

wintershall dea

RELINQUISHMENT REPORT

PL1010





wintershall dea

PL1010 Relinquishment report

Table of Contents

1 Location	1
2 License history	2
3 Database	5
3.1 Seismic data	5
3.2 Well data	6
4 Geological and Geophysical Studies	7
5 Prospect Update Report	9
6 Conclusion	11

List of Figures

1.1 PL1010 Location map.	1
2.1 Initial prospect overview from application	3
3.1 Overview of common seismic database (live traces).	5
4.1 RMS amplitudes top Lysing Formation	8
4.2 RMS amplitudes top Lysing Formation with seismic sections	8
5.1 Miocene depth map and geological model	9
5.2 Geological section through Trippier and Neymar Leads	10

List of Tables

2.1 Listing of meetings held in PL1010	4
3.1 Common seismic database	5
3.2 Wells included in the common well database	6
5.1 Volume and Risks based on complete evaluation	10

1 Location

PL1010 covers parts of blocks 6506/3, 6507/1, 6606/12 and 6607/10 with a total area of 1095 km² (Fig. 1.1). The license is located within the westernmost part of the Dønna Terrace and the eastern part of the Rås Basin. The Ytreholmen Fault Zone extends through the central part of the license in a NE-SW direction. The distance to shore is approximately 230 km, with water depth in the range of 300 - 400 m.

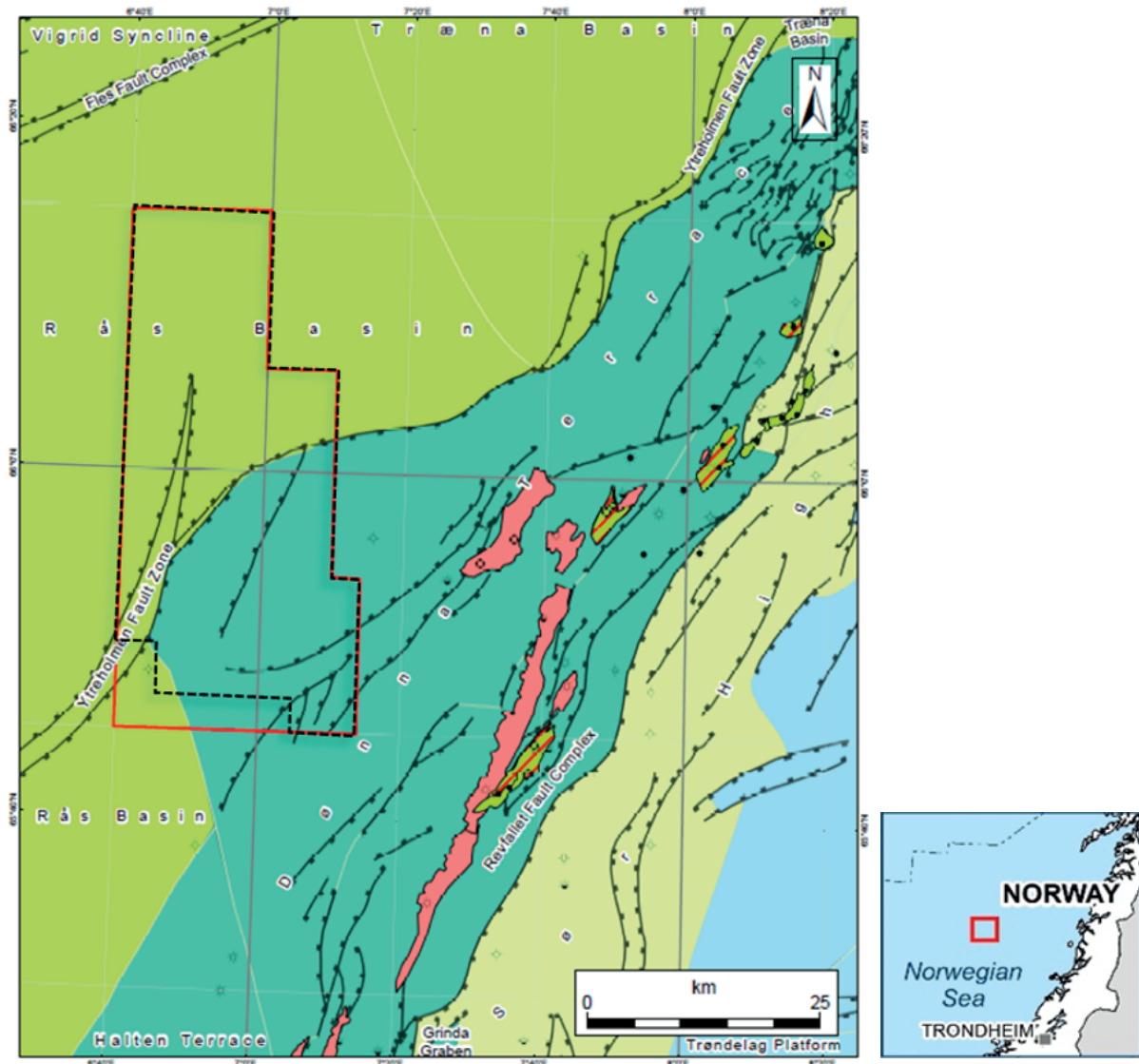


Fig. 1.1 PL1010 Location map.
License boundary shown in red.

2 License history

PL1010 was awarded 01.03.2019 as part of the APA 2018. The license group consisted of Dea Norge AS (operator 60%) and Vår Energy AS (40%). In 2019 DEA Norge AS merged with Wintershall Norge AS, and became Wintershall DEA Norge AS.

The planned work program for PL1010 was G&G studies and seismic reprocessing or acquire reprocessed seismic. The work program was fulfilled by reprocessing of key seismic data, including CFI_MNR 2D lines. A drill or drop decision was made within 2 years.

Key dates

Milestone: Drill or Drop 01.03.2021

License expiry: 01.03.2028

The southern part of PL1010 has been licensed before as part of other production licenses (mainly PL649), while the northern part has never been licensed. No wells have been drilled within the license.

Reasons for relinquishment

Initial exploration focus was on the Tertiary prospectivity. However, detailed seismic interpretation and studies indicated a very high risk on the reservoir model. Rather than sand-rich injectites, the observed features were interpreted as silica ooze or low velocity claystones. Well 6607/5-2, located approximately 50 km north of the PL1010 is considered a key data point. This well drilled extremely low velocity clay stones which has a very similar seismic character to the mapped leads within PL1010. An overview of the mapped prospectivity within the license is given in Fig. 2.1.

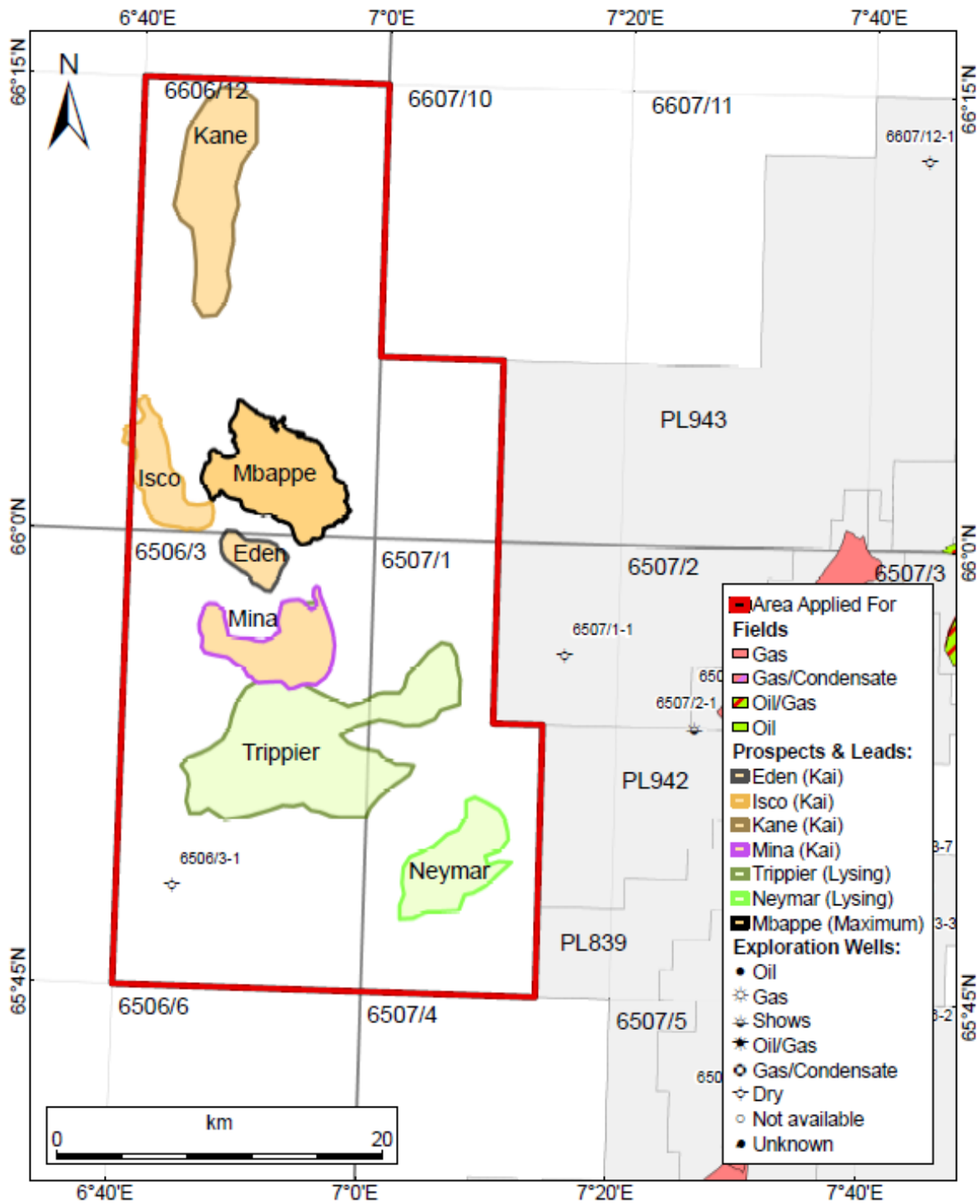


Fig. 2.1 Initial prospect overview from application

Following the downgrade of the Tertiary, focus shifted to the Cretaceous plays. The Lysing Formation was evaluated but no clear targets of significant size were identified. Some small traps with clear amplitude anomalies showing structural conformance are interpreted as minor, non-commercial gas accumulations. The presence of these small amplitude anomalies is considered a key observation, indicating that any hydrocarbon accumulation is likely to give rise to an amplitude anomaly. AVO modelling and the seismic signature of gas discoveries in the area supports this interpretation. All other prospectivity within the Cretaceous is considered too high risk to justify a continuation of the license period. The Jurassic is too deeply (high reservoir quality risk) buried within the license to represent a viable target.

Annual ECMC meetings and work meetings have been arranged to ensure good collaboration and communication within the license group. See Table 2.1 for meeting category and dates.

Table 2.1 Listing of meetings held in PL1010

Meeting category	Dates
ECMC	03.04.2019
Work-meeting	04.09.2019
ECMC	06.11.2019
ECMC	22.10.2020

3 Database

3.1 Seismic data

The common seismic database agreed for the license is listed in Table 3.1, and a map with live trace outline is shown in Fig. 3.1.

Table 3.1 Common seismic database

Survey name	Type	Vintage	Public	Quality	Comments
MC3D_DTW2000	3D	2000	Yes	Fair to good	Key 3D survey for Cretaceous
MC3D_DTW2000_Far Offset	3D	2000	No	Fair to good	Limited coverage
VNG13M01	3D	2013	Yes	Fair	Merged seismic cube
MegaMerge 3D	3D	2015	No	Poor to Fair	
TGS "Clari-Fi" MNR	2D	2013	No	Fair	448 kilometers part of common database
TGS "Clari-Fi" reprocessed MNR	2D	2013	No	Fair	Reprocessed in 2019

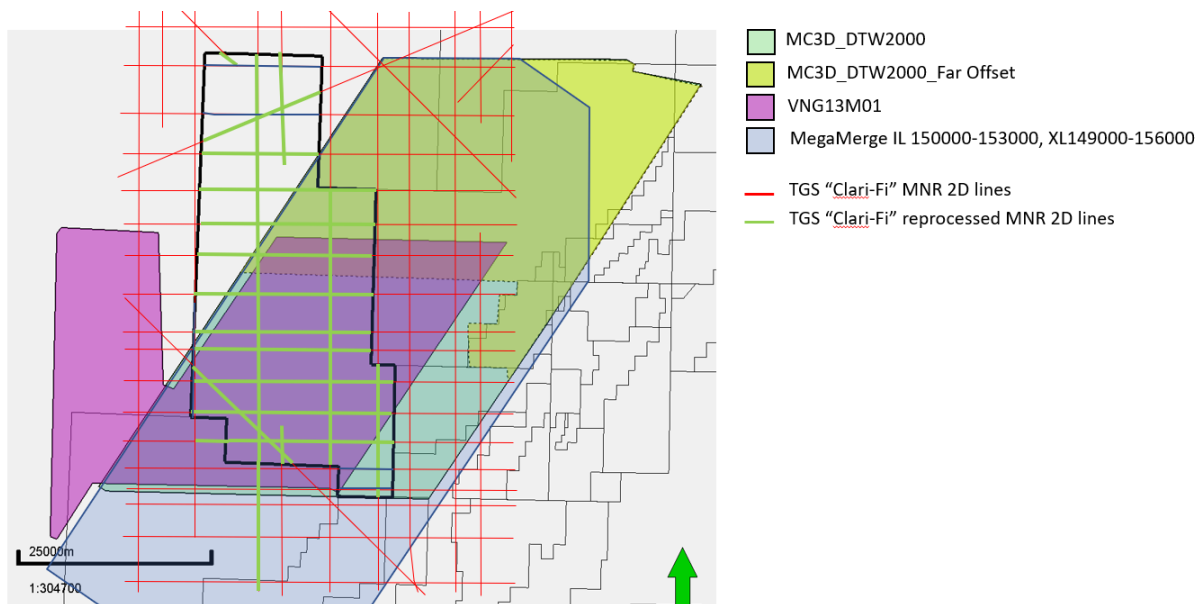


Fig. 3.1 Overview of common seismic database (live traces).

PL1010 license boundary in thick black

A selection of MNR-CFI 2D lines were reprocessed by the operator (indicated with green color in Fig. 3), in total 448 line kilometers. The process included structural denoising, spectral balancing, trim statics, frequency slice filtering, colored inversion, dip filtering, generation of relative acoustic and gradient impedances and the generation of a fluid factor cube (Extended Elastic Impedance 20). A similar workflow was performed on the VNG13M01 3D cube. The reprocessed seismic data was shared with the partners and uploaded to the Diskos database.



3.2 Well data

Table 3.2 gives an overview of all the wells included in the common well database. The wells were used for well ties and to collect statistics on reservoir and source rock.

Table 3.2 Wells included in the common well database

Well Number	Well/Prospect Name	Date	Operator	Primary Objective	Status	HC Occurrences/Comments	Source
6506/3-1	Harran	2001	Chevron	Brygge Fm	Dry	HC migration inferred from gas log data	Released
6506/6-1	Victoria	2000	Mobil	Fangst and Båt Gp	Gas	Gas in Fangst and Båt Gp's	Partner
6506/6-2	Albert	2012	Maersk	Lysing Fm	Dry	Shows most likely OBM	Released
6506/9-1	Victoria	2009	Total	Fangst and Båt Gp	Gas	Gas in Ile and Tilje Fm's	Partner
6507/1-1	Sahara	2004	Chevron	Lysing Fm	Dry	Shows likely to be OBM	Released
6507/2-2	Marulk (appraisal)	1991	Norsk Hydro	Garn, Ile and Tilje Fm's	Gas/Cond	Oil shows in Shetland Gp. Lysing and Lange both gas filled	Released
6507/2-3	B1 & B2	1994	Norsk Hydro	Lysing and Lange Fm's	Oil shows	Residual oil in Lange Fm	Released
6507/2-4	Marulk (appraisal)	2007	ENI	Lysing Fm	Gas/Cond	Gas/condensate in Lysing. Oil shows and gas peaks in Lange	Released
6507/3-3	Idun	1998	Den Norske	Fangst and Båt Gp	Gas	Gas in Fangst and Båt Gp's	Partner
6507/3-7	Idun North	2009	Statoil	Fangst and Båt Gp	Gas	Gas in Fangst Gp	Partner
6507/3-9 S	Snadd Outer	2012	BP	Lysing Fm	Gas	Gas in Lysing Fm. High gas readings in Kai Fm	Released
6507/5-1	Skarv	1997	Amoco	Fangst and Båt Gp	Oil/Gas/Cond	Oil in Lange. Gas/Cond and Oil in Fangst and Båt Gp's	Partner
6507/5-2	"A" fault block Skarv	1999	Amoco	Garn, Ile and Tilje Fm's	Gas/Cond	Gas/Cond in Garn Fm. Residual oil in Not Fm	Partner
6507/5-3	Ærflugl	2000	BP	Lysing Fm	Gas	Gas in Lysing Fm	Partner
6507/5-4	C-segment Skarv	2001	BP	Garn, Ile and Tilje Fm's	Oil/Gas	Oil/condensate in Cretaceous. Oil/gas discovered in Garn Fm	Partner
6507/5-5	Skarv	2001	BP	Garn, Ile and Tilje Fm's	Oil	Oil in Garn. Weak shows in Lange	Partner
6507/5-6 S	Ærflugl	2010	BP	Lysing Fm	Gas	Gas in Lysing Fm	Partner
6507/6-2		1991	Saga	Fangst Gp and Tilje Fm	Oil shows	Shows in Lysing Fm	Partner
6605/8-1	Stetind (A6)	2005	Norsk Hydro	Lysing Fm	Gas	Two gas zones in Lysing Fm. Gas shows in Nise Fm	Released
6605/8-2	Stetind (A6-III)	2008	Statoil	Lysing Fm	Dry	Shows in Tang, Springar, Kvitons and Lysing Fm's	Released
6608/10-17 S	Cape Vulture	2016	Statoil	Lange Fm	Oil/Gas	Two oil and gas columns in two separate Lange Fm sands	Traded
24/9-5	Volund	1993	Fina	Hermod & Balder Fm's	Oil	Oil in Balder Fm	Released
25/8-5 S	Jotun	1994	Esso	Statfjord & Heimdal Fm's	Oil	Oil in Heimdal Fm	Released
25/11-1	Balder	1966	Esso	Balder Fm	Oil/Gas	Gas and live oil in Balder Fm	Released
26/10-1	Zulu Øst	2015	Lundin	Utsira Fm	Gas (biogenic)	No oil shows recorded	Partner
34/7-4	Snorre E	1984	Saga	Statfjord Fm	Oil	Oil in Statfjord - sand injectites in Utsira Fm	Partner

4 Geological and Geophysical Studies

The following geological and geophysical studies were carried out:

- Seismic mapping and attribute studies
- Frequency decomposition and color blending (utilizing GeoTeric software)
- AVO feasibility study
- Post-migration reprocessing of MNR-CFI 2D data and generation of inversion cubes.
- Post-migration reprocessing of VNG13M01 data and generation of inversion cubes.
- Basin Model study
- *External*: Review of depositional models for the Miocene Leads in PL1010 by GeoScandia

The primary target within the license in the initial phase was the Tertiary, with several features interpreted as potential sand-rich injectites within the Kai Formation. As work within the license progressed it became clear that the reservoir model had to be considered very high risk, the reasons for which is being discussed in more detail in section 5.

Exploration focus then shifted from the Tertiary to the Cretaceous. The Lysing Formation consist of various types of turbidite deposits within the area of interest. The character of these deposits reflects a complex interplay between several different factors, including sea level fluctuations, tectonics, depositional rate and type of sediments available. The Marulk Field is located approximately 20 km to the east of the license and proves the potential of the Lysing and Lange Formation in the area.

Seismic mapping indicates that there are no significant dip-closures present within Cretaceous. Some small, fault-bounded closures do however appear to trap minor amounts of hydrocarbons within the Lysing Formation (Fig. 4.1 and Fig. 4.2). The AVO feasibility study supports the interpretation of these amplitude anomalies being small gas accumulations. Both basin modelling and the presence of nearby gas discoveries further supports gas as the most likely hydrocarbon phase in this area. The lack of any larger anomalies conforming to structures at the Lysing or Lange formation level was a key observation leading to license relinquishment.

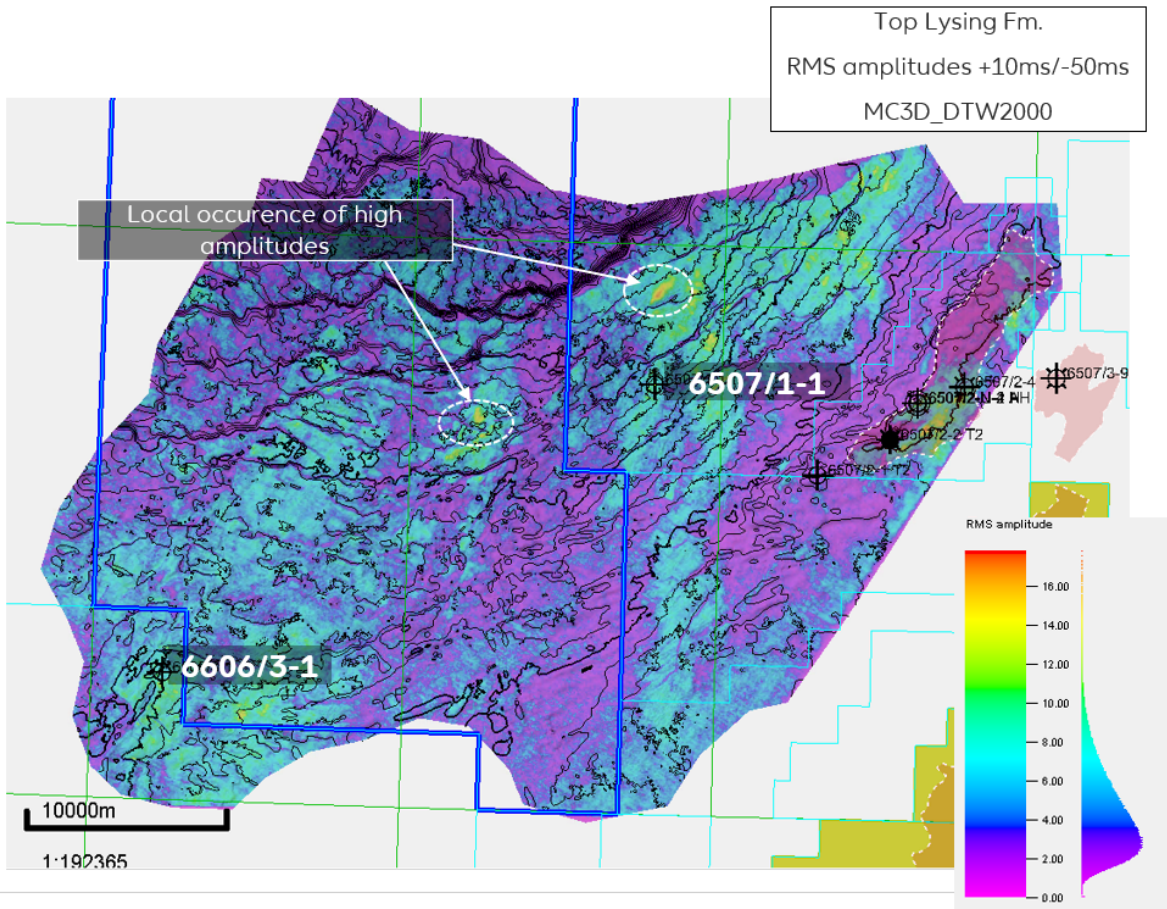


Fig. 4.1 RMS amplitudes top Lysing Formation

RMS amplitudes extracted within a window of +10/-50 ms around the interpreted Top Lysing Formation. Note the presence of some minor amplitude anomalies which are interpreted as small gas accumulations.

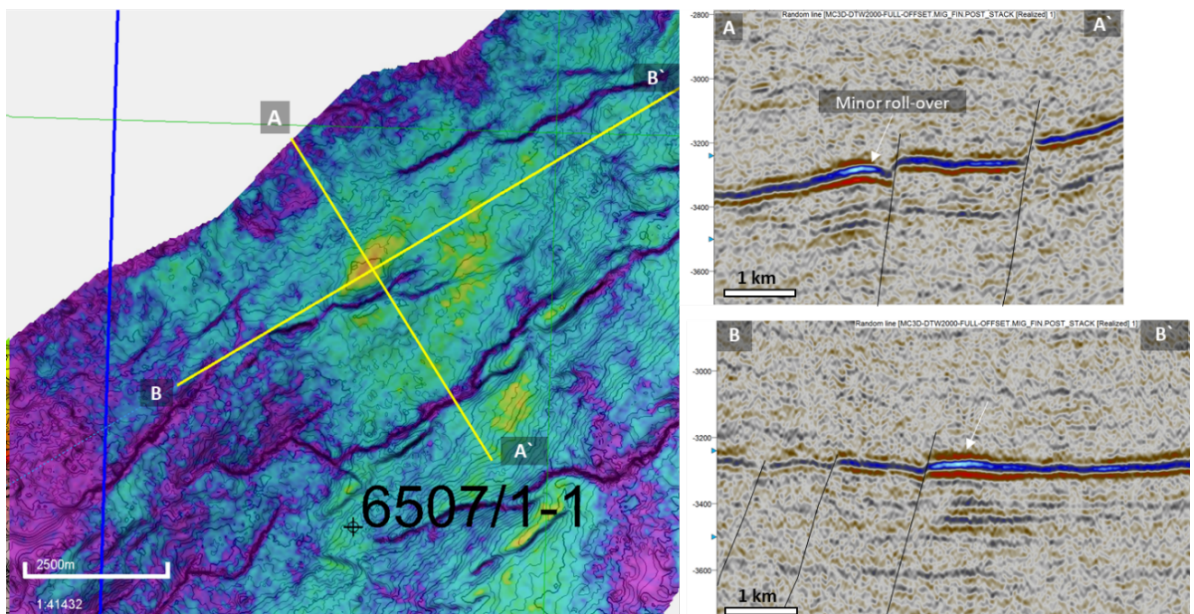


Fig. 4.2 RMS amplitudes top Lysing Formation with seismic sections

Left: RMS amplitudes extracted within a window of +10/-50 ms around the interpreted Top Lysing Formation. Depth contours shown. Note the relatively good conformance to structure. Right: Seismic sections as indicated on the map. Minor roll-over structure forming a small trap. Seismic survey is the public MC3D-DTW2000 full offset.

5 Prospect Update Report

Tertiary

The Middle Miocene Kai Formation was considered the primary prospective interval at the time the application was submitted. The Mbappe represented the largest and most robust of the mapped structures and was the main target (Fig. 5.1).

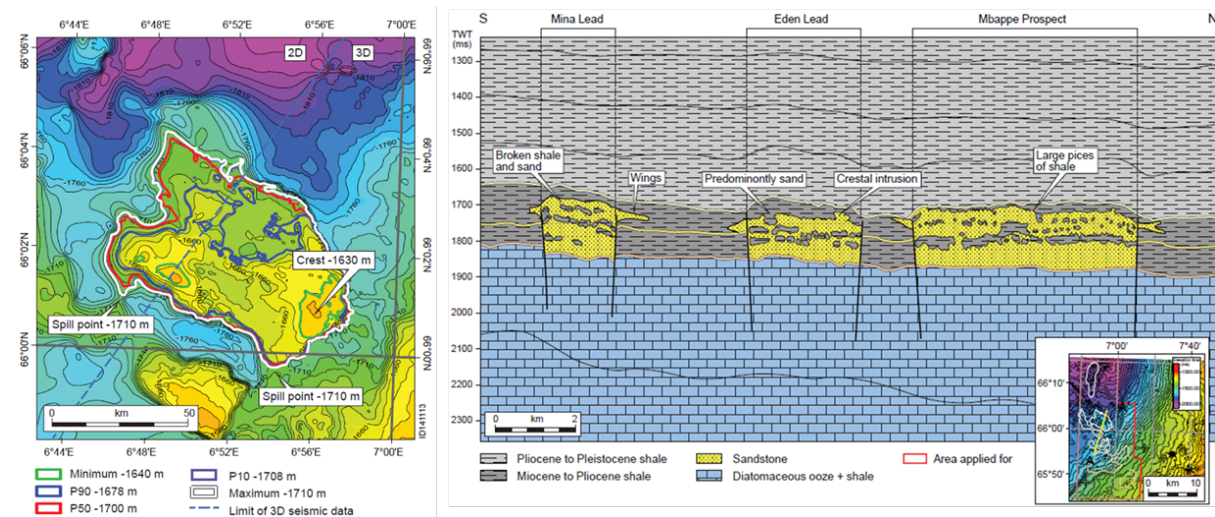


Fig. 5.1 Miocene depth map and geological model

Left: Miocene reservoir level in depth. Contour interval. of 10 m. Min to max outlines for the Mbappe is illustrated. Right: Geological interpretation of the seismic section indicated on the small map.

As more detailed seismic interpretation was carried out and more analogues were investigated, the injectite reservoir model for the Miocene play was considered very high risk. A similar feature to those observed within the license had been drilled by the 6607/5-2 well to the northeast. The well was drilled by Esso in 1991 and proved very low-density readings and slow travel times within claystones in the Kai Formation. The close similarities between the leads mapped within PL1010 and the structure drilled by the 6607/5-2 well resulted in the Tertiary being down-graded. Another key point was the lack of an obvious “mother sand” which could be remobilized and form injectites in the license area.

Cretaceous

The Top of the Lysing Formation can be interpreted with a relatively high level of confidence across the southern part of the license, while the northern part of the license is only covered by relatively sparse 2D data. Very deep burial in combination with poorer data quality means that the focus has been on the southern part of the license.

Two Cretaceous leads were defined in the APA application, the Trippier and Neymar. These were considered distal slope turbidite depositional systems. A geological section through both leads are shown in Fig. 5.2.

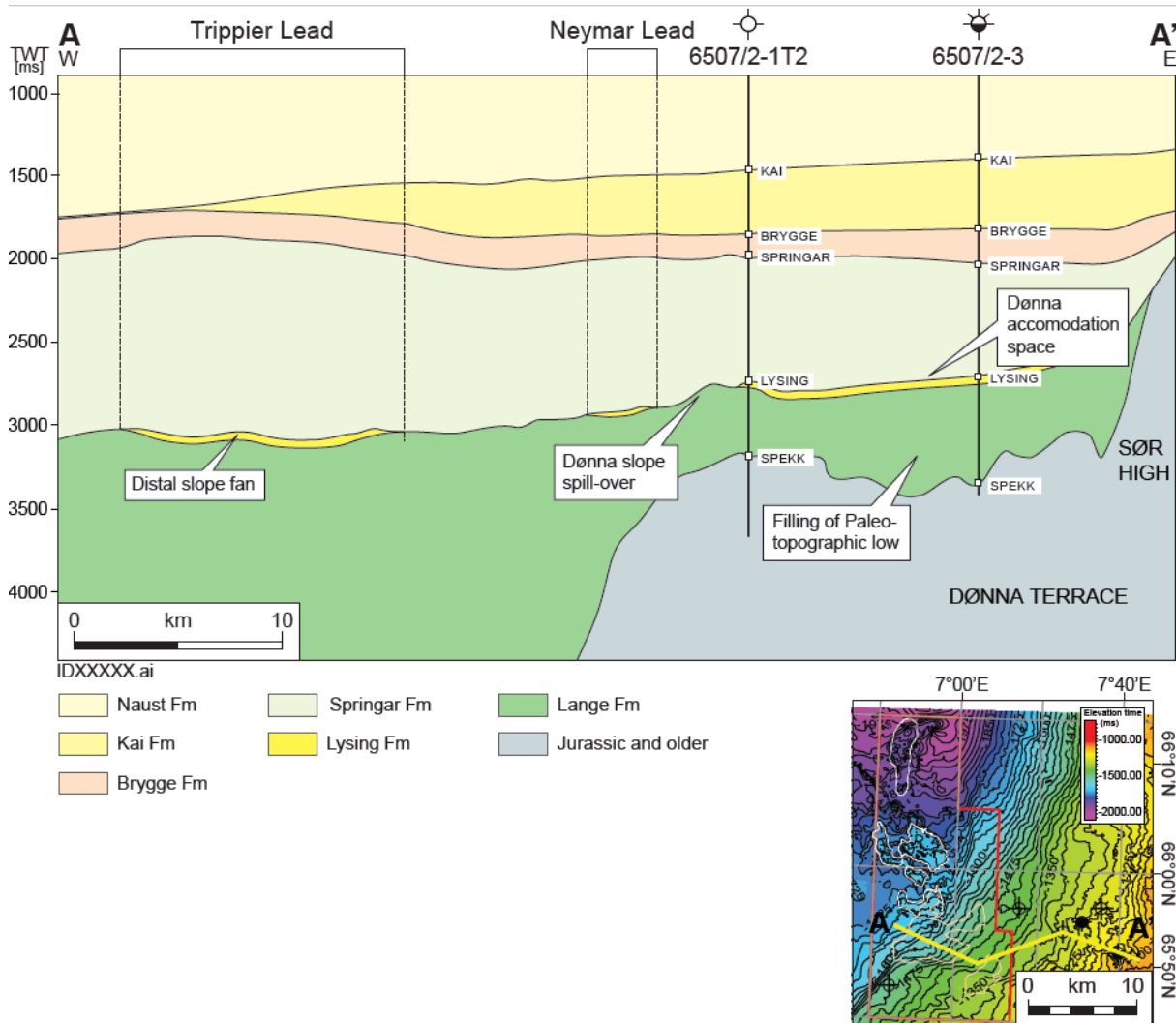


Fig. 5.2 Geological section through Trippier and Neymar Leads

The features are interpreted as possible distal turbidites systems.

As license work progressed, the Trippier and Neymar leads were considered very high risk, both with respect to trapping configuration and the actual presence of an amplitude anomaly. Both leads represent a slight increase in amplitudes, but this appears to represent variations in lithology rather than an actual anomaly indicative of hydrocarbon-fill. Therefore, also the Cretaceous prospectivity within the license is considered too high risk, leading to the drop decision of the license.

Prospectivity within the license has reviewed and volumes and risk were agreed with partners. Volumetric estimates as currently evaluated is summarized in Table 5.1.

Table 5.1 Volume and Risks based on complete evaluation

Prospect	Type	Age	Total Mean HIIP (mmboe)	Total Mean Rec. (mmboe)	GPOS (%)
Mbappe	Prospect	Kai Formation	165	81	12
Mina	Lead	Kai Formation	96	47	12
Kane	Lead	Kai Formation	94	46	12
Eden	Lead	Kai Formation	35	17	12
Isco	Lead	Kai Formation	2	1	12
Trippier	Lead	Lysing Formation	143	70	10
Neymar	Lead	Lysing Formation	26	13	10

6 Conclusion

The Tertiary prospectivity is considered high risk with regards to reservoir presence. A very similar feature to the mapped leads within the license was drilled by the 6607/5-2 well some distance to the northeast and proved low velocity clay stone layers. Cretaceous prospectivity is considered limited within the license, as no significant closures are present within the Lysing or Lange Formations. Some small traps (< 2km²) are showing clear amplitude anomalies conforming with structure. These anomalies are interpreted as minor gas accumulations, but not of sufficient economic value. The initially mapped Cretaceous prospectivity is also considered too high risk to justify further work.

The operator has not identified required economic prospectivity and the partnership agreed to relinquish the licence following the ECOMC meeting the 22th of October 2020. The official date of the relinquishment of the license is 2nd of March 2021.