AkerBP

PL 814

Relinquishment Report

Partners:

MOL

OMV

Relinquishment Report PL814

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1 Introduction

1.1 License Group

Aker BP ASA 40 % (Operator)

OMV Norge AS 30 %

MOL Norge AS 30 %

1.2 Award and work program

Production license 814 was awarded 05.02.2016 as part of the APA 2015, with a commitment to acquire and reprocess 3D seismic data over the prospect area.

Seismic data MC3D-Q15 and MC3D-Q16 was purchased as part of the work program. Dual azimuth reprocessing and merging of Q15, Q16 and NH9302 into ABP16M02 was performed.

During the two-year period following the PL814 award, a decision to drill an exploration well on the Garm Prospect was made.

After a positive drill decision was reached and the authorities was notified on the 18.01.2018, a well planning process was initiated, and a one year extension of the BOK and the subsequent deadlines was granted. The drilling of the Freke-Garm well (15/6-15) in May 2019 was a valid test of the Middle Jurassic play and the volume potential in the Garm structure. The well was dry and reservoir properties poorer than expected. Remaining prospectivity within the PL814 license area was downgraded.

As the work obligations have been fulfilled, a unanimous decision was made in PL814 to relinquish the license at the BOK gate 05.02.2021.

ECMC meetings held:

04.04.2016

17.11.2016

26.06.2017

28.11.2017

19.06.2018

15.11.2018

04.06.2019

20.11.2019

02.06.2020

19.11.2020

In addition, several work meetings and well specific meetings have been arranged.

1.3 Identified prospectivity

Several prospects are defined within PL814 (Fig. 1.1). The main Freke-Garm Prospect is a saltinduced rotated fault block just to the east of the Freke discovery well 15/6-10 drilled in 2009.

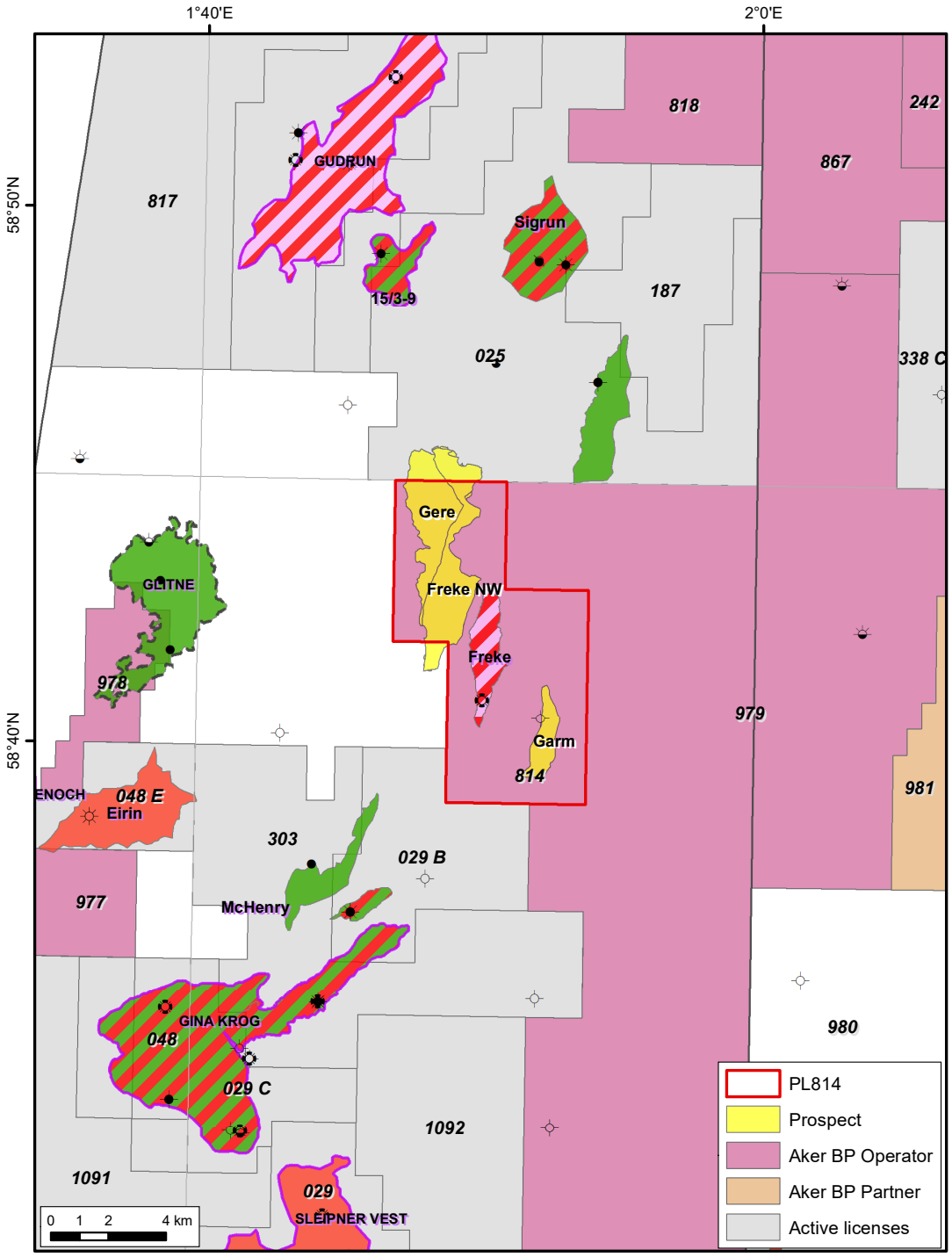

Fig. 1.1 Overview of the remaining prospects within PL814.

The objective of well 15/6-15 was to test the potential of the Freke-Garm Prospect with the primary target in Middle Jurassic Hugin shoreface and Sleipner fluvial sandstones, and secondary target in the Triassic fluvial sandstones of the Skagerrak Formation. Both the primary and secondary play are proven in the region (e.g. Eirin discovery and Gina Krog Field). The targeted reservoir unit is situated below Upper Jurassic claystones of the Heather and Draupne formations.

The chance of success for the Hugin and Sleipner formations was estimated to 40 %, with fault seal towards the east being the main risk. Secondly, reservoir quality og the Sleipner Formation (amout og reservoir sands) was associated with an intermedium risk. The presence of possible Hugin sands in the 15/6-15 well position was very uncertain as well 15/6-10 did not encounter any Hugin Formation.

The latest seismic interpretation of the Freke-Garm Prospect was based on the Aker BP in-house conditioned PGS16910VIK seismic data. The seismic interpretation of key reflectors used to define the prospect, such as the BCU and Top Sleipner coal pick were of high confidence (Fig. 1.2 and Fig. 1.3). As both the BCU and Top Sleipner coal pick came in within the prognosed uncertainty, no major changes to the seismic interpretation was required; apart from the Hugin Formation being absent. A semi-regional Top Sleipner depth-map with the 15/6-15 well location and nearby wells are shown in Fig. 1.4.

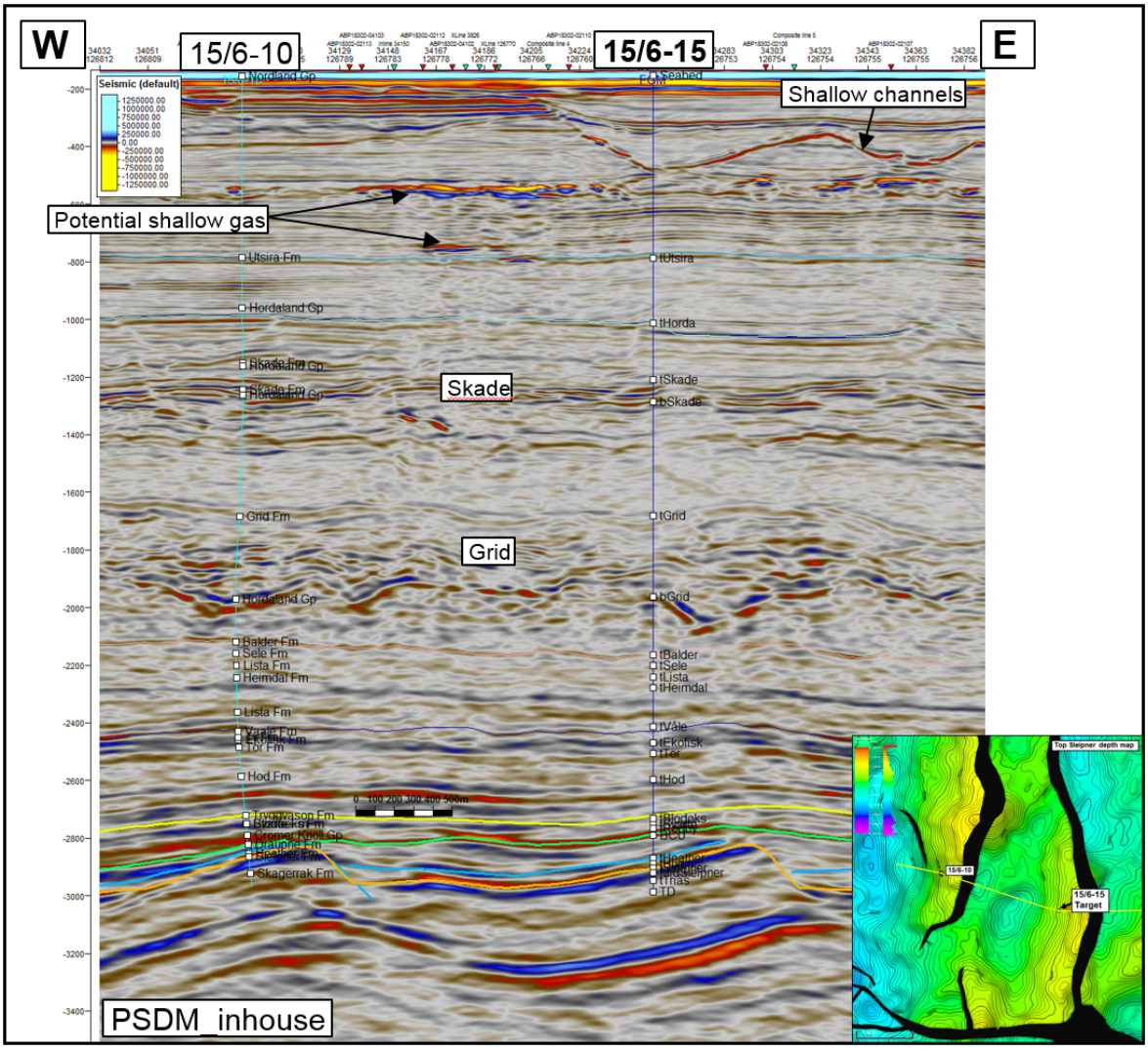

Fig. 1.2 West-east seismic line through 15/6-15 Garm well target.

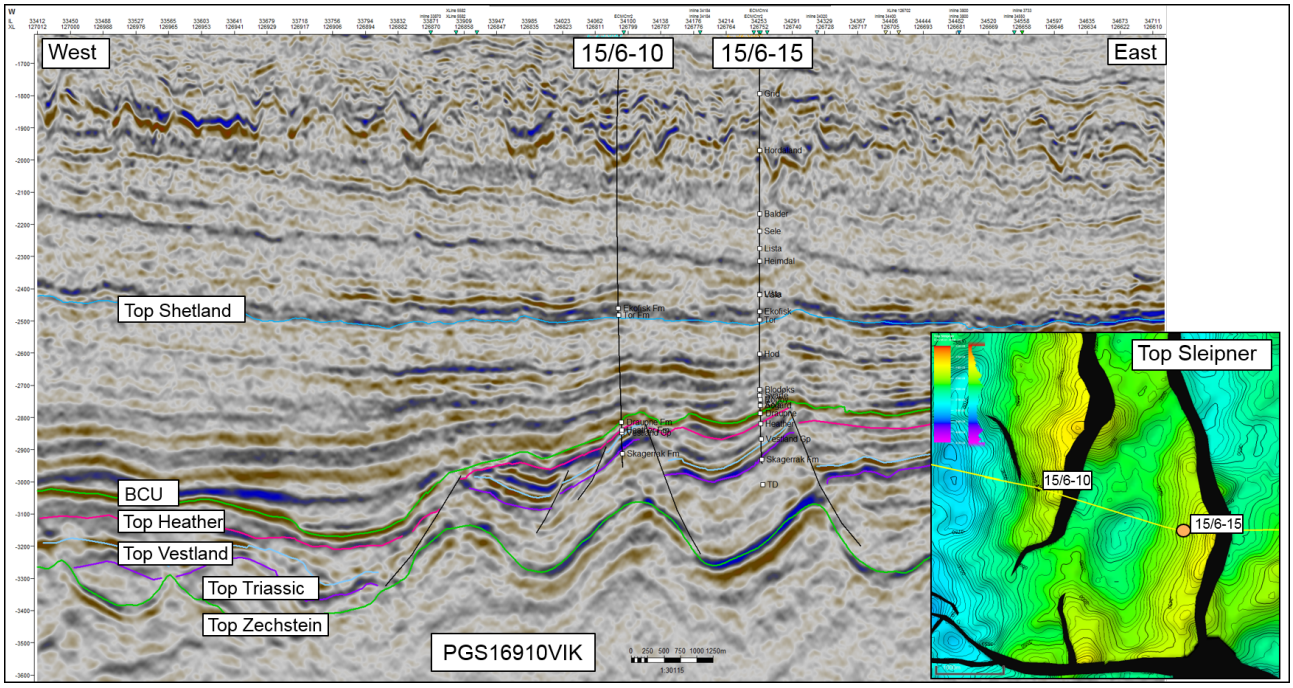

Fig. 1.3 Seismic section through the 15/6-10 and 15/6-15 well paths.

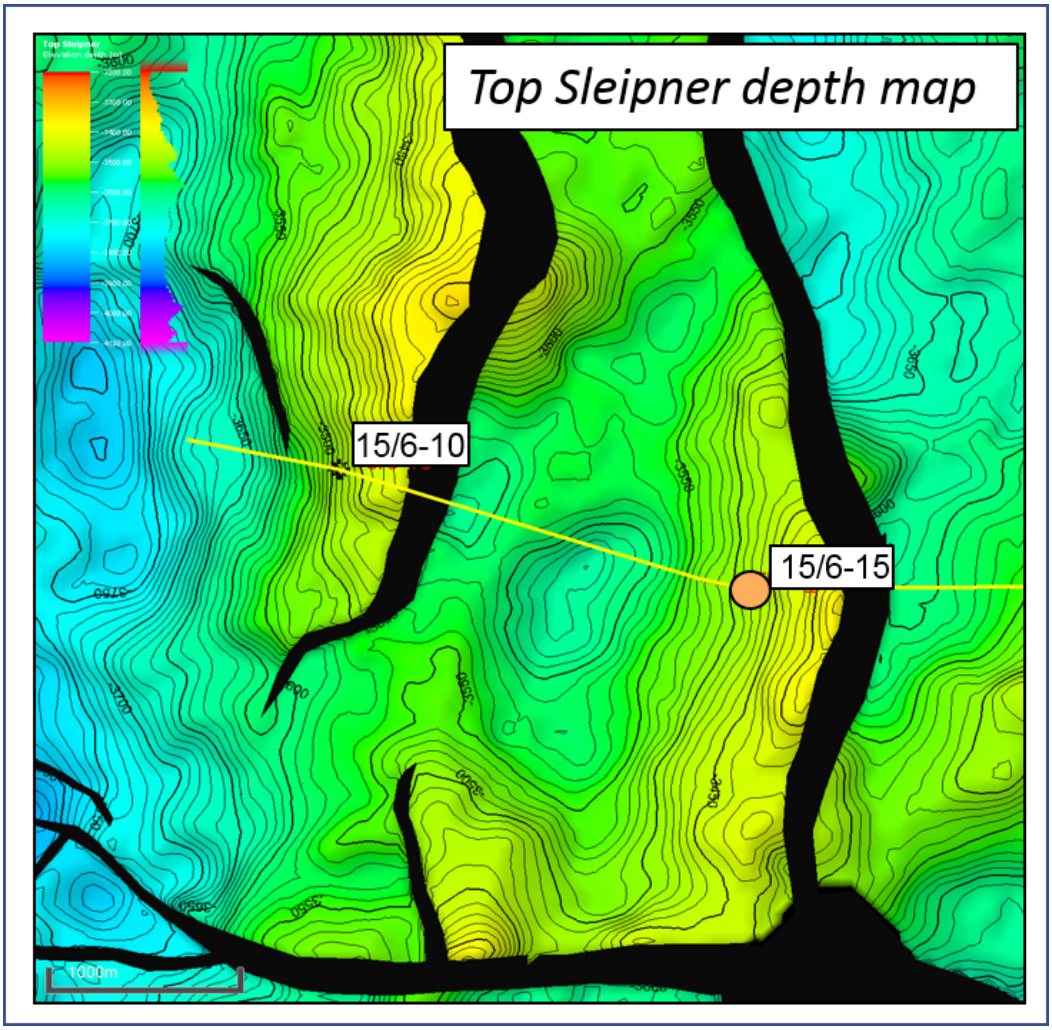

Fig. 1.4 Top Sleipner reservoir depth map with Garm Well 15/6-15 and Freke 15/6-10 locations.

The 15/6-15 exploration well was drilled in May 2019 with conclusive result. The well was drilled to 3795 m MD with TD in Triassic rocks (Fig. 1.5). The main Middle Jurassic target came in close to the prognosed depth with the Hugin Formation being absent and the Sleipner Formation comprising good-moderate reservoir quality. The secondary Triassic target came in close to prognosis and comprised poor reservoir quality.

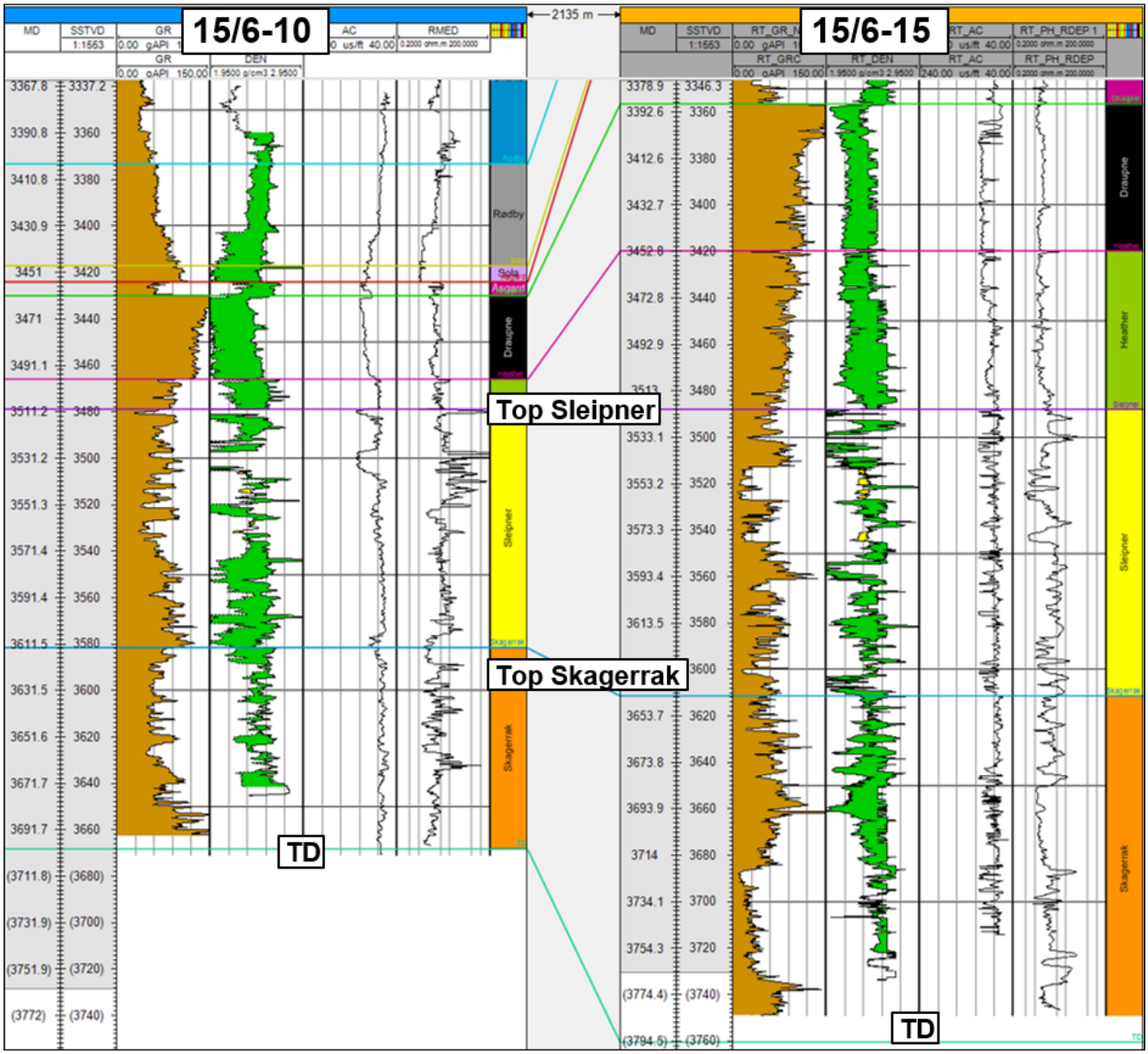

Fig. 1.5 Correlation of wells 15/6-10 and 15/6-15 for the main (Sleipner) and secondary (Skagerrak) targets.

Lack of hydrocarbons in the Garm structure is most likely due to seal failure of the eastern bounding fault, but migration failure can not be ruled out.

The remaining prospects have a medium-high chance of success, however, the resource potential is considered too low to be economically viable at present.

2 Database

2.1 Seismic data

To evaluate the Freke-Garm area, several seismic cubes were utilized prior to the APA 2015, but the main seismic data used was MC3D-Q15 (Fig. 2.1 and Table 2.1).

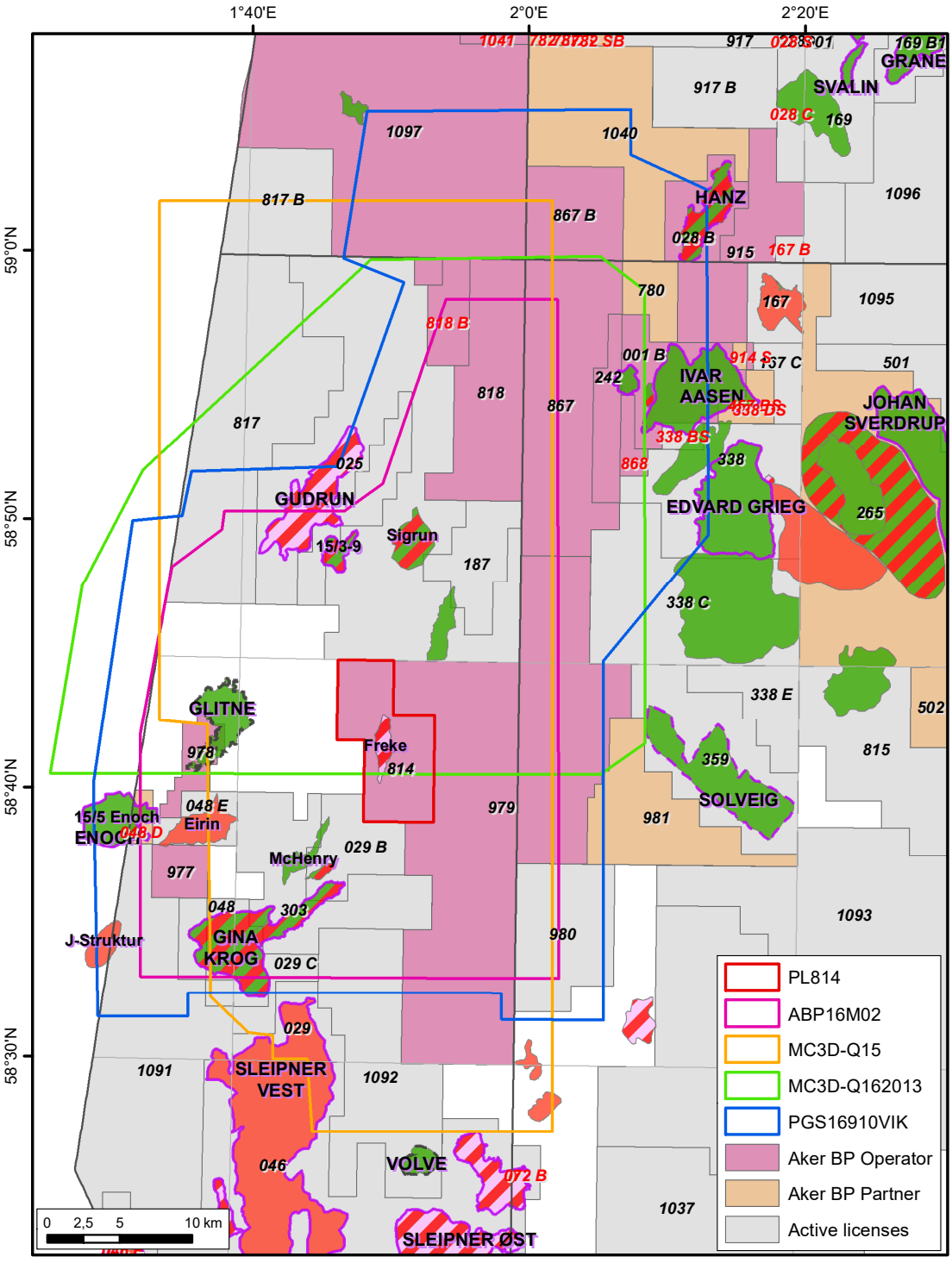

Fig. 2.1 Common seismic database

Table 2.1 Seismic database and survey details

Name	Wells covered	Area (sqkm)	Company	Comments	Aker BP ASA	MOL Norge AS	OMV (Norge) AS
MC3D-Q15		440	PGS	Background data	Yes	Yes	Yes
MC3D-Q162013	15/6 -4, -7, -9S, -10, -12, 15/3- 4, - 5, -6, -9T2	440	PGS	Background data	Yes	Yes	Yes
ABP16M02		440		Reprocessing by ION	Yes	Yes	Yes
PGS16910VIK	15/6 -4, -10, -12, 15/3- 4, - 5, -6, -9T2	389	PGS	Reprocessing by PGS	Yes		Yes

Seismic cube MC3D-Q16-2013 was purchased in 2015 as part of the license work program. Before landing on a positive drill decision on the Freke-Garm Prospect, the seismic cube was reprocessed by ION in 2017 (ABP16M02) and PGS in 2018 (PGS16910VIK). Further in-house conditioning was performed on both reprocessed cubes to enhance the seismic imaging.

2.2 Well Data

The wells defined in the PL814 common database are shown in Fig. 2.2 and Fig. 2.3.

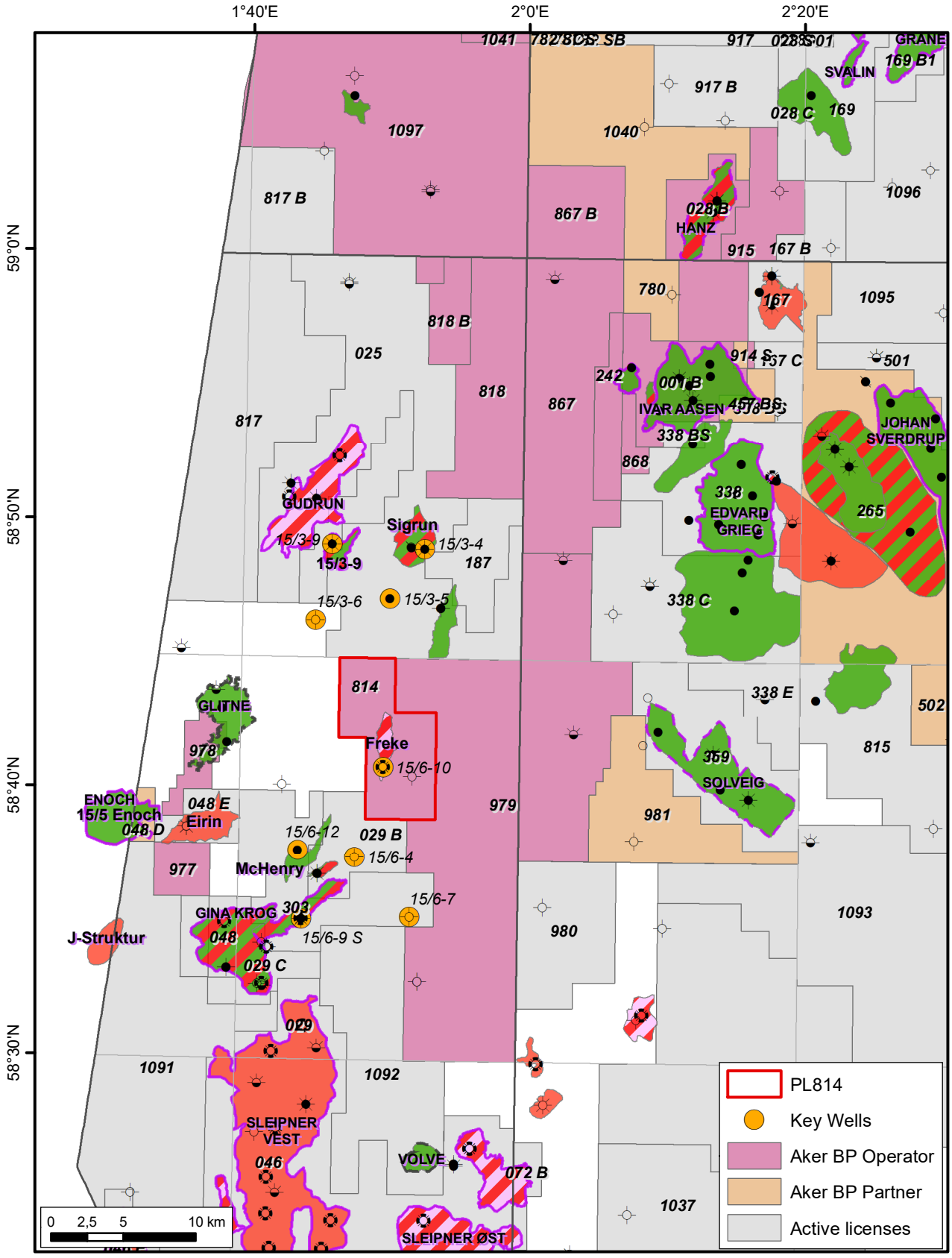

Fig. 2.2 Map of wells in common database in PL814.

Firm	Well	Informal Name	WDm	Year	Stratigraphy at TD	TDm md	Operator	Status	2 year released	20 year released
	15/3-4	Sigrun	107	1982	Triassic	4259	Elf	Oil/Gas		
	15/3-5	Sigrun	110	1984	Middle Jurassic	4130	Elf	Oil/Gas		
	15/3-6		105	1999	Late Cretaceous	2793	Amoco Norway Oil C	Dry		
*)	15/3-9T2	Gudrun	108	2010	Middle Jurassic	4654	Statoil Pet. ASA	Oil/Gas		
	15/6-4	Gina Krog	111	1976	Triassic	3550	Esso Explor & Production N	Oil		
	15/6-7	Gina Krog	107	1993	Triassic	3540	Deminex Norge AS	Dry		
*)	15/6-9S	Gina Krog	113	2007	Late Triassic	3940	Statoil ASA	Oil/Gas		
	15/6-10	Freke	111	2009	Late Triassic	3700	ExxonMobil Explor. & P.	Gas/Cond.		
	15/6-12	Mc Henry	115	2010	Late Triassic	3930	Statoil	Oil		

*) Only 2 year released data needed in Common Database

Yes No

Fig. 2.3 Wells in common database.

2.3 Special studies

Thin section and EDS analysis of four carbonate rich Triassic samples were performed (Hans Arne Nakrem, University of Oslo, 2019).

Composition analysis of RDT water/filtrate samples obtained in well 15/6-15 from the Sleipner and Skagerrak formations (Stratum Reservoir (Norway) AS, 2019).

Analysed DCG samples from well 15/6-15 for stable carbon and hydrogen isotopes (APT, 2019).

3 Remaining prospectivity

After drilling of the Freke-Garm structure, four prospects remain within PL814 (Fig. 3.1).

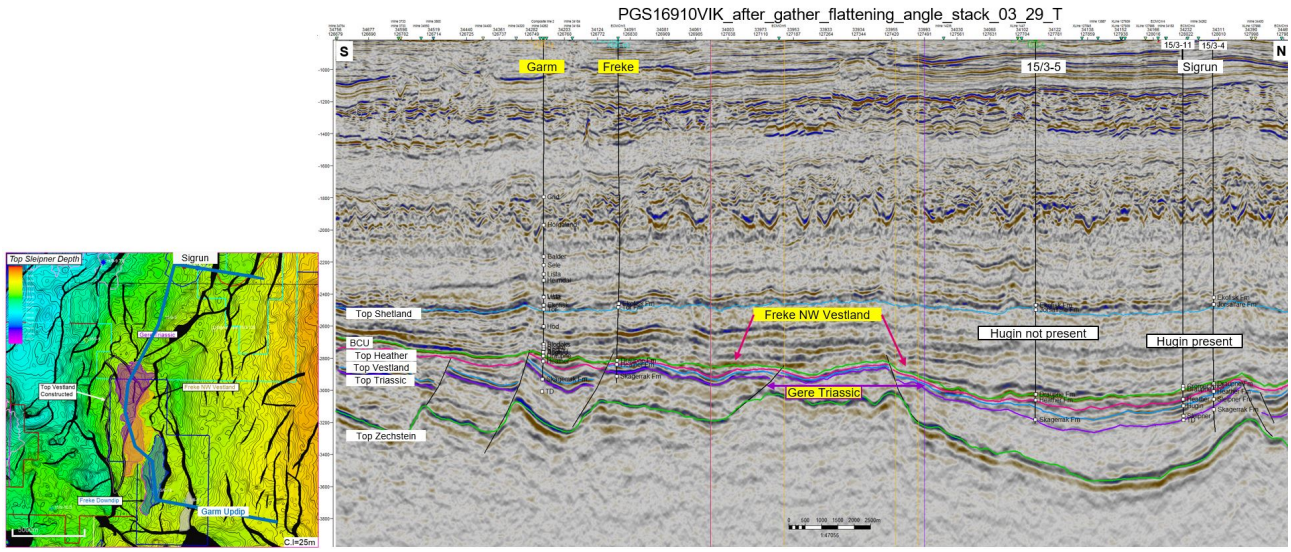

Fig. 3.1 Random seismic line through the Garm, Freke and Gere structures, showing the four remaining prospects.

The latest volumes and risk calculations in the license post-Garm well 15/6-15 is summarized in Table 3.1.

Table 3.1 Remaining prospectivity within PL814.

Prospect	Phase	Total Recoverable Resources [10^6 Sm^3] P90 – P50 – **Mean** – P10	Pg
Garm Updip	Gas/Cond	0.6 – 0.8 – **0.8** – 1.0	0.20
Freke Discovery and Downdip	Gas/Oil	1.2 – 1.6 – **1.7** – 2.5	0.72
Freke NW Vestland	Gas/Oil	0.6 – 0.9 – **1.0** – 1.5	0.43
Gere Triassic	Gas/Cond	0.9 – 1.8 – **2.0** – 3.3	0.38

The work performed in the license to mature the prospectivity post APA 2015 includes:

- Dual azimuth reprocessing and merging of Q15, Q16 and NH9302 into ABP16M02
- PGS16910VIK inhouse conditioning, well tie and AVA
- Extensive seismic interpretation on newer acquired and reprocessed/conditioned data
- Petroleum system (basin) modelling focusing on multiple migration pathways
- Sealing capacities, source rocks and thermal evolutions, are studied both in nearby wells, and through modelling
- AVO analysis on the Vestland Group reservoirs formation is evaluated and compared to nearby

well results
- The regional and local stress state is evaluated both through well-analysis, and numerical models

The above mentioned studies increased the confidence in the evaluation of the Freke-Garm structure and prospect model, and a decision to drill the Garm Prospect was made.

Before the 15/6-15 Garm and 15/6-16 S Hornet well results, Aker BP had developed an extensive and detailed Hugin depositional model of the area based on adjacent well data (e.g. well logs, core, biostrat, etc), regional interpretation and reconstruction of the structural and stratigraphic development in a salt influenced rift basin. However, due to the absence of Hugin Formation at the well locations, parts of the gross depositional Hugin shoreface model appears to be invalid, and thus, downgrading the surrounding Middle Jurassic prospects. Sleipner Formation remains a good reservoir target in the PL814 area, however, fault seal and migration risk is still high. In addition, the poor reservoir quality encountered by well 15/6-15 in the Skagerrak Formation further downgrades the remaining prospectivity in the license.

A limited up-dip potential in the structural fault-dependent Garm structure remains, but the Triassic reservoir contribution is reduced (Fig. 3.1).

The Freke Discovery is still expected to have a down-dip potential of oil, indicated by PVT (DewPoint study on MDT sample from well 15/6-10). Expected potential is lowered after the dry Garm well.

In the Freke NW Vestland, with proposed Sleipner reservoir in a structural fault-dependent trap, the volume potential is below minimum econimic field size as of 2021.

The Gere Triassic Prospect is the largest prospect remaining. The structure is a well defined four-way closure and it is favourably located with respect to migration from the basin to the west. Hugin and Sleipner formations are not expected to be present and the Skagerrak reservoir potential has been downgraded after the Garm well, leaving the volume potential economically non-viable.

4 Conclusion

The work program for PL814 has been fulfilled by purchasing and reprocessing 3D seismic data. In addition, exploration well 15/6-15 was drilled during May 2019. The well was dry and a valid test of the Garm structure. The well encountered water-bearing Sleipner and Skagerrak formations, that comprises very poor reservoir qualities in the Skagerrak Formation. Furthermore, the absence of the Hugin Formation at the well location suggests that the Hugin shoreface depositional model is invalid and needs rethinking.

In addition, migration into the Garm structure has increased risk, as applies also to the sealing capacity of faults through geologic time.

Improved seismic data quality, e.g. OBN data, is not expected to lift the remaining prospectivity above a technical-economical threshold.

Updating of prospect volumes and risk implementing the new learnings lead to a negative decision regarding a license continuation.

As the work obligations have been fulfilled, a unanimous decision was made in PL814 to relinquish the license at the BOK gate 05.02.2021.

5 References

Aker BP ASA, 2019: Well 15/6-15 Final Well Report. License PL814

Hans Arne Nakrem, University of Oslo, 2019: Thin section and EDS analysis of four carbonate rich Triassic samples

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