

**General information**

Wellbore name	2/1-4
Type	EXPLORATION
Purpose	APPRAISAL
Status	P&A
Factmaps in new window	link to map
Main area	NORTH SEA
Field	GYDA
Discovery	2/1-3 Gyda
Well name	2/1-4
Seismic location	BP 80 - 019 - 31A SP 1353
Production licence	019 B
Drilling operator	BP Petroleum Dev. of Norway AS
Drill permit	322-L
Drilling facility	ALADDIN
Drilling days	121
Entered date	05.04.1982
Completed date	03.08.1982
Release date	03.08.1984
Publication date	12.03.2011
Purpose - planned	APPRAISAL
Reentry	NO
Content	OIL
Discovery wellbore	NO
1st level with HC, age	LATE JURASSIC
1st level with HC, formation	ULA FM
Kelly bushing elevation [m]	25.0
Water depth [m]	66.0
Total depth (MD) [m RKB]	4525.0
Final vertical depth (TVD) [m RKB]	4522.0
Maximum inclination [°]	7.3
Bottom hole temperature [°C]	168
Oldest penetrated age	LATE PERMIAN
Oldest penetrated formation	ZECHSTEIN GP
Geodetic datum	ED50
NS degrees	56° 54' 40.59" N
EW degrees	3° 4' 0.86" E
NS UTM [m]	6307652.66
EW UTM [m]	504074.24



UTM zone	31
NPDID wellbore	48

Wellbore history

General

Well 2/1-4 was drilled on the margin between the southern Vestland Arch and the Central Trough in the North Sea. The first well in the block, well 2/1-1 drilled in 1972, was abandoned after taking a kick in the Late Jurassic. The second well, well 2/1-2 drilled in 1978 encountered water wet Late Jurassic sandstones. The 2/1-3 well was drilled in 1980 on the downthrown side of a NW-SE trending fault complex and found oil in a 60 m thick Late Jurassic sandstone. A second Jurassic sandstone in 2/1-3 (Ula Formation) was water wet. The primary objective of the 2/1-4 well was to appraise the oil in the Late Jurassic "2/1-3 sandstone" (Gyda member). Secondary objectives were to test the Ula and Bryne Formations and the Triassic.

The well is reference well for the Vidar Formation.

Operations and results

Appraisal well 2/1-4 was spudded with the semi-submersible installation Aladdin on 5 April 1982 and drilled to TD at 4525 m in the Late Permian Zechstein Group. The first and second spuds were unsuccessful and only the third spud, on 12 April and 60 + 50 ft in direction 315 deg away from the planned location, was successful. The 17 1/2" section from 633 to 2006 m and the upper part of the 12 1/4" section were drilled with severe swelling shale (gumbo) problems. The well was drilled with seawater and hi-vis pills down to 633 m, with CMC/gypsum mud from 633 m to 2006 m, and with CMC/gypsum/lignosulfonate mud from 2006 m to TD.

Well 2/1-4 penetrated the top of the Late Jurassic sandstone at 4040 m and the log and core analysis confirmed the formation to be oil bearing. The log evaluation and core studies showed the Late Jurassic sandstone to consist of two main zones. The upper zone (4040 m to 4101 m) had a net pay of 47.9 m and an average water saturation of 30%. The lower zone (4101 m to 4137 m) had a net pay of 18.7m and an average water saturation of 62%. The secondary targets of the Ula and Bryne formations were penetrated at 4251 m and 4262 m respectively. Both formations were found to be water saturated. The top of the "Triassic Group" was penetrated at 4346 m and proved to be water wet. No shows were observed above base Cretaceous. Good oil shows were observed in the Late Jurassic sandstone down to 4137 m. Good shows were also recorded throughout a dolomitic mudstone section within the Haugesund Formation and poor shows were recorded in the sandstone within the Bryne and Gassum formations. In the Triassic poor shows were observed in the sandstone of the Skagerrak formation.

Five cores were cut in the interval 4036 to 4138 m with 100% recovery in the Late Jurassic sandstone member. One RFT wire line fluid sample was taken at 4113.9 m. Only mud filtrate was recovered in the sample chambers.

The well was permanently abandoned on 3 August 1982 as an oil appraisal.

Testing

Three drill stem tests were carried out in the Late Jurassic sandstone to determine whether an oil water/contact was present, confirm formation parameters and obtain samples of the reservoir fluids.

DST 1 perforated the interval 4120.5 to 4129.7 m. It produced 1 bbl (0.16 m3) of oil



during the flow period and an estimated 1.5-2 bbls on reversing out. A total of 18.6 bbls (3.0 m³) of water cushion was also produced at surface with no trace of formation water. H₂S and CO₂ levels were zero throughout the test. The produced oil density was 0.81 g/cm³. Production of dry oil from DST 1 proved the oil-water contact to be below 4130 m (4105 m MSL). The maximum bottom hole temperature recorded in DST 1 was 153 deg C.

DST 2 perforated the intervals 4101 to 4110 m, 4112 to 4117 m, and 4120.5 to 4129.7 m. It produced dry oil at a final production rate of 182 Sm³ and gas at a final production rate of 20275 Sm³ through a 16/64" fixed choke. The GOR was 112 Sm³/Sm³ and the oil density was 0.816 g/cm³. The gas gravity was 0.758 (air = 1) with 30 ppm H₂S and 2.8% CO₂. The maximum bottom hole temperature recorded in DST 2 was 159 deg C.

DST 3 perforated the interval 4061.5 to 4087 m. It produced dry oil at a final production rate of 99 Sm³ and gas at a final production rate of 11412 Sm³ through an 8/64" fixed choke. The GOR was 115 Sm³/Sm³ and the oil density was 0.816 g/cm³. The gas gravity was 0.750 (air = 1) with 8 ppm H₂S and 2.6% CO₂. The maximum bottom hole temperature recorded in DST 3 was 158 deg C.

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
180.00	4513.00

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	4036.0	4063.7	[m]
2	4063.9	4082.4	[m]
3	4082.4	4101.1	[m]
4	4101.1	4119.4	[m]
5	4119.4	4138.0	[m]

Total core sample length [m]	101.8
Cores available for sampling?	YES

Core photos





4036-4042m

4042-4048m

4048-4054m

4054-4060m

4060-4063m



4063-4069m

4069-4075m

4075-4081m

4081-4082m

4082-4088m



4088-4094m

4094-4100m

4100-4101m

4101-4107m

4107-4113m



4113-4119m

4119-4119m

4119-4125m

4125-4131m

4131-4137m



4137-4138m

Palynological slides at the Norwegian Offshore Directorate

Sample depth	Depth unit	Sample type	Laboratory
3060.0	[m]	DC	UNIVSHEF
3080.0	[m]	DC	UNIVSH
3145.0	[m]	DC	UNIVSH
3165.0	[m]	DC	UNIVSH
3943.0	[m]	DC	HRS
3973.0	[m]	DC	HRS
3997.0	[m]	DC	HRS



4009.0 [m]	DC	HRS
4021.0 [m]	DC	HRS
4027.0 [m]	DC	HRS
4036.0 [m]	DC	HRS
4060.0 [m]	DC	HRS
4115.0 [m]	DC	HRS
4130.0 [m]	DC	HRS
4137.0 [m]	DC	HRS
4147.0 [m]	DC	HRS
4156.0 [m]	DC	HRS
4171.0 [m]	DC	HRS
4180.0 [m]	DC	HRS
4186.0 [m]	DC	HRS
4207.0 [m]	DC	HRS
4219.0 [m]	DC	HRS
4237.0 [m]	DC	HRS
4252.0 [m]	DC	HRS
4261.0 [m]	DC	HRS
4273.0 [m]	DC	HRS
4291.0 [m]	DC	HRS
4294.0 [m]	DC	RRI
4300.0 [m]	DC	HRS
4303.0 [m]	DC	RRI
4312.0 [m]	DC	RRI
4330.0 [m]	DC	HRS
4369.0 [m]	DC	RRI
4375.0 [m]	DC	HRS
4384.0 [m]	DC	RRI
4396.0 [m]	DC	RRI
4408.0 [m]	DC	RRI
4468.0 [m]	DC	RRI
4474.0 [m]	DC	RRI
4480.0 [m]	DC	RRI

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
91	NORDLAND GP
1715	HORDALAND GP



2917	ROGALAND GP
2917	BALDER FM
2932	SELE FM
2944	LISTA FM
3075	VIDAR FM
3136	LISTA FM
3174	SHETLAND GP
3174	EKOFISK FM
3190	TOR FM
3623	HOD FM
3710	BLODØKS FM
3723	HIDRA FM
3741	CROMER KNOLL GP
3741	RØDBY FM
3775	SOLA FM
3785	TUXEN FM
3825	ÅSGARD FM
4004	TYNE GP
4004	MANDAL FM
4040	NO FORMAL NAME
4137	FARSUND FM
4164	HAUGESUND FM
4251	VESTLAND GP
4251	ULA FM
4261	BRYNE FM
4346	SKAGERRAK FM
4470	SMITH BANK FM
4485	ZECHSTEIN GP

Composite logs

Document name	Document format	Document size [MB]
48	pdf	0.78

Geochemical information





Document name	Document format	Document size [MB]
48_1	pdf	2.25
48_2	pdf	0.73
48_3	pdf	1.71
48_4	pdf	0.32
48_5	pdf	0.27
48_6	pdf	0.17

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

Document name	Document format	Document size [MB]
48_01_WDSS_General_Information	pdf	0.20
48_02_WDSS_completion_log	pdf	0.32

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

Document name	Document format	Document size [MB]
48_2_1_4_Completion_log	pdf	3.22
48_2_1_4_Drilling_Completion_report	pdf	17.22
48_2_1_4_Geological_Completion_report	pdf	5.19

Drill stem tests (DST)

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	4120	4129	0.0
2.0	4101	4117	6.3
3.0	4061	4087	3.2

Test number	Final shut-in pressure [MPa]	Final flow pressure [MPa]	Bottom hole pressure [MPa]	Downhole temperature [°C]
1.0				
2.0				
3.0				





Test number	Oil [Sm3/day]	Gas [Sm3/day]	Oil density [g/cm3]	Gas grav. rel.air	GOR [m3/m3]
1.0					
2.0	182	20000	0.816	0.758	112
3.0	99	11000	0.823	0.750	115

Logs

Log type	Log top depth [m]	Log bottom depth [m]
CALI	3785	4500
CBL	3490	4172
CYBERDIP	45	3785
DLL MSFL GR CAL SP	3990	4193
HDT	3785	4500
HRT	70	601
HRT	100	2102
HRT	130	2102
ISF BHC GR SP	91	629
ISF BHC GR SP	3750	4196
ISF BHC GR SP CAL MAFL	625	2005
ISF BHC MAFL GR CAL SP	3897	4512
ISF BHC MSFL CAL GR SP	1997	3797
ISF GR	3897	4510
LDL CNL GR CAL	3786	4196
LDL CNL GR CAL	3990	4510
RFT GR	3786	4196
SEISLOOK	250	4508
WST	250	4508

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	165.0	36	172.0	0.00	LOT
SURF.COND.	18 5/8	625.0	24	633.0	0.00	LOT
INTERM.	13 3/8	1997.0	17 1/2	2006.0	1.88	LOT
INTERM.	9 5/8	3785.0	12 1/4	3793.0	2.11	LOT
LINER	7	4210.0	8 1/2	4525.0	0.00	LOT

**Drilling mud**

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
171	1.04			seawater	
633	1.11			seawater	
2006	1.57			cmc/gyp	
3793	1.62			cmc/gyp-lig	
4525	1.66			cmc/gyp-lig	

Thin sections at the Norwegian Offshore Directorate

Depth	Unit
4036.00	[m]
4038.00	[m]
4043.00	[m]
4048.00	[m]
4056.00	[m]
4061.00	[m]
4065.00	[m]
4076.00	[m]
4088.00	[m]
4096.00	[m]
4106.00	[m]
4116.00	[m]
4127.00	[m]
4130.00	[m]
4138.00	[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]
48 Formation pressure (Formasjonstrykk)	PDF	0.21

