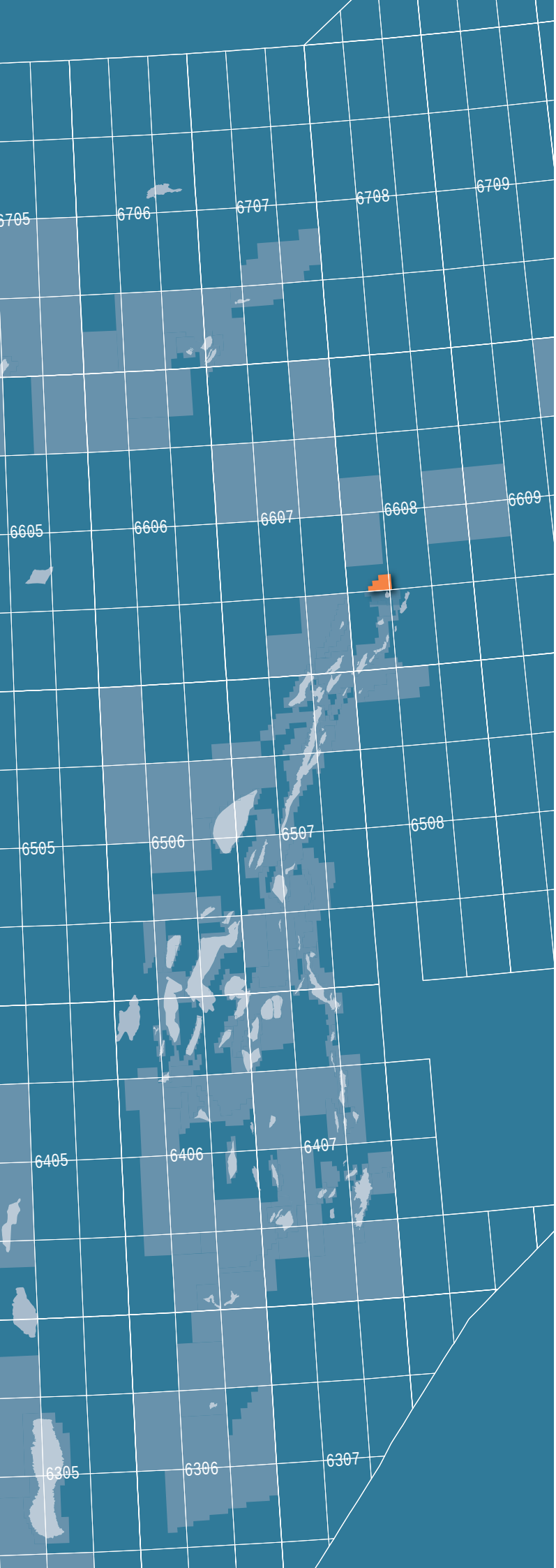

Relinquishment Report

PL761

Block
6608/7 and 8

NORECO

PL761 Relinquishment Report

Document last updated 18-03-2016 09:17 CET

PL761 Relinquishment Report

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1 License history

Production license PL761 was granted to Noreco Norway AS as an operator with 40 % interest, together with Dana Petroleum Norway AS and Explora Petroleum AS with 30 % interest each, on February 7th 2014 as part of awards from the APA 2013. The license was split between Block 6608/7 and Block 6608/8 and had an area of 36.170 km^2.

The license was active for 2 years and a total of 3 partner meetings were held during this period.

- 3 March 2014 (EC/MC Meeting No.1)
- 6 November 2014 (EC/MC Meeting No.2)
- 27 November 2015 (EC/MC Meeting No.3)

The initial period work commitment was as follows:

- Within 2 years from award
  - Reprocess 3D seismic over the awarded area
  - Approve an exploration well. Resolution on drilling is made in accordance with 'Avtale for petroleumsvirksomhet artikkel 3.2'

First phase of obligations was to reprocess existing 3D seismic within the license. ST9405 and MC3D-NON-2010 3D data sets were merged and reprocessed through anisotropic 3D pre-stack depth migration starting from field tapes. The new reprocessed data became the NO15M01 survey. This was again merged with NO11M02 to extend the dataset further to the south.

Two prospects were identified for the APA 2013 application. The Gjesdal and Geilo prospects with reservoirs in the Lower Jurassic Båt Gp. Following new interpretation on the NO15M01 survey and results from the Verdande well (6608/10-16) the Gjesdal Prospect was found to have very low reservoir quality due to too deep burial depth, and only the Geilo Prospect was taken through volume calculation and risking. The Geilo Prospect had two scenarios for trap. One 4-way closure with small volumes and low risk, and a larger truncation trap with very high risk. The 4-way closure was found to have too small volumes to be considered economic and the truncation trap was found to have too high risk, and thus the license partnership decided to relinquish the license. The license was relinquished on February 7th 2016.

2 Database

Well database

The original common well database included 25 wells. Later the 6608/10-16 (Verdande) well was included (Figure 2.1 and Table 2.1). The petrophysical logs and borehole samples such as cores and cutting descriptions were all used for the technical evaluations.

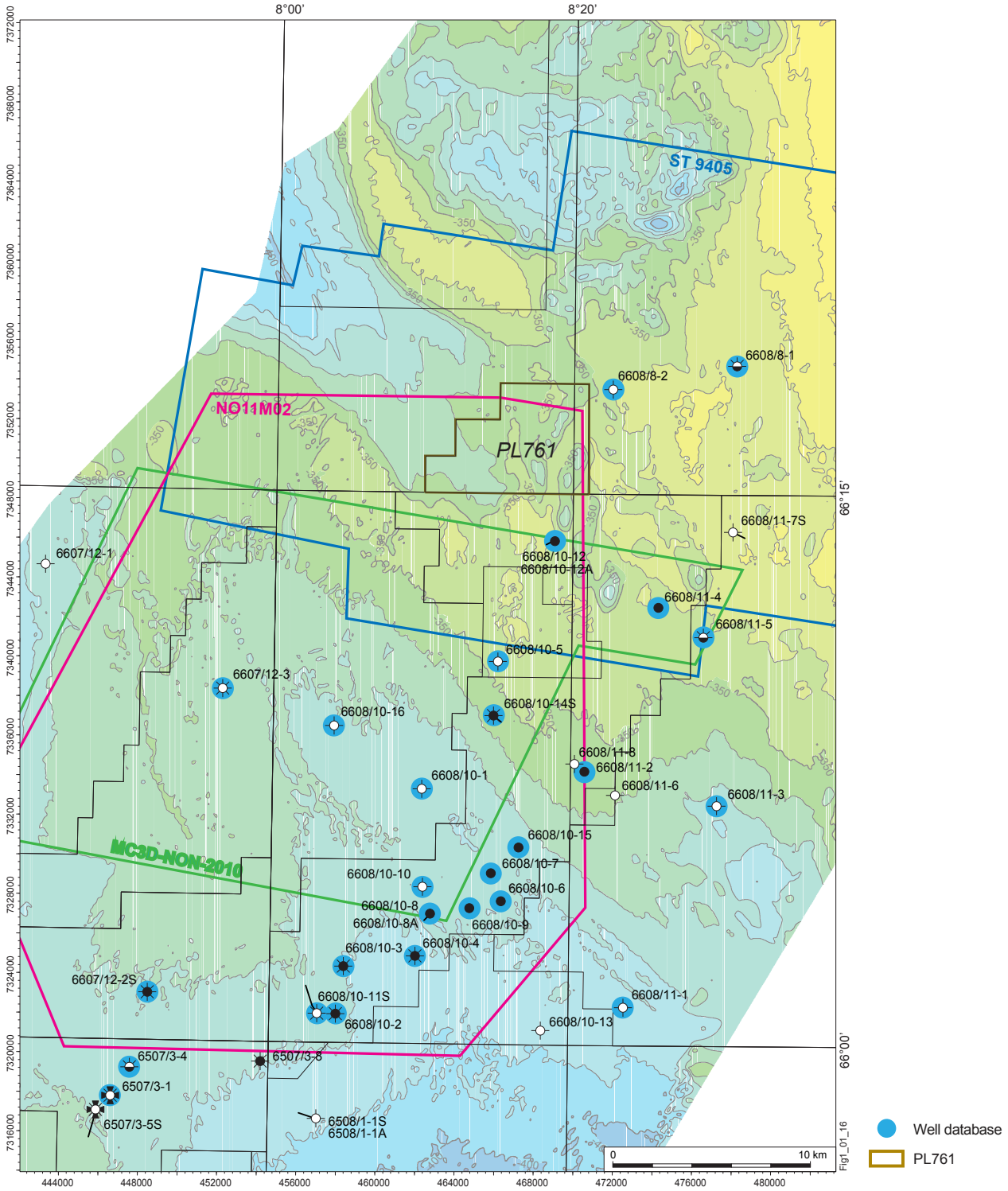

Figure 2.1 Seismic and well database. *The seismic outlines display the three seismic surveys, ST9405, MC3D-NON-2010 and NO11M02, which are included in the NO15M01 survey.*

Table 2.1: Well database

Well	Main Reservoir target	In 3D depth coverage	In 3D time coverage	CPI	Time Depth	Synthetic seismogram	Core
6507/3-1	Fangst, Båt			x	x	x	x
6507/3-4	Fangst, Båt			x	x	x	x
6607/12-2S	Lange, Fangst, Båt	x	x	x	x	x	x
6607/12-3T2	Lange, Fangst, Båt	x	x	x		x	x
6608/10-1	Fangst, Båt	x	x	x	x	x	x
6608/10-2	Fangst, Båt	x	x	x	x	x	x
6608/10-3	Fangst, Båt	x	x	x	x	x	x
6608/10-4	Melke, Fangst, Båt	x	x	x	x	x	x
6608/10-5	Fangst, Båt	x	x	x	x	x	
6608/10-6	Melke, Båt	x	x	x	x	x	x
6608/10-7	Melke, Båt	x	x	x	x	x	x
6608/10-8	Melke, Fangst, Båt	x	x	x	x	x	x
6608/10-9	Melke, Fangst, Båt	x	x	x	x	x	x
6608/10-10	Melke, Fangst, Båt	x	x	x	x	x	
6608/10-11S	Melke, Fangst, Båt	x	x	x	x	x	
6608/10-12	Lysing, Melke, Båt	x	x	x	x	x	
6608/10-12A	Lysing, Melke, Båt	x	x	x	x	x	
6608/10-14s	Fangst, Båt	x	x	x	x	x	
6608/10-16	Lange, Fangst, Båt	x	x	x	x	x	
6608/11-1	Båt, Triassic grey beds			x	x	x	x

Well	Main Reservoir target	In 3D depth coverage	In 3D time coverage	CPI	Time Depth	Synthetic seismogram	Core
6608/11-2	Båt, Triassic grey beds	x	x	x	x	x	x
6608/11-3	Melke, Båt, Triassic grey beds			x	x		x
6608/11-4	Båt, Triassic grey beds		x	x	x		x
6608/11-5	Båt, Triassic grey beds		x	x	x		x
6608/8-1	Red beds		x	x	x		x
6608/8-2	Lysing, Red beds		x	x	x	x	

Seismic database

The 3D seismic database used for the license 761 consists of NO15M01, (Figure 2.2)

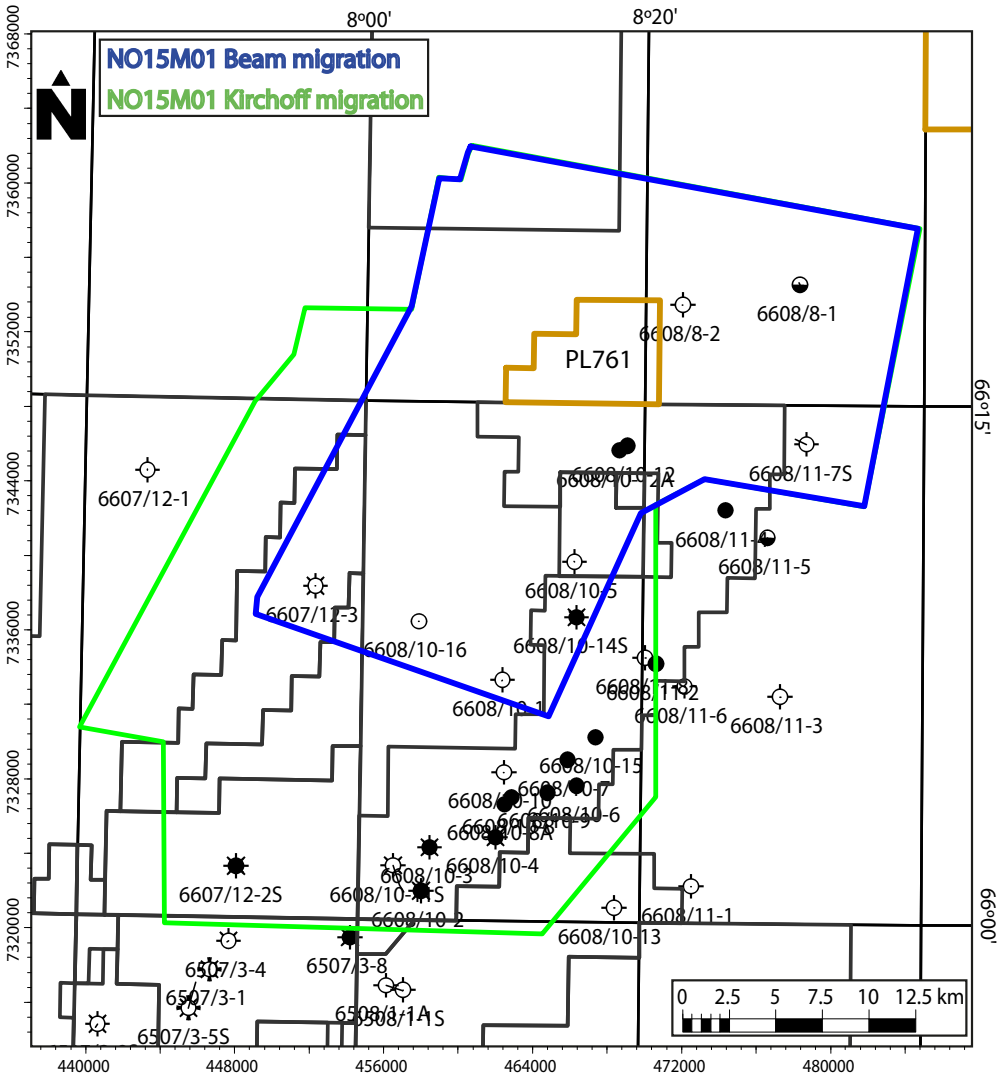

Figure 2.2 NO15M01 seismic coverage. *The beam migrated part of the seismic is shown in blue outline and the Kirchoff migrated seismic is shown in green outline (including the whole beam outline).*

The NO15M01 seismic data, 620 km², was reprocessed as part of the work program in PL761. The merge consists of ST9405 and MC3D_NON-2010. The ST9405 (410 Km2) was time-processed from field tapes and merged with already processed gathers from MC3D-NON-2010, (Figure 2.1).. A velocity model was built and Anisostropic Pre-Stack Depth Migration was done for the whole survey data set (620 Km2). This reprocessing was again merged and processed into the same grid as the NO11M02 survey. The quality of the data is good to very good. The survey was processed to be close to zero phase. A colour palette where blue represents an increase in acoustic impedance and red a decrease in acoustic impedance was chosen for the seismic interpretation. Beam migration time and depth cubes and Kirchoff migrated time, depth and angle stacks are available. The beam migrated cube was used for structural and horizon interpretation within the license, and the Kirchoff cubes were used for the Cretaceous interpretation, and amplitude modelling and extraction for all intervals.

Table 2.2: Seismic database

Survey name	Type (2D/3D)	Inhouse enhancement	Quality of data
NO15M01	3D	Anisotropic processed PSDM	Good
NO11M02	3D	Anisotropic processed PSDM	Good

3 Review of geological framework

The detailed description of the geological framework for the area can be found in the APA 2013 application for blocks 6608/7 & 8. The key play models in the license considered for the APA 2013 application shown in the lithostratigraphic column (Figure 3.1) were:

- The Early Jurassic Båt Gp (see NPD play type NHJL)
- Late Cretaceous Lange Fm (see NPD play type NHKU-2)

Of these play models the Early Jurassic play was considered to be most significant in terms of hydrocarbon potential in the Båt Gp reservoirs, more specifically Tofte and Tilje fms. The trap is mapped as a combination of a truncation of the Tilje Fm underneath the BCU and a down-flank 4-way dip closure on a Jurassic fault block. The primary source rock was considered to be shales of the Late Jurassic Heather Fm with small contributions from the Spekk and Åre fms.

No studies were performed during the license period.

Several discoveries within the NHJL play model has been successful on the Dønna Terrace (Dompap, Fossekall, Alve Nord and Norne).

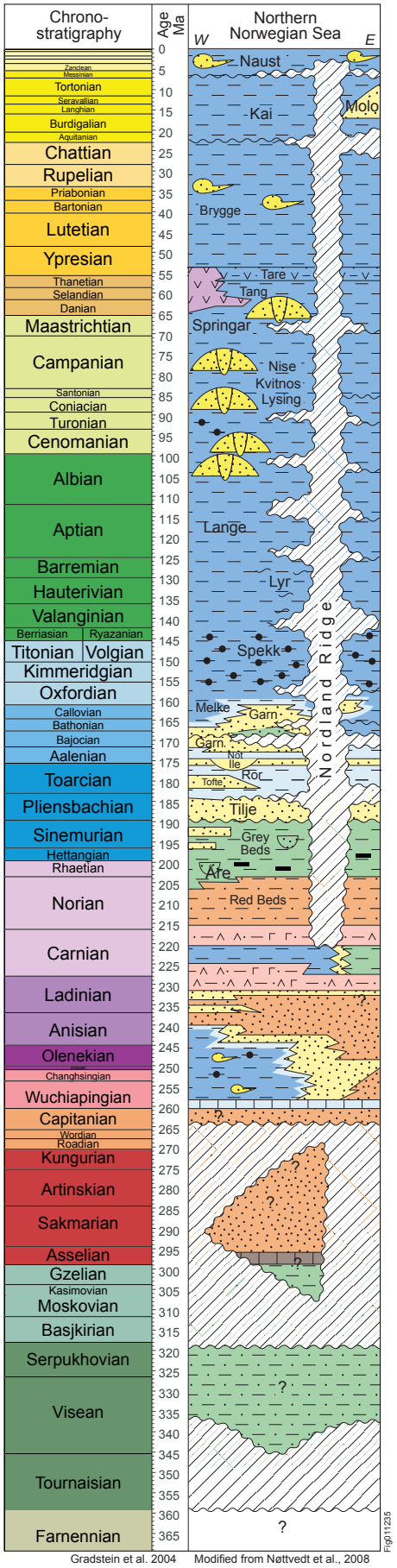

Figure 3.1 Lithostratigraphic column of the Northern Norwegian Sea.

4 Prospect update

For the APA 2013 license application, two Early Jurassic prospects were identified (Gjesdal and Geilo) together with possible leads within the Cretaceous Lange Fm. Following new 3D reprocessing and a new interpretation of the NO15M01 in the license, the Gjesdal Prospect and Cretaceous leads were discarded. The current outlines for the Geilo Prospect are shown in Figure 4.1.

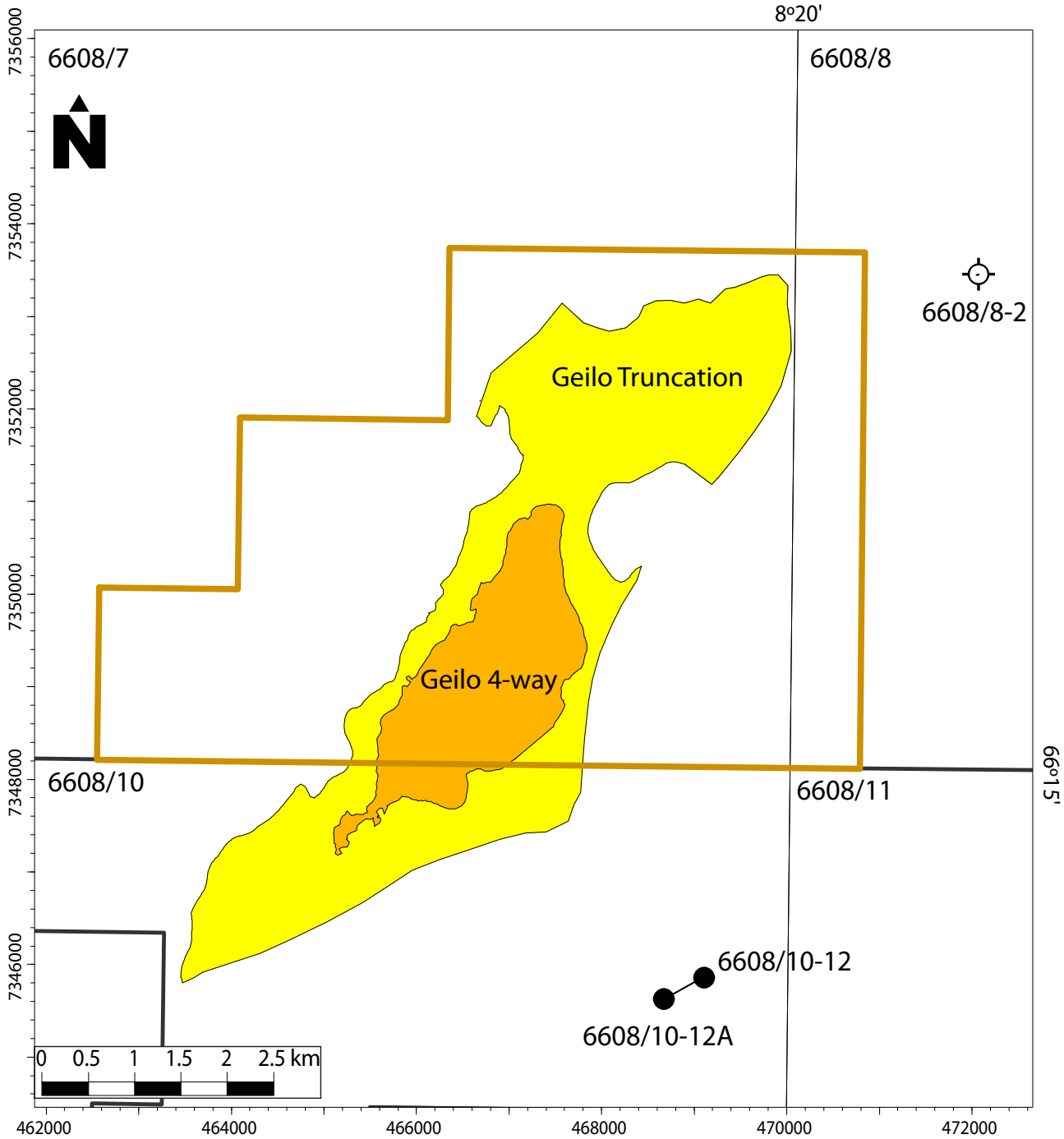

Figure 4.1 Prospect overview map. *The figure shows the extent of the Geilo Prospect 4-way closure and the Geilo Truncation trap.*

The Geilo Prospect

Trap and Sealing

The trap of the Geilo Prospect did not change with the new seismic and interpretation. Geilo is still a combination of at truncation of the Tilje Fm underneath the BCU and a down-flank 4-way dip closure on a rotated Jurassic fault-block (Figure 4.2 and Figure 4.4).

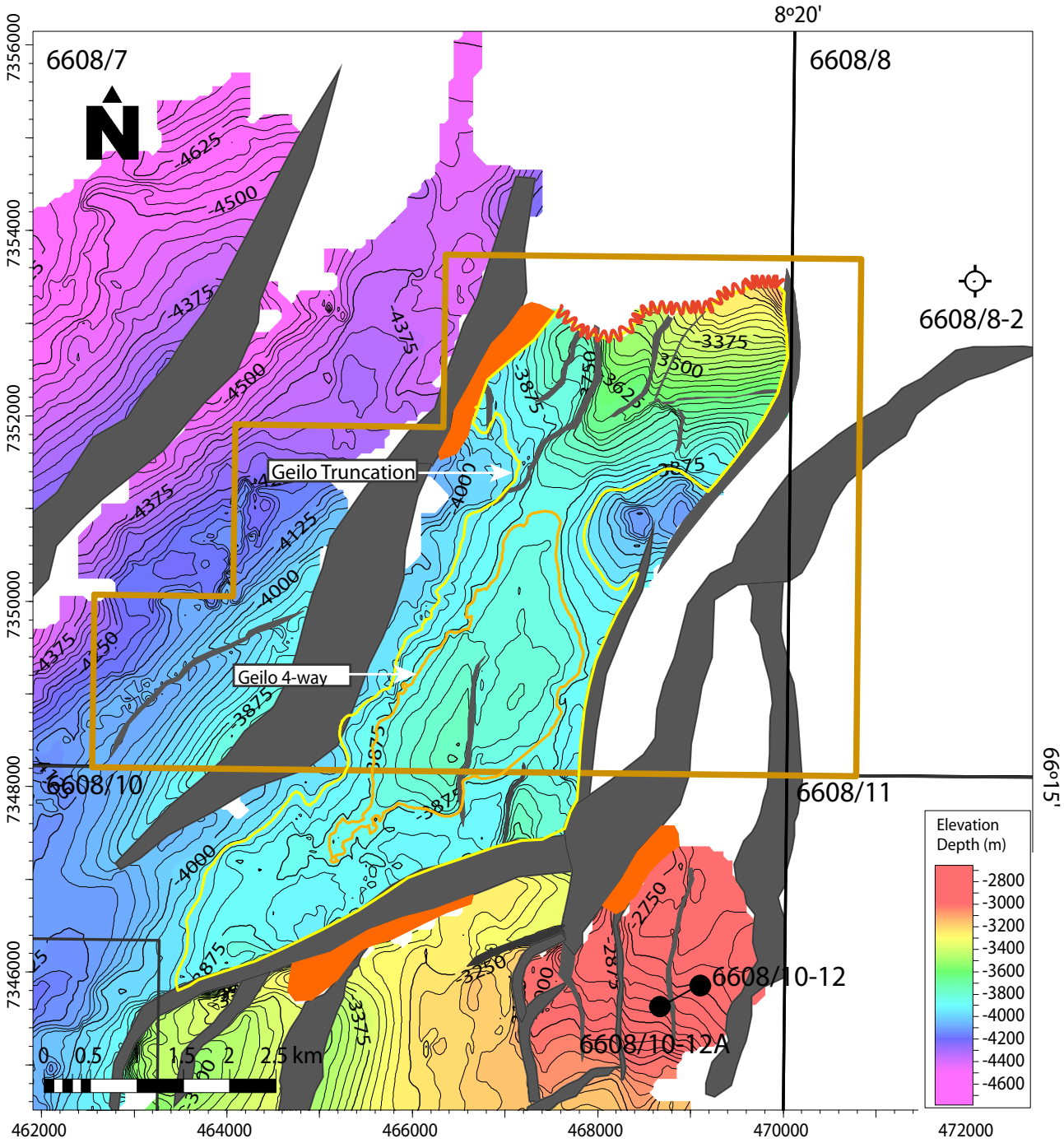

Figure 4.2 Top Tofte/Tilje fms structural map. *Geilo 4 way closure shown in orange and Geilo Truncation trap shown in yellow outlines. The Truncation trap is bounded by faults to the east and to the south.*

Due to seismic resolution the Tofte and Tilje fms are interpreted as one unit. To construct the top Tilje map a wedge map was designed for the Tofte thickness and this map was subtracted from the Tofte/Tilje map. The new seismic interpretation shows the Tofte Fm to not continue up into the truncation part of the Geilo trap. The interpreted thickness is seen to thin in the interval of Tofte-Tilje from the south to the north within the license and prospect(Figure 4.3). The pinching out of Tofte Fm is also seen from west towards east in wells and seismic south of PL761. The new model has therefore only the Tilje Fm continuing up into the truncation part of the model, and Tofte and Tilje in the 4-way closure (Figure 4.4).

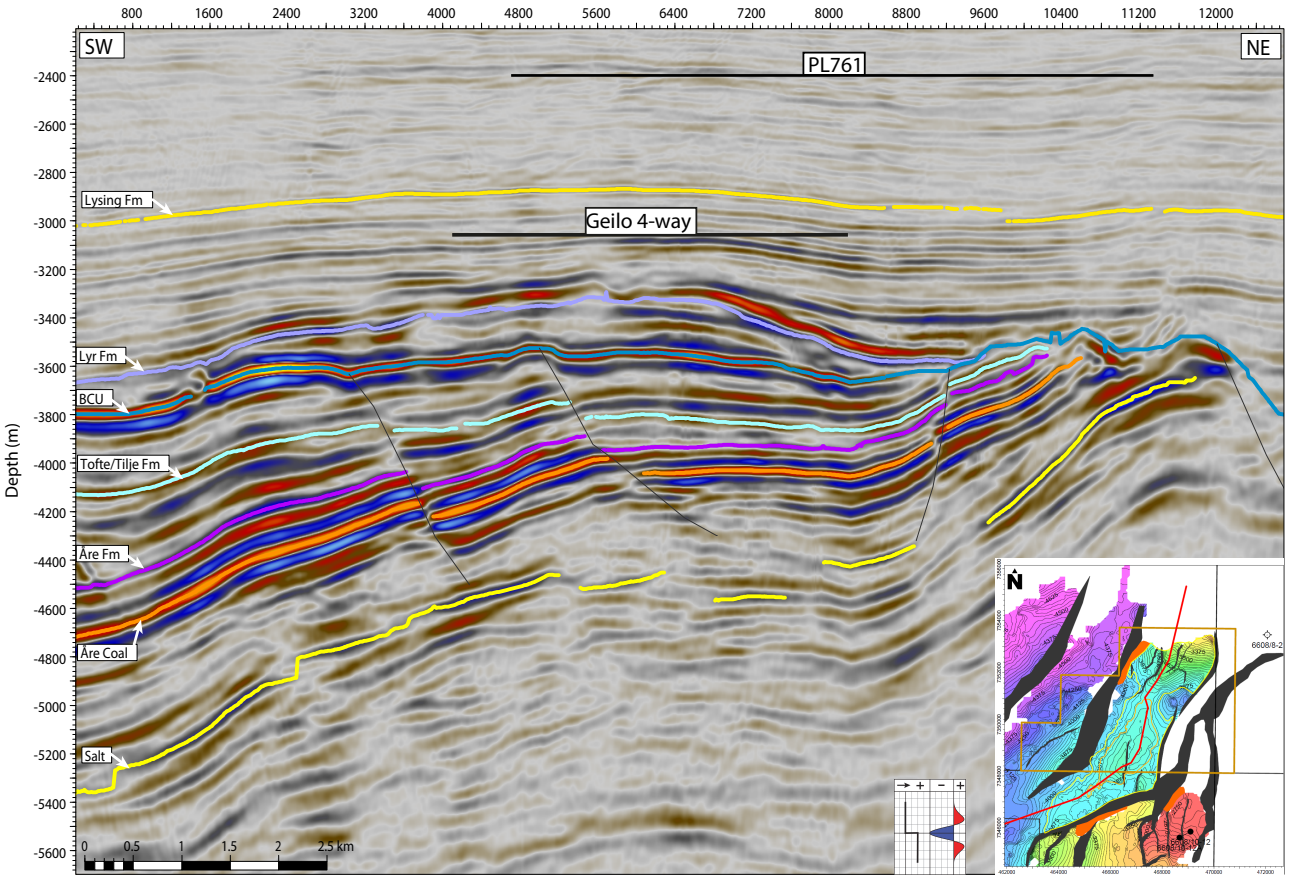

Figure 4.3 Seismic section through the Geilo Prospect. *The seismic line shows the thinning of the Tofte/Tilje inteval towards the truncation part of the prospect. The assumption is that the Tofte Fm pinches out and that the Tilje Fm continues up into the truncation part of the trap. The 4-way colosure is indicated on the figure.*

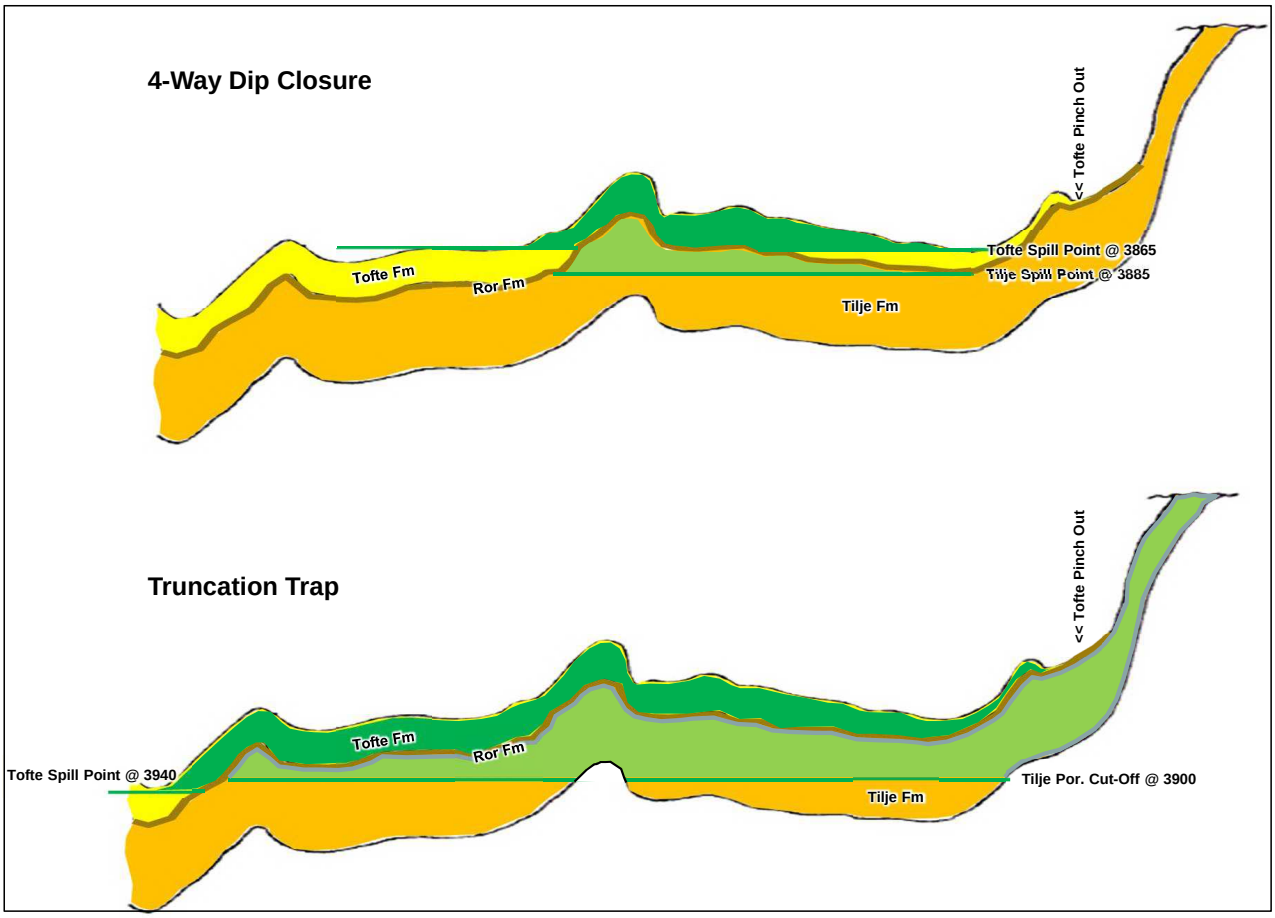

Figure 4.4 Geilo Prospect volumetric scenarios. *There are two volumetric scenarios for the Geilo Prospect. A small 4-way closure and a large truncation trap. Both scenarios have separate columns for Tofte and Tilje fms due to a sealing Ror Fm. The columns in the 4-way closure are controlled by the spill-point up into the truncation trap. The Tofte Fm column of the truncation trap is controlled by spill-point from the mapping, and the Tilje Fm column is controlled by the depth cut-off at 3900m of the reservoir quality.*

The 4-way is a robust trap, but the lager truncation trap has several issues.

From the seismic no Cretaceous thief sands is seen to disrupt the sealing potential of the truncation, but it cannot be fully excluded that sub-seismic sands might lie on top of the truncation trap. This larger trap also has problems when it comes to trapping against the faults to the east and south. The Geilo reservoirs are juxtaposed against Jurassic and Triassic sands across different faults and configurations along the whole eastern and southern flanks of the prospect (Figure 4.2). This is the main concern for the risk of this trap model scenario.

The Ror Fm is in the new models assumed to seal between Tofte and Tilje. This is based on analysis of several wells in the vicinity of the Geilo Prospect (Ex. 6607/12-2S, 660810-1, 6608-10-5).

Reservoir

When including the Verdande well (6608/10-16) in the reservoir quality plots (Figure 4.5) it was seen that the porosity and N/G used in the APA 2013 application were too high. The Tilje Fm cut-off has been increased from 10% to 12% and thus the base of N/G decreased from 55% (Application) to 40% in the current evaluation. Due to the reservoir quality degradation a depth cut-off has been set at 3900 m for the Tilje Fm. Tofte N/G base case was reduced from 90% to 80% due to the depth. Within these N/G ranges the effective porosity distributions are the same as in the APA 2013 Application.

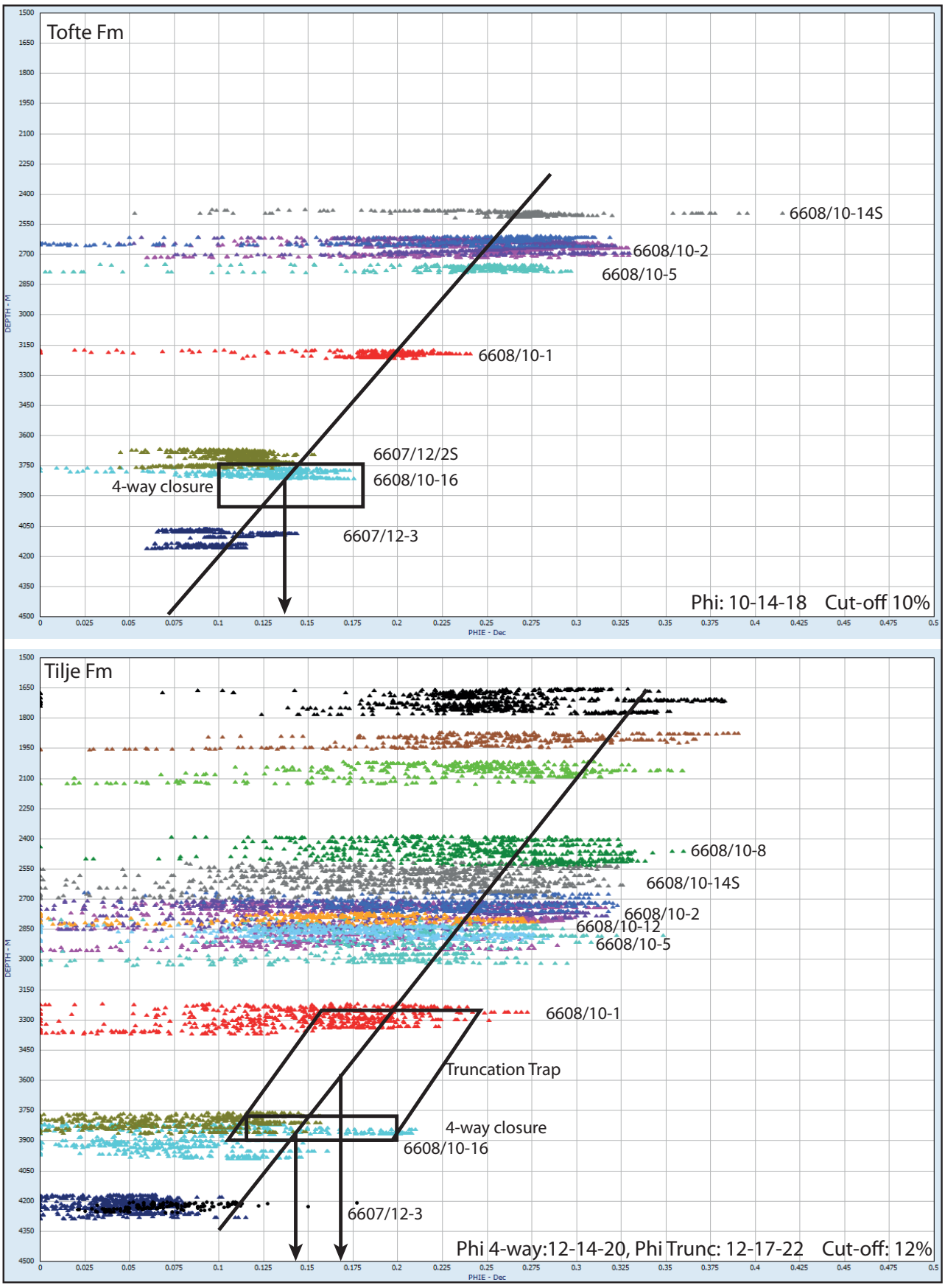

Figure 4.5 Geilo log porosity vs depth plots. *Porosity vs depth for Tofte Fm at the top and Tilje Fm at the bottom. The Tofte Fm has a cut-off of 10% and the Tilje has a cut-off of 12%. The Tilje Fm had two distributions due to a large difference in depth from the top of the Truncation trap og the 4-way closure.*

Basin Modelling

No new basin modelling has been done since the APA 2013 application for the PL 761 area. Oil is the main phase and the 4-way closure still needs to be filled before the updip truncation trap can be filled (see APA 2013 application).

Volume calculations

Compared to the APA 2013 Application the new maps show a shallower spill-point for the 4-way closure towards the truncation trap (Figure 4.4). The Tofte has a spill-point of 3865 m (old 3900 m) and Tilje Fm 3885 m (old 3950 m). This together with the reduction in N/G are the two primary reasons for the 1/3 reduction of the volumes within the 4-way closure. The volumes for the 4-way closure and the truncation trap are shown with combined volumes for the Tofte and Tilje fms in Table 4.1 and Table 4.2.

Risking

At time of application the Geilo Prospect 4-way closure had a probability of success of 40%. After the new interpretation and reservoir work done the new PoS is set to be 31% (Table 4.1), which better reflects the new understanding of the prospectivity. The difference in risking on the trap is the uncertainty of the sealing capacity of the fault intersecting the 4-way closure (Figure 4.2). If it seals, the 4-way is divided into two segments and the geometry will be different. Taking the fault juxtaposition towards the east and south into account for the risking on the larger truncation trap, this model has a 9% chance of success.

Table 4.1. Geilo 4-way closure NPD Prospect data.

Table 5: Prospect data (Enclose map)

Block	6608/7&8	Prospect name	Geilo	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil	Reported by company	Noreco	Reference document				Assessment year	2015
This is case no.:	1 of 2	Structural element	Dønna Terrace	Type of trap	4-way	Water depth [m MSL] (>0)	340	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)	7,30	9,00	10,00	12,80				
	Gas [10^9 Sm^3] (>0.00)					0,55	0,70	0,75	0,96
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	2,70	3,60	4,00	5,50				
	Gas [10^9 Sm^3] (>0.00)					0,20	0,29	0,31	0,40
Reservoir Chrono (from)	Pliensbachian	Reservoir litho (from)	Tilje Fm	Source Rock, chrono primary	Oxfordian	Source Rock, litho primary	Melke Fm	Seal, Chrono	Toarchian to Aalenian
Reservoir Chrono (to)	Toarchian	Reservoir litho (to)	Tofte Fm	Source Rock, chrono secondary	Kimmeridgian	Source Rock, litho secondary	Spekk Fm	Seal, Litho	Ror Fm & Not Fm
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	1,00	Oil case (0.00-1.00)	1,00	Gas case (0.00-1.00)	0,00	Oil & Gas case (0.00-1.00)	0,00		
Reservoir (P1) (0.00-1.00)	0,60	Trap (P2) (0.00-1.00)	0,64	Charge (P3) (0.00-1.00)	0,80	Retention (P4) (0.00-1.00)	1,00		
Parametres:	Low (P90)	Base	High (P10)	*Geilo 4- way closure Tofte and Tilje volumes combined. Tofte parameters for reservoir quality are used in the spreadsheet.Tofte is the largest contributor to the 4-way volumes. Tilje parameters: Por 0.12-0.14-0.17 and N/G 0.3-0.4-0.6 cut-off por>= 0.12 and cut-off Vclay <= 0.5.*					
Depth to top of prospect [m MSL] (> 0)		3725							
Area of closure [km^2] (> 0.0)	4,2	4,5	4,9						
Reservoir thickness [m] (> 0)	40	45	50						
HC column in prospect [m] (> 0)		140							
Gross rock vol. [10^9 m^3] (> 0.000)									
Net / Gross [fraction] (0.00-1.00)	0,70	0,80	0,85						
Porosity [fraction] (0.00-1.00)	0,12	0,14	0,16						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,25	0,30	0,35						
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)	0,75	0,79	0,84						
GOR, free gas [Sm^3/Sm^3] (> 0)									
GOR, oil [Sm^3/Sm^3] (> 0)	71	75	79						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,35	0,40	0,45						
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,35	0,40	0,45						
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	Por >=0,10	Vclay <=0,5	3.					Kart nr	NPD will insert value

Table 4.2. Geilo Truncation trap NPD Prospect data.

Table 5: Prospect data (Enclose map)

Block	6608/7&8	Prospect name	Geilo	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil	Reported by company	Noreco	Reference document				Assessment year	2015
This is case no.:	2 of 2	Structural element	Dønna Terrace	Type of trap	combination stratig	Water depth [m MSL] (>0)	340	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)	33,00	47,00	48,00	64,00				
	Gas [10^9 Sm^3] (>0.00)					2,40	3,30	3,60	4,80
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	12,00	16,80	19,40	28,00				
	Gas [10^9 Sm^3] (>0.00)					0,90	1,20	1,45	2,00
Reservoir Chrono (from)	Pliensbachian	Reservoir litho (from)	Tilje Fm	Source Rock, chrono primary	Oxfordian	Source Rock, litho primary	Melke Fm	Seal, Chrono	Toarchian to Aalenian
Reservoir Chrono (to)	Toarchian	Reservoir litho (to)	Tofte Fm	Source Rock, chrono secondary	Kimmeridgian	Source Rock, litho secondary	Spekk Fm	Seal, Litho	Ror Fm & Not Fm
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	1,00	Oil case (0.00-1.00)	1,00	Gas case (0.00-1.00)	0,00	Oil & Gas case (0.00-1.00)	0,00		
Reservoir (P1) (0.00-1.00)	0,60	Trap (P2) (0.00-1.00)	0,19	Charge (P3) (0.00-1.00)	0,80	Retention (P4) (0.00-1.00)	1,00		
Parametres:	Low (P90)	Base	High (P10)	*Combined Tofte and Tilje volumes for the Max /truncation trap for Geilo Prospect. Tilje reservoir information is in the table, Tofte formation information is the same as for the 4 way closure. The Max trap represents the upside potential of the 4 way-closure.*					
Depth to top of prospect [m MSL] (> 0)		3100							
Area of closure [km^2] (> 0.0)	8,4	9,0	9,8						
Reservoir thickness [m] (> 0)	90	100	110						
HC column in prospect [m] (> 0)		800							
Gross rock vol. [10^9 m^3] (> 0.000)									
Net / Gross [fraction] (0.00-1.00)	0,30	0,40	0,60						
Porosity [fraction] (0.00-1.00)	0,13	0,17	0,20						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,25	0,30	0,35						
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)	0,75	0,79	0,84						
GOR, free gas [Sm^3/Sm^3] (> 0)									
GOR, oil [Sm^3/Sm^3] (> 0)	71	75	79						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,35	0,40	0,45						
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,35	0,40	0,45						
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	Por >= 0,12	Vclay<= 0,5	3.					Kart nr	NPD will insert value

Table 4.3: Risking of Geilo 4-way pre and post application

Risk element	Geilo APA2013 Application	Geilo reinterpreted 2015
P1 Reservoir	0.63	0.6
P2 Trap	0.8	0.64
P3 Charge	0.8	0.8
P4 Retention	1.0	1.0
Pg	0.4	0.31

Gjesdal Prospect

The Gjesdal Prospect is too deeply buried for any producible reservoir and is thus no longer a prospect.

Cretaceous Play

In the APA 2013 Application it was indicated possible leads in the Cretaceous Lange Fm. With the new reprocessed seismic a new amplitude and AVO modelling has been conducted. The amplitudes within PL761 lies in the basin and not towards the flanks, and is interpreted to correspond to dry sands, with the same type amplitude, at the same stratigraphic level seen in Dompap (6608/10-12) and Bjørk (6608/8-2) wells (Figure 4.6). Thus the conclusion is that there is no prospectivity in the Cretaceous section within PL761.

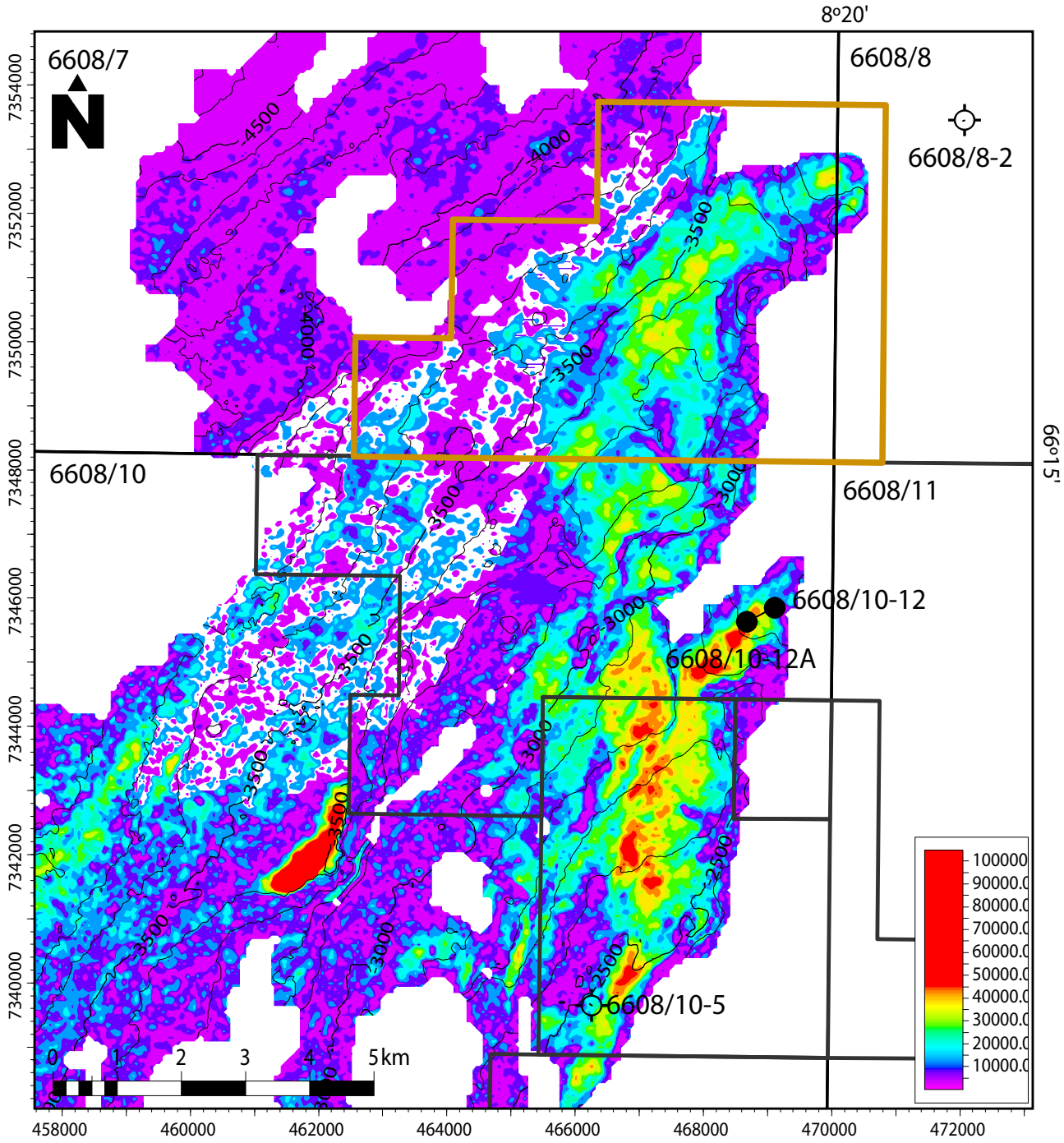

Figure 4.6 Cretaceous Intra Lange fm Far offset RMS amplitude map. *The bright amplitudes seen in 6608/10-12 (Dompap) are dry sands. Within PL761 the corresponding sands show even lower amplitude respons and are thus regarded to be dry as AVO amplitude modeling shows the HC effect is an increase in amplitude.*

5 Technical evaluations

No technical evaluations were performed for either case of the Geilo Prospect.

6 Conclusions

The volumes for the 4-way closure of the Geilo Prospect are considered to be too low to be economic ($4.0x10^6$ Sm^3 Oil) and the Truncation trap is regarded to have too high risk, a geological PoS of 9%. The result being a relinquishment of Production License 761.

7 References

Application in predefined areas 2013; Application for production licenses, Blocks: 6608/7 and 8.