General information

Wellbore name	2/4-23 S
Type	EXPLORATION
Purpose	WILDCAT
Status	P&A
Press release	link to press release
Factmaps in new window	link to map
Main area	NORTH SEA
Field	FENRIS
Discovery	2/4-23 S (Julius)
Well name	2/4-23
Seismic location	VGCNS05TI1.inline 8060 & crossline 18592
Production licence	146
Drilling operator	Statoil Petroleum AS
Drill permit	1562-L
Drilling facility	MÆRSK GALLANT
Drilling days	175
Entered date	12.03.2015
Completed date	05.09.2015
Release date	05.09.2017
Publication date	05.09.2017
Purpose - planned	WILDCAT
Reentry	NO
Content	GAS/CONDENSATE
Discovery wellbore	YES
1st level with HC, age	LATE JURASSIC
1st level with HC, formation	FARSUND FM
2nd level with HC, age	LATE JURASSIC
2nd level with HC, formation	ULA FM
Kelly bushing elevation [m]	48.0
Water depth [m]	69.0
Total depth (MD) [m RKB]	5548.0
Final vertical depth (TVD) [m RKB]	5448.0
Maximum inclination [°]	25.1
Bottom hole temperature [°C]	190
Oldest penetrated age	LATE TRIASSIC
Oldest penetrated formation	SKAGERRAK FM
Geodetic datum	ED50

NS degrees	56° 41' 26.95'' N
EW degrees	3° 6' 6.95'' E
NS UTM [m]	6283115.01
EW UTM [m]	506243.63
UTM zone	31
NPDID wellbore	7657

Wellbore history

General

Well 2/4-23 S was drilled to test the Julius prospect about 17 km northeast of the Ekofisk field, near the 2/4-21 (King Lear) discovery in the southern part of the North Sea. The primary objective was to prove petroleum in the Late Jurassic Ula Formation and the Middle Jurassic Bryne Formation. The secondary objective was to delineate the 2/4-21 discovery (King Lear), which was proven in Late Jurassic reservoir rocks within the Farsund Formation) in the summer of 2012. The tertiary exploration target for 2/4-23 S was to prove petroleum in the Late Triassic reservoir Skagerrak Formation.

Operations and results

Wildcat well 2/4-23 S was spudded with the jack-up installation Mærsk Galant on 12 March 2015 and drilled to TD at 5548 m in the Late Triassic Skagerrak Formation. At 5235 m, in the Ula Formation, the well kicked and a 12-m3 influx was taken into the well. A considerable amount of time was needed to regain control of the well, including bullheading operations followed by circulation of remaining gas out of the well. Eventually drilling was resumed with a bottom hole pressure of 2.15 g/cm3. The well was drilled with Seawater and hi-vis pills down to 224 m, with Glydril mud from 224 to 457 m, with Versatec oil based mud from 457 to 4876 m and with WARP oil based mud from 4876 m to TD.

Top of intra-Farsund Formation sandstones, King Lear appraisal target, was encountered at 4994 m (4893 m TVD). A 20-metre thick gas/condensate column was encountered here, in two five metres thick sandstones with moderate/good reservoir quality. The petroleum/water contact was not found. Pressure communication with the 2/4-21 King Lear discovery was confirmed. The Ula Formation was encountered at 5205 m (5105 m TVD) and proved to contain 41 metres of gas/condensate in sandstones of moderate reservoir quality. The petroleum/water contact was not encountered. The well also penetrated 30 gross metres of water-filled sandstone with poor reservoir quality in the Bryne Formation. The Skagerrak formation had poor reservoir quality and was water-filled. Despite the presence of hydrocarbons in the Farsund and Ula formation sandstones, no shows were detected on cutting samples. The use of oil based mud and the suspicion of a deep mud invasion could have masked any signs of live hydrocarbons.

By-pass coring in an open-hole sidetrack was planned in case of discovery in Ula or Skagerrak reservoirs. Despite Ula reservoir being gas filled, no by-pass coring was performed due to too high operational risk. MDT fluid samples were taken at 5012.3 m (gas/condensate), 5211.2 m (gas/condensate) and 5241.4 m (gas/condensate). All fluid samples were contaminated with oil based mud. The contamination ranged from 14.8 to 20.7 % of the STO liquid content in the samples. Cuttings samples from the 8 1/2" section (below 4876 m) are recorded on drillers depth, which is up to 12 m shallower than loggers depth.

88.1 days were spent on plug and abandon, exceeding the budget (22.3 days) by 65.8 days. The main drivers for exceeding the target and budget were:

-Stuck with cement stinger when circulating above cement plug #1

-Failure of annular preventer

-Remedial cementing of 9 7/8" production casing

-3 attempts to set cement plug in section milled interval in 9 7/8" casing

The well was permanently abandoned on 5 October as a gas-condensate discovery.

Testing

No drill stem test was performed.

Cuttings at the Norwegian Offshore Directorate

Cutting sample, top depth [m]	Cutting samples, bottom depth [m]
240.00	5548.00

Cuttings available for sampling?	YES

Palynological slides at the Norwegian Offshore Directorate

Sample depth	Depth unit	Sample type	Laboratory
4850.0	[m]	DC	PETROSTR
4859.0	[m]	DC	PETROS
4868.0	[m]	DC	PETROS
4877.0	[m]	DC	PETROS
4886.0	[m]	DC	PETROS
4895.0	[m]	DC	PETROS
4904.0	[m]	DC	PETROS
4913.0	[m]	DC	PETROS
4922.0	[m]	DC	PETROS
4931.0	[m]	DC	PETROS
4940.0	[m]	DC	PETROS
4949.0	[m]	DC	PETROS

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
MDT		5233.40	0.00	CONDENSATE		YES

MDT		5203.10	0.00	CONDENSATE		YES
MDT		5004.30	0.00	CONDENSATE		YES

Lithostratigraphy

Top depth [mMD RKB]	Lithostrat. unit
117	NORDLAND GP
1855	HORDALAND GP
3271	ROGALAND GP
3271	BALDER FM
3298	SELE FM
3340	LISTA FM
3368	VIDAR FM
3405	LISTA FM
3455	VÅLE FM
3484	SHETLAND GP
3484	EKOFISK FM
3604	TOR FM
4077	HOD FM
4798	BLODØKS FM
4824	HIDRA FM
4847	CROMER KNOLL GP
4847	RØDBY FM
4850	SOLA FM
4857	TUXEN FM
4886	ÅSGARD FM
4907	TYNE GP
4907	FARSUND FM
5142	HAUGESUND FM
5205	VESTLAND GP
5205	ULA FM
5310	HEGRE GP
5310	SKAGERRAK FM

Logs

Log type	Log top depth [m]	Log bottom depth [m]
GR IBC CBL	4000	4858
GR IBC CBL	4092	4410
HXPT GR	4986	5470
IBC CBL GR	3851	4825
LDS MSIP GR	3469	4876
MDT GR	4988	5004
MDT GR	5203	5233
MWD - ABG DGR EWR P4 PWD DIR	3560	4866
MWD - DGR EWR P4 PWD DIR	233	3560
MWD - DGR EWR P4 PWD DIR	4866	4876
MWD - GM EWR P4 PWD FTWD ALD CTN	4876	5548
MWD - GM EWR P4 PWD FTWD CTN DIR	4876	5548
NGI MSIP GR	4868	5549
QAIT HAPS LDS ECS HNGS	4768	5554
VSI GR	1346	4856
VSI GR	3000	5334
XLROCK GR	4988	5422
XLROCK GR	5305	5408

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	224.0	36	224.0	0.00	
SURF.COND.	20	443.7	24	457.0	1.48	FIT
PILOT HOLE		457.0	9 7/8	457.0	0.00	
LINER	16	1447.7	17 1/2	1452.0	1.78	FIT
INTERM.	13 5/8	3516.6	17 1/2	3560.0	1.97	FIT
INTERM.	9 7/8	4868.0	12 1/4	4876.0	2.23	FIT
		5235.0	8 1/2	5235.0	2.19	FIT
OPEN HOLE		5548.0	8 1/2	5548.0	2.20	FIT

Drilling mud

Depth MD [m]	Mud weight [g/cm3]	Visc. [mPa.s]	Yield point [Pa]	Mud type	Date measured
233	1.45	17.0		Glydril	
260	1.10	12.0		Glydril	
456	1.20	23.0		Glydril	
799	1.85	74.0		Versatec	
870	1.20	30.0		Versatec	
1452	1.25	41.0		Versatec	
1491	1.70	46.0		Versatec	
2866	1.84	54.0		Versatec	
3241	1.71	66.0		Versatec	
3560	1.72	57.0		Versatec	
3790	1.60	45.0		Versatec	
4045	1.85	59.0		Versatec	
4132	1.62	44.0		Versatec	
4148	1.85	53.0		Versatec	
4207	1.62	45.0		Versatec	
4238	1.85	59.0		Versatec	
4315	1.62	51.0		Versatec	
4328	1.85	48.0		Versatec	
4375	1.62	50.0		Versatec	
4378	1.85	56.0		Versatec	
4380	1.62	62.0		Versatec	
4530	1.65	50.0		Versatec	
4633	1.80	62.0		Versatec	
4776	2.00	52.0		WARP	
4787	1.82	61.0		Versatec	
4850	2.18	82.0		WARP	
4876	1.85	54.0		Versatec	
4932	2.00	40.0		WARP	
4957	2.18	64.0		WARP	
5041	2.00	36.0		WARP	
5235	2.16	54.0		WARP	
5338	2.18	70.0		WARP	
5500	2.04	45.0		WARP	
5548	2.18	62.0		WARP	