

**General information**

Wellbore name	31/4-9
Type	EXPLORATION
Purpose	APPRAISAL
Status	P&A
Factmaps in new window	link to map
Main area	NORTH SEA
Field	BRAGE
Discovery	31/4-3 Brage
Well name	31/4-9
Seismic location	NH 8501 - 129 SP 610
Production licence	055
Drilling operator	Norsk Hydro Produksjon AS
Drill permit	534-L
Drilling facility	POLAR PIONEER
Drilling days	44
Entered date	23.01.1987
Completed date	07.03.1987
Release date	07.03.1989
Publication date	06.01.2014
Purpose - planned	APPRAISAL
Reentry	NO
Content	OIL
Discovery wellbore	NO
1st level with HC, age	MIDDLE JURASSIC
1st level with HC, formation	FENSFJORD FM
Kelly bushing elevation [m]	23.0
Water depth [m]	147.0
Total depth (MD) [m RKB]	2480.0
Final vertical depth (TVD) [m RKB]	2480.0
Maximum inclination [°]	2.4
Bottom hole temperature [°C]	100
Oldest penetrated age	EARLY JURASSIC
Oldest penetrated formation	DRAKE FM
Geodetic datum	ED50
NS degrees	60° 32' 2.29" N
EW degrees	3° 5' 26.92" E
NS UTM [m]	6711042.08
EW UTM [m]	504983.64



UTM zone	31
NPDID wellbore	1026

Wellbore history

General

Well 31/4-9 was drilled as an appraisal well on the Brage Field on the Bjørgvin Arch in the North Sea. The main objective was to establish the OWC and confirm reservoir trends, hydrocarbon column and reserve potential in the east flank of the structure. TD was prognosed at 2500 m, 70 m into the Dunlin Group.

Operations and results

Appraisal well 31/4-9 was spudded with the semi-submersible installation Polar Pioneer on 23 January 1987 and drilled to TD at 2480 m in the Early Jurassic Drake Formation. No significant problem was encountered in the operations. The well was drilled with spud mud down to 974 m, with KCl/polymer mud from 974 m to 2027 m, and with NaCl/CaCO₃/polymer mud from 2027 m to TD.

The Fensfjord reservoir came in at 2168.5 m and consisted mainly of fine to medium grained sandstones grading into and interbedded with siltstones. The Fensfjord Formation was oil bearing down to the oil-water contact at 2172 m. The Brent sandstone was found to be water bearing. Oil shows were described in the cored sections from 2103.5 m in the Draupne Formation down to 2222 m in the Fensfjord Formation.

An attempt to take two cores in the Tertiary claystones failed. Eight cores were cut with good recovery in the interval 2103 to 2222 m in the Heather and Fensfjord formations. RFT oil samples were taken at 2171.5 m topmost in the Fensfjord Formation

The well was permanently abandoned on 7 March 1987 as an oil appraisal well.

Testing

Two drill stem tests were performed in the Fensfjord Formation.

DST 1 tested water from the interval 2193.1-2208.1 m through a 50.8 mm choke. The maximum production rate was 577.5 Sm³/day. An injection test was also performed with a maximum injection rate of 576 Sm³/day. Flowing bottom hole temperature was 90.8 deg C.

DST 2 tested oil from the interval 2169.6-2171.6 m through a 12.7 mm choke. The maximum flow rate for the oil was 311.1 Sm³/day and for the gas 23253 Sm³/day. DST 2 also produced 7-8% water and emulsion on average. The GOR was 75 Sm³/Sm³, the oil gravity was 0.875 g/cm³, and the gas gravity was 0.769 (air=1) with 0.5 - 1.0 % CO₂. Flowing bottom hole temperature was 88.1 deg C.

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
980.00	2480.00

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
3	2105.0	2106.8	[m]
4	2107.0	2114.9	[m]
5	2116.5	2131.5	[m]
6	2132.5	2151.1	[m]
7	2149.5	2164.5	[m]
8	2164.5	2176.5	[m]
9	2176.5	2194.4	[m]
10	2194.0	2222.0	[m]

Total core sample length [m]	116.2
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	DST2	2169.60	2171.60	OIL	01.03.1987 - 00:00	YES

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
170	NORDLAND GP
685	UTSIRA FM
846	HORDALAND GP
1793	ROGALAND GP
1793	BALDER FM
1852	SELE FM
1892	LISTA FM
2043	SHETLAND GP
2043	HARDRÅDE FM
2093	CROMER KNOLL GP



2102	VIKING GP
2102	DRAUPNE FM
2118	HEATHER FM
2169	FENSFJORD FM
2368	BRENT GP
2368	NESS FM
2398	RANNOCH FM
2411	DUNLIN GP
2411	DRAKE FM

Geochemical information

Document name	Document format	Document size [MB]
1026 1	pdf	0.28
1026 2	pdf	0.86
1026 3	pdf	0.57

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

Document name	Document format	Document size [MB]
1026 01 WDSS General Information	pdf	0.38
1026 02 WDSS completion log	pdf	0.20

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

Document name	Document format	Document size [MB]
1026 31 4 9 Completion log	pdf	3.54
1026 31 4 9 Completion report	.pdf	14.45

Drill stem tests (DST)

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	2193	2208	50.8
2.0	2170	2172	12.7





Test number	Final shut-in pressure [MPa]	Final flow pressure [MPa]	Bottom hole pressure [MPa]	Downhole temperature [°C]
1.0				90
2.0				88

Test number	Oil [Sm3/day]	Gas [Sm3/day]	Oil density [g/cm3]	Gas grav. rel.air	GOR [m3/m3]
1.0					
2.0	311	23253	0.875	0.769	75

Logs

Log type	Log top depth [m]	Log bottom depth [m]
CBL CST VDL GR	1500	2389
CST	2008	2471
DIL LSS GR SP	945	1855
DITE LDL CNL NGT	1998	2471
DLL MSFL SDT GR	1998	2471
GR	170	945
MWD - GR RES	181	2480
RFT	2120	2409
RFT	2171	0
SHDT	1998	2474
VSP	360	2466

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	254.0	36	254.0	0.00	LOT
SURF.COND.	13 3/8	974.0	17 1/2	974.0	0.00	LOT
INTERM.	9 5/8	1998.0	12 1/4	2077.0	0.00	LOT
LINER	7	2479.0	8 3/8	2480.0	0.00	LOT

Drilling mud



Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
169	1.20	29.0	10.0	WATERBASED	09.03.1987
253	1.03			WATERBASED	26.01.1987
466	1.03	99.0	99.0	WATERBASED	26.01.1987
849	1.20	29.0	10.0	WATERBASED	06.03.1987
920	1.03	99.0	99.0	WATERBASED	26.01.1987
970	1.03			WATERBASED	27.01.1987
974	0.00	25.0	15.0	WATERBASED	29.01.1987
974	1.03	99.0	99.0	WATERBASED	28.01.1987
1087	1.25	27.0	18.0	WATERBASED	30.01.1987
1363	1.25	25.0	17.0	WATERBASED	02.02.1987
1458	1.40	27.0	15.0	WATERBASED	02.02.1987
1800	1.20	29.0	10.0	WATERBASED	05.03.1987
1962	1.40	30.0	17.0	WATERBASED	04.02.1987
2027	1.40	34.0	20.0	WATERBASED	02.02.1987
2027	0.00	31.0	18.0	WATERBASED	03.02.1987
2033	1.20	28.0	9.0	WATERBASED	05.02.1987
2105	1.20	30.0	11.0	WATERBASED	09.02.1987
2115	1.20	27.0	8.0	WATERBASED	09.02.1987
2141	1.20	28.0	9.0	WATERBASED	09.02.1987
2159	1.20	29.0	10.0	WATERBASED	04.03.1987
2177	0.00	36.0	12.0	WATERBASED	27.02.1987
2177	0.00	35.0	11.0	WATERBASED	02.03.1987
2177	0.00	35.0	12.0	WATERBASED	02.03.1987
2177	0.00	29.0	10.0	WATERBASED	03.03.1987
2177	1.21	25.0	7.0	WATERBASED	09.02.1987
2222	1.21	27.0	10.0	WATERBASED	10.02.1987
2242	1.20	33.0	10.0	WATERBASED	20.02.1987
2242	0.00	33.0	10.0	WATERBASED	23.02.1987
2242	0.00	33.0	10.0	WATERBASED	24.02.1987
2242	0.00	30.0	10.0	WATERBASED	25.02.1987
2242	0.00	36.0	12.0	WATERBASED	26.02.1987
2377	1.21	29.0	10.0	WATERBASED	11.02.1987
2394	1.20	31.0	10.0	WATERBASED	19.02.1987
2479	1.20	26.0	8.0	WATERBASED	18.02.1987
2479	0.00	25.0	8.0	WATERBASED	18.02.1987
2479	0.00	25.0	7.0	WATERBASED	18.02.1987
2479	0.00	31.0	10.0	WATERBASED	18.02.1987



2480	1.20	26.0	10.0	WATERBASED	12.02.1987
2480	0.00	26.0	10.0	WATERBASED	13.02.1987
2480	0.00	26.0	10.0	WATERBASED	18.02.1987

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]
1026 Formation pressure (Formasjonstrykk)	pdf	0.22

