General information

Wellbore name	31/2-6
Type	EXPLORATION
Purpose	APPRAISAL
Status	P&A
Factmaps in new window	link to map
Main area	NORTH SEA
Field	TROLL
Discovery	31/2-1 (Troll Vest)
Well name	31/2-6
Seismic location	LINE 79-406 & SP185
Production licence	054
Drilling operator	A/S Norske Shell
Drill permit	296-L
Drilling facility	BORGNY DOLPHIN
Drilling days	89
Entered date	21.07.1981
Completed date	17.10.1981
Release date	17.10.1983
Publication date	06.06.2006
Purpose - planned	APPRAISAL
Reentry	NO
Content	OIL/GAS
Discovery wellbore	NO
1st level with HC, age	LATE JURASSIC
1st level with HC, formation	SOGNEFJORD FM
Kelly bushing elevation [m]	25.0
Water depth [m]	343.0
Total depth (MD) [m RKB]	1760.0
Final vertical depth (TVD) [m RKB]	1754.0
Maximum inclination [°]	1.25
Bottom hole temperature [°C]	73
Oldest penetrated age	MIDDLE JURASSIC
Oldest penetrated formation	FENSFJORD FM
Geodetic datum	ED50
NS degrees	60° 54' 13.57'' N
EW degrees	3° 38' 49.53'' E
NS UTM [m]	6752401.91
EW UTM [m]	535105.69

UTM zone	31
NPDID wellbore	399

Wellbore history

General

Well 31/2-6 is located in a fault block north-east on the main Troll structure, approximately 8 km NNE of 31/2-3. The main objective of the well was to test the north-eastern margin of the Troll structure and to prove hydrocarbon communication between block 31/2 and 31/3. The well location was picked to test the oil zone in a good sand reservoir. A second objective was to get reliable geologic tie to the seismic reflectors to allow for accurate lateral extrapolation of well data. Planned TD was 2500 m in Triassic sediments.

The well is Reference Well for the Sele Formation.

Operations and results

Appraisal well 31/2-6 was spudded with the semi-submersible installation Borgny Dolphin on and drilled to TD at 1760 m in the Late Jurassic Formation. The 9 5/8" casing collapsed at 771 m and was cut and retrieved from 760 m. As a result of this, well 31/2-6 was not deepened to the Triassic. The well was drilled with seawater gel down to 614 m and with KCl polymer mud from 614 m to TD.

Well 31/2-6 proved a similar hydrocarbon accumulation in this northern fault block area to that of the main field accumulation tested by wells 31/2-1,2,3 and 4. The well encountered the Sognefjord Formation at 1492 m. The Formation held a 79.4 m gross gas column underlain by a 10.3 m oil column. The GOC at 1571.4 m and the OWC was at 1582.2 m. Well 31/2-6 confirmed the overall interpretation of the flatspot as a direct hydrocarbon indicator. Oils shows were recorded on cores from 1504 m to 1601 m. In addition, cuttings gave patchy shows in the interval from 1710 m to 1758 m. Sidewall cores from this interval did not confirm shows in the latter interval.

Coring commenced at 1504.4 m and terminated at 1632.05 m, within the Sognefjord Formation. Thus 127.65 m of core was cut from which 123.65 m (97%) was recovered. An RFT gas sample was taken at 1518 m as a backup until samples could be obtained from the subsequent production test. No sample was attempted in the oil zone because of the badly washed out hole.

The well was permanently abandoned on 17 October 1981 as a gas and oil appraisal.

Testing

Production testing was carried out in both the oil and gas zones. The oil zone from 1576 m to 1579 m produced up to 151 Sm3 bbl/day of 27 °API oil with a GOR of up to 267 Sm3/Sm3. Maximum temperature recorded was 65.6 deg. C. The gas zone from 1518 m to 1537 m produced up to 1699000 Sm3 gas/day with a condensate/gas ratio of ca 0.00002 Sm3/Sm3 (GOR = ca 50000 Sm3/Sm3). The maximum recorded temperature in this test was 62.8 deg. C. The DST temperatures gives a temperature gradient above the Troll reservoir of ca 51 deg C /km, which is unusually high compared to the average for the Norwegian continental shelf.

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
480.00	1749.00

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	1504.4	1514.0	[m]
2	1514.0	1532.5	[m]
3	1532.5	1550.9	[m]
4	1551.0	1555.8	[m]
5	1557.5	1575.8	[m]
6	1576.0	1582.4	[m]
7	1583.9	1602.3	[m]
8	1602.8	1618.7	[m]
9	1618.8	1632.3	[m]

Total core sample length [m]	123.7
Cores available for sampling?	YES

Core photos


1504-1509m


1509-1514m


1514-1519m


1519-1524m


1524-1530m


1530-1532m


1532-1537m


1537-1543m


1543-1548m


1548-1550m


1551-1555m


1557-1562m


1562-1568m


1568-1573m


1573-1575m


1576-1581m


1581-1582m


1583-1589m


1589-1594m


1594-1600m

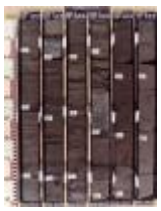

1600-1602m


1602-1608m


1608-1613m


1613-1618m


1618-1624m


1624-1629m


1629-1632m

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
910.0	[m]	DC	GEOCH
940.0	[m]	DC	GEOCH
970.0	[m]	DC	GEOCH
1000.0	[m]	DC	GEOCH
1030.0	[m]	DC	GEOCH
1060.0	[m]	DC	GEOCH
1090.0	[m]	DC	GEOCH
1120.0	[m]	DC	GEOCH
1150.0	[m]	DC	GEOCH
1180.0	[m]	DC	GEOCH
1212.0	[m]	DC	GEOCH
1242.0	[m]	DC	GEOCH
1272.0	[m]	DC	GEOCH
1302.0	[m]	DC	GEOCH
1326.0	[m]	DC	GEOCH
1353.0	[m]	DC	GEOCH
1380.0	[m]	DC	GEOCH
1407.0	[m]	DC	GEOCH
1434.0	[m]	DC	GROCH
1452.0	[m]	DC	GEOCH
1461.0	[m]	DC	GEOCH
1470.0	[m]	DC	GEOCH
1479.0	[m]	DC	GEOCH
1482.0	[m]	SWC	SHELL
1483.0	[m]	SWC	SHELL
1485.0	[m]	SWC	SHELL
1487.0	[m]	SWC	SHELL
1488.8	[m]	SWC	SHELL
1495.0	[m]	SWC	SHELL
1495.9	[m]	SWC	SHELL
1500.0	[m]	SWC	SHELL
1503.0	[m]	SWC	SHELL
1504.8	[m]	C	SHELL
1507.1	[m]	C	SHELL
1507.9	[m]	C	SHELL
1508.8	[m]	C	SHELL
1509.0	[m]	C	SHELL
1510.7	[m]	C	SHELL

1512.0	[m]	C	SHELL
1512.5	[m]	C	SHELL
1513.3	[m]	C	SHELL
1514.7	[m]	C	SHELL
1515.5	[m]	C	SHELL
1515.8	[m]	C	SHELL
1528.4	[m]	C	SHELL
1529.1	[m]	C	SHELL
1533.4	[m]	C	SHELL
1534.3	[m]	C	SHELL
1537.0	[m]	C	SHELL
1539.7	[m]	C	SHELL
1540.2	[m]	C	SHELL
1542.0	[m]	C	SHELL
1542.4	[m]	C	SHELL
1555.8	[m]	C	SHELL
1557.9	[m]	C	SHELL
1558.0	[m]	C	SHELL
1558.6	[m]	C	SHELL
1576.9	[m]	C	SHELL
1578.9	[m]	C	SHELL
1582.2	[m]	C	SHELL
1584.5	[m]	C	SHELL
1589.0	[m]	C	SHELL
1591.8	[m]	C	SHELL
1591.8	[m]	C	SHELL
1592.9	[m]	C	SHELL
1594.5	[m]	C	SHELL
1601.1	[m]	C	SHELL
1601.8	[m]	C	SHELL
1601.9	[m]	C	SHELL
1603.4	[m]	C	SHELL
1603.7	[m]	C	SHELL
1604.4	[m]	C	SHELL
1606.0	[m]	C	SHELL
1609.6	[m]	C	SHELL
1609.8	[m]	C	SHELL
1620.1	[m]	C	SHELL
1624.2	[m]	C	SHELL
1625.3	[m]	C	SHELL

1626.2	[m]	C	SHELL
1627.1	[m]	C	SHELL
1634.0	[m]	C	SHELL
1655.0	[m]	C	SHELL
1682.8	[m]	C	SHELL
1703.0	[m]	C	SHELL
1718.0	[m]	C	SHELL
1728.0	[m]	C	SHELL
1740.1	[m]	C	SHELL
1754.0	[m]	C	SHELL

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	1576.00	1579.00		20.09.1981 - 00:00	YES
DST	TEST2	1518.00	1536.00		06.10.1981 - 00:00	YES

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
368	NORDLAND GP
600	HORDALAND GP
600	NO FORMAL NAME
698	NO FORMAL NAME
1105	ROGALAND GP
1105	BALDER FM
1167	SELE FM
1225	LISTA FM
1450	VÅLE FM
1464	SHETLAND GP
1464	HARDRÅDE FM
1476	CROMER KNOLL GP
1481	VIKING GP
1481	DRAUPNE FM
1492	SOGNEFJORD FM
1673	FENSFJORD FM

Composite logs

Document name	Document format	Document size [MB]
399	pdf	0.29

Geochemical information

Document name	Document format	Document size [MB]
399_1	pdf	0.60
399_2	pdf	0.54

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

Document name	Document format	Document size [MB]
399_01_WDSS_General_Information	pdf	0.09
399_02_WDSS_completion_log	pdf	0.16

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

Document name	Document format	Document size [MB]
399_01_31_2_6_Drilling_programme	pdf	1.20
399_01_31_2_6_Exploration_well_resume	pdf	33.29
399_01_31_2_6_Well_summary_by_Anchor	pdf	1.55
399_01_Drilling_prospectus	pdf	6.83
399_02_31_2_6_Biostratigraphy_appendix_3	pdf	4.01
399_02_31_2_6_Completion_log	pdf	1.15
399_02_Composite_log	pdf	1.86
399_03_31_2_6_Petrophysical evaluation study_encl_01	pdf	1.48
399_03_31_2_6_Petrophysical_evaluation_study_by_Statoil	pdf	1.34
399_03_31_2_6_Petrophysical_invest._of_cores_by_Shell	pdf	1.48
399_03_Drilling_programme	pdf	3.19

399_04_31_2_6_Aut._kornstr.og_sort.analyse_by_Sintef	pdf	1.08
399_04_31_2_6_Conventional_Core_Analysis_core_1-9	pdf	3.19
399_04_31_2_6_Halvaut._kornstr.og_sort.analyse_by_Sintef	pdf	1.00
399_04_31_2_6_Partial_fluid_study_by_Corelabs	pdf	0.25
399_04_31_2_6_Partical_fluid_study_oil_zone_by_Corelabs	pdf	0.15
399_04_31_2_6_Porosity_and_perm._data_by_Geolab	pdf	0.96
399_04_31_2_6_Quick_sidewall_sample_descr	pdf	0.15
399_04_31_2_6_Relative_perm.measurements	pdf	1.09
399_04_31_2_6_Reservoir_fluid_study_by_Corelabs	pdf	0.65
399_04_31_2_6_Spec.core_analysis_measure_by_Sintef	pdf	1.28
399_04_31_2_6_Special_core_analysis_by_Sintef	pdf	0.70
399_04_31_2_6_Special_core_analysis_Cation_exch	pdf	2.54
399_04_31_2_6_Special_core_analysis_Cation_exch_encl_1	pdf	0.16
399_04_31_2_6_Special_core_analysis_Cation_exch_encl_2	pdf	0.20
399_04_31_2_6_Special_core_analysis_Cation_exch_encl_3	pdf	0.20
399_04_31_2_6_Special_core_analysis_Cation_exch_encl_4	pdf	0.21
399_04_31_2_6_Special_core_analysis_Cation_exch_encl_5	pdf	0.21
399_04_31_2_6_Special_core_analysis_Cation_exch_encl_6	pdf	0.21
399_04_Drill_stem_test_data	pdf	4.44
399_05_31_2_6_Expl._and_positioning_test_on_gas	pdf	0.43
399_05_31_2_6_Gas_tests_offshore_Norway_by_Thornton	pdf	0.51
399_05_31_2_6_Online_TDC_report_by_Geoservices	pdf	1.03
399_05_31_2_6_Overlagringstrykk_by_Statoil	pdf	0.91
399_05_31_2_6_Pressure_survey_report_test_1_run1_by_Sperry	pdf	0.92
399_05_31_2_6_Pressure_survey_report_test_1_run2_by_Sperry	pdf	0.61

399_05_31_2_6_Production_test_programme	pdf	1.79
399_05_31_2_6_Room_condition_Oil_by_Sintef	pdf	0.35
399_05_31_2_6_Sieve_analysis	pdf	3.29
399_05_31_2_6_Well_testing_report_clean_sand_gas_zone_Flopetrol	pdf	13.65
399_05_31_2_6_Well_testing_report_oil_zone_annexes_Flopetrol	pdf	16.00
399_05_31_2_6_Well_testing_report_oil_zone_Flopetrol	pdf	8.12
399_05_Geological_well_prognosis_and_drilling_program	pdf	1.20
399_06_31_2_6_Geochem_analysis_of_source_rock	pdf	0.24
399_06_31_2_6_Geochem_analysis_of_source_rock_encl_1	pdf	0.26
399_06_Geological_well_program	pdf	0.18
399_07_31_2_6_Global_interpretation_by_Slb	pdf	0.38
399_07_Individual_well_record	pdf	6.86
399_08_Log_analysis_rapport	pdf	0.10
399_09_Production_measurements_during_the_drill_stem_test	pdf	0.75
399_10_Analysis_chart_robertson	pdf	10.32
399_11_A_study_of_selected_sections_from_palaeogene	pdf	1.54
399_12_Biostratigraphy_and_organic_geochemistry	pdf	4.82
399_13_geochemical_study	pdf	2.13
399_14_Lithological_log	pdf	0.49
399_15_Lithology_and_abundance	pdf	0.21
399_16_Palynological_correlations_in_early_cretaceous	pdf	0.44
399_17_Preliminary_petroleum_geochemistry_results	pdf	1.42
399_18_Rapported_analyses_geochimiques_de_fluides	pdf	0.28
399_19_Rock_eval_pyrolysis	pdf	0.71
399_20_The_micropalaeontology_and_stratigraphy	pdf	1.43
399_21_Water_analysis	pdf	0.31
399_05_31_2_6_Bronntestrapport_by_Geco	pdf	2.67
399_05_31_2_6_Bronntestrapport_encl_1	pdf	0.45

Drill stem tests (DST)

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	1576	1579	7.9
2.0	1518	1537	50.8

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	144	25000	0.888	0.605	175
2.0	40	1699000	0.781	0.602	42475

Logs

Log type	Log top depth [m]	Log bottom depth [m]
BGT GR	447	814
BGT GR	447	817
BGT GR	447	817
CBL VDL	370	802
CBL VDL	635	1475
CBL VDL	850	1715
CST	801	1463
DLL MSFL CAL	1476	1756
FDC CNL GR CAL	447	819
FDC CNL GR CAL	801	1471
FDC CNL GR CAL	1476	1757
HDT	1476	1758
ISF BHC GR	447	817
ISF BHC GR	801	1473
ISF BHC GR	1476	1757
LDT	1476	1757
NGT	1476	1757
RFT	13	0
VELOCITY	0	0

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	448.0	36	456.0	0.00	LOT
SURF.COND.	20	800.0	26	820.0	0.00	LOT
INTERM.	13 3/8	1475.0	17 1/2	1485.0	1.62	LOT
INTERM.	9 5/8	1752.0	12 1/4	1760.0	0.00	LOT

Drilling mud

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
420	0.00			seawater	
820	1.12	50.0		water based	
1485	1.32	50.0		water based	
1532	1.18	52.0		water based	

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]
399_Formation_pressure_(Formasjonstrykk)	PDF	0.15