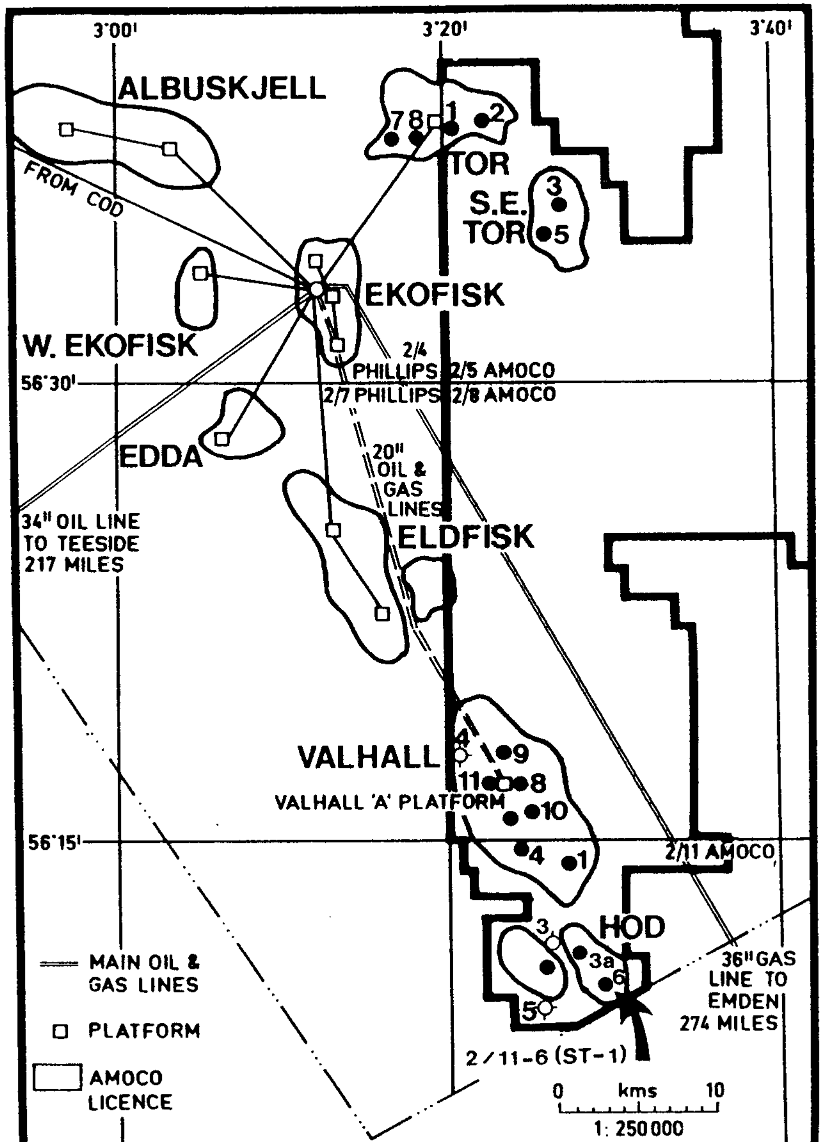
FINAL GEOLOGICAL WELL REPORT

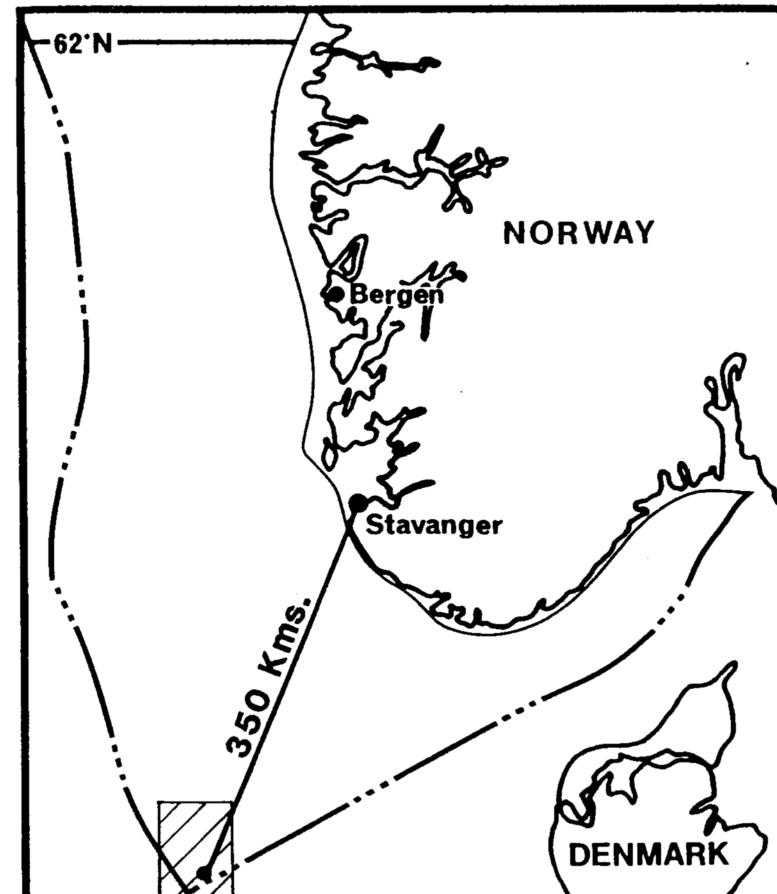
2/11-6, 2/11-6 ST-1

AMOCO NORWAY OIL COMPANY

STAVANGER

SEPTEMBER 1982





VALHALL & HOD FIELDS LOCATION MAP

TABLE OF CONTENTS

ATTACHMENTS

	2/11-6	2/11-6 ST-1
Composite Well Log: 1:500, Measured Depth	X	X
Composite Well Log: 1:500, TVD	-	X
Core Logs : Cores 1 - 7	X	-

INTRODUCTION

Well 2/11-6 was recommended based on a re-evaluation of the Hod Field in connection with a reinterpretation of the seismic data which was presented to partners in the report "Hod Field, Geology, Geophysics and Potential Reserves" in May 1981.

The following factors for the selection of the 2/11-6 well location were decisive:

1. The well had to be a potential producing well where a sizable amount of reserves could be drained.

2. The well had to prove a maximum of reserves as based on the results the decision had to be made if the Hod Field development would be economically feasible.

3. The well had to provide the maximum amount of information for a better understanding of the geologic history and structural outline to aid future development plans.

4. So far as possible, it had to be a low risk well, as poor results could delay further field development. In particular it was important not to drill a well that would find no pay and leave other possible reserves untested.

When Amoco Norway submitted the well proposal for 2/11-6 to the Norwegian Petroleum Directorate for approval, it was granted, but the well designation had to be changed to 2/11-A1 as the well, drilled through a 12 slot template, was considered to be a development well. Following a statement of Amoco Norway who strongly emphasized the exploratory character of this well NPD agreed at a later date that the well should bear its original 2/11-6 designation.

Well 2/11-6 reached a TD of 3970 m in Lower Hod Formation when the drill pipe got stuck and could not be retrieved. The well was then successfully sidetracked below the 9 5/8" casing and was designated

2/11-6A during the drilling period. However, at a later date it was corrected to 2/11-6 ST-1, as the objective in the two bore holes remained the same, both in geological and structural point of view. The report on the sidetracked well, which reached a TD of 4076 m in Lower Cretaceous, is attached to this report under a separate chapter.

A. WELL 2/11-6

SUMMARY OF WELL DATA

Well Classification	:	Appraisal Well on Hod
API No.	:	975770034800
Licence	:	033
Block	:	2/11
Partners	:	Amoco Norway (Operator) 25 % Amerada Norway 25 % Texas Eastern 25 % Noco 25 % (Statoil has a 10% net profit before taxes)
Location Coordinates/ Template	:	Latitude : 56°10'35,52"N Longitude: 03°27'36,62"E
Contractor	:	South Eastern Drilling Co.
Rig	:	Sedco 703 Semi-submersible
Mud Logging Company	:	The Analysts (Schlumberger)
Electrical Logging Company	:	Schlumberger Inland Services
RKB-MSL	:	26 m
Water Depth	:	72 m
Total Depth	:	3970 m RKB (2905 m TVD) (-2879 m MSL)
Date on Location	:	25 August 1981
Spud Date	:	02 September 1981
Date TD Reached	:	09 December 1981
Completion Date (Plugged)	:	17 December 1981 (before sidetrack)
Objectives	:	Upper Cretaceous Chalks of the Tor and Hod Formations on the East Hod Structure
Formation at TD	:	Upper Cretaceous Hod Formation
Present Status	:	P&A, fish in hole, sidetracked, 2/11-6 ST-1

Casing Records

30" Surface Conductor	:	167 m MD	167 m TVD
20" Casing	:	352 m MD	352 m TVD
13 3/8" Casing	:	1452 m MD	1271 m TVD
9 5/8" Casing	:	3593 m MD	2675 m TVD

Bottom Hole Locations - Well 2/11-6

Reference Point : Coordinates of Template:

Latitude : 56°10'35.52"N
Longitude: 03°27'36.62"E

UTM : 6.225.960.5 N
528.570.2 E

Top Chalk at : 3690 m MD RKB, 2732 m TVD RKB
(-2706 m TVD Subsea)

686.89 m South
2071.19 m East

Bottom Hole at : 3970 m MD RKB, 2904.96 m TVD RKB
(-2879.00 m TVD Subsea)

709.00 m South
2290.65 m East

Wireline Logs

The logging was performed by Schlumberger Inland Services.

The following logs were run:

ISF/BHC-GR*	Run No.	1	167 - 358 m	MD-RKB
DIS/LSS-GR-CAL 1)*	"	1	352 - 694 m	"
GR*	"	1	90 - 1460 m	"
DIS/LSS-GR-CAL*	"	2	1451 - 3600 m	"
DIS/LSS-GR*	"	3	3589 - 3790 m	"
LDT/CNL-GR-CAL*	"	1	3589 - 3790 m	"
CBL/VDL-GR 13 3/8" csg.	"	1	352 - 1408 m	"
CBL/VDL-GR 9 5/8" csg.	"	2	950 - 3554 m	"
CYBERBOND 9 5/8" csg.	"	1	950 - 3554 m	"

In addition Schlumberger provided the following logs:

WAVEFORM RECORDING	3589 - 3789 m MD-RKB
CORIBAND LOG*	3640 - 3790 m "

1) The Tool failed to penetrate below 694 m due to obstruction in the hole, and the GR log was run through the casing to cover the section.

* These logs are available in TVD versions as well. The bottom hole section 3790 - 3970 m RKB was not logged due to a fish in the hole. The pipe was freed at 3669 m and the well was sidetracked.

Conventional Coring

A total of seven conventional cores was taken in the Upper Cretaceous Chalk. Part of the coring was carried out with a plastic sleeve inner core barrel and using an oil-faze mud to preserve the native state of the core. The cores which were cut for special reservoir engineering studies, were waxed and sealed at the drill site and sent to Amoco's Laboratories at Tulsa, USA. In order not to damage the cores only a sketchy description of the cores could be carried out and is given on the following pages. The results of the core studies at Amoco's laboratory at Tulsa will be subject of a special report. Small core chips at about 50 cm intervals were sent to Robertson Research for age determination.

Core No.	Interval	Cored	Rec.	%	Age, Formation
1	3693.0-3702.0	9.0	4.72	52.4	Late Campanian
2	3702.0-3709.5	7.5	7.84	100.0	Early Campanian-
3	3709.5-3715.5	6.0	2.69	44.8	?Santonian
4	3715.5-3720.0	4.5	3.75	83.0	
5	3720.0-3724.5	4.5	3.75	83.0	Coniacian -
6	3724.5-3733.0	8.5	4.15	48.8	Turonian
7	3733.0-3741.0	8.0	7.10	89.0	

Tests

No tests were performed.

GEOLOGICAL AND STRUCTURAL DEVELOPMENT

In pre-Cretaceous times a trough was present in the Hod Field area. Throughout Jurassic and Lower Cretaceous time, the basin was filled with shale.

When the deposition of the chalk started, the region of the present Hod Field was predominantly flat. The underlying shale is believed to have been unstable due to overburden and started to flow, initiating structural growth. A continuous slow structural growth in a deep water environment (600 meters) existed throughout Lower Hod deposition, with a possible erosional phase at the end of Lower Hod time. The Lower Hod section in 2/11-2, thicker than in 2/11-5, indicates a paleocrest to the south of the present West Hod crest in Lower Hod time. Deep water conditions prevailed in Middle Hod time and a gradual shallower water environment existed during Upper Hod time.

Towards the end of Upper Hod time, erosion over a large part of West Hod took place, removing completely the Upper and Middle Hod on the crest. Some Middle Hod is present in 2/11-5 at the south flank of the West Hod structure. A thinner Middle-Upper Hod section in 2/11-3A compared to 2/11-3 is observed which indicates erosion of the Middle and Upper Hod.

Following this erosional phase at the end of Upper Hod time, deposition of the Tor Formation took place over the structure. Faulting caused thickening of the Tor Formation on the southwest flank of West Hod, on the crest and the east flank of East Hod. A subsequent erosional phase removed the Tor Formation completely from the crest of West Hod and on the upthrown side of the fault on East Hod. The presence of Tor Formation in the low between East and West Hod is postulated. During post-Danian time structural uplift continued, increasing the structural relief of the Hod structures but without affecting the distribution of the Chalk.

The Hod Field structures are shown as northwest-southeast oriented elongate domes. The trend is similar to other (Valhall and Eldfisk) structures in the southernmost Norwegian offshore acreage. The northwest-southeast trend of the faults over the Hod structure is also parallel to sub-parallel to the regional fault trend.

STRATIGRAPHY

INTRODUCTION

Well 2/11-6 drilled a nearly complete Tertiary section and bottomed in the lower part of the Chalk Group. Robertson Research International carried out a routine biostratigraphic study which is presented in a separate report (Robertson Research Int., Report No. 2788P/A, August 1982).

As the fossil assemblages in the Tertiary sequence do not always allow us to clearly recognize biostratigraphic units and since the bore hole has been subject to large washouts causing sloughing, it was attempted for correlation purpose to define primarily the three major lithostratigraphic groups of the Tertiary:

Nordland Group
Hordaland Group
Rogaland Group

Where possible the Tertiary ages recognized by Robertson Research were matched with distinctive lithologic and log breaks which are described and defined in Deegan and Scull (1977).

The Cretaceous sequence belonging entirely to the Chalk Group is subdivided into its formations and members which have been correlated with all Hod Field wells:

Tor Formation

Hod Formation
- Upper Hod Member
- Middle Hod Member
- Lower Hod Member

The Paleocene-Danian Ekofisk Formation has not been identified in this well.

The lowermost portion of the bore hole between 3790 and 3970 m (TD) is not covered by wireline logs due to a fish left in the hole. For correlation purposes the ROP curve of the mud log correlated with the GR in Well 2/11-6 ST-1 is used for placing the top of the Middle and Lower Hod Members.

STRATIGRAPHIC TOPS

Biostratigraphy

	2/11-6		
	RKB	TVD	Subsea TVD
QUATERNARY			
Pleistocene	98.0 m	98.0 m	-72.0 m
TERTIARY			
Pliocene	462.0 m	462.0 m	-436.0 m
Miocene	936.0 m	917.0 m	-891.0 m
Oligocene	1792.0 m	1496.0 m	-1470.0 m
Eocene	2574.0 m	2023.0 m	-1997.0 m
Palaeocene	3564.0 m	2659.0 m	-2633.0 m
UPPER CRETACEOUS			
Maastrichtian	3690.0 m	2732.0 m	-2706.0 m
Late Campanian	3693.0 m	2735.0 m	-2709.0 m
Early Campanian/Santonian	3702.0 m	2739.0 m	-2716.0 m
Coniacian/Turonian	3716.0 m	2748.0 m	-2722.0 m

Lithostratigraphy

	RKB	TVD	Subsea TVD
NORDLAND GROUP	98.0 m	98.0 m	-72.0 m
HORDALAND GROUP	1792.0 m	1496.0 m	-1470.0 m
ROGALAND GROUP	3564.0 m	2659.0 m	-2633.0 m
Upper Unit	3564.0 m	2659.0 m	-2633.0 m
Middle Unit	3585.0 m	2671.0 m	-2645.0 m
Lower Unit	3640.0 m	2702.0 m	-2676.0 m
CHALK GROUP	3690.0 m	2732.0 m	-2706.0 m
Tor Formation	3690.0 m	2732.0 m	-2706.0 m
Hod Formation	3716.0 m	2748.0 m	-2722.0 m
Upper Hod Member	3716.0 m	2748.0 m	-2722.0 m
Middle Hod Member	3784.0 m	2788.0 m	-2762.0 m
Lower Hod Member	3873.0 m	2843.0 m	-2817.0 m
CROMER KNOLL GROUP		Not Reached	

STRATIGRAPHIC SUMMARY

NORDLAND GROUP Age: Miocene to Recent (Roberts. Research)

Interval: 98 m - 1792 m MD (-72 to -1470 m TVD) 1398 m

Boundaries

The upper boundary is formed by the sea floor. The lower boundary is marked by the income of dark brown siltstones, and is marked on the gamma ray and sonic log as strong deflections to the left.

Lithology

The seabed sediments consist of bluish grey, soft clays with shell debris down to 210 m. The underlying section are mainly fine to medium-grained sands, which are subrounded and moderately sorted. Pyrite, glauconite, wood fragments and lignite are common accessories. Shell debris are very abundant, occasionally forming conquinas. From 310 m light grey, soft clays are the main lithology. The Miocene section consists mainly of soft, grey to brown-grey clays which gradually become firmer and grade to claystones. Below 1210 m white to tan limestone stringers are interbedded. At 1560 m green-grey claystones occur which become greener in colour downwards.

Comments

The contact between the Nordland and the Hordaland Group is above all based on a lithological change of greenish grey claystones to brown grey silty claystones and siltstones. Based on correlation with other Valhall and Hod wells, this event has been placed as an unconformity between the Lower Miocene and Oligocene. Almost as a rule hole conditions are very unstable in this section. Paleodating based purely on ditch cuttings should therefore be treated accordingly.

HORDALAND GROUP Age: Eocene to Oligocene

Interval: 1792 - 3564 m MD (-1470 to -2633 m TVD) 1163 m

Boundaries

The upper boundary is described above. The lower boundary is marked by the income at the steel grey tuff at the top of the Rogaland Group. The gamma ray and resistivity logs show an instantaneous increase when entering the Paleocene ash layer. The sonic log is cycle skipping over the same section, appearantly due to a wash-out just above and at the beginning of the tuff zone.

Lithology

The section down to 2250 m consists of homogeneous brown-grey siltstones interbedded with grey claystones and occasional stringers of fine-grained sandstones and limestones. The incoming of green-grey claystones at ca. 2750 m marks the top of the Lower Eocene, which normally is the thickest unit in the Tertiary in this area. White to buff limestone stringers become more frequent, and the silty claystones less abundant. Pyrite, glauconite and mica are common accessories.

ROGALAND GROUP Age: Late Paleocene to Early Paleocene, Danian (Robertson Research)

Interval: 3564 - 3690 m RKB (-2633 to -2706 m TVD SS)

Boundaries

The upper boundary is taken at the first income of tuff. The lower boundary with the Upper Cretaceous Chalk Group is clearly defined both by lithology and on wireline logs: at the top of the chalk the gamma ray readings show an abrupt decrease and the sonic log curve shows increasing velocity. Three Units can be distinquished in the Rogaland Group, but a correlation with the Balder, Sele and Lista Formations appears doubtful. In order to avoid confusion the three Units recognized in Well 2/11-6 are listed as Upper, Middle and Lower Units.

Lithology

The Rogaland Group consists of tuffaceous pale green, light grey and brown-grey shales, partially laminated and occasionally interbedded with few siltstone and limestone stringers. The amount of tuffaceous material decreases with depth and disappears completely in the lowermost part of the sequence.

Paleontology (Robertson Research)

Fossil assemblages indicative of Late Paleocene, comprising the Upper and the Middle Units, could not be identified by Robertson Research. The Lower Unit is recognized by log and lithological characteristics, and the fauna indicates an Early Paleocene - Danian age.

The age assigned to the Upper and Lower Units is based on stratigraphic position and the presence of volcanic material in the uppermost part of the interval.

The Rogaland Group can be subdivided into three units:

Upper Unit	3564.0 - 3585.0 m MD RKB	Late Paleocene
Middle Unit	3585.0 - 3640.0 m " "	
Lower Unit	3640.0 - 3690.0 m " "	Early Paleocene, Danian

Upper Unit

Interval: 3564.0 - 3585.0 m MD RKB   Age: Late Paleocene

Boundaries

The upper boundary is taken at the first income of tuff as described above. The lower boundary is basically a lithologic boundary with a colour change from dark brown to dark grey claystones and is placed where the GR shows a more regular high reading below the very high GR deflection.

Lithology

The Upper Unit is characterized by dark brown to pale green subfissile, soft to firm and non-calcareous shales with tuffaceous material of pale grey to light grey colour and with a granular texture. Glauconite is a rare constituent.

Middle Unit

Interval: 3585 - 3640 m MD RKB   Age: Late Paleocene

Boundaries

The boundary with the Upper Unit is described above. The lower boundary is mainly based on a lithological change from the overlying dark brown to light green shales to the more dark grey brown shales with limestone stringers. It was placed at the base of a sharp GR deflection to the left and at the base of a zone with higher resistivity readings.

Lithology

The Middle Unit is made up of dark grey to grey brown, subfissile, blocky, firm and noncalcareous shales with rare hard to medium hard limestone stringers of dark brown to buff colour.

Lower Unit

Interval: 3640 - 3690 m MD RKB   Age: Early Paleocene, Danian

Boundaries

The upper boundary is described above. The lower boundary is with the Chalk Group as defined under the Rogaland Group description.

Lithology

The Lower Unit is a sequence of light grey, soft, very calcareous shales interbedded with few limestone stringers of a buff to light brown colour.

Between 3670 and 3680 m a red-brown, soft to moderately hard, slightly to noncalcareous claystone is interbedded.

Comments

The red brown claystone has been spotted in nearly all wells drilled in the Valhall-Hod Field area and represents an marker bed above the Chalk Group.

CHALK GROUP — Age: Upper Cretaceous, Maastrichtian to Turonian (Robertson Research)

Interval: 3690 - 3970 m MD RKB (-2706 to -2879 m TVD SS)

The type area for the Chalk succession in the North Sea is the Ekofisk region where the Chalk Group is subdivided into five formations: the Ekofisk, Tor, Hod, Plenus Marl and Hidra Formations. The Ekofisk Formation which represents the Paleocene Danian in chalk facies is not present in Well 2/11-6; shales of Early Paleocene - Danian age unconformably overlie chalk of Early Maastrichtian. Only the Tor and Hod Formations have been penetrated in this well.

Boundaries

The upper boundary is with the shales of the Rogaland Group and is clearly seen on wireline logs and as a lithological change. The gamma ray curve deviates to the left in the chalk along with an increase in resistivity and sonic transit time. The lithology changes from light to medium grey shales of the Rogaland Group to pure, homogeneous white to tan chalk and is easily spotted in ditch cuttings.
The lower boundary of the Chalk Group with the Lower Cretaceous Cromer Knoll Group has not been drilled, due to a fish in the hole. The well was abandoned at a depth of 3970 m MD RKB in the lower part of the Lower Hod Member.

Lithology

The Chalk Group consists mainly of white to tan and buff, sometimes beige to brown-grey chalk and chalky limestone. Shales are frequently encountered and also more argillaceous varieties of chalk occur in the lower part of the sequence. Pyrite and in some cases glauconite are found on bedding planes and in fractures. The chalk is highly fractured.

The distinction between the Tor and the Hod Formations in the chalk lithology is based mainly on reservoir characteristics in combination with paleontological age dating and well log correlation with other Valhall-Hod Field wells.

Paleontology

The upper part of the Chalk sequence is covered by seven conventional cores, and in the lower part of the hole ditch cuttings have been used for age dating. Robertson Research assigns the Chalk sequence drilled in this well to range from Turonian to Early Maastrichtian. The Tor Formation is of Early Campanian/?Santonian to Maastrichtian and the Hod Formation of Turonian to Coniacian age. This age dating is basically in accordance with Deegan and Sculls (1977) definition of the Tor and Hod Formations.

Tor Formation

Interval: 3690 - 3716 m MD RKB (-2706 to -2722 m TVD SS)

Boundaries

The upper boundary is with the shales of the Rogaland Group as described above. The lower boundary is well recognized on the sonic log by a decrease in interval transit time, a sharp increase in density on the neutron density log an increase in resistivity. Lithologically it is a change from crumbly chalk to underlying dense chalky limestone.

Lithology

The Tor Formation consits of crumbly to firm, tan to light brown homogeneous chalk which is intensively crossed by hairline fractures. The Tor Formation is covered by cores 1 to 3 and is described in detail on the core logs.

Paleontology

According to Robertson Research the age of the Tor Formation ranges from Early Maastrichtian to Early Campanian to ?Santonian.

Hod Formation

Interval: 3716 - 3970 m MD RKB (-2722 to -2879 M TVD SS)

Boundaries

The upper boundary is described above. The lower boundary with the Hidra Formation has not been reached in this hole.

Lithology

remarkable Good Upper Hod porosity.

The Hod Formation consists of chalk and chalky limestone with more argillaceous sections. The porosity is markedly lower than in the Tor Formation. Pyrite and quartz are more common and shale bands are frequently seen. The fracture intensity is also considerably reduced compared with the overlying chalk.

Paleontology

According to Robertson Research the age range of the Hod Formation penetrated in Well 2/11-6 ranges from Coniacian to Turonian.

The Hod Formation is subdivided into:

Upper Hod Member	3716 - 3784 m MD RKB	
Middle Hod Member	3784 - 3873 m " "	
Lower Hod Member	3873 - 3970 m " "	(TD this hole)

Upper Hod Member

Interval: 3716 - 3784 m MD RKB (-2722 to -2762 m TVD SS)

Boundaries

The upper boundary is described above. The lower boundary with the Middle Hod Member is best illustrated by the logs of Wells 2/11-6 ST-1 where the sonic log shows a marked decrease in interval transit time and a characteristic gamma ray "kick" to the left. The resistivity curves show a slight but well recognizable decrease.

Lithology

The Upper Hod Member consists of chalk and chalky limestone. The section between 3716 to 3723 m MD RKB (log) is covered by cores 4 and 5 and described as a white to light grey and tan, dense, hard, brittle limestone, with abundant hairline fractures and bioturbations. Below this dense zone which is clearly seen on wireline logs follows a sequence of white to dirty white and buff, moderately hard, micritic chalk, with abundant fractures, stylolites and occasionally with a granular texture.

Middle Hod Member

Interval: 3784 - 3873 m M RKB (-2762 to -2817 m TVD SS)

Boundaries

The upper boundary is described above. The lower boundary with the Lower Hod Member is derived from the side tracked hole as due to a fish in the hole no logs have been run below 3790 m i.e. the interval of the Middle and Lower Hod Formations.

Lithology

The Middle Hod Member consists of off-white to buff, microcrystalline blocky and amorphous, soft to firm chalk, which includes some interbeds of medium grey, moderately soft to firm, slightly to very calcareous claystones. At the base the chalk becomes more argillaceous.

Lower Hod Member

Interval: 3873 - 3970 m MD RKB (-2817 to -2879 m TVD SS)

Boundaries

The upper boundary is described above. The well did not reach the boundary with the underlying Plenus Marl Formation.

Lithology

There is no obvious break in chalk lithology between the Middle and the Lower Hod Members and the change between the two members from ditch cuttings is gradational. Below 3930 m the chalk becomes a hard argillaceous chalk.

LITHOLOGICAL DESCRIPTION

All depths in meters below kelly bushing.
Description from ditch cuttings.

358 - 400 m: CLAY, grey, soft-sticky, soluble and mainly washed out. Trace of

SAND, loose grains, clear quartz, subang, mod srtd. Trace of glauconite, lignite and wood fragments. Good trace of shell debris.

400 - 490 m: SANDSTONE, loose, friable, fine-grained, occ grading to

SILTSTONE, ang-subang, mod srtd, non calc. Trace of glauconite, forams, shell fragments, lignite and wood fragments.

CLAY, grey, soft-sticky, soluble, amorph.

490 - 671 m: CLAY A/A, mainly washing out.

671 - 839 m: SANDSTONE interbedded with CLAY/CLAYSTONE

SAND/SANDSTONE, friable-loose, clear, occ lt brown quartz grains, subang, mod srtd, calc cmt, occ very abundant mica.

CLAY/CLAYSTONE, lt grey, occ blue grey, soft-firm, gen amorph, soluble, sticky, sl calc.

Trace of lignite, shell fragments, mica, forams, glauconite and occ pyrite.

839 - 1106 m: CLAY/CLAYSTONE locally grading to SILTSTONE, lt brown-grey-brown, firm, blocky, silty, micro-micaceous. Trace of lignite, shell fragment, mica, forams, glauconite and abundant pyrite.

1106 - 1369 m: CLAY/CLAYSTONE, lt-med grey, occ brown grey, soft-firm, blocky, non-sl calc, silty, micromicaceous, pyritic.

SANDSTONE, clear quartz, loose-friable, fine-med grained, ang-subang, poorly sorted. Trace of mica, pyrite, lignite, glauconite, shell fragments, forams.

Trace of LIMESTONE, buff-white, brown-dark grey-brown, soft-hard, microxln, argillaceous.

1369 - 1460 m: CLAYSTONE, lt-med grey, soft-firm, blocky, non-sl calc, micromic, silty, sl pyritic.

SANDSTONE, clear quartz, loose-friable, fine-med grained, ang-subang, poorly sorted, sl argill, non-sl calc, mic.

LIMESTONE, white-buff, occ dark brown, soft-hard, microxln, micritic, sl. argillaceous.

Trace of pyrite, glauconite, lignite, shell frag, forams, mica.

1460 - 1560 m: CLAYSTONE, lt-med grey, soft-firm, blocky, subfiss in places. Occ silty.

Trace of sand grains, fine-med, subang, loose, poorly srtd.

1560 - 1788 m: CLAYSTONE, lt greenish grey-med grey, firm-hard, occ subfissile, non calc, silty in places, grading to SILTSTONE. Trace of pyrite, calcite, mica.

1788 - 2255 m: SILTSTONE, lt brown-dark brown, occ grey brown. Firm, hard, blocky, sl.calc, mic, occ pyritic. Trace of pyrite, shell fragments, glauconite, forams, mica.

CLAYSTONE, lt-med grey, soft-firm, non calc, occ very silty, micaceous.

Trace of LIMESTONE, white-buff, occ dark brown, firm-hard, argill, occ trace of pyrite.

2255 - 2501 m: CLAYSTONE, lt-med grey, occ green grey, soft-firm, blocky and subfiss in places. Occ grading to

SILTSTONE, brown A/A.

LIMESTONE, lt brown, dense, occ white-buff, micritic, occ microxln, soft-hard, occ dolomitic, argillaceous. Occ abundant pyrite, occ glauconite.

2501 - 2590 m: CLAYSTONE, lt-med grey, mod hard, subfiss, silty-very silty, micromic, aggregated pyrite, glauconite specks.

SAND STRINGERS, clear-white quartz, loose-friable, fine to medium grained, frosted, mod-well srtd.

LIMESTONE, white-lt grey, mod hard, occ soft, sucrosic texture, micritic, occ pyrite, occ grading to DOLOMITE.

2590 - 3130 m: CLAYSTONE, lt grey-lt green grey, soft-firm, blocky, non calc, occ sl calc, occ silty, micromic, pyritic.

LIMESTONE, brown-buff, soft-firm, occ black carbonaceous streaks. Trace of pyrite, shell fragments, mica, occ glauconite.

3130 - 3560 m: CLAYSTONE, lt green grey - lt green, soft-firm, blocky, non-sl calc, occ silty, occ micromic.

LIMESTONE, lt brown-buff, micritic, argillaceous. Trace of pyrite, mica.

3560 - 3570 m: Tuffaceous SHALE/TUFF, lt grey, specked, soft-firm, silty, sucrosic texture, sl calc.

SHALE, green-lt green, firm, silty, sl calc, glauconitic.

SHALE, brown, firm, subfiss, non-sl calc. Occ abundant pyrite, glauconite, mica.

3570 - 3600 m: SHALE, dark grey brown-grey, firm subfiss, lam appearance, silty in places, non calc.

3600 - 3690 m: SHALE, dark grey to brown grey, occ green grey, firm, subfissile, occ blocky. Silty in places and in general non calcareous. Pyrite and glauconite are common accessories. Tuffaceous material is frequently encountered in the upper parts.

3690 - 3970 m: CHALK, white to light grey, occ brown grey to buff, in general hard, but crumbly sections occur at irregular intervals. Micritic, microxln and occ grading to LIMESTONE and MARL. Intensively fractured with both hairline fractures and larger open fractures. The fractures are in general filled with dark grey limestone or clear to dark calcite crystals. Pyrite is seen on bedding planes and in fractures.

B. WELL 2/11-6 ST-1

INTRODUCTION

The 2/11-6 ST-1 was sidetracked from 2/11-6 due to a fish in the hole. The well was sidetracked at 3626 m MD, and penetrated the chalk at an angle of 50 deg, compared with the original hole which was drilled with a 55 deg angle. The well encountered 220 m of chalk, and terminated in the Cromer Knoll Group of Lower Cretaceous age.

SUMMARY OF WELL DATA

Well Classification	:	Appraisal sidetrack from 2/11-6
API No.	:	975770034801
Operator	:	Amoco Norway
Location coordinates/ template	:	Latitude : 56°10'35.52"N Longitude: 03°27'36.62"E
Contractor	:	South Eastern Drilling Co.
Rig	:	Sedco 703
Mud Logging Company	:	The Analysts (Schlumberger)
Electrical Logging Company	:	Schlumberger Inland Services
RKB-MSL	:	26 m
Water Depth	:	72 m
Kick-off Point	:	3626 m MD RKB
Total Depth	:	4076 m MD (2981 m TVD) (-2955 m MSL)
Date on Location	:	25 August 1981
Spud Date	:	19 December 1981
Date TD Reached	:	29 December 1981
Completion Date	:	25 February 1982
Rig Released	:	27 February 1982
Total Days on Location	:	187 days, including 2/11-6
Objectives	:	Chalk of Upper Cretaceous age
Formation at TD	:	Lower Cretaceous, Cromer Knoll Group

Casing Records

7" liner	:	Top 3438 m Shoe 4072 m

Bottom Hole Location - Well 2/11-6 ST-1

Reference Point	:	Coordinates of Template Latitude : 56°10'35.52"N Longitude: 03°27'36.62"E UTM : 6.225.960.5 N 528.570.2 E
Top Chalk at	:	3685 m MD RKB, 2729 m TVD RKB (-2703 m TVD Subsea) 686.00 m East 2066.99 m South
Bottom Hole Location:		4076 m MD RKB, 2980 m TVD RKB (-2703 m TVD Subsea) 731.13 m East 2363.43 m South

Wireline Logs

The logging was performed by Schlumberger Inland Services. The following logs were run:

Type	Run No.	Interval	Date
DIL-LDL-NGT	1	3589-4076	30.12.1981
LDL-CNL-GR	2	3589-4080	02.01.1982
HDT	1	3589-4079	02.01.1982
RFT/GR 3675-3750 4 successful	1	3589-3952	02.01.1982
CST: Shots 30, Rec. 7, Lost 8, Misf. 15 in 7" liner	1		03.01.1982
CBL-VDL-CCL-GR	3	3386-4038	13.01.1982
Velocity Survey (SSL)	1		14.01.1982
HRT	1	3440-4028	14.01.1982

Tests

Two Drill Stem Tests were carried out. For the detail description of these tests please refer to the chapter on test results in the engineering section of the final well report.

DST No. 1	:	Interval 3875.0 - 3900.0 m MD RKB (-2825.7 to -2841.8 m TVD Subsea)
Flow Rate	:	2300 BOPD, 1.4 MMSCFGD
Choke	:	24/64"
GOR	:	608.7
FBHFP	:	5500 psi
FWHFP	:	2700 psi

DST No.2	:	Interval 3685.0 - 3735.0 m MD RKB (-2703.7 to -2735.8 m TVD Subsea)
Flow Rate	:	5800 BOPD, 3.3 MMSCFGD
Choke	:	48/64"
GOR	:	569.0
FBHFP	:	± 4500 psi
FWHFP	:	± 1200 psi

STRATIGRAPHY

INTRODUCTION

The sidetracked hole was kicked-off in the Rogaland Group at 3626 m RKB and drilled an almost identical chalk sequence as in the original 2/11-6 hole.

No conventional cores were cut as Tor and Hod Formations were considered to be sufficiently covered by cores from the original hole. For paleontological back-up sidewall cores were taken. Though the recovery was very low no attempt was made to run a second core gun for fear of damaging the bore hole prior to setting the 7" liner.

The biostratigraphy is based on ditch cuttings and on 7 sidewall cores and is presented in Robertson Research Report No. 2788P/A which is presented under separate cover.

STRATIGRAPHIC TOPS

The TVD depths are calculated from the Gyro Survey and are final results.

	MD	TVD	TVDSS	Thickness
ROGALAND GROUP	3564.0 m	2659.0 m	-2633.0 m	70 m
TOP CHALK GROUP	3685.0 m	2729.0 m	-2703.0 m	220 m
Tor Formation	3685.0 m	2729.0 m	-2703.0 m	14 m
Hod Formation	3706.0 m	2743.0 m	-2717.0 m	206 m
Upper Hod Member	3706.0 m	2743.0 m	-2717.0 m	43 m
Middle Hod Member	3773.0 m	2786.0 m	-2760.0 m	57 m
Lower Hod Member	3862.0 m	2843.0 m	-2817.0 m	106 m
CROMER KNOLL GROUP	4027.0 m	2949.0 m	-2923.0 m	+ 32 m
TOTAL DEPTH	4076.0 m	2981.0 m	-2955.0 m	

STRATIGRAPHIC SUMMARY

ROGALAND GROUP

Interval: 3564 - 3685 m MD RKB (-2633 to -2703 m TVD Subsea)

Boundaries

The upper boundary of the Rogaland Group is behind casing and described in the 2/11-6 well report.

The lower boundary is with the chalk and is clearly defined by wireline log: the gamma ray has a sharp and strong negative deflection; in addition there is a sharp velocity and a sharp resistivity increase. Lithologically it is a change from red brown/gray-green shales to tan, brownish-white chalk.

Lithology

The well was sidetracked 33 m below the 9 5/8" casing shoe with the kick-off point at 3626 m MD RKB and is made up of the same lithological sequence as described in Well 2/11-6: grey green and light grey, slightly to non-calcareous firm to soft shales, interbedded with few buff, microcrystalline, hard limestone beds. The red-brown, moderately firm claystone is reported between 3672.5 and 3680.0 m.

Paleontology

As in the original hole, Robertson Research divides the Rogaland Group into a Late and an Early Paleocene, the boundary being at 3637.5 m MD RKB. The interval representing the Late Paleocene has been defined based on its stratigraphic position. Though the fauna assemblages of the lower interval are very poor an Early Paleocene Danian age is suggested.

Hydrocarbon Shows

Nil

CHALK GROUP Age: Early Maastrichtian to Turonian, Robertson Research

Interval: 3685 - 4027 m MD RKB (-2703 to -2923 m TVD Subsea)

Boundaries

The upper boundary is marked by an abrupt change in lithology from shales of the Rogaland Group to Upper Cretaceous chalk. On wireline logs the break can be easily seen as deflection to the left in GR and an increase of the t curve.

The lower boundary is with the shales of the Lower Cretaceous Cromer Knoll Group. It is clearly defined on wireline logs and on lithological grounds. The logs show a marked increase of gamma ray and sonic transit time readings.

Lithology

The Chalk Group consists mainly of white to tan and buff, sometimes beige to brown-grey chalk and chalky limestone. Shales are frequently encountered in the lower parts of the sequence.

Subdivision

In the 2/11-6 ST-1 well the Chalk Group can be subdivided into two formations, the Tor and the Hod Formations and three members can be recognized in the Hod Formation.

Based on paleontological dating by Robertson Research and log correlation, the Plenus Marl and Hidra Formations cannot be identified. The Turonian Lower Hod Member unconformably overlies dark shales dated as Middle Albian of the Cromer Knoll Group.

Paleontology

Robertson Research assigns the Chalk Group an Early Maastrichtian to Turonian age.

Cores have not been taken and the paleontological dating is entirely based on ditch cuttings. This gives a slightly different age range of the upper chalk sequence compared with Well 2/11-6 which is covered by cores.

Tor Formation

Interval: 3685 - 3706 m MD RKB (-2703 to -2717 m TVD Subsea)

Boundaries

The upper boundary is formed by the top of the chalk and is marked by an abrupt change from shale of the Rogaland Group to Upper Cretaceous chalk. The boundary is easily seen on all Schlumberger logs. The gamma ray curve has marked negative deflection, and the sonic log shows increasing velocity.

The lower boundary is with the Hod Formation, and is seen on the sonic and density log as sharp deflection to the right.

Lithology

The Tor Formation consists of white to tan, occasionally buff to light grey, soft to firm, occasionally hard, blocky to crumbly, micritic chalk with abundant fractures.

Hydrocarbon Shows

Good oil shows. Petroliferous odour, bright yellow golden fluorescence, moderately fast streaming milky white cut, brownish residue.

Paleontology

According to Robertson Research the fossil assemblages indicate an Early Maastrichtian for the interval 3685 - 3702.5 m MD RKB and a Late to Early Campanian (?Santonian) for the interval 3702.0 - 2606 m MD RKB.

Hod Formation

The Hod Formation is divided into upper, middle and lower members based on log characteristics and lithology.

Upper Hod Member

Interval: 3706 - 3773 m MD RKB (-2717 to -2760 m TVD Subsea)

Boundaries

The upper boundary is with the Tor Formation and is recognized as a sharp deflection to the right on the sonic and density logs. The lower boundary with the Middle Hod Member is marked on both the sonic and density logs as a prominent shift to the right of the t and an increase in density.

Lithology

The section between 3706 - 3713 m consists of a grey white to tan, dense, hard, microcrystalline chalky limestone to limestone with hairline fractures. This interval is clearly defined on the density log. Below this dense zone follows a sequence of off-white to grey and buff, soft to firm, blocky chalk of uniform appearance.

Hydrocarbon Shows

The shows on ditch samples are rated as good to fair with a dull white to bright yellow and gold fluorescence, streaming yellow white cut, clouding brown white crush cut and a brown residue.

Paleontology

According to Robertson Research the Middle Hod Member ranges from Late Turonian to Early Campanian. The top of the Turonian is placed at 3742.5 m as defined by micropalentology and nannofossils.

Middle Hod Member

Interval: 3773 - 3862 m MD RKB (-2760 to -2817 m TVD Subsea)

Boundaries

The upper boundary is described above. The lower boundary with the Lower Hod Member is marked by slight deflections to the left on the gamma ray, sonic and density logs.

Lithology

The chalk of the Middle Hod Member has in general the same appearance as the chalk of Upper Hod. The chalk becomes somewhat harder down hole and there are some very rare thin, medium grey, firm, blocky and calcareous interbeds of claystones.

Hydrocarbon Shows

The shows on ditch samples are rated as poor to very poor, with a dull white to brown white fluorescence, none to poor dull white streaming cut, a yellow white cloudy crush cut and a trace of light brown residue.

Paleontology

The entire Middle Hod Member is within the Turonian.

Lower Hod Member

Interval: 3862.0 - 4027.0 m MD RKB (-2817 to -2923 m TVD Subsea)

Boundaries

The upper boundary is described above. The lower boundary is the contact with the Lower Cretaceous Cromer Knoll Group and is well defined both on gamma ray and sonic log as distinct log breaks: the gamma ray shows a sharp positive deflection of over 90 API units and the sonic log has a strong increase in transit time.

The lower boundary is an unconformity where chalk of the Turonian Lower Hod Member overlies Middle Albian, dark shales of the Cromer Knoll Group.

Lithology

The Lower Hod Member consists of off-white, light grey, firm to hard chalk and chalky limestone beds which are interbedded with medium grey, calcareous to non-calcareous claystones. The chalk becomes more argillaceous with increasing depth.

Hydrocarbon Shows

Very poor to nil shows have been reported on ditch cuttings.

Paleontology

The entire section of the Lower Hod Member belongs to the Turonian.

CROMER KNOLL GROUP

Interval: 4027 - 4076 m MD RKB & TD (-2923 to -2955 m TVD Subsea)

Boundaries

The upper boundary is with the Lower Hod Member. The well was drilled 51 meters into the Cromer Knoll Group and reached a total depth of 4076 m MD RKB.

Lithology

The sequence consists of medium to dark grey and blackish, hard, slightly to non-calcareous shales.

Paleontology

Faunal assemblages indicate a time range from Barremian to Middle Albian. The distinction between the Rødby and Valhall Formations could not be made. According to Deegan and Scull the whole section penetrated could be assigned to the Valhall Formation.

SIDE WALL CORE DESCRIPTION
RUN NO.1

Shots
- 30
- 15 Misfired
- 8 Lost
- 7 Recovered

Core	Depth	
15	3797.0 m	Recovery: 54.9 %
	CHALK:	Light grey, light beige, mod hard, crumbly, microxln-cryptoxln, very pyritic, in parts concretions of pyrite.
		Shows: Dull white fluor, pale white streaming cut, white crush cut, no residue.
	Remarks:	The Chalk seems to be compressed and fractured from the impact of the explosion. The apparent softness and porosity is possibly resulted from that.
14	3810.0 m	Recovery: 78 %
	CHALK:	Light grey - very light beige, mod hard, flaky, crumbly, microxln, trace pyrite. Trace calcite/xln chalk.
		Shows: White fluor, pale white streaming cut, milky white crush cut. No visible residue.
6	3911.0 m	Recovery 49 %
	CHALK:	Light grey - very light beige, mod hard-hard, flaky, crumbly, microxln in places.
		Shows: Dull light brown fluor. No streaming cut. Very pale white crush cut. No residue.
5	4017.0 m	Recovery: 40 %
	CHALK:	Light grey - very light beige, flaky, crumbly, microxln-xln in places. Trace glauconite, trace pyrite.
		Shows: Dull white fluor, slow pale white streaming cut, white-milky white crush cut.

Core	Depth	
4	4020.0 m Interbedded CHALK and CLAYSTONE:	Recovery: 50 % Chalk, light beige - tan, hard, crumbly, microxln. Shows: Dull yellow fluor, very pale white slow streaming cut. Pale white crush cut. Claystone, med-dark grey, mod hard, sticky, soft and soluble when wet, light brown chalky and grey argillaceous laminae, occ pyritic bands. Very calcareous.
3	4028.5 m CHALK:	Recovery: 37,5 % Light brown, mod hard, crumbly, microxln, grey argillaceous streaks w/trace muscovite and pyrite. Inclusions of light green shale, waxy lustre, appears as green specks in the Chalk. No fluor. Dull yellow cut; yellow brown crush cut.
1	4070.0 m LIMESTONE/ CHALK:	Recovery: 50 % Grey, brown, hard, fractured, slickensides, waxy lustre, grey, chalky, very pyritic in places, hard, microxln, brecciated? Few laminae of light green shale, mod hard, waxy lustre, pyritic, very calcareous.

CORRELATION 2/11-6 AND 2/11-6 ST-1

<u>Formation Tops</u>

Depth in meters

	2/11-6			2/11-6 ST-1		
	MD RKB	TVD RKB	TVD SS	MD RKB	TVD RKB	TVD SS
ROGALAND GROUP	3564	2659	-2633	3564	2659	-2633
CHALK GROUP						
Tor Formation	3690	2732	-2706	3685	2729	-2703
Hod Formation						
Upper Hod Member	3716	2748	-2722	3706	2743	-2717
Middle Hod Member	3784	2788	-2762	3773	2786	-2760
Lower Hod Member	3873	2843	-2817	3862	2843	-2817
CROMER KNOLL GROUP				4027	2949	-2923

COMMENTS

The prediction for Well 2/11-6 was based on the results of the 2/11-3A well and the structural map of the 1980 seismic interpretation. It was expected to drill the top of the chalk at -2677 m* subsea, at the same depth as in Well 2/11-3A. Well 2/11-6 ST-1 encountered the top chalk objective at -2703 m subsea, 26 m structurally lower than anticipated.

The explanation for cutting top Chalk 26 m lower is two-fold:

1. Well 2/11-6 ST-1 penetrated the chalk objective 92 m SW (Az. 202.38°) of the intended location. Structural dip at this location is calculated to be about 7° to the south. Due to this dip the top of the chalk is about 11 m structurally lower than at the intended location, i.e. at about -2688 m subsea.

   In summary, the difference of 15 m (i.e. 26 m - 11 m) between the actual and anticipated depths falls within the tolerance of seismic accuracy for a time/depth conversion in an area of limited control.

2. Well and seismic velocity control over the East Hod Field are limited and the 1981 Hod water gun seismic survey was not available when the well was recommended for drilling.

Based on the results of Well 2/11-3A it was anticipated to encounter a 48 m thick Tor chalk sequence in Well 2/11-6, 2/11-6 ST-1. However, only 14 meters of Tor Formation were encountered in Well 2/11-6 ST-1, as defined by log correlation and age dating. The drastic thinning of the Tor Formation between Wells 2/11-3A and 2/11-6 ST-1 is the result of a strong erosional phase in Late Maastrichtian time in combination with a paleohigh south of the Hod Field structures.

* This value was originally -2667 m subsea. Due to a survey error in Well 2/11-3A it had to be corrected to -2677 m subsea at a later date.