PL672 Relinquishment Report

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1 Key License History

Production License 672 was awarded to Talisman Energy Norge AS (50%) as operator, with partners Det Norske Oljeselskap ASA (25%) and Fortis Petroleum AS (25%). The license was awarded on February 8th, 2013 as part of the APA 2012 license round. On November 30th, 2014 25% of Talisman's interest was transferred to Ithaca. From October 6th, 2015 the ownership is changed to: Repsol Norge AS (25%), MOL Norge AS (25%), Det norske oljeselskap AS (25%) and Fortis Petroleum (25%).
The license was awarded with a work commitment such that within the first year i.e. by 8th February 2014 the partnership would:

- Purchase and merge 3D seismic and conduct geophysical and geological studies.
- Make a drill or drop decision. The drill or drop decision was approved by the ministry to be moved to 8th August 2014. A drilling decision was taken July 2014.
- Within 3 years (8th February 2016) drill a well and make a decision on concretization.

The commitment well was drilled in 2015 as a dry well and all work commitments and obligations for this license have been fulfilled.

The following meetings are held within the license since the award:

2013
3 ECMC meetings: 22.3.2013,20.6.2013, 20.11.2013,
4 Technical work meetings: 22.5.2013, 28.8.2013 , 26.9.2013, 6.11.2013

2014
5 ECMC meetings: 27.1.2014, 9.4.2014, 18.6.2014, 1.9.2014, 26.11.2014
MC work meeting: 24.3.2014
Technical work meetings: 17.1.2014, 2.6.2014, 16.9.2014, 28.10.2014, Snømus well data gathering and sidetrack options

2015
3 ECMC meetings: 29.1.2015, 17.6.2015, 25.11.2015
Well specific risk assessment: 15.1.2015
EC work meeting: 10.2.2015

The license is relinquished since no commercial attractive prospects are identified within the license after the negative results of 15/12-24S.

2 Database

The common seismic database for the license consists of three different 3D data sets: MC3D-GRV 2010, MC3D-LIN 2012 and MC3D-Varg-2002 (reprocessed in 2013 as TE13M002). The extension of the surveys are shown in Figure 2.1.

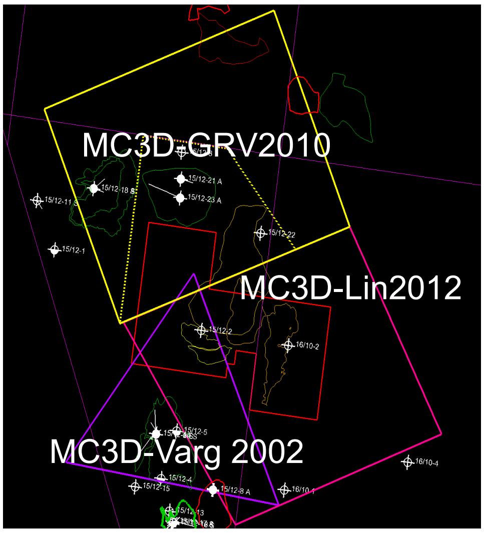

Figure 2.1 PL672 Seismic database

The MC3D-LIN2012 dataset is new broadband 3D seismic data with an increased seismic resolution compared to 3D data used pre-license award. This data set together with a detailed sequence stratigraphic study of all wells including all production wells provided an increased understanding of reservoir distribution and quality across the license.

Well 15/12-24S drilled in spring 2015, provided new and updated stratigraphic and hydrocarbon system information. The interpretation of geochemistry data from this well indicates that the Snømus trap never worked however, hydrocarbons have migrated through the reservoir. The analysis of results from the well has increased the risk of the remaining prospects and the impact on each prospect will be discussed in more detail under Section 4.

An updated sequence stratigraphic well-tie between Varg field, 15/12-24S and 16/10-2 is shown in Figure 2.2. The sequence stratigraphic interpretation is based on log interpretation and biostratigraphic analysis.

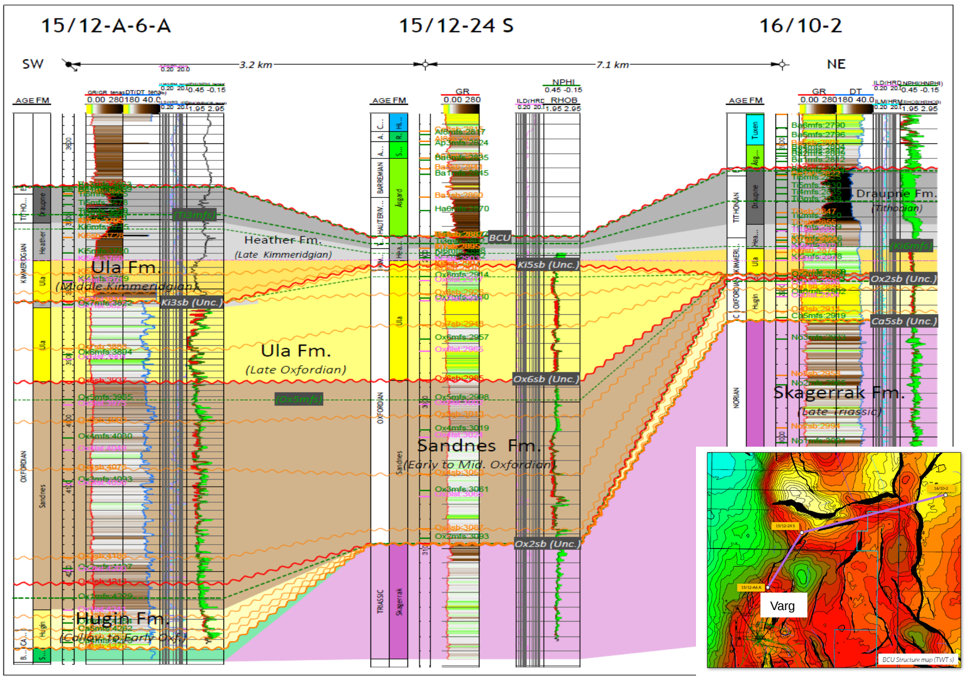

Figure 2.2 Well tie 15/12-A-6A, 15/12-24S and 16/10-2

3 Review of Geological Framework

The interpretation of new broadband 3D seismic data together with a detailed sequence stratigraphy study have increased the understanding of Jurassic reservoir distribution in the license. The understanding of both pre-rift and syn-rift Jurassic reservoir distribution has also been increased by integration of ongoing subsurface work for Varg and Grevling fields.
Well 15/12-24S was drilled in 2015 within the license and drilling results were incorporated into the stratigraphic framework built using all wells in the area (Figure 2.2). The drilling results have further increased the understanding of the huge variation in syn-rift presence and quality.
A well correlation from northeast 15/12-1 across PL672 wells 15/12-2 and 16/10-2 to 16/10-4 to the southeast is shown in Figure 3.1. This shows the back-stepping Ula formation from 16/10-4 to 15/12-2 and the shaling out of the sequence in 15/12-1. Sandnes formation is only interpreted to be present in 16/10-4. Hugin formation is shown to pinch-out between 16/10-2 and 16/10-4. Sleipner formation is shown to be present only in 15/12-1. The cross section shown in Figure 2.2 shows a thinning of Sandnes formation from northern part of Varg across Snømus to 16/10-2. Ula formation is shown to be fairly thick in all wells, and represents an age interval from the Ox6sb (mid-Oxfordian) to Ki6mfs in 16/10-2. This shows that Ula formation back-steps towards the east. Varg 15/12-A-6A and 16/10-2 is interpreted to have preserved Callovian Hugin formation. 15/12-A-6A is interpreted to TD in Bathonian Sleipner formation. 15/12-24S had Oxfordian Sandnes formation directly overlaying Triassic Skagerrak formation sands. These well results show the highly variable thickness and presence of Jurassic reservoir formations in the Varg area.

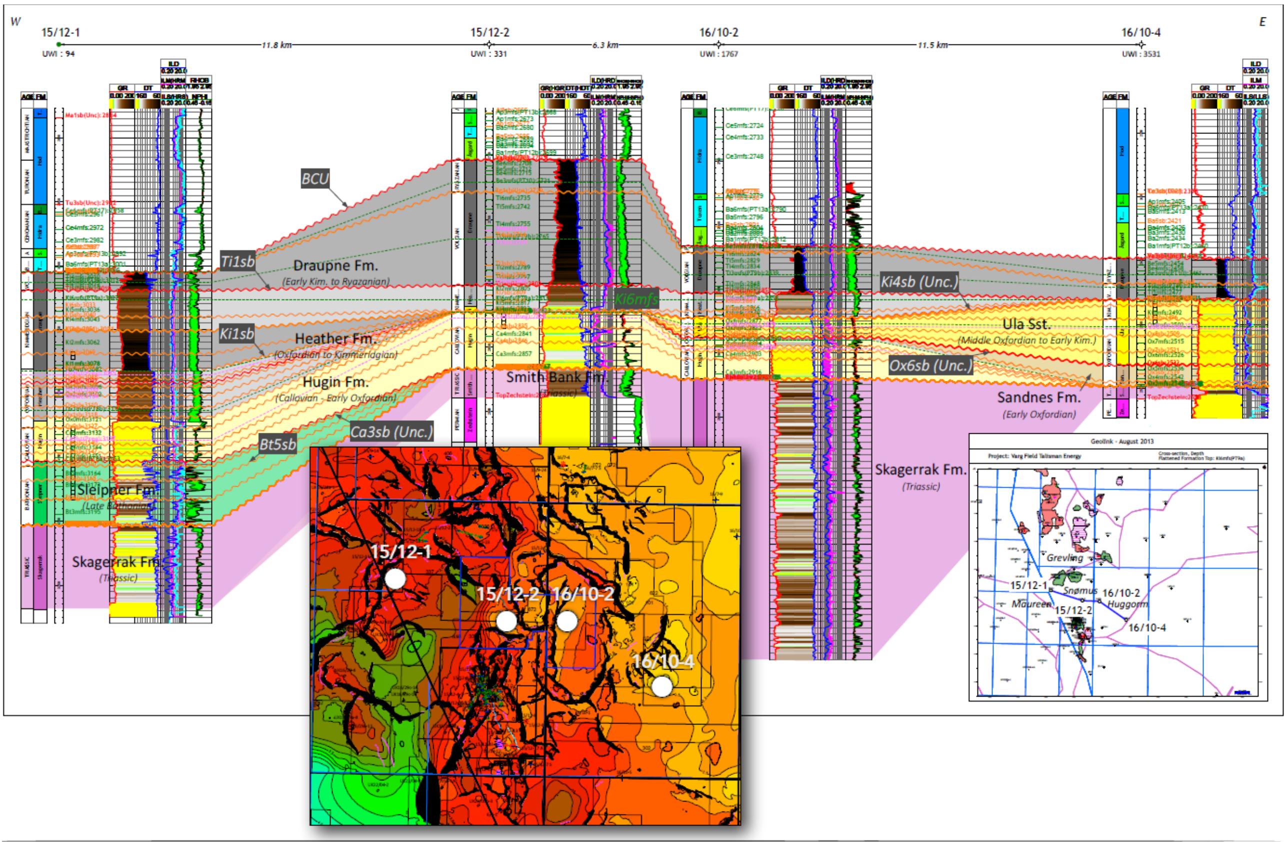

Figure 3.1 Well cross section 15/12-1,2 and 16/10-2 and 4

A seismic line from Grevling across PL672 to Varg is shown in Figure 3.2. The top Ula reflector represents top Ula reservoir sands in the east and central part of the license, while in the west towards Grevling field, Ula formation is not present and the mapped horizon is an intra Heather unconformity within an overall shaly sequence (Figure 3.3).

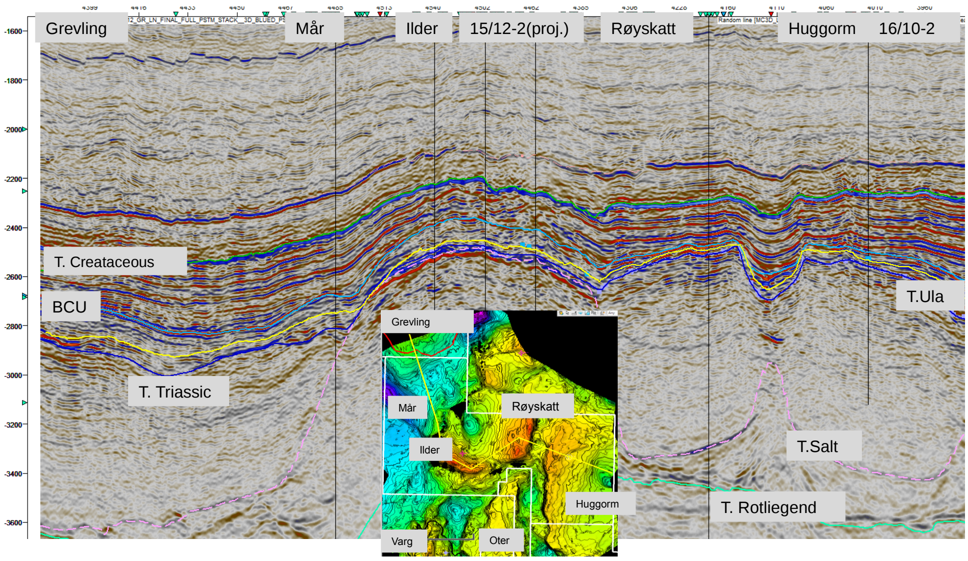

Figure 3.2 Northwest to southeast seismic cross section from Grevling discovery to Huggorm prospect

Geochemical studies of weak shows in 15/12-24S indicates some migration happens into this prospect. A geochemical characterization of isotube gases, headspace gases and the organic extract from cutting samples, in addition to a study of fluid inclusions were done to better understand the reason for the failure. The conclusion from the geochemical work is that the weak shows probably represent migrating hydrocarbons, where migrant oil stain was generated from a middle mature source rock. The staining correlates to a Draupne/Heather source, however, samples indicate that these are immature at the 15/12-24S location.

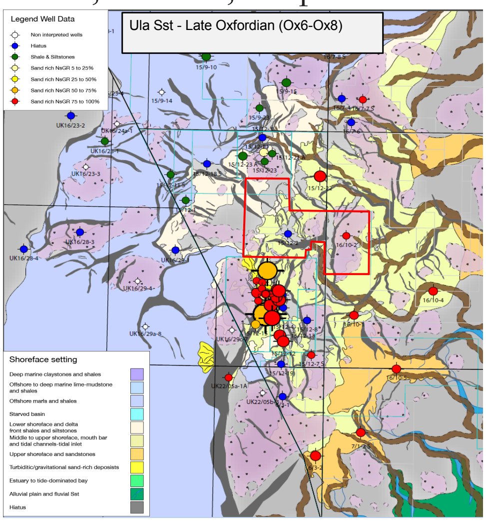

Figure 3.3 Late Oxfordian facies map (PL672 in red outline)

The interpretation of 15/12-24S results indicates that the reasons for failure of Snømus prospect could be:1) trap failed and probably never worked, or 2)Snømus had lack of access to sufficient amounts of migrating hydrocarbons. These results significantly increase the risk of the remaining prospects within the license and will be discussed in more detail in Section 4.

The Eocene Frigg formation has been interpreted to pinch out towards the east within the license area as shown in Figure 3.4. Paleocene Maureen/Ty formation is interpreted to pinch out west for PL672.

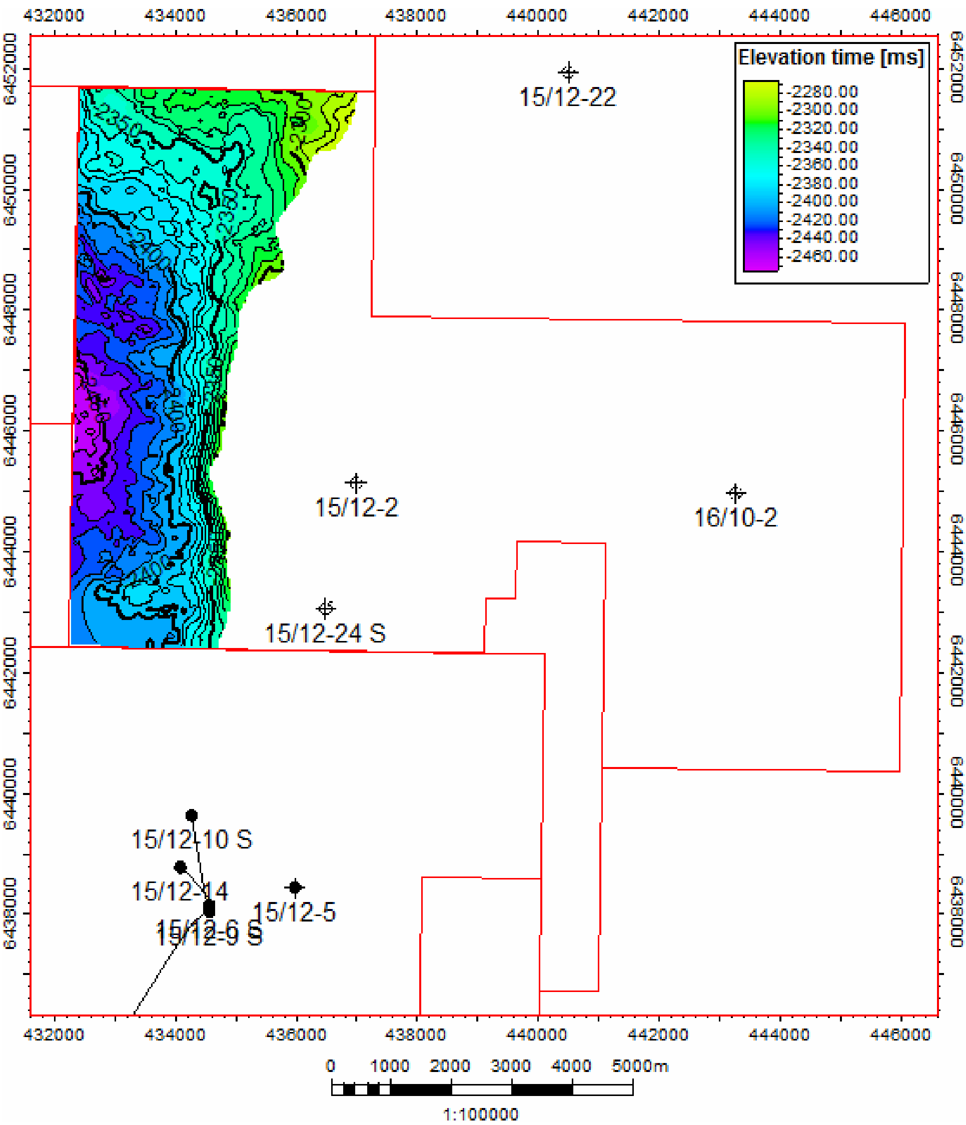

Figure 3.4 The Frigg formation has been interpreted to pinch out within the license area

4 Prospect Update

The area applied for in APA 2012 with the identified prospects and leads, and outline of current prospects within the license are shown in Figure 4.1.

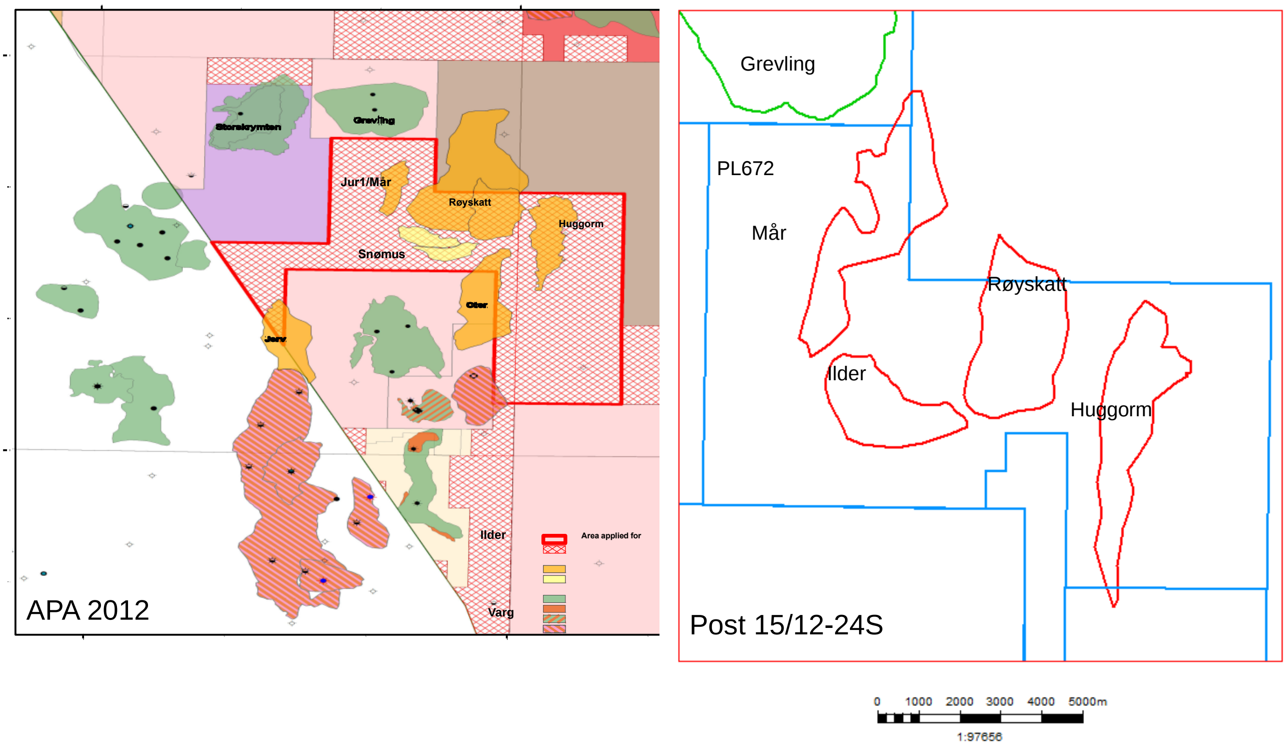

Figure 4.1 Prospects and Leads APA 2012 and outline of PL672 prospects post 15/12-24S

Volumes and risk of prospects in PL 672 from the APA application is shown in Table 4.1, and updated volumes and risks for PL672 prospects are shown in Table 4.2.

Table 4.1 APA 2012 NPD Table 2

Discovery / Prospect/ Lead name	D/ P/ L	Unrisked recoverable resources						Probability of discovery	Resources in acreage applied for %	Reservoir		Distance to infra-structure (km)
		Oil 106Sm3			Gas 109Sm3					Litho-/ Chrono-stratigraphic level	Reservoir depth (m MSL)	
		Low	Base	High	Low	Base	High					
15/12 Ilder	P	3.3	6.2	9.4	0.2	0.45	0.8	0.32	100	Hugin/Oxfordian	2600	7
15/12 Snømus	P	2.5	5.7	9.5	0.15	0.4	0.8	0.23	100	Hugin/Oxfordian	2815	7
15/12 Røyskatt	L								90	Hugin - Skagerrak/ Oxfordian - Triassic	2600	9
15/12 Huggorm	L								100	Hugin - Skagerrak/ Oxfordian - Triassic	2700	10
15/12 Oter	L								30	Skagerrak/ Triassic	2900	5
15/12 JUR1	L								100	Hugin/Oxfordian	2950	10
15/12 Jerv	L								21	Ty/ Paleocene	2800	5
15/12 Høgtangen	L								43	Heimdal - Ty/ Paleocene	2300	10

Table 4.2 PL672 Volumes and risks post 15/12-24S

Discovery/ Prospect/ Lead name	D/ P/ L	Unrisked recoverable resources: Oil 106Sm3			Gas 109Sm3			Probability of discovery	Resources in acreage applied for %	Reservoir: Litho-/ Chrono-stratigraphic level	Reservoir depth (m MSL)	Distance to infra-structure (km)
		Low	Base	High	Low	Base	High					
15/12 Ilder	P	0.2	1	2.4	0	0	0	0.29	100	Hugin/Callovian	2600	7
15/12 Snømus	Drilled	0	0	0	0	0	0	0	100	Ula,Sandnes/Oxfordian	2856	6
15/12 Røyskatt	P	0.2	1.6	4.3	0	0	0	0.15	90	Ula,Sandnes/Oxfordian	2600	9
15/12 Huggorm	P	0.1	1	2.5	0	0	0	0.16	100	Ula,Sandnes/Oxfordian	2700	10
15/12 Mår	P	0.4	2.5	6.2	0	0	0	0.17	100	Ula,Sandnes/Oxfordian	2900	10

An updated Top Ula map based on new 3D seismic and results from well 15/12-24S is shown in Figure 4.2. The map indicates that both 15/12-2 (down-dip Ilder) and 16/10-2 (down-dip Huggorm) are drilled on valid structural closures. Yellow area represents approximate structural closure and red area represents closures up-dip from dry wells. Dry wells 16/10-1 and 15/12-22 are also interpreted to be drilled on valid structures . Mår prospect is a 3-way structural closure with a stratigraphic pinch-out /fault seal in the other direction (western flank of salt-dome, same trapping mechanism as Snømus).

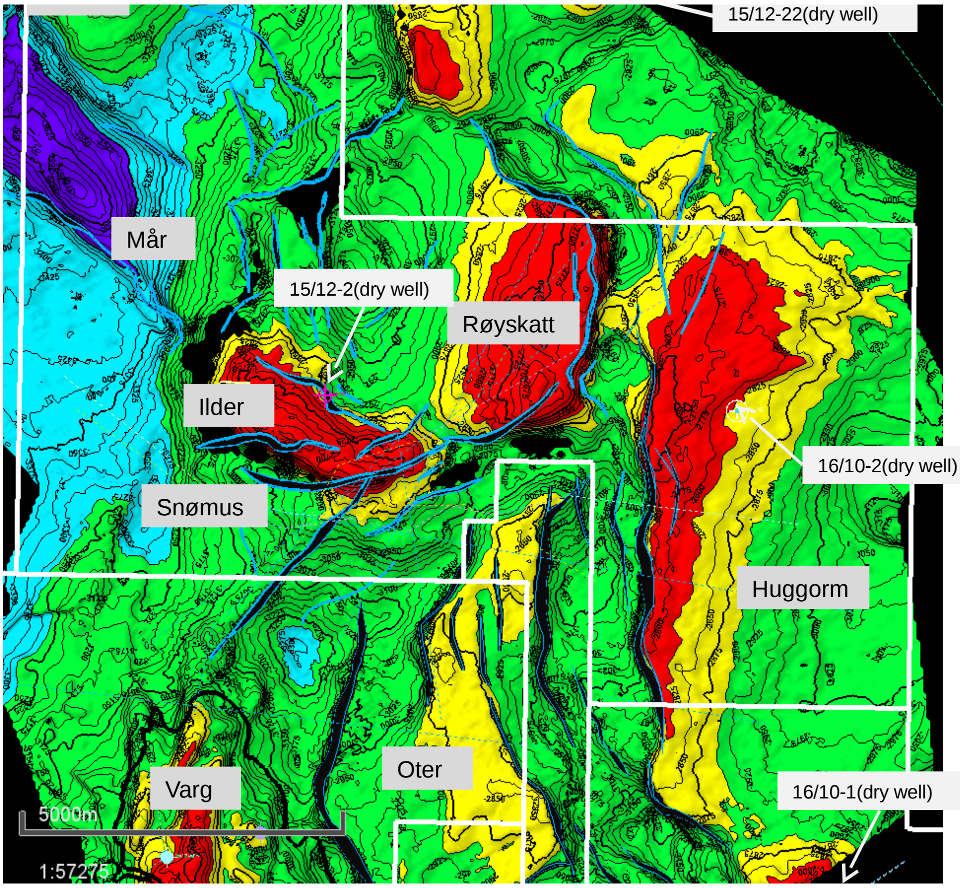

Figure 4.2 Top Ula depth map

The Snømus well was a dry well but with sporadic weak shows through the reservoir section. Mår prospect is located on the western flank of the salt dome with Snømus on the southern flank (Figure 4.2 and Figure 4.3). The prospect is located directly up-dip from the mature local basin, which has sourced the Grevling discovery. A possible reason for dry Snømus prospect is lack of lateral seal, this increases the risk of leaking lateral seal at Mår as well.

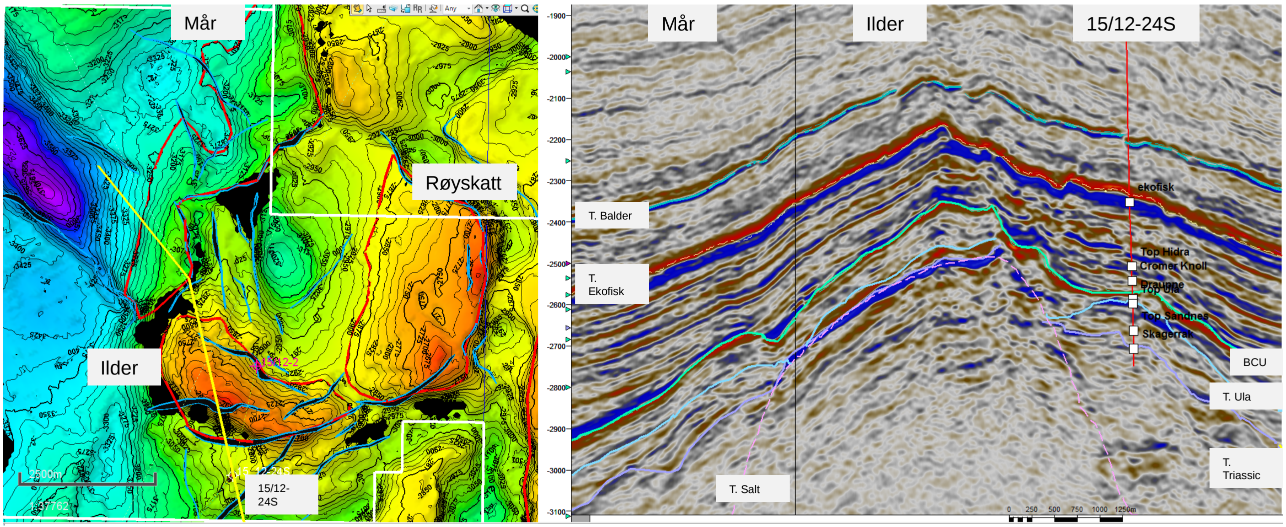

Figure 4.3 Top Ula fm. Mår, Ilder and Røyskatt prospects

Reservoir quality and presence will also be a risk for Mår since the prospect is located at the edge of transition from middle to lower shoreface for Upper Jurassic (Figure 3.3) and in an area were Hugin is pinching-out and Sleipner not present. The volume range and risk is shown in Table 4.2. The volume up-side is limited down-dip by known contacts across the syncline at the Grevling discovery.

Ilder is located at the crest of the Mår/Snømus salt dome (Figure 4.2) and is the less risky of the remaining prospects. The main risk for Ilder is migration and seal. Migration needs to be from the basin to the west through the Mår prospect or from the south through Snømus. The shows in the Snømus well shows that some migration happened at this location and the highest point in the area is Ilder. Both top seal and lateral seal would be a risk for the Ilder prospect, since the trap is cut by recent faulting and has a dry well down-dip which is mapped to be within structural closure. The reservoir presence and thickness is uncertain across the crest, since this area most likely was uplifted and eroded through both Ula and Sandnes times. Local erosion is most likely the sediment source for the thick Ula and Sandnes sands seen in 15/12-24S. Volumes and risk for the prospect is shown in Table 4.2.

Røyskatt and Huggorm are the smallest and most risky of the remaining prospects (Table 4.2). Both prospects are tilted Triassic fault blocks with Skagerrak formation potential reservoir draped by Upper Jurassic Ula/Sandnes reservoir sands. There is most likely no barrier between Skagerrak sands and Upper Jurassic sands and the prospects are therefore assessed using Upper Jurassic reservoir properties. Main risk for both prospects are hydrocarbon migration. The dry wells surrounding the prospects (15/12-22, 15/12-2, 15/12-24S and 16/10-2) tested valid traps with thick reservoir quality sands and no indication of migrating hydrocarbons except for the Snømus well, and shows the challenge in defining attractive prospects in the area.

5 Technical Evaluations

Minimum economic volumes for remaining PL672 prospects were calculated for a subsea tie back concept based on the CAPEX and OPEX for the field development of a P Mean Case in the Varg area. Synergies with Varg field was not considered, but it is assumed that a hub infrastructure is available in the area for a tie in. The economics are shown in Figure 5.1 and shows that a volume between 31 and 34 mmboe gross recoverable reserves is needed for an economic development in the license. It was also considered to have a long reach well from Varg A as possible Ilder production well, such a well would be more complex than any of the wells previously drilled in Varg field and requires special attention to hydraulics, torque and drag as well as wellbore stability. A long reach well from Varg is benchmarked against similar projects and Rushmore Performance. The well would be classified as World Class Challenge, and there would be a high risk of missing target as the ellipse of uncertainty is the same as the target box (Figure 5.2). There is also a risk of drilling through fault structure and into possible high pressure in salt, in addition to having wellbore stability issues at the toe of well. This could potentially be a show stopper prior to penetrating reservoir after substantial investment. A long reach production well from Varg A to Ilder was therefor judged to be to risky to be a viable development option. Mår, Røyskatt and Huggorm prospects are even further from Varg A and therefore not possible to reach from Varg.

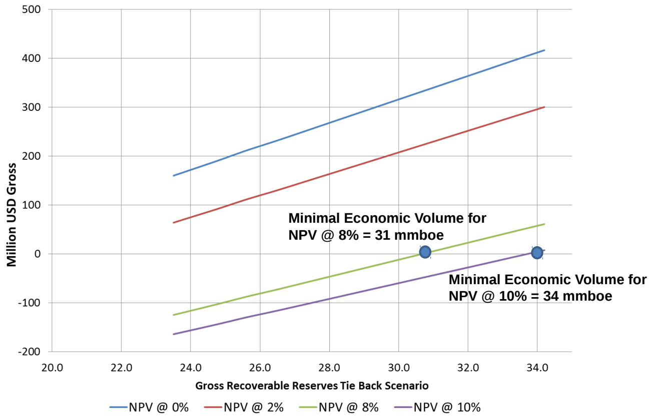

Figure 5.1 PL672 minimal economic volume

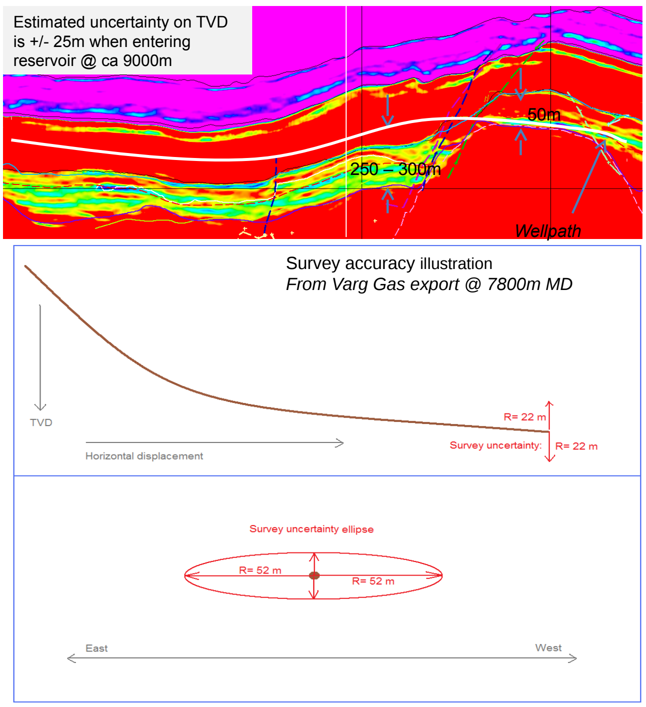

Figure 5.2 Long reach well from Varg A to Ilder prospect and uncertainty ellipse for a 7800m MD well

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6 Conclusions

Four prospects are identified within the license with mean volumes ranging from 5-16 MBO. The upside potential for the prospects are limited since dry wells are drilled on the flanks (15/12-2, 16/10-2 and 15/12-24S) of structural closures (Ilder, Huggorm and Røyskatt). Mår prospect is limited by contact observations in Grevling field. Upper Jurassic Ula and Sandnes formations are mapped as main reservoirs in all prospects except for Ilder, where Hugin formation is the main reservoir. Triassic Skagerrak formation might offer additional potential. Structural closures were in place prior to latest pulse of generation and expulsion. The dry wells indicates that migration pathway most likely offer the highest risk for the prospects. Snømus is interpreted to fail because of leaking seal (no trap), or no connection to mature hydrocarbon generating basin. This increases the risk for trap failure of Mår and Ilder prospects. Røyskatt and Huggorm prospects are located even further from mature kitchen than Snømus and have therefor even higher risk of no connection to mature basin. Volumes are evaluated to be economic unattractive and risk are high, therefore the decision to relinquish the license with all work commitments being met. The three dry well penetrations in the license shows the challenge in identifying economical attractive potential in this area (Figure 6.1).

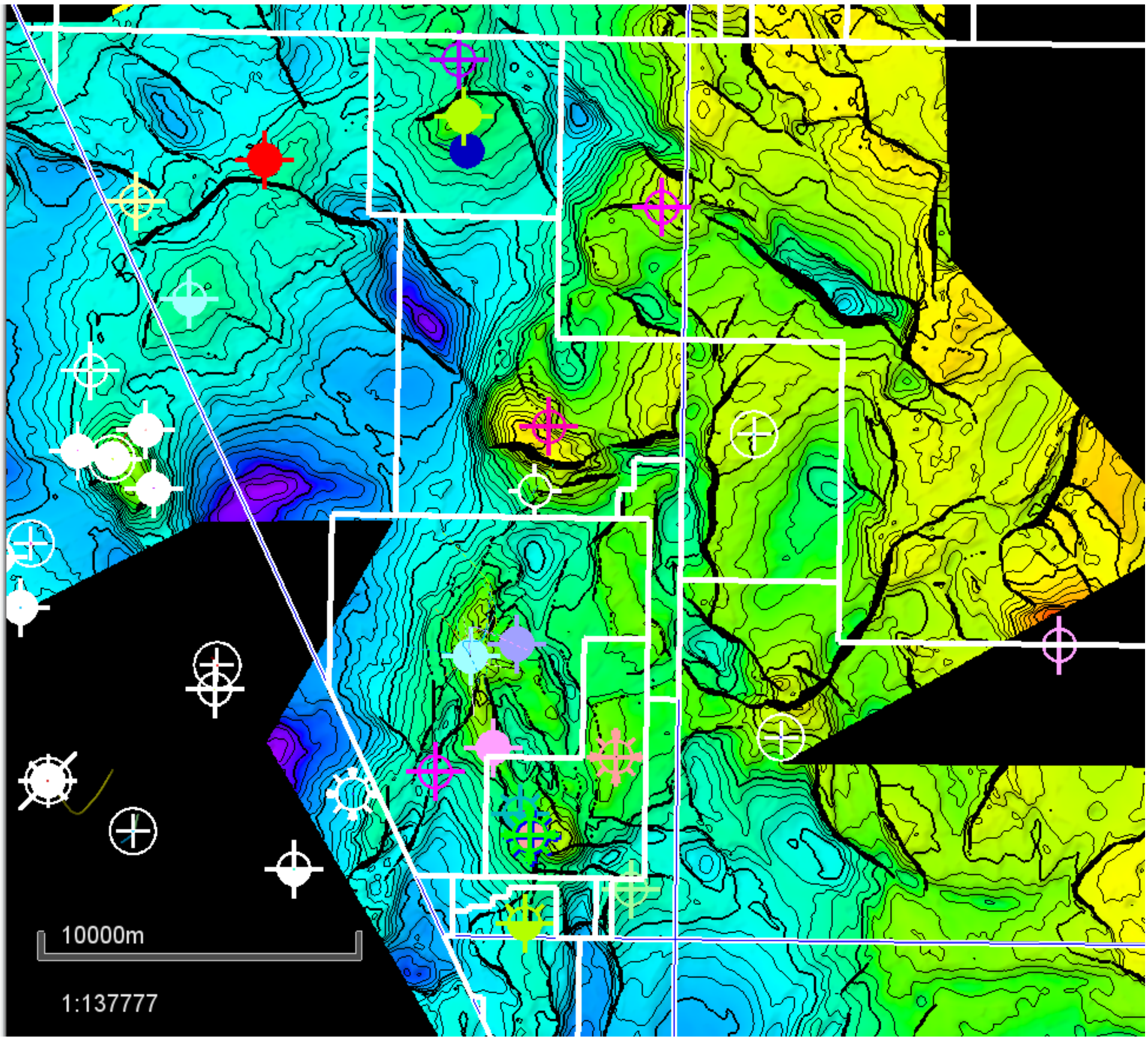

Figure 6.1 Base Createaceous PL 672 area