Relinquishment PL821/821B

Fig. 1 Lyderhorn

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1 INTRODUCTION

1.1 License Owners

Aker BP ASA 60 % (Operator)

Point Resources AS 40 %

1.2 Award and Work Program

The license PL821 was awarded on the 5th February 2016 with an drill decision within two (2) years and an initial period of seven (7) years following the APA Licensing 2015. The license 821B was awarded 10.02.2017 following the APA Licensing 2016, with the same deadlines as PL821.

The initial partners in the license were Aker BP (Op) and Core. In 2016 Core merged with Pure E&P and Spike Exploration and become Point Resources (in 2016).

License work obligations was, for both PL821 and 821B:

1) Reprocess 3 seismic

2) Drill or drop decision within 2 years

The work obligations has been fulfilled.

1.3 Identified Prospectivity

PL821/821B is situated in southern parts of Vana Sub-basin and cover parts of 24/12 (see Fig. 1.1) . The license is located south of Bøyla field.

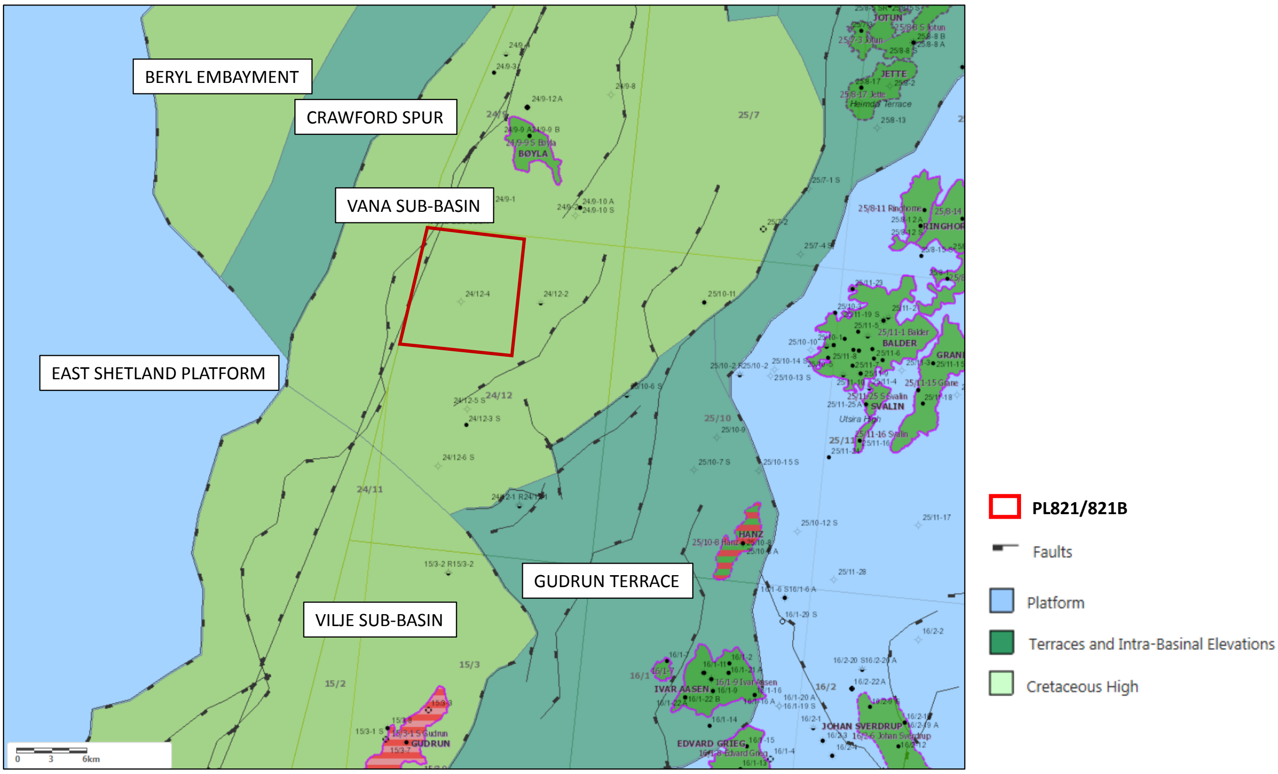

Fig. 1.1 License area and main structural elements

One prospect and one lead are identified within the PL821/PL821B acreage. The prospect is Lyderhorn with postulated Hermod reservoir. Additional a Heimdal lead called "Heimdal Lead" is identified. The prospect and lead are seen in Fig. 1.2.

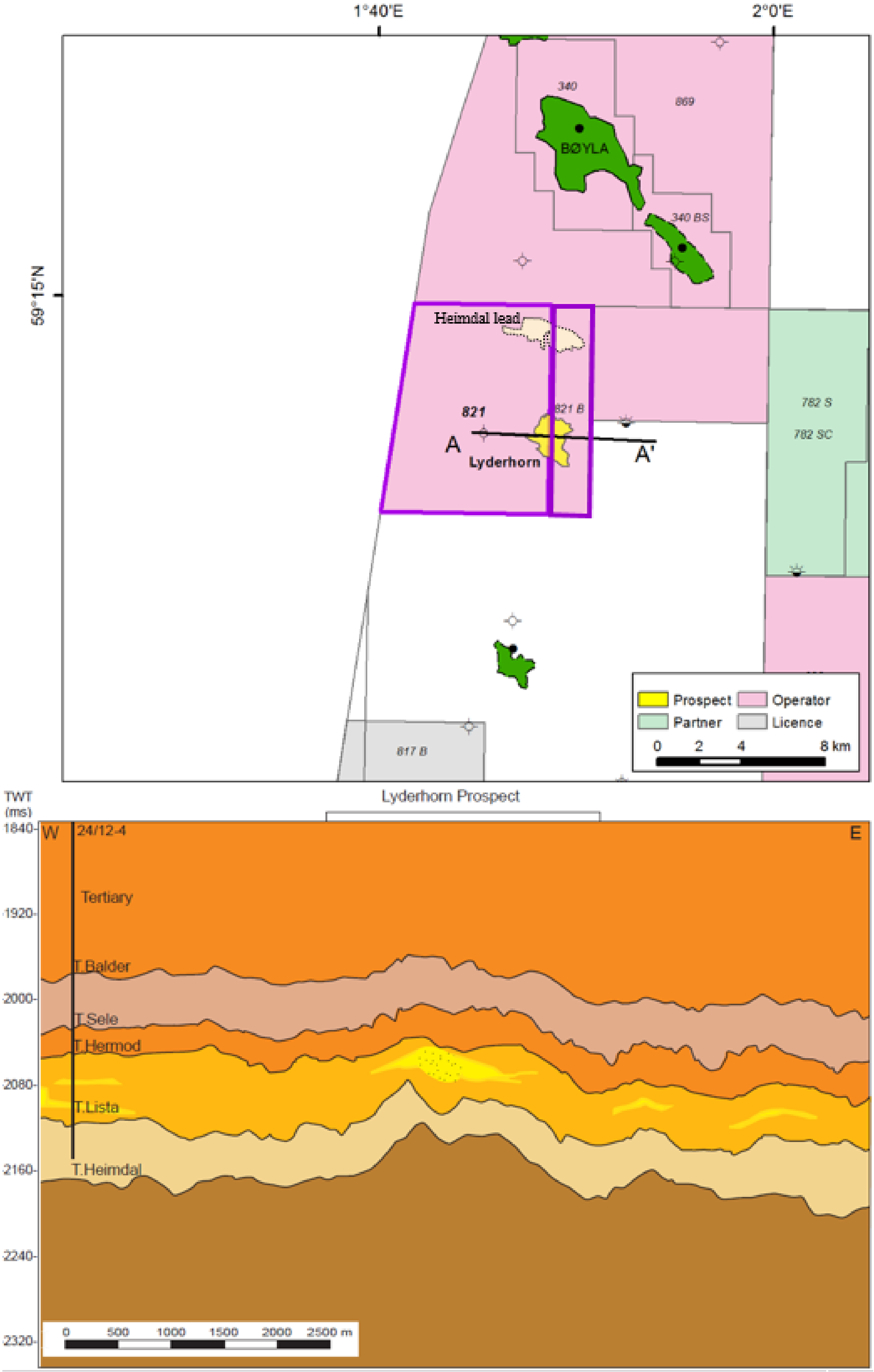

Fig. 1.2 Prospect overview

1.3 INTRODUCTION

2 DATABASE

2.1 Seismic Database

3D seismic reprocessing were done as described in 1.2 Award and Work Program. This was fulfilled by the reprocessed survey DN15M01, which is a part of the Greater Alvheim Area work carried out by Det norske (now AkerBP).

The Greater Alvheim reprocessing includes MC3D-NVG (NVG09/NVG10/NVG11), MC3D-SVG11, MC3D-BYL2013, MV3D-Q16203 and NH9603. DN15M01 is reprocessed using a state of the art PSDM processing flow including Complete Wavefield Imaging (CWI) comprising of Full Waveform Inversion (FWI) with Seperated Wavefield Imaging (SWIM) for quality control, TTI Velocity Model Building with dual azimuth model building over the NH9603 area and Final TTI Q-Kirchhoff Migration. This was done to increase the seismic resolution and improve the disturbed imaging beneath the shallow channels in the area. The seismic database is listed in Table 2.1and shown in Fig. 2.1

Table 2.1 Seismic database

Fig. 2.13D Seismic survey	Survey Type	Year	Offset data	Comment
DN15M01	PSDM Reprocessed 3D	2015	x	Detnor reprocessing including MC3D-NVG09/10/11, MC3DSVG11, MC3D-BYL2013, MV3D-Q16203 and NH9603

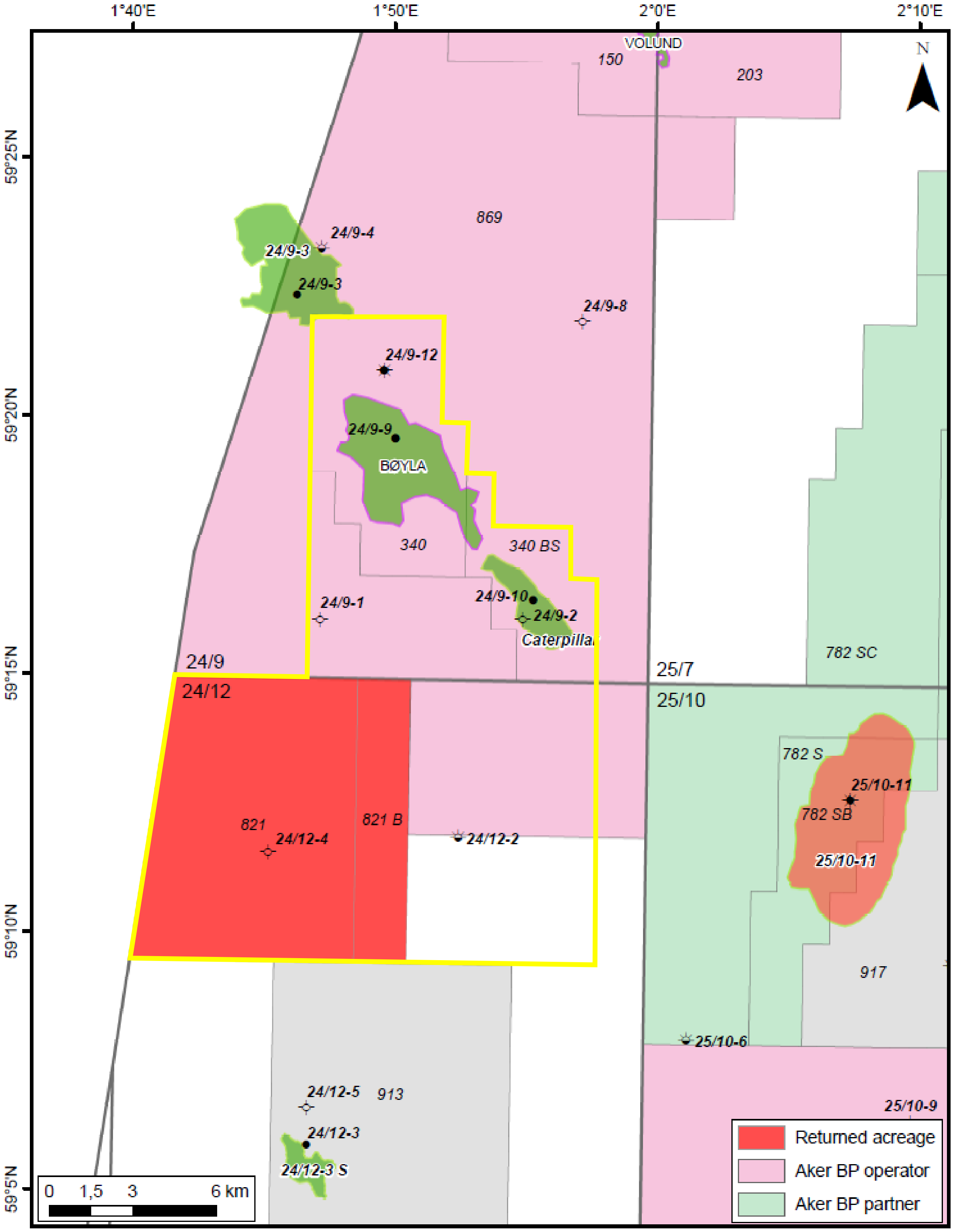

Fig. 2.1 Seismic database *Seismic database indicated by yellow polygone on map*

2.2 Well Data

Fig. 2.2 shows the wells used for evaluating the area. Key wells are highlighted in blue. All wells are also presented in Table 2.2 which includes well names, status, year drilled, TD depth and TD Formation. 24/12-3 and 5 S have been helpful to understand the southernmost extension of the Hermod Formation. The 24/12-5 S was drilled within the license period of PL341 where Det norske was operator, with Heimdal Formation as the target. New information from Bøyla and Caterpillar, especially wells 24/9-10A and 24/9-10S, released in 2013 and now in Aker BP's possession, has been important for the evaluation of the prospectivity.

Table 2.2 Well database

Well	Status	Year	TD MD m	TD Formation
24/9-1	Dry	1976	4907	Heather Fm
24/9-2	Dry	1977	2743	Tor Fm
24/9-9S	Oil	2009	2402	Heimdal Fm
24/9-9A	Oil	2009	2981	Sele Fm
24/9-10S	Oil	2011	2339	Lista Fm
24/9-10A	Oil	2011	2900	Lista Fm
24/12-5S	Dry	2007	2225	Heimdal Fm
24/12-2	Shows	1982	5100	Heather Fm
24/12-3 S	Oil	1996	3058	Våle Fm
24/12-4	Dry	2001	2265	Heimdal Fm

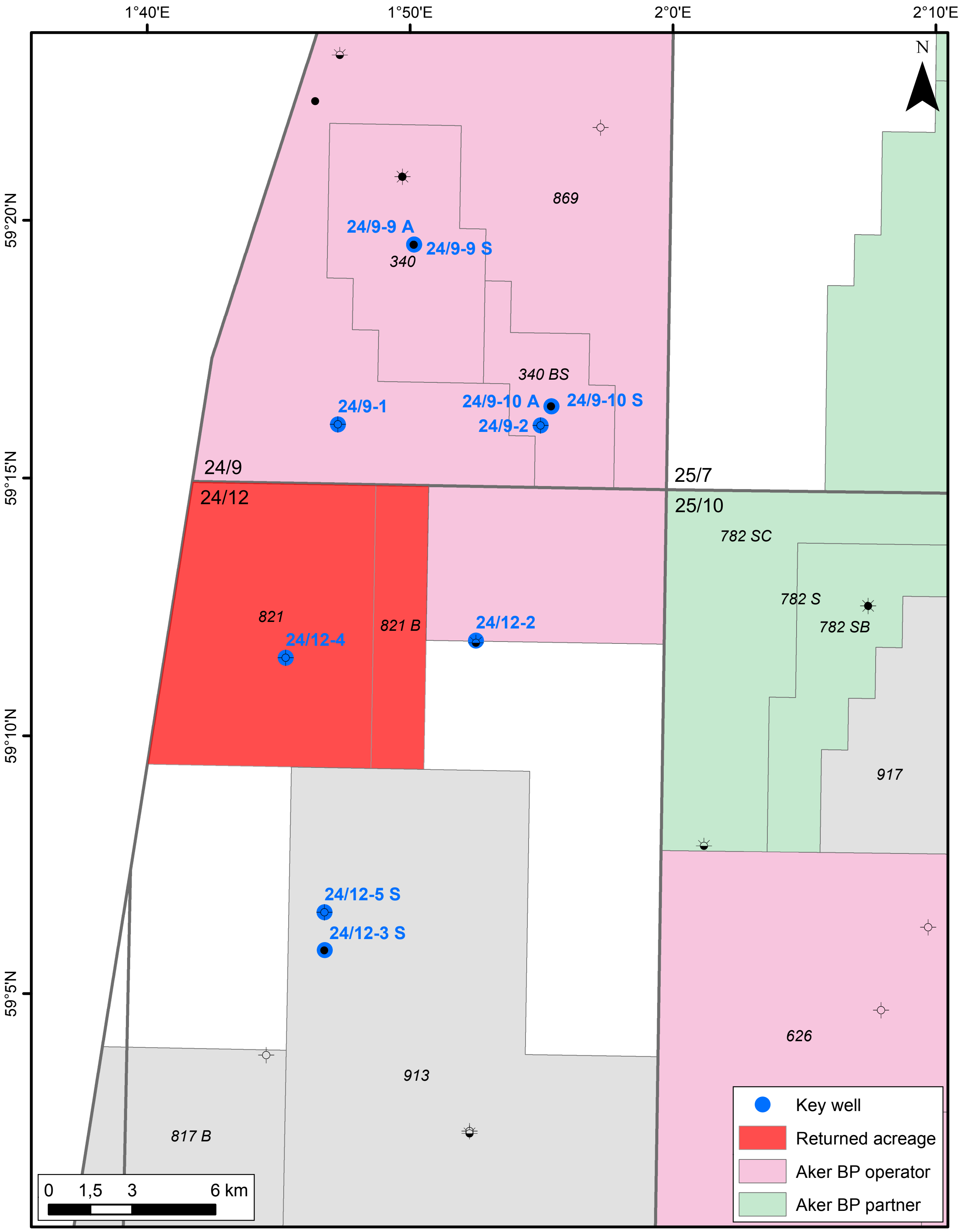

Fig. 2.2 Common well database *Key wells highlighted in blue*

2.3 Special Studies

Seismic conditioning and analysis

Extensive geophysical work has been carried out on the entire dataset. This includes de-noising, spectral balancing and variable time adjustment of every angle stack to optimize for further AVO work. Coloured inversion for every stack and EEI cubes (Intercept vs Gradient rotations) resulting in lithology and fluid cubes are also produced.

Spectral decomposition

Spectral attribute analysis through spectral decomposition (Partyka et al. 1999) on DN15M01 has been performed at several stratigraphic levels. The spectral decomposition was carried out in order to understand reservoir distribution, in particular to enhance the imaging of depositional structures and injectites. Spectral decomposition is a frequency transform of a relatively short time window to capture details from a certain stratigraphic interval. By decomposing the signal into discrete frequency bands, some details not distinguished in a full bandwidth signal will become visible. In the case of a discrete layer in a background model, low frequencies will tune at thicker intervals than high frequencies. By exploiting RGB colour blending techniques, the discrete frequency components can be blended to illustrate thickness changes, highlighting depositional features and exploring for anomalies related to hydrocarbons. If a fluid contact is present, this will also impose a tuning response towards a dipping reservoir. Results from these studies are integrated with the prospect evaluation for better evaluation.

OGS

OpenGeoSolution based in Calgary, Canada carried out a spectral inversion and curvature analysis study on the whole DN15M01 dataset. Spectral inversion maximises the detection and resolution of layering that can be characterised using the bandwidth of available signal. This is done by uncoupling the source wavelet shape from the interference profile within the bandwidth of usable signal. Traditional techniques ink resolution and detection to the source wavelet shape in context of a single layer embedded in a quiet background. Spectral inversion on the other hand, relates resolution and detection to the available signal bandwidth, signal-to-noise ratio, the complexity of the local layering architecture, and the complexity of impedance contrasts within the local distribution of layering.

3 REMAINING PROSPECTIVITY

3.1 Lyderhorn

The Lyderhorn Prospect is located in block 24/12, in PL821 and PL821B, approximately 18 km south of the Bøyla Field (AkerBP, Point and Lundin). See Fig. 1.2. Top Reservoir time and depth maps are shown in Fig. 3.1. Seismic and geological profiles are shown in Fig. 3.2

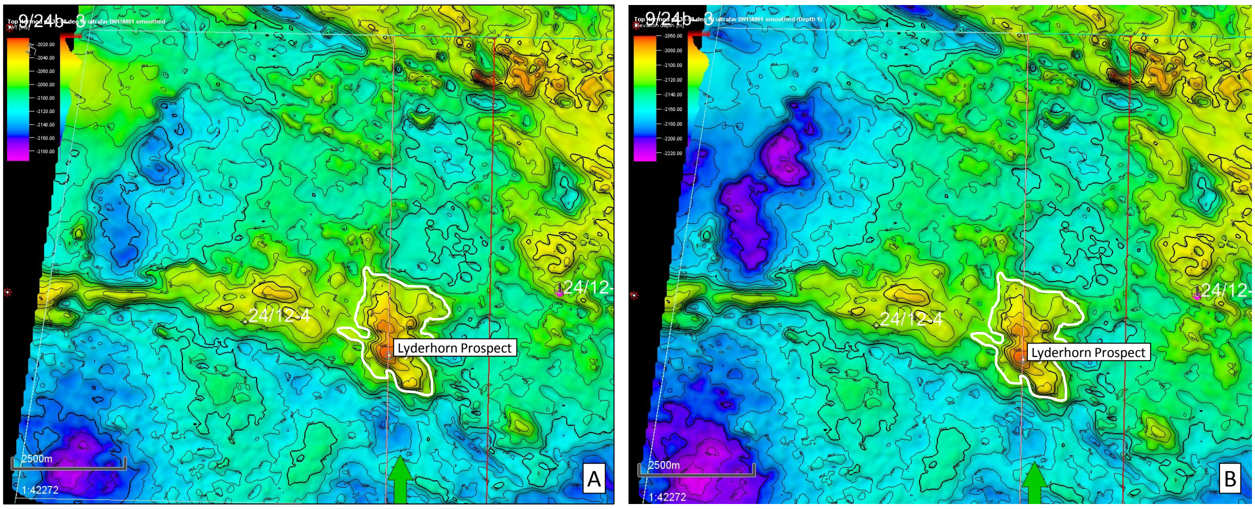

Fig. 3.1 Top Reservoir time and depth maps *A= time depth and B= depth map*

The Lyderhorn Prospect is primarily a 4-way dip-closure in the Hermod Formation which contains an area of bright negative far stack amplitudes in the southern part. The far stack response is clearly seen in the seismic data, which is also the case for the general isopach thickness trend. Although the far stack anomaly at Lyderhorn is very similar to that seen at the Caterpillar Discovery in Fig. 3.3, the difference is that it covers only a limited part of the structural closure. The anomaly is interpreted to be a channel feature containing good blocky sands, which correlate well to observations from both Bøyla and Caterpillar discoveries with respect to the far stack response. In Fig. 3.4 a time map and different amplitude maps are shown zoomed in at the Lyderhorn prospect. The far offset brightning is believed to be due to HC filled good quality sands, but it is only in southern parts of Lyderhorn Prospect, this gives small non-ecominical volumes. Reservoir presence and quality is also a main critical factor for the Lyderhorn prospect. Hermod reservoir is proven in the nearby 24/12-4 and 24/9-10S wells. The Bøyla (24/9-9S, -B and -A, see Fig. 3.5) and Caterpillar wells (24/9-10S and -A) shows good reservoir quality in bright amplitude areas as similar to the bright southern parts of Lyderhorn. Within the bright amplitude area the expectations of good reservoir quality is good, but poor Hermod development as in 24/12-4 (see Fig. 3.6) might cover most of the prospect. The amplitude anomalies are compared to newly drilled Marihøne B which was dry. The well confirmed that lack of amplitudes means water filled sand.

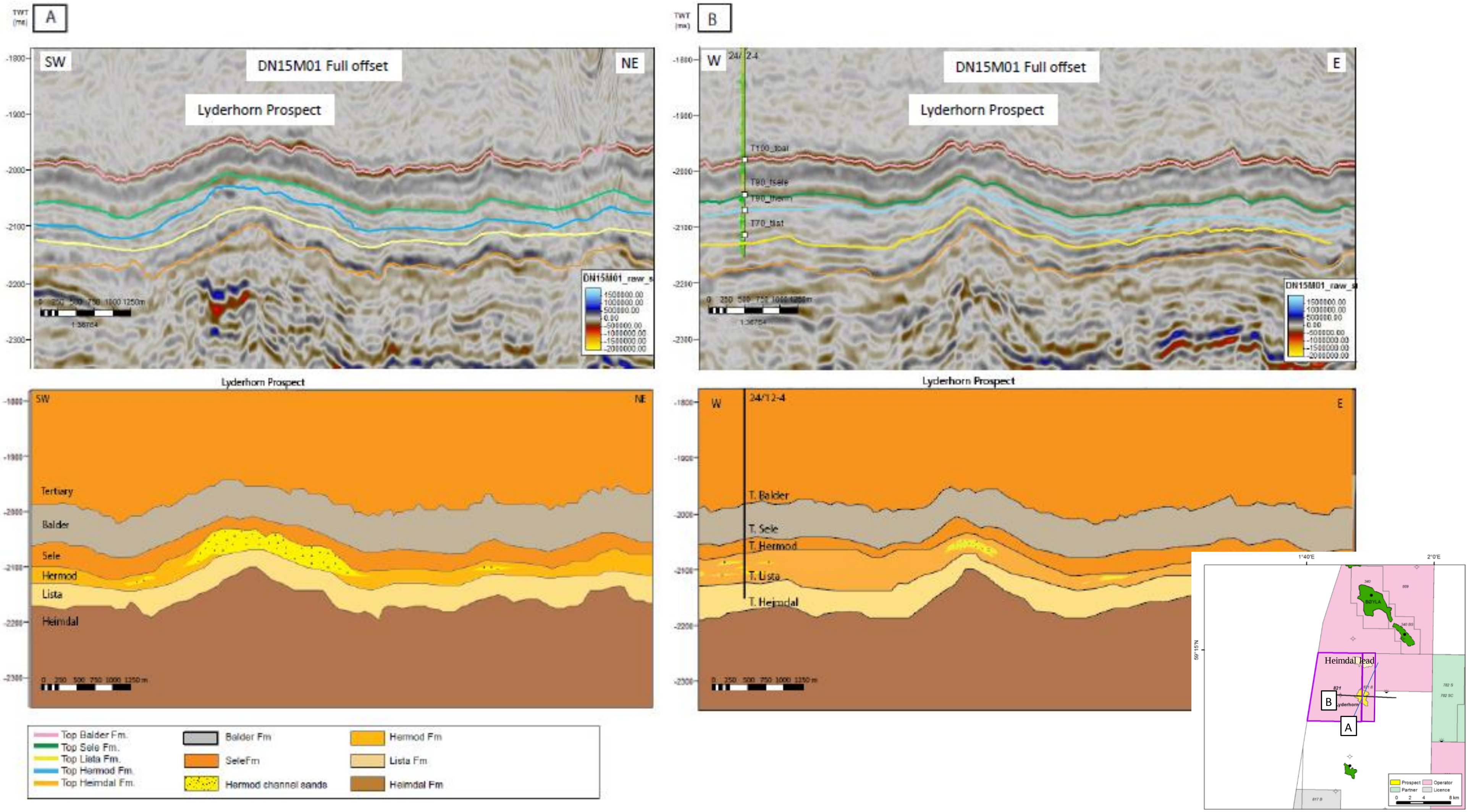

Fig. 3.2 Seismic profiles through the Lyderhorn Prospect *For line location, see W-E and SW-NE lines on small index map. A: SW-NE seismic line through the prospect with Hermod channel sands as main target. B:W-E sesmic line through the prospect with Hermod channel sands as main target*

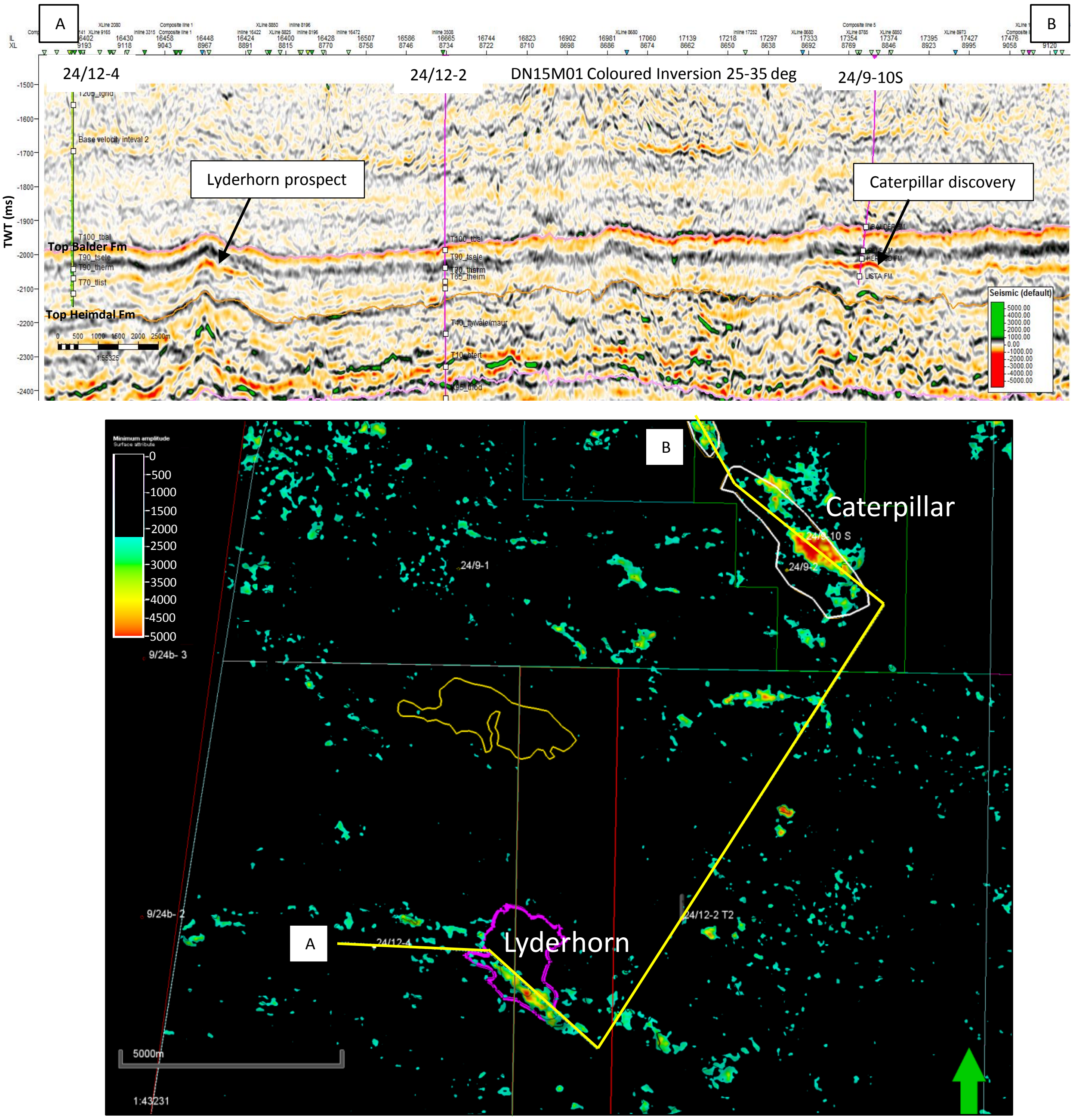

Fig. 3.3 Composite line *The line from Lyderhorn Prospect to Caterpillar Discovery shows a good correlation of the observed far offset bright anomaly for the discovery and the prospect. Amplitude map shows minimum amplitude (+/-12ms window on top Hermod map) on DN15M01 25-35 degrees (far). Low negative values are filtered out. Far offset brightening is believed to be due to HC filled good quality sands.*

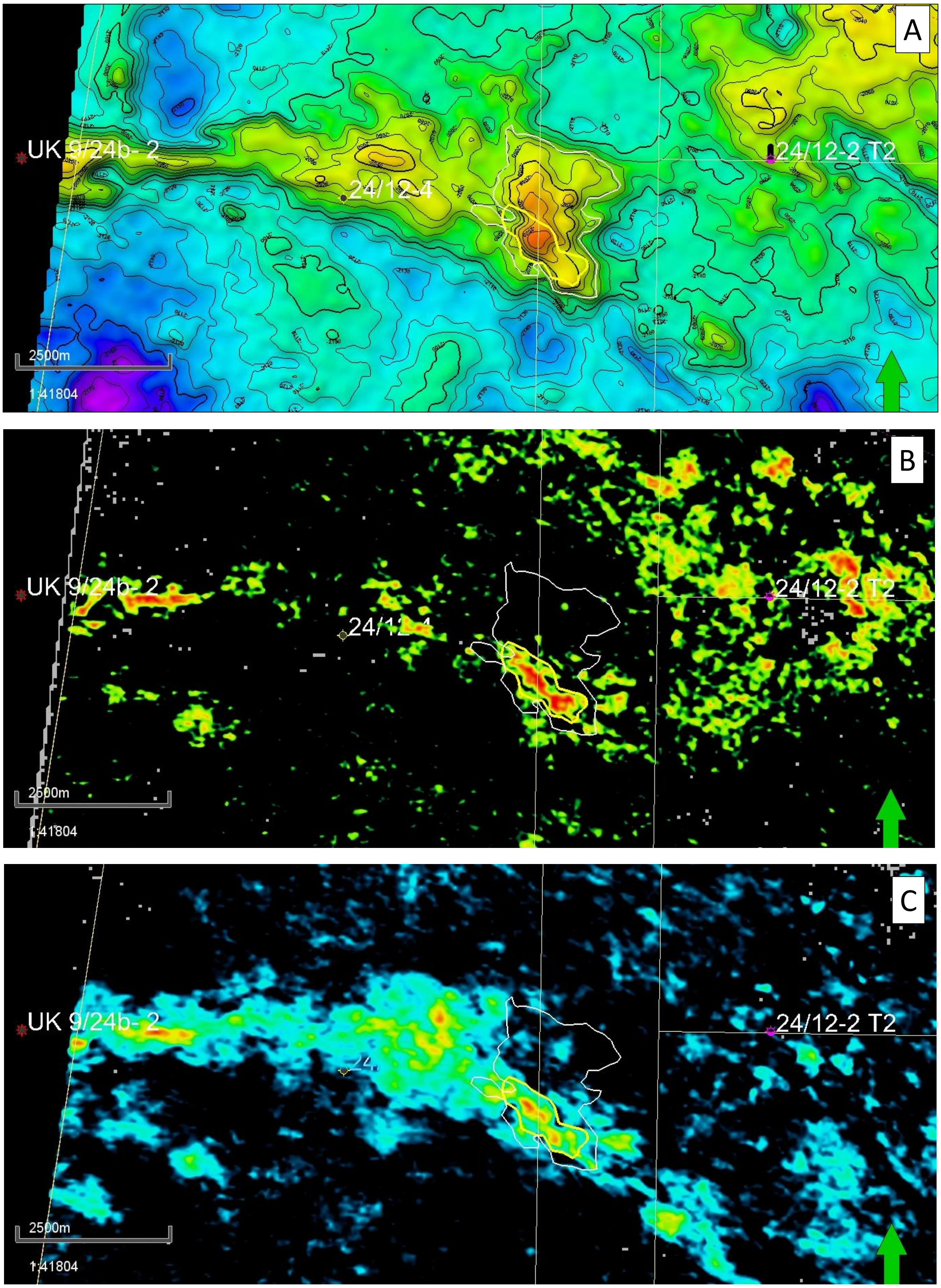

Fig. 3.4 Time map and amplitude maps at the Lyderhorn prospect *A= time map, B= Sum of negative amplitudes on 25-35deg CI within window: 15 ms above 20 ms below, C= Sum of negative amplitudes on 35-50 deg CI with window: 5 ms above 50 ms below*

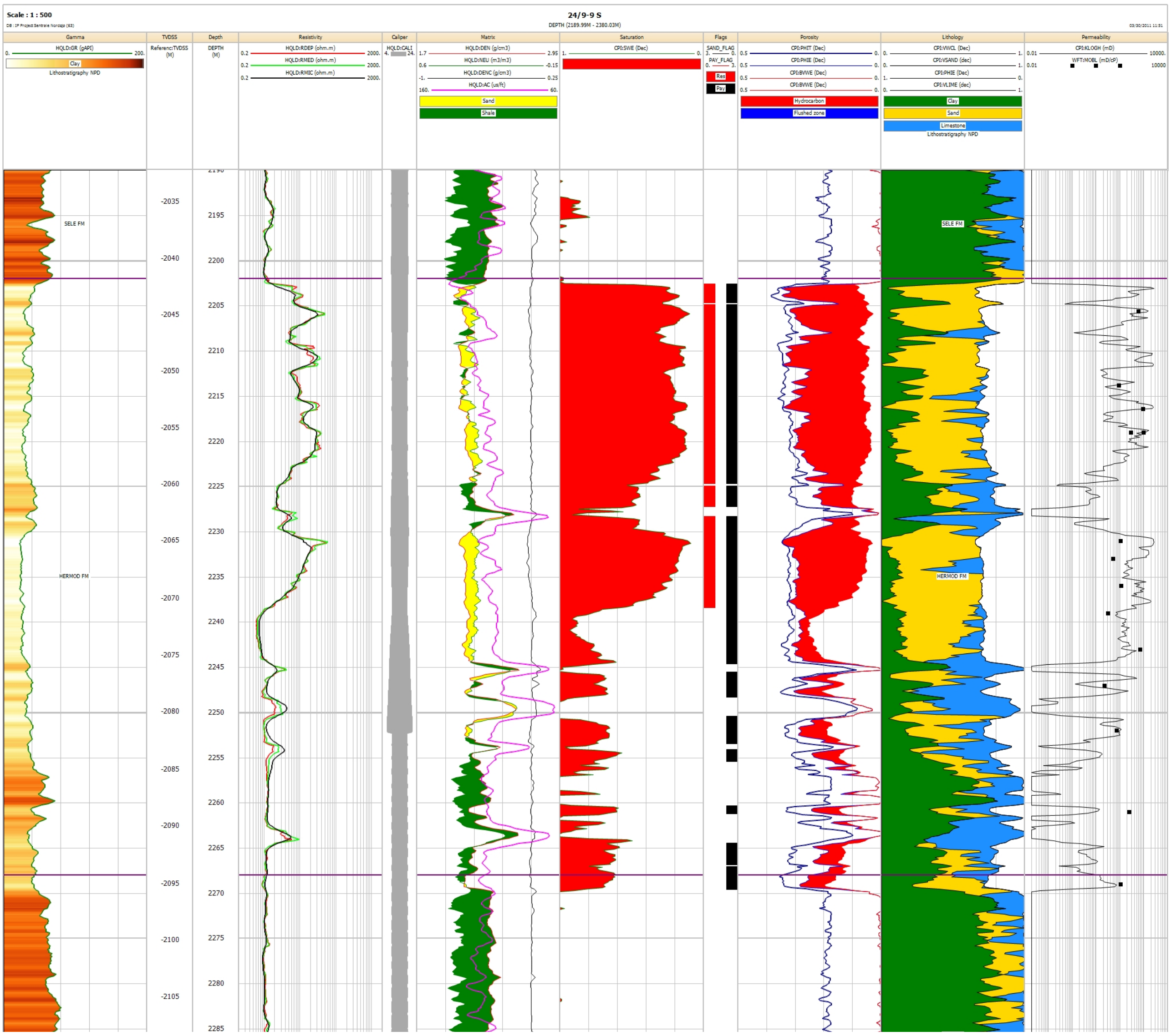

Fig. 3.5 CPI well 24/9-9S *The CPI of 24/9-9S shows good reservoir properties of the Hermod sand. In this well there is 41,5 net sand with average porosity of 27 %.*

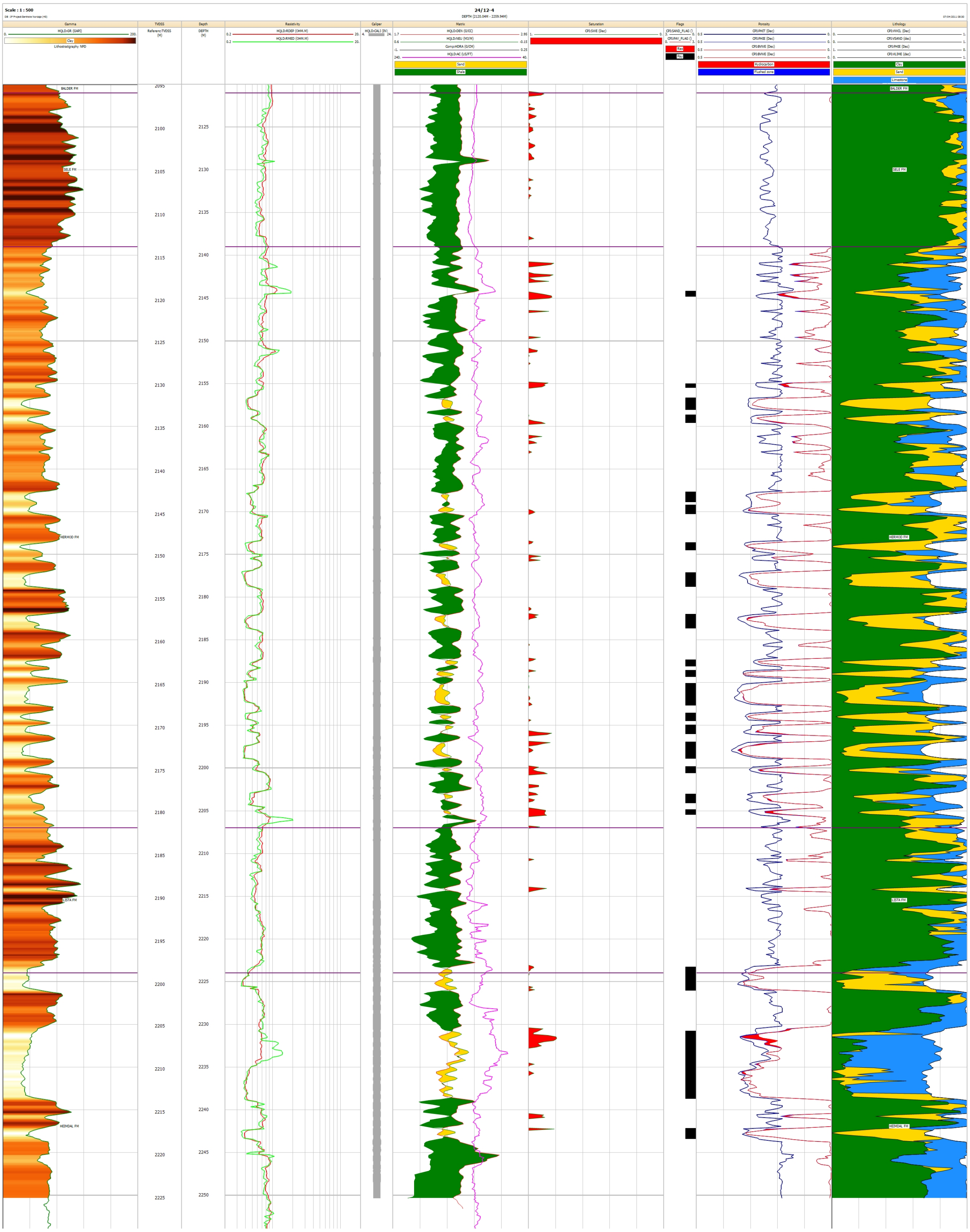

Fig. 3.6 CPI well 24/12-4 *The CPI of 24/12-4 shows several thin Hermod sand with good reservoir properties*

3.2 Heimdal Lead

In the PL821/821B license it is earlier observed a Heimdal lead, 4-way closure, see Fig. 3.7 and Fig. 3.8, but newer interpretations shows no AVO response in the Heimdal lead.

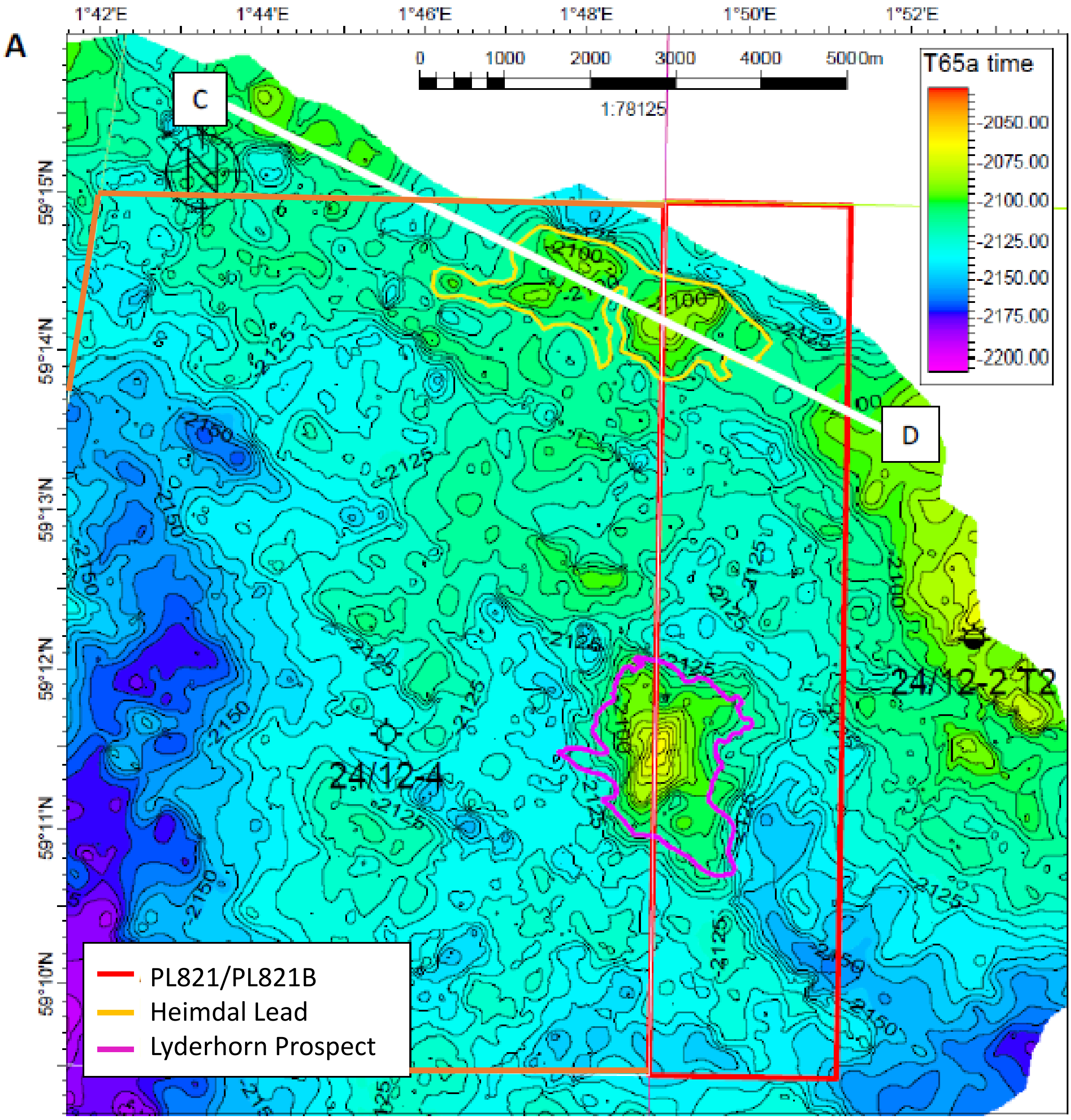

Fig. 3.7 Heimdal Lead on Top Heimdal map (time)

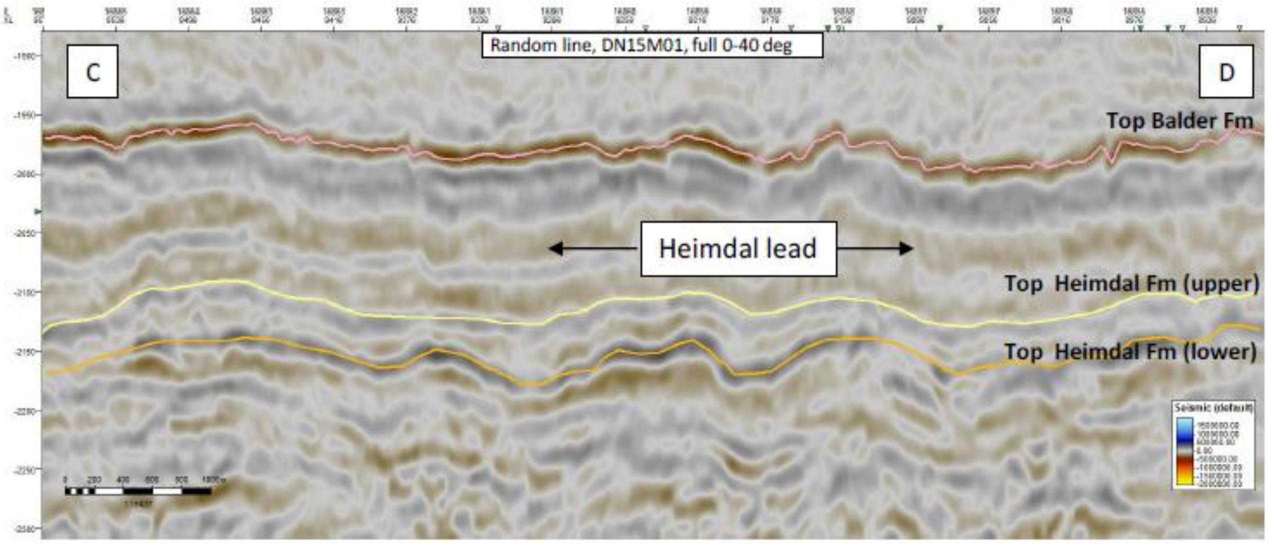

Fig. 3.8 Heimdal lead *Seismic line through lead*

4 CONCLUSION

The PL821/821B has one prospect, Lyderhorn. This is a 4 way closure with far offset brightning in southern parts of the closure. The anomaly shows good correlation with Caterpillar discovery and Bøyla field. The brightning is believed to be due to hydrocarbon filled good quality sands. However hydrocarbons are likely only within the anomaly area in southern parts of the prospect, these volumes are below minimum economical field size and it is not interesting to make a positive drill decision. The volumes are shown in table Table 4.1.

Table 4.1 Lyderhorn volumes

PL821/821B					**GROSS RECOVERABLE RESERVES/RESOURCES**					
					Low		**Base**		**High**	
CATEGORY	**RESERVOIR LEVEL**	**HC**	**RF (%)**	**POS (%)**	**Oil (MSm^3)**	**Gas (GSm^3)**	**Oil (MSm^3)**	**Gas (GSm^3)**	**Oil (MSm^3)**	**Gas (GSm^3)**
PROSPECTS										
Lyderhorn, case: 4-way	Hermod/Paleocene	oil	34	40	1,24	0,15	1,92	0,24	2,69	0,34
Lyderhorn, case: best amplitude area	Hermod/Paleocene	oil	34	40	0,5	0,06	0,73	0,09	0,97	0,13
LEADS										
Heimdal Lead	Heimdal/Paleocene	oil								

5 REFERENCES

Partyka et al. (1999): Interpretational applications of spectral decomposition in reservoir characterization, The Leading Edge, Vol.18, 353- 360.