

Relinquishment Report PL701

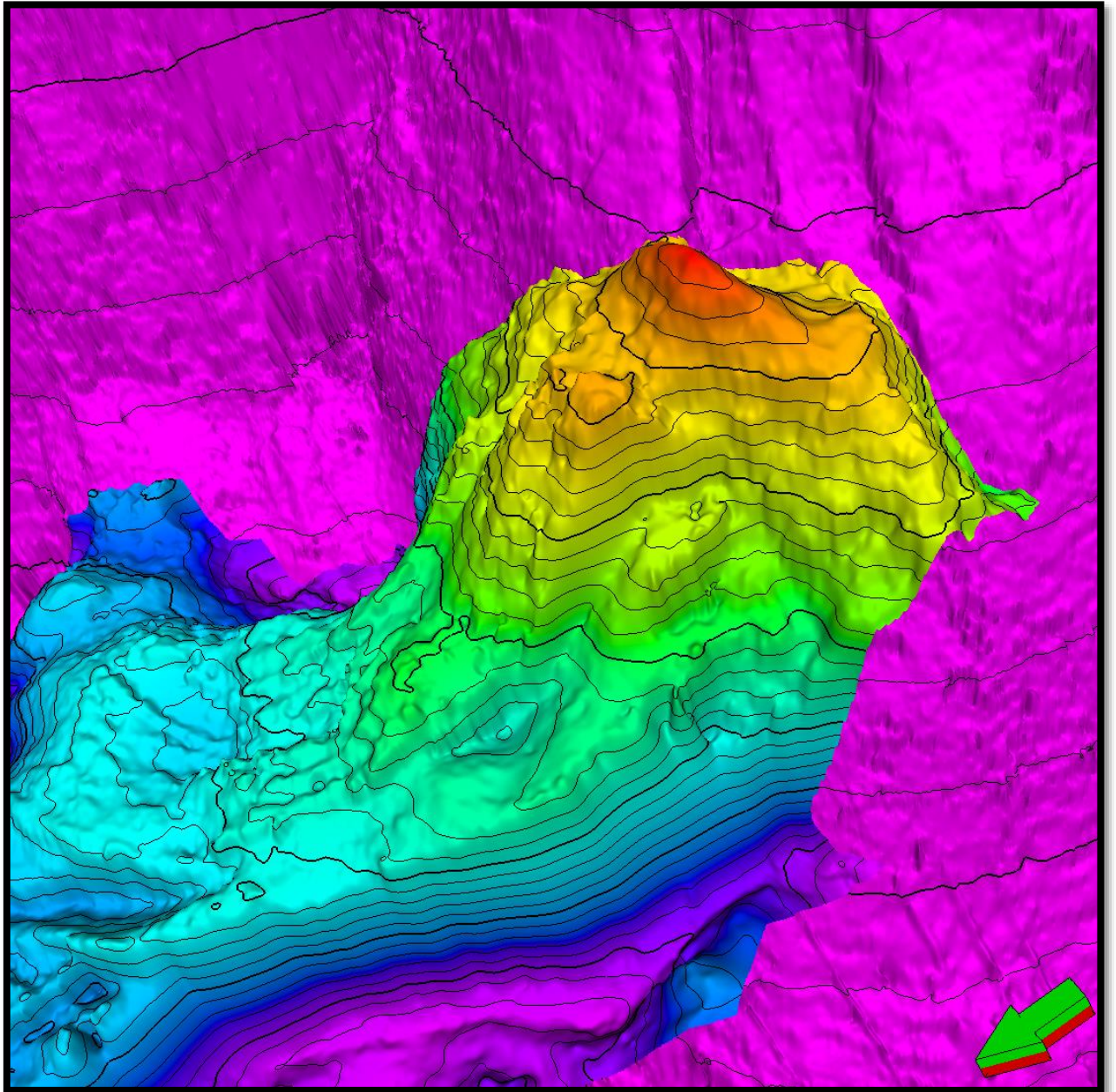


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1 INTRODUCTION

1.1 License owners

- Aker BP ASA (40%), operator
- ENGIE E&P Norge AS (30%)
- Tullow Oil Norge AS (30%)

1.2 Award and work program

The license was awarded on 8th February 2013 for an initial period of 6 years following the APA Licensing Round 2012, with a Drill or Drop decision within two years. The initial partners in the license were Noreco (Op), GDF Suez and Spring Energy. In 2016 Aker BP acquired Norecos assets in the Norwegian Sea and took over operatorship of the license.

License work obligations included the following:

- 3D seismic reprocessing within 2 years
- Re-interpretation and evaluation

The initial work obligations have been fulfilled, and approved within the appointed deadlines.

1.3 Identified prospectivity

PL701 is situated in the southern part of the Halten Terrace adjacent to the Vingleia Fault Complex and covers parts of blocks 6406/09, 6406/11 and 6406/12 (Fig. 1.1). The license is located in-between the Pil and Bue discoveries and the Njord field (Fig. 1.2).

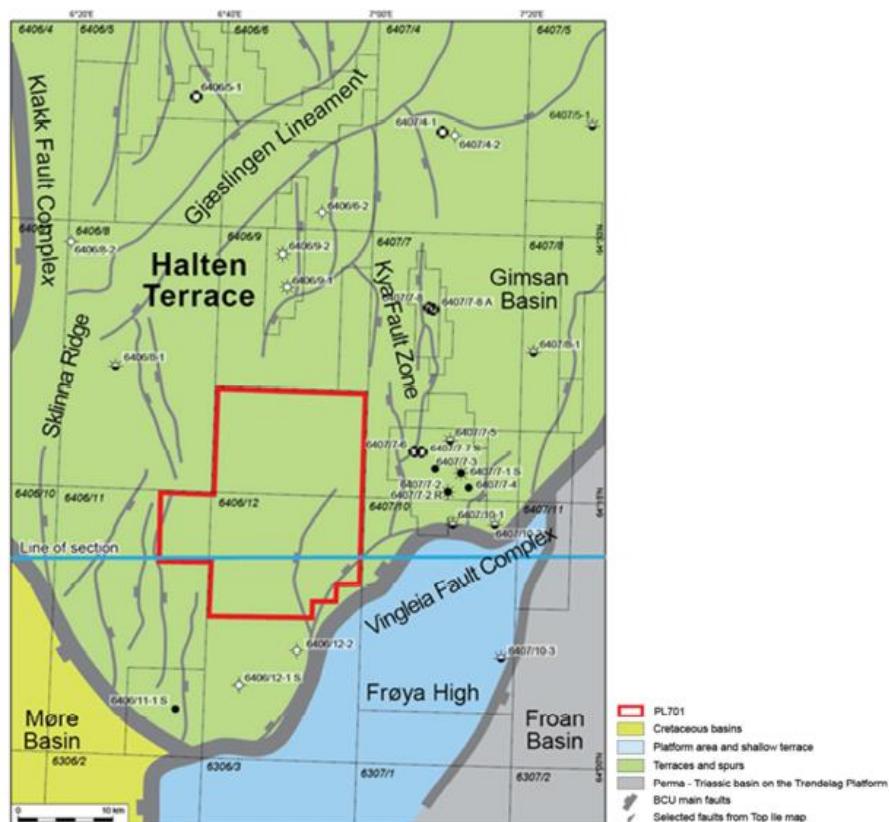


Fig. 1.1 License area and main structural elements

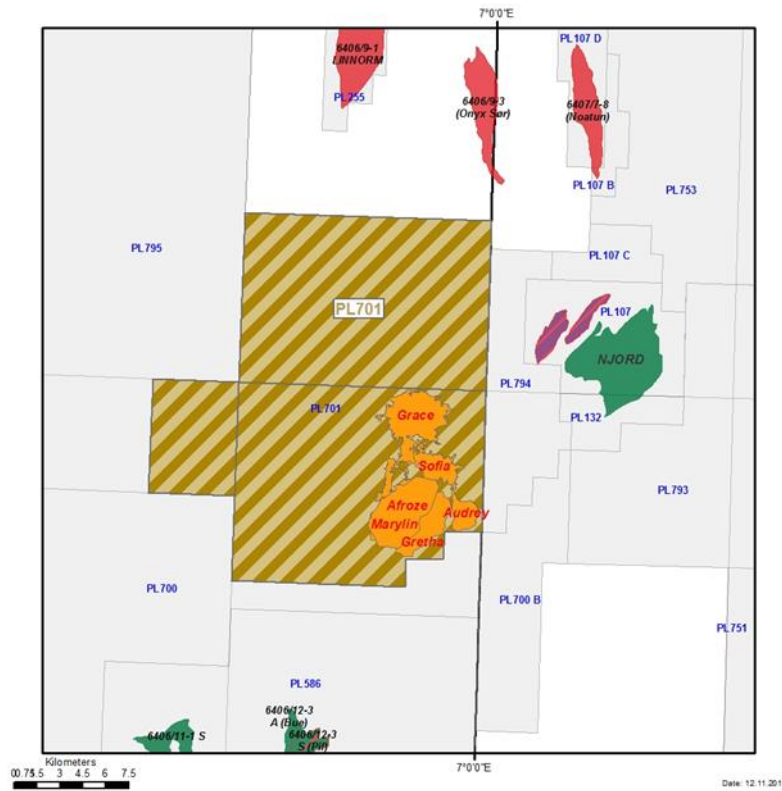
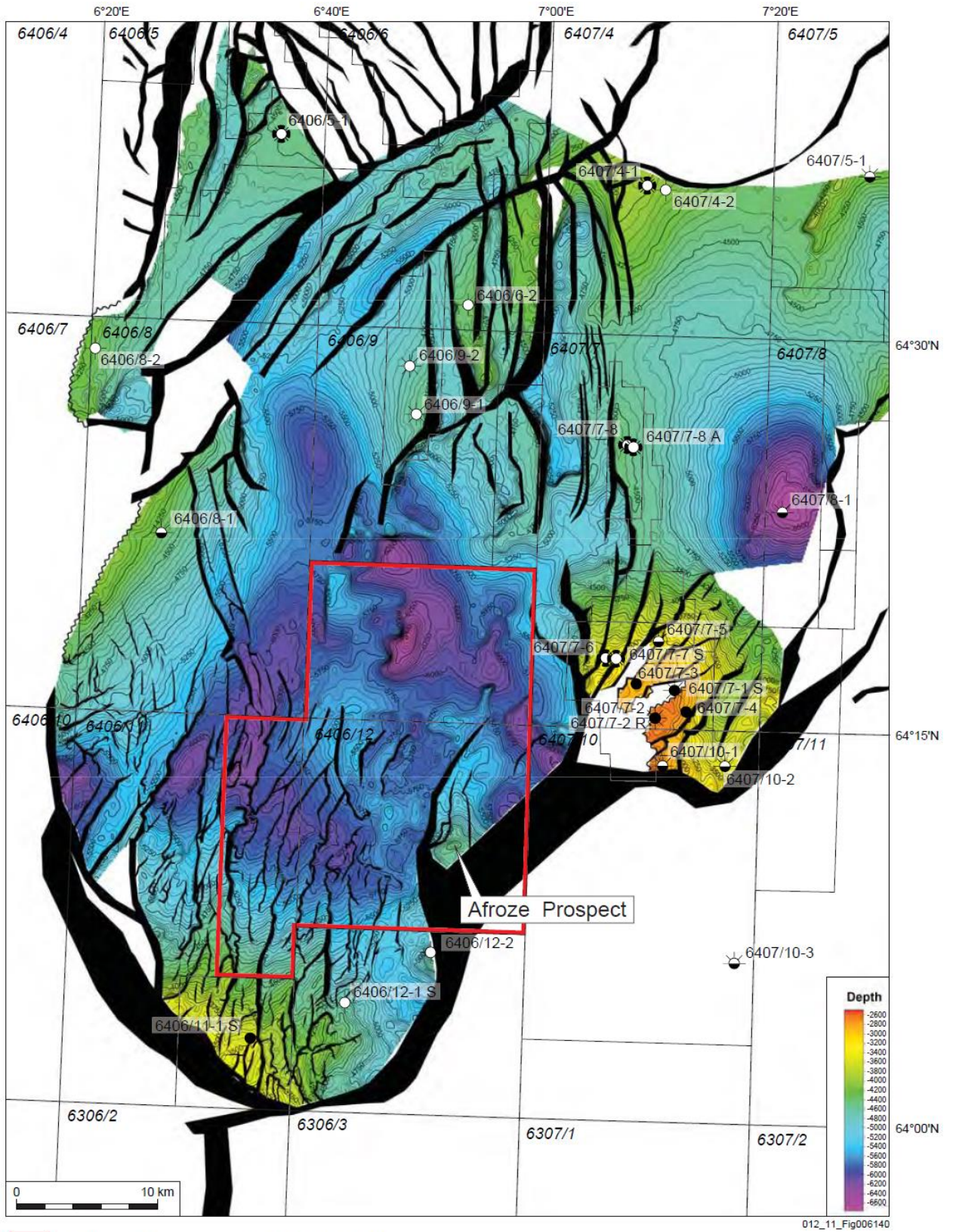


Fig. 1.2 Prospects and leads.

Noreco identified several prospects within the PL701 acreage. Their main prospect was the Afroze structure with postulated Lower to Middle Jurassic reservoirs. The prospect is bound towards the west by a N-S striking fault and towards the southeast by the NE-SW striking Vingleia Fault Complex (Fig. 1.2 and 1.3). On account of the deep burial, Afroze is expected to represent a HPHT gas condensate prospect.

Additionally, Upper Jurassic Grace, Sophia, Gretha, Audrey and Marilyn prospects were identified within the Rogn and Melke Fm. These prospects were seen as broadly similar to the Pil and Bue discoveries further west along the Vingleia Fault Complex (Fig. 1.1 and 1.2).

Aker BP considers the Afroze prospect as the main prospect in this license, whereas the Upper Jurassic possibilities are regarded as leads.



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Fig. 1.3 Noreco's Near Top Ile Depth Map, southern Halten Terrace (Contour interval: 50m).

2 DATABASE

2.1 Seismic database

The common 2D and 3D seismic database for the license area is listed in Table 2.1 and illustrated in Fig. 2.1. The area is largely covered by 3D seismic data, and public 2D data have been used to the extent necessary to fill in for missing 3D coverage. The reprocessed 3D seismic covers the identified prospectivity in the license.

Table. 2.1 Common seismic database in PL701

Survey name	Datatype	Year
MC3D-HT 2007-2008 (full fold)	3D	2007/2008
MC3D-2013R	3D	2014
MC2D_NH0508	2D	2005
HEBS83 2D	2D	1983

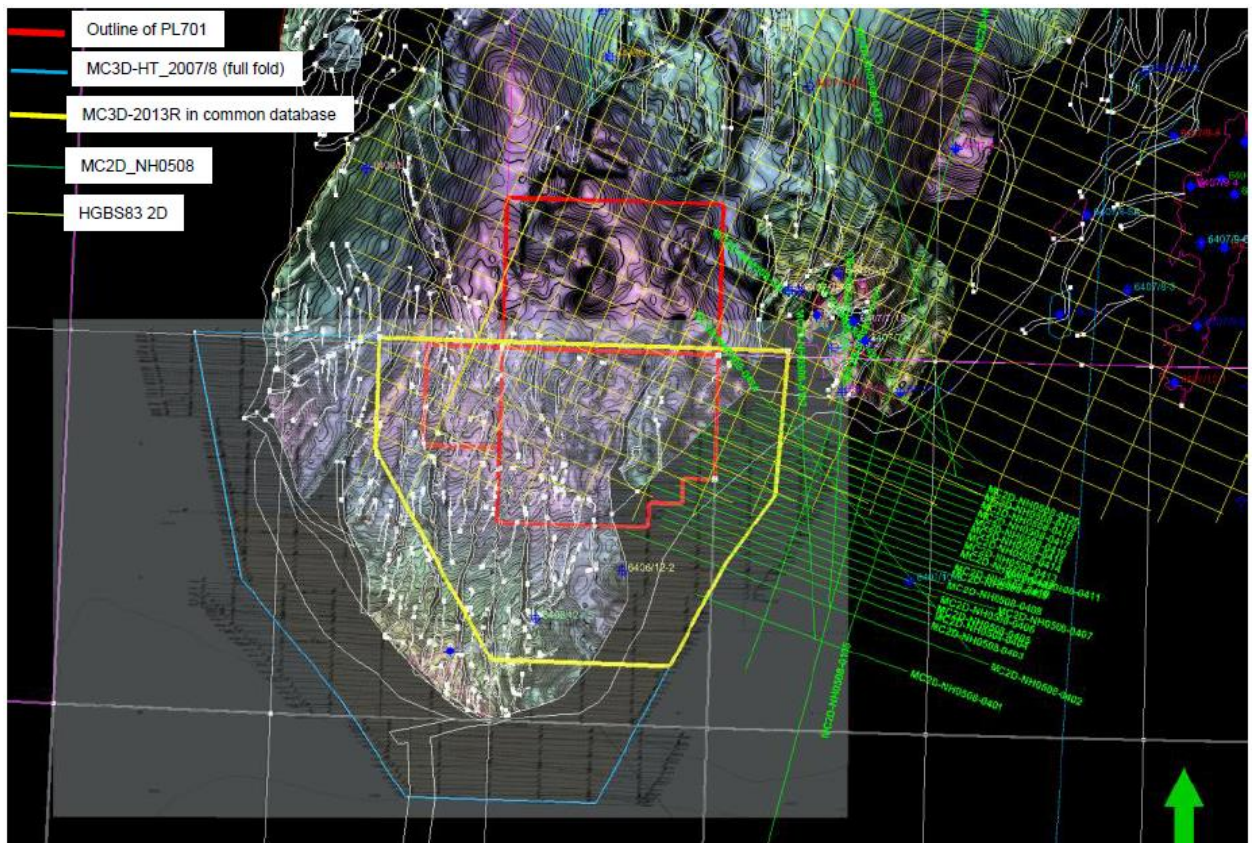


Fig. 2.1 Common 2D and 3D seismic database in PL701. MC3D-2013R is the reprocessed 3D seismic (yellow outline).

2.1.1 Seismic reprocessing

In order to fulfil license obligations, parts of MC3D-HT 2007-2008 covering all identified prospectivity was reprocessed in 2013-2014 by PGS (Fig. 2.1.) (PGS 2014).

2.2 Well data

The common well database is listed in Table 2.2. In 2014, 6406/9-3 (Onyx) was incorporated in the common well database as a reference for the Ile Fm reservoir. Additionally, the well database was updated with 9 wells with special significance for the Upper Jurassic Play (Table 2.2).

Table. 2.2 Common well database in PL701

Common well database		
Original well database from APA2012	Updated 2014	Updated (with public wells for Upper Jurassic evaluation)
6406/5-1, 1T2	6406/9-3 (Onyx)	6407/5-2S
6406/8-1		6407/6-7S
6406/8-2		6407/8-4S
6406/9-1		6407/9-1
6406/9-2		6407/9-3
6406/11-1S		6407/9-5
6406/12-1S		6407/9-6
6406/12-2		6407/9-10
6407/4-1		6407/12-1
6407/7-4		
6407/7-6		
6407/7-7S		
6407/10-1		
6407/10-2		
6407/10-3		

2.3 Special studies

Induced polarization

In June 2015 ORG Geophysical acquired the ORG15260-1 survey consisting of three 2D lines extending over block 6406/7-12 and focusing primarily on the prospectively between the Njord field and the Pil and Bue discoveries (ORG Geophysical 2015) (Fig. 2.2). The PL701 license is situated in-between these fields, and part of the ORG15260-1 survey have then been utilized for an IP chargeability study.

Fig. 2.3 shows the overview of the IP chargeability results along the three survey lines across PL701.

The IP chargeability results show the highest response above the Vingleia Fault Complex, south of Afroze, and above the Njord field, northeast of Afroze. The high IP anomaly above the Vingleia Fault Complex might indicate HC macro seepage. This macro seepage also indicates a negative fault closure at Afroze.

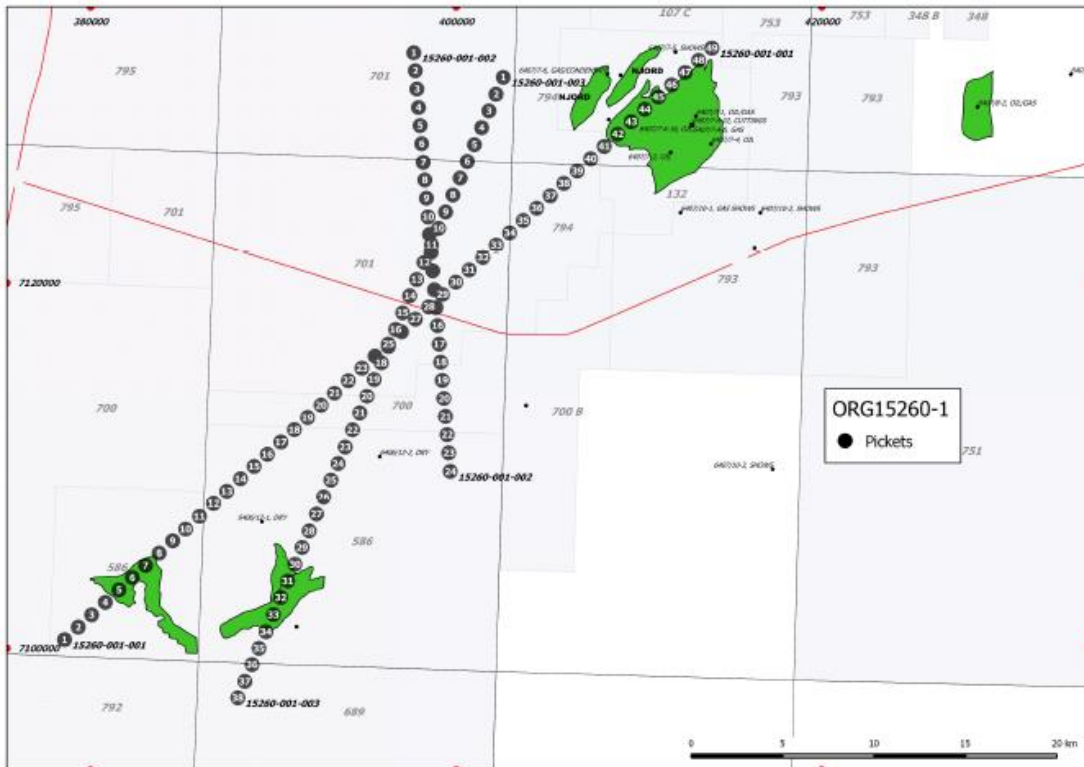


Fig. 2.2 ORG15260 survey lines, with measurement points indicated. The Pil and Bue discoveries are situated to the SW and the Njord field is situated to the NE.

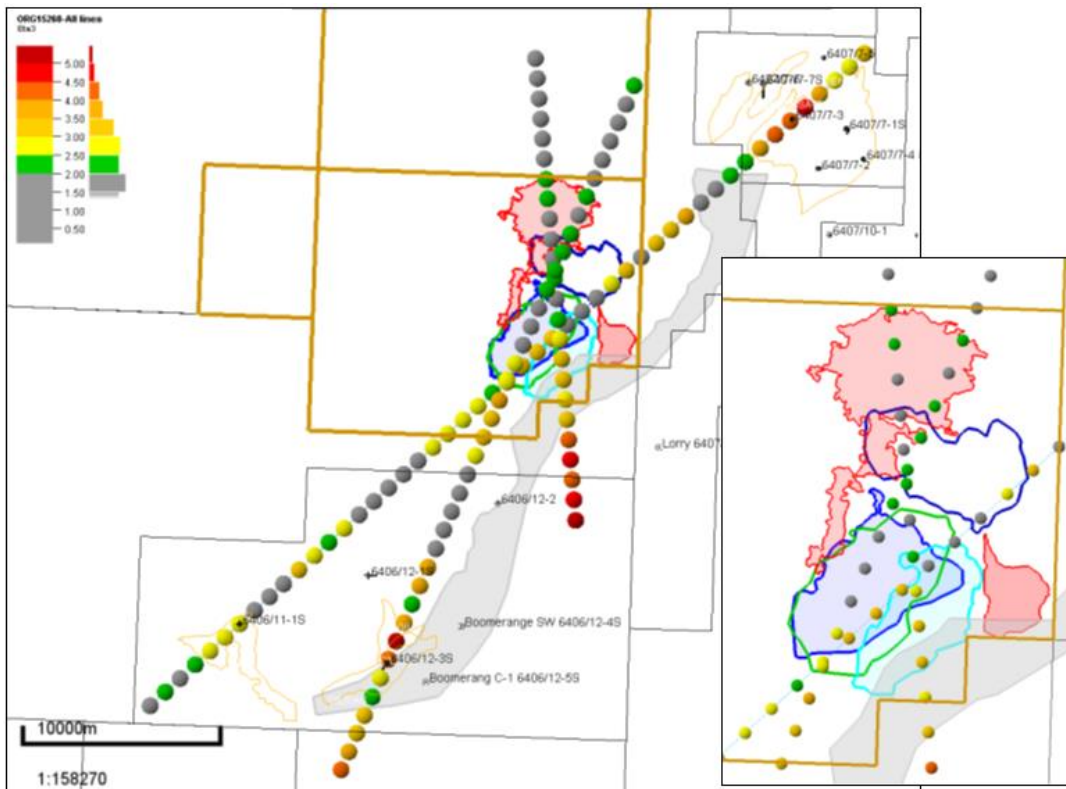


Fig. 2.3 Overview of the IP chargeability results from survey 15260-1 across PL701, with a close-up of the results above the prospects.

3 REMAINING PROSPECTIVITY

3.1 Afroze

As earlier mentioned, Noreco considered Afroze to be the main prospect within the license, and this view is also shared by Aker BP.

The prospect is a roll-over like structure, formed along the large Vingleia Fault Complex (Fig. 3.1).

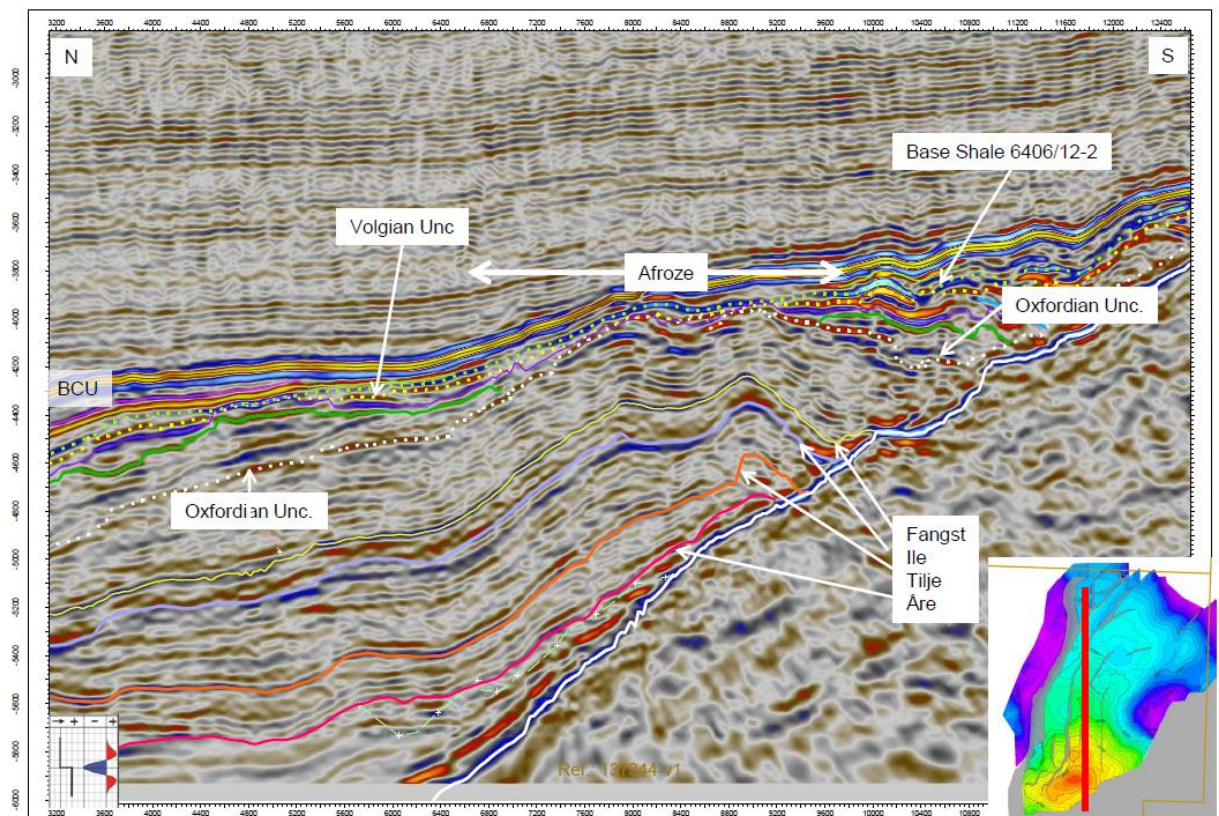


Fig. 3.1 N-S seismic section from the reprocessed MC3D HT2007-2008 showing the Afroze Prospect as defined by Noreco.

Close to the apex, Afroze shows small 4-way dip closures at Ile and Tilje Fm levels. For the deeper filling cases, one relies on downflank fault seal against the Vingleia Fault Complex (Fig. 3.1). The structure is expected to be capped by the Not shale or, alternatively shales of the lowermost part of the Melke Fm.

Assuming that Fangst/Båt lithologies are present, the main reservoirs are the Ile and Tilje Fm sandstones. Alternatively, the prognosed Fangst/Båt reservoirs may be missing, and the sedimentary sequence could then be interpreted as Melke lithologies.

If present, reservoir properties in the Ile and Tilje Fm is seen as moderate to low because of potential reservoir degradation due to the substantial depth of burial. The apex of the structure at Ile Fm level is at approximately 4320m (Fig. 3.2) and for the Tilje Fm at 4580m (Fig. 3.3).

The Spekk Fm is considered to be the main source rock on the Halten Terrace. In addition, the lower half of the Melke Fm and the entire Åre Fm are considered as possible, additional source rocks.

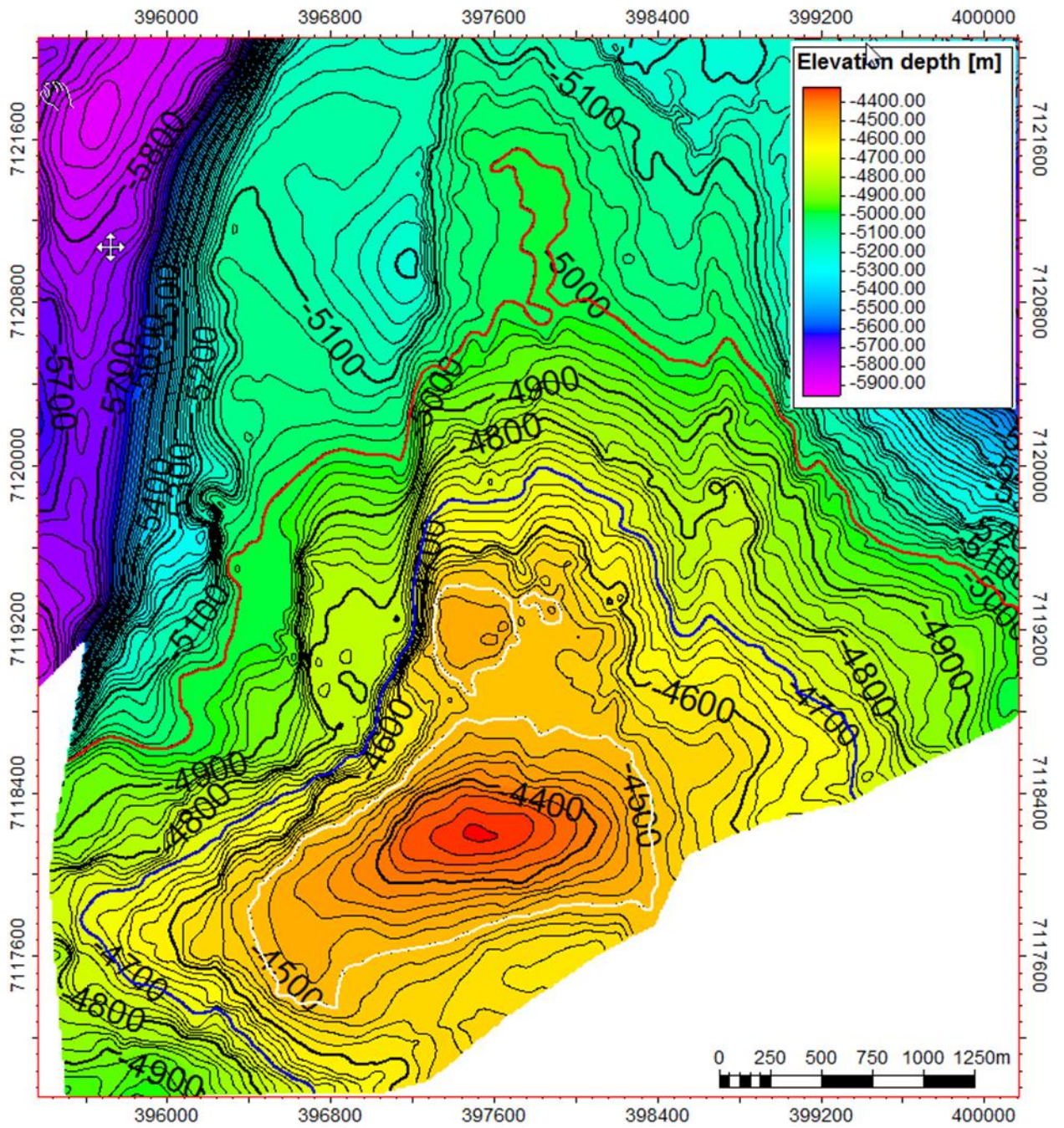


Fig. 3.2 Norco depth map Ile Fm. Aker BP filling cases (5000 max, 4700 mode and 4500 min).

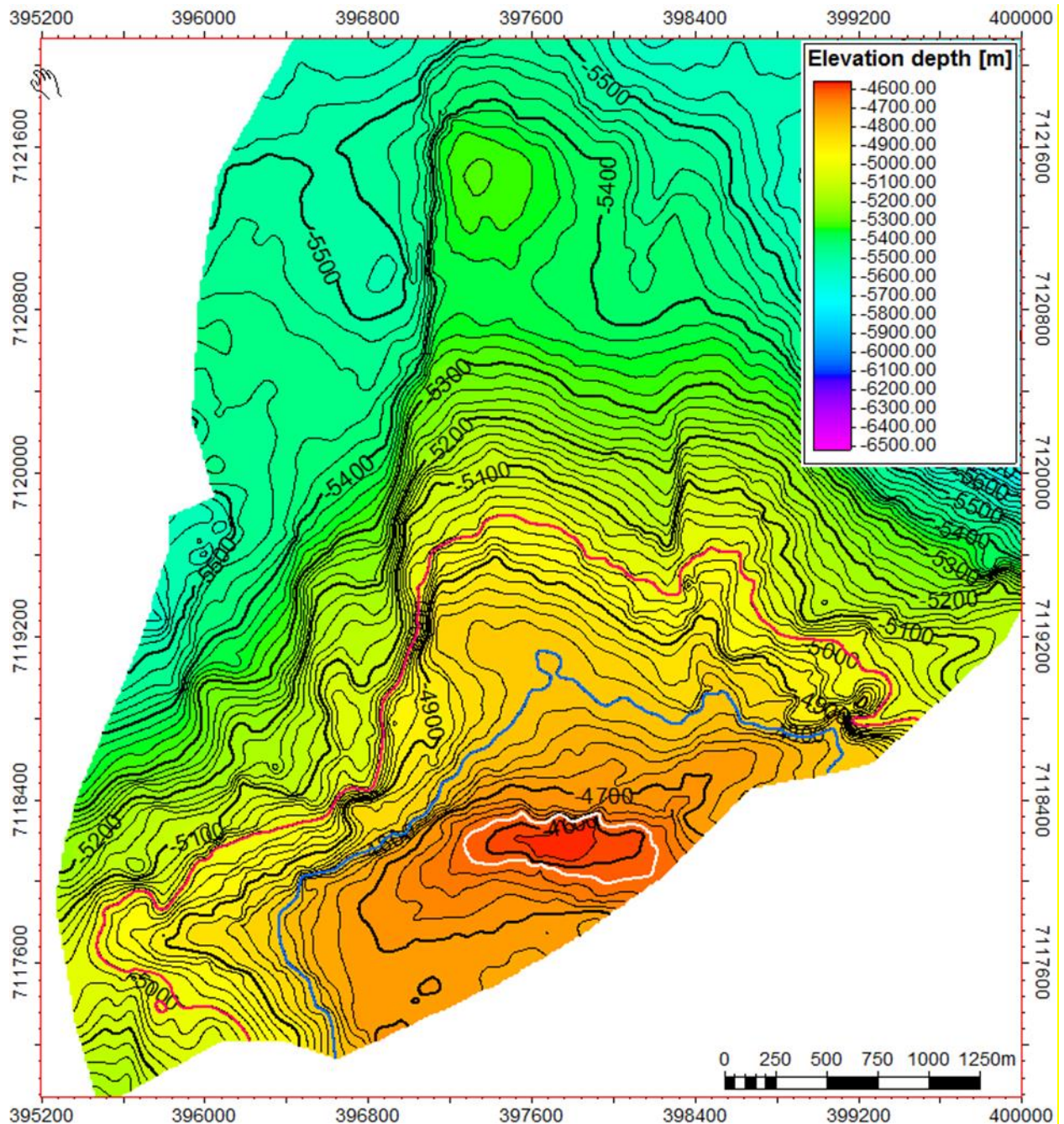


Fig. 3.3 Noreco depth map Tilje Fm. Aker BP filling cases (5000 max, 4800 mode and 4620 min).

3.1.1 Aker BP filling cases

Aker BP has relied on Noreco's depth maps for the prospect definition. Noreco interpreted the main reservoir horizons directly on the reprocessed and depth converted 3D seismic cube.

Filling cases with regards to the Ile Fm are defined in Fig. 3.2. The minimum case at 4500m is defined by the 4-way dip closure, whereas the max case at 5000m is defined by postulated reservoir degradation with depth. The mode at 4700m gives a column height of 380m.

The main applied reservoir parameters are given in Table 3.1.

Table 3.1 Aker BP Petrophysical Parameters and recovery factors, Ile Fm

Parameter	Min	Mode	Max
N/G	0.1	0.36	0.7
Porosity	0.1	0.145	0.17
Gas saturation	0.6	0.7	0.8
Recovery factor Condensate	0.25	0.35	0.4

Filling cases with regards to the Tilje Fm are defined in Fig. 3.3. The minimum case at 4620m is defined by the 4-way dip closure, whereas the max case at 5000m is defined by postulated reservoir degradation with depth. The mode at 4800m gives a column height of 220m.

The main applied reservoir parameters are given in Table 3.2.

Table 3.2 Aker BP Petrophysical Parameters and recovery factors, Tilje Fm

Parameter	Min	Mode	Max
N/G	0.1	0.2	0.4
Porosity	0.1	0.15	0.17
Gas saturation	0.6	0.7	0.8
Recovery factor Condensate	0.25	0.35	0.4

Aker BP's Pd and hypothetical recoverable volume estimates for the Ile and Tilje Fm, respectively, are given in Table 3.3. Estimated hypothetical recoverable volumes for the combined Ile and Tilje Fm is 52,5 MMBOE with a Pd of 0.11 (Table 3.3).

Table 3.3 Afroze Prospect. Aker BP's risk and hypothetical recoverable volumes.

Prospect	Afroze		
Reservoir	0,56		
Trap	0,27		
Charge	0,70		
Retention	1		
P(d)	0,11		
	P90	P50	P10
Rec. Volumes Ile Fm (MMBOE)	17,6	37,2	60,2
Rec. Volumes Tilje Fm (MMBOE)	6,2	15,3	28,4
Total Rec. Volumes (MMBOE)	23,8	52,5	88,6

In Noreco's risking, Afroze has a Pd of 0.39 with main risks being equal between reservoir presence and trap (Table 3.4). Estimated hypothetical recoverable volumes are 89MMBOE.

With respect to Afroze, Norecos Pd and hypothetical recoverable volume estimates are given in Table 3.1

Table 3.4 Afroze prospect. Noreco's risk and hypothetical recoverable volumes.

Prospect	Afroze		
Reservoir	0,70		
Trap	0,70		
Charge	0,80		
Retention	1		
P(d)	0,39		
Rec. Volumes (MMBOE)	P90	P50	P10
	20	89	138

3.2 Other prospects/leads

As defined by Noreco, the Upper Jurassic Grace, Sophia, Gretha, Audrey and Marilyn are additional prospects in this area. Noreco's definition of the various Rogn Fm and Melke Fm prospects are shown in Fig. 3.4, and their risking and hypothetical recoverable volumes are given in Table 3.5. All the Upper Jurassic possibilities rely on working stratigraphic traps.

According to Aker BP's view, the risk regarding seal and reservoir quality to these prospects is so high that it gives a chance of success lower than 10%. Aker BP therefore classifies them as high risk leads. However, in Norecos risk evaluation they represent prospects with an estimated Pd between 0.14-0.31 (Table 3.5).

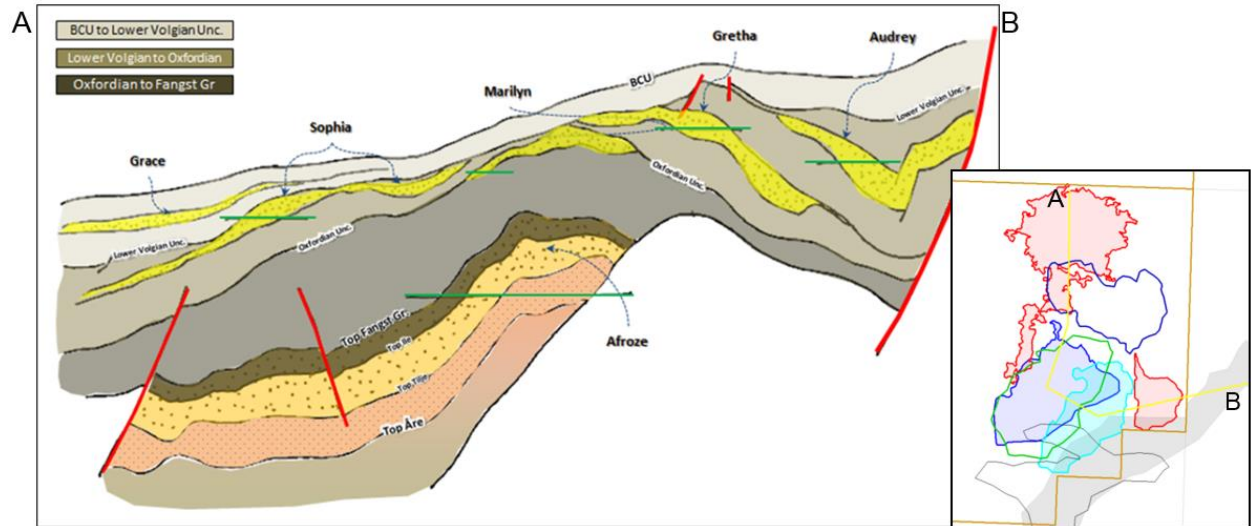


Fig. 3.4 Vertical section and location map of Afroze prospect and the Upper Jurassic prospects/leads.

Table 3.5 Upper Jurassic prospects/leads. Noreco's risk and hypothetical recoverable volumes

Prospect/lead	Greta			Audrey			Sophia			Grace			Marilyn		
Reservoir	0,81			0,81			0,72			0,42			0,72		
Trap	0,42			0,24			0,36			0,36			0,36		
Charge	0,90			0,90			0,90			0,90			0,90		
Retention	1			1			1			1			0,90		
P(d)	0,31			0,17			0,23			0,14			0,21		
Rec. Volumes (MMBOE)	P90	P50	P10	P90	P50	P10	P90	P50	P10	P90	P50	P10	P90	P50	P10
	17	27	42	10	16	25	18	28	85	4	6	9	24	37	55

4 Conclusion

In Noreco's evaluation in connection with the DoD decision, Afroze economics based on a P50 85MMBOE case with subsea tie-back to Njord gave a breakeven oil price of 52 USD/bbl.

The project showed a positive NPV of 491 MNOK at an oil price of 60 USD/bbl (Noreco 2015).

In Aker BP's evaluation the P50 total recoverable volumes are only 52,5MMBOE. Also, recent developments with regards to the oil price shows that a target price of 60 USD/bbl is uncertain and may not be realised in the foreseeable future. Afroze therefore does not meet Aker BP's expectations as a robust prospect given the combined geological and financial risk.

Thus, the relinquishment of PL701 has been cumulatively based on the following issues:

- Moderate HC volumes and low probability for discovery
- High risk on the seal along the Vingleia Fault Complex.
- Moderate to high risk on the reservoir properties of the Ile and Tilje Fm.
- Afrozes depth of burial, and position close to a HP area will most likely cause an exploration well to be drilled as a HPHT well with correspondingly high costs.
- The possible volumetric upside in the Upper Jurassic leads will most likely never materialise because of their high risk trapping mechanism as well as high risk on reservoir degradation.

Based on these factors, the majority of the partnership concluded a negative well decision in 2016, and the license was relinquished 8th December 2016.

5 References

Noreco 2015: PL 701 DoD Decision, ppt presentation, 24 pp. Presented at MC meeting 25.11.2015.

ORG Geophysical 2015: DNME Survey Report, ORG15260-1. PL701-Exclusive, 37pp.

PGS 2014: Seismic Processing Report. Halten Terrace MC3D HT2007-2008 PL701,102pp.