

General information

Wellbore name	31/3-2
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	31/3-2
Seismic location	ST 8007 - 338 A SP. 204.5
Production licence	085
Drilling operator	Norsk Hydro Produksjon AS
Drill permit	403-L
Drilling facility	TREASURE SEEKER
Drilling days	57
Entered date	05.03.1984
Completed date	30.04.1984
Release date	30.04.1986
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]	340.0
Total depth (MD) [m RKB]	2090.0
Final vertical depth (TVD) [m RKB]	2090.0
Maximum inclination [°]	1.4
Bottom hole temperature [°C]	73
Oldest penetrated age	EARLY JURASSIC
Oldest penetrated formation	DRAKE FM
Geodetic datum	ED50
NS degrees	60° 52' 11.41" N
EW degrees	3° 40' 41.79" E
NS UTM [m]	6748639.40
EW UTM [m]	536836.48

UTM zone	31
NPDID wellbore	100

Wellbore history

General

Well 31/3-2 was drilled immediately to the southeast of a fault that was interpreted as a boundary fault between Troll West and Troll East. The main objectives of the appraisal well 31/3-2 were to determine if hydrocarbons were present on the downthrown south side of the fault, to determine the contacts, and to determine the degree of communication across the fault plane. A test would be performed in the case of moveable hydrocarbons, in order to observe boundary effects where the pay zone is narrow and thin. The well was planned to reach total depth in the Early Jurassic Drake Formation at 2050 m if drilling through the "boundary fault". In the case of drilling entirely within the hanging-wall block the total depth was estimated to 2130 m.

Operations and results

Well 31/3-2 was spudded with the semi-submersible installation Treasure Seeker on 5 March 1984 and drilled to TD at 2090 m in claystones of the Early Jurassic Drake Formation. No significant technical problems occurred during drilling and testing. The well was drilled with pre-hydrated gel/seawater with sweeps of high viscous mud down to 629 m and with KCl/polymer mud from 629 m to TD.

The Sognefjord Formation (1567 - 1706 m) was found oil bearing down to 1578.5 m where the oil/water contact was established. The oil-bearing reservoir consisted of very fine to very coarse-grained sandstones. They are friable to loose with only traces of siliceous or calcareous cement. The total net sand in the Sognefjord Formation was calculated to 132 m out of 139 m gross thickness, giving a net/gross ratio of 0.95 and an average porosity of 26.6%. A thin (0.5 m) gas cap could be present on top of the oil column. This was identified from LDT/CNL logs and was also consistent with the GOR development during the test, but was not confirmed by RFT data. There were no oil shows above the Sognefjord Formation, and no oil shows below 1595 m, and the Middle to Early Jurassic sandstones was found water bearing.

Evidence from seismic interpretations, dip meter analysis, and subsequent geometrical considerations indicated that well 31/3-2 penetrated the "boundary fault" at top Brent Group level, between 1940 and 1955 m. In this zone two calcite cemented bands were encountered thought to be associated with the fault plane. The OWC was found to be 3.5 m shallower than in well 31/2-6, but the pressure data from wells in the area did not have sufficient reproducibility and resolution to support different pressure regimes in the different compartments.

Five cores were cut between 1565 m and 1640 m from the lower part of the Draupne Formation and into the Sognefjord Formation. RFT pressure recordings and sampling were performed in the reservoir interval and pressure tests were also made in sand intervals in the underlying formations with the deepest point in the Drake Formation (Dunlin Group). Segregated RFT fluid samples were recovered from 1567.6 m (two samplings, one with oil and one with gas and oil), 1576 m (mud filtrate and water), and 1577.8 m (mud filtrate with trace oil and gas),

The well was permanently abandoned on 30 April 1984 as a gas and oil appraisal.

Testing

One production test was performed over the interval 1567 - 1577 m in the oil zone at the top of the Sognefjord Formation. The test produced 1271.9 Sm³/day of 27.5 deg. API oil together with 562588 Sm³/day of gas with gravity 0.620 (air = 1). The choke size was 63.5 mm. The GOR was 442 Sm³/Sm³ and the CO₂ content was 1.0%. The pore pressure at the top of the reservoir was measured to be 158.15 bara (2293.8 psi). The temperature measured during the test was 69.5 deg. C.

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
460.00	2090.00

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	1565.0	1575.5	[m]
2	1581.0	1590.7	[m]
3	1593.0	1606.3	[m]
4	1608.0	1626.0	[m]
5	1626.0	1639.9	[m]

Total core sample length [m]	65.3
Cores available for sampling?	YES

Core photos



1565-1570m



1570-1575m



1575-1576m



1581-1586m



1586-1590m



1593-1598m



1598-1603m



1603-1606m



1608-1613m



1613-1618m



1618-1623m



1623-1626m



1626-1631m



1631-1636m



1626-1639m

Palynological slides at the Norwegian Offshore Directorate

Sample depth	Depth unit	Sample type	Laboratory
700.0	[m]	DC	RRI
720.0	[m]	DC	RRI
740.0	[m]	DC	RRI
760.0	[m]	DC	RRI
780.0	[m]	DC	RRI
800.0	[m]	DC	RRI
820.0	[m]	DC	RRI
880.0	[m]	DC	RRI
940.0	[m]	DC	RRI
960.0	[m]	DC	RRI
980.0	[m]	DC	RRI
1000.0	[m]	DC	RRI
1020.0	[m]	DC	RRI
1040.0	[m]	DC	RRI
1060.0	[m]	DC	RRI
1080.0	[m]	DC	RRI
1100.0	[m]	DC	RRI
1120.0	[m]	DC	RRI
1140.0	[m]	DC	RRI
1160.0	[m]	DC	RRI
1180.0	[m]	DC	RRI
1200.0	[m]	DC	RRI
1220.0	[m]	DC	RRI
1240.0	[m]	DC	RRI
1260.0	[m]	DC	RRI
1280.0	[m]	DC	RRI
1300.0	[m]	DC	RRI
1320.0	[m]	DC	RRI
1340.0	[m]	DC	RRI
1360.0	[m]	DC	RRI
1380.0	[m]	DC	RRI
1400.0	[m]	DC	RRI
1420.0	[m]	DC	RRI
1440.0	[m]	DC	RRI
1460.0	[m]	DC	RRI

1480.0 [m]	DC	RRI
1565.0 [m]	C	OD
1566.0 [m]	C	OD
1567.0 [m]	C	OD
1569.0 [m]	DC	OD
1571.0 [m]	DC	OD
1575.0 [m]	C	OD
1582.5 [m]	C	OD
1583.5 [m]	C	OD
1584.7 [m]	C	OD
1588.0 [m]	C	OD
1590.3 [m]	C	OD
1593.0 [m]	C	OD
1597.5 [m]	C	OD
1600.8 [m]	C	OD
1610.8 [m]	C	OD
1610.9 [m]	C	OD
1613.2 [m]	C	OD
1613.6 [m]	C	OD
1614.6 [m]	C	OD
1614.7 [m]	C	OD
1615.5 [m]	C	OD
1616.0 [m]	C	OD
1616.1 [m]	C	OD
1617.0 [m]	C	OD
1618.0 [m]	C	OD
1618.2 [m]	C	OD
1618.8 [m]	C	OD
1620.1 [m]	C	OD
1622.2 [m]	C	OD
1624.5 [m]	C	OD
1626.0 [m]	C	OD

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
365	NORDLAND GP
540	HORDALAND GP
540	NO FORMAL NAME

605	NO FORMAL NAME
1121	ROGALAND GP
1121	BALDER FM
1194	SELE FM
1280	LISTA FM
1452	VÅLE FM
1471	SHETLAND GP
1533	CROMER KNOLL GP
1533	MIME FM
1541	VIKING GP
1541	DRAUPNE FM
1567	SOGNEFJORD FM
1706	HEATHER FM
1725	FENSFJORD FM
1851	KROSSFJORD FM
1929	HEATHER FM
1939	BRENT GP
1939	TARBERT FM
1952	NESS FM
1966	ETIVE FM
2006	DUNLIN GP
2006	DRAKE FM

Composite logs

Document name	Document format	Document size [MB]
100	pdf	0.32

Geochemical information

Document name	Document format	Document size [MB]
100_1	pdf	0.33
100_2	pdf	3.30

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

Document name	Document format	Document size [MB]
100_01_WDSS_General_Information	pdf	0.18
100_02_WDSS_completion_log	pdf	0.21

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

Document name	Document format	Document size [MB]
100_01_31_3_2_Completion_repor_and_Completion_log	pdf	13.56
100_01_31_3_2_Final_Well_Report_by_Exlog	pdf	5.88
100_02_31_3_2_Drilling_program	pdf	3.26
100_02_31_3_2_Prospect_descr.and_prognosis	pdf	2.30
100_02_31_3_2_Prospect_descr_and_prognosis_encl_1	pdf	0.52
100_02_31_3_2_Prospect_descr_and_prognosis_encl_2	pdf	9.51
100_02_31_3_2_Prospect_descr_and_prognosis_encl_3	pdf	8.08
100_02_31_3_2_Prospect_descr_and_prognosis_encl_4	pdf	0.38
100_02_31_3_2_Prospect_descr_and_prognosis_encl_5(7)	pdf	0.24
100_03_31_3_2_Biostrat.kerogen_analysis_by_Stratlab	pdf	10.30
100_03_31_3_2_Formation_resistivity_meas	pdf	0.27
100_03_31_3_2_Grain_size_distr.analysis	pdf	0.68
100_03_31_3_2_Historie-tilpasning_by_Statoil	pdf	0.97
100_03_31_3_2_Hydrocarbon_characterisation	pdf	3.55
100_03_31_3_2_Permeability_thin_section	pdf	0.12
100_03_31_3_2_Petrophysical_evaluation	pdf	1.97
100_03_31_3_2_Petrophysical_evaluation_encl_1	pdf	0.71
100_04_31_3_2_Core_gamma_surface_log	pdf	0.15
100_04_31_3_2_Routine_core_analysis	pdf	1.79
100_05_31_3_2_31_3_2_High_acc.press.tem.p.meas_82816_Flopetrol	pdf	4.43
100_05_31_3_2_Drillsteam_test_report	pdf	8.08
100_05_31_3_2_High_acc.press.temp.meas_82816_encl_1	pdf	0.16

100 05 31 3 2 High acc.press.temp.meas 82802 Flopetrol	pdf	6.25
100 05 31 3 2 Oil test program	pdf	2.30
100 05 31 3 2 Pressure survey report	pdf	2.40
100 05 31 3 2 Production test report	pdf	1.39
100 05 31 3 2 PVT Analyse av olje fra Troll	pdf	1.40
100 05 31 3 2 Repeated formation tester	pdf	0.30
100 05 31 3 2 Results and implications	pdf	1.28
100 05 31 3 2 Results and implications encl 1	pdf	0.17
100 05 31 3 2 Results of the quality by Oilplus	pdf	2.86
100 05 31 3 2 Sampling report	pdf	1.68
100 05 31 3 2 SDP CRG press.and temp.survey0 by Flopetrol	pdf	10.05
100 05 31 3 2 SDP CRG press.and temp.survey 29C Flopetrol	pdf	10.28
100 05 31 3 2 SDP CRG press.and temp.survey 29C encl 1	pdf	0.13
100 05 31 3 2 SDP CRG press.and temp.survey 29E encl 1	pdf	0.16
100 05 31 3 2 SDP CRG press.and temp.survey 29E encl 2	pdf	0.14
100 05 31 3 2 SDP CRG press.and temp.survey 29E Flopetrol	pdf	9.98
100 05 31 3 2 SDP CRG press.and temp.survey encl 1	pdf	0.12
100 07 31 3 2 Borehole geoph.well Geophone	pdf	0.24
100 07 31 3 2 Borehole geoph.well Geophone encl 1	pdf	0.38
100 07 31 3 2 Borehole geoph.well Geophone encl 10	pdf	0.42
100 07 31 3 2 Borehole geoph.well Geophone encl 11	pdf	0.44
100 07 31 3 2 Borehole geoph.well Geophone encl 12	pdf	0.34
100 07 31 3 2 Borehole geoph.well Geophone encl 13	pdf	0.28
100 07 31 3 2 Borehole geoph.well Geophone encl 14	pdf	0.40
100 07 31 3 2 Borehole geoph.well Geophone encl 15	pdf	0.39
100 07 31 3 2 Borehole geoph.well Geophone encl 16	pdf	0.26

100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_17	pdf	0.28
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_18	pdf	0.17
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_19	pdf	0.35
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_2	pdf	1.09
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_20	pdf	0.31
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_21	pdf	0.39
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_22	pdf	0.38
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_23	pdf	0.31
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_24	pdf	0.32
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_25	pdf	0.19
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_26	pdf	0.16
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_27	pdf	0.14
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_28	pdf	0.14
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_29	tif	0.14
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_3	pdf	0.03
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_4	pdf	0.04
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_5	pdf	0.82
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_6	pdf	1.06
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_7	pdf	3.81
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_8	pdf	3.34
100 07 31 3 2 Borehole_geoph.well_Geoph one_encl_9	pdf	0.09

Drill stem tests (DST)

Test number	From depth MD [m]	To depth MD [m]	Choke size [mm]
1.0	1567	1577	63.5

Test number	Final shut-in pressure [MPa]	Final flow pressure [MPa]	Bottom hole pressure [MPa]	Downhole temperature [°C]
1.0				60

Test number	Oil [Sm ³ /day]	Gas [Sm ³ /day]	Oil density [g/cm ³]	Gas grav. rel.air	GOR [m ³ /m ³]
1.0	1272	563000	0.890	0.620	442

Logs

Log type	Log top depth [m]	Log bottom depth [m]
CBL VDL	610	1499
CBL VDL	1390	1705
CBL VDL	1400	1736
CET GR	1385	1702
CST	1040	1494
CST	1505	1979
CST	1750	2087
DLL MSFL GR SP CAL	1502	1639
HDT	610	1492
ISF LSS GR SP	451	622
ISF LSS GR SP	610	1491
ISF LSS GR SP	1502	2085
LDT CNL CAL GR	451	624
LDT CNL CAL GR	610	1493
LDT CNL CAL GR	1502	1639
LDT CNL CAL GR	1502	2086
RFT	1567	1567
RFT	1567	1725
RFT	1567	1567
RFT	1576	1576
RFT	1577	1577
RFT	1725	2022
SHDT	1502	2087

VSP-O	1000	2075
-------	------	------

Casing and leak-off tests

Casing type	Casing diam. [inch]	Casing depth [m]	Hole diam. [inch]	Hole depth [m]	LOT/FIT mud eqv. [g/cm ³]	Formation test type
CONDUCTOR	30	451.0	36	451.0	0.00	LOT
SURF.COND.	20	609.0	26	625.0	1.45	LOT
INTERM.	13 3/8	1502.0	17 1/2	1515.0	1.56	LOT
INTERM.	9 5/8	1805.0	12 1/4	2090.0	0.00	LOT

Drilling mud

Depth MD [m]	Mud weight [g/cm ³]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
460	1.06			WATER BASED	
560	1.37	11.0		WATER BASED	
650	1.20	18.0		WATER BASED	
1250	1.25	19.0		WATER BASED	
1355	1.30	18.0		WATER BASED	
1650	1.22	40.0		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]
100 Formation pressure (Formasjonstrykk)	pdf	0.19

