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Status Report at License Surrender of PL 757 in Blocks 6506/1 & 6506/4

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1 Key License History

PL 757 was awarded on 7th February 2014 following an application in the APA 2013. The original partnership comprised:

- Centrica Resources (Norge) AS - 40% (current operator)
- VNG Norge AS - 60% (operator at award)

In May 2014 VNG transferred a 30% share in the license to a new partner, Explora Petroleum AS. Also, in May 2014, the partners agreed that Centrica should take operatorship and this was subsequently approved by the authorities. In February 2016 North E&P bought Explora Petroleum AS, including their 30% share in this license. The current partnership therefore comprises:

- Centrica Resources (Norge) AS - 40% (current operator)
- VNG Norge AS - 30% (operator at award)
- North E&P AS - 30%

The initial license work committments were to reprocess 3D seismic and to make a 'drill or drop' decision before 7th February 2016. The group fulfilled the reprocessing commitment by merging and reprocessing parts of two separate 3D seismic surveys to give the new CE14M01 survey, which covers 1011 sqkm.

The partnership applied for a one year extension to the 'drill or drop' decision, following delays in the seismic reprocessing project. This extension was granted by the authorities.

The area to be surrendered is interpreted to have limited exploration potential. In particular the main Gunung Batur Prospect in the Lysing Fm is considered to be moderate to high risk and, in addition, only the upper part of the prospect resource range exceeds the threshold for minimum economic field size (MEFS) in this area.

The operator's decision to surrender PL 757 was presented to the management committee in a meeting on 6th September 2016. The decision was supported by all members of the partnership and formally agreed on L2S in September 2016. The Ministry of Petroleum and Energy was informed of the decision to surrender in October 2016

The license prospectivity was presented by the operator and discussed by the group at the following partner meetings.

Meeting	Date	Purpose
ECMC	28th June 2014	Agreement of license database and area of seismic reprocessing. Discussion of prospectivity
ECMC	1st December 2014	Seismic reprocessing update and discussion of regional studies
EC	14th October 2015	Presentation of preliminary prospect evaluation and presentation of newly reprocessed seismic data

Meeting	Date	Purpose
ECMC	30th November 2015	Discussion of requirement for gather conditioning on newly processed seismic data and requirement to evaluate a larger prospect model, with Strat pinchout, at Gunung Batur
ECMC	6th September 2016	Presentation of final Gunung Batur Prospect evaluation and relinquishment decision

2 Database

Following award the group merged and reprocessed (using PSTM) parts of the BG0701 and SKHN99 3D seismic surveys to give the newly reprocessed CE14M01 survey covering 1011 sqkm (see Fig. 2.1). The processing contractor was Dolphin Geophysical. The objectives of the reprocessing were to improve the seismic image and to generate pre-stack datasets that could be used to check for the presence of DHIs using AVO analysis. In addition the operator reprocessed the MNR05 7282 2D line to give a tie between CE14M01 and the important 6506/6-2 well. The reprocessed line subsequently became redundant after most members of the partnership purchased an area of the HVG2011 survey to the east of PL 757.

During the evaluation the operator and some of the partners had access to a large area of the HVG2011 PGS broadband 3D seismic survey, which lies to the east of PL 757. There was not an agreement among the PL 757 partners to add this survey to the PL 757 license database, therefore the reader is referred to the PL 798 surrender report where it is possible to see the Lysing Fm interpretation completed by the operator on the HVG2011 3D survey, which overlaps with the interpretation made in PL 757.

The operator also evaluated the Lysing Sst fairway on a number of released seismic surveys covering the Dønna Terrace and the northern part of the Halten Terrace

No new wells were drilled and no unreleased wells were included in the license common database.

To support the seismic interpretation and prospect evaluation the operator undertook an in-house Lysing Fm rock physics study which utilised 11 relevant offset wells. In addition the operator undertook a petrophysical analysis of the Lysing and Lange Fms in 25 relevant offset wells to understand reservoir distribution and quality on the Dønna Terrace and northern part of the Halten Terrace (see table below).

Well	Petrophysics	Rock Physics
6505/10-1	Yes	No
6506/11-3	Yes	No
6506/3-1	Yes	Yes
6506/6-1	Yes	Yes
6506/6-2	Yes	Yes
6506/9-1	Yes	Yes
6506/9-2S	Yes	No
6507/1-1	Yes	Yes
6507/2-1	Yes	No
6507/2-2	Yes	Yes

Well	Petrophysics	Rock Physics
6507/2-3	Yes	Yes
6507/2-4	Yes	Yes
6507/3-9S	Yes	Yes
6507/5-1	Yes	No
6507/5-3	Yes	Yes
6507/5-4	Yes	No
6507/5-5	Yes	No
6507/5-6S	Yes	No
6507/7-1	Yes	No
6507/7-11S	Yes	No
6507/7-12	Yes	No
6507/7-14S	Yes	Yes
6507/7-15S	Yes	No
6605/8-2	Yes	No
6605/8-1	Yes	No

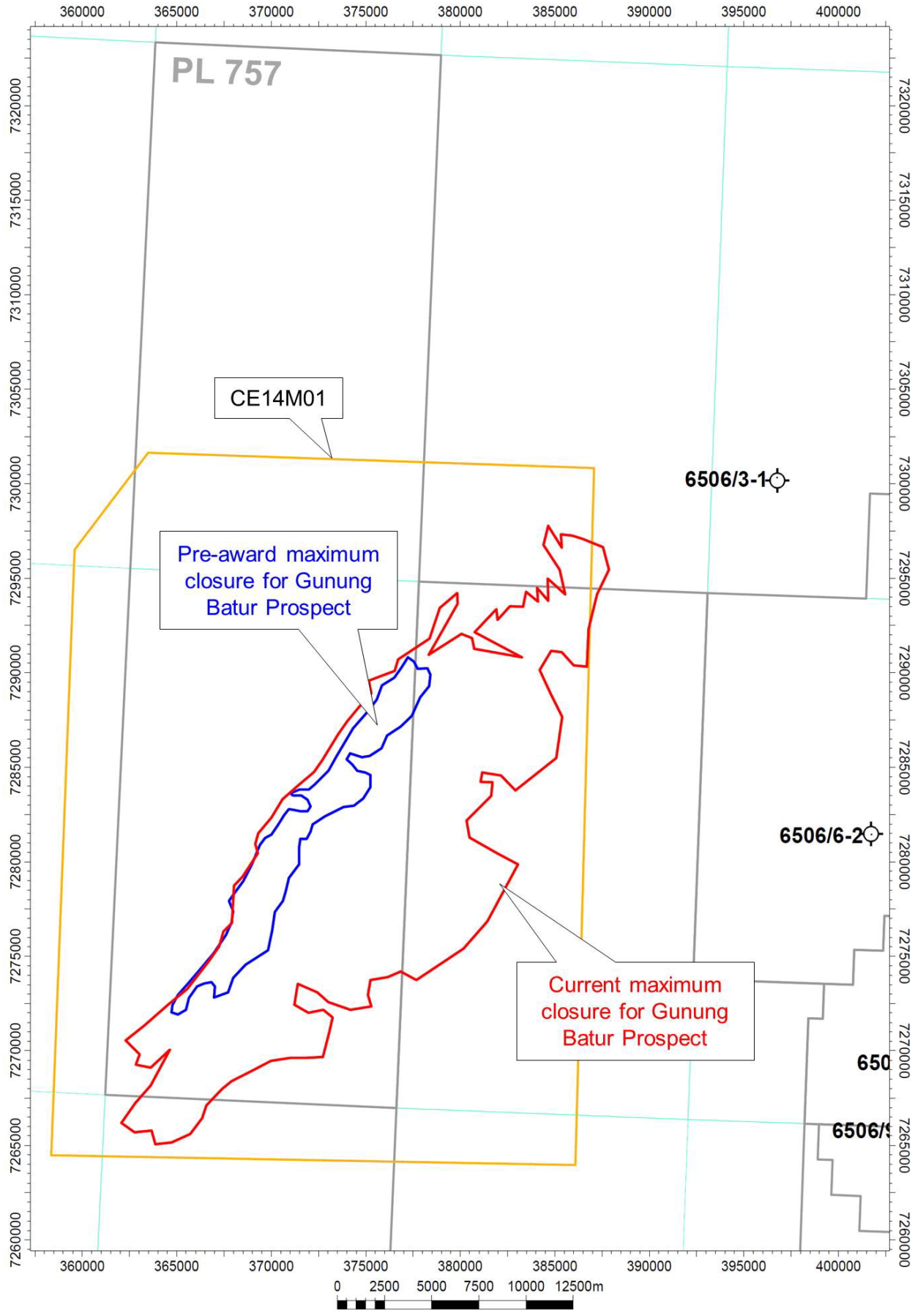

Fig. 2.1 PL 757 Basemap.

3 Review of Geological Framework

During the evaluation of PL 757 the operator was evaluating the same prospective levels in the neighbouring PL 798, which had a similar partner grouping. The operator undertook significant regional scale work to support the evaluation of both PL 757 and PL 798.

The Lysing Fm Sst fairway was the primary target level in PL 757. The Lysing Fm in this area is a widespread turbidite facies. Petrophysics and regional mapping work undertaken by the operator confirmed the pre-award model that there is a broad trend of deteriotating reservoir quality (porosity, NG and permeability) from NE to SW across the Dønna Terrace and the northern part of the Halten Terrace. The Lysing Fm also shows a trend of gradual thickening from NE to SW, the thickening becomes more noticeable at the western edge of the Halten and Dønna Terraces, where the Gunung Batur Prospect is located.

Some of the best quality Lysing reservoir is seen at the Marulk Discovery on the Dønna Terrace, which is believed to be sitting in the proximal part of the fairway. An examination of the 3D seismic surveys in the vicinity of Marulk showed that there are smaller scale variations in the distribution of reservoir quality that result from depositional heterogeneity. In addition there are smaller scale thickness changes that appear to be linked to the underlying Jurassic topography. The reservoir quality appears to be better where the top Lysing seismic reflector indicates a decrease in acoustic impedance. This empircal observation is supported by rock physics modelling, which shows that the best Lysing Ssts have a class IIP or III AVO response that becomes brighter with the presence of gas. Unfortunately this response is not seen in PL 757, where the top Lysing Fm is represented by a hard reflector (increase in acoustic impedance) across all offset angles, suggesting poorer reservoir quality.

The claystones of the lower Shetland Group provide a competent top seal to the underlying Lysing Sst.

The main source rock in the area is the deeply buried Spekk Fm, which went through peak gas expulsion in the Late Cretaceous and is now considered to be over mature. This introduces a potential migration timing risk, with respect to trap formation.

4 Prospect Update

The Lysing Fm Gunung Batur Prospect was the only prospect at the time of application. It is a faulted, three-way dip closure in the footwall of the Ytreholmen Fault Zone. At the time of application the main volumetric uncertainties related to reservoir quality, the position of the spill point and the degree of hydrocarbon fill. The key prospect risk was the timing of hydrocarbon migration with respect to trap formation. A number of leads were also identified.

Gunung Batur was the focus of the partnership's seismic reprocessing project, the aim was to improve the imaging of the exisiting BG0701 survey and to generate gathers and angle stack volumes for AVO analysis and the identification of direct hydrocarbon indicators (DHIs). The partnership decided to extend the reprocessing area to the east (by merging in the SKHN99 survey) in order to give an overlap with the high quality HVG2011 survey. Unfortunately the reprocessed CE14M01 survey did not give an improvement in imaging compared to the original BG0701 survey. The main problem was noise on the near-mid angle traces that was generated by the severely rugose seafloor. The problem proved so intractable that the near traces were not included in the 'full' stack volume of the CE14M01 survey, hence the full stack volumes are effectively mid-far stack volumes. It transpired that the same decision had been taken for the processing of the original BG0701 survey.

Despite the difficulties with the seismic reprocessing it was possible to advance the evaluation of the Gunung Batur Prospect using the partnership's improved understanding of the Lysing Fm fairway that resulted from the regional seismic mapping and the petrophysics and rock physics studies. It was concluded that Gunung Batur is not favourably located to encounter good quality reservoir.

The seismic character at Gunung Batur suggests that reservoir quality is poor to moderate. In the area around the prospect the top of the Lysing Fm is represented by a hard reflector on the mid to far offset angles. Seismic forward modelling at the 6506/6-2 well indicates that the maximum possible average porosity associated with such a response is around 18% if the sst is water bearing and 16% if the sst is gas bearing. The hard top Lysing reflector is relatively bright to the north and east of the prospect where the formation is pinching out onto a structural high. The nearby 6506/3-1 well drilled Lysing Fm with a similar seismic character and found only 3m of water bearing sst at the top of a 20m thick Lysing Fm package with ratty ssts.

The seismic character observations are consistent with the prospect being in the distal part of the Lysing fairway, which was also the conclusion from the regional mapping and petrophysics study. In addition there is a structural high to the east of Gunung Batur, which is likely to have blocked the deposition of high energy, sand-rich turbidites. Seismic mapping shows that the Lysing Fm thins and pinches out onto the structural high. The Uppermost Lange Fm shows no thinning onto the high, therefore it probably formed between deposition of the Lange and Lysing Fms. It was probably part of a regional structural event that also rejuvenated the Cretaceous hinterland, triggering the basinal influx of Lysing Sst following relatively quiescent conditions during the deposition of the Upper Lange Fm.

Gunung Batur was originally mapped as a faulted dip closure that spills into the structural high to the east. However the maximum closure is now bigger because the original spill point is seen to coincide with a potential stratigraphic pinchout of the Lysing Fm onto the high. In addition

there is upthrown fault closure to the south east. Given that these additional trap elements are sealing, the next deepest spill point is the northern structural saddle that separates Gunung Batur from the area of Lysing Fm tested by the 6506/3-1 well. The newly identified trapping elements are illustrated in Fig. 4.1. Example seismic lines through Gunung Batur are shown in Fig. 4.2

This new interpretation gives a significantly bigger maximum closure, but it extends the area of closure to the north and the east where the seismic character suggests the Lysing reservoir is thin and of poor quality. Therefore the increase in the size of the closure is accompanied by a decrease in average reservoir properties. The new maximum closure extends beyond the eastern border of PL 757, into Block 6506/5.

The Ytreholmen Fault Zone, which bounds Gunung Batur to the east, appears to have been active at the time of peak gas expulsion from the Spekk Fm in the late Cretaceous. Hence there is a risk that trap formation post-dates the main gas charge or that the configuration of the trap changed post-charge leaving it only partially filled. This potential migration timing problem was recognised as the main geological risk at the time of application and has not been mitigated by recent work. In fact the lack of a DHI could be seen as further evidence for a lack of charge, however it could also be the result of poor reservoir quality. The migration timing uncertainty is reflected in the volumetrics as a large range in the depth of the GWC. An updated prospect summary is shown in Fig. 4.3.

The license contains a number of poorly defined Lysing and Lange Fm leads in the hangingwall of the Ytreholmen fault zone. At Lysing level they are more distally positioned than the Gunung Batur Prospect and are therefore not expected to have good reservoir quality and at Lange level there are significant reservoir presence and effectiveness risks. The large Gunung Bromo lead that relies on a Tertiary Tare or Tang Fm Sst has a significant migration timing risk given that the reservoir appears to post-date the main gas charge from the Spekk Fm.

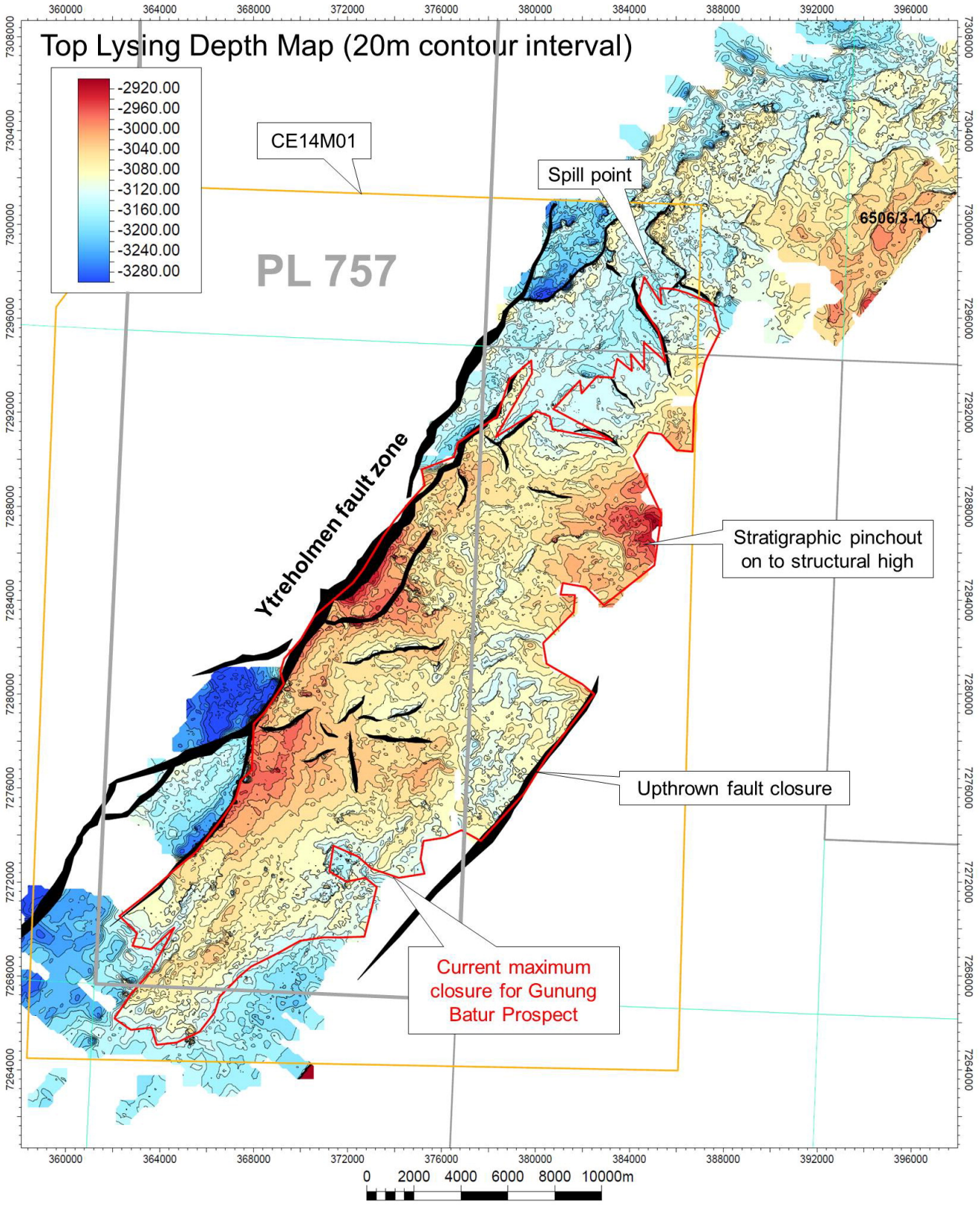

Fig. 4.1 Top Lysing Fm Depth Map Showing Gunung Batur Prospect. *In the maximum closure case the Prospect relies on upthrown fault closure to the west and SE, there is stratigraphic pinchout to the east and dip closure to the north and south. The maximum closure spills to the north via a saddle that separates it from the area of water bearing Lysing Fm drilled by the 6506/3-1 well.*

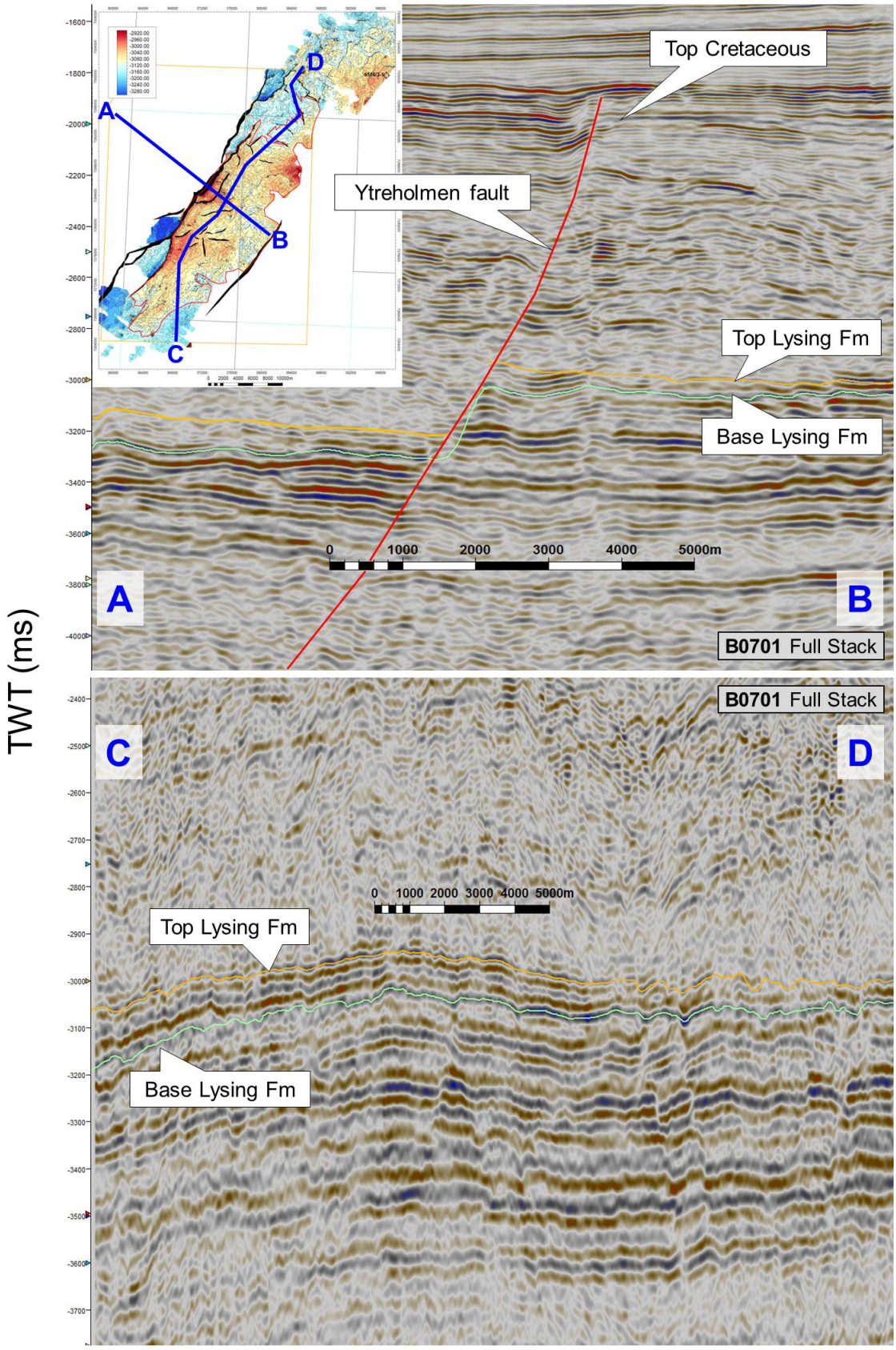

Fig. 4.2 Dip and Strike Seismic Lines Through the Gunung Batur Prospect (BG0701 3D survey). *The dip line (A-B) shows that the bounding fault was active into the late Cretaceous at the time of the main gas charge. The dip line also shows a thickening of the Lysing Fm to the west. The strike line (C-D) shows a thickening of the Lysing Fm to the south and west. Note that top Lysing Fm is a blue reflector (increase in impedance), which suggests relatively poor reservoir quality.*

Table 5: Prospect data (Enclose map)

Block	6506/4 & 5	Prospect name	Gunung Batur	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)	No	Outside play (Y/N)	No				
Oil, Gas or O&G case:	Gas	Reported by company	Centrica	Reference document				Assessment year	2016
This is case no.:		Structural element	Dønna Terrace	Type of trap	4-way dip closure	Water depth [m MSL] (>0)	400	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)	10.90		20.70	34.00				
Recoverable resources	Oil [10^6 Sm^3] (>0.00)					0.51		1.24	2.19
	Gas [10^9 Sm^3] (>0.00)	6.51		13.30	22.20				
Reservoir Chrono (from)	Upper Turonian	Reservoir litho (from)	Lysing Fm.	Source Rock, chrono primary	Late Jurassic	Source Rock, litho primary	Spekk Fm.	Seal, Chrono	Coniacian
Reservoir Chrono (to)	Lower/Middle Coniacian	Reservoir litho (to)	Lysing Fm.	Source Rock, chrono secondary	Callovian	Source Rock, litho secondary	Melke Fm.	Seal, Litho	Kvitnos Fm.
Probability [fraction]									
Technical (oil + gas + oil & gas case) (0.00-1.00)	0.24	Oil case (0.00-1.00)	0.00	Gas case (0.00-1.00)	0.24	Oil & Gas case (0.00-1.00)	0.00		
Reservoir (P1) (0.00-1.00)	0.70	Trap (P2) (0.00-1.00)	0.80	Charge (P3) (0.00-1.00)	0.60	Retention (P4) (0.00-1.00)	0.70		
Parametres:	Low (P90)	Base	High (P10)	*The volumes listed include the 'out of PL 757 volumes' (the prospect extends east into block 6506/5 in the high case)*					
Depth to top of prospect [m MSL] (> 0)	3065	3065	3065						
Area of closure [km^2] (> 0.0)	4.0	15.0	63.0	*Changes vs 2013 assessment at time of application:*					
Reservoir thickness [m] (> 0)	50	63	80	*Larger range of column height to reflect uncertainty over degree of fill due to potential for trap reconfiguration following gas charge*					
HC column in prospect [m] (> 0)	20	60	200	*Reservoir properties are lower and the ranges are wider*					
Gross rock vol. [10^9 m^3] (> 0.000)	0.130	0.570	2.400	*The maximum area of closure is increased to reflect the potentially larger trap due to a new strat pinchout trap element*					
Net / Gross [fraction] (0.00-1.00)	0.20	0.50	0.80	*Fluid parameters and RFs are little changed*					
Porosity [fraction] (0.00-1.00)	0.11	0.13	0.16						
Permeability [mD] (> 0.0)	1	10	50						
Water Saturation [fraction] (0.00-1.00)	0.20	0.35	0.50						
Bg [Rm3/Sm3] (< 1.0000)	0.0032	0.0035	0.0038						
1/Bo [Sm3/Rm3] (< 1.00)									
GOR, free gas [Sm^3/Sm^3] (> 0)	6667	10000	20000						
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)	0.50	0.64	0.80						
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0.45	0.60	0.75	For NPD use:					
Temperature, top res [°C] (>0)	94			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)	390			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. porosity >= 10 %	2. VClay <= 50 %	3.					Kart nr	NPD will insert value

Fig. 4.3 Gunung Batur Prospect Summary Sheet.

5 Technical Evaluations

It is assumed that a gas discovery in PL 757 would be developed as a subsea tieback to one of the main gas hubs on the Halten Terrace e.g. the Heidrun Field. The operator's technical and economic evaluation of PL 757 showed that the minimum economic field size (MEFS) is around 31 GSm^3 of gas. The MEFS estimate is based on a set of generic volume cases because there is not a prospect in the license with volumes that are close to being economic. The following assumptions were used:

- 2018 exploration well
- 2024 first production
- horizontal gas production wells (due to low relief structure)
- gas price of NOK 1.75 /Sm3
- 2% inflation

6 Conclusions

It has not been possible to mitigate the significant migration timing risk associated with the main Gunung Batur Prospect.

The partnership now recognises the potential for a larger stratigraphic closure at Gunung Batur. However the regional geological interpretation and seismic character of the prospect indicate poor reservoir quality and therefore only the upper part of the prospect resource range exceeds the threshold for minimum economic field size (MEFS) in this area.

All members of the partnership agree that the risked volumes at the Gunung Batur prospect are unattractive and that PL 757 should be surrendered.