

**General information**

Wellbore name	31/2-13 S
Type	EXPLORATION
Purpose	APPRAISAL
Status	P&A
Factmaps in new window	link to map
Main area	NORTH SEA
Field	TROLL
Discovery	31/2-1 (Troll Vest)
Well name	31/2-13
Seismic location	81 007-412 SP 337.5 & 82-430 SP 102
Production licence	054
Drilling operator	A/S Norske Shell
Drill permit	401-L
Drilling facility	BORGNY DOLPHIN
Drilling days	74
Entered date	02.01.1984
Completed date	15.03.1984
Release date	15.03.1986
Publication date	19.12.2007
Purpose - planned	APPRAISAL
Reentry	NO
Content	OIL/GAS
Discovery wellbore	NO
1st level with HC, age	LATE JURASSIC
1st level with HC, formation	SOGNEFJORD FM
Kelly bushing elevation [m]	25.0
Water depth [m]	333.0
Total depth (MD) [m RKB]	2010.0
Final vertical depth (TVD) [m RKB]	1727.6
Maximum inclination [°]	46.2
Bottom hole temperature [°C]	60
Oldest penetrated age	MIDDLE JURASSIC
Oldest penetrated formation	FENSFJORD FM
Geodetic datum	ED50
NS degrees	60° 47' 14.15" N
EW degrees	3° 26' 3.43" E
NS UTM [m]	6739329.73
EW UTM [m]	523646.72



UTM zone	31
NPDID wellbore	93

Wellbore history

General

Well 31/2-13 S was drilled as an appraisal in the Troll West oil province in the Northern North Sea. The main objectives of were to investigate the reservoir properties and accumulation conditions between the wells 31/2-5 and 31/2-11. Water and/or gas - coning tests were to be conducted.

Operations and results

Appraisal well 31/2-13 S was spudded with the semi-submersible installation Borgny Dolphin on 2 January 1984 and drilled to TD at 2010 m in the Middle Jurassic Fensfjord Formation. Due to bad weather the string parted and was observed lying across the temporary guide base when the well was spudded. The fish was recovered. Straight hole was drilled down to 500 m where the hole was kicked off with an angle of 1 1/2 degree. Some problems due to tight hole occurred in the 17 1/2" hole. Mud losses to the formation occurred at 1531 and 1700 m, 100 bbls at each depth. A drill break occurred at 1744 m in the 12 1/4" hole section. The well was drilled with seawater and viscous pills down to 473 m, with Gelled mud from 473 m from 473 m to 750 m, with seawater from 750 m to 825 m, and with oil based mud from 825 m to TD. The Oil based mud used was termed "Fazekleen, low toxicity invert oil emulsion mud, based on Shell Sol D70 oil"

Top reservoir (top Sognefjord Formation) was penetrated at 1732 m (1526.5 m TVD), top Heather Formation at 1855 m (1613 m TVD), and top Fensford Formation sandstone at 1934 m (1671 m TVD). Oil and gas were encountered in the Sognefjord Formation. The GOC was at 1790 m (1567 m TVD) and the FWL was estimated at 1828.5 m (1594 m TVD). Strong to moderate fluorescence was observed on the cores down to 1844 m (1606 m TVD), but heavy contamination from the oil-based mud made shows detection somewhat uncertain. The upper half of the oil bearing formation consisted of generally clean sandstones. Below 1555 m TVD the sands were micaceous. Tight calcareous streaks occurred over the whole section. The core permeability in the clean sands ranged from 4 D to 15 D. In the micaceous sands the permeability were from 10 mD to 100 mD.

Eight fibreglass sleeve cores were cut from 1744 to 1844 m in the Sognefjord Formation sands. Seventy metres (70%) were recovered. An RFT segregated fluid sample was taken in the oil zone at 1800 m.

The well was permanently abandoned on 15 March 1984 as a gas and oil appraisal well.

Testing

A Production test was performed through a 5" production tubing in the Late Jurassic sequence. During clean-up producing 810 Sm³/day gas cap gas broke through. The well was then produced at rates up to 604 Sm³/day. The gas-oil ratio increased from solution GOR (57 Sm³/Sm³) to 552 Sm³/Sm³. The produced oil had a gravity 0.88 - 0.89 G7cm³ (28 deg API), the gas 0.70-0.63 (air = 1). No formation water produced. The estimated critical rate (to gas coning) in 31/2-13, ca 315 Sm³/day, was significantly lower than in 31/2-5 (795 Sm³/day). Maximum down-hole temperature recorded in the production test was 65.2 deg C.



Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
480.00	2006.00

Cuttings available for sampling?	YES
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Cores at the Norwegian Offshore Directorate

Core sample number	Core sample - top depth	Core sample - bottom depth	Core sample depth - uom
1	1744.0	1754.0	[m]
2	1754.0	1757.0	[m]
3	1772.0	1782.0	[m]
4	1784.0	1795.0	[m]
5	1795.0	1807.0	[m]
6	1807.0	1813.0	[m]
7	1813.0	1824.0	[m]
8	1825.0	1840.7	[m]

Total core sample length [m]	78.7
Cores available for sampling?	YES

Core photos



1744-1756m



1756-1774m



1774-1778m



1778-1781m



1781-1786m



1786-1789m



1789-1793m



1793-1796m



1796-1800m



1800-1803m



1803-1807m



1807-1811m



1811-1814m



1814-1817m



1818-1822m



1822-1825m



1826-1829m



1829-1832m



1833-1837m



1837-1839m

Oil samples at the Norwegian Offshore Directorate

Test type	Bottle number	Top depth MD [m]	Bottom depth MD [m]	Fluid type	Test time	Samples available
DST	DST1	1801.00	1806.00	OIL	03.03.1984 - 00:00	YES

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
358	NORDLAND GP
783	HORDALAND GP
1460	ROGALAND GP
1460	BALDER FM
1540	SELE FM
1577	LISTA FM
1718	VÅLE FM
1728	SHETLAND GP
1732	VIKING GP
1732	SOGNEFJORD FM
1855	HEATHER FM
1934	FENSFJORD FM

**Documents - older Norwegian Offshore Directorate WDSS reports and other related documents**

Document name	Document format	Document size [MB]
93 01 WDSS General Information	pdf	0.18
93 02 WDSS completion log	pdf	0.19

Documents - reported by the production licence (period for duty of secrecy expired)

Document name	Document format	Document size [MB]
93 01 31 2 13 Completion Report and Completion log	PDF	7.74
93 02 31 2 13 Core description core 2-8	pdf	5.93
93 02 31 2 13 Data from meas. on samples	pdf	0.10
93 02 31 2 13 Directional drilling report	pdf	0.72
93 02 31 2 13 Drilling fluids summary	pdf	2.16
93 02 31 2 13 Drilling programme a	pdf	1.50
93 02 31 2 13 Drilling programme b	pdf	1.03
93 02 31 2 13 Drilling programme encl 1	pdf	0.43
93 02 31 2 13 Grain size distribution analysis	pdf	0.26
93 02 31 2 13 High Acc.press.temp	pdf	1.63
93 02 31 2 13 High acc.pressure Report post acid 82014	pdf	6.68
93 02 31 2 13 High acc.pressure Report post acid 83064	pdf	5.80
93 02 31 2 13 High acc.pressure Report pre acid a	pdf	2.66
93 02 31 2 13 High acc.pressure Report pre acid b	pdf	2.27
93 02 31 2 13 High rate gas flow test	pdf	0.72
93 02 31 2 13 Palynological results	pdf	0.91
93 02 31 2 13 Petrofysisk hurtig-evaluering	pdf	0.87
93 02 31 2 13 Petrofysisk hurtig-evaluering encl 1	pdf	0.83
93 02 31 2 13 Poro perm results	pdf	0.44
93 02 31 2 13 Poro perm results encl 1	pdf	0.14
93 02 31 2 13 Production test program	pdf	1.74
93 02 31 2 13 Production test program encl 1	pdf	0.20





93 02 31 2 13 Production test program en cl 2	pdf	0.26
93 02 31 2 13 Production test program en cl 3	pdf	0.15
93 02 31 2 13 Reservoir fluid study	pdf	0.77
93 02 31 2 13 Special core analysis study	pdf	2.45
93 02 31 2 13 Special core analysis study	pdf	0.72
93 02 31 2 13 Well testing report	pdf	26.29

Drill stem tests (DST)

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	1801	1807	21.0

Test number	Final shut-in pressure [MPa]	Final flow pressure [MPa]	Bottom hole pressure [MPa]	Downhole temperature [°C]
1.0				60

Test number	Oil [Sm3/day]	Gas [Sm3/day]	Oil density [g/cm3]	Gas grav. rel.air	GOR [m3/m3]
1.0	540	144180	0.880	0.630	267

Logs

Log type	Log top depth [m]	Log bottom depth [m]
CBL VDL GR	635	1697
CBL VDL GR	1450	1968
CST	0	0
DIL BHC GR	805	1675
DIL LSS GR	1699	2006
ISF BHC GR	455	823
LDL CNL GR	804	1677
LDL CNL GR	1699	2007
LDT CNL GR	455	825
NGS	1699	2007
RFT	1800	1800
RFT GR HP	1750	1992
VELOCITY	455	2006



**Casing and leak-off tests**

Casing type	Casing diam. [inch]	Casing depth [m]	Hole diam. [inch]	Hole depth [m]	LOT/FIT mud eqv. [g/cm3]	Formation test type
CONDUCTOR	30	455.5	36	468.0	0.00	LOT
SURF.COND.	20	806.0	26	813.0	1.81	LOT
INTERM.	13 3/8	1700.0	17 1/2	1710.0	1.61	LOT
INTERM.	9 5/8	1999.0	12 1/4	2007.0	0.00	LOT

Drilling mud

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
500	1.05			WATER BASED	
550	1.07			WATER BASED	
600	1.10			WATER BASED	
800	1.12			WATER BASED	
830	1.30			OIL BASED	
900	1.31			OIL BASED	
1140	1.40			OIL BASED	
1550	1.41			OIL BASED	
1750	1.25			OIL BASED	

Pressure plots

The pore pressure data is sourced from well logs if no other source is specified. In some wells where pore pressure logs do not exist, information from Drill stem tests and kicks have been used. The data has been reported to the NPD, and further processed and quality controlled by IHS Markit.

Document name	Document format	Document size [MB]
93 Formation pressure (Formasjonstrykk)	pdf	0.17

