



Generell informasjon

Brønnbane navn	31/2-3
Type	EXPLORATION
Formål	APPRAISAL
Status	P&A
Faktakart i nytt vindu	lenke til kart
Hovedområde	NORTH SEA
Felt	TROLL
Funn	31/2-1 (Troll Vest)
Brønn navn	31/2-3
Seismisk lokalisering	62-4421 SP.175
Utvinningstillatelse	054
Boreoperatør	A/S Norske Shell
Boretillatelse	247-L
Boreinnretning	BORGNY DOLPHIN
Boredager	115
Borestart	28.03.1980
Boreslutt	20.07.1980
Frigitt dato	20.07.1982
Publiseringsdato	15.02.2006
Opprinnelig formål	APPRAISAL
Gjenåpnet	NO
Innhold	OIL/GAS
Funnbrønnbane	NO
1. nivå med hydrokarboner, alder	LATE JURASSIC
1. nivå med hydrokarboner, formasjon.	SOGNEFJORD FM
2. nivå med hydrokarboner, alder	MIDDLE JURASSIC
2. nivå med hydrokarboner, formasjon	FENSFJORD FM
Avstand, boredekk - midlere havflate [m]	25.0
Vanndybde ved midlere havflate [m]	334.0
Totalt målt dybde (MD) [m RKB]	2601.0
Totalt vertikalt dybde (TVD) [m RKB]	2600.0
Maks inklinasjon [°]	2.65
Temperatur ved bunn av brønnbanen [°C]	73
Eldste penetrerte alder	LATE TRIASSIC



Eldste penetrerte formasjon	HEGRE GP
Geodetisk datum	ED50
NS grader	60° 50' 27.84" N
ØV grader	3° 35' 10.82" E
NS UTM [m]	6745386.82
ØV UTM [m]	531872.26
UTM sone	31
NPDID for brønnbanen	236

Brønnhistorie

General

Well 31/2-3 was drilled in the Troll West area, approximately 8 km NNE of the Troll Discovery well 31/2-1. The well was drilled to appraise the Troll Discovery. It should evaluate reservoir parameters along the axis of maximum gross hydrocarbon column; prove maximum hydrocarbon reserves in the major northern fault block; confirm the significance of the seismic flatspot as a direct hydrocarbon indicator; further assess the significance of the oil shows found in 31/2-1; and evaluate the influence of earlier Kimmerian fault movements on reservoir characteristics.

Operations and results

Appraisal well 31/2-3 was spudded with the semi-submersible installation Borgny Dolphin on 28 March and drilled to TD at 2601 m in Late Triassic sediments in the Statfjord Formation. Drilling took 115 days. The reason for the long drilling period was safety inspection of the rig as a result of the "Alexander Kielland" accident and a strike amongst the Norwegian rig crew. The well was drilled with bentonite and seawater down to 816 m and with a gypsum/lignosulphonate mud from 816 m to TD.

No potential reservoir zones were encountered above top Jurassic. The well confirmed that the Late Jurassic sandstone reservoir encountered in wells 31/2-1 and 2 was well developed also in this more northerly part of the structure. A gross gas column of 189 m was penetrated with top at 1384 m. The uppermost 120 m was in a good clean sand (Sognefjord Formation) while the lower part of the gas column was in a micaceous and poor reservoir sand (Heather and Fensfjord Formations). Below the gas a 12 m thick oil zone was encountered, the same thickness and at the same level as in well 31/2-2. In this well however, the oil was in a very micaceous and poorly developed reservoir. The reservoir was unconformably overlain by Palaeocene claystones, which thus act as an effective seal for the reservoir. Below the OWC at 1585 no moveable hydrocarbons were seen in the well, but shows continued down to 1612 m and isolated shows were seen at 1630 m and at 1638 m.

The seismic Flatspot did coincide with the base of the gas column in well 31/2-3, supporting that the Flatspot indeed is a direct hydrocarbon indicator over the entire prospect.

Coring was performed in the Middle to Late Jurassic interval from 1412 m to 1645.5 m. Twenty-one cores with a total recovery of 194.4 m (84%) were cut. Coring started approximately 28 m below the top reservoir and continued well below the hydrocarbon/water contact. Prior to the full scale production test programme, a series of runs were made with the Schlumberger Repeat Formation Tester (RFT). A total of 10 RFT runs were made. The first run indicated pressure gradients very similar to those obtained in Wells 31/2-1 and 31/2-2. It was, however, impossible to confirm the 12-meter oil gradient indicated by RFT's in well 31/2-2. Sampling attempts in the water zone failed



as only mud filtrate was recovered. In the suspected oil zone, no samples were obtained in spite of numerous attempts as the tool probe always plugged in the relatively tight and poorly consolidated formation. Only two gas samples were obtained, at 1458 m and 1568.5 m.

The well was permanently abandoned on 20 July 1980 as a gas and oil appraisal well.

Testing

Four Production Tests were conducted in the Middle to Late Jurassic. PT1 tested the interval 1600.5 m to 1605.5 m in the water zone, PT2 tested the interval 1577.5 m to 1582.5 m in the oil zone, PT3 tested the interval 1520 m to 1535 m in the micaceous part of the gas bearing section, and PT4 tested 1435 m to 1460 m in the top clean sand of the gas section.

After the bottom hole test valve was opened for the test in the water zone, the well flowed for 17 minutes until it died. Some 87.5 litres of formation water (70.000 ppm NaCl equivalent) were recovered.

In the oil zone test (PT2) the well came in at a low rate and flowed at about 4.5 - 6.6 Sm³/day for four days. The oil was about 24 deg API and the GOR around 36 Sm³/Sm³. The micaceous gas zone test (PT3) stabilized at a rate of about 142000 Sm³/day on 28/64" choke during the clean up period. The produced fluids were gas of gravity 0.617 (air = 1) and condensate of 50.3 API, with some water (mostly brine) and traces of sediment. The gas contained no detectable H₂S and approximately 0.4% CO₂. Sequential rate tests followed where the rates continuously improved up to 923000 Sm³/day. The test was terminated while production rates were still increasing. The reason for the increasing rates was assumed to be development of a channel behind the casing creating communication with the better sand some 10 meters above the top of the perforations. The clean sand gas test was performed with a gravel pack completion. Severe turbulence effects dominated it. After the initial clean up at 368000 - 481000 Sm³/day flow rate, the well produced at maximum rate of about 1133000 Sm³/day. The fluids had similar composition as in PT3.

Temperatures measured during the test gave a formation temperature of 60 - 62 deg C in the gas-bearing section of the reservoir. This corresponds to a linear temperature gradient from seafloor to top reservoir of ca 50 deg C, which is very high for the area.

Borekaks i Sokkeldirektoratet

Borekaksprøve, topp dybde [m]	Borekaksprøve, bunn dybde [m]
460.00	2599.00

Borekaks tilgjengelig for prøvetaking?	YES
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Borekjerter i Sokkeldirektoratet

Kjerneprøve nummer	Kjerneprøve - topp dybde	Kjerneprøve - bunn dybde	Kjerneprøve dybde - enhet
1	1412.0	1415.5	[m]
2	1421.0	1425.0	[m]
3	1425.0	1441.0	[m]



4	1443.0	1449.3	[m]
5	1450.0	1461.2	[m]
6	1462.4	1467.8	[m]
8	1469.2	1473.0	[m]
9	1473.0	1475.0	[m]
10	1484.5	1496.4	[m]
11	1496.4	1514.5	[m]
12	1514.5	1529.6	[m]
13	1533.0	1540.9	[m]
14	1551.0	1564.5	[m]
15	1564.5	1566.5	[m]
16	1566.6	1584.3	[m]
17	1584.0	1599.7	[m]
18	1601.0	1619.3	[m]
19	1619.0	1623.9	[m]
20	1624.0	1627.7	[m]
21	1628.0	1645.4	[m]
22	2116.0	2133.9	[m]

Total kjerneprøve lengde [m]	216.4
Kjerner tilgjengelig for prøvetaking?	YES

Kjernebilder



1412-1414m



1414-1416m



1421-1423m



1423-1425m



1425-1427m



1427-1430m



1430-1433m



1433-1435m



1435-1438m



1438-1441m



1443-1445m



1445-1448m



1448-1449m



1450-1452m



1452-1455m



1455-1458m



1458-1460m



1460-1461m



1462-1463m



1469-1471m



1471-1473m



1473-1475m



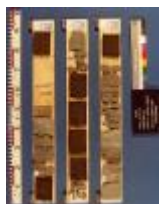
1484-1487m



1487-1489m



1489-1492m



1492-1495m



1495-1496m



1496-1499m



1499-1501m



1501-1504m



1504-1507m



1507-1509m



1509-1512m



1512-1514m



1514-1517m



1517-1519m



1519-1522m



1522-1525m



1525-1528m



1528-1529m



1533-1535m



1535-1538m



1538-1540m



1551-1553m



1553-1556m



1556-1559m



1559-1561m



1561-1564m



1564-1566m



1566-1569m



1569-1572m



1572-1574m



1574-1577m



1577-1580m



1580-1582m



1582-1584m



1584-1586m



1586-1589m



1589-1592m



1592-1594m



1594-1597m



1601-1603m



1603-1606m



1606-1609m



1609-1611m



1611-1614m



1614-1617m



1617-1619m



1619-1621m



1621-1623m



1624-1626m



1626-1627m



1628-1630m



1730-1633m



1633-1636m



1636-1638m



1638-1641m



1641-1644m



1644-1645m



2116-2118m



2118-2121m



2121-2124m



2126-2129m



2129-2132m



2132-2133m

Oljeprøver i Sökkeldirektoratet

Test type	Flaske nummer	Topp dyp MD [m]	Bunn dyp MD [m]	Væske type	Test tidspunkt	Prøver tilgjengelig
DST	DST1	1577.00	1582.00	WATER	06.06.1980 - 20:00	YES

Litostratigrafi

Topp Dyb [mMD RKB]	Litostrat. enhet
359	NORDLAND GP
643	HORDALAND GP
1145	ROGALAND GP
1145	BALDER FM
1200	SELE FM
1242	LISTA FM
1374	VÅLE FM



1384	VIKING GP
1384	SOGNEFJORD FM
1508	HEATHER FM
1561	FENSFJORD FM
1677	KROSSFJORD FM
1755	HEATHER FM
1812	BRENT GP
1902	DUNLIN GP
1902	DRAKE FM
2010	COOK FM
2055	AMUNDSEN FM
2097	JOHANSEN FM
2176	AMUNDSEN FM
2236	STATFJORD GP
2358	HEGRE GP

Spleisede logger

Dokument navn	Dokument format	Dokument størrelse [KB]
236	pdf	0.45

Geokjemisk informasjon

Dokument navn	Dokument format	Dokument størrelse [KB]
236_1	pdf	1.29
236_2	pdf	0.51

Dokumenter - eldre Sökkeldirektoratets WDSS rapporter og andre relaterte dokumenter

Dokument navn	Dokument format	Dokument størrelse [KB]
236_01_WDSS_General_Information	pdf	0.15
236_02_WDSS_completion_log	pdf	0.18

Dokumenter - rapportert av utvinningstillatelsen (frigitt ihht til regelverk)





Dokument navn	Dokument format	Dokument størrelse [KB]
236 01 31 2 3 Completion Report	pdf	35.06
236 02 31 2 3 Completion log	pdf	1.29
236 31 2 3 Biostratigraphy appendix	pdf	2.43
236 31 2 3 Bottom hole press.calc	pdf	0.44
236 31 2 3 Core description core 1-21	pdf	10.79
236 31 2 3 Core report core 1-22 final report	pdf	10.10
236 31 2 3 Form.testing services report D ST1	pdf	0.36
236 31 2 3 Formation survey analysis	pdf	0.06
236 31 2 3 Geochem eval of source rock	pdf	0.44
236 31 2 3 Geochem eval of source rock encl 1	pdf	0.12
236 31 2 3 Geological investigation cores vol 3	pdf	139.86
236 31 2 3 Geological investigation cores vol 1	pdf	17.61
236 31 2 3 Geological Investigation cores vol 2	pdf	20.73
236 31 2 3 Palynofacies invest on the Jurassic	pdf	6.05
236 31 2 3 Press.surv.rep test1 run3	pdf	1.25
236 31 2 3 Press.surv.rep test2 run1	pdf	0.77
236 31 2 3 Press.surv.rep test2 run2	pdf	1.51
236 31 2 3 Press.surv.rep test3 run1	pdf	1.22
236 31 2 3 Press.surv.rep test3 run2	pdf	1.66
236 31 2 3 Press.surv.rep test3 run3	pdf	1.43
236 31 2 3 Press.surv.test1 run1	pdf	0.60
236 31 2 3 Press.surv.test clean sand	pdf	0.84
236 31 2 3 Prod.test sampling	pdf	0.54
236 31 2 3 Production test	pdf	1.97
236 31 2 3 Production test programme	pdf	2.69
236 31 2 3 PVT study on b.h.sample	pdf	0.50
236 31 2 3 Rapport fra prod.test	pdf	1.12
236 31 2 3 Res.fluid study	pdf	0.32
236 31 2 3 Res.fluid study 2	pdf	0.71
236 31 2 3 Res.fluid analysis 80167	pdf	0.35
236 31 2 3 Res.fluid analysis 80167B	pdf	0.34
236 31 2 3 Res.fluid analysis 80168	pdf	0.33
236 31 2 3 Res.fluid analysis 80169	pdf	0.34
236 31 2 3 Res.fluid analysis 81.12	pdf	0.56





236 31 2 3 Res.fluid analysis 91.13	pdf	0.28
236 31 2 3 Res.fluid study 80090	pdf	0.20
236 31 2 3 Res.fluid study 80091	pdf	0.23
236 31 2 3 Res.fluid study by Sintef	pdf	0.38
236 31 2 3 Rock mineral analysis	pdf	0.14
236 31 2 3 Sidewall sample description	pdf	0.69
236 31 2 3 Sieve analysis	pdf	2.60
236 31 2 3 Test information micace	pdf	0.75
236 31 2 3 Well summary by Anchor	pdf	2.06
236 31 2 3 Well testing data sheet	pdf	2.29
236 31 2 3 Well test interpretation	pdf	11.20
236 31 2 3 Well test report DST1 DST2	pdf	6.07
236 31 2 3 Well test report gas no1	pdf	5.32
236 31 2 3 Well test report gas no1 mica ceous	pdf	9.81
236 31 2 3 Well test report gas no2	pdf	3.63
236 31 2 3 Well test report gas no2 annexes	pdf	6.10
236 31 2 3 Facies inndeling basert paa lo gg	pdf	1.31

Borestrengtester (DST)

Test nummer	Fra dybde MD [m]	Til dybde MD [m]	Reduksjonsven til størrelse [mm]
1.0	1575	1580	0.0
2.0	1552	1557	6.4
3.0	1495	1510	50.8
4.0	1410	1435	38.1

Test nummer	Endelig avstengningstrykk [MPa]	Endelig strømningstrykk [MPa]	Bunnhullstrykk [MPa]	Borehullstemperatur [°C]
1.0				
2.0				
3.0				
4.0				





Test nummer	Olje produksjon [Sm3/dag]	Gass produksjon [Sm3/dag]	Oljetetthet [g/cm3]	Gasstyngde rel. luft	GOR [m3/m3]
1.0					
2.0	14	560	0.910		40
3.0		914000			
4.0		1133000			

Logger

Type logg	Topp dyp for logg [m]	Bunn dyp for logg [m]
CBL	350	1816
CBL	630	1352
CST	1	0
CST	2	0
CST	3	0
DLL MSFL GR	1352	1824
FDC CNL GR CAL	445	818
FDC CNL GR CAL	803	1367
FDC CNL GR CAL	1352	1824
FDC CNL GR CAL	1817	2590
HDT	1352	1819
HDT	1817	2596
ISF BHC GR SP	445	814
ISF BHC GR SP	803	1368
ISF BHC GR SP	1352	1821
ISF BHC GR SP	1817	2593
LSS GR	445	816
LSS GR	803	1364
LSS GR	1352	1819
LSS GR	1817	2594
RFT	1387	1750

Foringsrør og formasjonsstyrketester

Type utforing	Utforing diam. [tommer]	Utforing dybde [m]	Brønnbane diam. [tommer]	Brønnbane dyp [m]	LOT/FIT slam eqv. [g/cm3]	Type formasjonstest
CONDUCTOR	30	420.0	36	425.0	0.00	LOT
SURF.COND.	20	779.0	26	789.0	1.43	LOT



INTERM.	13 3/8	1328.0	17 1/2	1339.0	1.55	LOT
INTERM.	9 5/8	1791.0	12 1/4	1798.0	1.74	LOT
LINER	7	2576.0	8 1/2	2576.0	0.00	LOT

Boreslam

Dybde MD [m]	Egenvekt, slam [g/cm3]	Viskositet, slam [mPa.s]	Flytegrense [Pa]	Type slam	Dato, måling
789	1.31	54.0		seawater	
1338	1.32	60.0		seawater	
1433	1.28	52.0		seawater	
1941	1.18	52.0		seawater	
2267	1.19	48.0		seawater	

Tynnslip i Sokkeldirektoratet

Dybde	Enhet
1414.40	[m]
1432.80	[m]
1443.45	[m]
1450.20	[m]
1471.25	[m]
1486.90	[m]
1492.80	[m]
1505.10	[m]
1534.35	[m]
1540.40	[m]
1553.70	[m]
1558.45	[m]
1563.90	[m]
1565.65	[m]
1568.65	[m]
7574.45	[m]
1574.45	[m]
1579.86	[m]
1585.79	[m]
7586.92	[m]
1586.92	[m]
1590.54	[m]



1599.08	[m]
1609.86	[m]
1615.50	[m]
1623.24	[m]
1628.12	[m]
1414.00	[m]
1433.00	[m]
1443.00	[m]
1450.00	[m]
1471.00	[m]
1487.00	[m]
1493.00	[m]
1505.00	[m]
1513.00	[m]
1523.00	[m]
1534.00	[m]
1540.00	[m]
1554.00	[m]
1558.00	[m]
1564.00	[m]
1566.00	[m]
1569.00	[m]
1575.00	[m]
1580.00	[m]
1586.00	[m]
1587.00	[m]
1628.00	[m]

Trykkplott

Porertrykksdataene kommer fra logging i brønnen hvis ingen annen kilde er oppgitt. I noen brønner der trykk ikke er logget, er det brukt informasjon fra formasjonstester eller brønnspar. Trykkdataene er rapportert inn til Oljedirektoratet og videre prosessert og kvalitetssikret av IHS Markit.

Dokument navn	Dokument format	Dokument størrelse [KB]
236 Formation pressure (Formasjonstrykk)	pdf	0.22

