

**General information**

Wellbore name	34/4-7
Type	EXPLORATION
Purpose	APPRAISAL
Status	P&A
Factmaps in new window	link to map
Main area	NORTH SEA
Field	SNORRE
Discovery	34/4-1 Snorre
Well name	34/4-7
Seismic location	SG 8420 - 084 SP. 595
Production licence	057
Drilling operator	Saga Petroleum ASA
Drill permit	535-L
Drilling facility	TREASURE SAGA
Drilling days	85
Entered date	17.02.1987
Completed date	12.05.1987
Release date	12.05.1989
Publication date	26.10.2009
Purpose - planned	APPRAISAL
Reentry	NO
Content	OIL
Discovery wellbore	NO
1st level with HC, age	LATE TRIASSIC
1st level with HC, formation	LUNDE FM
Kelly bushing elevation [m]	26.0
Water depth [m]	354.0
Total depth (MD) [m RKB]	2950.0
Final vertical depth (TVD) [m RKB]	2950.0
Maximum inclination [°]	3.6
Bottom hole temperature [°C]	110
Oldest penetrated age	LATE TRIASSIC
Oldest penetrated formation	LUNDE FM
Geodetic datum	ED50
NS degrees	61° 31' 9.83" N
EW degrees	2° 15' 15.45" E
NS UTM [m]	6821032.19
EW UTM [m]	460326.58



UTM zone	31
NPDID wellbore	943

Wellbore history

General

Well 34/4-7 was drilled in the north-eastern margin of the Snorre Field. The Late Triassic - Early Jurassic reservoirs of the Snorre Field are made up of a complete series of rotated fault blocks dipping between 5 and 12 degrees towards west and northwest. The primary purpose of the well was to assess the upper part of the Lunde Formation. The well was located to provide data on the reservoir quality of both oil and water bearing parts of upper Lunde, and to investigate potential changes in porosity and permeability across the oil/water contact. Further objectives were to verify a revised velocity model for the 34/4 part of the Snorre Field and reduce structural uncertainty.

Operations and results

Wildcat well 34/4-7 was spudded with the semi-submersible installation Treasure Saga on 17 February 1987 and drilled to TD at 2950 m in the Late Triassic Lunde Formation. Drilling proceeded without significant problems. The 26" section was drilled first as a 17 1/2" pilot hole down to 915 m as a precaution against shallow gas, then opened up to 26" with an underreamer. The well was drilled with seawater and bentonite down to 470 m, with gel mud from 470 m to 915 m, with gypsum/polymer mud from 915 m to 2407 m, and with KCl mud from 2407 m to TD.

Apart from the Pliocene Utsira Formation at 1062 m and some minor sandy intervals in Middle Oligocene to Late Miocene, the upper section down to Triassic consists mainly of claystones. No Jurassic sediments were encountered in the well. The Triassic Lunde Formation was encountered at 2502 m, 35 m deeper than expected and is composed of sandstones with minor siltstones in the upper part. From 2736 m the Lunde Formation consists of interbedded sandstone, claystone and limestone and from about 2872 m to TD the lithology is mainly sandstones with minor claystone and limestone. Hydrocarbons were encountered in the section belonging to the upper member of the Lunde Formation, from 2502 m down to an OWC, defined from FMT pressure gradients and PLT logging during DST, at 2586 m. The cores from the oil bearing part reservoir shows light brown oil stain with good odour, strong bright yellow fluorescence, instant blue white cut and pale yellow residue upon evaporation. Below 2586 m both shows and cut become poorer, and from 2610 m there were no shows.

Apart from in the reservoir as described above traces of shows were seen first at 2080 m in silty/sandy laminas of the Shetland Group. These are described as yellow fluorescence with slowly to very slowly streaming white yellow cut. From 2270 m the shows are slightly decreasing to a dull yellow fluorescence with very slow streaming light yellow cut, occasionally no cut.

Ten cores were cut in the Lunde Formation in the interval 2506 - 2711.5 m with a total recovery of 199.4 m. Segregated FMT samples were taken at 2509 m, 2581.5 m, 2584.4 m, and at 2592.5 m. The sample from 2509 m was sent to the laboratory for PVT analyses. It contained ca 2 l oil and 1.1 l of mud filtrate.

The well was permanently abandoned on 12 May 1987 as an oil appraisal

Testing

Two production tests were performed in the upper member of the Lunde Formation.



Test No 1 was carried out from the intervals 2579 - 2587 m and 2590 - 2596 m, straddling the oil/water contact. The main flow produced 190 Sm³ oil and 215 m³ water/day through a 7.9 mm choke. The GOR was 105 Sm³/Sm³, the dead oil density was 0.833 g/cm³ and the gas gravity was 0.81 (air = 1). A Production Logging Test (PLT)-flow followed. The PLT flow confirmed the OWC at exactly 2586 m. The temperature recorded by the Production Logging tool was 99.4 deg C, close to the maximum 99.6 deg C measured in the preceding more unstable clean-up flow. After the PLT flow an injection test was performed as the final part of Test No 1.

Test No 2 was carried out from the intervals 2506 - 2512.5 m, 2517 - 2529 m, 2532.5 - 2535.5 m, 2544 - 2550.5, and 2560 - 2566 m in the oil zone. The well produced oil without water continuously for 18 days. During the last 17 days the test produced initially 1550 Sm³/day declining to a fairly constant rate around 1390 Sm³/day through a 14.3 mm choke. The GOR stabilised at 85 Sm³/Sm³ while the temperature stabilized at 96.9 deg C. The dead oil density was 0.835 g/cm³ and the gas gravity was 0.73 (air = 1). The wellhead pressure dropped from 184 to 161 bar through the test.

The down-hole test temperatures are significantly higher than the wire line temperatures from similar depths. The bottom hole temperature at final TD in the well are based on the temperature gradient given by the DST temperatures.

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
480.00	2950.00

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	2506.0	2511.0	[m]
2	2512.0	2531.2	[m]
3	2536.0	2563.5	[m]
4	2563.5	2591.3	[m]
5	2591.3	2603.0	[m]
6	2619.3	2647.0	[m]
7	2647.0	2656.5	[m]
8	2656.5	2675.0	[m]
9	2675.0	2692.7	[m]
10	2693.0	2711.7	[m]

Total core sample length [m]	183.3
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	DST1	2579.00	2596.00		02.04.1987 - 04:00	YES
DST	DST2	2506.00	2566.00		19.04.1987 - 16:00	YES

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
380	NORDLAND GP
1180	UTSIRA FM
1200	HORDALAND GP
1456	NO FORMAL NAME
1470	NO FORMAL NAME
1700	ROGALAND GP
1700	BALDER FM
1733	LISTA FM
1824	SHETLAND GP
1824	JORSALFARE FM
2076	KYRRE FM
2492	CROMER KNOLL GP
2492	RØDBY FM
2495	MIME FM
2502	HEGRE GP
2502	LUNDE FM

Geochemical information

Document name	Document format	Document size [MB]
943_1	pdf	0.79
943_2	pdf	2.14

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





Document name	Document format	Document size [MB]
943_01_WDSS_General_Information	pdf	0.42
943_02_WDSS_completion_log	pdf	0.24

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

Document name	Document format	Document size [MB]
943_01_34_4_7_Completion_Log	pdf	2.83
943_01_34_4_7_Completion_report	pdf	10.00

Drill stem tests (DST)

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	2596	2579	7.9
2.0	2506	2566	14.3

Test number	Final shut-in pressure [MPa]	Final flow pressure [MPa]	Bottom hole pressure [MPa]	Downhole temperature [°C]
1.0		13.000	38.000	99
2.0				96

Test number	Oil [Sm3/day]	Gas [Sm3/day]	Oil density [g/cm3]	Gas grav. rel.air	GOR [m3/m3]
1.0	190	19950	0.833	0.870	105
2.0	1378	118000	0.835	0.730	85

Logs

Log type	Log top depth [m]	Log bottom depth [m]
CBL GR	640	1872
CDL CNL GR	1872	2647
CDL CNL GR	2472	2940
CDL GR	902	1863
COREGUN	918	1867
COREGUN	1984	2925





DIFL LSBHC GR	902	1882
DIFL LSBHC GR	1872	2939
DIPLOG	1872	2941
DLL MLL GR	2450	2646
FMT HP	2509	2632
FMT HP	2509	2874
MWD	0	915
MWD	915	1887
MWD	1887	2950
VELOCITY	907	2926

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	465.0	36	470.0	1.16	LOT
SURF.COND.	20	902.0	26	915.0	1.59	LOT
INTERM.	13 3/8	1872.0	17 1/2	2145.0	1.83	LOT
INTERM.	9 5/8	2921.0	12 1/4	2950.0	0.00	LOT

Drilling mud

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
422	1.06			WATER BASED	18.02.1987
470	1.06			WATER BASED	20.02.1987
470	1.06			WATER BASED	23.02.1987
680	1.12	4.0	12.0	WATER BASED	23.02.1987
915	1.14	4.0	12.5	WATER BASED	23.02.1987
915	1.14	7.0	16.3	WATER BASED	23.02.1987
915	1.16	6.0	14.9	WATER BASED	24.02.1987
915	1.03			WATER BASED	27.02.1987
1113	1.16	20.0	10.6	WATER BASED	27.02.1987
1480	1.20	20.0	10.1	WATER BASED	02.03.1987
1644	1.30	25.0	11.1	WATER BASED	02.03.1987
1863	1.47	21.0	8.2	WATER BASED	05.03.1987
1887	1.47	21.0	7.2	WATER BASED	05.03.1987
1887	1.47	24.0	9.6	WATER BASED	05.03.1987
1887	1.47	24.0	10.6	WATER BASED	05.03.1987



2145	1.58	23.0	10.1	WATER BASED	10.03.1987
2298	1.68	26.0	11.5	WATER BASED	10.03.1987
2407	1.70	26.0	13.0	WATER BASED	10.03.1987
2471	1.70	23.0	7.7	WATER BASED	10.03.1987
2513	1.70	23.0	8.7	WATER BASED	10.03.1987
2563	1.70	26.0	8.7	WATER BASED	12.03.1987
2591	1.70	24.0	7.7	WATER BASED	12.03.1987
2647	1.70	25.0	8.7	WATER BASED	13.03.1987
2647	1.70	27.0	8.2	WATER BASED	23.03.1987
2647	1.70	25.0	8.7	WATER BASED	23.03.1987
2675	1.70	25.0	8.2	WATER BASED	23.03.1987
2712	1.70	25.0	8.2	WATER BASED	23.03.1987
2792	1.70	25.0	7.2	WATER BASED	23.03.1987
2869	1.70	13.0	4.4	WATER BASED	27.03.1987
2869	1.70	14.0	4.4	WATER BASED	27.03.1987
2869	1.70	12.0	5.3	WATER BASED	31.03.1987
2869	1.03			WATER BASED	13.04.1987
2869	1.70	20.0	4.8	WATER BASED	27.03.1987
2950	1.70	22.0	4.4	WATER BASED	27.03.1987
2950	1.70	25.0	8.2	WATER BASED	23.03.1987
2950	1.70	22.0	5.3	WATER BASED	
2950	1.70	23.0	6.3	WATER BASED	23.03.1987
2950	1.70	24.0	6.8	WATER BASED	23.03.1987
2950	1.70	22.0	4.4	WATER BASED	24.03.1987

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]
943 Formation pressure (Formasjonstrykk)	pdf	0.22

