



## **General information**





Wellbore name	2/6-5
Type	EXPLORATION
Purpose	WILDCAT
Status	P&A
Factmaps in new window	<a href="#">link to map</a>
Main area	NORTH SEA
Discovery	<a href="#">2/6-5 (Sundal)</a>
Well name	2/6-5
Seismic location	SG-9508 INLINE 1070 & CROSSLINE 692
Production licence	<a href="#">008</a>
Drilling operator	Saga Petroleum ASA
Drill permit	866-L
Drilling facility	<a href="#">DEEPSEA BERGEN</a>
Drilling days	56
Entered date	17.11.1996
Completed date	11.01.1997
Release date	11.01.1999
Publication date	24.09.2003
Purpose - planned	WILDCAT
Reentry	NO
Content	OIL
Discovery wellbore	YES
1st level with HC, age	LATE CRETACEOUS
1st level with HC, formation	TOR FM
Kelly bushing elevation [m]	23.0
Water depth [m]	70.0
Total depth (MD) [m RKB]	3260.0
Final vertical depth (TVD) [m RKB]	3258.0
Maximum inclination [°]	4.6
Bottom hole temperature [°C]	125
Oldest penetrated age	PRE-DEVONIAN
Oldest penetrated formation	BASEMENT
Geodetic datum	ED50
NS degrees	56° 35' 36.69" N
EW degrees	3° 45' 42.73" E
NS UTM [m]	6272539.87
EW UTM [m]	546787.12
UTM zone	31
NPDID wellbore	2885



## Wellbore history

### General

Block 2/6 is structurally located on the eastern margin of the Norwegian part of the Feda Graben. The block partly covers the Piggvar Terrace, the metamorphic Mandal high and the northwestern part of the Søgne basin.

Well 2/6-5 is located in the central western part of the block, high on a structural closure defined on Top Shetland Group

The main objective of well 2/6-5 was to test the presence of hydrocarbons and reservoir properties within the primary target intervals of the Shetland Group, located within a structural closure above the northern part of the Mandal High. It was prognosed approximately 40 m below the distinct Late Cretaceous Top Ekofisk Formation reflector.

Reservoir units were expected in several intervals, some in pressure communication and some not. A possible secondary target of sediment fill in the interval between the Shetland Group and the basement topography would be penetrated before reaching TD in metamorphic rocks. However, this possible wedge was defined on a poor seismic response and could represent intra basement reflectivity. The well was planned as a possible future producer.

### Operations and results

Exploration well 2/6-5 was spudded by the semi-submersible installation "Deepsea Bergen" 17 November 1996 and drilled to TD at 3260 m in metamorphic rocks. The well was drilled with a sea water/bentonite mud system down through the 12 1/2" hole section to 2515 m. The deeper part of the well was drilled with a KCL polymer glycol mud system.

Above the Shetland Group the formation tops and lithologies were drilled within the uncertainty limits of the prognosis. The Tertiary succession (including Quaternary) was found to be 2872 m thick. The Nordland Group was 1404.7 m thick and consisted of clay/claystones and sands. Top of the Hordaland Group was encountered at 1499.5 m and the Group was found to be 1229.4 m thick, generally consisting of reactive clays. Top Rogaland Group was drilled at 2729 m Top. The Rogaland succession contained Balder, Sele/Lista, and Våle Formations and was 88 m thick. Top of the Shetland Group was drilled at 2817 m. Top Tor Formation was drilled at 2897.5 m.

The Shetland Group interval velocity was experienced to be much higher than the prognosis based on stacking velocities indicated. The explanation to the observed discrepancy in seismic velocities contra the experienced well velocities is explained as azimuthal anisotropy combined with the seismic sampling configuration. The result is a reasonable seismic tie in two-way travel time to the well, but a significant mismatch in depth prognosis for the Top Hod and deeper strata.

Top Hod Formation was prognosed at 3015 +/- 75 m and was drilled at 3155 m. The Base Cretaceous Unconformity was prognosed at 3103 +/- 125 m and was drilled at 3230.5 m (+125.5m). The secondary target, defined as a possible wedge resting on basement turned out not to be present and the seismic image had to be considered as intra basement reflectivity. Logs and core data both conclude that a rather tight chalk lithology is present in the well. Only few intervals of allochthonous chalk were observed. Immediately below the chalk interval, only separated by thin clay unit (altered basement rocks), fractured metamorphic basement consisting of chists were penetrated. A short core was cut, confirming oil shows in fractures within the basement rocks.

Weak oil shows were reported from the Ekofisk Formation (2817-2897.5 m), and one



core was cut. Six more cores were cut in the Tor Formation (2897.5- 3155 m). The cores had variable recovery, especially in core # 6 with only 7.5 % recovery. In addition to the weak shows reported from the Ekofisk Formation, shows were observed in fractures both in the Tor Formation and in the Basement. Matrix staining was only seen within the Tor Formation, in zones of less than 30 cm thickness in the interval from 2929 to 2935 m. A Modular Formation Dynamics Tester (MDT) with a RPQS gauge was used to obtain formation pressure measurements and fluid samples. Due to very tight formation, the pressure measurements were of questionable quality. Two segregated samples were taken at respectively 2929.5 m and 2951.5 m. Two multi samples chambers and one 1 gal chamber were taken at 3026.3 m. Unfortunately, the obtained MDT fluid samples were not representative due to mud contamination and low chamber pressure at shut-in. The MDT fluid sample from 2929.5 m contained 1: 3 oil/water. Only water was retrieved in the samples from 2951.5 and 3026.3 m. The water samples held a high concentration of Na, Ca, K, and Cl. These concentrations can partly be explained by mud invasion of KCl mud. The remaining salinity has to be explained as abnormal NaCl concentrations, which complicates the petrophysical well evaluation. Based on the limited pressure information and log interpretation an OWC was indicated at 2944.8 m (2942.8 m TVD RKB).

After a drill stem test lasting from 24 December 1996 to 8 January 1997 the well was permanently abandoned as an oil discovery on 11 January.

### Testing

A drill stem test with two perforated intervals (2955-2948 m and 2941-2929 m) within the Tor Formation was conducted. The test results show a very tight reservoir with a test permeability of 0.4 mD. No indications of natural fractures were observed. After acid stimulation (LCA acid frac.), the perforated intervals produced water with 3% oil content at a stable rate. The test was shut in after a flow period of 46 hours. The reservoir pressure was 447 bar and the temperature 117.3 deg C at mid-perforation (2938.5 m).

### Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
820.00	3252.00

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	2852.0	2854.0	[m ]
2	2904.0	2917.0	[m ]
3	2929.0	2934.7	[m ]
4	2935.0	2953.0	[m ]
5	2953.0	2956.8	[m ]
6	2957.0	2958.5	[m ]
7	2977.0	2980.1	[m ]
8	3252.0	3254.1	[m ]



Total core sample length [m]	49.1
Cores available for sampling?	YES

### Core photos



2852-2854m



2904-2909m



2909-2914m



2914-2917m



2929-2934m



2934-2935m



2935-2940m



2940-2945m



2945-2950m



2950-2953m



2953-2956m



2957-2958m



2977-2980m



3252-3254m

### Palynological slides at the Norwegian Offshore Directorate

Sample depth	Depth unit	Sample type	Laboratory
2410.0	[m]	DC	UNIVSHET
2430.0	[m]	DC	UNIVSH
2450.0	[m]	DC	UNIVSH
2470.0	[m]	DC	UNIVSH
2490.0	[m]	DC	UNIVSH
2510.0	[m]	DC	UNIVSH
2530.0	[m]	DC	UNIVSH
2550.0	[m]	DC	UNIVSH
2570.0	[m]	DC	UNIVSH
2590.0	[m]	DC	UNIVSH



2610.0	[m]	DC	UNIVSH
2630.0	[m]	DC	UNIVSH
2650.0	[m]	DC	UNIVSH
2670.0	[m]	DC	UNIVSH
2690.0	[m]	DC	UNIVSH
2709.0	[m]	DC	UNIVSH
2727.0	[m]	DC	UNIVSH
2730.0	[m]	DC	UNIVSH
2733.0	[m]	DC	UNIVSH
2748.0	[m]	DC	UNIVSH
2769.0	[m]	DC	UNIVSH
2787.0	[m]	DC	UNIVSH
2802.0	[m]	DC	UNIVSH
2811.0	[m]	DC	UNIVSH
2814.0	[m]	DC	UNIVSH
3228.0	[m]	DC	UNIVSH
3237.0	[m]	DC	UNIVSH
3246.0	[m]	DC	UNIVSH
3257.0	[m]	DC	UNIVSH

### 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	0.00	0.00		04.01.1997 - 14:00	YES

### Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
93	<a href="#">NORDLAND GP</a>
1500	<a href="#">HORDALAND GP</a>
2729	<a href="#">ROGALAND GP</a>
2729	<a href="#">BALDER FM</a>
2738	<a href="#">SELE FM</a>
2777	<a href="#">LISTA FM</a>
2809	<a href="#">VÅLE FM</a>
2817	<a href="#">SHETLAND GP</a>



2817	<a href="#">EKOFISK FM</a>
2898	<a href="#">TOR FM</a>
3155	<a href="#">HOD FM</a>
3231	<a href="#">BASEMENT</a>

**Composite logs**

Document name	Document format	Document size [MB]
<a href="#">2885</a>	pdf	0.44

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

Document name	Document format	Document size [MB]
<a href="#">2885_2_6_5_COMPLETION_LOG</a>	pdf	9.96
<a href="#">2885_2_6_5_COMPLETION_REPORT</a>	pdf	26.87

**Drill stem tests (DST)**

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	2955	2919	11.1

Test number	Final shut-in pressure [MPa]	Final flow pressure [MPa]	Bottom hole pressure [MPa]	Downhole temperature [°C]
1.0	44.000	30.000		117

Test number	Oil [Sm3/day]	Gas [Sm3/day]	Oil density [g/cm3]	Gas grav. rel.air	GOR [m3/m3]
1.0	8		0.831		

**Logs**

Log type	Log top depth [m]	Log bottom depth [m]
DSI DLL NGT GR ACTS	2490	3257
FMI	2490	3257







FMI GR ACTS	2832	2993
LDT DSI BGT GR ACTS	802	2519
MDT GR ACTS	2800	2968
MDT GR ACTS	2951	2951
MDT GR ACTS	3020	3026
MDT GR AMS	2832	2993
MWD - GR RES DIR	170	3260
PEX CMR ACTS	2423	3257
VSP	1689	3159

**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	170.0	36	170.0	0.00	LOT
SURF.COND.	13 3/8	802.0	17 1/2	805.0	1.82	LOT
INTERM.	9 5/8	2494.0	12 1/4	2496.0	1.78	LOT
LINER	7	3260.0	8 1/2	3260.0	0.00	LOT

**Drilling mud**

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
130	1.03			WATER BASED	
709	1.04			WATER BASED	
808	0.00			WATER BASED	
1086	1.35	24.0		WATER BASED	
2515	1.60	36.0		WATER BASED	
2801	1.60	44.0		WATER BASED	
2904	1.60	38.0		WATER BASED	
2919	1.60	39.0		WATER BASED	
2955	1.62	32.0		WATER BASED	
2984	1.61	30.0		WATER BASED	
3129	1.60	32.0		WATER BASED	
3176	1.60	39.0		WATER BASED	
3252	1.60	38.0		WATER BASED	
3260	1.62			WATER BASED	

**Thin sections at the Norwegian Offshore Directorate**

Depth	Unit
3231.00	[m ]
3234.00	[m ]
3237.00	[m ]
3240.00	[m ]
3243.00	[m ]
3246.00	[m ]
3249.00	[m ]
3252.00	[m ]
3253.00	[m ]
3254.00	[m ]

**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]
<a href="#">2885 Formation pressure (Formasjonstrykk)</a>	pdf	0.21

