tr v f Sd grains.		
42	3691,5	80	Sh: chocolate brn, hd, blky, sl sly, non calc.		
41	3704	50	Mrlst/Slst: wh-lt gy, firm-mod hd, blky, tr wh mineral fluor, no cut, tr v f Sd grains.		
40	3710	50	Sst: lt blue-wh, hd-v hd, v f grdg Slst, v calc, ang, mod srtd, tight, poor por, no show.		

SIDE WALL CORES DESCRIPTION		SERVICE COMPANY Schlumb.
WELL	15/5-1	ASKED 30
LICENCE	048	RECOVERED 27
		SHOT 29
		LOST 2
		FULL BULLET 25
		GEOLOGIST Nils Fagerland
	RUN NO. 6	
	PAGE NO. 2	
	DATE 9/3 78	

tr : trace - M medium - G good

APPENDIX 3

WELL SUMMARY

WELL SUMMARY

2.

Well:

15/5-1

RFT RESULTS					
RUN 1		RUN 2		RUN 3	
DEPTH (KB)	FORMATION PRESSURE	DEPTH (KB)	FORMATION PRESSURE	DEPTH (KB)	FORMATION PRESSURE
1 3560 m	6828 PSIG	1 3728 m	7459 PSIG	1 3611.8 m	6874 PSIG
2 3597 m	6825 PSIG	2 3728 m	7459 PSIG		
3 3595 m	6851 PSIG	3 3724 m	7453 PSIG		
4 3592 m	TIGHT	4 3745 m	TIGHT		
5 3589.2 m	6845 PSIG	5 3755.5 m	TIGHT		
6 3586.5 m	6849 PSIG	6 3728 m	7402 PSIG		
7 3584 m	6845 PSIG	7 3724 m	7398 PSIG		
8 3582 m	6846 PSIG	8 3613 m	6848 PSIG		
9 3580 m	6845 PSIG	9 3612 m	6842 PSIG		
10 3578 m	6846 PSIG	10 3611 m	6838 PSIG		
11 3573 m	6840 PSIG	11 3601 m	6831 PSIG		
12 3568.5 m	6840 PSIG	12 3598 m	6830 PSIG		
13 3565 m	6836 PSIG	13 3596 m	6826 PSIG		
		14 3612 m	6842 PSIG		
		15 3611.8 m	6841 PSIG		

FORMATION FLUID SAMPLES WERE TAKEN AT 3560m AND 3611.8m. CONTENTS OF SAMPLE CYLINDERS FOUND NOT TO BE REPRESENTATIVE OF TRUE FORMATION HYDROCARBON COMPOSITION. THE SEPARATOR SAMPLES FROM THE PRODUCTION TEST WILL BE USED AS REFERENCE DATA.

DST SUMMARY

TEST NUMBER AND PERFOR. INTERVAL	EVENT	TIME HOURS	CHOKE SIZE INCHES	RECORDED BOTTOM HOLE PRESSURE BAR	BOTTOM HOLE TEMP. °C	FLOWING WELLHEAD PRESSURE BAR	WELLHEAD TEMP. °C	GAS FLOW RATE $10^3 \text{Nm}^3/\text{d}$	GAS GRAVITY (SP.GR.)	OIL FLOW RATE STm^3/d	OIL GRAVITY °API	WATER FLOWRATE m^3/d	GAS-OIL RATIO Nm^3/STm^3
DST no 1 3610-3614 m	Initial shut in			478.2									
	Flow no. 1	4.3	20/64	352.9		77.9	3.3	63.3	0.804	15.7	43.0	0	4024
	Flow no. 2	4.8	12/64	411.4	125.6	120.8	8.3	33.7	"	18.1	"	"	1861
	Final shut in	8.9		469.0									
DST no 2 3561-3584 m	Initial shut in			474.5									
	Flow no. 1	7.8	22/64	461.6	125.6	298.4	53.9	363.6	0.761	232.1	46.1	0	1321
	Flow no. 2	6.9	32.5/64	451.2	126.2	247.1	73.9	499.8	0.775	377.9	46.0	"	1322
	Flow no. 3	6.5	48/64	445.2	126.7	192.3	73.3	622.9	0.778	474.0	43.4	"	1320
	Flow no. 4	1.0	-	449.4	126.7	-	-	± 500	-	-	-	-	-
	Final shut in	15.2		472.7	122.8								

NOTE: FLOWS IN DST 1 NOT STABILIZED

$1 \text{Nm}^3 = 37.326 \text{ SCF}$
 $1 \text{Nm}^3/\text{STm}^3 = 5.934 \text{ SCF/STB}$

GEOLOGICAL WELL SUMMARY

1.

GEOLOGICAL WELL SUMMARY

2.