



Generell informasjon

Brønnbane navn	6406/2-4 SR
Type	EXPLORATION
Formål	APPRAISAL
Status	P&A
Faktakart i nytt vindu	lenke til kart
Hovedområde	NORWEGIAN SEA
Felt	KRISTIN
Funn	6406/2-1 Lavrans
Brønn navn	6406/2-4
Seismisk lokalisering	HWM94- INLINE 1500 & CROSSLINE 2063
Utvinningstillatelse	199
Boreoperatør	Saga Petroleum ASA
Boretillatelse	876-L2
Boreinnretning	DEEPSEA BERGEN
Boredager	96
Borestart	12.11.1998
Boreslutt	15.02.1999
Plugget og forlatt dato	15.02.1999
Frigitt dato	15.02.2001
Publiseringsdato	11.04.2003
Opprinnelig formål	APPRAISAL
Gjenåpnet	YES
Årsak til gjenåpning	DRILLING
Innhold	GAS/CONDENSATE
Funnbrønnbane	NO
1. nivå med hydrokarboner, alder	MIDDLE JURASSIC
1. nivå med hydrokarboner, formasjon.	GARN FM
2. nivå med hydrokarboner, alder	EARLY JURASSIC
2. nivå med hydrokarboner, formasjon	BÅT GP
Avstand, boredekk - midlere havflate [m]	23.0
Vanndybde ved midlere havflate [m]	273.5
Totalt målt dybde (MD) [m RKB]	5080.0
Totalt vertikalt dybde (TVD) [m RKB]	4969.6
Maks inklinasjon [°]	25.1



Temperatur ved bunn av brønnbanen [°C]	177
Eldste penetrerte alder	EARLY JURASSIC
Eldste penetrerte formasjon	ÅRE FM
Geodetisk datum	ED50
NS grader	64° 47' 58.34" N
ØV grader	6° 32' 29.26" E
NS UTM [m]	7188560.78
ØV UTM [m]	383212.30
UTM sone	32
NPDID for brønnbanen	3627

Brønnhistorie

General

Appraisal well 6406/2-4 S was drilled on the southern part of the Lavrans structure in the eastern part of block 6406/2, south of the Sørbukk Field and west of the Trestakk Field on Haltenbanken. The Lavrans structure is a rotated fault block west of the Trestakk Fault on the Halten Terrace. The purpose of the well was to appraise the southward extension of hydrocarbons in the Garn, Ile and Tofte Formations in the Lavrans structure, and to test separate closures in the Tilje and Åre formations. In addition, the well was planned to test the productivity improvement achievable by hydraulic stimulation. The well should also penetrate two sandy zones of Turonian (Lysing Formation) and Cenomanian/Albian age (Intra Lange sandstone).

Operations and results

The deviated appraisal well 6406/2-4 S was spudded 18 January 1997 with the semi-submersible installation "Deepsea Bergen". It was drilled to 4546 m (4457 m TVD) in the Melke Formation. Mainly because of the weather conditions (41 days of WOW and weather-related problems) drilling of 6406/2-4 S was significantly delayed. Due to environmental restrictions in the area the well had to be suspended on April 5 1997 before the well targets had been reached. Well 6406/2-4 S R was re-entered 12 November at depth 4534 m (4446 m TVD), below the 9 5/8" casing shoe in the initial well, and drilled to final TD at 5080 m (4969 m TVD) in Early Jurassic Åre Formation sediments. The well bores were drilled with KCl mud / spud mud down to 1110 m, with KCl mud and "ANCO 208" glycol from 1110 m to 2260 m, and with oil based "ANCOVERT" mud from 2260 m to final TD.

Down to Base Cretaceous Unconformity the stratigraphy was as expected, the prognosis matched the experienced stratigraphy well. Below ECU, 154 meters of Upper Jurassic shales were penetrated before the drilling had to be stopped. Prognosed thickness of the Upper Jurassic shales was 44 m TVD. High total gas was observed when drilling through the Cretaceous sandy intervals, the Lysing and Lange Formations, but shows were not described in the cuttings.

Well 6406/2-4 S R proved gas/condensate bearing sandstones in the Garn, Tofte and Tilje formations in hydrocarbon-down-to situations. The well penetrated a large fault within the Garn Formation, so that the Ile Formation along with parts of the Garn, most of the Not, the entire Upper Ror and the upper part of the Tofte Formation were faulted out. This fault came on depth as prognosed, but it had considerably larger throw than expected. In addition to this large fault, two smaller faults were penetrated in the Tilje



Formation. The quality of the reservoir formations was somewhat lower than expected due to the tectonic influence. In the Tofte Formation, the proximity to the fault has reduced reservoir quality due to fractures and higher degree of cementation. In the Tilje Formation, the best-developed reservoir zones were either fractured or faulted out. The Garn Formation was intensively brecciated and fractured. Disregarding the faults, thickness of the formations approximates those of the neighbouring wells on Lavrans. The Åre Formation gave some gas readings during drilling but was regarded to be without hydrocarbons. No cores were cut and no wire line samples taken in well bore 6406/2-4 S. In the re-entry a total of ten conventional cores with a total length of 325.1 m were drilled, of which 322.8 m (99.3 %) were recovered. The cores were cut in the Middle Jurassic.

A total of seven fluid samples were acquired in 6406/2-4 S R. Two hydrocarbon samples were taken in the Tofte Formation at 4701 m, four hydrocarbon samples were taken in the Tilje Formation at 4945.2 m and 4881.0 m, and one water sample was acquired in the Tilje Formation at 4835 m. The mud contamination from base oil in the MDT hydrocarbon samples were analysed to be from 25 to 71 % by weight. Well 6406/2-4 S R was permanently abandoned on 15 February 1999 as a gas and condensate appraisal well.

Testing

The Tilje (4874 m - 4904 m) and Tofte (4684 m - 4704 m) formations were production tested. Test 1 in the Tilje Formation produced 237000 m³ gas/day and 93 m³ condensate/day through a 9.53 mm choke. Test 2 in the Tofte Formation produced 42855 m³ gas/day and 18.1 m³ condensate/day through a 7.94 mm choke. The flow capacity of the test was severely influenced by fractures.

Borekjerener i Sokkeldirektoratet

Kjerneprøve nummer	Kjerneprøve - topp dybde	Kjerneprøve - bunn dybde	Kjerneprøve dybde - enhet
1	4615.0	4619.4	[m]
2	4620.0	4627.9	[m]
3	4692.0	4719.0	[m]
4	4762.0	4818.2	[m]
5	4818.5	4838.2	[m]
6	4838.5	4857.2	[m]
7	4857.2	4898.4	[m]
8	4898.5	4936.1	[m]
9	4939.1	4992.2	[m]
10	4992.2	5046.5	[m]

Total kjerneprøve lengde [m]	320.0
Kjerner tilgjengelig for prøvetaking?	YES

Kjernebilder



4615-4619m



4620-4625m



4625-4694m



4694-4699m



4699-4704m



4704-4709m



4709-4714m



4714-4719m



4762-4767m



4767-4772m



4772-4777m



4777-4782m



4782-4787m



4787-4792m



4792-4797m



4797-4802m



3802-4807m



4807-4812m



4812-4817m



4817-4821m



3821-4826m



4826-4831m



4831-4836m



4836-4840m



4840-4845m



4845-4850m



4850-4855m



4855-4859m



4859-4864m



4864-4869m



4869-4874m



4874-4879m



4879-4884m



4884-4889m



4889-4894m



4894-4898m



4898-4903m



4903-4908m



4908-4913m



4913-4918m



4918-4923m



4923-4928m



4928-4933m



4933-4937m



4937-4942m



4942-4947m



4947-4952m



4952-4957m



4957-4962m



4962-4967m



4967-4872m



4972-4977m



4977-4982m



4982-4987m



4987-4992m



4992-4996m



4996-5001m



5001-5006m



5006-5011m



5011-5016m



5016-5021m



5021-5026m



5026-5031m



5031-5036m



5036-5041m



5041-5046m



5046-5047m

Litostratigrafi

Topp Dyb [mMD RKB]	Litostrat. enhet
296	NORDLAND GP
296	NAUST FM
1576	KAI FM
1946	HORDALAND GP
1946	BRYGGE FM
2462	ROGALAND GP
2462	TARE FM
2528	TANG FM
2589	SHETLAND GP
2589	SPRINGAR FM
2725	NISE FM
2913	KVITNOS FM
3485	CROMER KNOLL GP
3485	LYSING FM
3502	LANGE FM
3565	NO FORMAL NAME
3623	LANGE FM
4372	LYR FM
4388	VIKING GP
4388	SPEKK FM
4406	MELKE FM
4612	FANGST GP



4612	GARN FM
4667	NOT FM
4671	BÅT GP
4671	TOFTE FM
4755	TILJE FM
4950	ÅRE FM

Spleisede logger

Dokument navn	Dokument format	Dokument størrelse [KB]
3627	pdf	0.45

Geokjemisk informasjon

Dokument navn	Dokument format	Dokument størrelse [KB]
3627_1	pdf	1.93
3627_2	pdf	0.68

Dokumenter - rapportert av utvinningstillatelsen (frigitt ihht til regelverk)

Dokument navn	Dokument format	Dokument størrelse [KB]
3627_6406_2_4_R_COMPLETION_REPORT	.pdf	32.80

Borestrengtester (DST)

Test nummer	Fra dybde MD [m]	Til dybde MD [m]	Reduksjonsven til størrelse [mm]
1.0	4905	4874	9.5
2.0	4704	4684	7.9

Test nummer	Endelig avstengningstrykk [MPa]	Endelig strømningstrykk [MPa]	Bunnhullstrykk [MPa]	Borehullstemperatur [°C]
1.0	44.000	31.000	52.000	
2.0	50.000	12.000	51.000	





Test nummer	Olje produksjon [Sm3/dag]	Gass produksjon [Sm3/dag]	Oljetetthet [g/cm3]	Gasstyngde rel. luft	GOR [m3/m3]
1.0	93	237000	0.773	0.780	2925
2.0	18	42855	0.789	0.743	2300

Logger

Type logg	Topp dyp for logg [m]	Bunn dyp for logg [m]
AIT IPLT	4534	5081
CMR ECS HNGS	4534	5060
MDT	4619	5008
MDT	4643	4988
MDT	4945	4945
MSCT	4610	4764
MWD - GR RES DIR	4534	5080
UBI DSI	4534	5060
VSP	4400	5080

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
INTERM.	9 5/8	4534.0	12 1/4	4534.0	1.87	LOT
LINER	7	5080.0	8 1/2	5080.0	0.00	LOT

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 brønnspark. Trykkdataene er rapportert inn til Oljedirektoratet og videre prosessert og kvalitetssikret av IHS Markit.

Dokument navn	Dokument format	Dokument størrelse [KB]
3627 Formation pressure (Formasjonstrykk)	pdf	0.28

