General information

Wellbore name	31/3-1
Type	EXPLORATION
Purpose	APPRAISAL
Status	P&A
Factmaps in new window	link to map
Main area	NORTH SEA
Field	TROLL
Discovery	31/6-1 (Troll Øst)
Well name	31/3-1
Seismic location	ST 8116 - 138 SP 481
Production licence	085
Drilling operator	Den norske stats oljeselskap a.s
Drill permit	379-L
Drilling facility	DEEPSEA BERGEN
Drilling days	88
Entered date	17.07.1983
Completed date	13.10.1983
Release date	13.10.1985
Publication date	15.02.2006
Purpose - planned	WILDCAT
Reentry	NO
Content	GAS
Discovery wellbore	NO
1st level with HC, age	LATE JURASSIC
1st level with HC, formation	SOGNEFJORD FM
2nd level with HC, age	MIDDLE JURASSIC
2nd level with HC, formation	FENSFJORD FM
Kelly bushing elevation [m]	23.0
Water depth [m]	334.0
Total depth (MD) [m RKB]	2374.0
Final vertical depth (TVD) [m RKB]	2374.0
Maximum inclination [°]	2.15
Bottom hole temperature [°C]	73
Oldest penetrated age	TRIASSIC
Oldest penetrated formation	HEGRE GP
Geodetic datum	ED50
NS degrees	60° 46' 47.86'' N
EW degrees	3° 44' 3.4'' E

NS UTM [m]	6738661.73
EW UTM [m]	539989.88
UTM zone	31
NPDID wellbore	20

Wellbore history

General

The wildcat 31/3-1 was drilled ca 17 km NNE of well 13/6-1 in the Troll East area. The two wells were drilled at the same time and together they established the existence of a Troll East gas field. The objective of 31/3-1 was to test possible gas and oil accumulations in sandstones of Late to Middle Jurassic age. Secondary objective was to test possible hydrocarbon accumulations in Middle to Early Jurassic and Late Triassic.

Operations and results

Wildcat well 31/3-1 was spudded with the semi-submersible installation Deepsea Bergen on 17 July 1983 and drilled to TD at 2374 m in the Triassic Hegre Group. No significant problems occurred during drilling except some technical problems when running the BOP for the 26" section. The well was drilled with spud mud down to 865 m, with KCl/polymer from 865 m to 1300 m, with gel/lignosulphonate from 1300 m to 1833 m, and with lignite/lignosulphonate from 1833 m to TD.

Top reservoir (Sognefjord Formation) was encountered at 1351.5 m. The Sognefjord, Heather, and Fensfjord Formations were found to hold a gas column of ca 220 m gas down to an approximate 4 m oil column. The OWC was at ca 1576m.Geochemical analyses of the reservoir gas show clear signs of biodegradation. Neither the Early Jurassic nor the Late Triassic contained hydrocarbons.

Twelve cores were cut continuously from 1351 m to 1610 m in the Late and Middle Jurassic reservoir sequences. FMT fluid samples were taken at 1374.2 m, 1570 m, 1574.2 m, and 1579.2 m.

The well was permanently abandoned on 13 October 1983 as a gas appraisal well.

Testing

Two DST's were performed, and gas was produced from both. DST 1 was performed from the interval 1519 m to 1529 m and produced 842400 Sm3 gas /day on a 22 mm choke. The gas had a gravity of 0.635 (air = 1). DST2 was performed from the interval 1373 m to 1383 m and produced 733500 Sm3 gas /day on a 19 mm choke. The gas had a gravity of 0.635 (air = 1). Turbulence was a problem during the tests. Although stable static bottom hole temperatures were not obtained the data indicated a reservoir temperature of 54.8 deg C at 1353 m. With a seafloor temperature of 4 deg C this correspond to a linear temperature gradient of 51 deg C/km from top reservoir to the sea floor.

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
430.00	2374.00

Cuttings available for sampling?	YES

Cores at the Norwegian Offshore Directorate

Core sample number	Core sample - top depth	Core sample - bottom depth	Core sample depth - uom
1	1351.0	1362.3	[m]
2	1366.0	1371.5	[m]
3	1372.0	1390.7	[m]
4	1391.0	1405.2	[m]
5	1407.0	1424.0	[m]
6	1424.3	1442.3	[m]
7	1442.6	1461.3	[m]
8	1461.0	1480.0	[m]
9	1480.0	1498.0	[m]
10	1498.1	1516.8	[m]
11	1516.0	1535.4	[m]
12	1535.4	1553.6	[m]
13	1553.9	1572.6	[m]
14	1572.6	1578.6	[m]
15	1591.3	1610.0	[m]

Total core sample length [m]	240.0
Cores available for sampling?	YES

Core photos

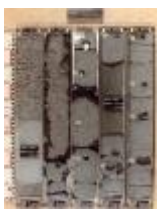

1351-1356m


1356-1361m


1361-1362m


1366-1371m


1371-1372m


1372-1377m


1377-1382m


1382-1387m


1387-1390m


1391-1396m


1396-1401m


1401-1405m


1406-1411m


1411-1416m


1416-1421m


1421-1424m


1424-1429m


1429-1434m


1434-1439m


1439-1442m


1442-1447m


1447-1452m


1452-1457m


1457-1461m


1461-1466m


1466-1471m


1471-1476m


1476-1480m

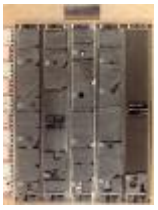

1480-1485m


1485-1490m


1490-1495m


1495-1498m


1498-1503m


1503-1508m


1508-1513m


1513-1516m


1516-1521m


1521-1526m


1526-1531m


1531-1535m


1535-1540m


1540-1545m


1545-1550m


1550-1553m


1553-1558m


1558-1563m


1563-1568m


1568-1572m


1572-1577m


1577-1581m


1582-1587m


1587-1590m


1591-1596m


1596-1601m


1601-1605m


1606-1610m

Palynological slides at the Norwegian Offshore Directorate

Sample depth	Depth unit	Sample type	Laboratory
610.0	[m]	DC	GEOCH
640.0	[m]	DC	GEOCH
670.0	[m]	DC	GEOCH
700.0	[m]	DC	GEOCH
730.0	[m]	DC	GEOCH
760.0	[m]	DC	GEOCH
790.0	[m]	DC	GEOCH
820.0	[m]	DC	GEOCH
850.0	[m]	DC	GEOCH

880.0	[m]	DC	GEOCH
909.0	[m]	DC	GEOCH
930.0	[m]	SWC	IKU
936.0	[m]	DC	GEOCH
963.0	[m]	DC	GEOCH
990.0	[m]	DC	GEOCH
1017.0	[m]	DC	GEOCH
1026.0	[m]	SWC	IKU
1038.0	[m]	SWC	IKU
1044.0	[m]	DC	GEOCH
1071.0	[m]	DC	GEOCH
1098.0	[m]	DC	GEOCH
1100.0	[m]	SWC	IKU
1125.0	[m]	DC	GEOCH
1152.0	[m]	DC	GEOCH
1157.0	[m]	SWC	IKU
1179.0	[m]	DC	GEOCH
1206.0	[m]	DC	GEOCH
1219.0	[m]	SWC	IKU
1224.0	[m]	DC	GEOCH
1229.0	[m]	SWC	IKU
1233.0	[m]	DC	GEOCH
1251.0	[m]	DC	GEOCH
1282.0	[m]	SWC	IKU
1290.0	[m]	SWC	IKU
1312.0	[m]	SWC	IKU
1317.0	[m]	SWC	IKU
1322.0	[m]	SWC	IKU
1342.0	[m]	SWC	IKU
1612.0	[m]	SWC	IKU
1780.0	[m]	SWC	IKU
1825.0	[m]	SWC	IKU
1845.0	[m]	SWC	IKU
1865.0	[m]	SWC	IKU
1900.0	[m]	SWC	IKU
1920.0	[m]	SWC	IKU
1980.0	[m]	DC	IKU
2040.0	[m]	SWC	IKU

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	TEST1	1519.00	1529.00	OIL	22.09.1983 - 14:50	YES
DST	TEST2	1373.00	1383.00		04.10.1983 - 15:30	YES

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
357	NORDLAND GP
531	HORDALAND GP
931	ROGALAND GP
931	BALDER FM
1038	SELE FM
1136	LISTA FM
1225	VÅLE FM
1235	SHETLAND GP
1273	CROMER KNOLL GP
1273	RØDBY FM
1320	VIKING GP
1320	DRAUPNE FM
1352	SOGNEFJORD FM
1497	HEATHER FM
1516	FENSFJORD FM
1668	KROSSFJORD FM
1779	HEATHER FM
1796	BRENT GP
1844	DUNLIN GP
1844	DRAKE FM
1945	COOK FM
1992	AMUNDSEN FM
2001	JOHANSEN FM
2088	AMUNDSEN FM
2105	STATFJORD GP
2160	HEGRE GP

Composite logs

Document name	Document format	Document size [MB]
20	pdf	0.50

Geochemical information

Document name	Document format	Document size [MB]
20_1	pdf	5.74
20_2	pdf	0.29
20_3	pdf	1.74
20_4	pdf	0.22
20_5	pdf	3.56
20_6	pdf	0.36

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

Document name	Document format	Document size [MB]
20_01_WDSS_General_Information	pdf	0.19
20_02_WDSS_completion_log	pdf	0.25

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

Document name	Document format	Document size [MB]
20_01_31_3_1_Completion_Report_and_Completion_log	PDF	30.93
20_02_31_3_1_Final_well_report_by_Exlog	pdf	5.87
20_03_31_3_1_Final_well_report_encl_01	pdf	2.89
20_04_31_3_1_Final_well_report_encl_02	pdf	0.64
20_05_31_3_1_Final_well_report_encl_03	pdf	0.45
20_06_31_3_1_Final_well_report_encl_04	pdf	0.35
20_31_3_1_Biostratigrafisk_analyse	pdf	7.92
20_31_3_1_Biostratigraphy_by_IKU	pdf	7.34
20_31_3_1_Clay_contrib_to_obs.prod.loss	pdf	4.45
20_31_3_1_Comp.of_reserv_Fluids_DST1,2	pdf	0.44
20_31_3_1_Completion_fluids_by_Statoil	pdf	0.78

20_31_3_1_Core_gamma_surface_log	pdf	0.35
20_31_3_1_DST_1-2_pre-post_gravel_pack_by_Otis	pdf	12.58
20_31_3_1_Formation_res.factor_analysis	pdf	0.30
20_31_3_1_Geochem.analyse_TOC	pdf	0.21
20_31_3_1_Geochem.correlation_of_HC	pdf	1.83
20_31_3_1_Geochemistry_source_rock_Evaluation	pdf	3.80
20_31_3_1_Geolog.progn_and_drilling_progr	pdf	2.09
20_31_3_1_Geolog.progn_and_drilling_progr_encl_01	pdf	0.90
20_31_3_1_Geolog.progn_and_drilling_progr_encl_02	pdf	0.16
20_31_3_1_Grain_size_distr.analysi	pdf	3.15
20_31_3_1_Gravel_Pack_Operations	pdf	1.27
20_31_3_1_Gravel_Pack_Operations_encl_01	pdf	0.16
20_31_3_1_Gravel_Pack_Operations_encl_02	pdf	0.14
20_31_3_1_High_Acc.press.temp.meas	pdf	4.47
20_31_3_1_High_Acc.press.temp.meas	pdf	5.56
20_31_3_1_High_acc.press.temp.meas_encl_01	pdf	0.17
20_31_3_1_High_acc.press.temp.meas_encl_02	pdf	0.03
20_31_3_1_High_acc.press.temp.meas_encl_03	pdf	0.03
20_31_3_1_High_acc.press.temp.meas_encl_04	pdf	0.02
20_31_3_1_High_acc.press.temp.meas_encl_05	pdf	0.02
20_31_3_1_High_acc.press.temp.meas_Flopetrol	pdf	3.04
20_31_3_1_High_acc.press.temp	pdf	2.46
20_31_3_1_High_acc.press.temp_b	pdf	1.33
20_31_3_1_High_acc.press.temp_b_encl_01	pdf	0.39
20_31_3_1_High_acc.press.temp_encl_01	pdf	0.37
20_31_3_1_High_Acc.press.temp_e_encl_01	pdf	0.17
20_31_3_1_High_Acc.press.temp_e_encl_02	pdf	0.06
20_31_3_1_High_Acc.press.temp_e_encl_03	pdf	0.03
20_31_3_1_High_Acc.press.temp_e_encl_04	pdf	0.02
20_31_3_1_High_Acc.press.temp_e_encl_05	pdf	0.03
20_31_3_1_High_Acc.press.temp_e_encl_06	pdf	0.04
20_31_3_1_High_Acc.press.temp_e_encl_07	pdf	0.03
20_31_3_1_High_Acc.press.temp_e_encl_08	pdf	0.02

20_31_3_1_High_Acc.press.temp_e_Flopetrol	pdf	4.52
20_31_3_1_Mon.quality_of_compl.fluids	pdf	3.80
20_31_3_1_Mud_and_Res.gas_Geochemistry	pdf	0.37
20_31_3_1_Multivariat_behandling_by_Rogforsk	pdf	0.61
20_31_3_1_Overlagringstrykk	pdf	1.09
20_31_3_1_Palynofacies_and_stratigraphy	pdf	40.84
20_31_3_1_Petrophysical_evaluation	pdf	1.42
20_31_3_1_Petrophysical_evaluation_encl_01	pdf	0.41
20_31_3_1_Petrophysical_evaluation_encl_02	pdf	2.21
20_31_3_1_Point_counting_test	pdf	0.13
20_31_3_1_Press.survey_rep.test1_run1	pdf	1.27
20_31_3_1_Press.survey_rep.test1_run2	pdf	2.18
20_31_3_1_Press.survey_rep.test2_run1	pdf	0.92
20_31_3_1_Press.survey_rep.test2_run3	pdf	1.87
20_31_3_1_Press.survey_rep.test2_run4	pdf	1.25
20_31_3_1_Routine_core_analysis	pdf	4.46
20_31_3_1_Special_core_analysis	pdf	9.10
20_31_3_1_Special_core_analysis_by_Robertson	pdf	2.28
20_31_3_1_Special_core_analysis_rev_report_by_Geco	pdf	6.00
20_31_3_1_TBP_distillation_of_stock_tank	pdf	0.67
20_31_3_1_Tritiated_water_in_the_mud	pdf	0.55
20_31_3_1_Troll_single_well_Geochemical_study	pdf	0.21
20_31_3_1_Use_of_tritiated_water	pdf	2.63
20_31_3_1_Weesite_Gas_Analysis	pdf	0.46
20_31_3_1_Well_test_report_FMT_no.1,2	pdf	5.40
20_31_3_1_Und_av_GravelPack_vaesker	pdf	1.27

Drill stem tests (DST)

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	1519	1529	16.9
2.0	1373	1383	12.7

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

2.0				

Test number	Oil [Sm3/day]	Gas [Sm3/day]	Oil density [g/cm3]	Gas grav. rel.air	GOR [m3/m3]
1.0		355000			
2.0		479000			

Logs

Log type	Log top depth [m]	Log bottom depth [m]
4ARM DIP/STRATDIP	1288	2374
ACBL	355	1285
ACBL	1000	1814
CDL CNL GR CAL	1285	2372
CDL GR CAL	845	1299
DIFL BHC AC	350	866
DIFL BHC AC GR SP CAL	845	2374
DLL MLL GR	1285	1835
FMT	1352	1695
PROLOG	1340	1650
VELOCITY	1110	2375

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	421.0	36	422.0	0.00	LOT
SURF.COND.	20	849.0	26	865.0	1.55	LOT
INTERM.	13 3/8	1285.5	17 1/2	1300.0	1.66	LOT
INTERM.	9 5/8	1815.5	12 1/4	1835.0	1.65	LOT
OPEN HOLE		2374.0	8 1/2	2374.0	0.00	LOT

Drilling mud

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
450	1.07	51.0		seawater	

1000	1.08	53.0		seawater	
1260	1.28	22.0		seawater	
1775	1.30	60.0		seawater	
1950	1.12	53.0		seawater	

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]
20_Formation_pressure_(Formasjonstrykk)	pdf	0.20