

**General information**

Wellbore name	24/9-7
Type	EXPLORATION
Purpose	APPRAISAL
Status	P&A
Press release	link to press release
Factmaps in new window	link to map
Main area	NORTH SEA
Field	VOLUND
Discovery	24/9-5 Volund
Well name	24/9-7
Seismic location	inline 958 5590 NH 960
Production licence	150
Drilling operator	Marathon Petroleum Norge AS
Drill permit	1073-L
Drilling facility	DEEPSEA DELTA
Drilling days	24
Entered date	02.03.2004
Completed date	25.03.2004
Plugged date	25.03.2004
Release date	25.03.2006
Publication date	23.05.2006
Purpose - planned	APPRAISAL
Reentry	NO
Content	OIL/GAS
Discovery wellbore	NO
1st level with HC, age	EOCENE
1st level with HC, formation	NO FORMAL NAME
Kelly bushing elevation [m]	29.0
Water depth [m]	124.0
Total depth (MD) [m RKB]	2280.0
Final vertical depth (TVD) [m RKB]	2279.0
Maximum inclination [°]	3.84
Bottom hole temperature [°C]	79
Oldest penetrated age	PALEOCENE
Oldest penetrated formation	HEIMDAL FM
Geodetic datum	ED50
NS degrees	59° 28' 42.6" N
EW degrees	1° 57' 44.49" E



NS UTM [m]	6593946.86
EW UTM [m]	441212.92
UTM zone	31
NPDID wellbore	4910

Wellbore history

General

Well 24/9-7 was drilled on the Hamsun prospect located immediately to the west and south west of the Gekko structure in PL203 (Figure 1). The prospect was a "horse-shoe" shape around the Grieg structure, drilled by wells 24/9-5 and 24/9-6 in 1993 and 1994. The Hamsun prospect was defined by the recognition and interpretation of a series of distinct seismic anomalies and mapped as a sandstone injection complex, sourced from early Eocene Hermod Formation sands. These anomalies were interpreted to represent oil-filled, highly porous sandstone dykes and sills. Several well bores were proposed to test the prospect. The prime vertical well was planned to intersect the thickest part of the injection complex to test bright amplitude, low acoustic impedance seismic reflectors interpreted to represent major sandstone dyke complexes. A sidetrack well bore was planned depending on the results of the first well.

Operations and results

A total of four wells were drilled from the surface location for 24/9-7 (the planned vertical well, an unplanned down-dip sidetrack 24/9-7 A, the planned up-dip sidetrack 24/9-7 B and a further unplanned lateral sidetrack 24/9-7 C). Taken as a whole, the four well bores took a total of 43.11 days to drill. All were drilled from the semi-submersible installation Deepsea Delta. No significant problems were encountered in the operations. Well 24/9-7 was drilled with seawater down to 953 m. From this depth to TD 24/9-7 and all sidetracks were drilled with Versavert oil based mud.

The prime vertical well bore 24/9-7 was spudded on 2 March 2004 and drilled to TD at 2280 m in the Late Paleocene Heimdal Formation. The well was plugged back for sidetracking on 24 March 2004. Well 24/9-7 A was kicked off at 1500 m and drilled to TD at 2277 m (2216.9 m TVD) in Heimdal Formation sandstone. The well was plugged back for a second sidetrack on 28 March 2004. Well bore 24/9-7-B was sidetracked from 1060 m and drilled to TD at 2230 m (2120.1 m TVD) in Lista Formation claystone. This well bore was plugged back for the final sidetrack on 2 April 2004. Sidetrack 24/9-7 C was kicked off at 1000 m and drilled to TD at 2363 m (2078.5 m TVD) in Sele Formation claystone.

Well 24/9-7 encountered hydrocarbons in two injected sandstone dyke complexes ("upper" and "lower"), together with numerous thin injectites distributed throughout the formations in proximity to the main dyke features. Thin injectite sands were first noted at 1822.6 m TVD, ca 54 m TVD shallower than the main injection feature. The upper, gas-bearing complex was penetrated at 1876.9 m TVD and the lower oil-bearing complex was penetrated at 1961.8 m TVD. Average porosities in the pay zones were estimated to 31.7% in the upper complex and 31.3% in the lower complex. The gas-oil and oil-water contacts were not seen directly on logs or core, but were interpreted at 1920 m TVD and 2024.8 m TVD respectively, based on formation pressure gradients.

Based on these results, sidetrack 24/9-7 A was permitted to evaluate the upper dyke complex down-dip in the oil leg with the intention of encountering an OWC in the lower complex. This sidetrack encountered the upper and lower complexes, approximately 126 m to the north of the original well, at 1927.6 m TVD and 2032.4 m TVD respectively. Gas-bearing pay was encountered distributed in thin breccia injectite intervals above the upper complex, which was oil-bearing throughout with ca 31.6 m vertical oil pay with



average porosity of 32.2%. The lower complex was entirely water bearing as it was penetrated below the previously noted OWC. Wire line log interpretation and formation pressure analysis confirmed the oil column data and results recorded in 24/9-7 and the well was plugged back for the programmed up-dip sidetrack.

Well 24/9-7B was drilled to the planned target location up-dip of the main dyke feature but at 1794 m TVD encountered only thin, sporadic, gas-bearing injectites in the fringe complex.

Well 24/9-7C was drilled with LWD tools to a tight target 728 m northeast of the initial vertical well. The well encountered oil-bearing injected sandstone with a clearly defined OWC at 2024.3 m TVD. Confirmation of the OWC was obtained through formation pressure analysis and a total of 29 m vertical oil pay was recognized with an average porosity of 33.5%.

Four conventional cores were cut from 1830 m to 1916 m in 24/9-7 and one core from 1922.5 m to 1978 m in 24/9-7 B. Four suites of logs were run in 24/9-7 with RCI fluid sampling at different depths within the reservoir. Single Phase samples were taken as follows: oil from 1965 m and 1966.5 m in the lower dyke; 2 gas from 1887 m and 1893.5 m in the upper dyke. PVT samples were taken as follows: oil samples were taken at 1965 m and 1966.5 m; gas was sampled at 1906.5 m, 1887 m, and 1893.5 m. The samples analysed showed a gas gravity of 0.679 sg while the oil samples analysed showed a density of 858.3kg/m³, viscosity of 0.75cp and a gas/oil ratio (GOR) 104.5 m³/m³. Three suites of logs were acquired in 24/9-7A, again with fluid sampling in the reservoir section. Here, PVT samples were taken as follows: oil from 1996 m and water from 2095 m. A single suite of logs was acquired in each of 24/9-7 B and 24/9-7 C.

Rig operations were completed and the wells temporarily suspended on 11 April 2004. The well bores were classified as gas oil appraisal wells.

Testing

No drill stem test was performed in the well bores.

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
960.00	2280.00

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	1830.0	1856.8	[m]
2	1857.0	1876.5	[m]
3	1876.5	1906.8	[m]
4	1906.9	1915.4	[m]

Total core sample length [m]	85.1
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Cores available for sampling?	YES
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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			YES

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
153	NORDLAND GP
460	UTSIRA FM
722	HORDALAND GP
722	NO FORMAL NAME
1149	GRID FM
1268	NO FORMAL NAME
1305	GRID FM
1329	NO FORMAL NAME
1878	NO FORMAL NAME
1911	NO FORMAL NAME
1946	ROGALAND GP
1946	BALDER FM
1963	NO FORMAL NAME
1975	BALDER FM
2074	SELE FM
2115	LISTA FM
2169	HEIMDAL FM

Composite logs

Document name	Document format	Document size [MB]
4910_24_9_7	pdf	0.39



**Logs**

Log type	Log top depth [m]	Log bottom depth [m]
CBIL EART GR	1799	2113
GR HDIL ZDL CNL XMAC	125	2280
LWD - ARC GR	212	953
LWD - RAB6 ARC6 GR	940	1829
LWD - RAB6 ARC6 GR	1810	2275
RCI GR	1843	1966
RCI GR	1883	2195
RCI GR	1883	2195
VSP GR	600	2265

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	212.0	36	212.0	0.00	LOT
SURF.COND.	13 3/8	947.0	17 1/2	953.0	0.00	LOT
INTERM.	9 5/8	987.0	12 1/4	990.0	1.42	LOT
OPEN HOLE		2280.0	8 1/2	2280.0	0.00	LOT

Drilling mud

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
212	1.30			HIVIS GEL MUD	
565	1.30			HIVIS GEL MUD	
953	1.20	26.0		GLYDRILL MUD	
1060	1.27	30.0		VERSAVERT OBM	
1915	1.30	29.0		VERSAVERT OBM	
2280	1.30	26.0		VERSAVERT OBM	

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]
4910 Formation pressure (Formasjonstrykk)	pdf	0.22

