General information

Wellbore name	16/4-6 S
Type	EXPLORATION
Purpose	WILDCAT
Status	P&A
Press release	link to press release
Factmaps in new window	link to map
Main area	NORTH SEA
Field	SOLVEIG
Discovery	16/4-6 S Solveig
Well name	16/4-6
Seismic location	LN0902.inline 4044 & crossline 1536
Production licence	359
Drilling operator	Lundin Norway AS
Drill permit	1429-L
Drilling facility	BREDFORD DOLPHIN
Drilling days	54
Entered date	11.03.2013
Completed date	03.05.2013
Release date	03.05.2015
Publication date	20.05.2015
Purpose - planned	WILDCAT
Reentry	NO
Content	OIL/GAS
Discovery wellbore	YES
1st level with HC, age	JURASSIC
Kelly bushing elevation [m]	25.0
Water depth [m]	100.5
Total depth (MD) [m RKB]	2233.0
Final vertical depth (TVD) [m RKB]	2213.0
Maximum inclination [°]	13
Bottom hole temperature [°C]	85
Oldest penetrated age	LATE TRIASSIC
Oldest penetrated formation	SKAGERRAK FM
Geodetic datum	ED50
NS degrees	58° 41' 33.84'' N
EW degrees	2° 13' 52.02'' E
NS UTM [m]	6506243.36
EW UTM [m]	455431.36

UTM zone	31
NPDID wellbore	7098

Wellbore history

General

Well 16/4-6 S was drilled on the Luno II prospect about 15 km south of the Edvard Grieg field on the Utsira High in the North Sea. The primary objective of the well was to prove petroleum in Middle to Late Jurassic reservoir rocks. Secondary objective was to test the hydrocarbon potential in underlying older rocks.

Operations and results

Wildcat well 16/4-6 S was spudded with the semi-submersible installation Bredford Dolphin on 11 March 2013 and drilled to TD at 2233 m (2213 m TVD) in the Late Triassic Skagerrak Formation. No significant problem was encountered in the operations. The well was drilled with spud mud down to 610 m and with water based Performadril mud from 610 m to TD.

Top of the target reservoir was reached at 1950 m (1931 m TVD). The target reservoir is capped by a 10 cm thick Cromer Knoll Group at 1950 m (1931 m TVD). The reservoir section consisted of a 248 m thick sandstone sequence assigned mainly to the Skagerrak Formation with the exception of the top four meters that could belong to the Vestland Group, based on the occurrences of a few questionable terrestrial palynomorphs of Middle Jurassic age. The reservoir contained a gross oil column of ca 45 metres down to an OWC at 1995 m (1975 m TVD). About 30 metres of the oil-bearing zone had good reservoir properties. The oil is saturated and is in contact with a thin gas zone at the top of the reservoir, above the tested zone. Below the OWC, there is a zone of biodegraded oil shows in contrast to the non-biodegraded oil above. This suggest that there has been more than one generation of hydrocarbons present. Diminishing oil shows are described intermittently down to the base of the cored section at 2024 m.

Three cores were cut in the interval from 1943.5 in the Tor Formation to 2024 m in the Skagerrak Formation. The core recovery was 99.7 to 100%. The core depth is ca 1 m deeper than logger's depth for all three cores. MDT fluid samples were taken at 1951.34 m (wet gas), 1952.54 m (wet gas), 1966.39 m (oil), 1978.73 m (oil), 1991.29 (water with trace oil), 1995.9 m (water), and 2028.18 m (water).

The well was permanently abandoned on 3 May 2013 as an oil discovery.

Testing

One Drill Stem Test was performed from the interval 1960.6 to 1980.6 m. In the main flow the test produced 271 Sm3 oil and 53900 Sm3 gas /day through a 40/64" choke. The GOR was 209 Sm3/Sm3, the oil density was 0.85 g/cm3, and the gas gravity was 0.82 - 0.85 (air = 1). H2S and CO2 contents were low, ca 0.1 ppm and 0.1 %, respectively. The DST temperature was 76.6 °C.

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
620.00	2233.00

Cuttings available for sampling?	YES

Cores at the Norwegian Offshore Directorate

Core sample number	Core sample - top depth	Core sample - bottom depth	Core sample depth - uom
1	1943.5	1968.7	[m]
2	1968.7	1997.0	[m]
3	1997.0	2023.9	[m]

Total core sample length [m]	80.4
Cores available for sampling?	YES

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		0.00	0.00	OIL	23.04.2013 - 00:00	YES
MDT		1966.39	0.00	OIL	04.04.2013 - 00:00	NO
MDT		1952.50	0.00	OIL	04.04.2013 - 00:00	NO

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
126	NORDLAND GP
126	UNDIFFERENTIATED
747	UTSIRA FM
950	UNDIFFERENTIATED
1053	HORDALAND GP
1053	UNDIFFERENTIATED
1077	SKADE FM
1232	NO FORMAL NAME
1610	NO FORMAL NAME
1778	ROGALAND GP
1778	BALDER FM

1787	SELE FM
1831	LISTA FM
1908	VÅLE FM
1915	SHETLAND GP
1915	EKOFISK FM
1922	TOR FM
1948	HOD FM
1951	CROMER KNOLL GP
1951	ÅSGARD FM
1951	VESTLAND GP
1951	UNDIFFERENTIATED
1955	HEGRE GP
1955	SKAGERRAK FM
2198	SMITH BANK FM

Drill stem tests (DST)

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	1961	1981	18.4

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

Test number	Oil [Sm3/day]	Gas [Sm3/day]	Oil density [g/cm3]	Gas grav. rel.air	GOR [m3/m3]
1.0	325				180

Logs

Log type	Log top depth [m]	Log bottom depth [m]
ADT PEX HRLA ECS HNGS	1915	2148
FMI HRLA PEX	1931	2229
FMI MSIP	1915	2149
MDT	1952	2028
MWD - GR RES DIR	1916	1943

MWD - GR RES NEU DEN SON DIR PWD	1917	2144
MWD - GR RES PWD DIR SON NEU	602	1921
MWD - GR RES SON DIR PWD	125	605
VSP	331	2210
XL-ROCK	1931	2207
XPT CMR GR	1930	2149

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	205.0	36	205.0	0.00	
SURF.COND.	20	603.0	26	610.0	1.95	LOT
PILOT HOLE		610.0	9 7/8	610.0	0.00	
OPEN HOLE		615.0	17 1/2	615.0	0.00	
INTERM.	9 5/8	1915.0	12 1/4	1921.0	1.50	FIT
OPEN HOLE		2233.0	8 1/2	2233.0	0.00	

Drilling mud

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
1392	1.39	53.0		Water Based	
1907	1.39	66.0		Water Based	
1996	1.20	30.0		Water Based	
2006	1.23	28.0		Water Based	
2006	1.20	27.0		Water Based	
2233	1.23	40.0		Water Based	