

CONFIDENTIAL.

REPORT NO. NSEP - 22.

A/S NORSKE SHELL

RESUMÉ OF EXPLORATION WELL

25/12-1

BY

PETROLEUM ENGINEERING

AND

EXPLORATION DEPARTMENTS

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PART A. OPERATIONAL DATA.

A.1. General Summary.

WELL - 25/12-1.

CLASSIFICATION - Wildcat.

AREA - Field 25; Block 12; Production Licence No. 010  
Drilling Permit .No. 95

CONTRACTOR - Sedco Inc., Dallas, Texas, U.S.A.

RIG - Sedco 135 G - Semi-submersible.

COORDINATES - N 59° 01' 47. 0"  
E 02° 49' 17. 1"

WATER DEPTH - 443' below mean sea level.

ROTARY TABLE - 112' above mean sea level.

RIG HEADING - 143° True.

OBJECTIVES - a) Investigation of Paleocene sands and Upper Cretaceous chalk.  
b) Investigation possible sands in Lower Cretaceous and Jurassic-Triassic.

PROGNOSIS<sup>+</sup> -

	( <u>Quaternary</u>	Glacial till, boulder Clay.
	( <u>Tertiary</u>	
Seabed - 5220'	( Pliocene )	Sands, Clay Claystone
	( Miocene )	
	( Oligocene )	
	( Eocene	Shale, sst, Basal tuff
5221' - 5667'	Paleocene	sst, Shale.
	<u>Cretaceous</u>	
5667' - 7078'	Upper Cretaceous	Chalk, Limestone, Shale, Marl
7078' - 7596'	Lower Cretaceous	Shale, sst.
7596' - 9310'	<u>Jurassic/ Triassic</u>	Shale, Sandstone
? 9310' - 9400'	<u>Basement</u>	Metamorphic Schist, Gneiss or Granite.

<sup>+</sup> All depths in this report, unless mentioned otherwise, are in ft. bdf.

A.i. General Summary. (Continued)

RESULTS - Dry Hole.  
STATUS - Plugged and Abandoned.  
TOTAL DEPTH - 9400 ft. bdf.

A. 2. DATES OF OPERATIONS.

Start of tow (from Hamburg)			
- location 25/12-A	-	13th September 1973	0445 hrs)
Rig on contract (near location waiting on weather)	-	19th September 1973	(0000 hrs)
Spudded 25/12-1	-	3rd October 1973	(1245 hrs)
Reached total depth	-	6th December 1973	(1730 hrs)
Abandoned (with seabed clear)	-	20th December 1973	(2030 hrs)
Rig released to Shell U.K. Expro.	-	27th December 1973	(0045 hrs)

A.3. - TOW SEDCO 135 G - HAMBURG - LOCATION 25/12-1.

After completion of the refit in Hamburg, the rig left the shipyard at 04.45 hours on September 13th, 1973. Time taken for the distance Hamburg - 25/12-A (532 NM) was 139 hours, i.e. an average speed of 3.8 knots.

The rig arrived on location and was taken on contract with A/S Norske Shell at 00.00 hours 19.9.73.

The Sedco 135 G is provided with nine main anchors, but because of poor anchoring conditions, it was necessary to lay additional backup anchors. The final anchoring pattern was as follows:-

Main Anchor	1st Backup	2nd Backup	Direction
No. 1 LWT 15 T			112°
No. 2 LWT 15 T			158°
No. 3 LWT 15 T	Danforth 15 T		188°
No. 4 Baldt 17 T	Hall 15 T	Hall 15 T	224°
No. 5 Baldt 15 T	Danforth 15 T		258°
No. 6 Baldt 17 T	Danforth 15 T		295°
No. 7 Baldt 17 T	Baldt 17 T		339°
No. 8 Baldt 17 T	LWT 8 T	Danforth 8 T	017°
No. 9 Baldt 17 T	Hall 15 T	LWT 8 T	066°

Barge heading = 143°

Adverse weather and seabed conditions caused anchoring delays and the rig was not anchored and in position until 19.00 hours on 2.10.73. Total time involved: 13 days 19 hours.

All anchors were pretensioned satisfactorily to min. 250 kips.

Location 25/12-A was spudded as 25/12-1 at 12.45 hours on 3.10.73.

A. 4. DRILLING HISTORY.

Location 25/12-A was spudded as well 25/12-1 on October 3rd, 1973 at 1245 hrs.

Final coordinates were N 59° 01' 47.0", E 02° 49' 17.1", and the water depth was 443 ft. below MSL with the derrick floor elevator 112 ft. above MSL.

36" hole was drilled to 826' with a 26" bit and a 36" hole opener. 350 bbls. of viscous mud were spotted and the 30" casing run to 803' and cemented to surface with 1011 sx Pozmix cement.

26" pilot hole (17½" bit + 26" HO) was drilled to 840' and the 24" riser with diverter run. 17½" hole was continued to 1520'. Whilst enlarging the hole with a 26" underreamer, the riser unlatched (leaking "O" ring) and 750 bbls. of mud were lost. After relatching the riser, 26" hole was continued to 1520'. The 20" casing was run to 1497' and cemented with 1390 sx Pozmix, the casing being tested to 250 psi.

After running and testing the 20" stack, 17½" hole was drilled to 4481'. Intermediate logging was then begun, the first Schlumberger run standing up at 3778'. Whilst reaming the hole, the drillstring was stuck at 4022'. After spotting a pipelax/diesel pill with no success, a 15% HCl acid pill was spotted around the drill collars, and the pipe pulled free with 400,000 lbs. total pull. The borehole was reamed to bottom with mud losses of ± 800 bbls. and intermediate logging completed without further problems. The 13.3/8" casing was successfully run to 4452' and cemented with 1460 sx Pozmix + 824 sx Class B cement, the casing being tested to 3000 psi.

Following running and testing the 13.5/8" stack, a formation gradient test equivalent to 798 psi mud was made at 4500' and 12.1/4" hole was drilled to 6213' where the drillstring twisted off at the 7.3/4" Dailey jar at 5798'. The fish was successfully recovered at the first attempt with a Bowen overshot (total time lost 19½ hours). 12.1/4" hole was continued to 6515'. The first long run stood up at 6185' but after reaming the hole, the logging was completed. The 9.5/8" casing was run to 6491' and cemented with 1420 sx Class B cement. During the cement displacement, no bumping pressure was observed, and the top cement inside the 9.5/8" casing was later found to be at 6235' (some 176' high). Since the cement had then set, the string was tested to only 1500 psi to avoid cement sheath cracking.

Drilling 8½" hole was continued to 7629' when a severe gale necessitated hanging off the pipe in the 9.5/8" wear bushing and disconnecting the riser. Anchors 7 and 8 shipped and the rig moved off the wellhead. After 6 days 2 hours, all the anchors had been pretensioned to 250 kips and the string was reconnected and the hole washed and reamed to 7122' with only one pod functioning properly. Bad weather again forced hanging off, but the riser was not disconnected. After 2 days 23 hours, the string was reconnected with difficulty as the rig was slightly off location. The hole was reamed to bottom and drilling continued to 7873' when the weather deteriorated and the pipe had to be hung off again.

Whilst waiting on weather, pressure was lost on both pods. An attempt to retrieve both pods with the guide frame failed and so the marine riser had to be pulled. Repairs proved difficult and the riser was run and pulled once again before drilling was continued with one pod functioning. The time spent in repairing underwater equipment during this period was 5 days 20½ hours, whilst the weather downtime since drilling ceased was 12 days 23 hours for same period.

Core No. 1 was cut from 8037' to 8057' with a recovery of 18' 7" (93%). Pod pressure was lost whilst tripping out of the hole and the HR-4 connector was found to be leaking, the total mud losses were estimated at 260 bbls. Repairs took 2 days to complete.

After reaming and circulating, intermediate Schlumberger logging operations were carried out, but were discontinued after a leaking valve caused excessive pressure in the Rucker drillstring compensator which caused damage to the logging heave compensating equipment.

8½" hole was continued to a total depth of 9400' and after a final logging programme and velocity survey, the hole was abandoned by means of four cement plugs.

The 9.5/8" casing was cut at 566' bdf and 17.42 ft. of casing were recovered. After recovering the stack, the 13.3/8" and 20" casings were being cut when a twist off occurred both above and below the marine swivel. A total of 2 days 5 hours was spent in recovering the fish. The 13.3/8" and 20" casings were finally cut at 563.5'bdf. The 30" casing was cut at 556.1' bdf and pulled on the main guide base.

An attempt to recover the TGB was unsuccessful but a diving visual inspection declared the seabed clear.

The well was officially abandoned and went off contract at 0045 hours 27/12/1973.



A. 5. - CRITIQUE.

Regan Diverter System.

Before drilling the 17½" pilot hole, the diverter was installed as a precaution against shallow gas pockets. Whilst rigging up, it was found that the hydraulic fluid channels in the top and bottom flanges were not coaxial due to a machining defect. As Regan could not be contacted, a field repair of drilling a 'relief' channel was carried out successfully. The total time spent on the repair was 13 hours.

As with all machining defects, it is difficult to see how this could have been avoided as checking this piece of equipment would have meant stripping down the diverter itself.

Subsea Equipment.

There were numerous instances when the subsea equipment failed in some way, the two main causes being the age and obsolescent nature of the rig's Kooimey system and also the severe weather encountered.

When drilling the 26" hole with the underreamer, the marine riser HR-4 pin connector unlatched causing 750 bbls. of muddy seawater to be lost. It was concluded that there was a slight leak in the 'O' rings of the pin connector and/or in the hose bundle used. In subsequent wells, a Sedco-supplied pin connector will be used instead of the Shell UK -supplied connector. Final rig time lost was 1½ hours.

Whilst waiting on weather on the 16th November at 7873', after the first and most severe of the November gales, all pressure was lost on the red control pod. As the blue pod was already defective, an attempt to retrieve both pods with the guide frame failed and so the marine riser was pulled. After repairs and rerunning the blue pod and riser, pressure was again lost. The whole sequence had to be repeated, drilling being continued eventually with only one pod functioning.

Whilst tripping out of the hole after cutting core No. 1, pressure was again lost on the blue pod. The HR-4 was also observed to be leaking, the final amount of mud lost being 260 bbls. The marine riser was pulled and both blue and red pods repaired, tested and rerun.

Suggested modifications include eliminating some of the many wires running to the wellhead, by making the two pods retrievable with the marine riser and having all the hydraulic hoses clamped to the riser. Total time lost on repairing underwater equipment was 8 days 16 hours.

Stuck Pipe.

Whilst reaming the 17½" hole for logging, the drillstring was stuck with the bit at 4022'. Differential sticking was not suspected and one of the stabilizers was thought to be held up on a hard dolomite ledge. Spotting

a 110 bbl. diesel/pipelax pill around the collars did not succeed, hence an 88 bbl. pill of 15% HCL acid (HAI retarded) was spotted. 3½ hours after the acid was in place, the pipe pulled free with 400,000 lbs. pull. The final rig time lost was 34½ hours.

On subsequent circulation, no returns were obtained so an LCM was spotted. During further reaming, LCM was kept in the active mud system but a total of 800 bbls. of mud was lost. However, the use of the acid to dissolve away the dolomite seems to have been justified.

#### Twist Off During Drilling.

During drilling the 12.1/4" hole at 6213', a twist off occurred at the 7.3/4" Dailey drilling jar. The fish was recovered at the first attempt with a Bowen overshot at 5798'. The final time spent was 2½ hours.

The twist off occurred at a shoulder in the jar mandrel; as the jar was new, a manufacturing defect cannot be ruled out but Whipstock have not yet completed their examination. Dailey jars are run in other Shell areas without frequent twist offs.

#### Twist Off During Cutting Casing.

Whilst cutting the 13.3/8" and 20" casings at 565' with 800 psi pump pressure and 200 rpm, pressure was lost and the rpm speeded up.

The string was recovered showing a twist off had occurred in the 4½" IF box on top of the marine swivel. The fish was caught on the second attempt with a modified overshot, but was lost while pulling out. A spear was run to recover the 13.3/8" casing but encountered an obstruction four feet into the 13.5/8" wellhead. Several runs with various size overshots, grapples and impression blocks failed to recover or identify the fish, but it was finally recovered and found to consist of 11.6' of the 5" pup joint and the cutting tool. The pup joint had twisted off 2 feet below the top tool joint. Twist offs have occurred both below and above the marine swivel. The 13.3/8" and 20" casings were then recut at 563.5' (1½" above the first cut) in 2 hours 5 minutes with 800 psi and 100 rpm. The marine swivel was not recovered.

The difficulties encountered may have been caused by:-

1. The rotary speed being too high.
2. The 5" pup joint was not strong enough to withstand shockloads caused by the cutting action.
3. The tooljoint on top of the marine swivel probably twisted off after the twist off of the 5" pup joint as rotation was not immediately stopped upon losing pressure, this break being caused by a flapping and underneath guidance was lost.

In future, a stronger pup joint should be used to space out between the cutter

and swivel and rotation limited to 120 rpm. Also the 4½" IF connection on top of the swivel should be replaced by a stronger connection, (e.g. 6.5/8").

Ferrobar.

Two hundred tons of a 50/50 Ferrobar and barytes mixture were used in the well as weight material. Ferrobar is a synthetic iron oxide of sg 4.7 and at the time of drilling, had a cost of NKr. 410 per metric ton as compared with the price of NKr. 472 for barytes.

Low mud weights and long periods of downtime, caused by bad weather and underwater equipment repairs, made it difficult to evaluate this field test but the following points were noted:-

- a) The strong dark red colour is unfavourable from environmental considerations.
- b) Its abrasiveness, as regards pump wear, could not be evaluated.
- c) It seemed to adhere more strongly to the shaker screens during roundtrips requiring good cleaning of the screens to prevent surface losses when circulation was resumed.
- d) Ferrobar mud seemed to have a low yield point but this was not proved decisively.
- e) It showed no apparent effect on the logs run.

A.6. - EVALUATION.

Wireline Operations.

A summary of Schlumberger logs run in the well and petrophysical evaluation made on them are enclosed as ..... Appendix V.

Lists detailing the Schlumberger sidewall samples can be found in ..... Appendix XI, XII.

A velocity survey was carried out by SSL from surface to 9350' bdf.

Full Hole Coring.

One core was taken from 8037' to 8057' (93% recovery). A full description can be found in ..... Appendix XIII.

Hydrocarbon Indications.

A condensed tabulation of the indications obtained during drilling by formation logging (Geoservices) can be found in ..... Appendix VI.

A. 7. - PLUGGING AND ABANDONMENT.

After reaching T. D. at 9400' and final logging at this depth, the hole was plugged back by means of 4 cement plugs. All the plugs were set with 5" drillpipe and 536' of open ended 2. 7/8" tubing stinger.

Abandonment Plug No. 1. - was set over interval 9337' - 8787' with 220 sxs Class E cement of slurry weight 850 psi/1000 ft.

Abandonment Plug No. 2. - was set over interval 6752' - 6200' with 230 sxs Class E cement of slurry weight 850 psi/1000 ft. After pulling the pipe to 6100' and circulating clean and WOC for 9 hours, the plug could not be located.

This plug was re-set over the same interval with 200 sxs Class B cement of slurry weight 820 psi/1000 ft. and the top plug located at 6333' bdf. with 20,000 lbs. WOB.

Abandonment Plug No. 3. - was set over interval 3516' - 2966' with 210 sxs Class E + 1½% CaCl<sub>2</sub> accelerator of slurry weight 850 psi/1000 ft.

Abandonment Plug No. 4. - was set over interval 1099' - 603' with 195 sxs Class E + 1½% CaCl<sub>2</sub> accelerator of slurry weight 850 psi/1000 ft. The hole was circulated clean at 603' bdf. and no cement contamination was observed.

Cutting and Recovery of Casing Strings.

The 9. 5/8" casing was cut at 566' bdf. (11' below seabed) and recovered.

The marine riser was pulled without the stack and after 26 hours waiting on weather, the stack was retrieved on drillpipe.

An attempt to cut the 13. 3/8" and 20" casings at 565' failed due to a double twist off occurring above and below the marine swivel. The upper part of the fish was engaged with a modified overshot but was lost while tripping out. Part of the fish still in the hole was recovered using a 5" grapple. The A-1 marine swivel was not recovered.

The 13. 3/8" and 20" casings were then cut at 563.5' and recovered.

The 30" conductor pipe was cut at 556' and recovered with the permanent guide base.

The J-tool was then run and connected to the temporary guide base. After 15½ hours of pulling 320,000 lbs., bumping and circulating without success, the temporary guide base was left on bottom.

A final dive showed seabottom clear and the top of the TGB visible.

The present status of the well can be seen on Appendix VIII.

Handling anchors started at 11.00 hours on 23rd December 1973 and was completed at 00.45 hours on 27th December 1973. The operation was interrupted for  $8\frac{1}{2}$  hours by weather.

The rig was released and handed over to Shell U. K. Expro Ltd. on 00.45 hours on 27th December 1973.

## PART B. GEOLOGICAL DATA.

Stratigraphya) Chronostratigraphy.

The preliminary subdivision based on stratigraphical paleontological and electric log data is given below:-

<u>Age</u>	<u>Interval</u>		<u>Depth b. m. s. l.</u>
	<u>Depth</u>	<u>b. d. f.</u>	
(No samples available)	555 -	830	443 - 718
Lower Pleistocene	830 -	1220	718 - 1108
Pliocene	1220 -	2960	1108 - 2848
Miocene	2960 -	3680	2848 - 3568
Oligocene	3680 -	4100	3567 - 3988
Upper Eocene	4100 -	4700	3988 - 4588
Lower Eocene	4700 -	4920 <sup>+</sup>	4588 - 4808
Lower Paleocene	4920 -	5235 <sup>+</sup>	4808 - 5123
Upper Cretaceous : Maastrichtian	5235 -	5600	5123 - 5488
Campanian	5600 -	5900	5488 - 5788
Santonian-Cenomanian	5900 -	6260	5788 - 6148
Lower Cretaceous	6260 -	7175	6148 - 7063
Upper Jurassic	7175 -	7363	7063 - 7251
Middle Jurassic	7363 -	7957	7251 - 7845
Pre-Jurassic (? Devonian)	7957 -	9400 TD.	7845 - 9288 TI

Tops marked with an asterisk (+) have been adjusted to coincide with log markers.

The subdivision is based mainly on microfaunal investigations down to 7363' and on palynological data below that depth. However, all samples below 7950' were found to be barren of microflora. The tentative assignment of the latter interval down to TD as Devonian (Old Red Sandstone) is based solely on the lithofacies encountered.

b) Lithostratigraphy.

<u>Depth in ft. b. d. f.</u>	<u>Lithology.</u>
555 - 830'	No samples: returns to seabed.
830 - 1220'	<u>BOULDER CLAY</u> : Grey sandy, silty clay with cobbles/pebbles of rock fragments at top. Interbedded sands; shell beds. Abundant lignite.
1220 - 1580'	Predominantly silty <u>CLAY</u> medium grey, firm to soft, plastic interbedded sand.
1580 - 1725'	Silty <u>CLAY</u> , trace fossil fragments.
1725 - 2940'	<u>CLAYSTONE</u> , grey-green, soft, silty calcareous, trace glauconite, carbonaceous material.
2940 - 3315'	<u>CLAYSTONE</u> grading to <u>SHALE</u> grey-green. Abundant glauconite; base calcareous silty <u>SANDSTONE</u> .
3315 - 4040'	<u>SHALE</u> dk brown, calcareous with <u>DOLOMITE</u> streaks, brown, IA silty. Below 3730' dolomitic <u>SANDSTONES</u> hard, generally well cemented.
4040 - 4783'	<u>SHALE</u> grey-brown grey; silty - sandy in parts. Abundant microcrystalline <u>DOLOMITE</u> beds below 4450'.
4783 - 5235'	<u>SHALE</u> grey-green-red, generally mottled. Interbedded <u>TUFFACEOUS</u> layers, variegated colours, very hard feldspathic from 4900 - 5050'.
5235 - 6080'	<u>CHALK</u> white soft - mod. hard, traces of chert in upper part, and below 6000'. Below 5780' thin interbeds of argillaceous <u>CHALK</u> , grey-green or pink-red.
6080 - 6215'	Interbedded <u>CHALK</u> as above, <u>MARL</u> and <u>MARLY LIMESTONE</u> light grey-green; trace glauconitic <u>SST.</u>
6215 - 6390'	<u>MARL</u> - silty <u>CLAYSTONE</u> .
6390 - 7175'	Interbedded argillaceous <u>LIMESTONES</u> and calcareous <u>SHALE/MARL</u> grey - dark grey.
7175 - 7363'	Black pyritic <u>SHALE</u> soft, waxy texture, calcareous; abundant pyritical organic remains, fish scales, etc.
7363 - 7635'	Silty <u>SANDSTONES</u> grey, pyritic, glauconitic, fine grained; calc - dolomitic cement. Fair porosity. Interbedded dk. grey <u>SHALE</u> .



Depth in ft. b. d. f.

Lithology.

7635 - 7957'	<u>SHALE and SILTSTONE</u> , purple - magenta - orange - yellow - red with interbedded <u>SANDSTONES</u> white medium grained calc. cement; good porosity.
7957 - 8760'	Polymict <u>CONGLOMERATE</u> , reddish - green, with cobbles of granite, schist, gneiss, marble. Sandy, feldspathic matrix.
8760 - 9400'	<u>SANDSTONE</u> red-brown, fine - coarse grained, friable, silty, micaceous. Fair porosity.

c) Paleontology/Palynology.

Routine and semi-detailed investigations have been carried out and are continuing. Below - 7,600 ft. no autochthonous microfauna was present due to the red-bed facies encountered. All sidewall samples below the Upper Jurassic Shale were therefore examined palynologically. The deepest age assignment obtained from palynology was at 7950', below which all samples were barren of microflora.

A finalized report together with distribution charts will be issued at a later date.

LIST OF APPENDICES.

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