Relinquishment Report PL 738

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1 Key license history

Production License 738 was awarded to Tullow Norge AS (60% and operator) and Explora Petroleum AS (40%) after the APA 2013, and became effective on the 7th of February, 2014. The license covers part of block 25/3 (Fig. 1.1) and has a size of 156 km².

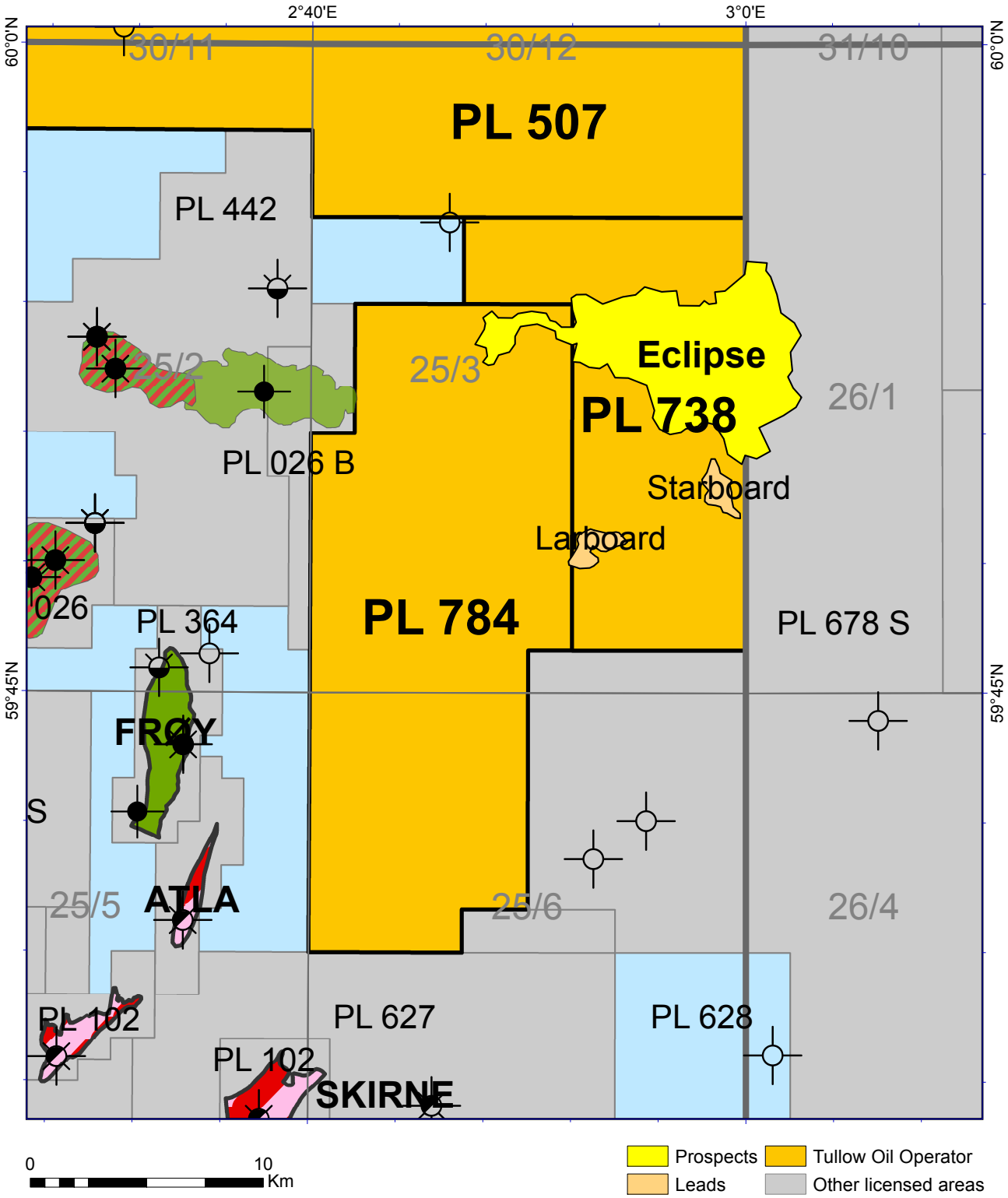

Fig. 1.1 License prospect and leads map. *The Eclipse prospect and the Starboard and Larboard leads.*

The work commitment of the license has been fulfilled by reprocessing existing 3D Seismic data and to perform relevant geological and geophysical studies prior to a DoD decision, 7th of February, 2016.

One prospect was identified in the submittet application in 2013, with two smaller leads. Both prospect and leads were defined in the Paleocene Hermod Formation play. The prospect, Eclipse, was analogue to the planned Lupus prospect (in PL507) which was under planning during the application phase. The result from the Lupus well had a strong impact on the evaluation of PL738.

Three formal MC/EC meetings have been held in the license, and one EC work meeting. Minutes and/or presentations from the meetings are found on L2S.

The license reprocessed 3D seismic data (TUN15M02) in the summer of 2015, to fully cover the license area and the identified prospectivity. Based on the new data, the license group has performed geological and extensive geophysical analysis to evaluate the prospectivity and commercial potential of the license acreage.

Based on the reprocessed 3D seismic data and the studies of the exploration potential in the identified prospectivity, the licence has concluded that the probability of proving commercial quantities of hydrocarbons is too low to justify a decision to drill an exploration well.

A uniform decision to relinquish the licence was taken by the Management Committee, and the Ministry of petroleum and Energy was notified by letter dated 05.01.2016

2 Database

Seismic database

The work commitment for PL783 was to acquire 3D seismic coverage of the licence. In the summer of 2015 the licence group gathers multiple public 3D surveys (18 in total) and reprocessed them as one single survey, TUN15M02 (Fig. 2.1). Prior to this merge being finished, the G&G work was done on the background vintage data, and when the TUN15M02 survey was ready, all the G&G work was confirmed on this dataset. The license database also includes Amplitude Inversion volume derived from the TUN15M02 survey .

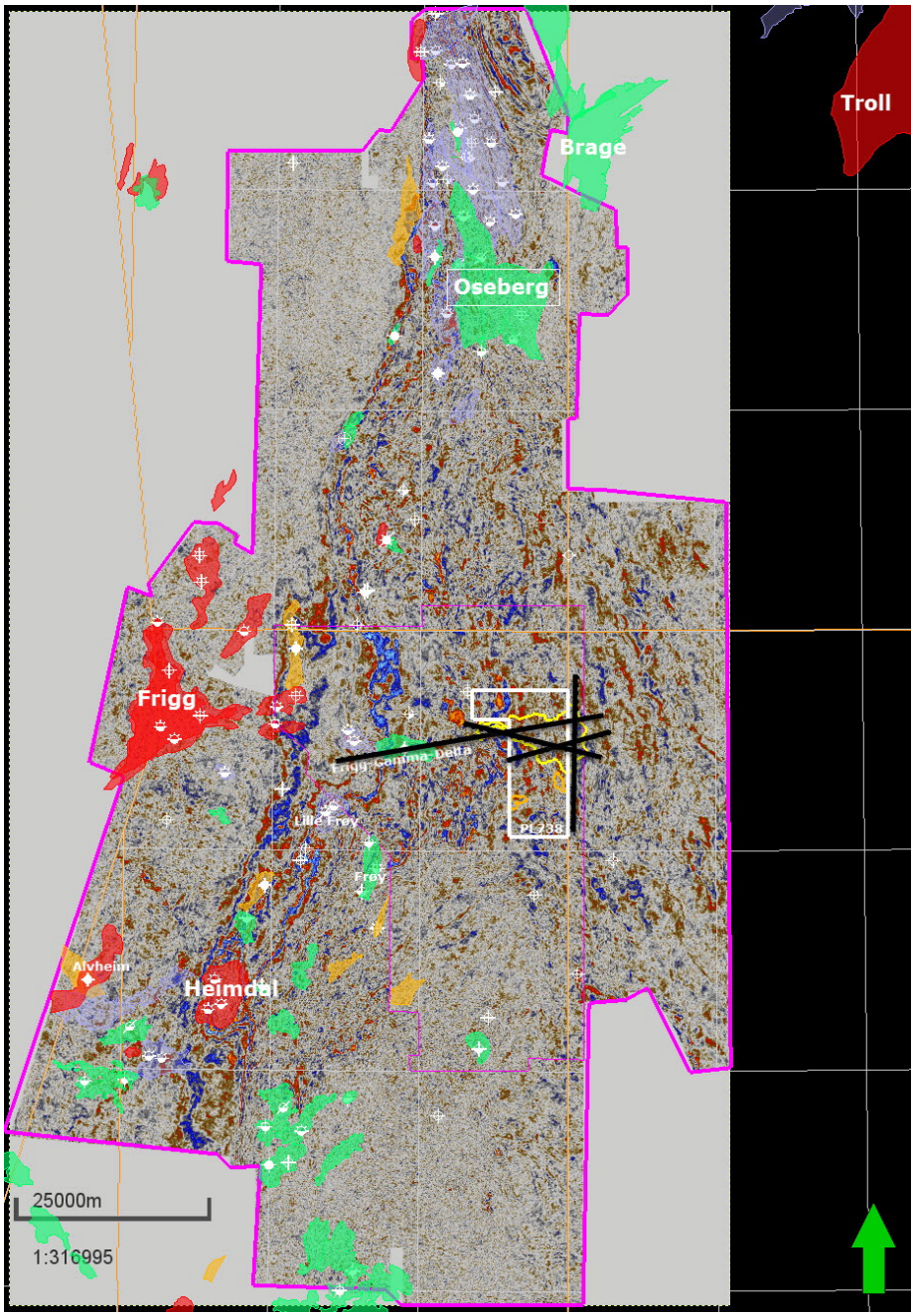

Fig. 2.1 Database for the PL738. *TUN15M02 outline in pink with PL738 license area and IP lines outline in black*

Well database

The wells used to evaluate the prospectivity of the PL738 license is listed in (Fig. 2.2) During the license period, well 31/10-1 in the Lupus prospect in PL507 was drilled.

WELL NAME	CONTENT	OPERATOR	COMPLETION YEAR	TD (mRKB)	Age at TD
15/3-6	DRY	AMOCO	1999	2793	JORSALFARE FM
24/9-5	OIL	FINA	1994	2860	JORSALFARE FM
24/9-9 S	OIL	MARATHON	2009	2402	HEIMDAL FM
25/1-6	DRY	ELF	1978	2895	JORSALFARE FM
25/1-10	DRY	ELF	1988	4739	BRENT GP
25/1-11 A	OIL/GAS	DET NORSKE	2010	2410	HEIMDAL FM
25/2-3	DRY	ELF	1974	2795	HARDRÅDE FM
25/2-5	OIL/GAS	ELF	1976	4000	SMITH BANK FM
25/2-7	SHOWS	ELF	1982	4110	DUNLIN GP
25/2-12		ELF	1988	4102	STATFJORD GP
25/2-12 A	GAS/CONDENSATE	ELF	1989	3865	HUGIN FM
25/2-13	OIL/GAS	ELF	1990	3908	SMITH BANK FM
25/2-14	DRY	ELF	1991	3623	STATFJORD GP
25/2-17	OIL	STATOIL	2009	2193	SELE FM
25/3-1	DRY	ELF	1989	3922	STATFJORD GP
25/4-6 S	GAS/CONDENSATE	ELF	1991	4170	STATFJORD GP
25/5-2	OIL	ELF	1989	3304	DRAKE FM
25/5-7	GAS/CONDENSATE	TOTAL	2010	3045	HEGRE GP
25/6-3	DRY	DET NORSKE	1999	2475	HARDRÅDE FM
25/7-5	OIL	HYDRO	1997	2736	VÅLE FM
25/7-6	OIL SHOWS	HYDRO	2000	2250	HEIMDAL FM
25/8-1	OIL	ESSO	1970	2606	ROTLIEGEND GP
25/8-10 S	OIL/GAS	ESSO	1997	1890	EKOFISK FM
25/8-11	OIL	ESSO	1997	1994	STATFJORD GP
25/11-5	OIL	ESSO	1974	2164	NO GROUP DEFINED
25/11-19 S	OIL/GAS	ESSO	1995	2250	STATFJORD GP
26/4-1	DRY	BP	1987	3690	NO GROUP DEFINED
26/4-2	DRY	SHELL	2004	2302	TOR FM
30/8-2	OIL SHOWS	HYDRRO	1996	2405	JORSALFARE FM
30/11-1	DRY	SHELL	1975	2682	HARDRÅDE FM
30/11-3	OIL/GAS SHOWS	SHELL	1983	4662	STATFJORD GP
30/11-4	OIL SHOWS	SHELL	1984	5255	STATFJORD GP
30/11-5	OIL	SHELL	1997	3726	DRAKE FM
30/11-6	SHOWS	HYDRO	2004	3550	DRAKE FM
30/11-7	GAS/CONDENSATE	STATOIL	2009	4067	DRAKE FM
30/11-8 S	OIL/GAS/CONDENSATE	STATOIL	2011	4043	DRAKE FM
30/12-1	DRY	HYDRO	1994	3641	STATFJORD GP
31/10-1	DRY	TULLOW	2014	2388	HARDRÅDE FM

Fig. 2.2 Well database. *Well 31/10-1 (Lupus) was drilled within the license period*

3 Review of geological framework

The License PL738 is located on the Bjørgvin Arch, north of the Utsira High and west of the Stord Basin (Fig. 3.1). Major oil and gas fields and discoveries are in the vicinity. To mention a few, are the Eocene Frigg and Frigg-Gamma-Delta field west of the license, Jurassic Oseberg field north of the license, and the Paleocene Heimdal field south west of the license. The play concept for the Eclipse prospect includes Paleocene, Hermod sandstone reservoir, interpreted as a distal, gravity flow with stratigraphic trap.

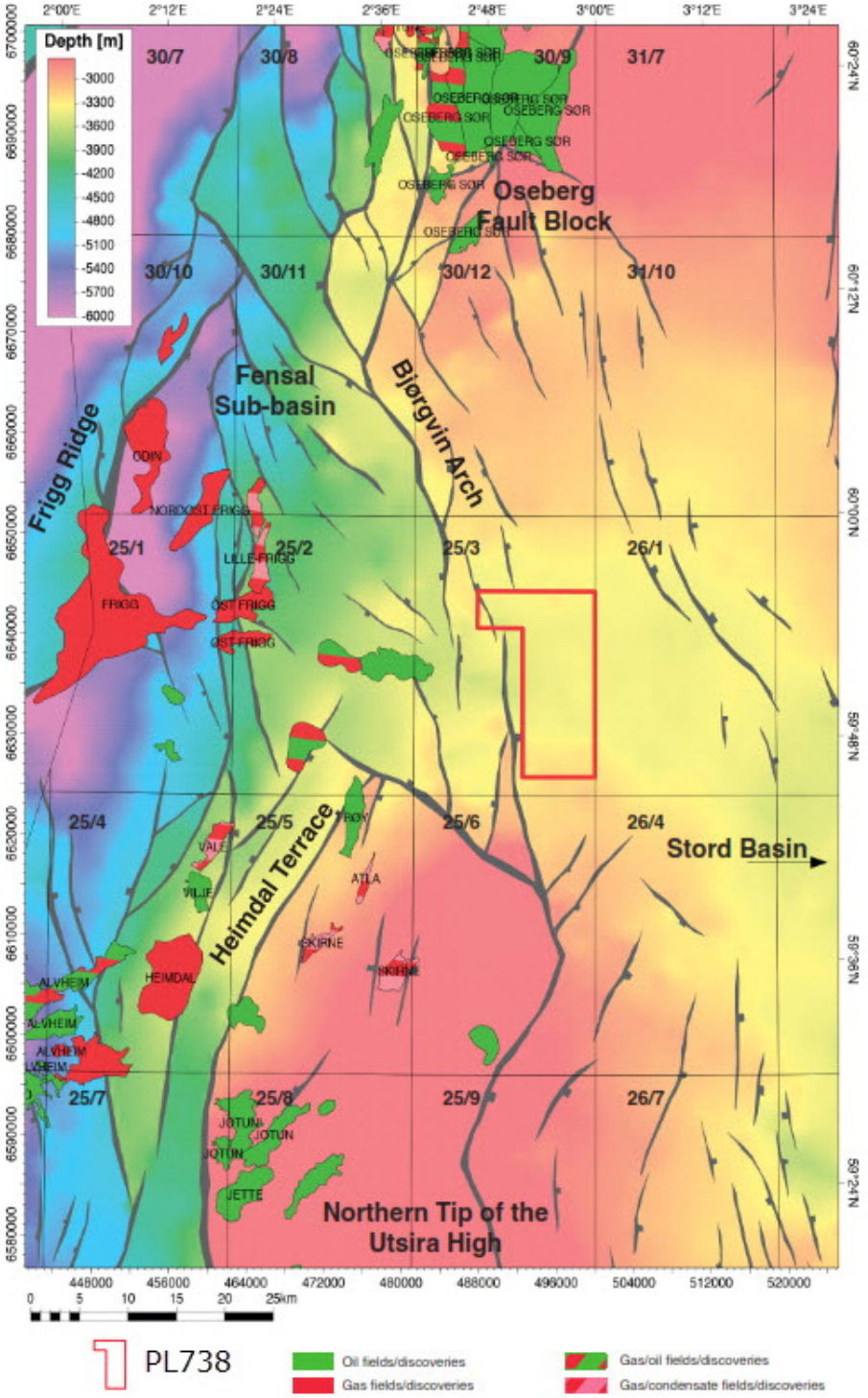

Fig. 3.1 Structural elements in the North Sea including the Bjørgvin Arch.

The Hermod Formation, defined as sandstone layers within the Sele Formation, was deposited at a later stage of the East-Greenland Cycle of first order transgressive and regressive phases (Early Paleocene - Early Miocene), during a rapid basin subsidence. The Formation onlaps the Lista Formation that separates the older, more regional sand distribution of the Heimdal Formation, to the more localised sand distributed Hermod Formation.
The general trend for the Paleocene/Lower Eocene sands is a west to east thinning pinch-out where the sediments were displaced as gravity flows. This generated deposition was controlled by local basin topography and the net sand is found to be more than 100m thick. A blended spectral decomposition volume (RGB blend) created on top reservoir level, indicates a more channelised depositional systems, with amalgamated channels in the distal parts, as in PL738.

The following geophysical studies has been done after the APA 2013 award to enhance the prospect evaluation:

- The seismic data TUN15M02 was a post-stack merged seismic volume, processed in-house from multiple vintage datasets. A thorough quality assurance of input data prior to the merging process was done in order to get an optimum result. The volume was then used to re-interpret the Eclipse prospect and put it into a regional setting with the Lupus prospect, both within the dataset

- The new dataset TUN15M02 went through an acoustic inversion in order to increase the resolution for improved map-ability and lithology prediction of the Hermod Formation

- The license group inititated acquistion of 4 IP (Induced Polarization) lines by ORG Geophysical (Fig. 2.1). The survey was done in the summer of 2015 and the result of the data was interperted in Q3 2015. [redacted]

- Geochemistry work on well 31/10-1 indicating lack of migration to the distal part of the Hermod sand deposits

4 Prospect update

The prospect and leads definition in PL738 (Fig. 4.1), remains the same with its reservoir definition and recoverable resources, after the geophysical program was fullfilled. However, the probablity of success has been redused due to dry Lupus well 31/10-1 (Fig. 4.2).

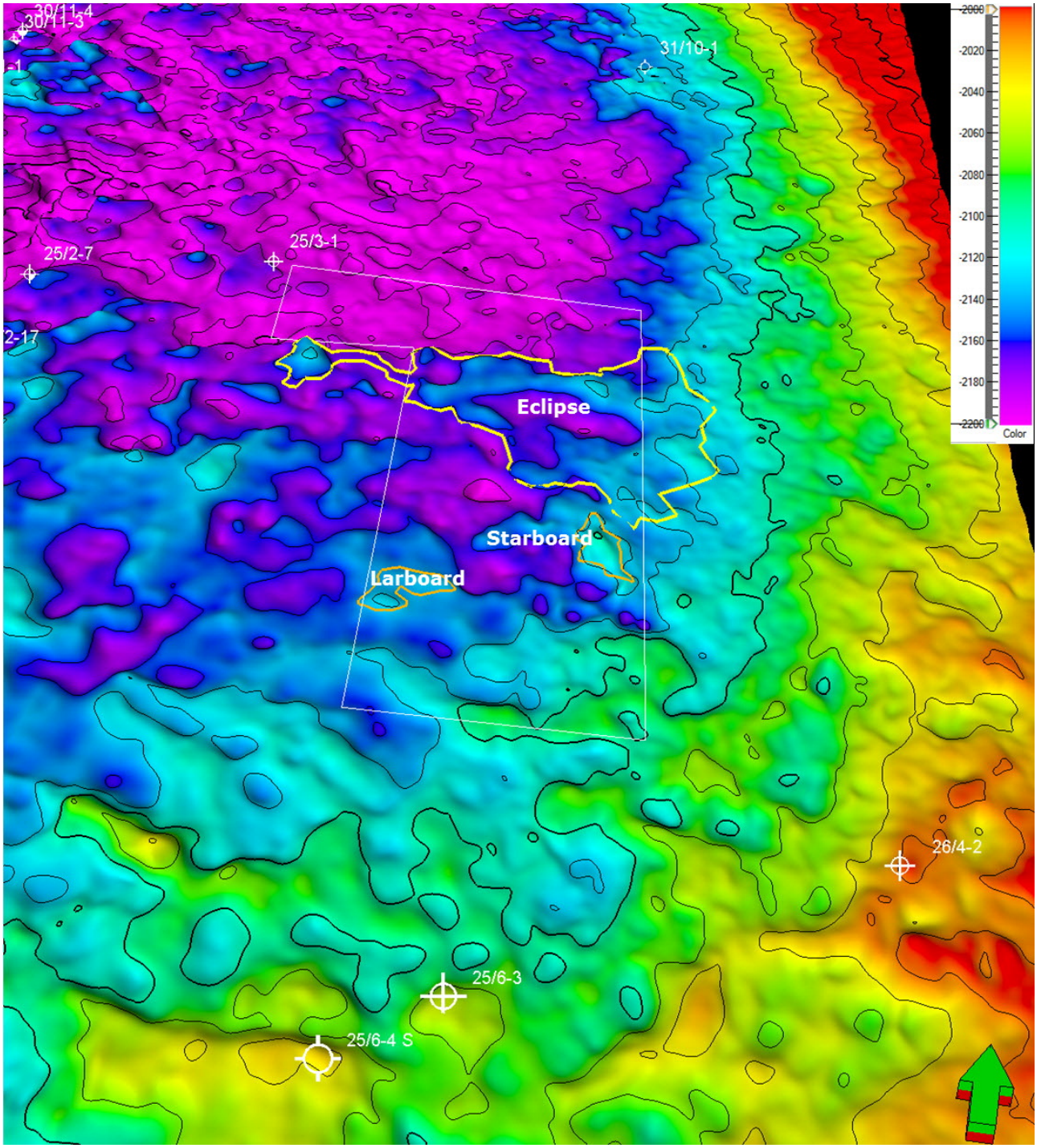

Fig. 4.1 License prospect and leads map. *The Eclipse prospect and the Starboard and Larboard leads.*

Discovery/prospect/lead name	D/P/L	Unrisked recoverable resorces						Probability of discovery %	Resources in acreage applied for %	Reservoir		Distance to infra-structure (km)
		Oil 10 6 Sm 3			Gas 10 9 Sm 3					Litho-/Chrono-stratigraphic level	Reservoir depth (m MSL)	
		Low	Base	High	Low	Base	High					
Eclipse	P	3.08	12.70	25.89	0.62	2.54	5.18	5	68	Hermod Fm /Thanetian	2100	50
Starboard	L								100	Hermod Fm /Thanetian	2100	55
Larboard	L								100	Hermod Fm /Thanetian	2100	55

Fig. 4.2 Review risk potential. *Updated table from the APA13 application. Probablility change highlighed in yellow*

Eclipse Prospect

The main prospect in PL738, the Eclipse prospect, is defined within the Paleocene Hermod Formation play (described in chapter 3), and outlined on the top Paleocene surface (Fig. 4.1). The prospect was re-interpreted using the TUN15M02 seismic 3D survey, including the inversion data, but became unchanged both in size and volume.

The negative result of the Lupus well, 31/10-1, increased the risking parameters for the Eclipse prospect, from a POS of 12% to a POS of 5% (Fig. 4.2).
The major concerns for the Eclipse prospect was related to the charge risk and lateral seal. The prospect is defined as a combination of a structural dip to the west and north, and a stratigraphic pinch-out to the east and south. The stratigraphic pinch-out could easily be defined in an RGB blend map (Fig. 4.3), where the blending was done on the base reservoir level, to get the best sharpness of channel systems. The structural component of the prospect was defined by the top Sele Formation level.

The vertical seal was still considered being a low risk, with Hermod sand deposited within the Sele shales. The lateral seal, that in the application was highly risked, was, due to a waterwet Lupus well, risked even harder.
The lateral seal was defined from the RGB blend volume, which indicated sand pinch-out to the east and south, separating the Eclipse prospect from the drilled Beluga well 26/4-2 (Fig. 4.4). The Lupus well had a similar setting, where the prospect was defined around channel systems defined on RGB blend and offset volumes. Even though the Lupus well was located off the main channel, it showed a massive, homogeneous sand package in the Hermod Formation, indicating more sand in the system than orignially anticipated based on RGB blend. This is in support of connections among the amalgamated channels. It is then believed that any hydrocarbons in the Paleocene system, would migrate upflanks further to the south or south-east, where there are wells drilled and tested, with no shows (Fig. 4.4).
The Lupus well strengthened the possibility to believe that the Eclipse prospect is within the migration shadow.
However, the presence of the reservoir was strengthened by the well, which showed a 43m massive and highly porous sand in the Hermod Formation (Fig. 4.3).

In addition to the Eclipse prospect, two leads have been defined as Starboard and Larboard. The areas after the license work remains respectively, 2.1km2 and 2.3km2 (Fig. 4.1), hence no commercial resources.

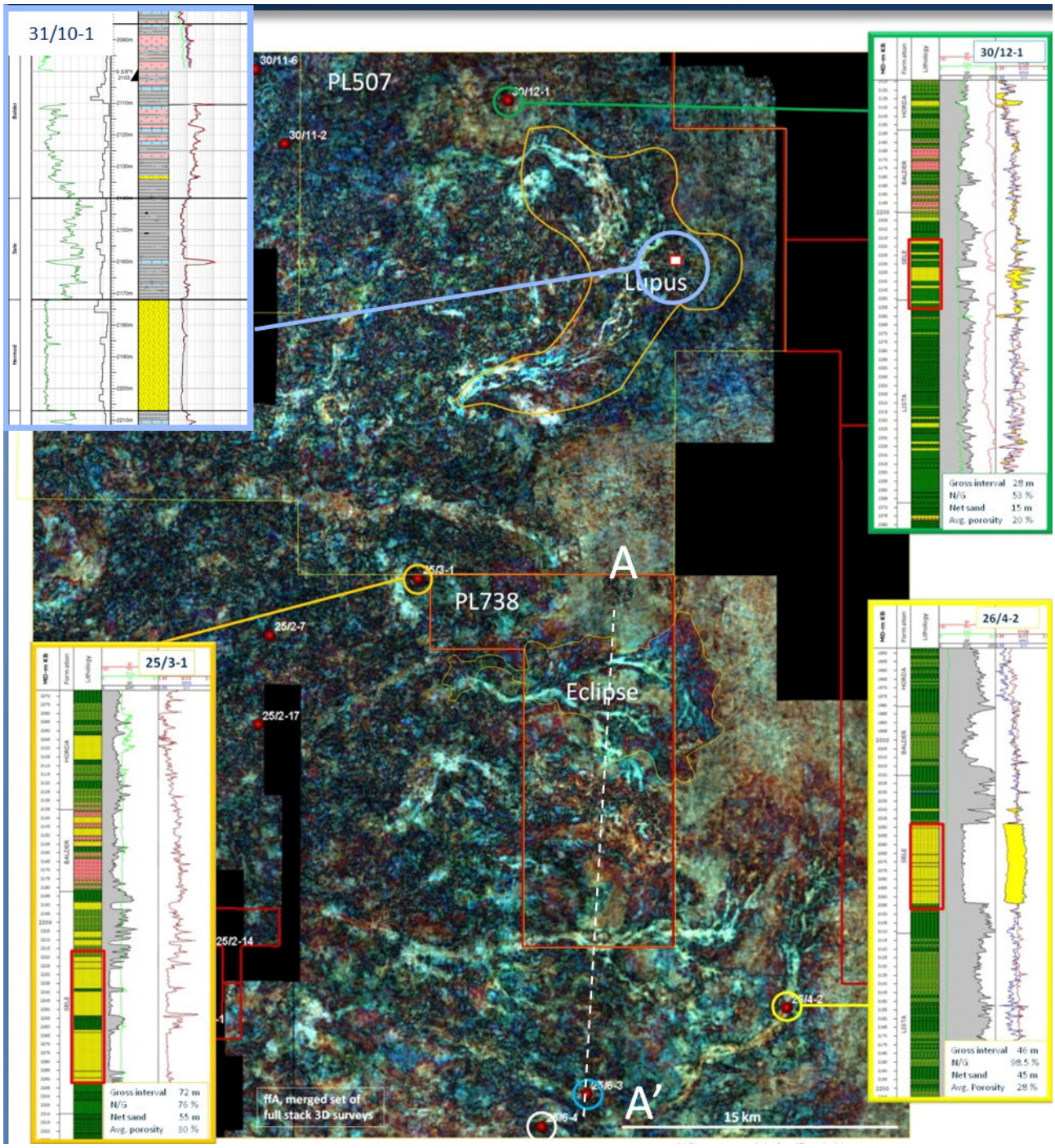

Fig. 4.3 RGB blending and key wells. *Key wells with lithology logs showing thick Hermod sand. Line A-A' is shown in Fig 4.4*

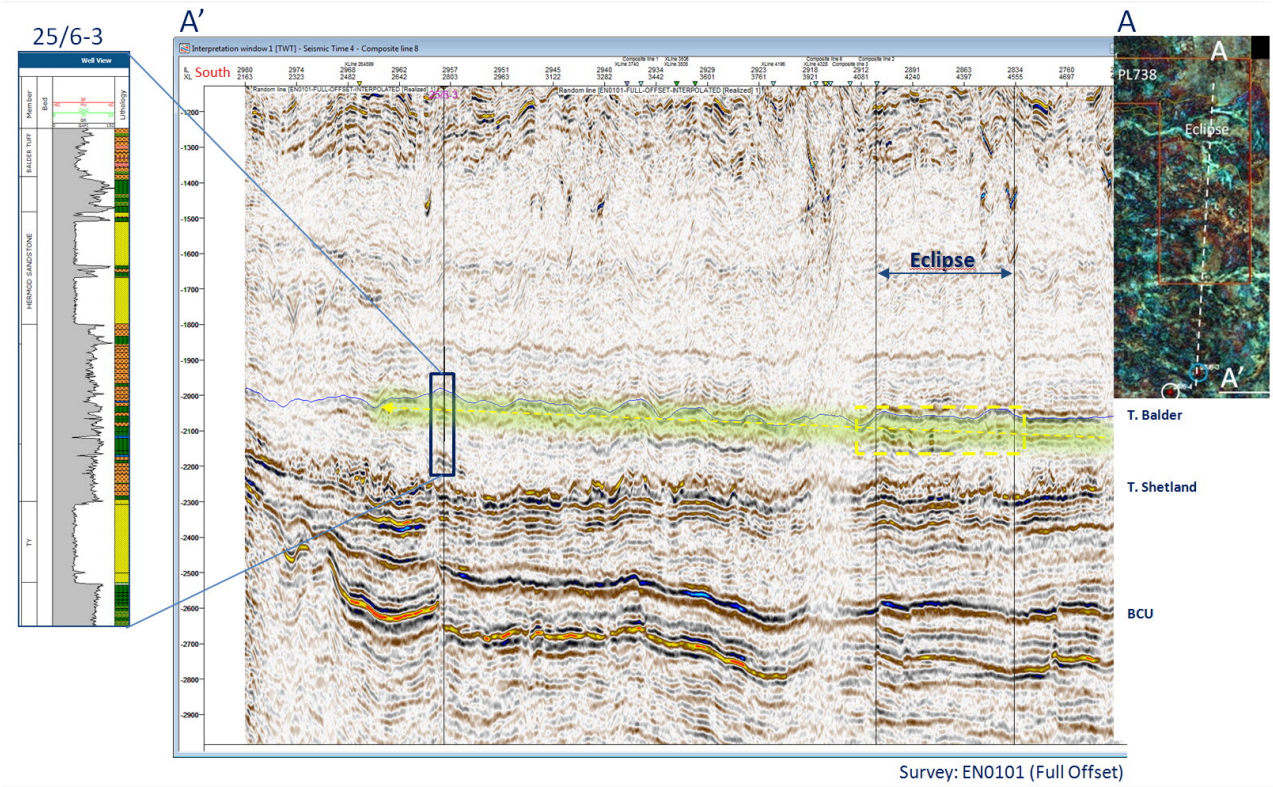

Fig. 4.4 Seismic section across the Eclipse prospect. *Seismic section A - A' highlighed in figure 4.3*

5 Technical evaluations

No new evaluation regarding possible development has been performed since the APA2013 application.

6 Conclusions

The Eclipse prospect is an analogue to the Lupus prospect in PL507 that was drilled in 2014, 25km north of the PL738 license. The well, 31/10-1 had 43m of massive and highly porous Hermod sandstone, but waterwet with no shows. Geophysical interpretation of the Eclipse prosepct reveals a lack of seal to the south. As no hydrocarbons are observed in the updip located well 25/6-3, it is regarded unlikely that there are no charge into the Eclipse area.

The risk elements on trap and migration was downgraded suceeding the geophysical work and the Lupus well, to a probability of succes of 5% rather than 12%.

The high risk on migration and seal, together with Lupus well being dry, makes it difficult to pursue stratigraphic traps on Paleocene level in this area.

The lack of Jurassic prospectivity and high risk on migration and trap integrity of the Eclipse prospect, does not reflect a commercial potential to support a decision to drill an exploration well.

The partnership in the PL738 license has in good cooperation evaluated and concluded on the exploration and commercial potential, and an unanimous decision to drop the license was taken in February 2016.