PL 393B Relinquishment report

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PL 393B – Relinquishment report

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1 Key Licence history

PL393B was carved out from PL393 on the 10th of September 2010 (Fig. 1) and awarded additionally to the 19th Concession Round with initial period until the 10th September 2013. The initial period was postponed twice until the 10th June 2015. The licence area was 73.461 km^2 covering part of blocks: 7125/4 (37.304 km^2) and 7125/5 (36.157km^2) (Fig. 2). The work commitment was one firm well with TD in Hekkingen Fm. or 1000 m MSL. The work commitment was fulfilled by drilling of well 7125/4-3 which tested the Ensis prospect.

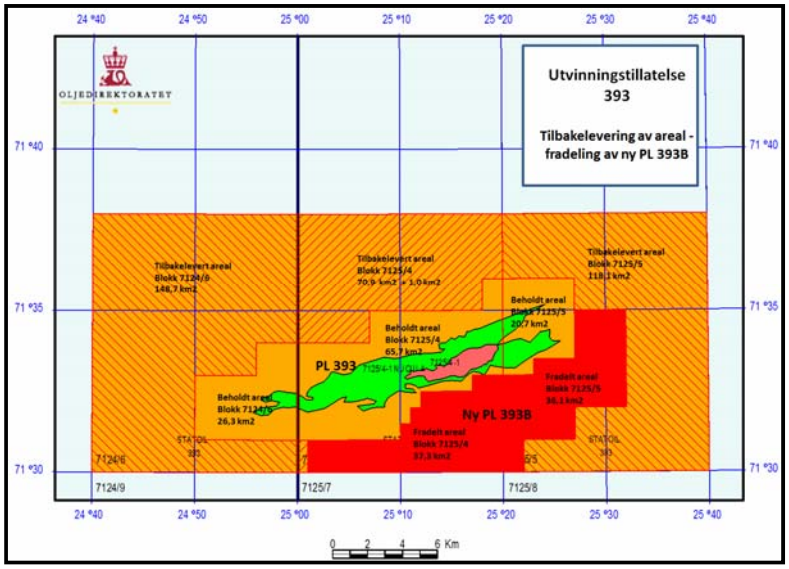

Figure 1. Map indicating area carved out from PL393 on the 10th of September 2010 and awarded additionally to the 19th Concession Round as PL393B.

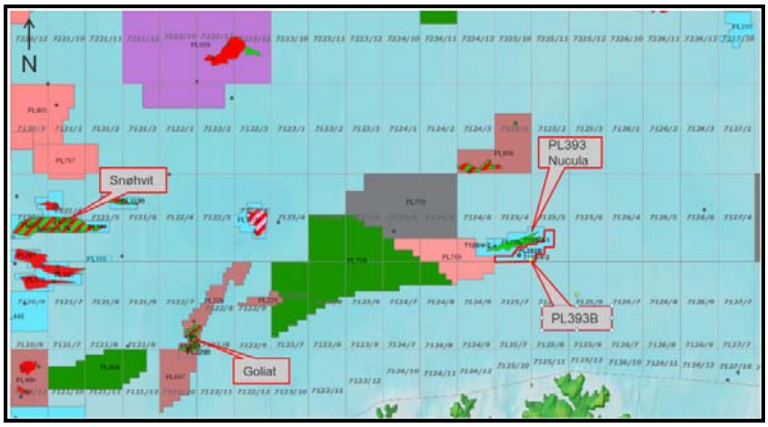

Figure 2. Area map with licenses, Snøhvit and Goliat fields, discoveries and relevant wells.

Licence PL393B was operated by Statoil with variable partner equity (Tab. 1). The latest partner constellation, which also drilled the exploration well (7125/4-3) was as follows: Statoil Petroleum AS (op, 25%), Capricorn Norge AS (25%), Petoro AS (20%), Concedo ASA (20%), OMV (Norge) AS (10%).

Overview over the Management and Exploration Meetings held in the licence is presented in Table 2.

Table 1. Licensee history.

Licensee valid from date	Licensee valid to date	Company longname	Interest [%]
29.08.2014	10.06.2015	Capricorn Norge AS	25.000000
		Statoil Petroleum AS	25.000000
		Petoro AS	20.000000
		Concedo ASA	20.000000
		OMV (Norge) AS	10.000000
31.10.2013	29.08.2014	Statoil Petroleum AS	50.000000
		Petoro AS	20.000000
		Concedo ASA	20.000000
		OMV (Norge) AS	10.000000
30.12.2010	31.10.2013	Statoil Petroleum AS	50.000000
		OMV (Norge) AS	30.000000
		Petoro AS	20.000000
29.12.2010	30.12.2010	OMV (Norge) AS	30.000000
		Statoil Petroleum AS	30.000000
		BG Norge AS	20.000000
		Petoro AS	20.000000
01.10.2010	29.12.2010	Statoil Petroleum AS	60.000000
		BG Norge AS	20.000000
		Petoro AS	20.000000
10.09.2010	01.10.2010	Statoil Petroleum AS	30.000000
		Eni Norge AS	30.000000
		BG Norge AS	20.000000
		Petoro AS	20.000000

Table 2. Overview of the meetings held in the licence.

Meeting date	Meeting type
12.11.2010	MC in PL393 and 393B
06.10.2010	EC
11.05.2011	EC (well location)
04.10.2011	EC/MC
24.10.2012	EC/MC
20.08.2013	EC
14.10.2013	EC
22.11.2013	EC/MC
10.11.2014	EC/MC

Reason for relinquishment

The exploration well 7125/4-3 (Ensis prospect) was drilled in the license during August and September 2014. The well was dry. Results of the dry Ensis well and evaluation of the remaining hydrocarbon potential within and around PL393B suggested that volumes were not significant enough to retain the license, even if jointly developed with the Nucula discovery in PL393. Therefore, the relinquishment application was delivered to the authorities on the 30th April 2015 and licence was relinquished on the 10th June 2015.

2 Database

Common database in PL393B was approved at the MC No.1 in 2010 and comprises of discovery well 7125/4-1 (Nucula-1) and appraisal well 7125/4-2 (Nucula-2). In addition following seismic data was utilized in the technical evaluation of PL393B: part of the 3D seismic cube MC3D MFZ02 (73 km^2 covering the license acreage) and its reprocessed version seismic cube MFZ02R08 (also 73 km^2 covering the license acreage) (Fig. 3). In addition following analogue wells with Early Cretaceous target were analyzed in more detailed with respect to sand potential: 7120/1-2, 7120/2-3 S, 7120/6-3S, 7120/10-2, 7121/9-1 and 7122/2-1 (Fig. 4), however not included in the common database.

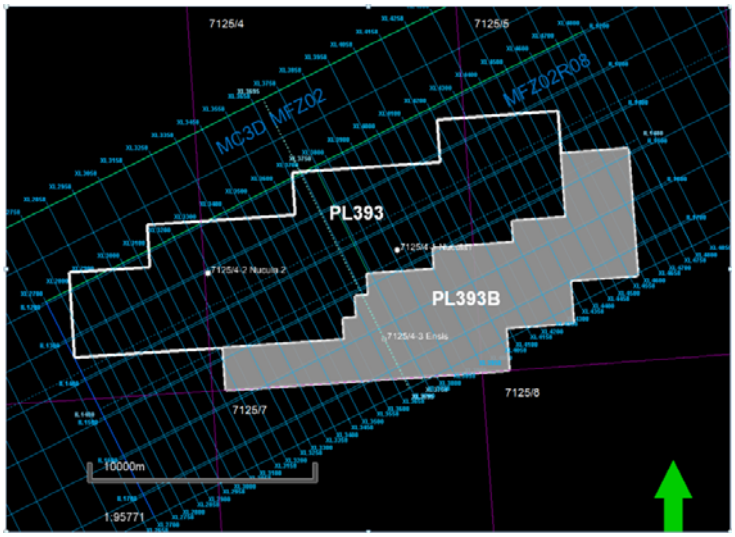

Figure 3. Common database in PL393B comprises of wells 7125/4-1 (Nucula-1) and 7125/4-2 (Nucula-2), part of the 3D seismic cube MC3D MFZ02 (73 km^2 covering the license acreage) and its reprocessed version seismic cube MFZ02R08 (73 km^2 covering the license acreage).

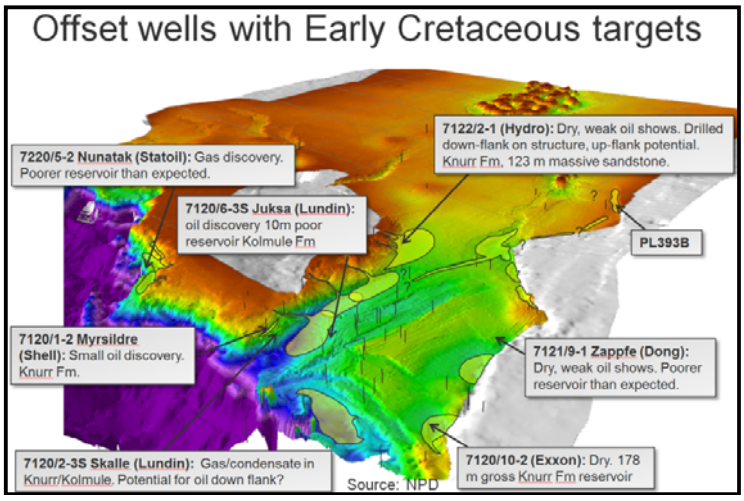

Figure 4. Analogue wells in the Hammerfest Basin with Early Cretaceous targets.

3 Review of geological framework

Nearly all the geological framework for PL393B was performed while this licence was a part of PL393 and very few geological studies were done within PL393B except for the well planning, evaluation of the well results and evaluation of the remaining prospectivity at all stratigraphic levels which is summarized in Chapter 6. For the studies performed in PL393 see the EC/MC meetings documentation on L2S, special reports on L2S, Final Well Reports for wells 7125/4-1 and 7125/4-2 and other special reports from these wells.

The structural elements in the PL393B area, around the main prospect Ensis, are the result of a Late Jurassic – Early Cretaceous rift phase. The Ensis prospect is thought to represent a submarine fan deposited in the Måsøy graben as this developed through Late Jurassic/Early Cretaceous. Analysis of the major fault to the south, the Troms Finnmark Platform fault complex, indicates movement during Volgian – Barremian time. This movement increased through Aptian and Albian time and created a local depocenter along the southern margin of the Måsøy Graben. Jurassic and Triassic strata were exposed and eroded on the Finnmark platform to the south and as the Nucula (in PL393) structure emerged; it trapped and diverted the sediments on their way northward. This controlled the shape of the Ensis basin floor fan in Early Cretaceous, giving it its NE-SW elongated shape time (Figs. 5 and 6).

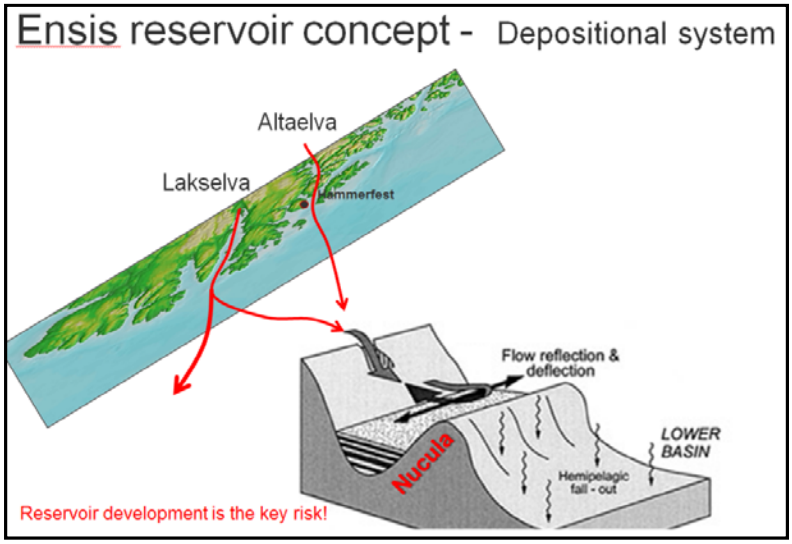

Figure 5. Cartoon of the depositional concept showing Nucula structure controlling shape of the Ensis prospect basin floor fan in Early Cretaceous.

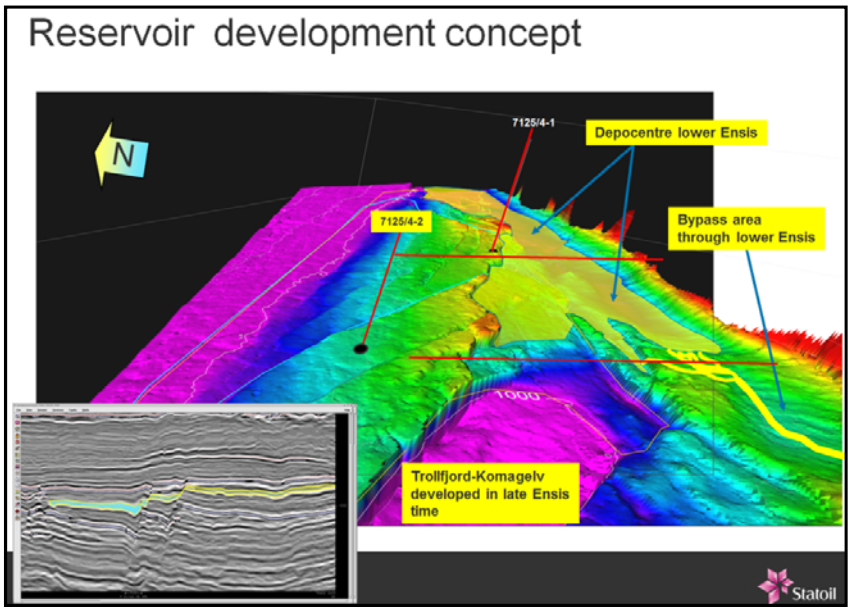

Figure 6. Reservoir development concept of the Ensis prospect.

The Nucula structure north of Ensis consisted then of newly deposited (loose) sediments of the Fruholmen, Nordmela and probably Tubåen Formations. It is uncertain whether or not the Stø Fm. was deposited in this area. During Late Jurassic, the Fuglen and Hekkingen Formations completed the pre-Cretaceous infill, where Hekkingen Fm shows a clear thickening in the Måsøy Fault Complex – indicating syn-sedimentation and that the local depocentre outlining the Ensis prospect was initiated in Late Jurassic. The fault bounding the Nucula structure to the south, i.e. the fault separating the Nucula discovery from the Ensis prospect, shows evidence of collapse during Early Cretaceous and the deposition of the Ensis fan. The fault collapse may have triggered mass flows into the Måsøy Graben, but also – and most importantly, it disrupted any fault seal between Nucula and Ensis. This was part of the Ensis concept; if sand in Ensis – these sands should have been in communication with the hydrocarbon phases in Nucula (Figs. 7 and 8).

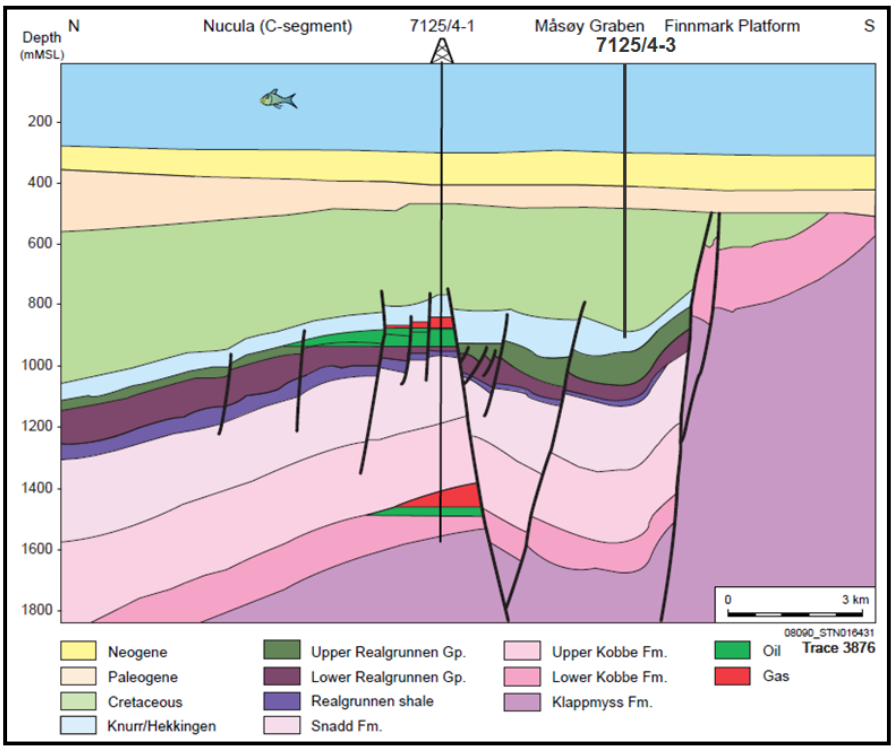

Figure 7. Structural and stratigraphic cross section through Nucula discovery well (7125/4-1) and the Ensis well (7125/4-3).

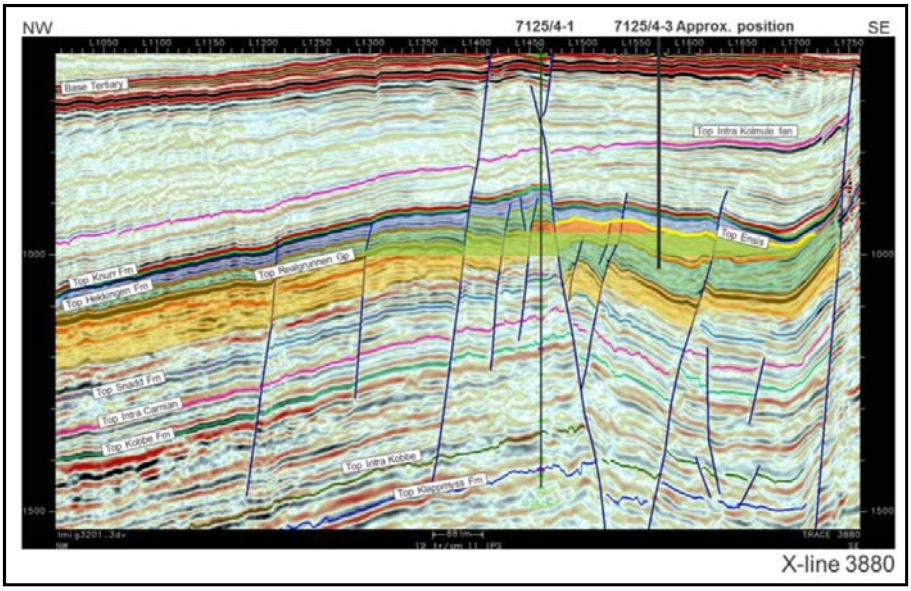

Figure 8. Seismic cross section illustrating the prognosed common hydrocarbon contacts in the Nucula discovery (well 7125/4-1) and the Ensis prospect.

4 Prospect update

PL393B was awarded based on the potential in the Ensis prospect. The main evaluation of the Ensis prospect was performed by PL393 and after it was carved out and formed PL393B the well was drilled in the licence. In addition, several prospects and leads have been identified later on. These have been evaluated entirely within the 3D seismic data and are presented in the Chapter 6.

The Ensis prospect and 7125/4-3 (Ensis) well results

The reservoir concept of Ensis was based on the assumption that Jurassic and Triassic sandstones were eroded from the Finnmark Platform and deposited in the Ensis area as a basin floor fan in the Early Cretaceous. The Ensis prospect is a structural/stratigraphic closure separated from the Nucula discovery by a fault towards the NW and pinching out in the SE towards the Finnmark Platform. The prognosed Intra Knurr Fm. reservoir was based on a clear thickening seen in the seismic in the Måsøy Fault Complex graben which suggested syn-kinematic sedimentation that was initiated in the Late Jurassic (Figs. 5 and 6).

The Ensis well 7125/4-3 is the only well drilled in PL393B. It is located approximately 4 km south-east from the Nucula discovery well (7125/4-1) in PL393 and 106 km northeast from Hammerfest (Fig.2). The main objective of the well was to prove economic hydrocarbon volume in the Knurr Fm and in addition prove communication with Nucula discovery. The well was drilled 50 m into the Hekkingen Fm. (Late Jurassic). For details about the well see the 7125/4-3 Final Well Report. The well was primarily positioned for an Intra Knurr target and there was no closure in underlying formations, including the hydrocarbon bearing intervals of the Nucula structure at the well location. The reservoir was believed to be of Volgian (?) to Hauterivian age belonging to the Knurr Fm. Good reservoir sand has been confirmed in several wells further west in the Hammerfest Basin, i.e. 7120/1-2, 7120/10-2 and 7122/2-1 (Fig. 4).

The apex of Ensis prospect was approximately at 797 m TVD MSL. The well was supposed to penetrate top Ensis at approximately 863 m TVD MSL. The most likely hydrocarbon case was based on the hydrocarbon column observed in 7125/4-1 (Nucula discovery well), where the GOC was at 871 m and ODT at 916 m. The expected OWC in 7125/4-1 was at 920-925 m. In Ensis, maximum OWC was set to 945 m, where an oil gradient would hit the water pressure in the 7124/3-1 well north of the Nucula discovery (Figure 8 and 9). Probability of success for Ensis was 23 % and calculated volumes were mean 20.4 MSm3 recoverable oil. The High NTG-zone represented mean 15.9 MSm3 of this volume (Fig. 10). However, shales and marls were encountered in the reservoir interval in the Ensis well 7125/4-3 suggesting heterogenic sediments and not sandstones were eroded locally from the Finnmark Platform. The well was dry with no shows and very poor reservoir quality (Fig. 11). CPI logs confirm absence of good sand. No pressure points were obtained in the well nor was fluid sampling performed. There was not enough temperature data to asses true formation temperature due to only one wireline run. Since the reservoir was not encountered in the well, no conclusions can be drawn on the robustness of the trap or hydrocarbon charge into the closure. Likewise, the prospect model, which was based on a common hydrocarbon filling between Ensis and Nucula discovery based on communication across the bounding fault, remains untested due to lack of reservoir at Ensis. However, CPI logs indicate possible hydrocarbons in the secondary potential target, the Early Cretaceous Intra Kolmule Fm., but the interval was only 3 m thick. More information about the hydrocarbon potential in the Intra Kolmule Fm is given in Chapter 6.
Updated prospect data is given in Table 3.

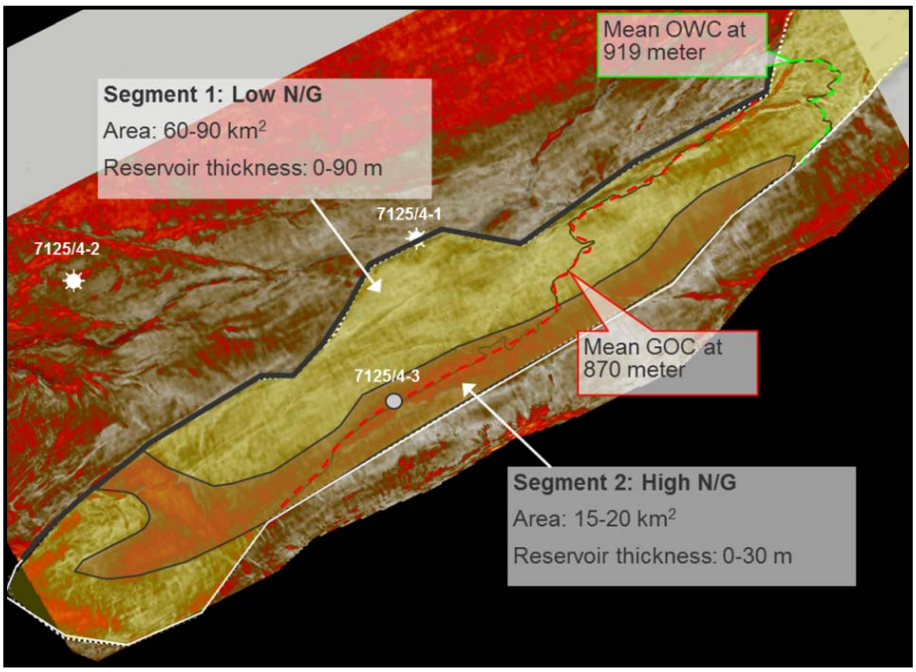

Figure 9. Top Knurr AVO anomaly map with Ensis segment outlines and pre-well expected hydrocarbon contacts.

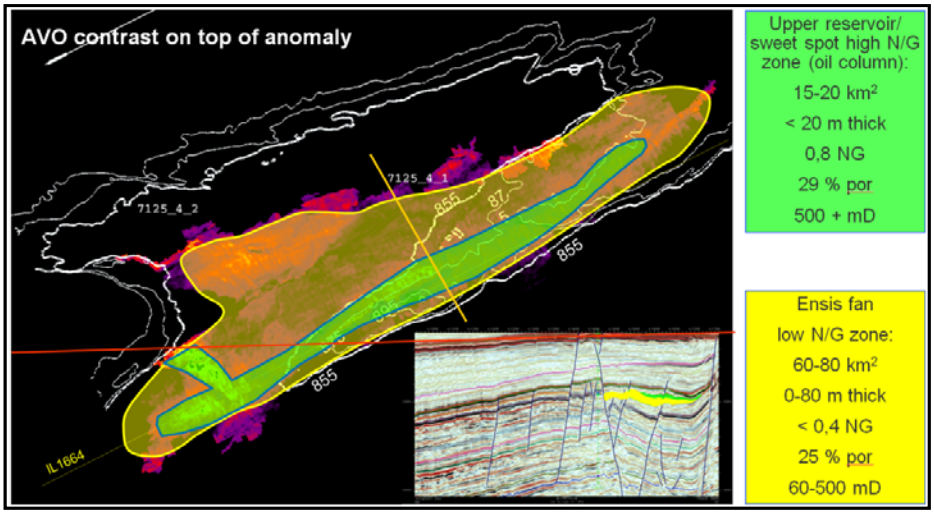

Figure 10. AVO contrast on top of the Ensis anomaly showing extend of the high (green) and low (yellow) N/G zones.

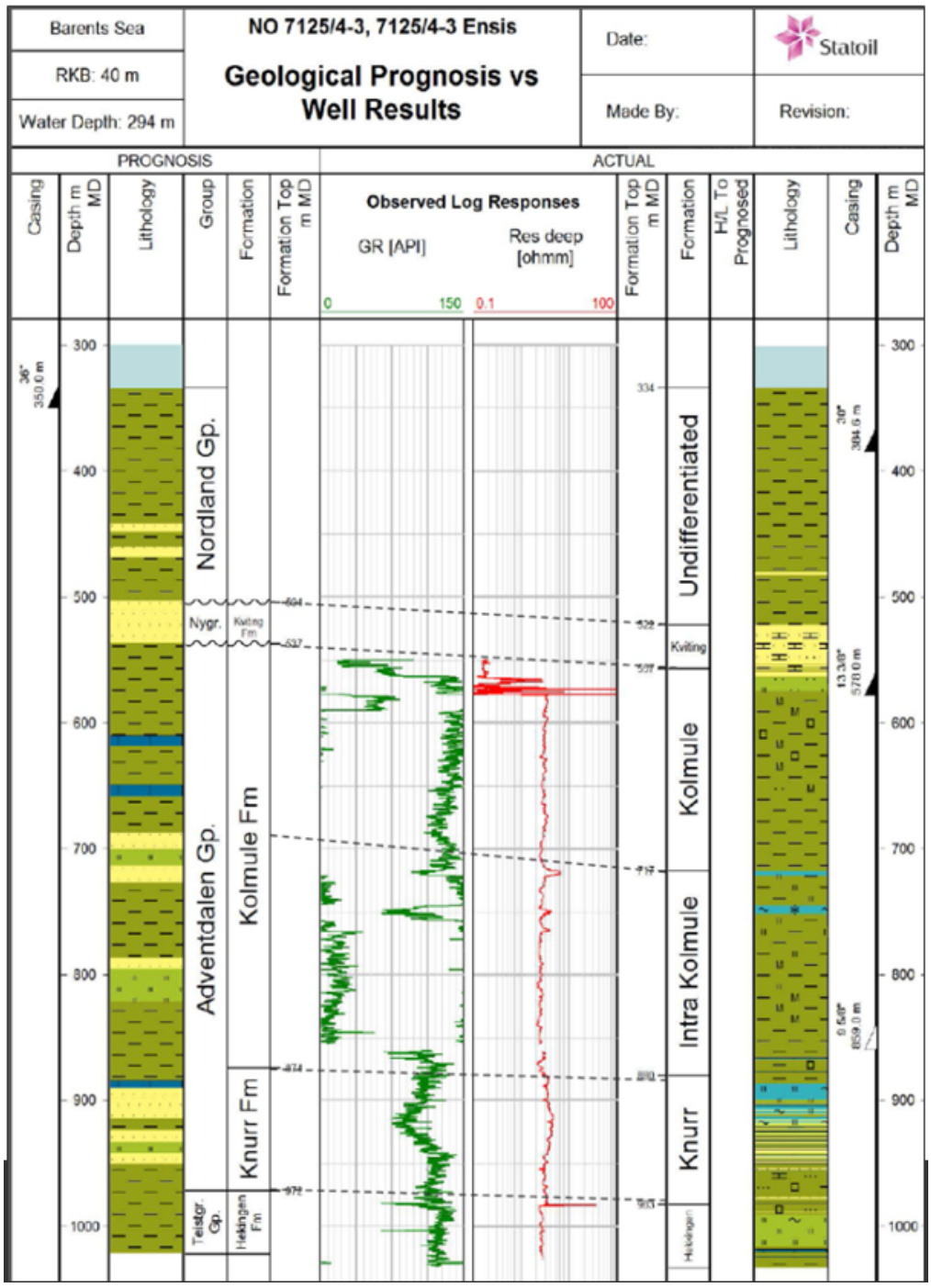

Figure 11. Geological prognosis vs. well results in Ensis well 7125/4-3.

Table 3. Updated prospect data.

Block 7125/4	Prospect name	Ensis	Discovery/Prosp/Lead	Well 7125/4-3	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case	Reported by company	Statoil	Reference document	Final Well Report 7125/4-3, Relinquishment Report for PL393B		Assessment year	2014	
This is case no.: 1 of 1	Structural element	Måsøy Graben	Type of trap	Structural/stratigraphic	Water depth [m MSL] (>0)	300	Seismic database (2D/3D)	3D
Resources IN PLACE and RECOVERABLE	**Main phase**				**Associated phase**			
Volumes, this case	Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10^6 Sm^3] (>0.00)							
	Gas [10^9 Sm^3] (>0.00)							
Recoverable resources	Oil [10^6 Sm^3] (>0.00)							
	Gas [10^9 Sm^3] (>0.00)							
Reservoir Chrono (from)	Lower Cretaceous	Reservoir litho (from)	Lower Cretaceous	Source Rock, chrono primary	Upper Jurassic	Source Rock, litho primary	Hekkingen Fm	Seal, Chrono	Lower Cretaceous
Reservoir Chrono (to)	Lower Cretaceous	Reservoir litho (to)	Lower Cretaceous	Source Rock, chrono secondary	Lower-Mid Triassic	Source Rock, litho secondary		Seal, Litho	Upper Knurr Fm shales a
Probability [fraction]								
Total (oil + gas + oil & gas case) (0.00-1.00)		Oil case (0.00-1.00)		Gas case (0.00-1.00)		Oil & Gas case (0.00-1.00)			
Reservoir (P1) (0.00-1.00)		Trap (P2) (0.00-1.00)		Charge (P3) (0.00-1.00)		Retention (P4) (0.00-1.00)			
Parametres:	Low (P90)	Base	High (P10)	*Well 7125/4-3 drilled on the Ensis prospect was dry. The reservoir concept of Ensis was based on the assumption that Jurassic and Triassic sandstones were eroded from the Finnmark Platform and deposited in the Ensis area as a basin floor fan in the Early Cretaceous. Well 7125/4-3 penetrated the main target, Intra Knurr Fm., but this was dry with no shows and very poor reservoir quality. CPI logs confirm absence of good sand. No pressure points obtained in the well. No fluid sampling was performed. Not enough temperature data to asses true formation temperature due to only one wireline run. Because of arguements above there are no probability values or volumes or reservoir parameters in this table. For more information about the well see Final Well Report 7125/4-3.*						
Depth to top of prospect [m MSL] (> 0)		797 m TVDSS							
Area of closure [km^2] (> 0.0)									
Reservoir thickness [m] (> 0)									
HC column in prospect [m] (> 0)									
Gross rock vol. [10^9 m^3] (> 0.000)									
Net / Gross [fraction] (0.00-1.00)									
Porosity [fraction] (0.00-1.00)									
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)									
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)									
GOR, free gas [Sm^3/Sm^3] (> 0)									
GOR, oil [Sm^3/Sm^3] (> 0)									
Recov. factor, oil main phase [fraction] (0.00-1.00)									
Recov. factor, gas ass. phase [fraction] (0.00-1.00)									
Recov. factor, gas main phase [fraction] (0.00-1.00)									
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)				For NPD use:					
Temperature, top res. [°C] (>0)				Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert	NPD will insert value
Pressure, top res [bar] (>0)				Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
Cut off criteria for N/G calculation	1.	2	3.					Kart nr	NPD will insert value

5 Technical evaluations

The PL393B is neighbouring PL393 to the north-west and the Ensis well (7125/4-3) was drilled only 4.2 km away from the Nucula discovery well (7125/4-1). PL393B is located approximately 105 and 150 km east of Goliat and Snøhvit fields, respectively (Fig. 2). The water depth is approx. 300m.

The Ensis base case solution was a combined development together with the Nucula discovery with a floater with an oil storage and reinjection of gas. However, this solution had limited economic value. There were several alternative solutions that could have been considered as upsides: tie-back to Goliat (need new technology) or connection to a potential Johan Castberg pipeline to shore. Due to large uncertainties with these solutions they did not give better results and have not been included in the technical-economical analysis.

6 Conclusions

The Ensis prospect was assessed pre-drill as having the largest volume potential in PL393B. The remaining post-drill prospectivity for different stratigraphic levels both within and around PL393B is summarized below:

- The Kolmule Fm (Early Cretaceous) was penetrated in the Ensis well (7125/4-3) and in the neighbouring license PL393 by a discovery well 7125/4-1 and appraisal well 7125/4-2. Thin (~ 2 m) sandstone was encountered in both last mentioned wells, but HC shows were only reported in well 7125/4-1. In Ensis well 7125/4-3 also a thin (~ 3 m) sandstone interval was observed but it had wet gas (no shows) and no visible porosity. Hydrocarbon accumulation within PL393B in this interval is possible assuming updip sealing against the Troms-Finnmark Fault Complex and with stratigraphic closure to the southwest (Figs. 12 and 13). This is supported by an AVO anomaly at the Intra Kolmule level which brightens updip towards the fault. Estimated recoverable oil volume in a very optimistic case could be mean 4.3 MSm3.

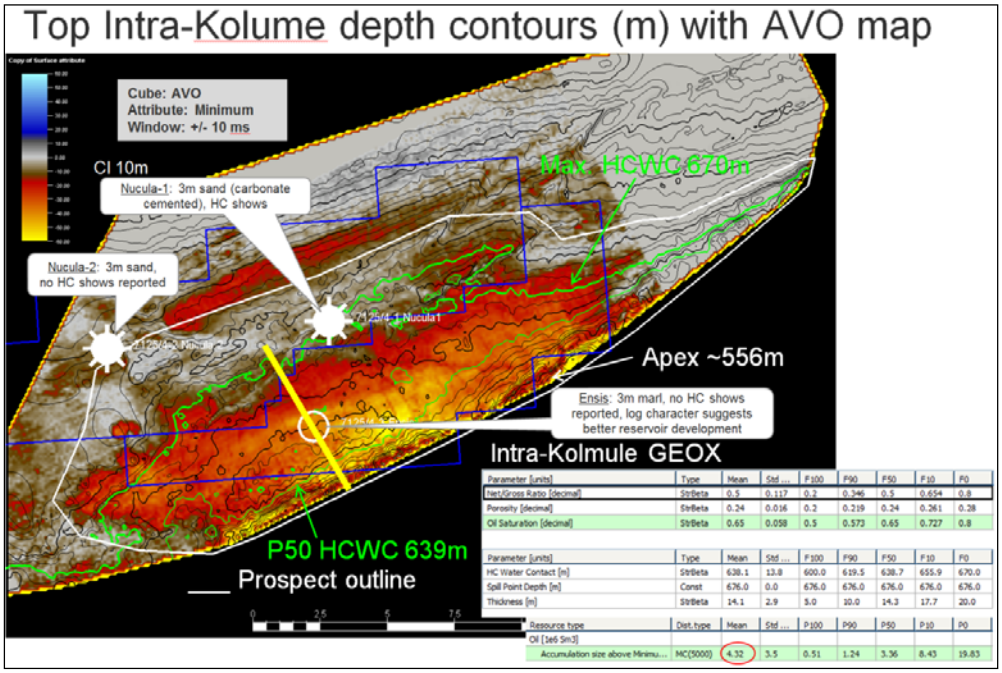

Figure 12. Top Intra-Kolume map with AVO map and HC fill contours used in the evaluation. Volumetrics in the table.

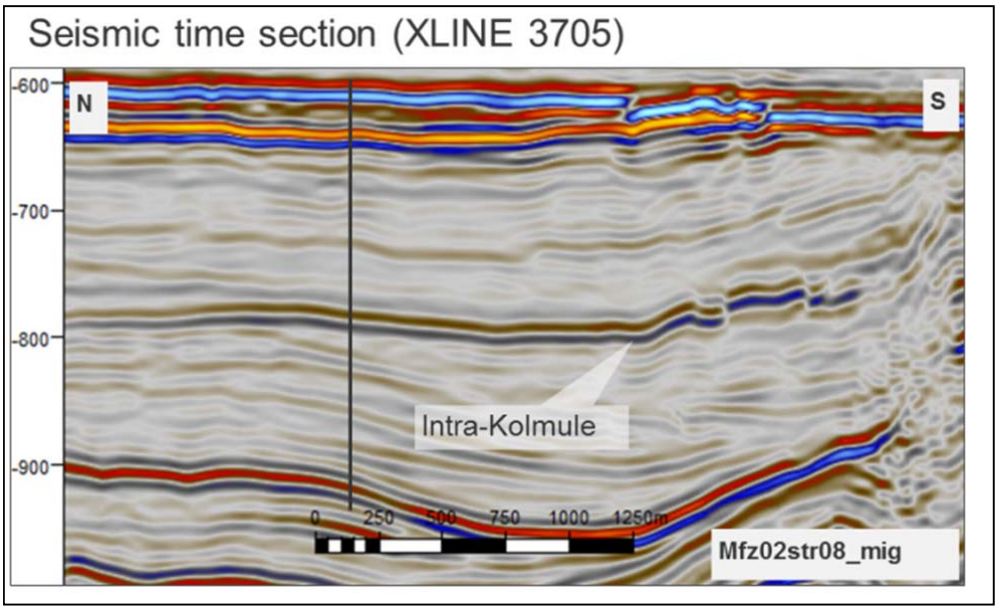

Figure 13. Dip line through the Intra Kolmule Fm. in the Ensis well (seismic line location shown in yellow on Fig. 12).

- Another anomaly in the Kolmule Fm. is the Ostrea prospect observed outside the license in the open acreage. Simple volume calculation of this prospect shows potential of mean 5.2 MSm^3 (Fig. 14).

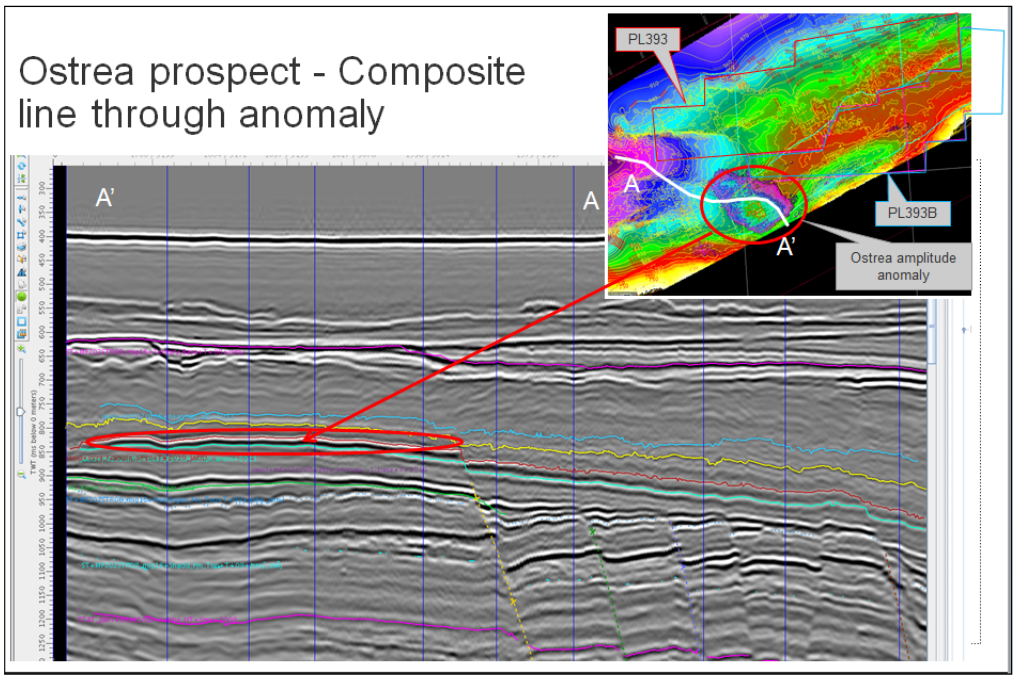

Figure 14. Seismic section and amplitude map of the Ostrea prospect in the Kolmule Formation.

- The Knurr Fm (Early Cretaceous) was tested by the dry well 7125/4-3 and shows no reservoir potential within PL393B.
- Fluvial channels in the Fruholmen Fm (Late Triassic) were tested by wells 7125/4-1 and 7125/4-2. They show very limited volume extension within PL393B.
- Extension of the Snadd Fm (Mid- to Late Triassic) shows good reservoir quality channels in the Nucula discovery in PL393; however the potential of this formation is very limited within PL393B.
- The Kobbe Fm (Mid Triassic) was tested by wells 7125/4-1 and 7125/4-2. Oil shows were observed in the Upper Kobbe in both wells. However, these sandstones are thin and too scattered across the area and extension of this formation is very limited inside PL393B.
- The Klappmyss Fm (Early Triassic) consists of coastal plain deposits which have not been tested. Wells 7125/4-1 and 7125/4-2 entered only the upper part of this formation and the Ensis well 7125/4-3 did not extend to this depth. Volume calculation shows that the Klappmyss Fm. could potentially add up to mean 1.8 MSm3 o.e. recoverable volumes located within PL393B (Fig. 15).

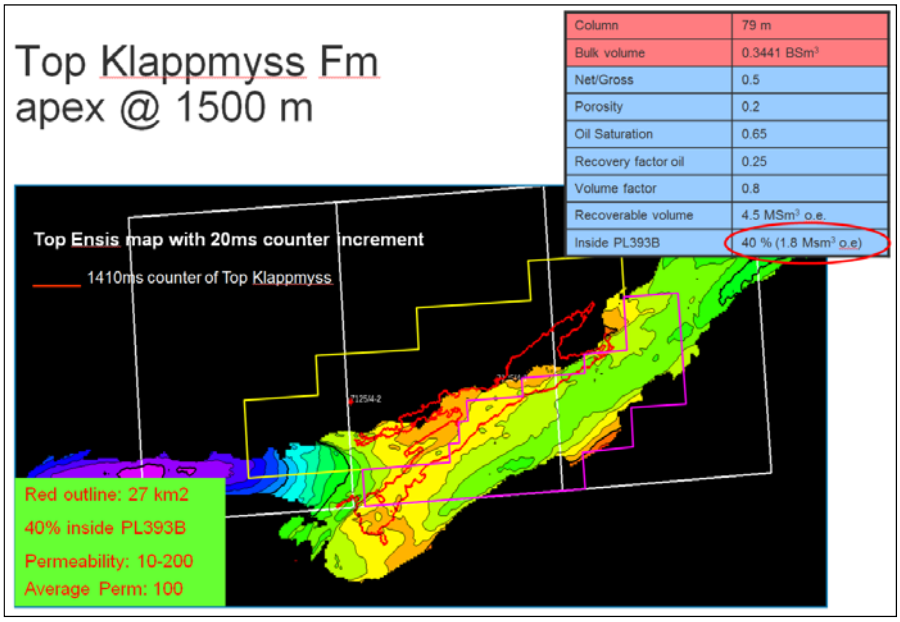

Figure 15. Top Klappmyss Formation closure in PL393B plotted on Top Intra Knurr Fm (Top Ensis) and its volume potential.

- In the Havert Fm (Early Triassic) there is no structural or stratigraphic closure within the PL393B boundary.
- The Permian stratigraphic level is not tested, but two carbonate plays in the Intra Permian (Polarrev Fm.) and Base Permian level were mapped by the partnership. It has been calculated that together they could possibly add up to mean 3.3 MSm3 o.e. recoverable volumes within PL393B (Figs. 16 and 17).

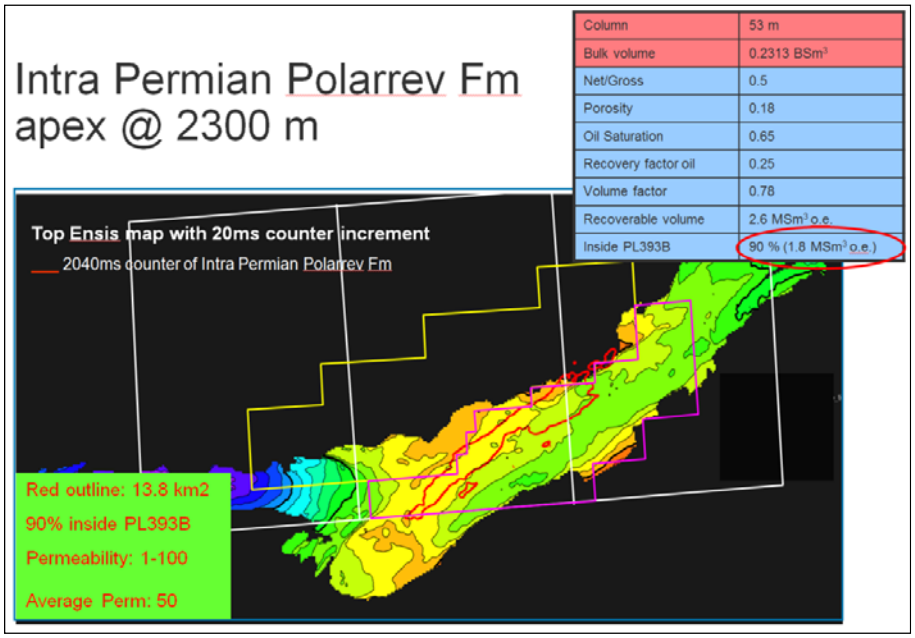

Figure 16. Intra Permian (Polar Rev Fm.) closure in PL393B plotted on Top Intra Knurr Fm (Top Ensis) and its volume potential.

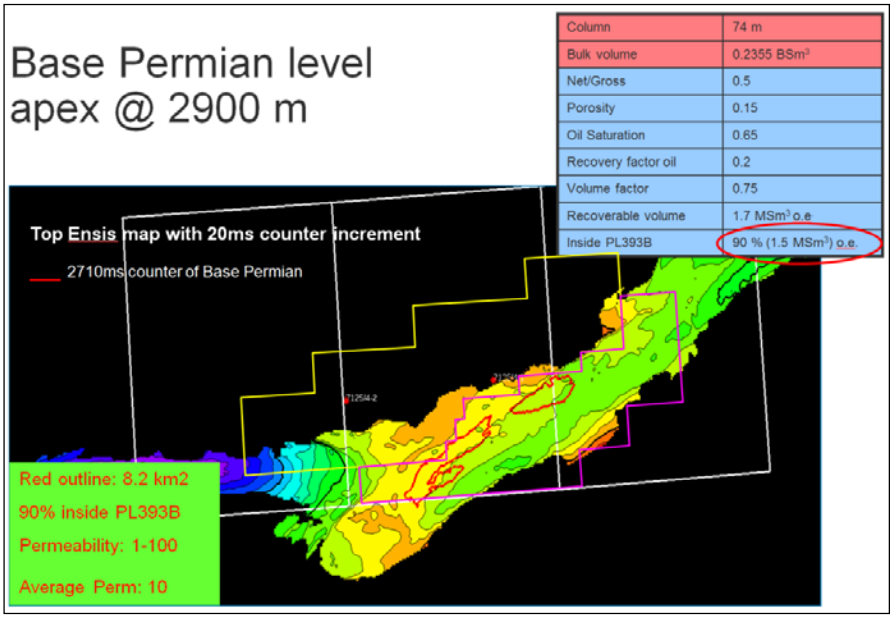

Figure 17. Base Permian closure in PL393B plotted on Top Intra Knurr Fm (Top Ensis) and its volume potential.

Based on the above, the partnership believes the remaining potential within and around PL393B is not significant enough to retain the license. The oil volume from any potential discovery or discoveries is not likely to be large enough to trigger a commercial development even if jointly developed with the Nucula discovery in neighbouring PL393. Therefore a decision to relinquish the license was taken by the partnership.