

License relinquishment report: PL675

Doc. No. AU-EXP NOR ELNS-00169

Valid from

Rev. no.

PL675 relinquishment report

LICENSE RELINQUISHMENT REPORT PL675

This report outlines the key license history, database, prospects and technical evaluation of production license 675 (PL675).

1 KEY LICENSE HISTORY

Production license 675 is located in the South Viking Graben in 24/12 and part of 24/11 (Figure 1). The license was awarded to Statoil Petroleum AS on 8th February 2013 as a part of the 2012 APA round. The license partners are:

- Statoil Petroleum AS, Operator 60 %
- Total E&P Norge 40 %

The work program for phase 1 has been fulfilled. The original license application focused on the Hodejegerne prospect and the Flaggermusmannen lead. During the work program of phase 1 the Hodejegerne prospect was re-evaluated on the newly reprocessed 3D seismic and the Flaggermusmannen lead was matured into a prospect. The results of the geological and geophysical studies revealed a reduced volume potential for the Hodejegerne and Flaggermusmannen prospects in the license area.

The license did not recommend acquiring new seismic data and has made the decision to relinquish PL 675 on 6th November 2015. The initial period for PL675 expiry was the 8th February 2020. Due to delays on seismic reprocessing the deadline was extended to 08th May 2021.

Work program

Phase 1 tasks	Initial expiry date	Updated expiry date
Reprocess 3D seismic	08.02.2014	08.02.2015
Perform relevant geological and geophysical studies	08.02.2014	08.02.2014
Decision on acquisition of 3D seismic or relinquish	08.02.2014	08.11.2015

The following Management and Exploration committee meetings have been held in the license:

- MC meeting - 25.04.2013
- EC/MC meeting - 05.11.2013
- EC/MC meeting - 27.11.2014
- EC meeting - 11.12.2014
- EC meeting - 02.03.2015
- EC meeting - 10.09.2015

2 DATABASE

The seismic survey used for the western part of PL675 including the Hodejegerne prospect was the 3D survey TGS WGS-24-12 (Figure 1). This survey has been reprocessed during the license work program and a PSTM and PSDM dataset have been generated (WGS-24-12T14_RAWMIG_trim and WGS-24-12D14 PROC PSDM MIGRATION FULL STACK). The reprocessed volumes were the basis for the technical evaluation of the Hodejegerne prospect. The seismic survey used in the eastern part of PL675 including the Flaggermusmannen prospect was the 3D survey MC3D-SVG11.

Key wells are 15/3-2R, 24/12-1R, 24/12-3S, 24/12-5S, 24/12-6 ST2, 25/10-6S, 25/10-8, 25/10-9, GB 9/28a-8, GB 9/28-5 and GB 9/28b-17 (Figure 1).

3 REVIEW OF GEOLOGICAL FRAMEWORK

Since the license application in 2012, no new wells have been drilled in the license. The regional geological understanding since the APA 2012 application did not change. The studies performed in phase 1 of the work program concentrated on maturation of the Hodejegerne and Flaggermusmannen prospects. The results of the studies improved understanding of the prospects and provided support for volumetric input parameters.

In detail, the studies for the Hodejegerne prospect were the following:

- Reprocessing of 3D seismic
- AVO analysis of reprocessed seismic
- Remapping of Hodejegerne prospect on reprocessed PSTM and PSDM data
- Updated volume calculations based on new mapping and revised fluid and reservoir parameters
- Interpretation of hydrocarbons in 24/12-3S well and implementation of fluid phase for Hodejegerne
- Updated biostratigraphy of Paleocene sections for surrounding wells

For the Flaggermusmannen prospect the following studies were performed:

- Refined prospect mapping
- Volume calculations
- Petrographic analysis of Upper Jurassic sandstone in 24/12-1R well using thin sections
- Evaluation of fluid phase in 24/12-1R well
- Local source rock study for Flaggermusmannen prospect area

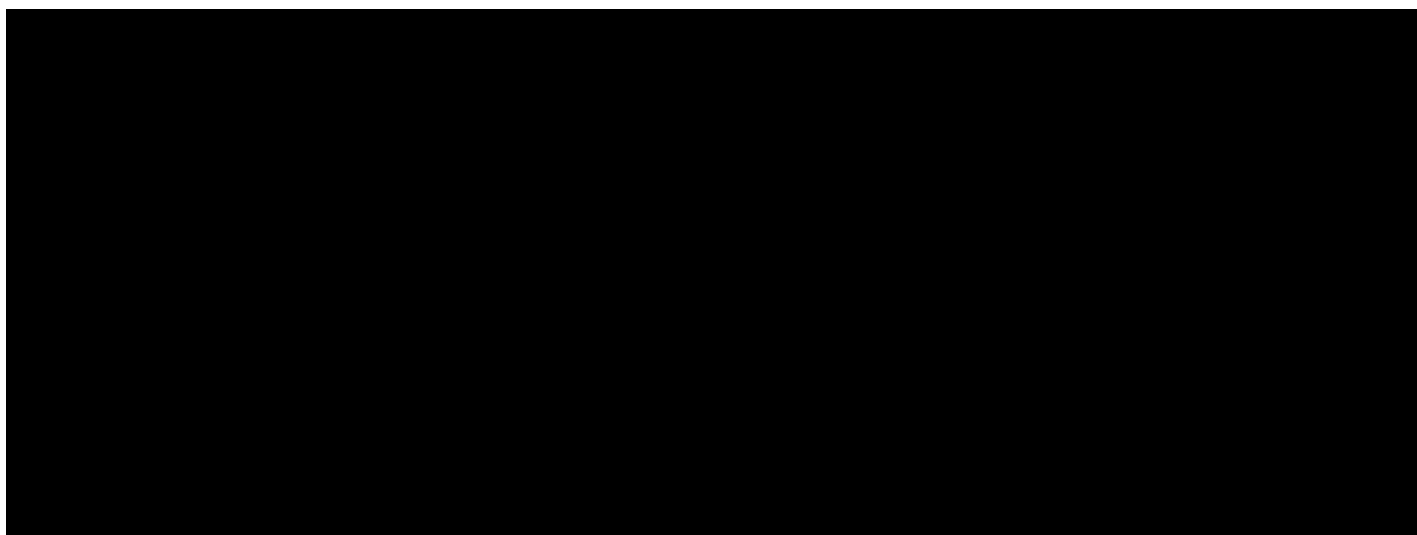
4 PROSPECT UPDATE

Hodejegerne prospect:

An important work obligation for the Hodejegerne prospect was to conduct a PSDM reprocessing of the TGS WGS-24-12 3D survey. The Hodejegerne structure is a low relief 4-way closure, which is very sensitive to velocity effects of the overburden. Therefore, careful velocity modelling of the overburden and in particular of shallow channels above the prospect has been undertaken. The PSDM velocity model building took a top to bottom approach. The PSDM and PSTM route used the same input data and mostly the same post-processing in order to be consistent. Finally, the PSDM stack results showed improvements below the channels. Some tomography iterations needed to be revised to improve confidence. This resulted in delays in the reprocessing workflow and the expiry date for this work obligation had to be postponed by one year to 8th February 2015.

The reprocessed PSTM and PSDM volumes have been used for the update of the Top Heimdal and overlying formation structure maps, which formed the basis for the maturation and resource review of the Hodejegerne prospect. On the reprocessed PSTM and PSDM the Hodejegerne 4-way closure is still a very low relief structure and in addition to that the spillpoint is still poorly defined (Figures 2, 3 and 4). In summary, the mapping results reveal that the uncertainty in the geometry could not be derisked with the new seismic data.

The reprocessed data was further used for AVO work. Due to the overall low quality of the seismic data, in particular the low frequency content, as well as the limited thickness of the reservoir, no HC-related AVO responses were observed.



Flaggermusmannen prospect:

The Flaggermusmannen prospect is an Upper Jurassic sandstone reservoir that was post-depositionally faulted into a graben structure. The trap is a combination of three different trap styles: 1) downfaulting, 2) pinchouts and 3) truncation against the Base Cretaceous Unconformity (BCU) (Figure 5 and Figure 6). The seal is provided by Draupne Shales for most parts of the prospect and Lower Cretaceous shales, where the BCU is cutting into the Draupne reservoir sandstone. In the northern part of the prospect the trap relies on fault seal to work.

The key well for the Flaggermusmannen prospect with respect to reservoir and fluid properties is the 24/12-1R well drilled in 1978 by Den Norske Stats Oljeselskap A.S. The well tested a 3-way closure against a fault with reservoir in Middle Jurassic Hugin Formation. The closure is located on a structural high adjacent to the graben, where the Flaggermusmannen prospect is defined (Figure 7 and Figure 8). The well found an intra-Draupne sandstone of small thickness (<5m), which was examined further in thin sections during the work program of the PL675 license. Analysis of the sections revealed fine-grained cemented sandstone. Very similar poortight reservoirs have been encountered on structural highs of the Gudrun Field, whereas wells in the graben areas of the field showed better properties. These observations have been used as analog for the Flaggermusmannen prospect. It is proposed that the prospect, which is located in a graben, contains Intra-Draupne sandstone of better quality than the sandstone in the 24/12-1R well. A thicker intra-Draupne sandstone is also expected in the Flaggermusmannen graben.

Further work included re-evaluation of the petroleum phase for the 24/12-1R well. It is reported that well encountered a small accumulation of oil in tight Hugin reservoir sandstone. Based on interpretation of poisson's ratio and gas logs it was concluded that the well encountered a gas column instead of oil.

Two migration scenarios are possible for the Flaggermusmannen prospect (Figure 8). One is migration of gas from the 24/12-1R well across a major fault. The source rocks of this gas are located on the Gudrun terrace and deeper in the center of the graben to the west of 24/12-1R. The second migration scenario is migration of oil generated from Draupne Formation as local source. The oil case has a probability of 60% and the gas case a probability of 40%.

Key risk for the Flaggermusmannen prospect is trap seal (0,3) due to the complexity of the trap, which relies on stratigraphic components and fault seal to work. A high risk is also assigned to reservoir presence (0,4) due to the reduced thickness and poor properties of the sandstone in the 24/12-1R well and the lack of seismic indicators for

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reservoir presence in the prospect area. The chance of success for the Flaggermusmannen prospect is 9,6% (Table 3). The resources for the prospect are summarized in Table 4.

5 TECHNICAL EVALUATIONS

Hodejegerne:

The valuation of Hodejegerne is based on a one 4-slot subsea template tied back to Gudrun. A strong aquifer support is assumed and the recovery factor is set to 30% considering a depletion drainage strategy (analogue to Grane and Alvheim). An exploration well in 2017 is assumed.

Flaggermusmannen:

The development concept for the Flaggermusmannen prospect is a one 4-slot subsea template tied back to Gudrun, and drainage strategy is depletion. Assumed recovery is 22% for the oil case and 40% for the gas case.

6 CONCLUSIONS

The work program for phase 1 for PL675 has been fulfilled: 3D seismic has been reprocessed and relevant geological and geophysical studies have been performed. The results of the geological and geophysical studies and the technical evaluation led to a reduced volume potential for the Hodejegerne and Flaggermusmannen prospects in the license area. The license partnership did not recommend acquiring new seismic data and made the decision to relinquish PL 675 on 6th November 2015.

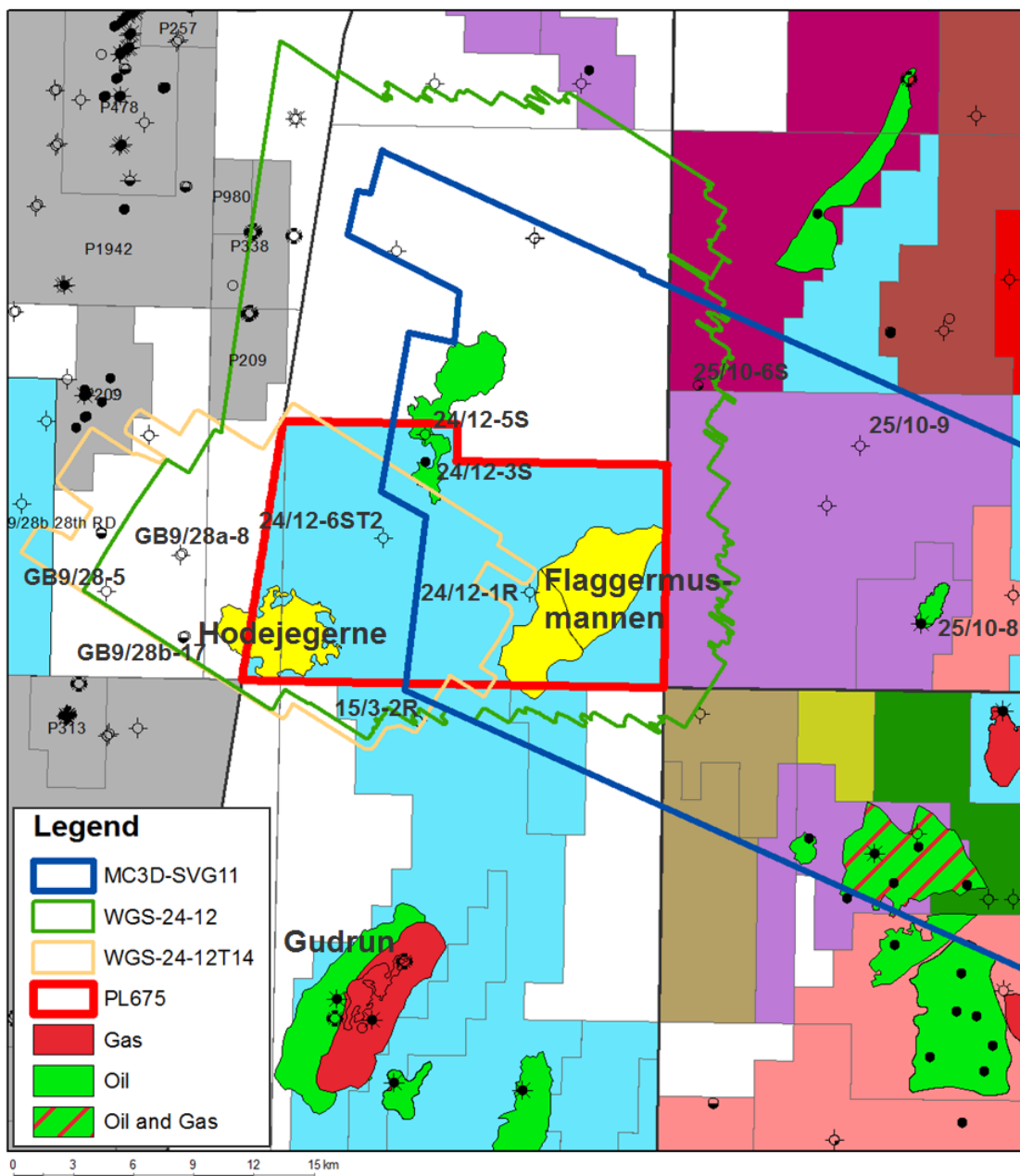
7 FIGURES


Figure 1. License overview map with discoveries, key wells, prospects (yellow outlines), seismic surveys and PL675 area (red outline). Statoil operated licenses in blue. Note that reprocessing focused only on Hodejegerne prospect (WGS-24-12T14).

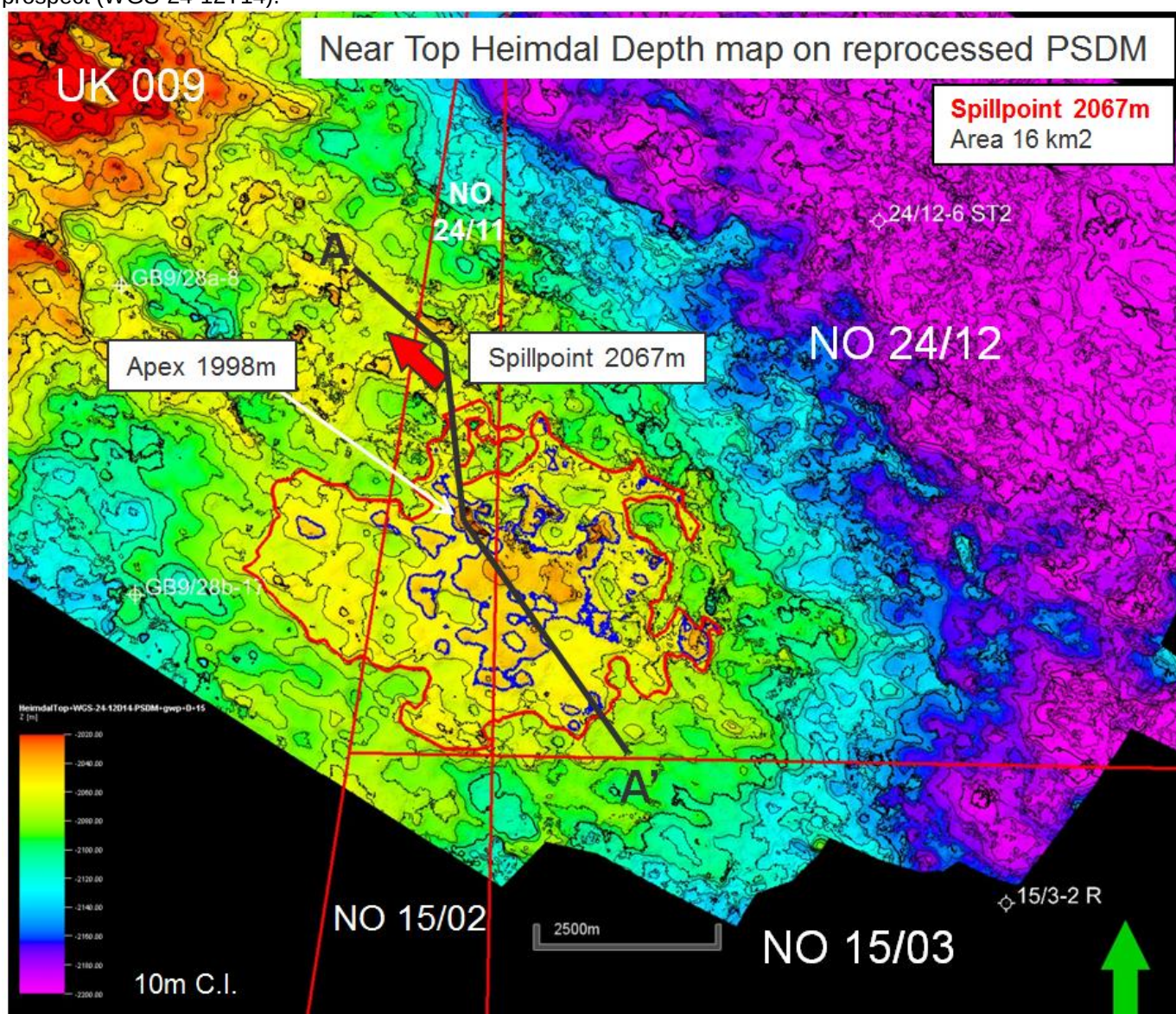


Figure 2. Depth structure map of Top Heimdal reservoir for Hodejegerne prospect based on reprocessed PSDM.

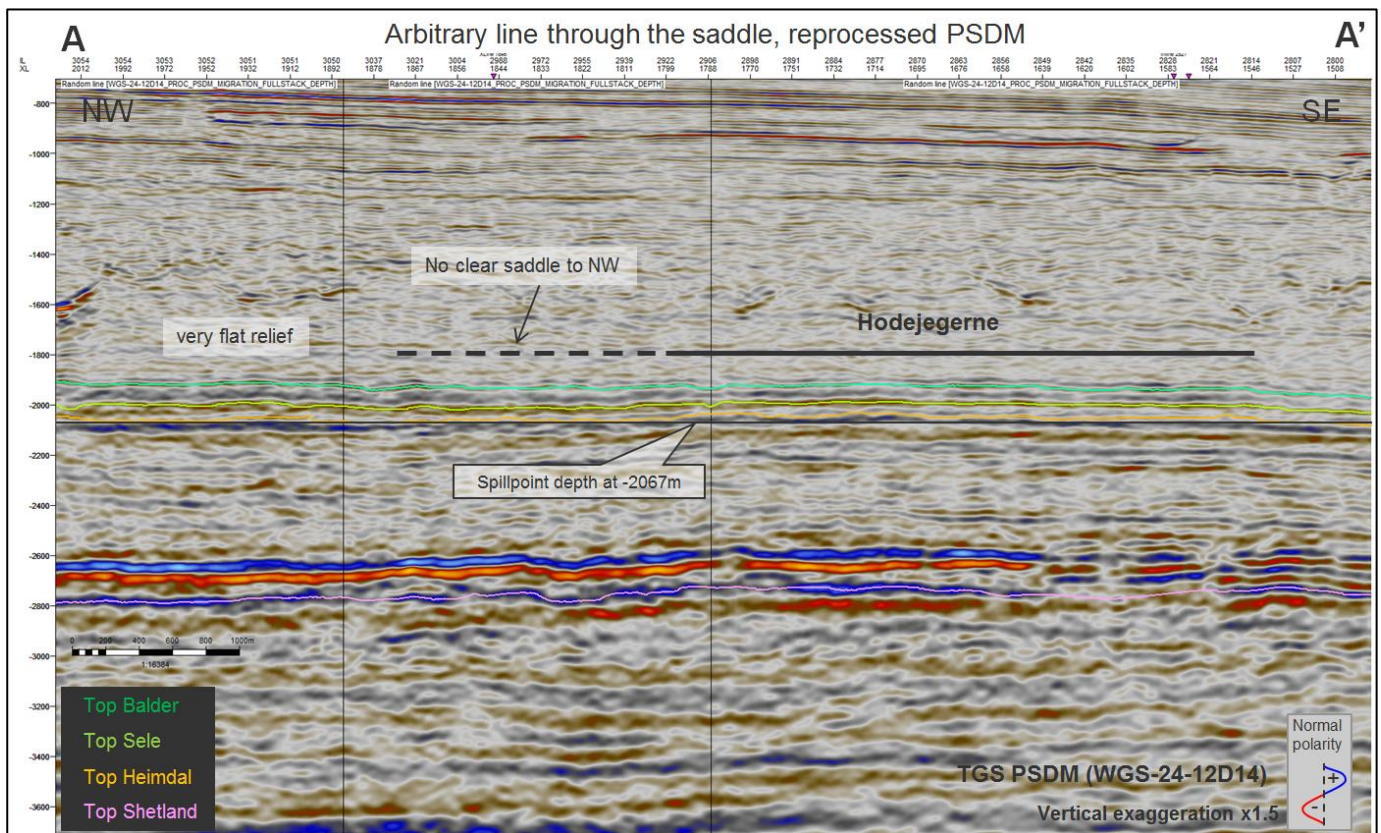


Figure 3. Seismic line through Hodejegerne prospect on reprocessed PSDM.

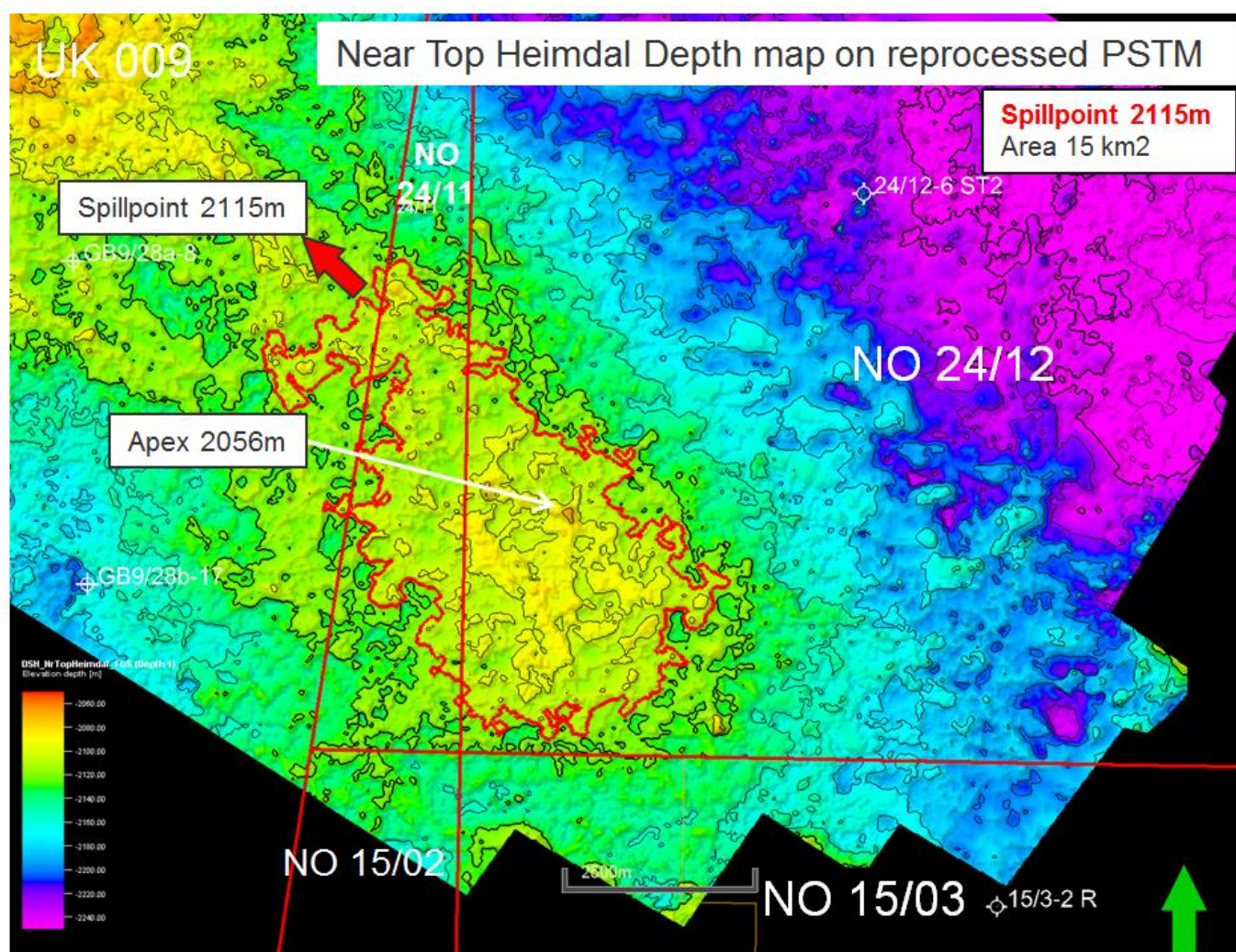


Figure 4. Depth structure map of Top Heimdal reservoir for Hodejegerne prospect based on reprocessed PSTM. Depth converted using regional velocity model.

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Risk elements	APA 2012	2015 update
Trap geometry	0,5	0,5
Trap seal	0,6	0,6
Reservoir presence	0,7	0,7
Source and migration	1,0	0,9
HC phase	1,0	0,5
Pg %	21	9,5

Table 1. Overview of Hodejegerne risking for APA 2012 and 2015 evaluation. Updated risk numbers are marked in bold.

Prospect	Version	Unrisked recoverable resources						
		Oil 10^6Sm^3			Gas 10^9Sm^3			Total oe
		P90	Mean	P10	P90	Mean	P10	Mean
Hodejegerne	APA 2012	3,75	9,36	16,02	0,29	1,01	1,87	10,4
Hodejegerne	2015 update	1,88	4,32	6,59	0,21	0,53	0,86	4,86

Table 2. Resources for Hodejegerne prospect for an oil case for APA 2012 and 2015 update.

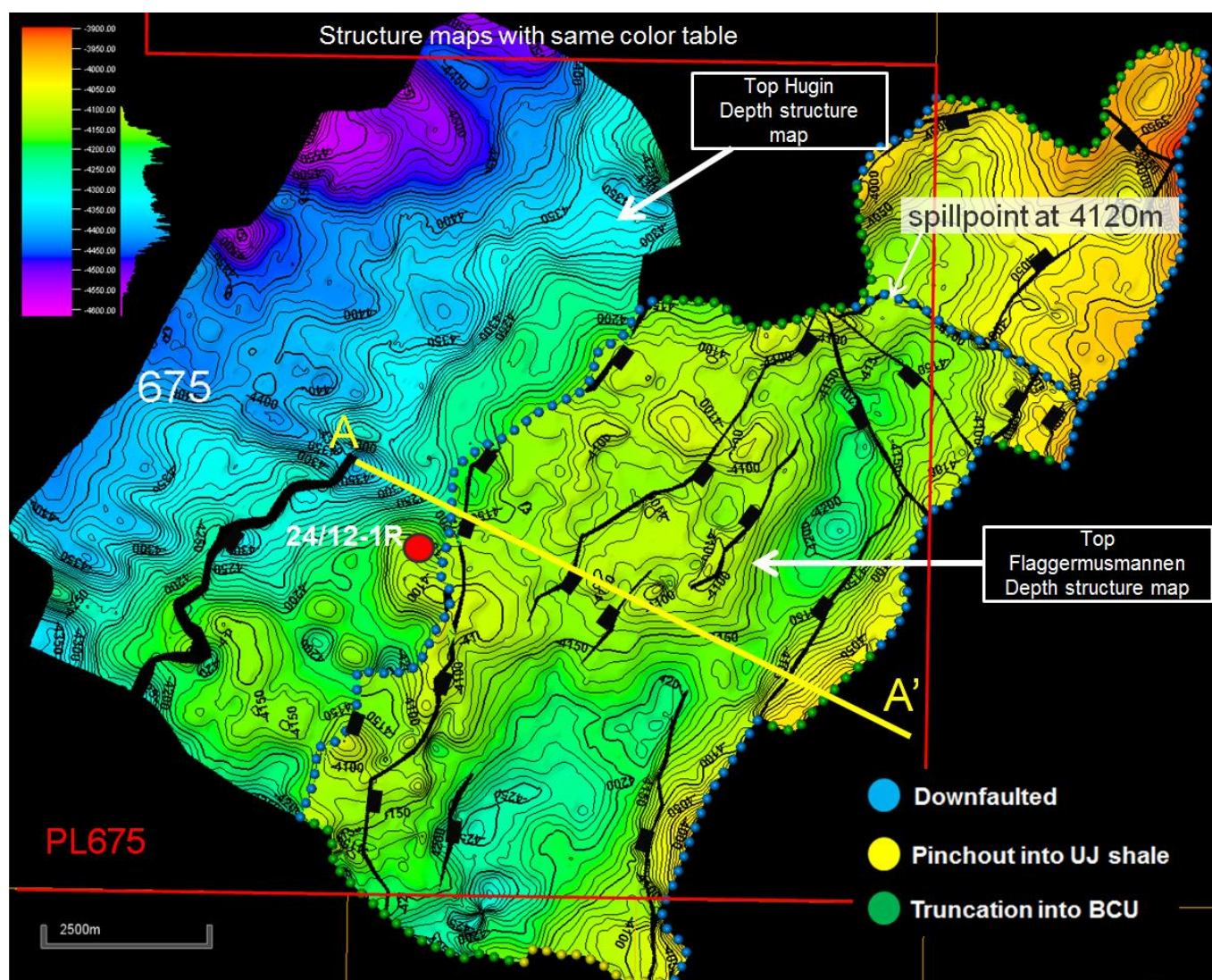


Figure 5. Depth structure map for Flaggermusmannen prospect showing faults and main trap elements. Depth converted using regional velocity model. Within prospect boundaries (colored dots) map reflects Top Flaggermusmannen reservoir (Intra-Draupne sandstone). West of the prospect the map is at Top Hugin level.

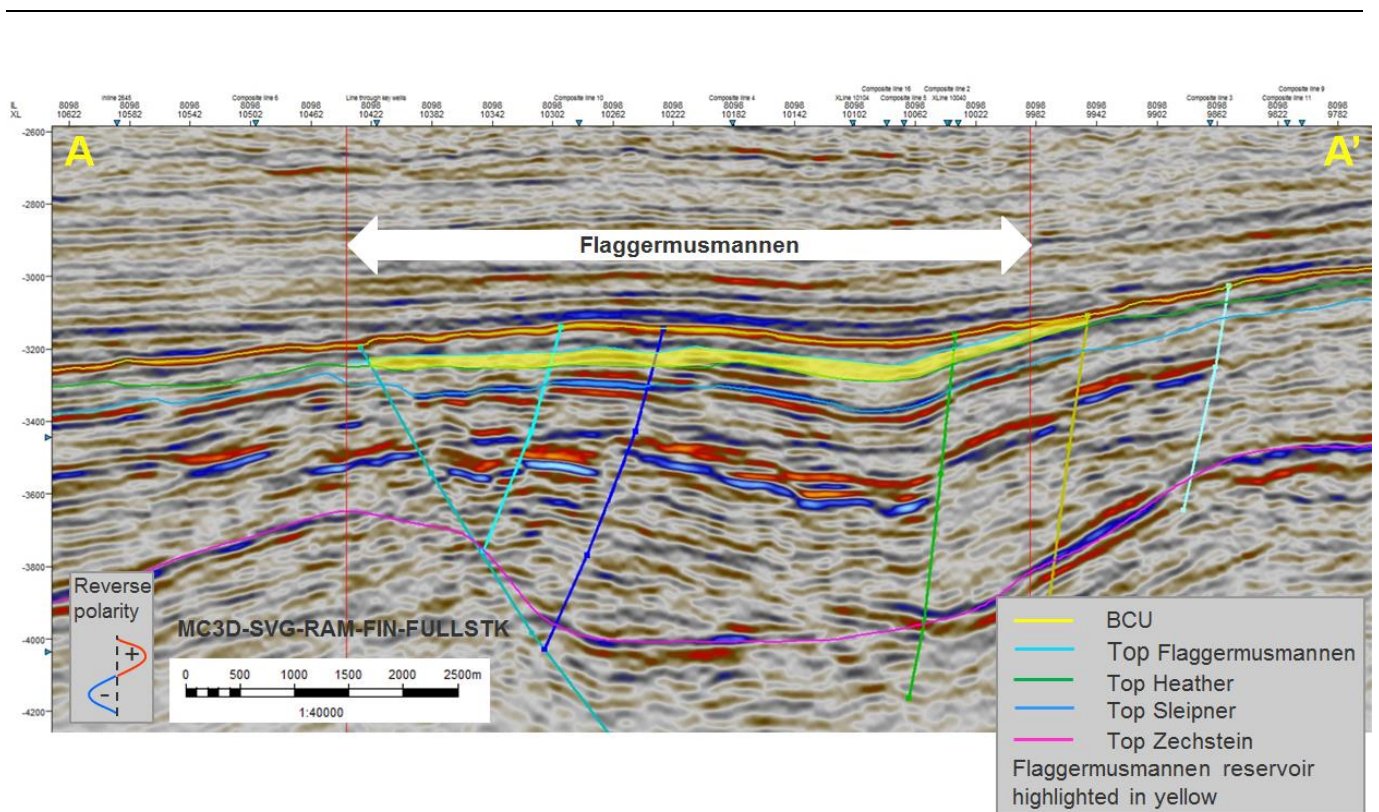


Figure 6. Seismic line through Flaggermusmannen prospect. See location on Figure 5.

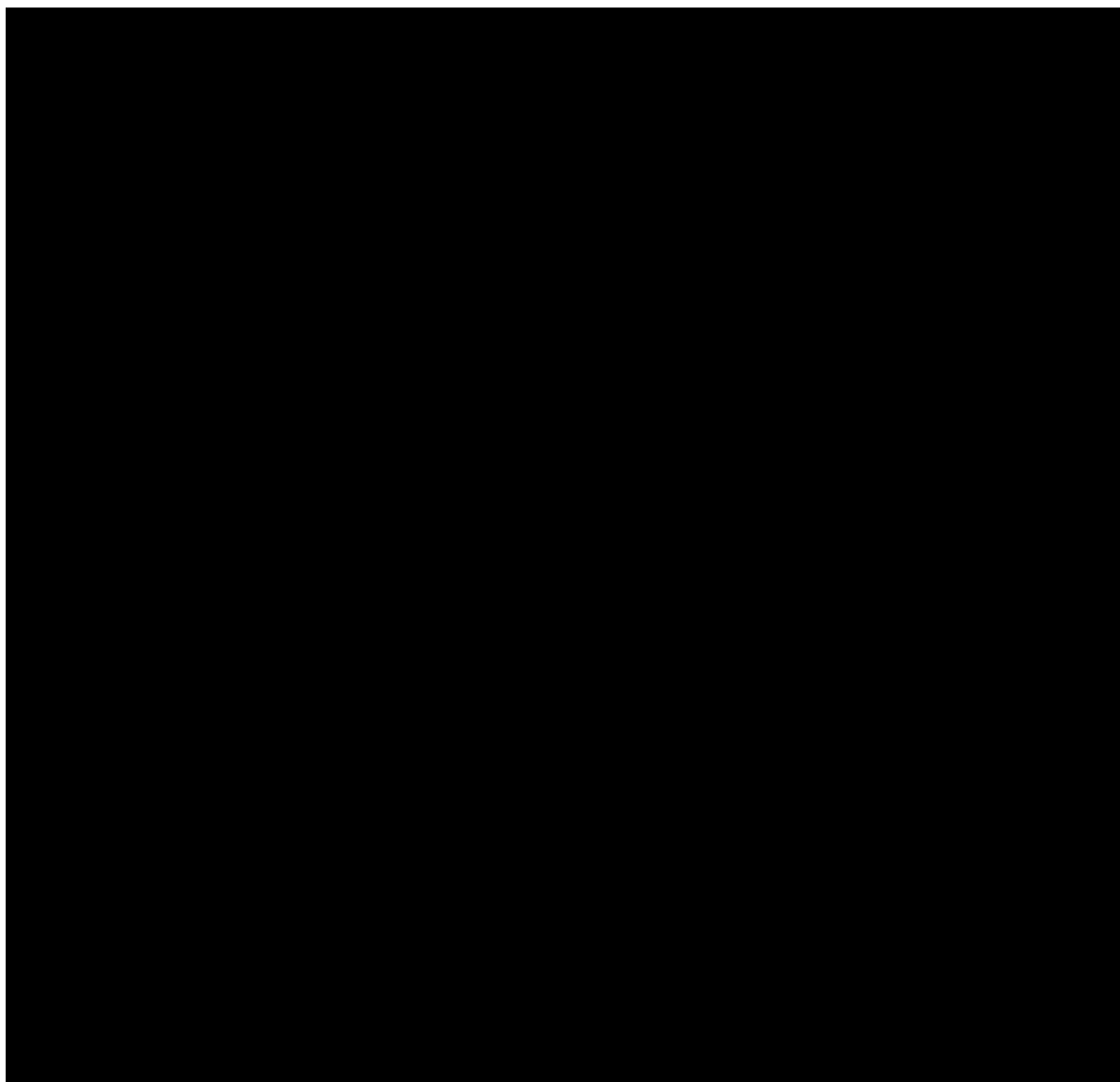


Figure 7. Depth structure map for Flaggermusmannen prospect showing segment boundaries and important contact depths. The segments to the east and north are considered leads.

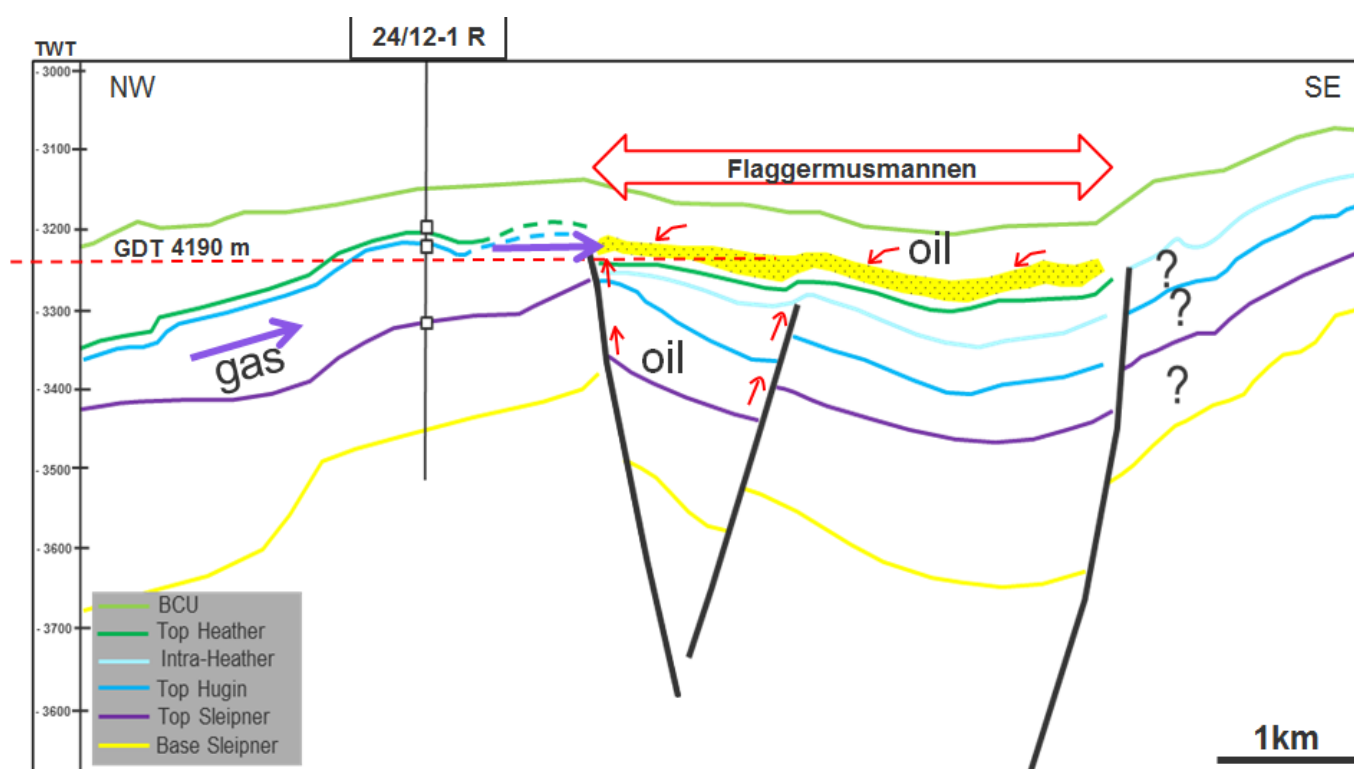


Figure 8. Cross section through the neighboring well 24/12-1R and Flaggermusmannen prospect showing migration routes for gas and oil cases.

Risk elements	2015 evaluation
Trap geometry	1,0
Trap seal	0,3
Reservoir presence	0,4
Source and migration	0,8
Pg %	9,6

Table 3. Overview of risking for Flaggermusmannen prospect.

Prospect	Unrisked recoverable resources						
	Oil 10^6Sm^3			Gas 10^9Sm^3			Total oe
	P90	Mean	P10	P90	Mean	P10	Mean
Flaggermusmannen Gas case				0,26	3,28	8,33	3,28
Flaggermusmannen Oil case	0,37	2,13	5,58	0,27	1,54	4,03	3,67

Table 4. Resources for Flaggermusmannen prospect