

Relinquishment Report PL736S

Table of Contents

1 INTRODUCTION	1
1.1 License Owners	1
1.2 Award and Work Program	1
1.3 Identified Prospectivity	1
2 DATABASE	3
2.1 Seismic Database	3
2.1.1 Seismic reprocessing	3
2.2 Well Data	4
2.3 Special Studies	5
3 REMAINING PROSPECTIVITY	6
3.1 Ty Øst & Sørøst	6
3.2 Firfisle	10
4 CONCLUSION	15
5 REFERENCES	16

List of Figures

1.1 License area and main structural elements.....	1
1.2 Prospect overview	2
2.1 Seismic data coverage DN15M01	4
3.1 Top Våle Fm Depth Structure Map	6
3.2 DN15M01 Seismic Crossline 8544.....	7
3.3 DN15M01 Seismic Crossline 8224.....	7
3.4 Tectonostratigraphic summary.	8
3.5 Stratigraphic cross-section 1	9
3.6 Stratigraphic cross-section 2	9
3.7 RGB Top Heimdal Fm.....	11
3.8 Top Heimdal Depth Structure Map.....	12
3.9 Top Heimdal Depth Map with closure and fan from RGB map plotted on.....	13
3.10 Seismic composite line, far data.	14
4.1 Resource potential	15

List of Tables

2.1 Historic seismic database	3
2.2 Seismic database	3
2.3 Well database.....	5

1 INTRODUCTION

1.1 License Owners

- Aker BP ASA (65%), Operator
- ConocoPhillips (20%)
- Lundin (15%)

1.2 Award and Work Program

The license was awarded on 7th February 2014 for an initial period of 8 years following the APA Licensing Round 2013, with a Drill or Drop decision within three years. The initial partners in the license were Marathon (Op), ConocoPhillips and Lundin. In 2014 Det norske merged with Marathon and become Aker BP which took over operatorship of the license.

License work obligations included the following:

- 3D seismic reprocessing within 3 years

The initial work obligations have been fulfilled, and approved within the appointed deadlines.

1.3 Identified Prospectivity

PL736S is situated in southern parts of Heimdal High against the Vana Sub-basin and cover parts of block 25/7 (See Fig. 1.1). The license is located between the Volund and Jotun fields, and just south-east of the Gekko discovery.

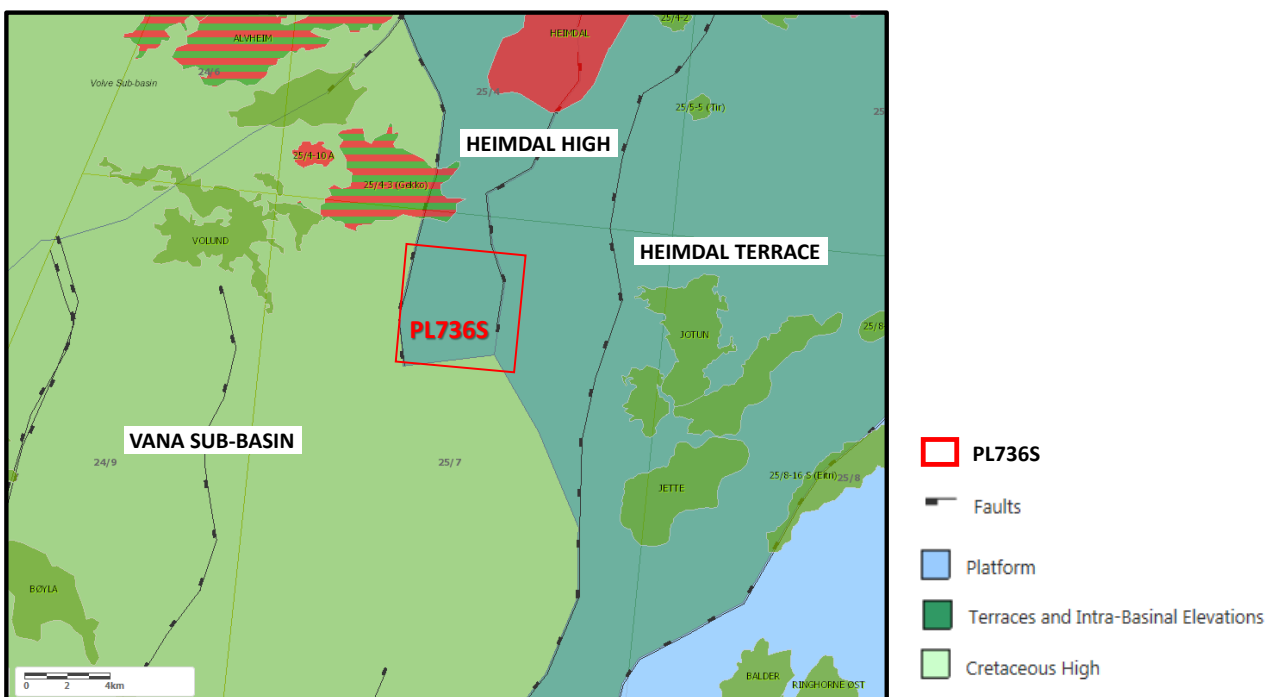


Fig. 1.1 License area and main structural elements

3 prospects are identified within the PL736S acreage. The main prospects are Ty Øst and Sørøst with postulated Ty reservoir. Additionally a Heimdal lead called Firfisle is identified. These prospects are seen in Fig. 1.2

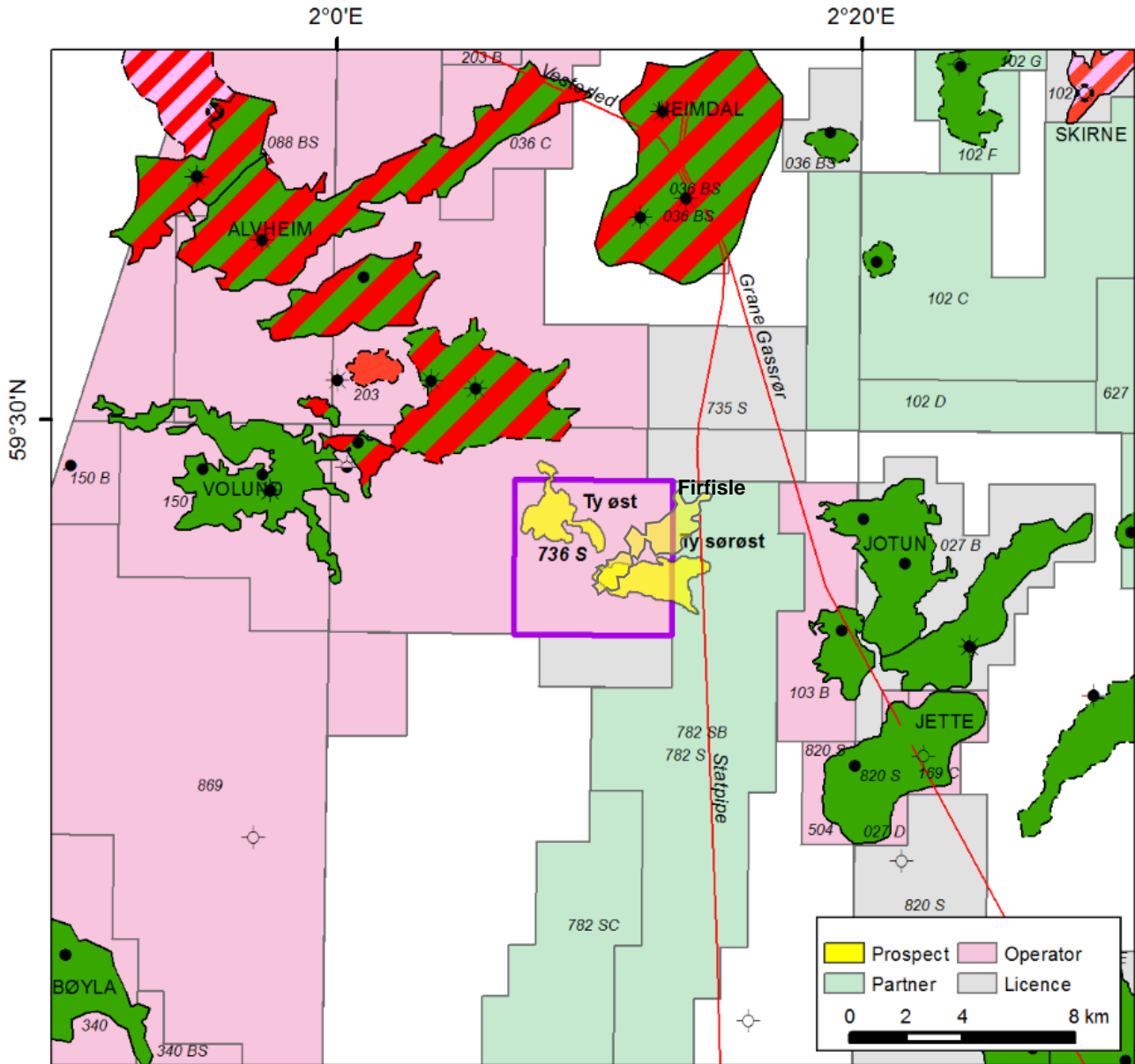


Fig. 1.2 Prospect overview

2 DATABASE

2.1 Seismic Database

Several seismic datasets have been used in the evaluation of the PL736S area. The NH9603 survey was reprocessed by PL203 in 2007 and 2009 and was the primary survey defining the Ty prospects in the 2013 APA application. The second survey used in the 2013 APA application was the PGS MC3D-NVG10M Geostreamer™ survey which was aquired during 2009 & 2010 and reprocessed by PL203 in 2013 (CGG reprocessing). The final geophysical evaluation of PL736S was done on the 2015 reprocessing and merge of the NH9603 and PGS MC3D Geostreamer surveys (PGS reprocessing).

Table 2.1 Historic seismic database

3D Survey	Operator / Origin	Vintage	Area (km ²)
NH9603	Marathon PSTM reprocessing (2009)	1996	1450
MC3D-NVG10M	PGS Geophysical AS / PSTM processing (2010)	2010	1350
MC3D-NVG10M	CGG PSDM reprocessing (2013)	2010	520
DN15M01 (merge of surveys NH9603 and MC3D-NVG09/-NVG10/-NVG11/-SVG11/-BYL2013/-Q16)	PGS PSDM reprocessing (2015)	1996-2013	3221

2.1.1 Seismic reprocessing

License work obligations included the following: 3D seismic reprocessing within 3 years. This was fulfilled by the newly 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 2.2 and shown in Fig. 2.1

Table 2.2 Seismic database

3D Seismic survey	Survey type	Year	Offset data	Comment
DN15M01	PSDM Reprocessed 3D	2015	x	Detnor reprocessing including MC3D-NVG09/10/11, MC3D-SVG11, MC3D-BYL2013, MV3D-Q16203 and NH9603

Table 2.3 Well database

Well name	Operator	Type	Spud/well	Status	TD (MDm)
24/9-5	Fina Production Licenses AS	Exploration	07.12.1993	P&A	2860
25/7-5	Norsk Hydro Produksjon AS	Exploration	16.07.1997	P&A	2736
25/4-3	Elf Petroleum Norge AS	Exploration	13.10.1974	P&A	2714
25/4-4	Elf Petroleum Norge AS	Exploration	16.05.1975	P&A	2681
25/4-5	Elf Petroleum Norge AS	Exploration	26.06.1980	P&A	4355
25/8-6	Esso Exploration and Production Norway A/S	Exploration	19.05.1995	P&A	2577
25/8-13	Esso Exploration and Production Norway A/S	Exploration	31.10.2001	P&A	2276
25/7-2	Conoco Norway Inc.	Exploration	08.02.1990	P&A	4850

2.3 Special Studies

The final DN15M01 seismic datasets were delivered from PGS in April 2016. Further in-house conditioning and analysis of the seismic datasets included: denoise, spectral enhancement (full stack), spectral shaping (near, mid, far & ultra far), variable time adjustment (near, mid, far & ultra far), coloured inversion of all stacks, intercept & gradient stacks and coloured inversion of these, extended elastic impedance and spectral decomposition (RGB).

A research study by OGS (OpenGeoSolutions) was also initiated on the DN15M01 seismic with a November 2016 delivery of spectral inversion, spectral discontinuity and curvature attributes. Norsk Regnesentral is also doing a pre-stack Bayesian inversion to get a robust coupling to the rock physics model.

3 REMAINING PROSPECTIVITY

3.1 Ty Øst & Sørøst

The Ty Øst and Sørøst prospects are located within the PL736S license, see Fig. 3.1, Fig. 3.2 and Fig. 3.3, both are identified as low relief 4-way structural closures generated by a combination of differential compaction and structural movements. They depend on a clean and unbroken overlying Våle shale for seal. No direct, relevant analogue exists for the Ty Øst & Sørøst prospects where the potential reservoir is overlain by a thick section of Heimdal Fm sandstone. The Paleocene shales are not generally considered to be good seals as hydrocarbons normally occur only in the shallowest reservoir unit in any well.

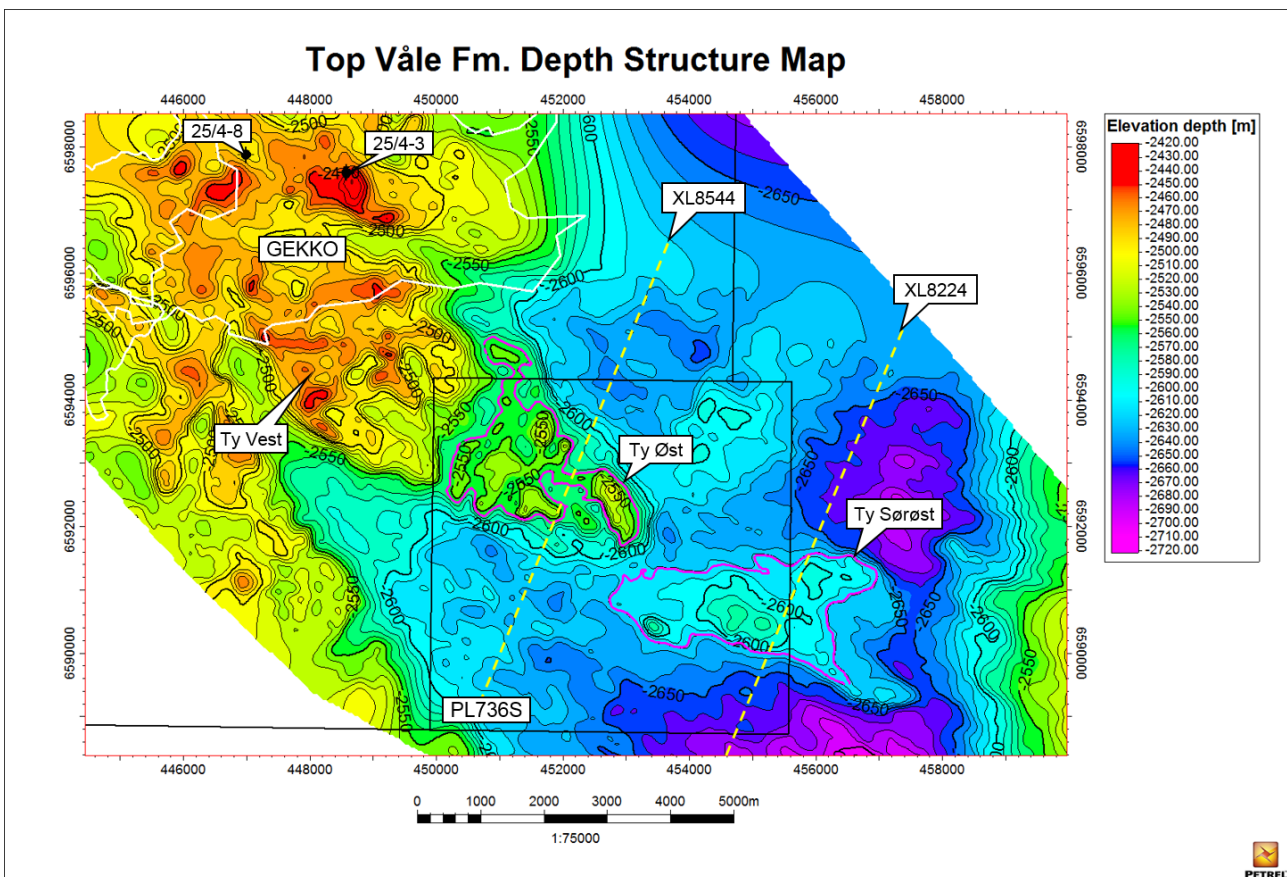


Fig. 3.1 Top Våle Fm Depth Structure Map

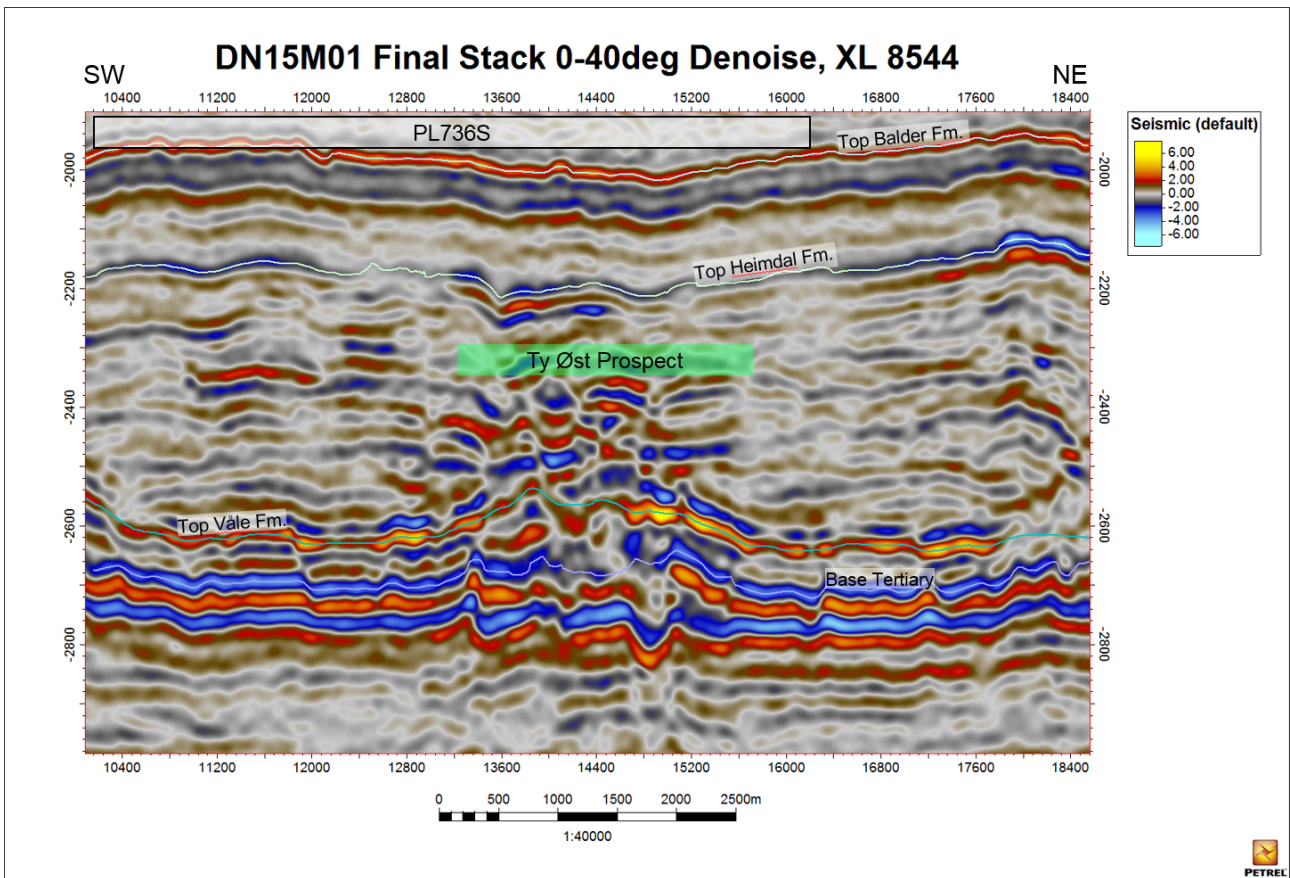


Fig. 3.2 DN15M01 Seismic Crossline 8544

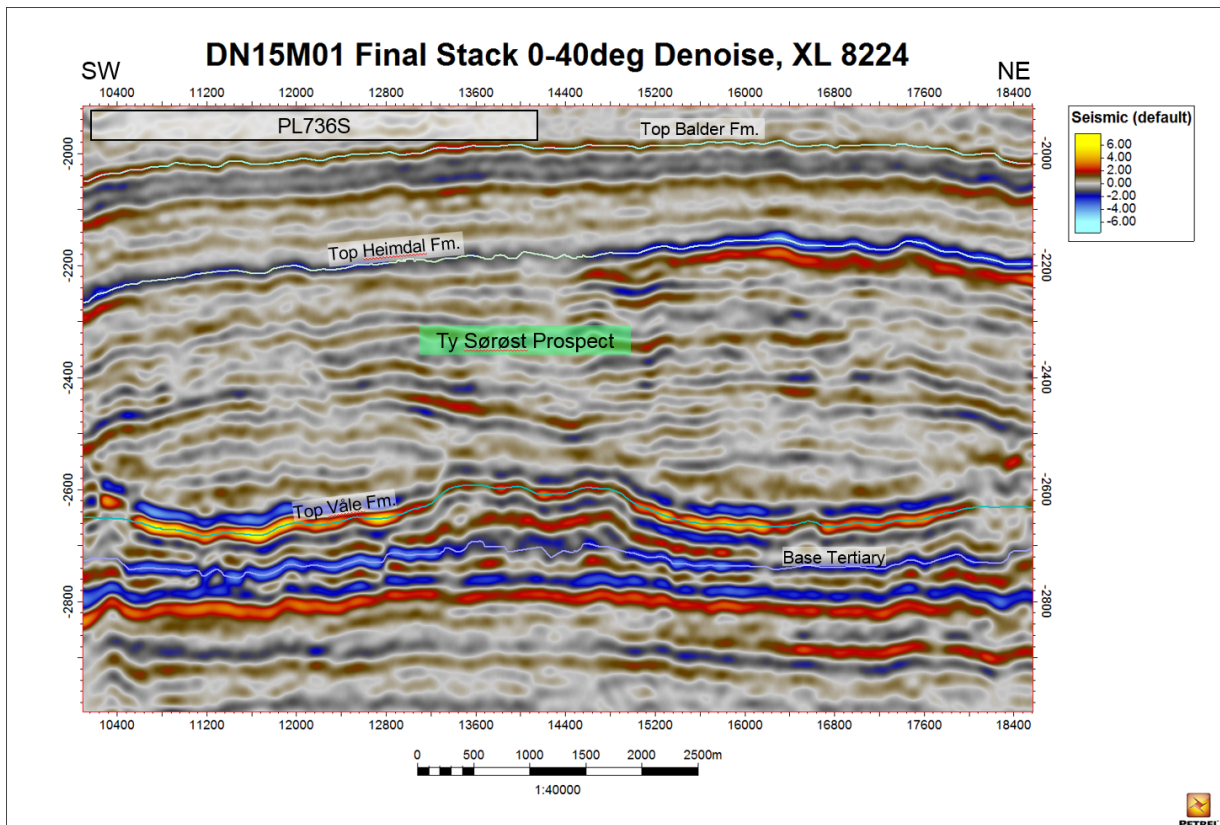


Fig. 3.3 DN15M01 Seismic Crossline 8224

The reservoir section for the Ty prospects are the Ty/Maureen Fm sandstone of Danian to Selandian age in the older Stages of the Paleocene Epoch, see Fig. 3.4. The Ty Fm is a thick unit of high quality reservoir sand in the Greater Alvheim area varying from less than hundred meters to several hundred meters (Fig. 3.5, Fig. 3.6). Key wells in the study area are 25/4-3 (Gekko) and 25/7-5 (Kobra), Fig. 3.5.

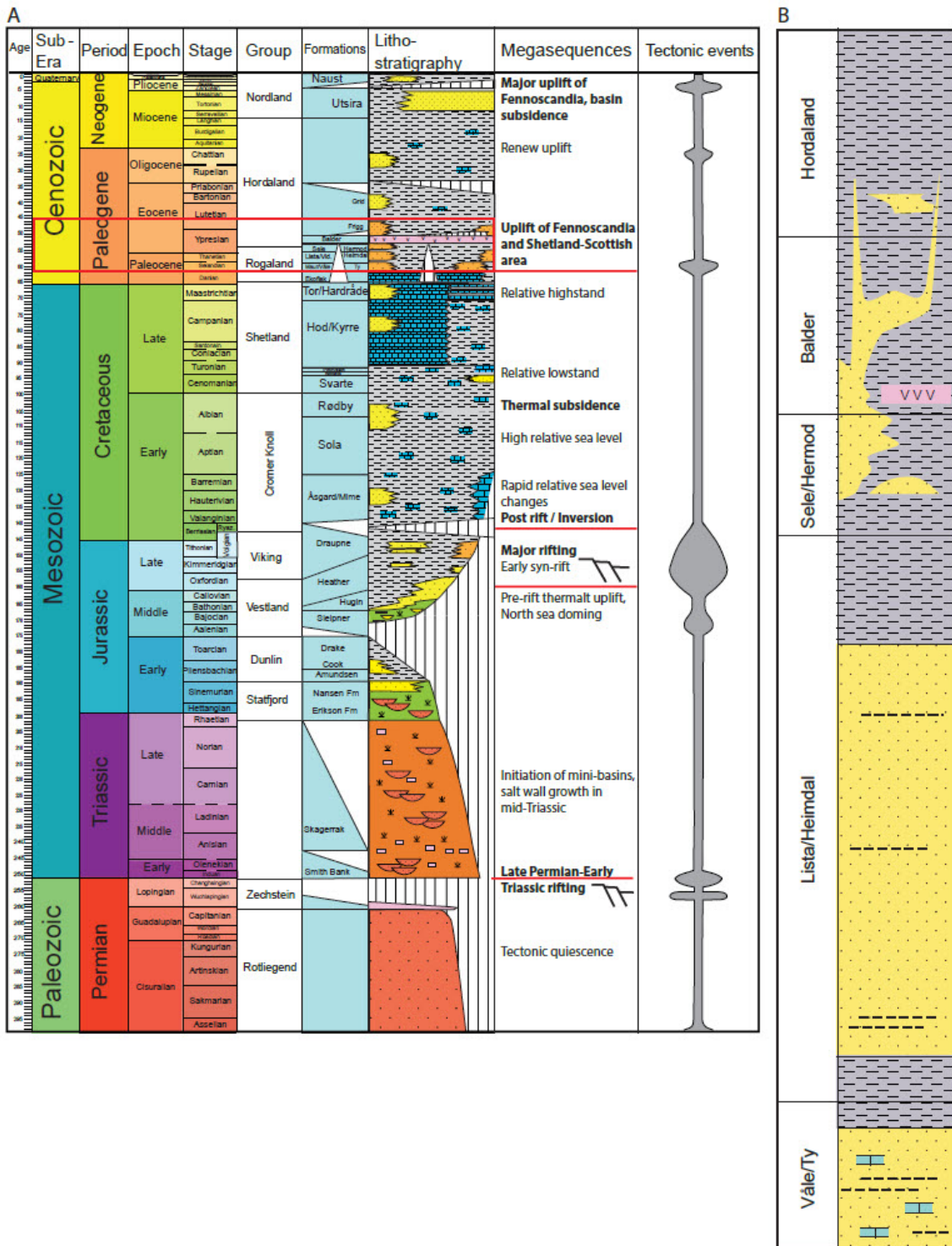


Fig. 3.4 Tectonostratigraphic summary. A) Chronostratigraphy from Gradstein et al. (2004). Lithostratigraphy modified from Deegan and Scull (1977). Tectonostratigraphy modified from Coward et al. (2003). B) Detailed lithostratigraphic section of main play: Ty/Maureen sandstones in Paleocene

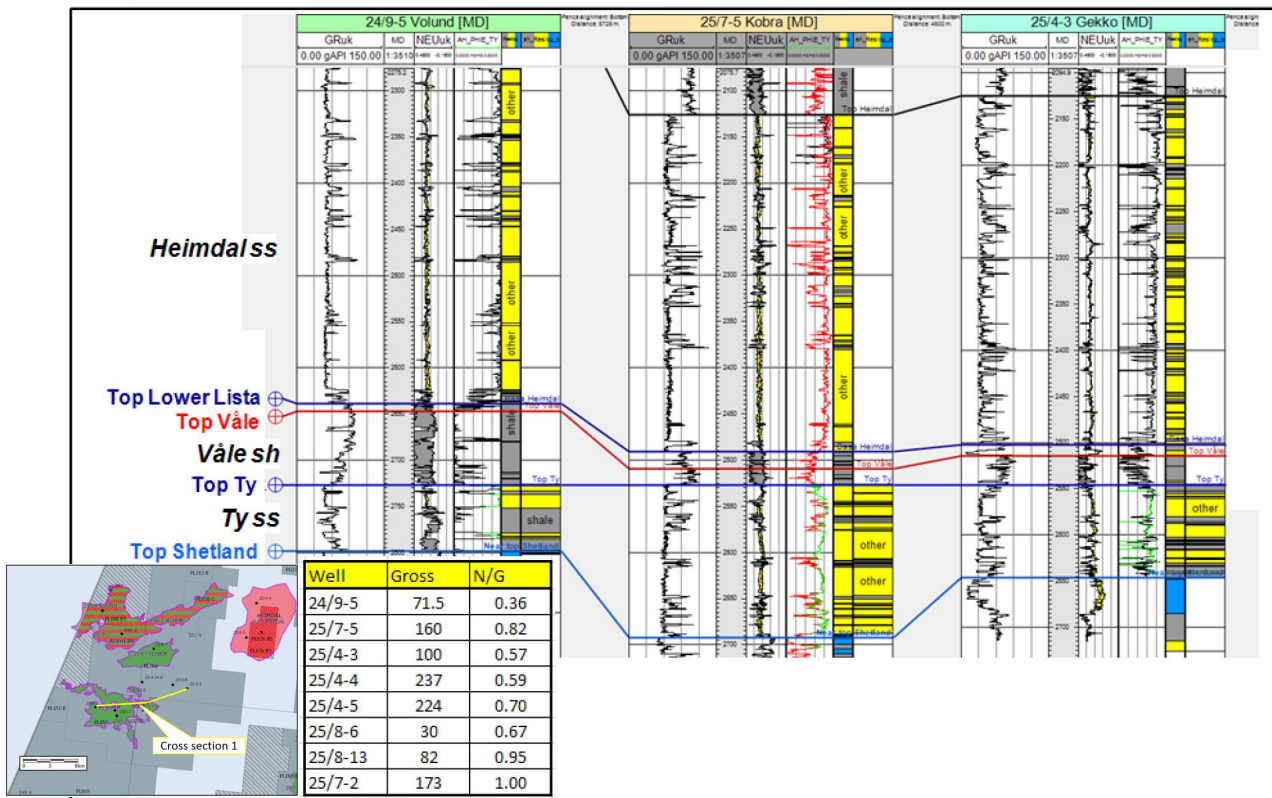


Fig. 3.5 Stratigraphic cross-section 1

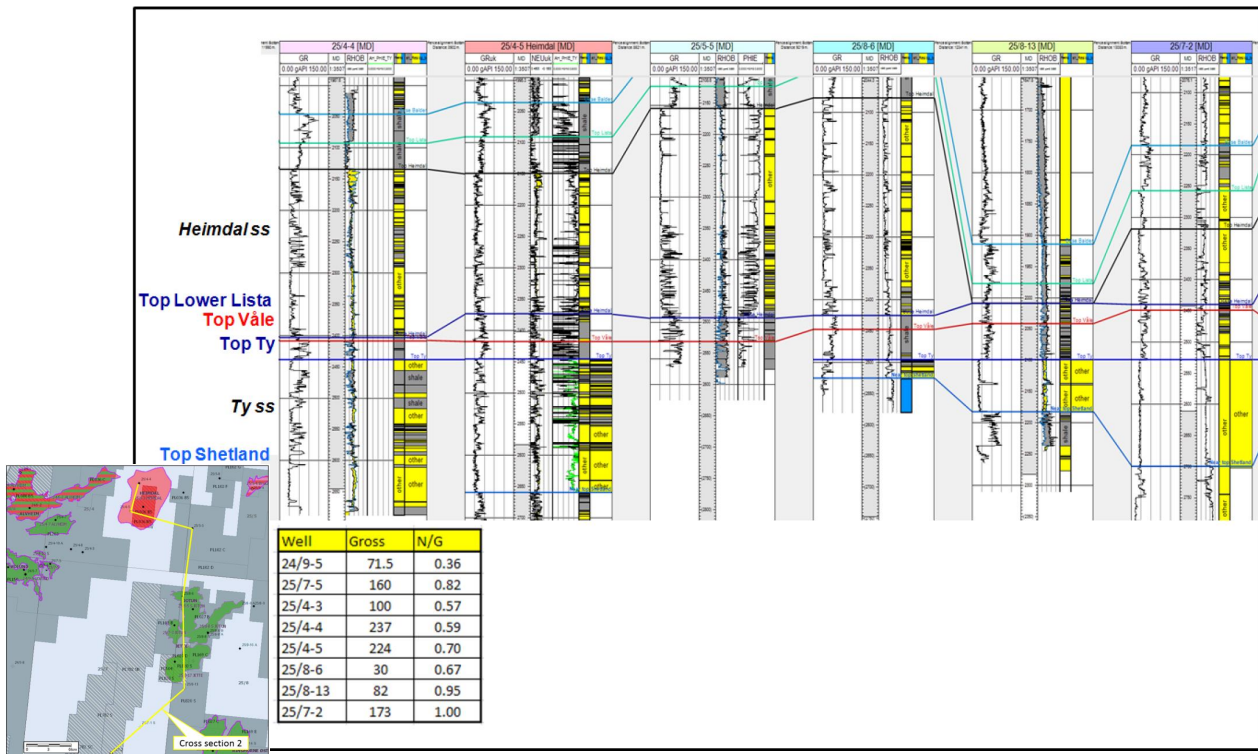


Fig. 3.6 Stratigraphic cross-section 2

The seismic interpretation of the top Våle Fm is uncertain and rock physics modelling indicate limited expected AVO response from potential hydrocarbon-filled Ty Fm sands (as indicated in the APA 2013 application). The DN15M01 PSDM reprocessing has improved the imaging of top Våle

Fm in the PL736S area, indicating less structural mounding of the Ty Fm than what was interpreted on datasets available in 2013. Remaining seismic disturbance on the DN15M01 datasets within the Våle/Ty and lower Lista/Heimdal formations are likely an effect of fluid migration and/or structural remobilisation. The seismic interpretation on the DN15M01 datasets define two low-relief 4-way structural closures at top Våle Fm level with limited volume potential. The DN15M01 mapping also indicate that the 25/4-3 well penetrated wet Ty Fm sand within a mapped top Våle Fm 4-way structural closure.

3.2 Firfisle

A small Heimdal Fm Prospect is defined in the license, the prospect is called Firfisle and is a 4-way structural closure. Most of it lies within the PL736S license, but it also stretches into PL782 SB, see Fig. 3.9.

The Firfisle Prospect consists of the npc-1 play with deep marine sandstones of the Heimdal Fm. The Paleocene deep-marine sandstone play is very well established in this area, and the play is proven in the area through several discoveries and producing fields (Alvheim, Gekko, Vilje, Heimdal, Jotun, Jette). The Heimdal Fm (Selandian-Thanetian) follows the deposition of the Ty Fm system and represents the second phase of sub-marine fan deposition in the region. It is dominated by thick units of medium to poorly sorted, fine to coarse grained sandstones, that are often associated with seismic amplitude/amplitude versus offset (AVO) anomalies set up by this very high reservoir quality. The sandstone units are interbedded with grey and black shales, limestones and sandy limestones, but massive, clean, well sorted sandstones also developed.

The deep-water fan deposits of the Heimdal Fm in the greater Alvheim- Heimdal area are sand-rich with excellent reservoir properties. Amalgamation of individual channel lobes has resulted in sheet-like and relatively uniform sandstone bodies covering large areas. These are characterized with high net/gross ratios typically 80-90%, porosity in the mid to high twenties, and permeability up to several Darcies.

RGB maps show a channel/fan at Heimdal level in the PL736S area (see Fig. 3.7) , and a small 4-way closure (see Fig. 3.8 & Fig. 3.9) is observed within PL736S. But no obvious amplitude anomaly or phase shift at Heimdal level (as in Heimdal and Gekko) is seen, see Fig. 3.10 .

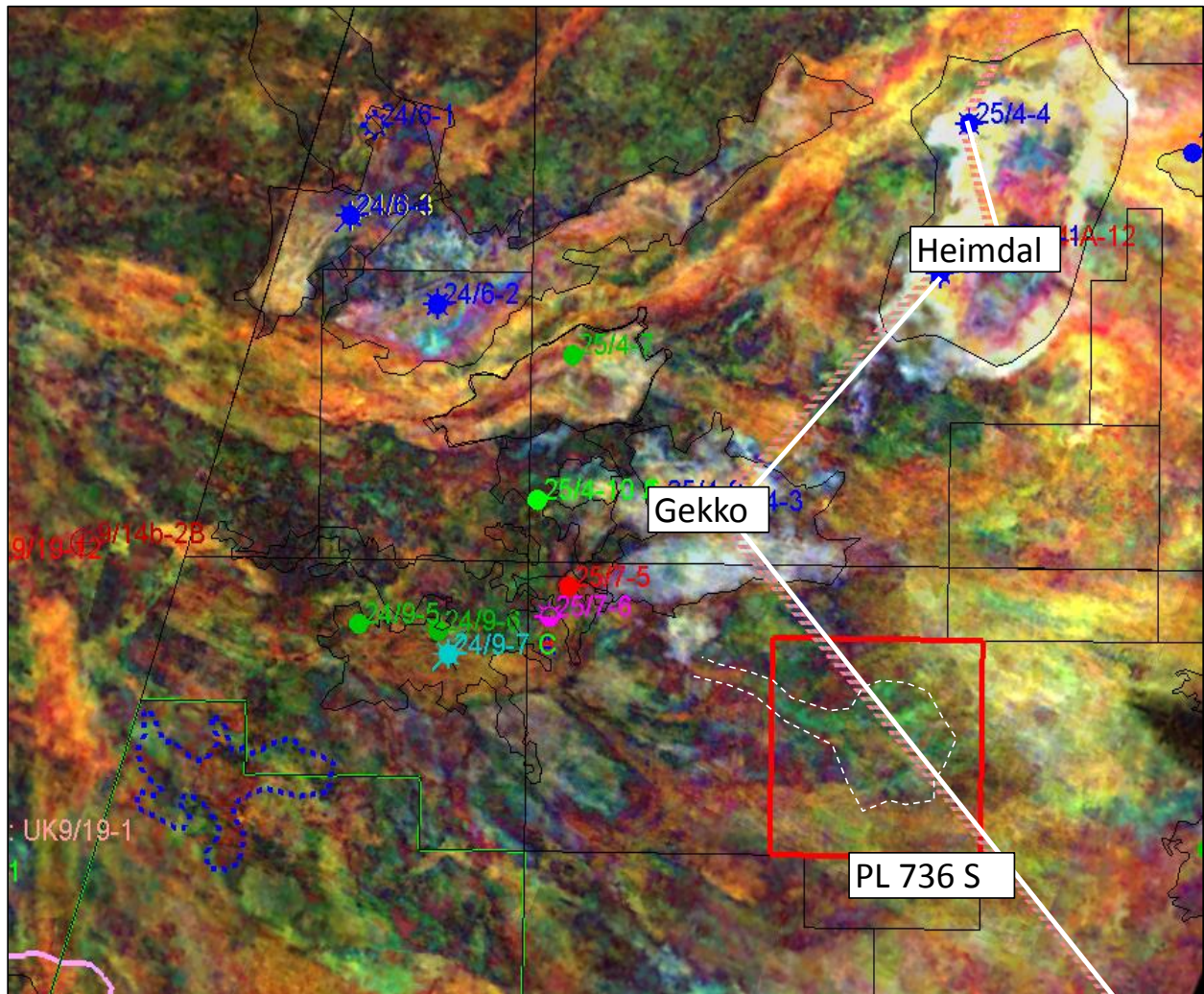


Fig. 3.7 RGB Top Heimdal Fm. The RGB map show a channel/fan at Heimdal level in PL736 S area. A composite line is shown as a bold white line and is referring to Fig. 3.10.

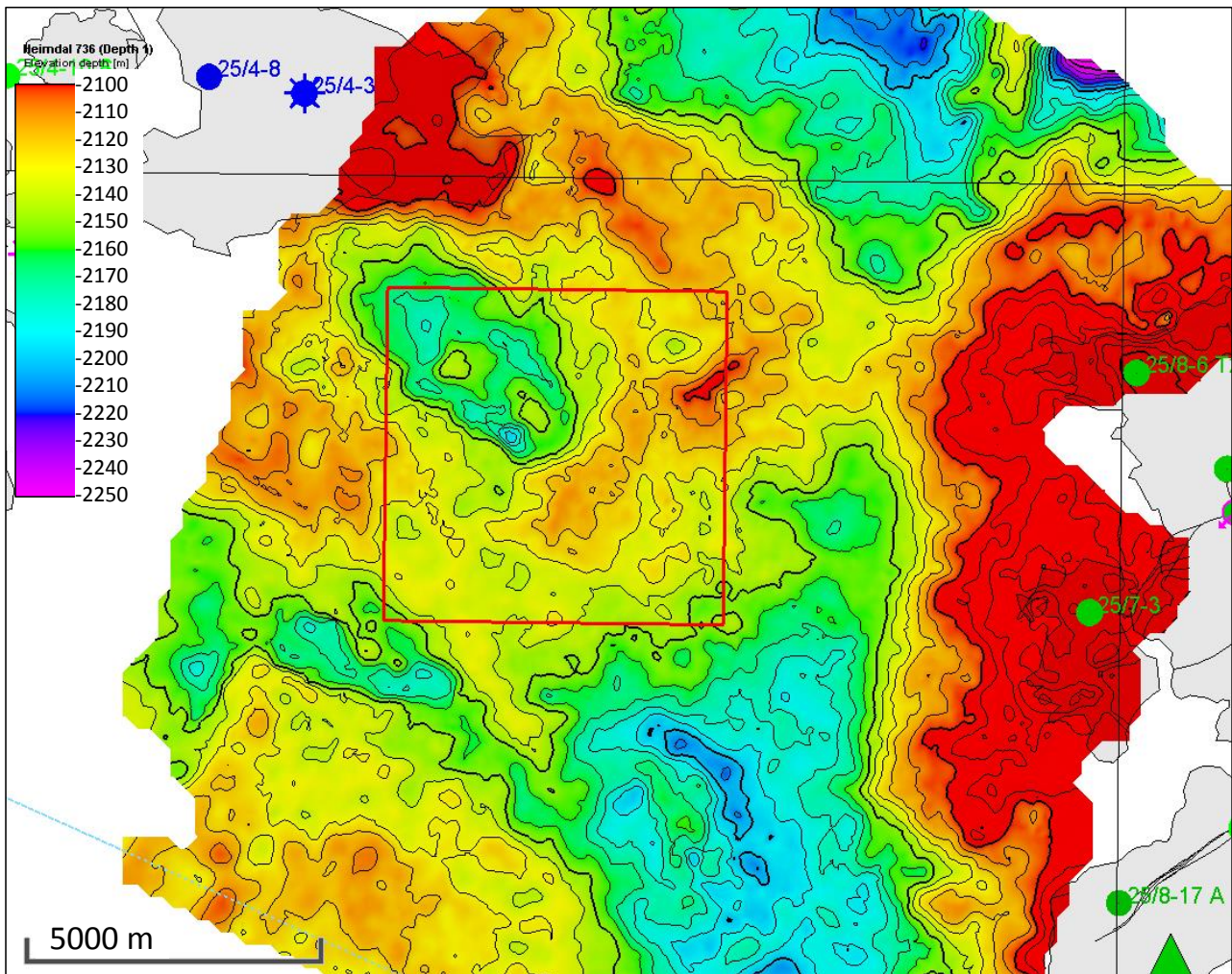


Fig. 3.8 Top Heimdal Depth Structure Map. Apex: 2095 m, spill: 2120 m, area: 4,86 km²

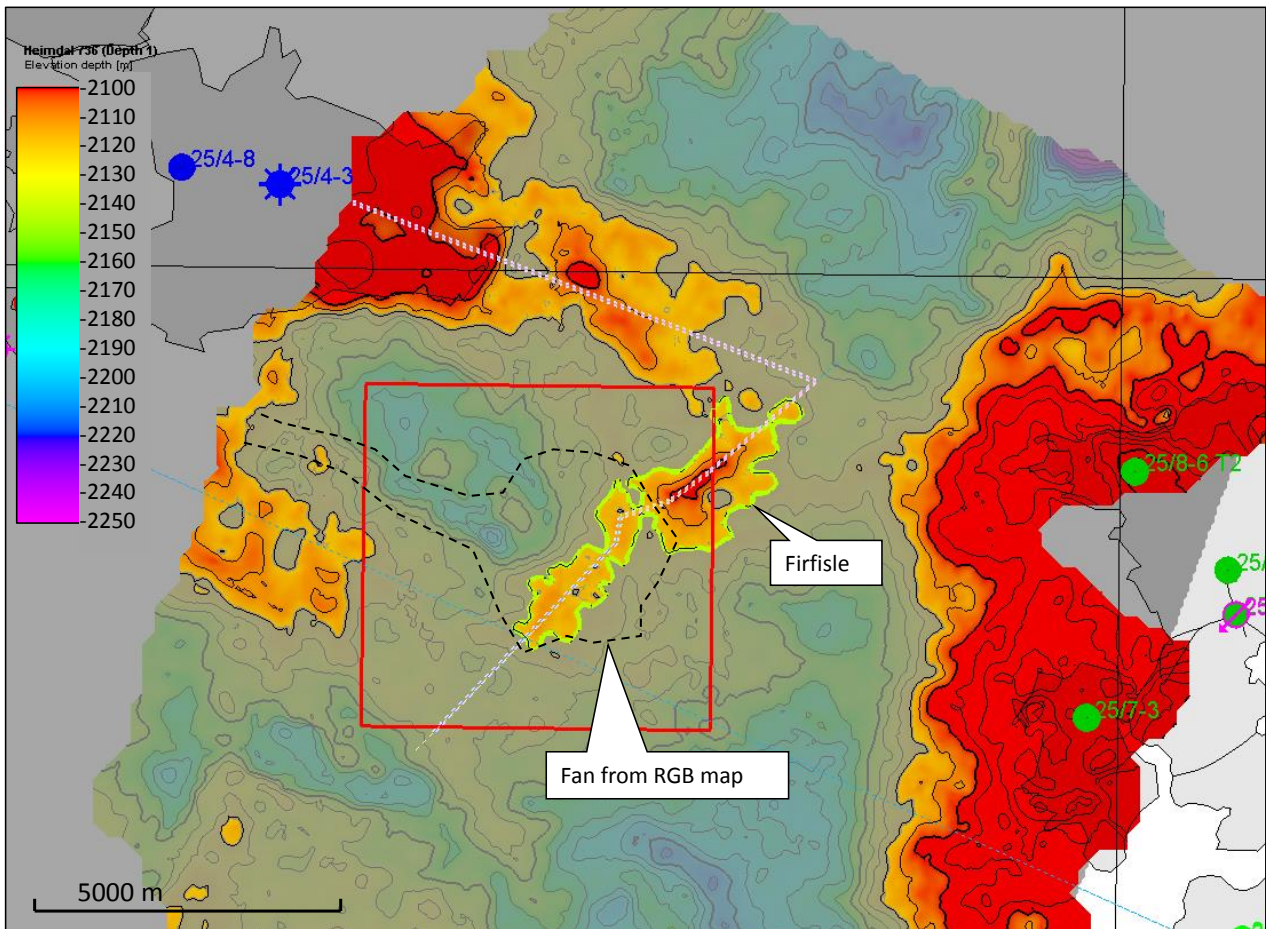


Fig. 3.9 Top Heimdal Depth Map with closure and fan from RGB map plotted on.

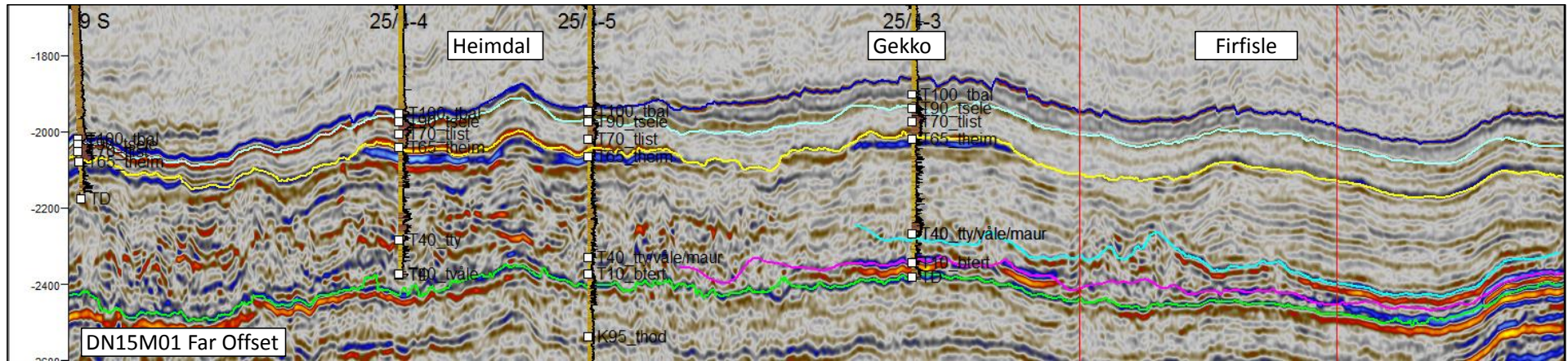


Fig. 3.10 Seismic composite line, far data. Showing comparison of far brightening on Heimdal, Gekko and Firfisle

4 CONCLUSION

There are identified 3 prospects in the PL736S license, but it is considered that the volumes are too small and the COS is too low. It was considered that a positive well result from drilling the appraisal well in Gekko (PL203) into the lower Paleocene Ty Fm would have a major impact on Ty East's potential in the PL736S. As a consequence of this an application for extension was submitted to NPD in November 2016. The application was denied 09.02.2017. With current information, the identified prospects within PL736S, are not considered volumetrically interesting to make a positive drill decision.

PL736S					Resources IN PLACE						Resources RECOVERABLE					
CATEGORY	RESERVOIR LEVEL	HC	RF (%)	POS (%)	Low		Base		High		Low		Base		High	
					Oil (MSm ³)	Gas (GSm ³)	Oil (MSm ³)	Gas (GSm ³)	Oil (MSm ³)	Gas (GSm ³)	Oil (MSm ³)	Gas (GSm ³)	Oil (MSm ³)	Gas (GSm ³)	Oil (MSm ³)	Gas (GSm ³)
PROSPECTS																
Ty Øst	Ty/Lower Paleocene	Oil	23-37-50	12	2.56	0.93	3.45	1.39	4.52	2.03	0.88	0.6	1.26	0.92	1.74	1.35
Ty Sørøst	Ty/Lower Paleocene	Oil	23-37-50	18	3.44	1.22	4.32	1.76	5.34	2.46	1.16	0.79	1.58	1.14	2.08	1.64
Firfisle	Heimdal/Paleocene	Oil	35-40-45	20	0.24	0.02	0.83	0.07	2.63	0.24	0.1	0.01	0.33	0.03	1.06	0.09

Fig. 4.1 Resource potential

5 REFERENCES

APA 2013 Parts of block 25/7, Marathon.

Coward, M.P., Dewey, J., Hempton, M. & Holroyd, J. (2003): Tectonic evolution. In: Evans, D., Graham, C., Armour, A. & Bathurst, P. (eds). The Millennium Atlas: Petroleum Geology of the central and northern North Sea, The Geological Society of London, London, pp. 17-33.

Deegan, C. E., and Scull, B. J. (1977): A standard lithostratigraphic nomenclature for the Central and Northern North Sea. Reports Institute of Geological Sciences. No. 77/25: Bulletin Norwegian Petroleum Directorate 1. Her Majesty's Stationary Office, London

Gradstein, F.M., Ogg, J.G., Smith, A.G., Agterberg, F.P., Bleeker, W., Cooper, R.A., Davydov, V., Gibbard, P., Hinnov, L., House, M.R., Lourens, L., Luterbacher, H.-P., McArthur, J., Mrlchin, M.J., Robb, L.J., Shergold, J., Villeneuve, M., Wardlaw, B.R., Ali, J., Brinkhuis, H., Hilgen, F.J., Hooker, J., Howarth, R.J., Knoll, A.H., Laskar, J., Monechi, S., Powell, J., Plumb, A., Raffi, I. Röhl, U., Sanfilippo, A., Schmitz, B., Shackelton, N.J., Shields, G.A., Strauss, H., Van Dam, J., Veizer, J., van Kolfschoten, Th., Wilson, D. (2004): A Geological Time Scale. pp 500.