

wintershall dea

RELINQUISHMENT REPORT

PL1021



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1 Location

PL1021 is situated in the southernmost part of Hammerfest Basin, in the junction of the Troms-Finnmark Fault Complex and the Ringvassøy-Loppa Fault Zone, about 80 km from coastline (Fig. 1.1). The license is located at 200 m water depth within blocks 7119/12, 7120/10, 7019/2, 7019/3 and 7020/1, covering a total area of 619 km².

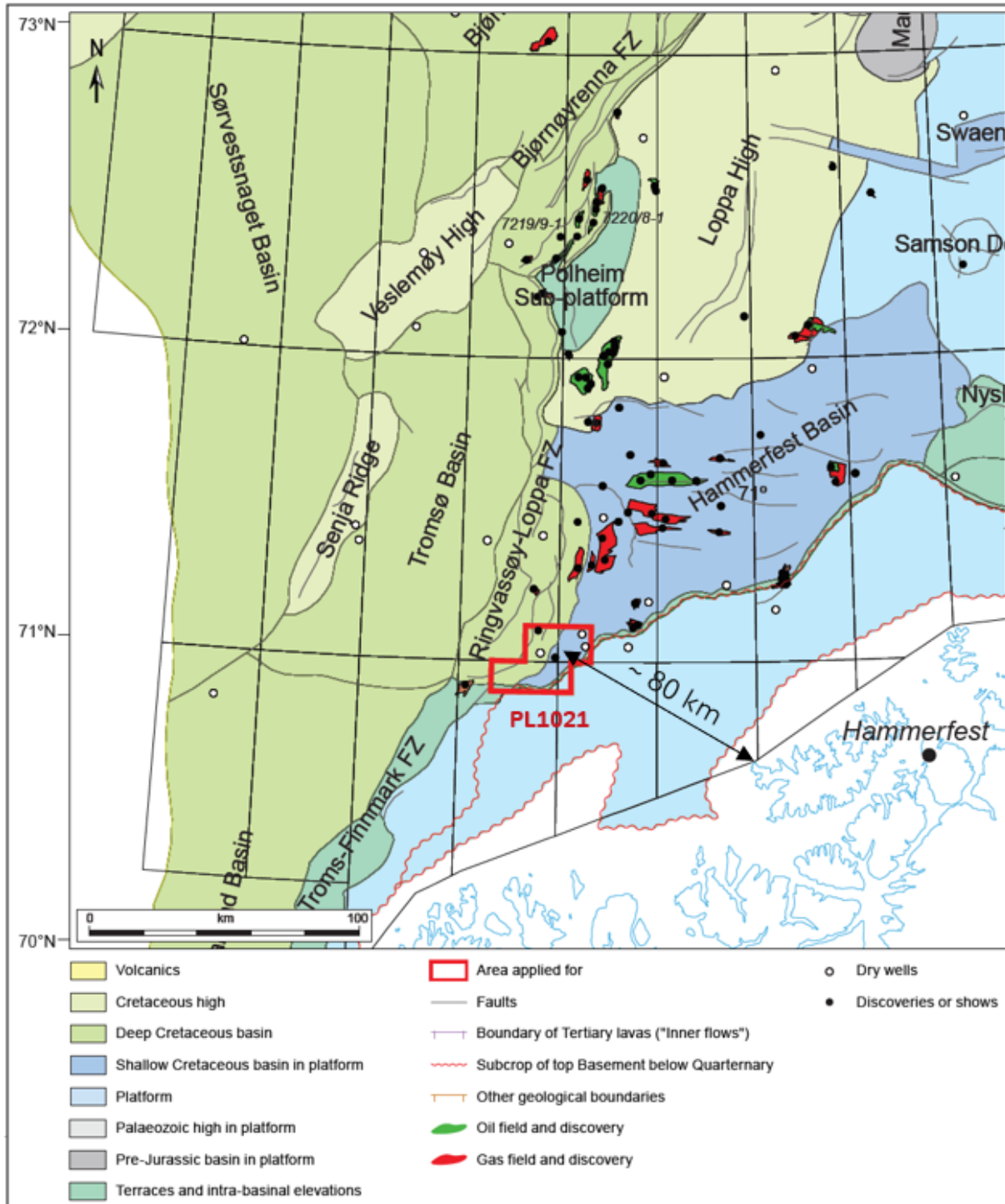


Fig. 1.1 PL1021 Location map

2 License history

PL1021 was awarded 01.03.2019 following TFO 2018. The license group consisted of Dea Norge AS (operator 50%) and DNO Norge AS (50%). In November 2019 the Dea Norge AS merged with Wintershall Norge AS, and became Wintershall DEA Norge AS.

The work program was G&G studies and seismic reprocessing or acquire reprocessed seismic. The work program was fulfilled Q3 2019 with the purchase of the pre-stack reprocessed and merged LN14M02. A drill or drop decision was made within 2 years.

Key dates:

Milestone: Drill or Drop 01.03.2021

License expiry: 01.03.2026

The main purpose of the PL1021 work program was to evaluate the exploration potential in Middle Triassic Kobbe Formation with Dovregubben as the main prospect. As the evaluation revealed volumes below the minimum economic field size, secondary targets in Upper Triassic and Lower Cretaceous were also evaluated. The volume potential proved to be below minimum economic field size. The Realgrunnen play has been tested with three wells and was therefore not a target for the license group.

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 PL1021

Meeting category	Dates
<i>MC</i>	<i>04.04.2019</i>
<i>Work-meeting</i>	<i>11.09.2019</i>
<i>ECMC</i>	<i>08.11.2019</i>
<i>EC</i>	<i>19.06.2020</i>
<i>ECMC</i>	<i>24.11.2020</i>

3 Database overview

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

The color codes match the live traces map on Fig. 3.1.

Survey name	Type	Vintage	Public	Quality	Comments
EN0701	3D	2007	Yes	Fair	FinMig
NA94-TRM-R3D	3d	1994	Yes	Fair	FinMig, reprocessed 2003
ST0825	3D	2008	No	Fair	FinMig
ST09M03	3D	2009	No	Fair	Merge of ST0306, ST0706, ST0714, ST0729, ST0824 & ST0825
LN14M02	3D	2014	No	Fair	Merge of ST0714, ST0824 and ST0825
NA9701-301	2D	1997	Yes	Fair	FinMig
NBR11-233605	2D	2011	No	Fair	FinMig
BARE05-711730	2D	2005	Yes (partially)	Fair	FinMig
BARE05-2200	2D	2005	Yes (partially)	Fair	FinMig
BARE05-711800	2D	2005	Yes (partially)	Fair	FinMig



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

See Table 3.1 for survey names. PL1021 license boundary in white.



As the seismic quality was poor, especially over the Dovregubben prospect, the operator produced an in-house conditioned version of the ST09M03, which was shared with the partner and used for structural interpretation only. The work commitment was fulfilled with the purchase of Lundin's LN14M02. This was a pre-stack reprocessed merge found to be of improved quality, compared to ST09M03, based on the received test cube.

In addition, it was agreed in the license to use 5 2D seismic lines for seismic tie to the Goliath field (well 7122/7-1) (Fig. 3.1).

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	Date	Operator	Primary Objective	Total Depth (MD - mRKB)	TD Formation	Status	Source
7019/1-1	2000	Norsk Agip	Realgrunnen	3003	Tubåen	Gas	Released
7119/12-1	1980	Den Norske Stats Oljeselskap	Mid Jurassic	3088	Stø	Oil shows	Partner
7119/12-2	1981	Den Norske Stats Oljeselskap	Mid Jurassic	1902	Fruholmen	Oil shows	Partner
7119/12-3	1983	Den Norske Stats Oljeselskap	Early-Mid Jurassic	3314	Nordmela	G&C	Partner
7119/12-4	2011	Statoil Petroleum	Mid Jura. Stø & Nordmela	2917	Fruholmen	Dry	Partner
7120/1-2	1989	Norske Shell	Early Cretaceous	2630	Fruholmen	Oil	Released
7120/2-3S	2011	Lundin	Cretaceous and Jurassic	2625	Snadd	Gas	Partner
7120/6-3S	2012	Lundin	Early Cretaceous	3030	Nordmela	Shows	Released
7120/9-2	1984	Norsk Hydro	Permian sandstones	5072	Permian	Gas	Partner
7120/10-1	1984	Esso	Early-Mid Jurassic	2000	Fruholmen	Dry	Released
7120/10-2	1990	Esso	Valanginian turbidites	2497	Hekkingen	Dry	Released
7120/12-1	1980	Norsk Hydro	Jurassic and Triassic	3573	Kobbe	Shows	Released
7120/12-2	1981	Norsk Hydro	Early-Mid Jurassic	4680	Basement	G&C	Released
7120/12-3	1983	Norsk Hydro	Early-Mid Jurassic	2523	Fruholmen	Gas	Released
7120/12-4	1984	Norsk Hydro	Permian sandstones	2199	Carboniferous	Dry	Released
7120/12-5	2011	Eni Norge	Stø, Snadd and Kobbe	3630	Kobbe	Dry	Released
7122/2-1	1992	Norsk Hydro	Early Cretaceous	2120	Stø	Dry	Released
7122/7-1	2000	Eni Norge	Jurassic and Triassic	1524	Snadd	Oil	Released
7122/7-2	2001	Eni Norge	Jurassic and Triassic	1418	Snadd	Oil	Released
7122/7-3	2005	Eni Norge	Jurassic and Triassic	2726	Permian	O&G	Released
7122/7-4S	2006	Eni Norge	Jurassic and Triassic	2550	Havert	O&G	Released
7122/7-5	2006	Eni Norge	Jurassic and Triassic	2228	Klappmyss	Dry	Released
7122/7-6	2012	Eni Norge	Jurassic and Triassic	2026	Klappmyss	O&G	Released
7124/3-1	1987	Saga Petroleum	Mid Jurassic	4730	Carboniferous	O&G	Released
7124/4-1S	2011	GDF Suez	Realgrunnen	2814	Havert	Dry	Released
7125/4-1	2007	Norsk Hydro	Realgrunnen	1615	Klappmyss	O&G	Released
7125/4-2	2008	StatoilHydro	Realgrunnen	1750	Klappmyss	Oil	Released
7219/9-2	2017	Statoil Petroleum	Early Cretaceous	2568	Stø	Oil	Traded

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
- Pre-stack conditioning of ST09M03
- PSDM time post stack conditioning of LN14M02
- Pre-stack conditioning test on LN14M02.
- Basin Model study
- *External:* Purchase of mud-gas logs from GeoProvider. Fig. 4.1 shows the number of wells that was purchased.
- *External:* Rock Evaluation study by APT on source rocks. Table 4.1 shows the APT samples received and what geochemical analyses that was carried out

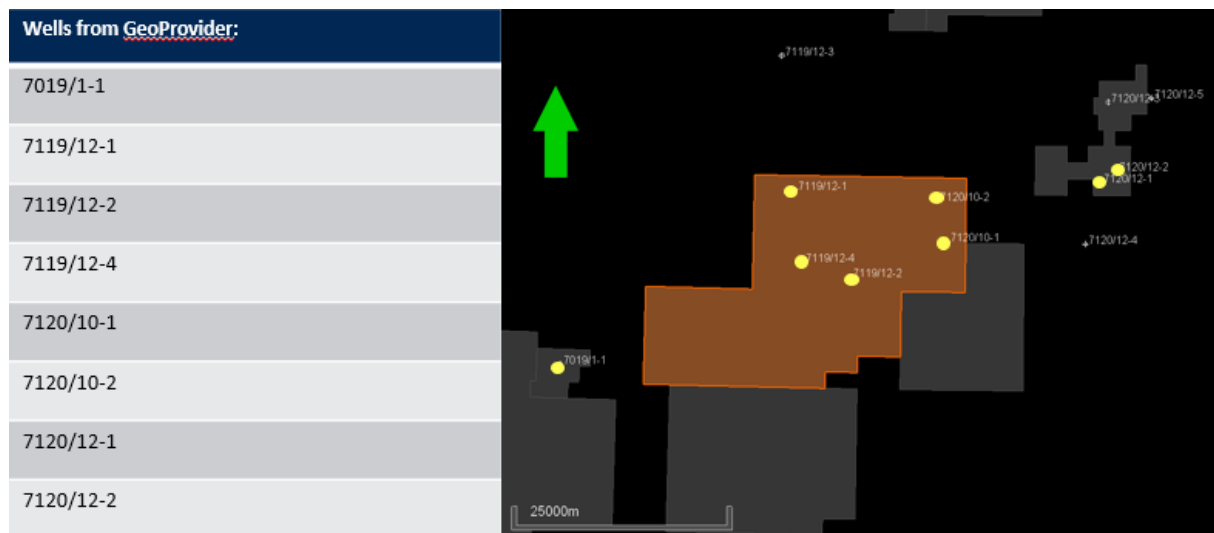


Fig. 4.1 Wells with mud gas logs from GeoProvider used in the common database

Table 4.1 APT geochemical analyses carried out

APT ID	Well	Type	Depth (m)	Fm	Lithology	Crush	TOC	RE	Extract	GC-EOM	MS-Alk	MS-Aro
220474	7119/12-1	DC	2271	Kolje	Shale	✓	✓	✓	✓	✓		
220475	7119/12-1	DC	2442	Knurr	Shale	✓	✓	✓	✓	✓	✓	
220476	7119/12-1	DC	2605	Hekkingen	Shale	✓	✓	✓	✓	✓		
220477	7119/12-1	DC	2647	Fuglen	Shale	✓	✓	✓	✓	✓		
220478	7119/12-1	DC	2695	Stø	Sst	✓	✓	✓	✓	✓		
220479	7119/12-1	COCH	2718	Stø	Sst	✓	✓	✓	✓	✓		
220480	7119/12-1	COCH	2720	Stø	Sst	✓	✓	✓	✓	✓	✓	✓
220481	7119/12-1	DC	2790	Stø	Sst	✓	✓	✓	✓	✓		
220482	7119/12-1	DC	2905	Nordmela	Shale/Sst	✓	✓	✓	✓	✓		
220483	7119/12-1	DC	3058	Tubåen	Sst	✓	✓	✓	✓	✓		
220484	7119/12-2	DC	1144	Knurr	Shale	✓	✓	✓	✓	✓		
220485	7119/12-2	DC	1318	Hekkingen	Shale	✓	✓	✓	✓	✓	✓	
220486	7119/12-2	DC	1324	Fuglen	Shale	✓	✓	✓	✓	✓		
220487	7119/12-2	DC	1372	Stø	Sst	✓	✓	✓	✓	✓		
220488	7119/12-2	DC	1460	Stø	Sst	✓	✓	✓	✓	✓	✓	
220489	7119/12-2	COCH	1475	Stø	Sst	✓	✓	✓	✓	✓	✓	✓
220490	7119/12-2	COCH	1563	Nordmela	Sst	✓	✓	✓	✓	✓	✓	
220491	7119/12-2	DC	1902	Fruholmen	Shale/Sst	✓	✓	✓	✓	✓	✓	
220492	7119/12-4	DC	1880	Kolje	Shale	✓	✓	✓	✓	✓		
220493	7119/12-4	DC	1960	Knurr	Shale	✓	✓	✓	✓	✓		
220494	7119/12-4	DC	2235	Hekkingen	Shale	✓	✓	✓	✓	✓		
220495	7119/12-4	DC	2300	Stø	Sst	✓	✓	✓	✓	✓		
220496	7119/12-4	DC	2387	Stø	Sst	✓	✓	✓	✓	✓	✓	
220497	7119/12-4	DC	2391	Stø	Sst	✓	✓	✓	✓	✓	✓	✓
220498	7119/12-4	DC	2483	Nordmela	Sst	✓	✓	✓	✓	✓	✓	✓
220499	7119/12-4	DC	2849	Fruholmen	Sst	✓	✓	✓	✓	✓		
220500	7120/10-2	DC	2500	Hekkingen	Shale	✓	✓	✓	✓	✓		
220501	7120/12-2	DC	1855	Hekkingen	Shale	✓	✓	✓	✓	✓		
220502	7120/12-2	DC	3038	Kobbe	Shale	✓	✓	✓	✓	✓	✓	✓
220503	7120/12-2	DC	3095	Kobbe	Shale	✓	✓	✓	✓	✓		
220504	7120/12-2	DC	3545	Klappmyss	Shale	✓	✓	✓	✓	✓		

The rationale behind the PL1021 application was to evaluate the Middle Triassic Kobbe formation with expectations of improved reservoir quality in this area, having sand derived from the Caledonian terrain. This is based on a mineral study presented by Flemming et al., 2016.

Reinterpretation of the Top Kobbe reservoir revealed that the Kobbe formation was situated much deeper than first anticipated, reducing the reservoir quality dramatically, which again had strong negative effect on the volume potential. Consequently, additional prospectivity in the Snadd formation and the Cretaceous section was evaluated. This resulted in the definition of four leads. However, the volume potential was low and the risk high.

The seismic reflectors are of good quality down to Kobbe formation, except from the southwestern part of the license, where the seismic is heavily disturbed in the junction of the Troms-Finnmark Fault Complex and the Ringvassøy-Loppa Fault Zone. The quality of the attribute mapping was poor due to the poor seismic quality, especially in the Dovregubben area. No brightening on FAR stack was seen. The AVO feasibility study was negative, meaning any AVO result could not be trusted, due to the poor angle stack data quality. The conditioning of the seismic 3D cubes improved the continuity of the reflectors, and consequently the seismic structural maps, but could not be used for amplitude studies.

The frequency decomposition and color blending study gave some indications of minor channels towards the Dovregubben area, but amplitudes were not strong enough to be mapped in detail. A slump system evolving to a proximal fan was observed and used to define the Knurr Fan Lead.

The Basin Model study, with integrated APT analysis of key wells, have three main learnings:

1. The Hekkingen formation is the main source rock in this area and shows in 7119/12-1, 7119/12-4 and 7119/12-2 have been generated from this source rock.
2. There is a potential for Kobbe source rock proven in 7120/12-2.
3. Migrant oil stain in Stø Formation sample in 7119/12-1 is probably from a peak-oil mature Hekkingen source rock
4. Maturity maps indicate that potential source rocks in Snadd and Kobbe formations would be in the oil window at present day in the Dovregubben drainage area.

5 Prospect Update Report

Due to the updated interpretation of Top Kobbe formation, the prospect outlines have changed from the application (Fig. 5.1), and the surrounding Mid-Triassic leads is now too deep to be prospective. In the updated map of Top Kobbe, only Dovregubben remains (Fig. 5.2).

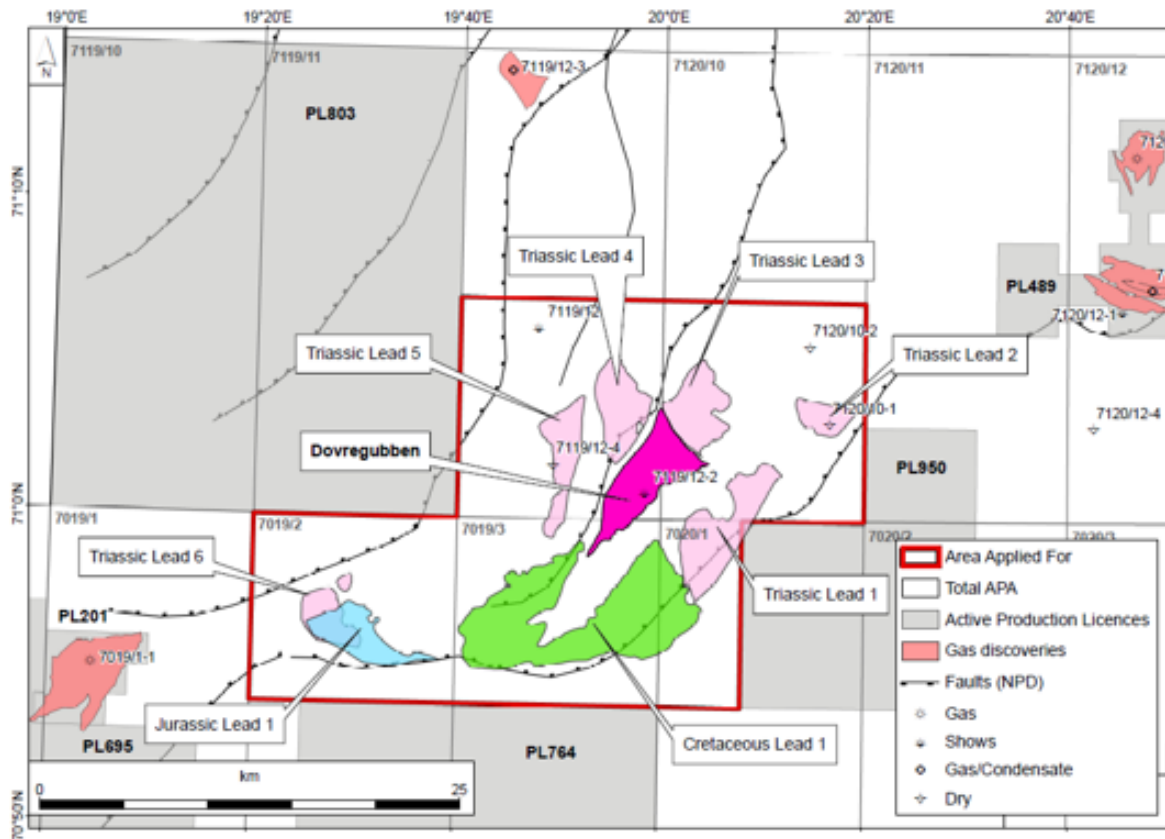


Fig. 5.1 Initial prospect overview from application

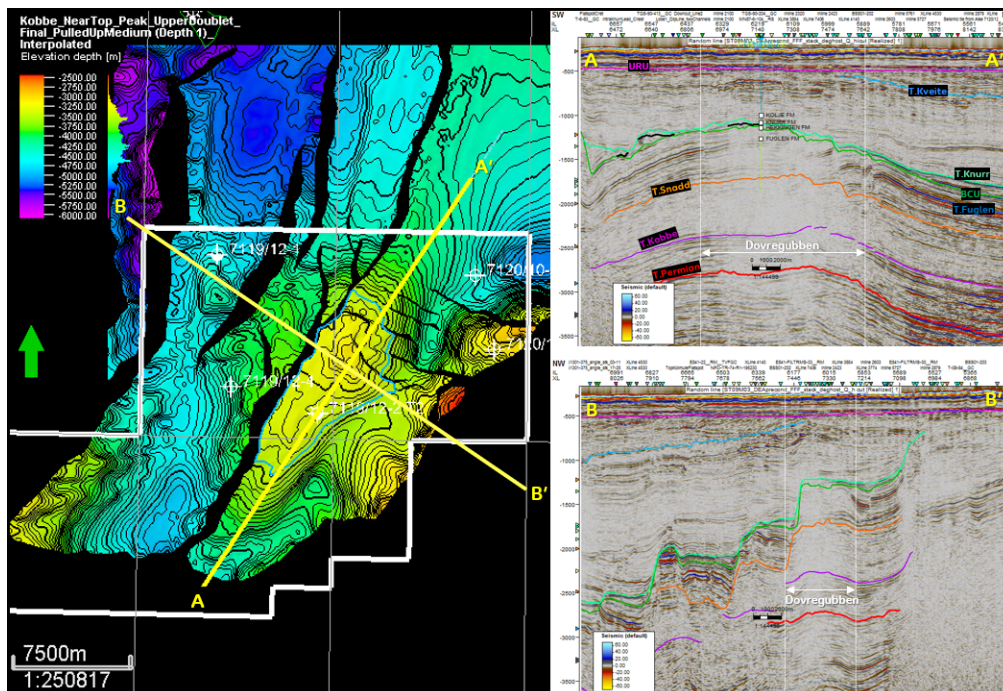


Fig. 5.2 Top Kobbe Fm. structural depth map with Dovregubben prospect. C.I: 50m

Dovregubben is the shallowest structure within the Kobbe formation, with a crest at 3035m. By adding 1200 m of Neogene uplift will give a poor prognosis for reservoir quality and consequently decreased volumes.

The two Snadd leads can be found in Fig. 5.3; Bobbo is situated in the same structure as Dovregubben, and Lie is situated at the structure drilled by the Jurassic well 7119/12-1.

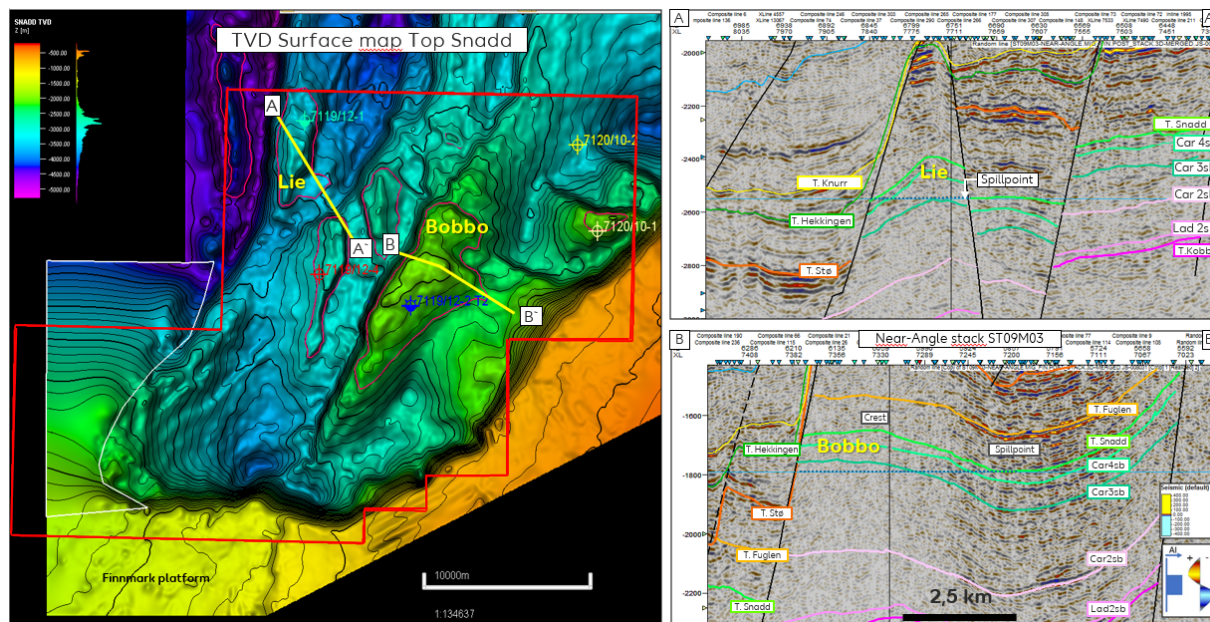


Fig. 5.3 Top Snadd Fm. structural depth map with seismic sections through Bobbo and Lie Leads

The Cretaceous section has low prospect potential and few structural closures. Fig. 5.4 show the Intra Knurr formation depth map with the Knurr fan lead. Steep inclination from the crest gives small volumes.

INTRA KNURR LEAD

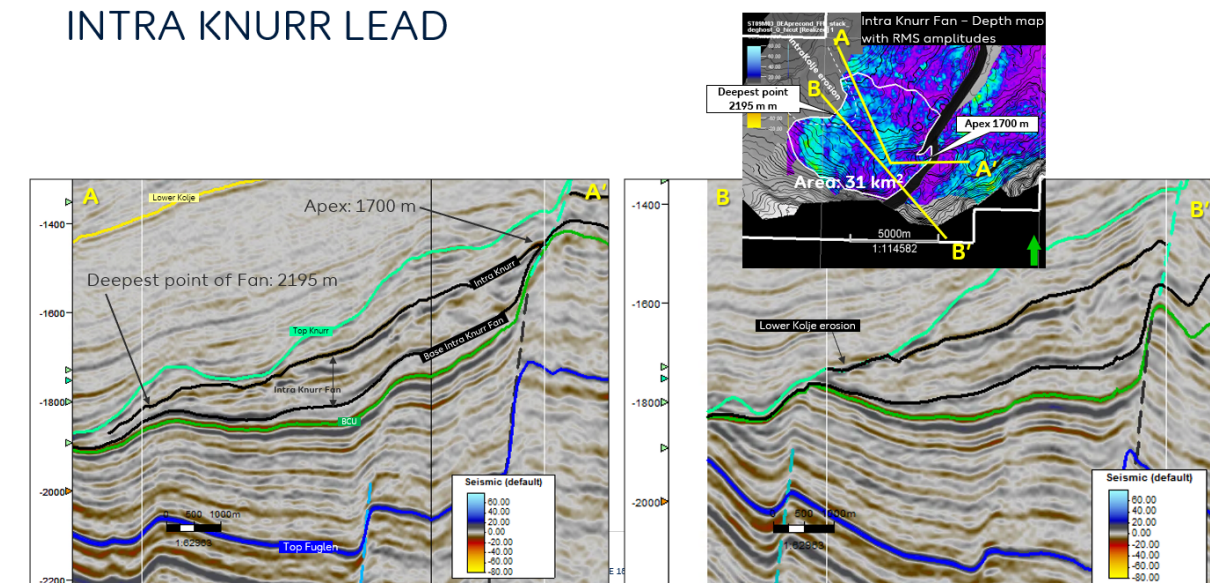


Fig. 5.4 Intra Knurr depth map with seismic sections through the Knurr Fan Lead

Top Kolmule lead is a small, low relief structural closer on a downfaulted terrace (Fig. 5.5).

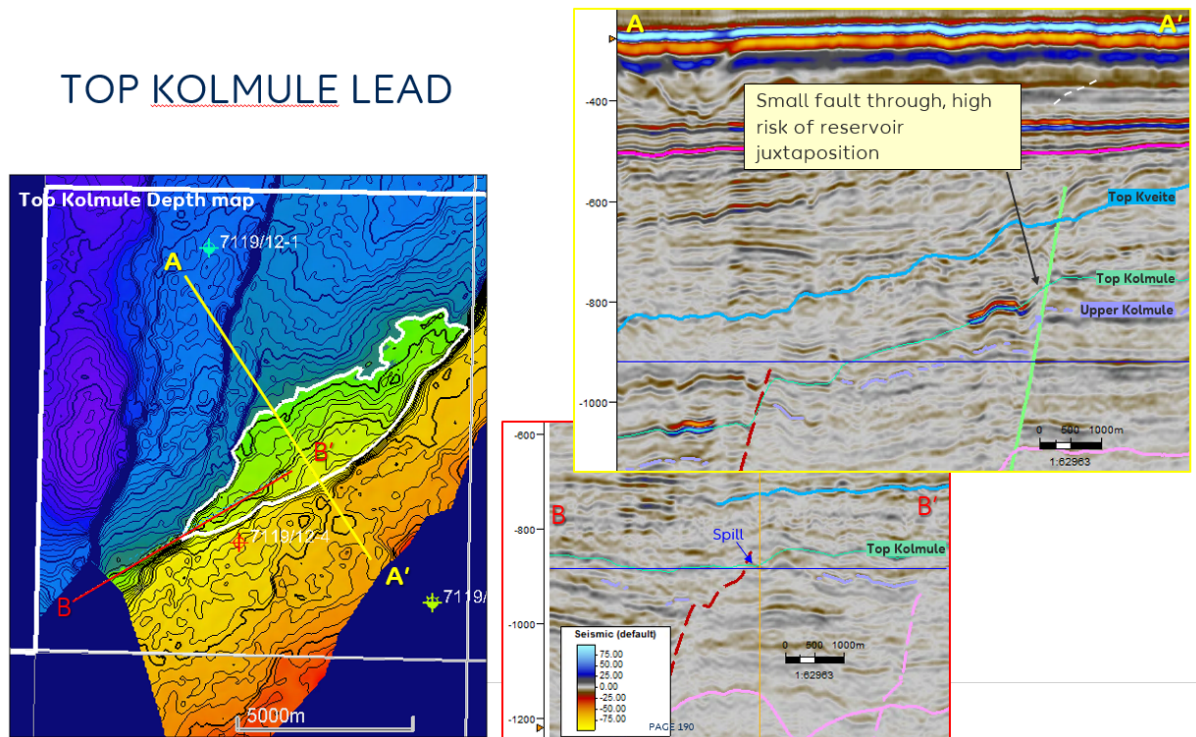


Fig. 5.5 Top Kolmule Formation. Depth map with seismic sections through the Kolmule Lead

All prospects and leads (Fig. 5.6) have been reviewed by the licensees. The leads as shown in Table 5.1 were quality checked during a legacy QC-Session (Pre-PAT) at 11/11/2020 and the revised volumes of the Dovregubben prospect were quality checked during a legacy QC-Session (Peer Review) at 03/02/2020 and presented to the partner in licence meetings.

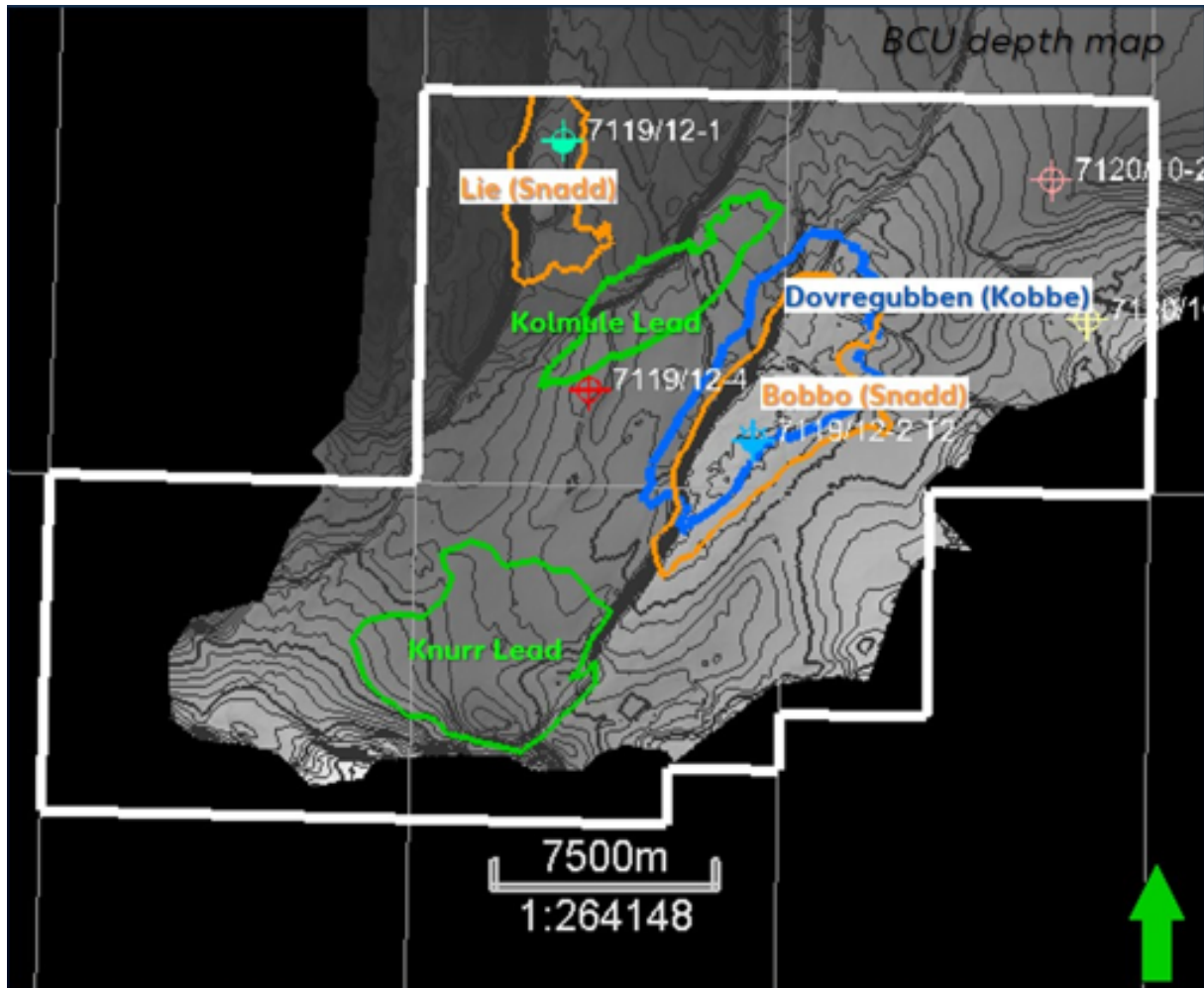


Fig. 5.6 Updated prospect and leads outlines in PL1021

Table 5.1 Final Volume and Risks

Prospect	Type	Age	Total Mean HIIP (mmboe)	Total Mean Rec. (mmboe)	GPOS (%)
Dovregubben	Prospect	Kobbe Fm	43	16	20
Bobbo	Lead	Snadd Fm	76	31	19
Lie	Lead	Snadd Fm	22	9	10
Knurr Fan	Lead	Knurr Fm	57	26	20
Kolmule	Lead	Kolmule Fm	62	28	15

6 Conclusion

Reinterpretation of the prospect showed that the Kobbe Formation reflector was deeper than the initial interpretation. The volumes of Dovregubben decreased significantly and well below the minimum economic field size (80mmboe) in the area.

The licensees have not identified any economic prospectivity and the partnership agreed to relinquish the licence following the MC meeting the 24th of November 2020.