



General information

Wellbore name	2/4-20
Type	EXPLORATION
Purpose	WILDCAT
Status	P&A
Press release	link to press release
Factmaps in new window	link to map
Main area	NORTH SEA
Well name	2/4-20
Seismic location	Line 7832 Trace 17200 (VGCNS-05 3D)
Production licence	018
Drilling operator	ConocoPhillips Skandinavia AS
Drill permit	1142-L
Drilling facility	MÆRSK GALLANT
Drilling days	175
Entered date	22.09.2007
Completed date	14.03.2008
Release date	14.03.2010
Publication date	14.03.2010
Purpose - planned	WILDCAT
Reentry	NO
Content	DRY
Discovery wellbore	NO
Kelly bushing elevation [m]	45.0
Water depth [m]	68.0
Total depth (MD) [m RKB]	5719.0
Final vertical depth (TVD) [m RKB]	5673.0
Maximum inclination [°]	3
Bottom hole temperature [°C]	197
Oldest penetrated age	EARLY PERMIAN
Oldest penetrated formation	ROTLIEGEND GP
Geodetic datum	ED50
NS degrees	56° 36' 43.17" N
EW degrees	3° 8' 40.08" E
NS UTM [m]	6274345.10
EW UTM [m]	508867.61
UTM zone	31
NPDID wellbore	5556



Wellbore history

General

Well 2/4-20 was drilled in the Feda Graben ca 8 km north of the Ekofisk Field and 5 km east of the Albuskjell Field in the Central Graben of the North Sea. The purpose of the 2/4-20 North Ekofisk exploration well was to test potential reservoirs in the pre-Cretaceous High-Pressure-High-Temperature play at both Jurassic and Permian Rotliegendes levels. The 2/4-17 Tjalve Discovery drilled in 1991 ca 9 km to the north-east of 2/4-20 had proved condensate in deep Oxfordian sand and traces of hydrocarbons in the Rotliegendes Group. The main targets in the well were two Jurassic potential reservoir horizons: a primary target J50 (Oxfordian) sandstone and a secondary target J40 (Callovian) sandstone. In the Permian excellent reservoir sandstones analogous to 2/4-17 were expected to consist of Rotliegendes Group strata, largely of aeolian origin. Planned TD was at 5695 m with an expected TD temperature of 195 deg C.

Operations and results

Wildcat well 2/4-20 was spudded with the jack-up installation Mærsk Galant on 22 November 2007 and drilled to TD at 5719 m in the Early Permian Rotliegendes Group. The 2/4-20 HPHT well was drilled within risked AFE time and cost. The well took a total of 189.1 days (including 7.9 days WOW). The R70 shallow gas reflector (Crenulate Reflector) was drilled at 645 m with 11.0 ppg mud and a gas peak of 4.4% recorded. The section was cased with a 16" liner. At 1786m, a 35 bbl kick of 13.65 ppg intensity was taken in a thin (1.5m thick) sand sitting directly on the Mid Miocene unconformity. The mud weight at the time was 13.0 ppg. The well was killed with 14.0 ppg mud using a modified driller's method. With a maximum measured temperature at TD of 194 deg C, Horner corrected to 197 deg C, this was the hottest well on the Norwegian continental shelf to date.

The well was drilled with seawater/hi-vis sweeps/spud mud down to 479 m, with Versatec OBM from 479 m to 2888 m, with Paratherm OBM from 2888 m to 4766 m, and with WARP OBM from 2888 m to TD. The WARP mud used in the 8 1/2" and 5 3/4" hole sections proved difficult to clean off the cuttings samples. It posed problems for biostratigraphic analyses and proved detrimental to organic geochemical analyses.

The Late Jurassic J60 - J70 Kimmeridge Clay equivalent (Draupne Formation) seen in the 2/4-19 B well was not present in 2/4-20 having been eroded down into the Farsund Formation at crest of structure. A significant thickness of sand was penetrated at a number of stratigraphic levels. The J50 target sands were not developed in the well location. Below this however, was encountered a thick J54 Lower Ula Sandstone sequence (top 5183.5 m); well developed sands of the J40-J22 Bryne Formation (top 5340 m); and a 51m-thick (gross) sandstone/shale unit of undifferentiated Jurassic/Triassic age (top 5453 m). Below the Zechstein evaporites, a sequence of Permian Rotliegendes sandstones was drilled down to the TD of the well.

Jurassic reservoir presence and quality was significantly greater than pre-drill estimates. Jurassic J54 net porosity-metres was seven times greater than the pre-drill P50 prediction with two, thick, stacked shoreface sequences totalling 156.5 m gross being penetrated. The J40 ? J22 fluvio-deltaic Bryne reservoir consisted of 113m gross of interbedded sands, silts and coals. Pre-drill there was estimated to be only a 20% chance of this reservoir being present. The Rotliegendes Auk Formation, penetrated at 5592.5 m, consisted of 99.5 m of an Upper Unit of very tight non-reservoir argillaceous sandstones, underlain by 35 m-thick Lower Unit of better quality sandstones down to TD.

Shows detection was made difficult by the Versatec, Paratherm and WARP oil based mud used as drilling fluids for the entire well below 479 m. The only shows encountered were in the top of the Ekofisk Formation where faint oil shows were observed, and in the



upper part of the Rotliegende Sandstone where very weak slow white cut fluorescence was noted. White fluorescent fluid inclusions in the Rotliegende strengthened the evidence for migrated light hydrocarbons in these strata

No sidewall or conventional cores were cut in the well. No wire line fluid samples were taken. Pressure points were recorded with the XPT and MDT tools. In the Rotliegende sandstone at TD pressures were acquired with the XPT-H tool, run in this well as the first in the world. The number of good pressure points obtained were in general sparse, but showed that the Jurassic and Permian reservoirs sections were in different pressure compartments. The logging programme also included a CMR magnetic resonance run in the 8 1/2" section to explore the poroperm properties of the lower Ula Formation sandstone.

The well was permanently abandoned on 14 March 2008 as a dry well.

Testing

No drill stem test was performed.

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
210.00	5719.00

Cuttings available for sampling?	YES
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Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
113	NORDLAND GP
1774	HORDALAND GP
3115	ROGALAND GP
3115	BALDER FM
3123	SELE FM
3144	LISTA FM
3254	VÅLE FM
3268	SHETLAND GP
3268	EKOFISK FM
3402	TOR FM
3862	HOD FM
4677	BLODØKS FM



4692	HIDRA FM
4745	CROMER KNOLL GP
4818	TYNE GP
5176	VESTLAND GP
5176	ULA FM
5225	BRYNE FM
5426	SMITH BANK FM
5496	ZECHSTEIN GP
5631	ROTLIEGEND GP

Logs

Log type	Log top depth [m]	Log bottom depth [m]
CMR GR	5167	5250
MWD LWD - DGR	479	2888
MWD LWD - DGR EWR PWD	3551	5719
MWD LWD - DWD	113	479
MWD LWD - EWR PWD AGR ALD CTN BA	2888	3551
QAIT QSLT QLDT QCNT QTGC SON GR	100	5433
QAST	1441	5715
QLDT QCNT QTGC	5450	5727
QLDT QCNT QTGC QSLT QSCS	5300	5560
WAIT QSLT QTGC	5440	5727
XPT QTGC	5185	5352
XPT QTGC	5694	5723

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	195.0	36	201.0	0.00	LOT
SURF.COND.	20	473.0	26	479.0	1.51	LOT
INTERM.	16	1451.0	20	1461.0	0.00	LOT
INTERM.	13 5/8	2883.0	17 1/2	2888.0	1.87	LOT
INTERM.	10 3/4	4763.0	12 1/4	4766.0	1.91	LOT
LINER	7	5565.0	8 1/2	5565.0	2.25	LOT
OPEN HOLE		5719.0	5 3/4	5719.0	0.00	LOT

**Drilling mud**

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
94	1.08	5.0		SPUD MUD	
128	1.05	6.0		WATER BASE	
146	1.13	7.0		WATER BASE	
442	1.39	36.0		OIL BASE	
445	1.57	39.0		OIL BASE	
670	1.70	35.0		OIL BASE	
1082	1.75	41.0		OIL BASE	
1204	1.73	43.0		OIL BASE	
1353	1.38	33.0		OIL BASE	
1402	1.77	51.0		OIL BASE	
1410	1.77	46.0		OIL BASE	
1448	1.38	33.0		OIL BASE	
1667	2.08	60.0		OIL BASE	
4746	1.77	42.0		OIL BASE	
4847	2.12	57.0		OIL BASE	
5002	2.12	59.0		OIL BASE	
5133	2.12	61.0		OIL BASE	
5440	2.12	61.0		HPHT OB WARP	
5608	2.06	55.0		OIL BASE	
5719	2.08	49.0		OIL BASE	