PL 571 Licence Surrender Report

Part of blocks 25/10 & 25/7

Statoil SUNCOR

PL 571 Surrender Report

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1 Key licence history

Summary

PL 571 was awarded as part of the APA 2010 licence round on the 4th of February 2011. The initial period was set to 6 years (2+2+1+1), of which the first decision, a drill or drop, was due on the 4th of February 2013 (Figure 1.1). Due to delays in seismic processing, a one year extension to the Drill or Drop deadline was granted (4th of February 2014). Two exploration wells were drilled in the licence, and a 1 year extension to the BoK was granted (4th of February 2017). In January 2017 Suncor proposed to test the remaining prospectivity in the licence with an additional well; Statoil could not support this decision. For Suncor to seek a new partner, willing to operate a well in 2017, an application of a 3 months extension of the BoK (4th of May 2017) was submitted. Suncor was not able to find a partner and therefore the extension application was withdrawn. The licence PL 571 was surrendered effective of 4th of February 2017.

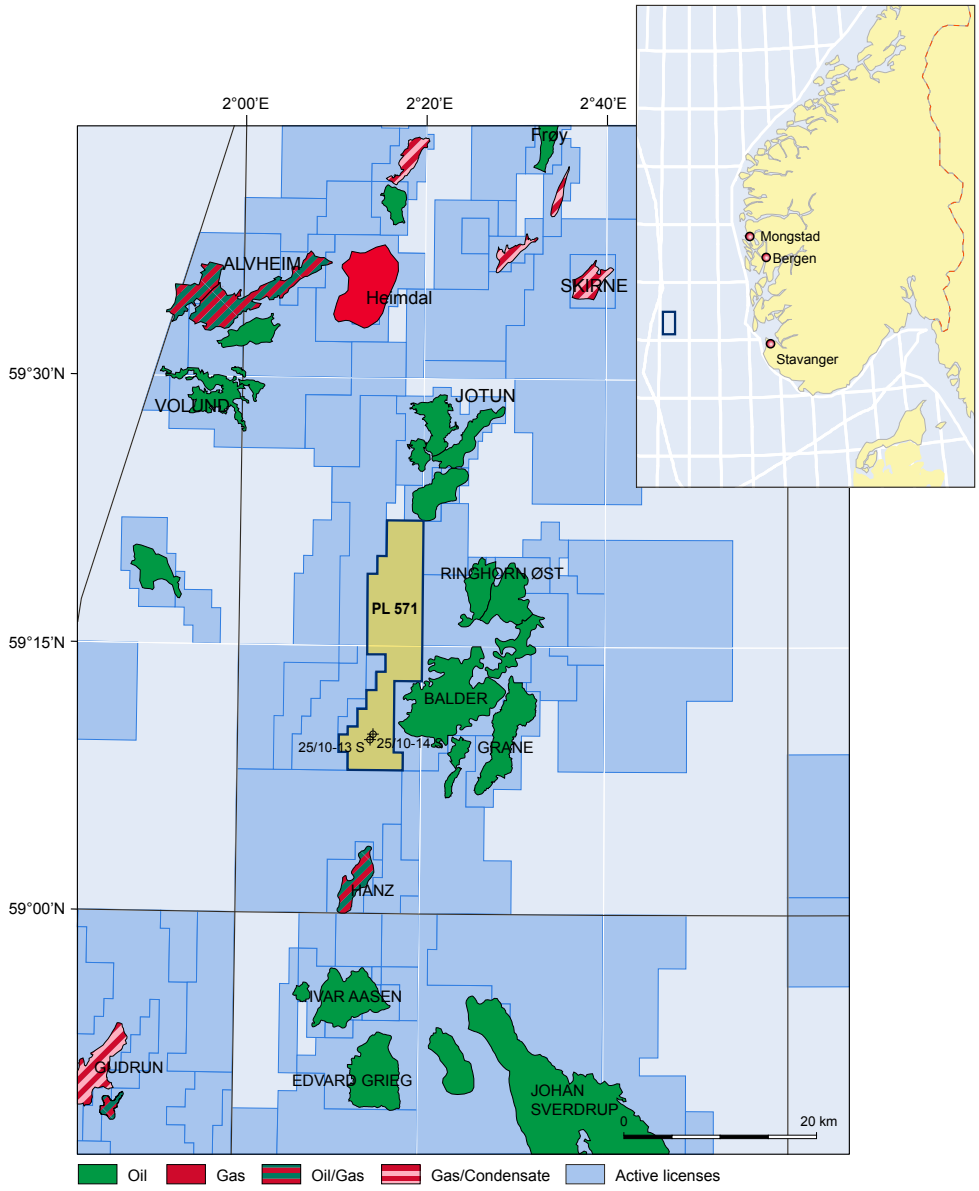

Figure 1.1 ***PL 571 Location map***
North Sea, parts of block 25/10 and 25/7.

Participants
Suncor Energy Norge AS (60%, operator), with partners Statoil Petroleum AS (40%). Initial partner with 40% share was Det norske oljeselskap ASA, which farmed out 23.07.2014. Statoil farmed in to the licence 30.09.2014.

Work Commitment
The work commitment was fulfilled by drilling 2 exploration wells, 25/10-13 S (2015) and 25/10-14 S (2016).

Meetings held
MC meetings were held at least once a year in accordance with JOA article 2.1.

Below is a list of the meetings held during the licence term.

1. ECMC start-up meeting on 03/03/2011 at Suncor offices in Stavanger.
2. ECMC meeting on 28/11/2011 at Suncor offices in Stavanger.
3. Seismic processing work meeting on 30/01/2012 at PGS offices in Oslo.
4. ECMC meeting on 27/11/2012 at Suncor offices in Stavanger.
5. Work meeting on 27/02/2013 at Suncor offices in Stavanger.
6. Work meeting on 29/08/2013 at Suncor offices in Stavanger.
7. Work meeting on 27/09/2013 at Suncor offices in Stavanger.
8. ECMC meeting on 16/10/2013 at Suncor offices in Stavanger.
9. Well planning work meeting 27/05/2014 at Suncor offices in Stavanger.
10. Well planning work meeting 24/06/2014 at Suncor offices in Stavanger.
11. Well planning work meeting 18/09/2014 at Suncor offices in Stavanger.
12. ECMC meeting on 18/11/2014 at Suncor offices in Stavanger.
13. Well planning work meeting 19/03/2015 at Suncor offices in Stavanger.
14. DWOP (drill the well on paper) meeting 07/05/2015 at Oljemuseet in Stavanger
15. Well planning work meeting 13/05/2015 at Suncor offices in Stavanger.
16. Post well work meeting 23/06/2015 at Suncor offices in Stavanger.
17. Well planning work meeting 01/09/2015 at Suncor offices in Stavanger.
18. DWOP (drill the well on paper) meeting 08/09/2015 at City Scandic Hotel in Stavanger
19. ECMC meeting on 11/11/2015 at Suncor offices in Stavanger.
20. Post well work meeting 31/03/2016 at Suncor offices in Stavanger.
21. ECMC meeting on 10/11/2016 at Suncor offices in Stavanger.

Reasons for licence surrender
Prospectivity was identified within the licence area, and a drill decision was taken by Suncor. Due to the initial period ending 4th of February 2019, a well had to be drilled in 2017. Statoil could not support this drill decision. Suncor was not able to find a partner ready to commit to a well in 2017. Consequently, the licence has to be surrendered.

2 Database

2.1 Seismic Database

The seismic database used in the APA 2010 comprised all available public 2D and 3D seismic surveys covering the license acreage listed set in Table 2.1 and shown in Figure 2.1.

Table 2.1 ***Seismic database***

Seismic Survey	NPDID	Survey Type	Survey Year	Status	Comments
Common Database					
ST15M06	-	3D	2016	Licence owned	PSDM Broadband, merge of surveys: MC3D-NVG10(7189), MC3D-SVG11(7378) and EM0101(4097)
MC3D-SVG11	7378	3D	2011	Multi-Client	
NH07M02	-	3D	2007	Public	Merge of surveys: ST9105(3454), CN25_93(3578), ES9403(3644)
ST9304	3628	3D	1993	Public	
ST9105	3454	3D	1991	Public	
APA 2010 Database					
ST9304	3628	3D	1993	Public	
ST9105	3454	3D	1991	Public	
VGST-89	3303	2D	1989	Public	
ST8401	2670	2D	1984	Public	
SG8718	3022	2D	1987	Public	
GNSR-91	3391	2D	1991	Public	
EU88	3104	2D	1988	Public	
EU90	3312	2D	1990	Public	
BPN8802	3088	2D	1988	Public	

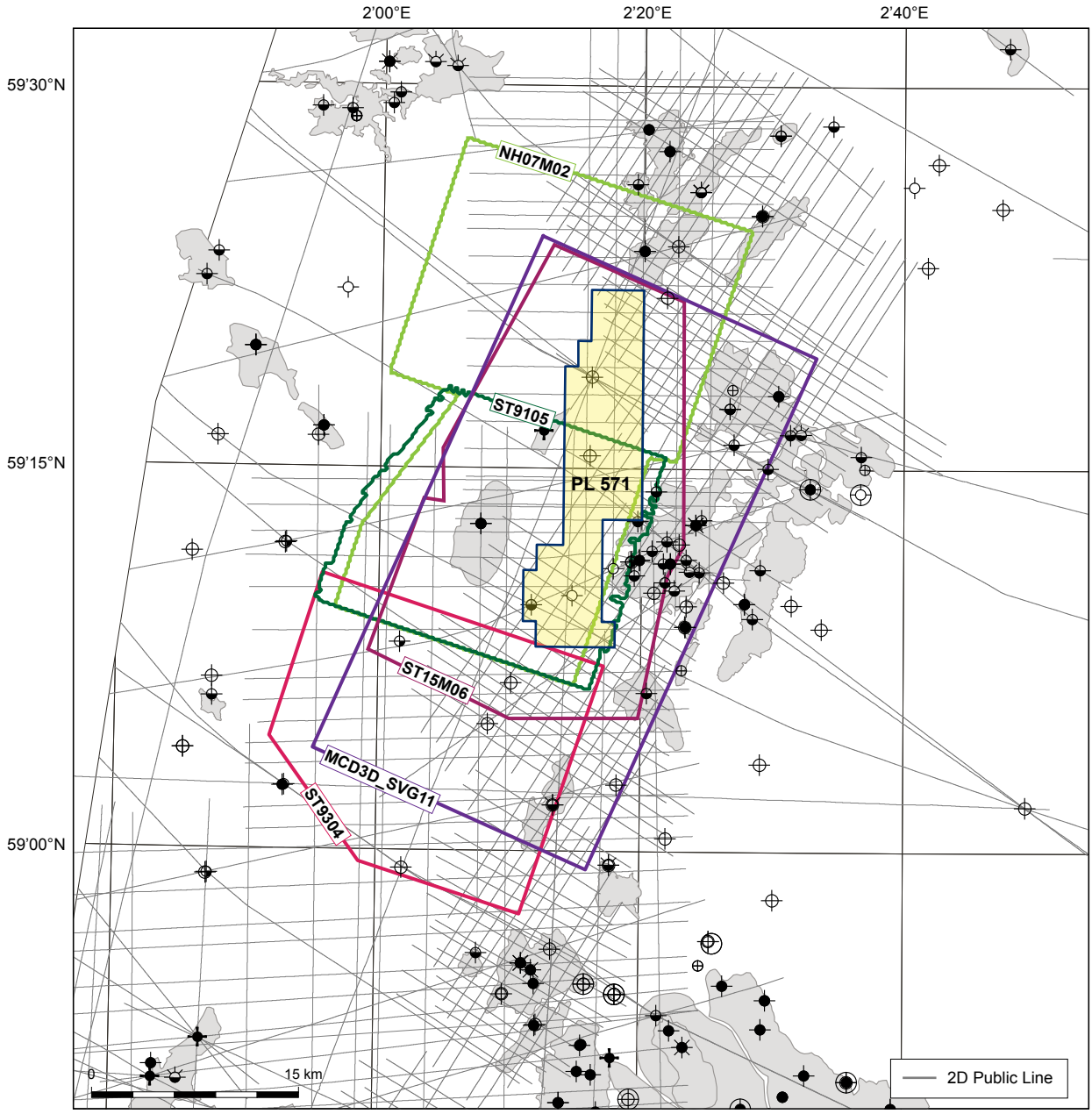

Figure 2.1 ***Seismic database map***

The common database consists of three additional 3D surveys *(*Figure 2.1*):* MC3D-SVG11, NH07M02 and ST15M06. As part of the work program, the seismic survey MC3D-SVG11 was purchased from Petroleum Geo-Services (PGS) in 2012. Also the 3D survey NH07M02 was included in the common database, a merge consisting of three 3D surveys ST9105, CN2593 and ES9403. In 2015-16 a new merge and reprocessing ST15M06 was done by CGG for Statoil which operated the neighbouring licence PL783. A significant uplift of the seismic quality was achieved with this PSDM broadband processed survey. The latest evaluation of the licence is based on ST15M06.

2.2 Well Database

The list of wellbores of which well results are used in the evaluation of the PL 571 licence is given in Table 2.2. Well 25/10-13 S and 25/10-14 S are drilled by the licence.

Table 2.2 ***PL 571 Common well database***
Wells marked with has full access to data, the other wells have only access to raw data.*

Well	NPDID	Well	NPDID	Well	NPDID
24/9-1	344	25/8-2	363	25/10-7 S	2769
24/9-2	345	25/8-5 S	2390	25/10-8	2955
24/9-3	346	25/8-6	2573	25/10-8 A	3098
24/9-9 A*	6239	25/8-7	2612	25/10-9	6120
24/9-9 B*	6254	25/8-8 S	2646	25/10-10*	6345
24/9-9 S*	6222	25/8-9	2988	25/10-11 T2*	6563
24/12-1	347	25/8-11	3209	25/10-13 S*	7704
24/12-1 R	513	25/8-12 A	3772	25/10-14 S*	7794
24/12-2	348	25/8-12 S	3771	25/11-1	143
25/4-1	359	25/8-13	4438	25/11-3	185
25/5-1	884	25/8-14 S	4805	25/11-5	366
25/5-2	1346	25/8-15 S	5000	25/11-6	367
25/5-3	1488	25/8-16 S	6082	25/11-9	213
25/5-4	1691	25/9-1	2476	25/11-13	373
25/6-1	524	25/9-2 S	4735	25/11-15	1872
25/6-3	3885	25/10-1 R	512	25/11-16	1920
25/7-1 S	898	25/10-2 R	511	25/11-17	1921
25/7-2	1494	25/10-3	182	25/11-19 S	2562
25/7-3	2623	25/10-4	217	25/11-23	3755
25/7-4 S	3114	25/10-4 R	510	25/11-24	5470
25/7-5	3132	25/10-5	365	25/11-25 A	5643
25/8-1	173	25/10-6 S	2728	25/12-1	374

2.3 Special studies

Several studies are performed to evaluate the prospectivity in the PL 571 licence.

Stratigraphic study (2012)

- *Sequence stratigraphy and depositional environments in the Utsira High west margin, Jurassic and Paleogene Succession (Geolink).* A PL 571 proprietary study executed in cooperation with Geolink. A study performed to revise and unify the regional geological criteria of the available well datasets. Based on this stratigraphic interpretation, paleogeographic reconstructions through time (Triassic to Paleogene) were performed. This is linked to the seismic interpretation and the understanding of the structural setting, and from this, new depositional maps are suggested.

Rock physics and seismic inversion study (2012-2013)

- *PL 571 Rock Physics & Seismic Inversion Feasibility Study (Ikon Science, 2012).* A PL 571 proprietary study executed in cooperation with Ikon Science. A study to assess the feasibility of fluid and lithology prediction from seismic data for several prospective intervals at the eastern margin of the South Viking Graben. The intervals of interest were in the Triassic, Jurassic and Paleocene, with the main emphasis on the Lower Paleocene reservoirs.
- *PL 571 Rock Physics & Seismic Inversion Study (Ikon Science, 2013).* Supplemantary work to previous study with more wells and emphasing on all reservoir levels (Triassic, Jurassic and Paleocene).

Structural reconstruction study (2013)

- *Utsira High backstripping & forward modelling (Suncor Energy / Badleys).* A PL 571 proprietary 2D study executed in cooperation with Badleys. The main objective of this study was to increase the understanding of the regional context and structural development of the Utsira High area, east flank of South Viking Graben, within quadrant 25, by producing a quantitative geological model, combining backstripping and forward modelling, from the Permo-Triassic to present-day, which can explain the first-order structural, depositional and erosional features of the area.

Reprocessing (2013)

- *Pre-Stack pro processing PL 571 (Sharp reflections).* A PL 571 proprietary reprocessing executed by Sharp Reflections. The scope of work in the project was perform a Pre-stack, post-migration seismic analysis study on a 3D seismic dataset using Sharp reflections Pre-Stack Pro visual processing software on license PL 571.

Basin modelling study (2016)

- *Petroleum system analysis of the Sebastian prospect in PL 571, southern Viking Graben Norwegian North Sea (Torena AS).* A PL 571 proprietary study executed in cooperation with Torena AS. A study executed to determine the basin development, deposition of source rocks, and fetch areas and migration pathways for the Sebastian prospect on the Heimdal terrace.

Fluid replacement and AVO modelling study (2016)

- Depth trend analysis, Fluid replacement and Synthetic modelling for the Sebastian prospect in PL 571 (Suncor Internal study). A study to assess the feasibility of fluid and lithology prediction from seismic for the Sebastian prospect.

Stratigraphic study (2016)

- A regional depositional study conducted in cooperation with East Cheshire Geoscience in conjunction with APA 2016. The new structural understanding of the area after the Havfrue wells (25/10-13 S and 25/10-14 S) was incorporated, and new depositional maps were created.

3 Review of Geological and Geophysical studies

A regional framework was described in the APA 2010 application. As part of the first licence phase work, obtaining 3D seismic data over the licence area and executing different geological/geophysical studies was performed, see 2.3 Special studies. Based on the increased geological understanding of the licence, a drill decision was taken. As part of the second licence phase, two exploration wells were drilled. The first exploration well, 25/10-13 S, was drilled to test 3 stacked prospects: Havfrue (Ty Fm reservoir), Fomle (Upper Jurassic reservoir) and Kong Triton (Triassic reservoir). All prospective intervals were water wet. The Havfrue target had good reservoir quality as expected. The Fomle prospect did not find the expected Upper Jurassic reservoir, instead surprisingly good qualitiy of Upper Triassic/Lower Jurassic Statfjord Gp reservoir was encountered. The Kong Triton prospect, Triassic reservoir, had poorer reservoir qualities than expected. Due to the downflank location of the well and the unexpected Fomle reservoir, the partnership decided to drill an upflank well, to ensure no economical volumes were left untested in the Havfrue and Fomle prospects. The second well, 25/10-14 S, was also wet, but the reservoir quality in the Statfjord Gp was still of high quality.

After the 25/10-13 S and 25/10-14 S wells, the depositional model and structural understanding of the area changed, and a regional depositional study was revised in 2016. With new seismic (ST15M06), received in Q3 2016, clarity of the existing Sebastian prospect and overlaying new Svimse prospect were revealed.The Sebastian prospect was pre Havfrue wells considered to consist of Lower Triassic reservoir. With the new seismic and depositional model, Lower Jurassic Statfjord Gp is now the expected reservoir. The Svimse prospect is evaluated to consist of Middle Jurassic Hugin Fm. An Upper Jurassic lead, Dory, is overlying the Svimse prospect, see 4 Prospect update.

4 Prospect update

The main prospect in the APA 2010 application was the Paleocene Havfrue prospect with possible upside potentials in Jurassic and Triassic levels. Two wells were drilled on the Havfrue prospect and the additional Jurassic (Fomle) and Triassic (Kong Triton) prospects. Both wells were dry, see Figure 4.1. The Havfrue target had thinner reservoir than pre drill prognosis (38 vs 74 m), but higher net to gross (93% vs 83%) and porosities (27% vs 24%) than expected. The failure mechanism for the prospects was lateral seal and lack of migration cannot be excluded.

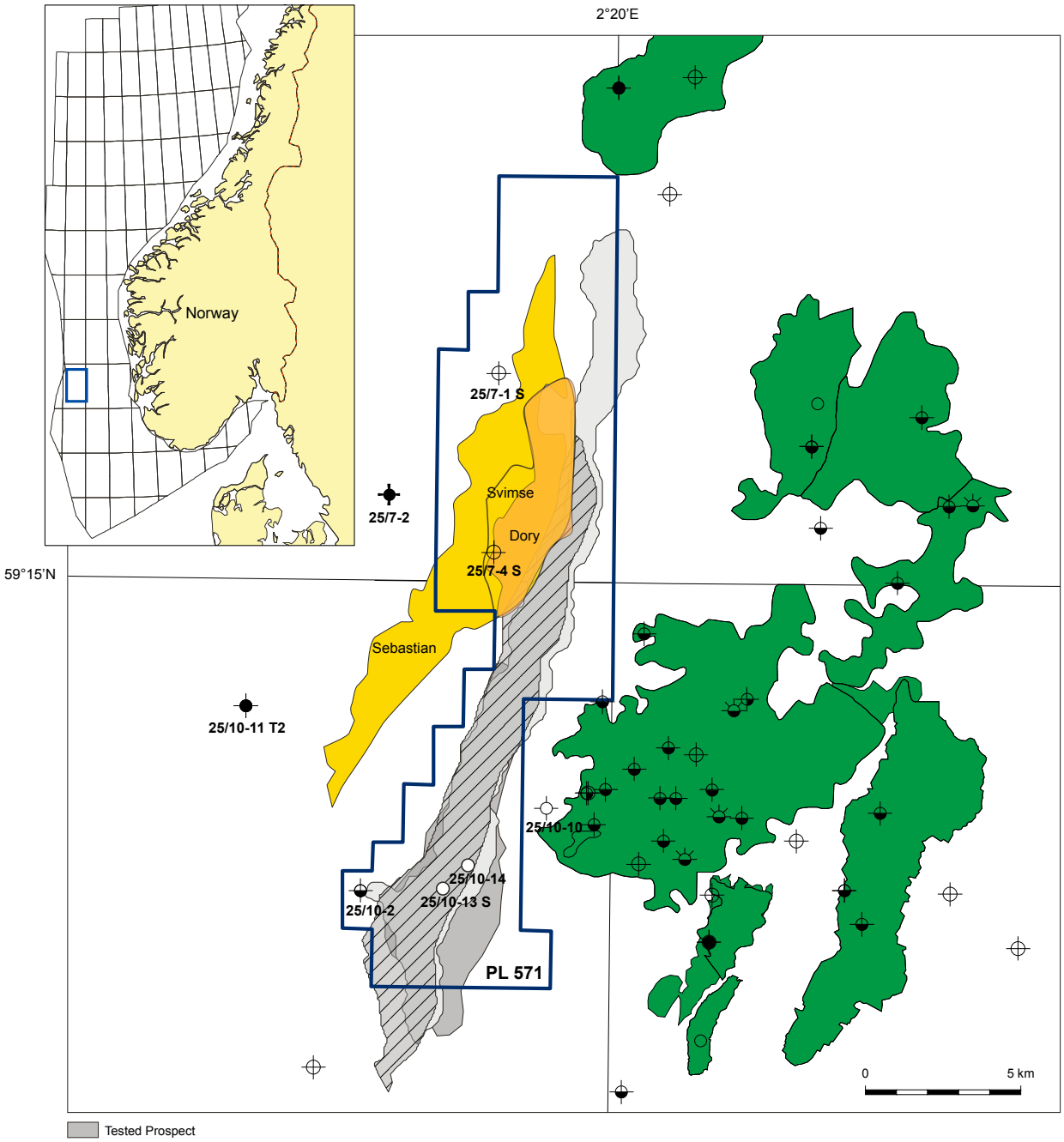

Figure 4.1 ***Original PL 571 prospectivity and new prospectivity map***
The original prospectivity (grey polygons) decribed in APA 2010 is tested by the 25/10-13S and 25/10-14S wells. 2 new undrilled prospects and 1 lead are located northwest of the former targets.

Two prospects matured during the licence periode, the Sebastian and Svimse prospects. There is additional upside potential in the Upper Jurassic Dory lead, see Figure 4.2.

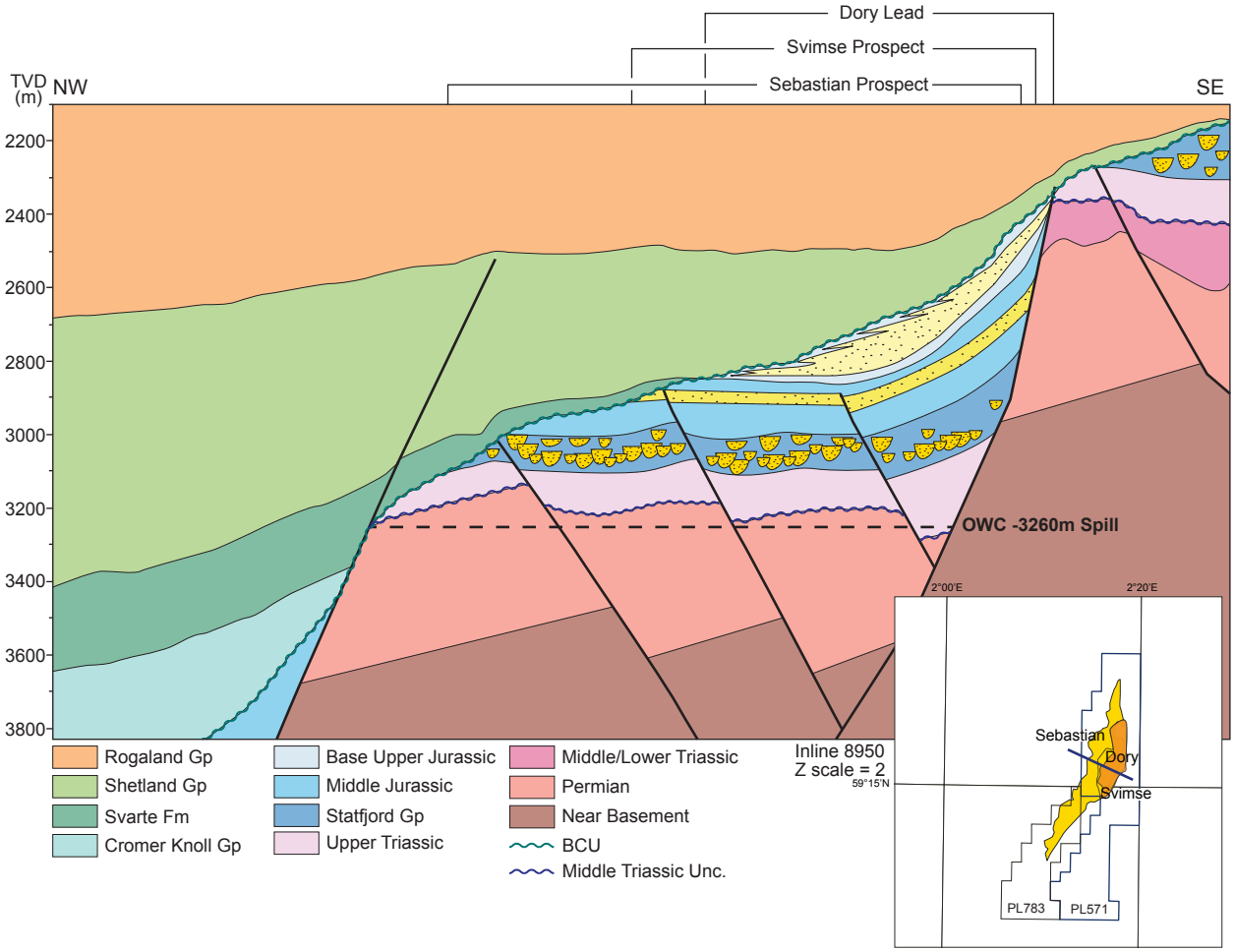

Figure 4.2 ***Geological cross section with prospectivity***
2 prospects and 1 lead are evaluated after the well results and the new seismic. The Sebastian (Statfjord Gp) and Svimse (Middle Jurassic) are the main prospects. Dory is an Upper Jurassic lead.

A summary of the remaining exploration potential is given in Table 4.1.

Table 4.1 ***Exploration potential sumary***
The Sebastian and Svimse prospects have a 50% probability for oil with a gas cap and 50% probability for gas.

					Expected Inplace Resources				Expected Recoverable Resources			
Statfjord prospectivity	COS	Case	HC probability	HC phase	P90	P50	P10	Mean	P90	P50	P10	Mean
Sebastian prospect	23 %	oil with gas cap	50 %	Oil 10^6 Sm^3	5	34	87	42	2	13	36	17
				Gas 10^9 Sm^3	0	0	3	1	1	6	17	8
		gas condensate	50 %	Gas 10^9 Sm^3	4	24	60	29	2	15	38	18
				Condensate 10^6 Sm^3					1	5	14	7
Hugin prospectivity		Case	HC probability	HC phase								
Svimse prospect	24 %	oil with gas cap	50 %	Oil 10^6 Sm^3	2	10	26	13	1	4	11	5
				Gas 10^9 Sm^3	0	3	11	5	1	3	7	4
		gas condensate	50 %	Gas 10^9 Sm^3	5	11	23	13	3	7	14	8
				Condensate 10^6 Sm^3					1	2	5	3
Draupne prospectivity												
Dory lead												

Sebastian prospect

The Sebastian prospect is a structural trap located on a downdip terrace west of Utsira High, see Figure 4.3. The trap is a combination of a three and two way closure. In the northern part Sebastian is limited towards west and east by two major faults of Late Jurassic age and eroded by BCU in the western part, see Figure 4.4. In the southern part, the structure is more complex. In addition to the two main faults and BCU erosion, the prospect is truncated by one or several basal sliding planes, see Figure 4.5. The main structures are fairly well imaged on seismic, but the internal reflections in the Jurrasic and Triassic level are weak and poorly imaged, hence the interpretation of top and base reservoir is uncertain, Figure 4.4 and Figure 4.5.

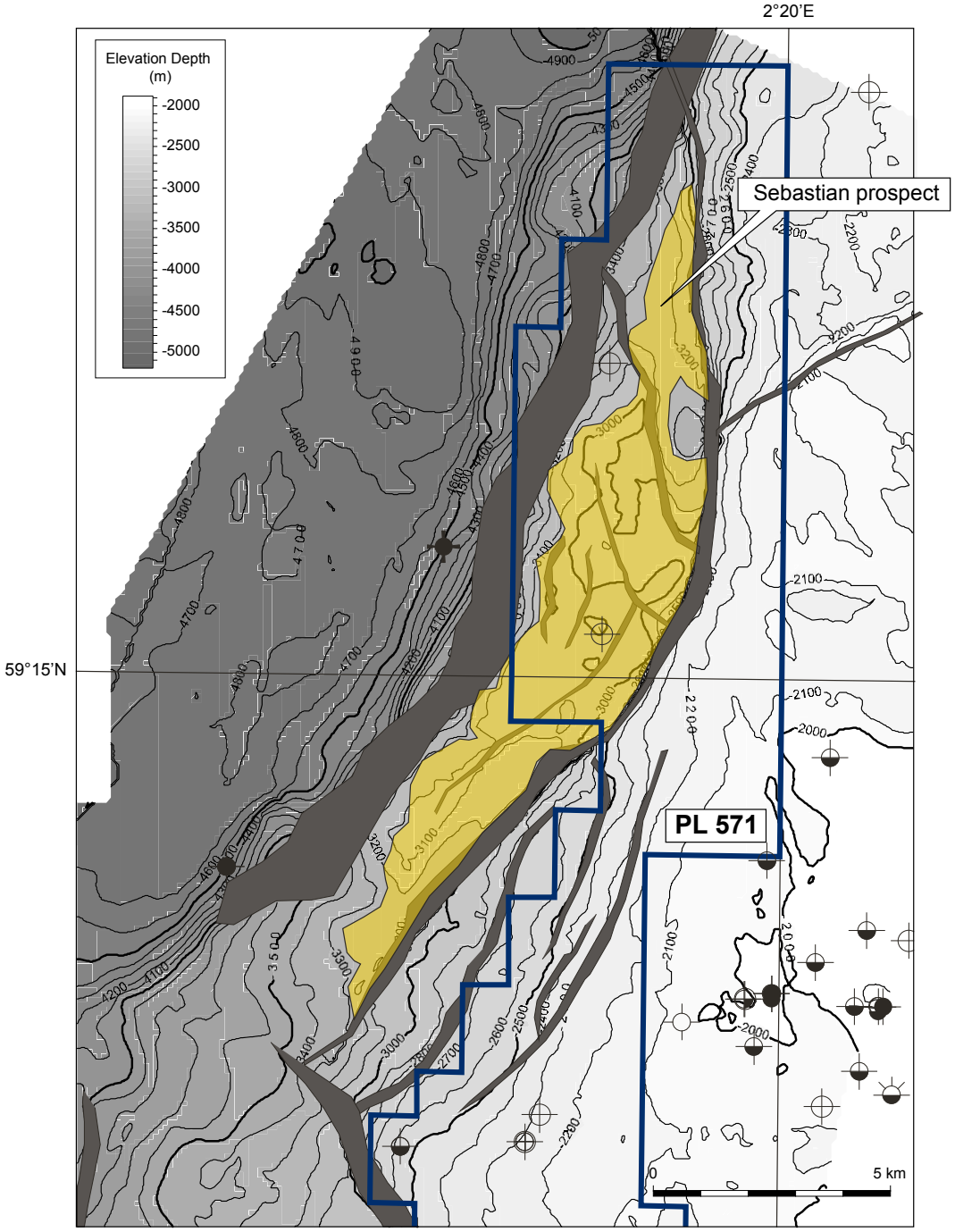

Figure 4.3 ***Depth map Top Statfjord Gp.***
Outline of the Sebastian prospect

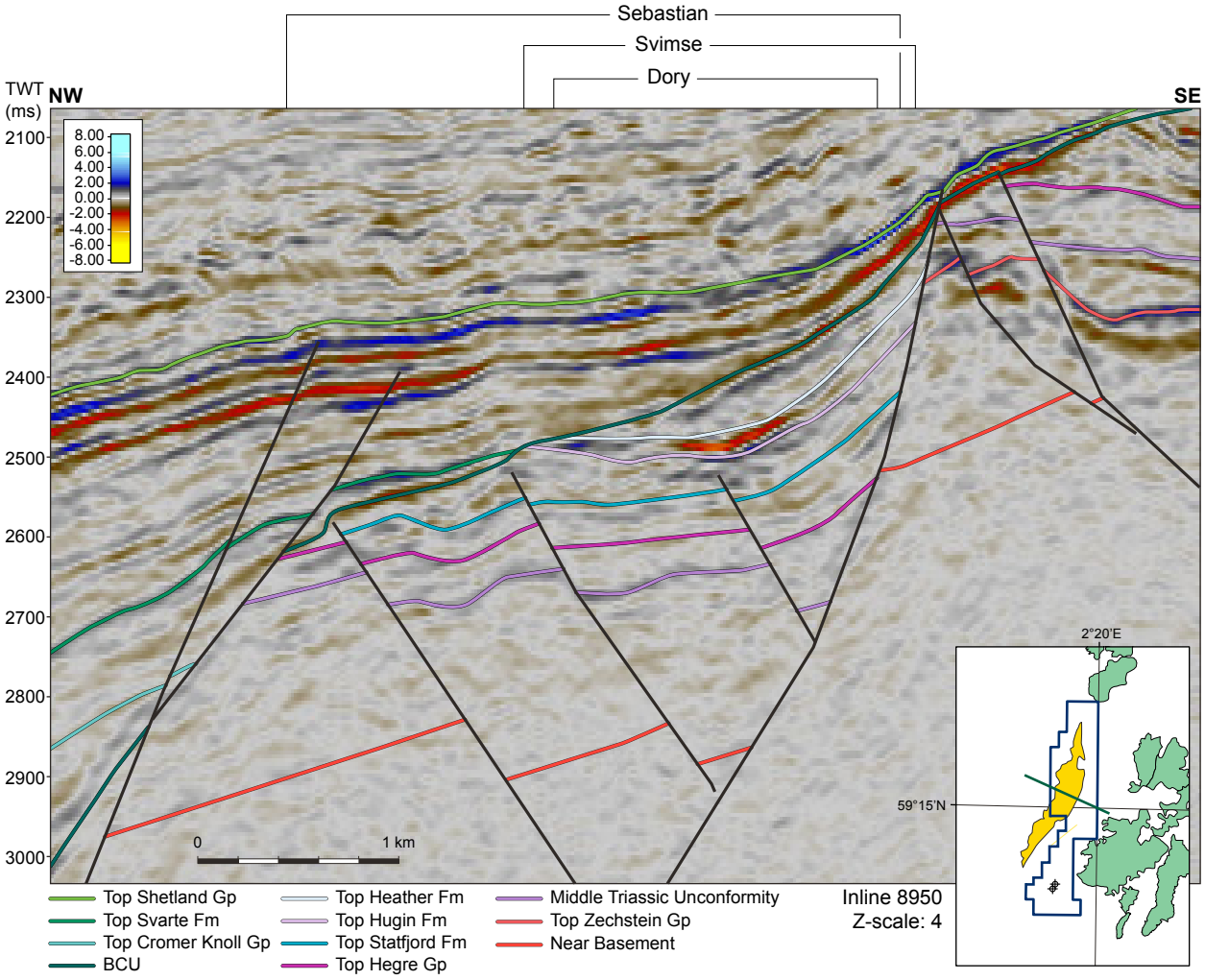

Figure 4.4 ***Northern part of trap, Sebastian***

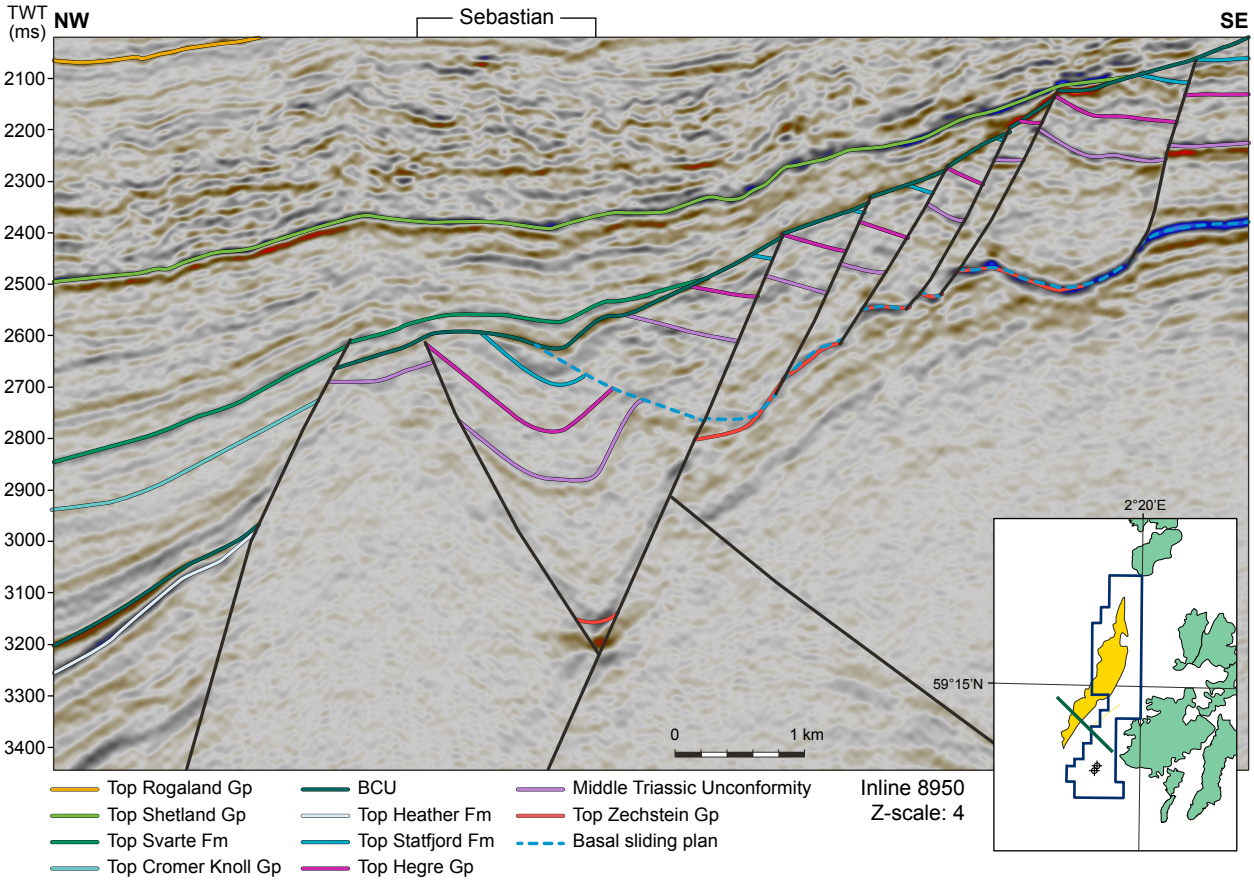

Figure 4.5 ***Southern part of trap, Sebastian***

The top seal consists of Middle Jurassic and Lower Cretaceous marine shales. The expected reservoir is Lower Jurassic Statfjord Gp fluvial deposits with good properties. The prospect is charged from Upper Jurassic source rocks, Draupne Fm and Heather Fm, in the adjecent Viking Graben. Lateral migration is proven by downdip and updip discoveries. The hydrocarbon phase is uncertian, hence a 50/50 chance of oil with gas cap versus gas is applied in the prospect evaluation.

In the north-eastern part of Sebastian, juxtaposition to the overlying Svimse prospect is likely, hence, the two prospects are probably in communication. For the oil with gas cap case, most of the gas cap is captured in the Svimse prospect, see Table 4.1, with most of the oil located in Sebastian.

Svimse prospect

The Svimse prospect is a structural three way closure overlying the Sebastian prospect, see Figure 4.2. Svimse is limited towards east against the major fault towards the Utsira High, towards west it is truncated by the BCU. The top seal consists of Upper Jurassic and Lower Cretaceous marine shales. The expected reservoir is Middle Jurassic shoreface sandstones of the Hugin Fm with very good properties. The prospect is charged from Upper Jurassic source rocks, Draupne Fm and Heather Fm, in the adjecent Viking Graben. Lateral migration is proven by downdip and updip discoveries. Similar to the Sebastian prospect, hydrocarbon phase is an uncertainty and a 50/50 chance of oil with gas cap versus gas is applied in the prospect evaluation.

Dory Lead

The Dory lead is a stratigraphic trap, well defined on seismic. The top seal is Upper Jurassic and Lower Cretaceous marine shales. The expected reservoir is Upper Jurassic Draupne Fm submarine fan deposits. Charge is from the Upper Jurassic source rock, and lateral migration is proven by downdip discoveries.

5 Technical evaluations

A technical evaluation of the development potential in the license was performed on the main prospect, Sebastian.

Base assumptions are formation pressure of 530 bar and temperature of 108 degree Celsius, at a depth of 2900 mTVDss, with good reservoir quality of 50m or greater net thickness and 500-1000 md average permeability. The water depth is 126m.

Two development scenarios were considered – oil with gas cap and gas only.

For the oil with gas cap case, only Sebastian was included for development. The fluid was assumed to be a volatile oil with high gas content. An upside of this assumption is a full oil case. The drainage strategy was pressure maintenance/displacement with water injection. The P50 case considered a subsea tieback to Grane about 17km away, with subsea water injection. The P10 case considered a standalone platform development at site, with oil and gas processed further through Grane. The P50 and P10 cases had positive economic indicators, while the P90 was judged to be too small for a subsea development, so a drill and abandon result was assumed.

For the gas condensate case, both Sebastian and Svimse were included. The fluid was assumed to be a rich gas with a high condensate yield. The drainage strategy was primary depletion, with no pressure support and minimal expectations of an active aquifer. The P50 case considered partial processing at site plus a tieback to Heimdal, about 34 km away. The P10 case considered a standalone platform with full processing and gas exported directly into the nearby gas infrastructure. The P50 and P10 cases had positive economic indicators, while the P90 was judged to be too small for a subsea development, so a drill and abandon result was assumed.

6 Conclusions

The partnership had different views on the technical economical evaluation for the prospect and were unable to reach a positive drill decision, hence the licence is surrendered to the authorities.