

PL 777

Relinquishment Report



Partners:



Relinquishment Report PL777, B, C & D

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1 Introduction

1.1 License Group

Aker BP ASA 40 % (Operator)

OMV Norge AS 20 %

Vår Energi AS 20 %

Petoro 20 %

1.2 Award and work program

Production license 777 was awarded 06.02.2015 as part of the APA 2014, with a commitment to acquire 3D coverage over the prospect area. During a three-year period following the PL 777 award, license extension was applied for with the same work program, i.e. production license 777B was awarded 05.02.2016 as part of the APA 2015, production license 777C was awarded 10.02.2017 as part of the APA 2016 and production license 777D was awarded 02.03.2018 as part of the APA 2017.

Seismic data MC3D-Q16_2013 was purchased as part of the work program.

After a positive drill decision was reached and the authorities was notified on the 20.12.2017, a well planning process was initiated, and well 15/6-16 S was spudded in May 2019. The dry well 15/6-16 S was a valid test of the Middle Jurassic play and the volume potential up-flank of well position is limited. The negative well results give increased risk on the remaining prospectivity within PL 777.

As the work obligations have been fulfilled, a unanimous decision was made in PL 777 to relinquish the license at the BOK gate 06.08.2020.

1.3 Identified prospectivity

Several prospects and one lead are defined within PL 777, B, C and D (Fig. 1.1). The main Hornet prospect is a Middle Jurassic low relief structure, located north and east of the Gina Krog and Glitne fields, respectively.

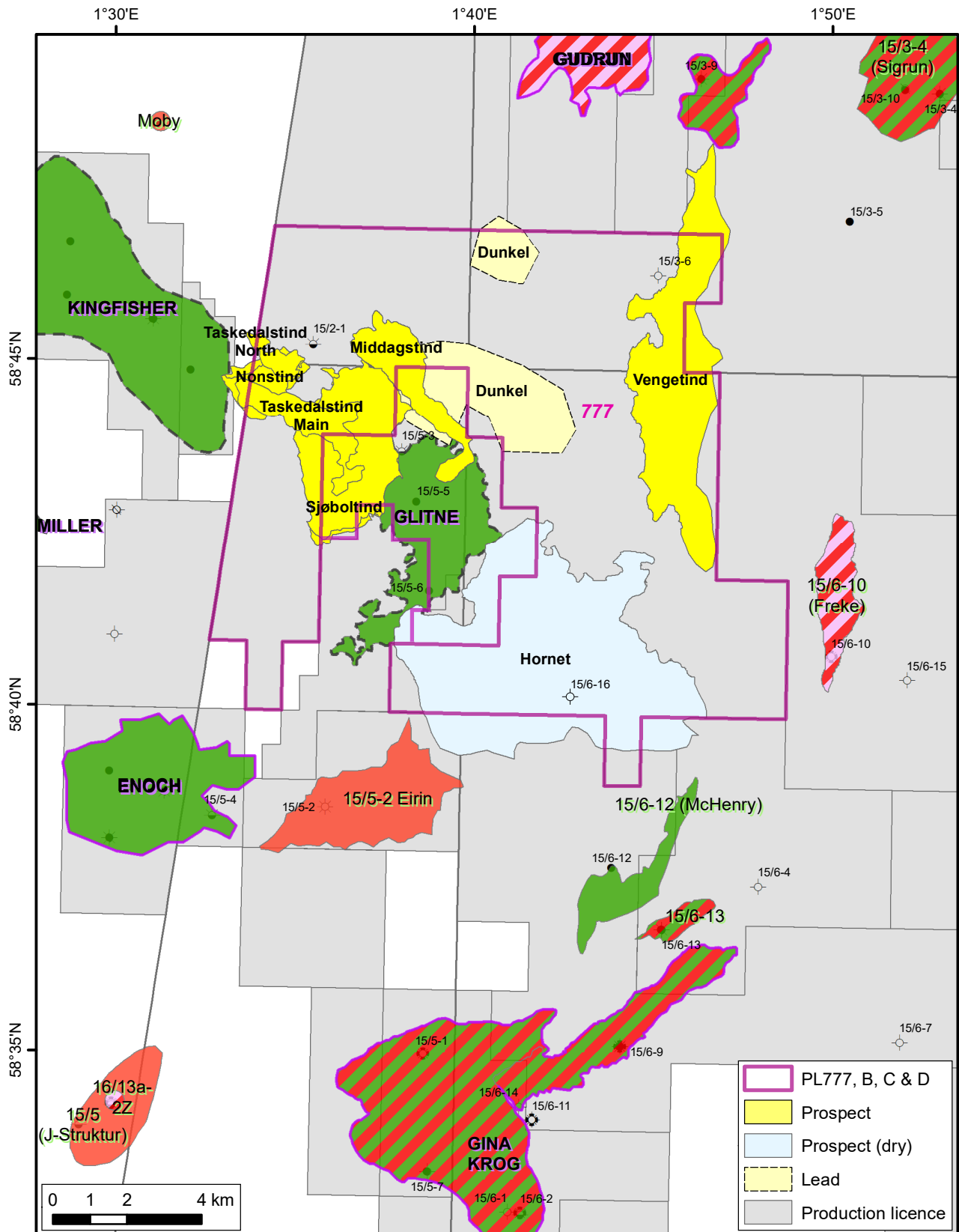


Fig. 1.1 Overview of the remaining prospects and lead within PL 777

The objective of well 15/6-16 S was to test the potential of the Hornet 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 Formation was estimated to 27%, with reservoir presence being the main risk and the chance of success for the Sleipner Formation was estimated to be 35% with reservoir quality being the main risk.

The latest seismic interpretation of the Hornet 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). 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 coal pick depth-map with the 15/6-16 S well location and nearby wells are shown in Fig. 1.3.

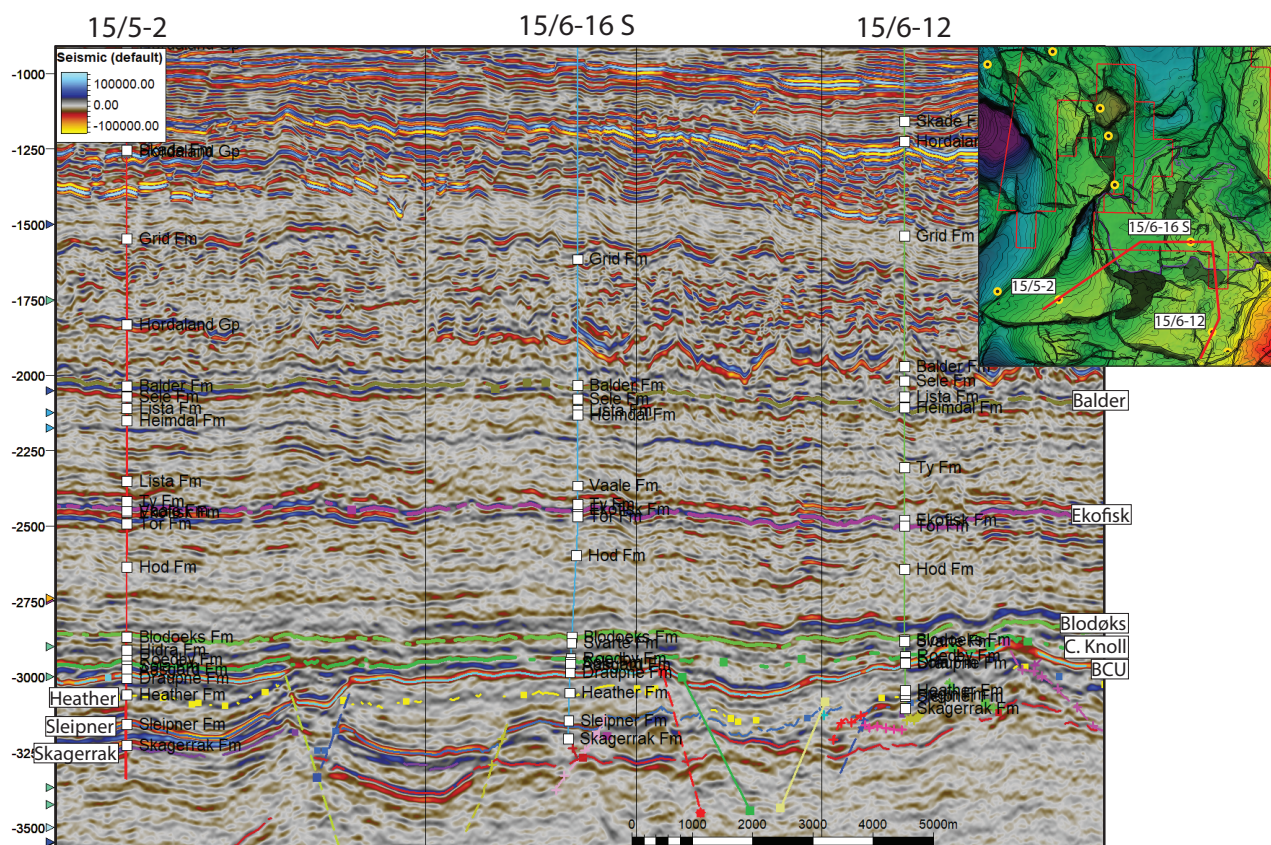


Fig. 1.2 Random seismic line through Hornet well 15/6-16 S and adjacent wells (15/5-2 and 15/6-12)

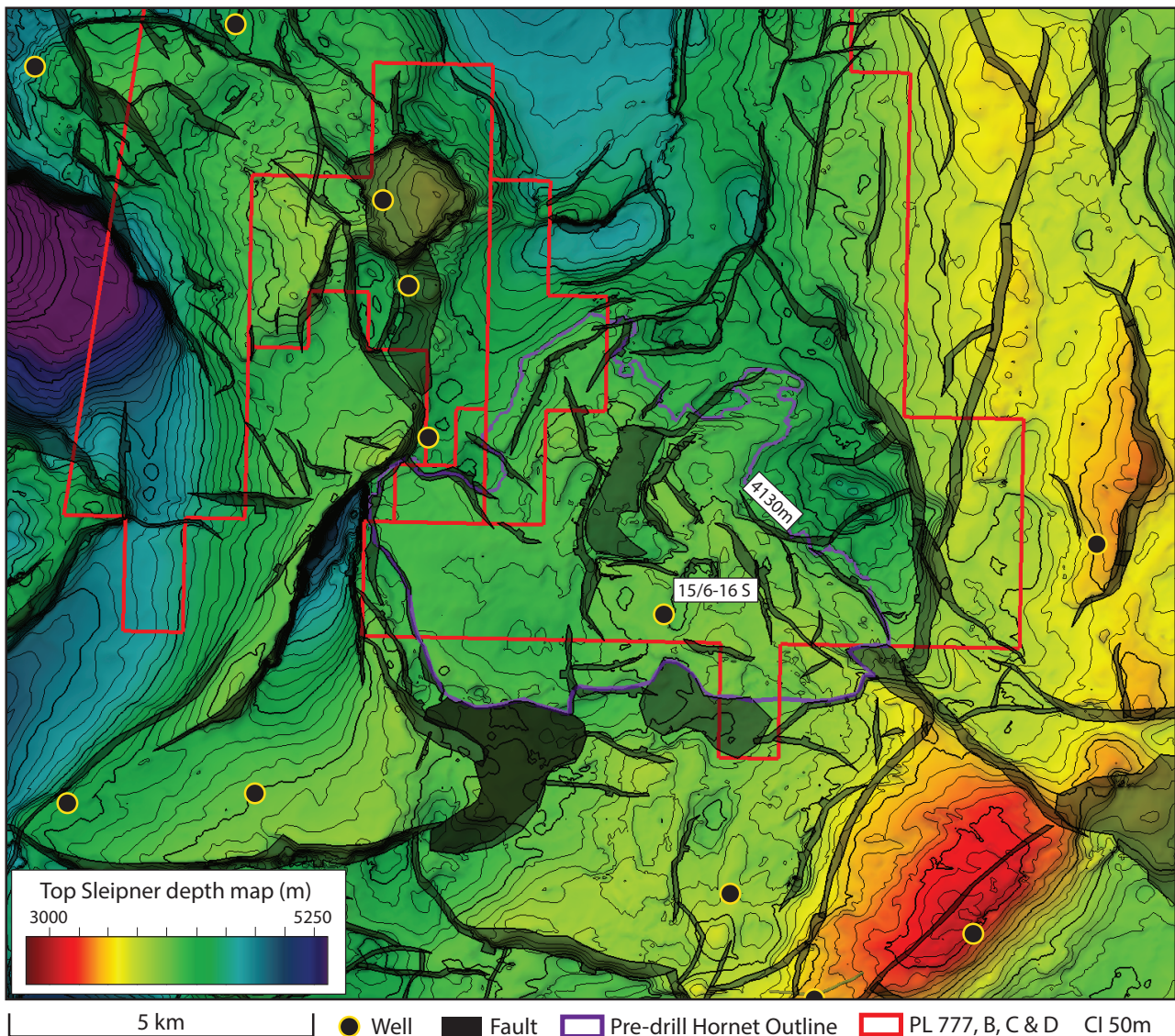


Fig. 1.3 Top reservoir depth map with Hornet Well 15/6-16 S location and adjacent wells

The 15/6-16 S exploration well was drilled during May-June 2019 with conclusive results. The well was drilled to 4203m MD with TD in Triassic rocks (Fig. 1.4). The main Middle Jurassic target came in close to the prognosed depth with the Hugin Formation being absent and the Sleipner Formation comprising poor reservoir quality. The secondary Triassic target came in close to prognose and comprised poor reservoir quality.

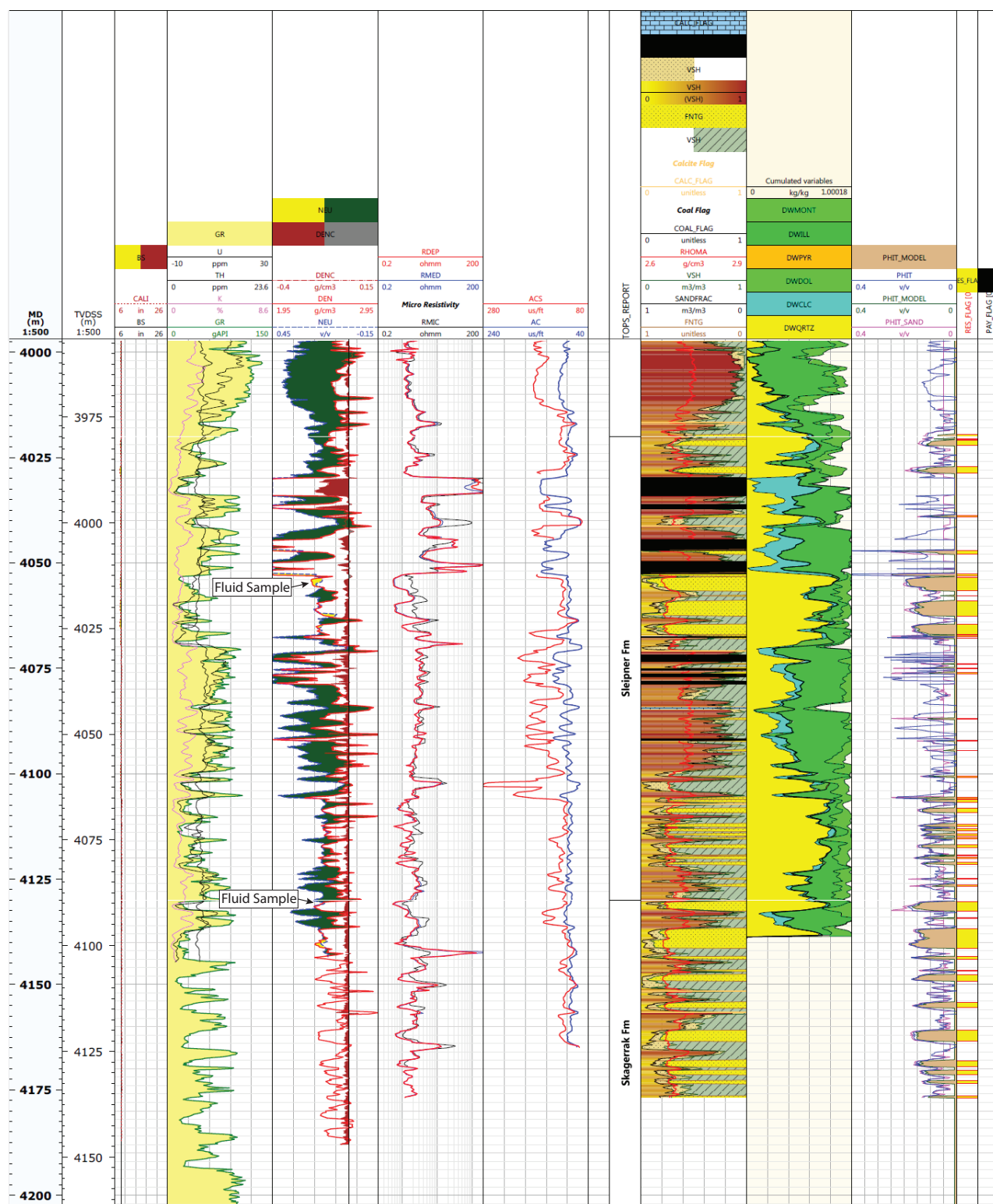


Fig. 1.4 CPI plot for well 15/6-16 S for the main (Sleipner) and secondary (Skagerrak) targets *Sample interval is indicated in CPI plot*

Fluid samples were obtained at 4054.31 m MD in the Sleipner Formation and 4131.31m MD in the Skagerrak Formation (Fig. 1.4). All samples contained water contaminated by the OBM.

Formation pressure tests with GeoTap (LWD) were performed to determine pressure and mobility within the Sleipner and Skagerrak formations. The test gave a pressure gradient of 1.086 g/cc

(0.107 bar/m) which indicates water (Fig. 1.5). However, the quality of the gradient is poor due to the low mobility in the reservoir rocks resulting in a high uncertainty (± 0.027 bar/m). The formation pressure measured up to 692 bar (285 bar overpressure) in the Sleipner Formation and 710 bar (292 bar overpressure) in the Skagerrak Formation.

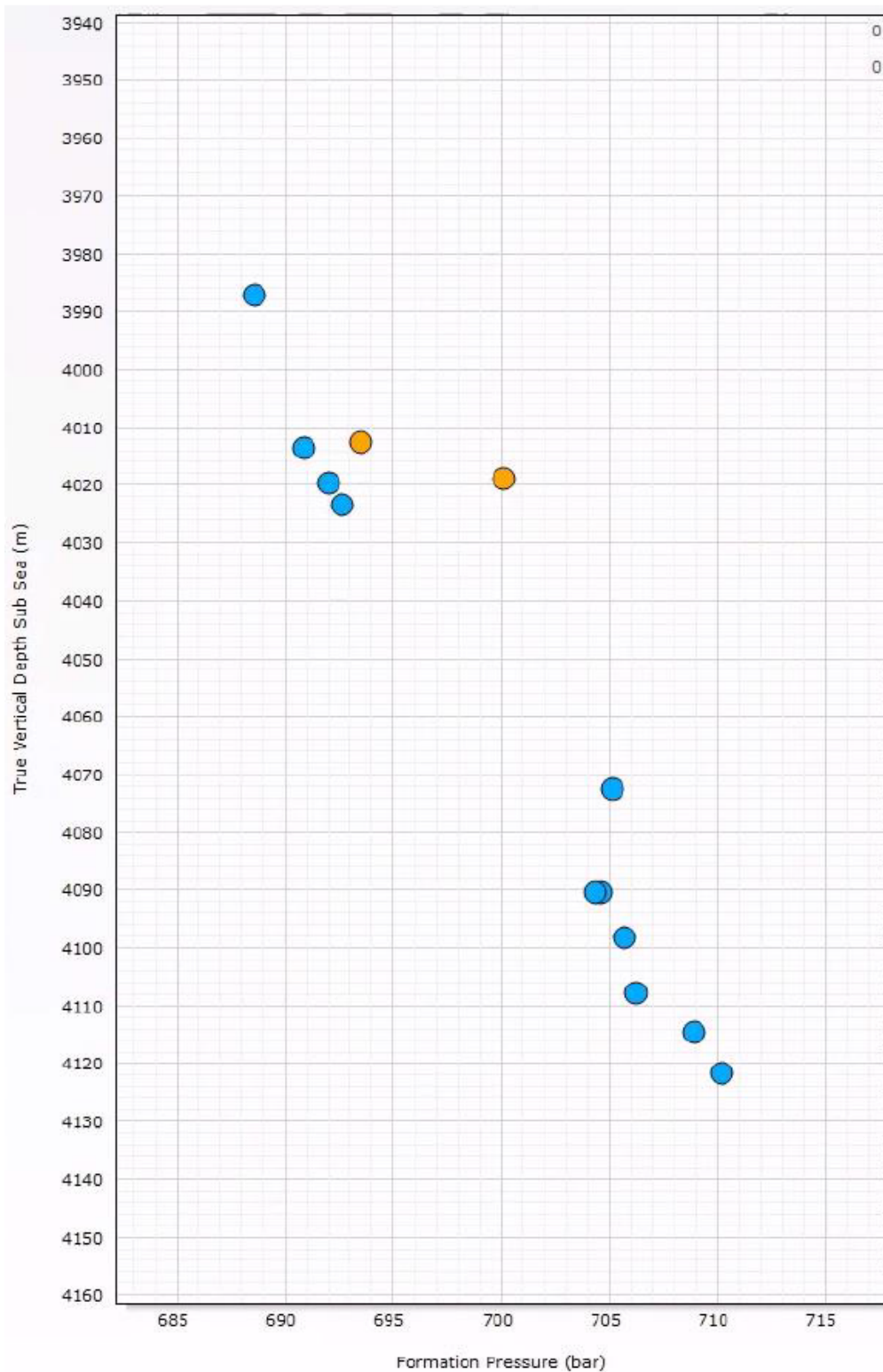


Fig. 1.5 Pressure vs depth plot for well 15/6-16 S Measured formation pressure with pressures from WL in blue and LWD in orange.

2 Database

2.1 Seismic data

To interpret the Hornet area, several seismic cubes were utilized prior to the APA 2014, but the main seismic data used was ST04M11 (Fig. 2.1 and Table 2.1).

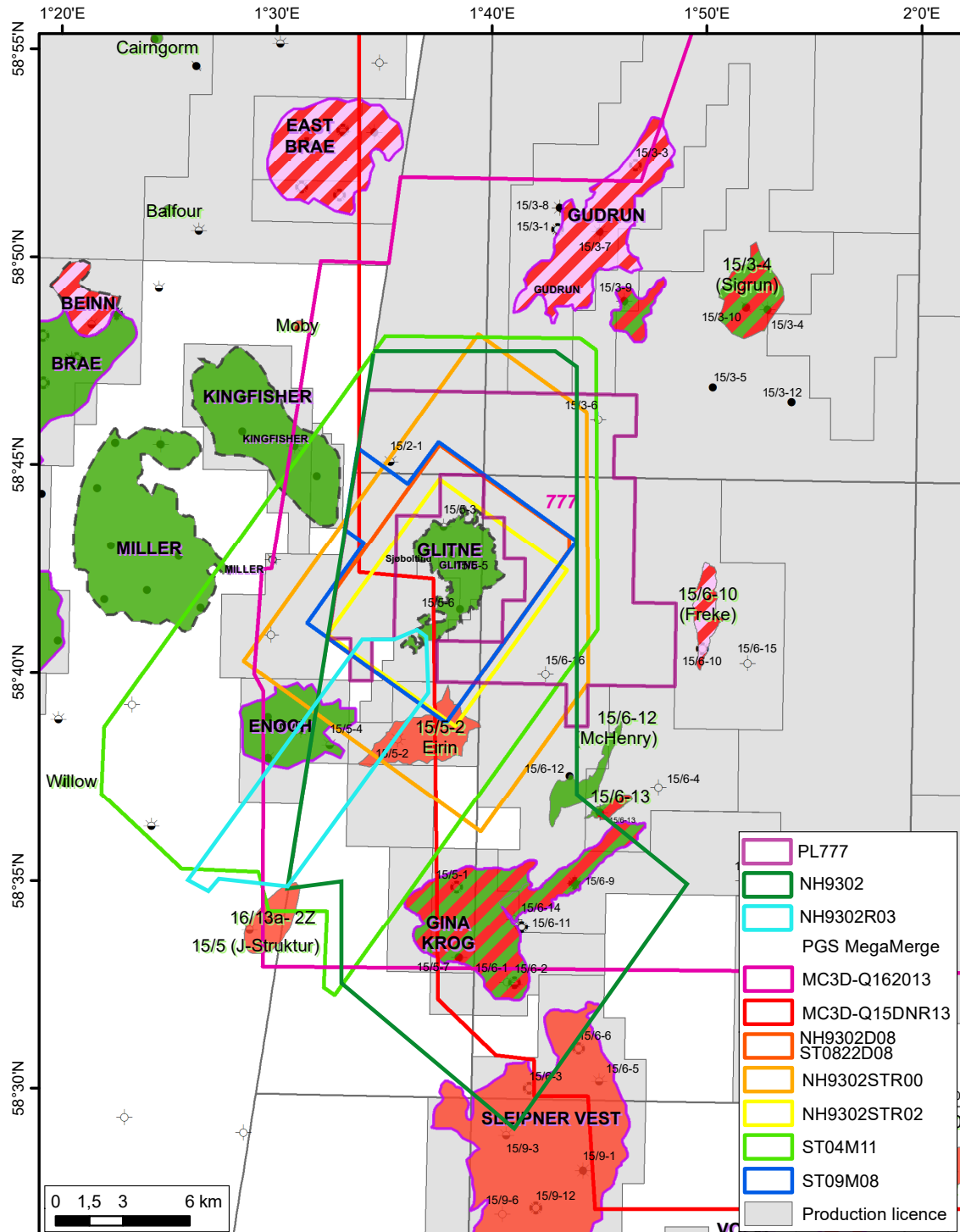


Fig. 2.1 Common seismic database

Table 2.1 Seismic database and survey details

Name	Survey type	Year	Offset data	Comments
Q15DNR13	Reprocessed 3D	2013	X	Detnor reprocessing of the MC3D-Q15 data
ST04M11	Reprocessed and merged 3D	2004	X	Reprocessed and merged from NH9302 and Miller 3D 16-93
ST0822D08	4D processed	2009	X	
ST09M08	Merged 3D	2009	X	Merge ST0022 and NH9302
PGS Megamerge	Merged 3D			
NH9302	Original 3D	1993		
NH9302STR00	Reprocessed 3D	2000	X	Detnor high frequency inversion of the NH9302STR00
NH9302STR02	Reprocessed 3D	2002	X	
NH9302R03	Reprocessed 3D	2003	X	
NH9302D08	4D processed	2009	X	
MC3D-Q162013	Original 3D	2013	X	Background data
ABP16M02	Reprocessed 3D	2017	X	Reprocessing MC3D-Q162013 by ION
PGS16910VIK	Reprocessed 3D	2018	X	Reprocessing MC3D-Q162013 by PGS

Seismic cube MC3D-Q16-2013 was acquired in 2014 as part of the license work program. Before landing on a positive drill decision on the Hornet 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 PL 777 common database are shown in Fig. 2.2.

Well	Informal Name	WDm	Year	Stratigraphy at TD	TDm MD	Operator	Status
15/2-1		109	1982	Late Perm	4600	Norsk Hydro	Oil/Gas shows
15/3-1S	Gurdrun	109	1975	Mid Jura	5129	Elf	Gas/Cond
15/3-3	Gurdrun	109	1979	Triassic	5115	Elf	Gas/Cond
15/3-4	Sigrun	107	1982	Triassic	4259	Elf	Oil/Gas
15/3-5	Sigrun	110	1984	Mid Jura	4130	Elf	Oil
15/3-6		105	1999	Late Cret	2793	Amoco Norway Oil	Dry
15/3-7	Gudrun	109	2001	Mid Jura	4818	Statoil	Oil/Gas
15/3-9	Brynhild	108	2010	Mid Jura	4654	Statoil	Oil/Gas
15/5-1	Gina Krog	119	1978	Late Triassic	3775	Norsk Hydro	Gas/Cond
15/5-2RT2	Eirin	121	1979	Triassic	4322	Norsk Hydro	Gas
15/5-3		110	1980	Devonian	5042	Norsk Hydro	Dry
15/5-4	Enoch Appr	120	1991	Paleocene	2300	Norsk Hydro	Oil shows
15/5-5	Glitne	109	1995	Paleocene	2645	Norsk Hydro	Oil
15/5-B1-H	Glitne	109	2001	Paleocene	2376	Norsk Hydro	Dry
15/5-6	Glitne	110	1997	Paleocene	2725	Statoil	Oil
15/6-3	Sleipner Vest	113	1974	Late Triassic	3795	Esso	Gas/Cond
15/6-4	Gina Krog	111	1976	Triassic	3505	Esso	Dry
15/6-6	Sleipner Vest	110	1982	Late Triassic	3760	Esso	Gas/Cond
15/6-7	Gina Krog	107	1993	Triassic	3540	Deminex	Dry
15/6-10	Freke	111	2009	Late Triassic	3700	ExxonMobil	Gas/Cond
15/6-11S	Gina Krog	116	2010	Early Jura	4042	Statoil	Dry
15/6-12	McHenry	115	2011	Late Triassic	3930	Statoil	Oil
15/6-13	East 3	114	2015	Late Triassic	3577	Statoil	Oil
UK16/8-1			1972	Mid Jura	4883		Oil
UK16/8a-4			1986	Mid Jura	4910		Gas/Cond
UK16/8a-10			1988	Mid Jura	4907		Dry
UK16/13-1			1977	Mid Jura	4502		Oil

Fig. 2.2 Common well database

2.3 Special studies

Surface Geochemical Survey using ORG sub-sea sampling and analysis within the Sleipner area (ORG Engineering AS, 2017).

Petrographic analysis of ditch cuttings from the Sleipner and Skagerrak formations in well 15/6-16 S were performed in order to evaluate the reservoir quality (RPS, 2019).

Composition analysis of RDT water/filtrate samples obtained in well 15/6-16 S from the Sleipner and Skagerrak formations (Stratum Reservoir (Norway) AS, 2019).

Analysed DCG samples from well 15/6-16 S for stable carbon and hydrogen isotopes (APT, 2019).

3 Remaining prospectivity

Apart from the Hornet Prospect, five additional prospects and one lead remains within PL 777 (Fig. 1.1).

The latest volumes and risk calculations in the license post-Hornet well 15/6-16 S i summarized in Table 3.1.

Table 3.1 Remaining resources within PL 777

Discovery/ Prospect/ Lead name ¹	D/ P/ L ²	Case (Oil/ Gas/ Oil&Gas) ³	Unrisked recoverable resources ⁴						Probability of discovery ⁵ (0.00 - 1.00)
			Oil [10 ⁶ Sm ³] (>0.00)			Gas [10 ⁹ Sm ³] (>0.00)			
			Low (P90)	Base (Mean)	High (P10)	Low (P90)	Base (Mean)	High (P10)	
Sjøboltind Sleipner	P	Gas				0,78	1,52	2,42	0,19
Sjøboltind Triassic	P	Gas				1,50	4,00	7,11	0,23
Nonstind Sleipner	P	Gas				0,26	0,45	0,68	0,19
Nonstind Skagerrak	P	Gas				0,40	0,81	1,29	0,23
Middagstind	P	Gas				0,37	0,88	1,51	0,10
Vengetind	P	Gas				3,44	6,45	10,30	0,12
Taskedalstind Main	P	Oil	1,86	2,44	3,11	0,12	0,18	0,24	0,20
Taskedalstind North	P	Oil	0,40	0,47	0,56	0,02	0,03	0,05	0,40
Dunkel	L	Oil	1,41	2,00	2,65	0,08	0,12	0,17	0,01

Before the 15/6-16 S 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 location, parts of the gross depositional Hugin shoreface model appears to be invalid, and thus, downgrading the surrounding Middle Jurassic prospects. In addition, the poor reservoir quality encountered by well 15/6-16 S in the Sleipner and Skagerrak formations further downgrades the remaining prospectivity in the license.

The Sjøboltind and Nonstind prospects have a 4-way closure at both Sleipner and Skagerrak levels (Fig. 3.1). High overpressure in surrounding wells is seen as the main risk regarding top seal failure in addition to the poor reservoir quality at depth.

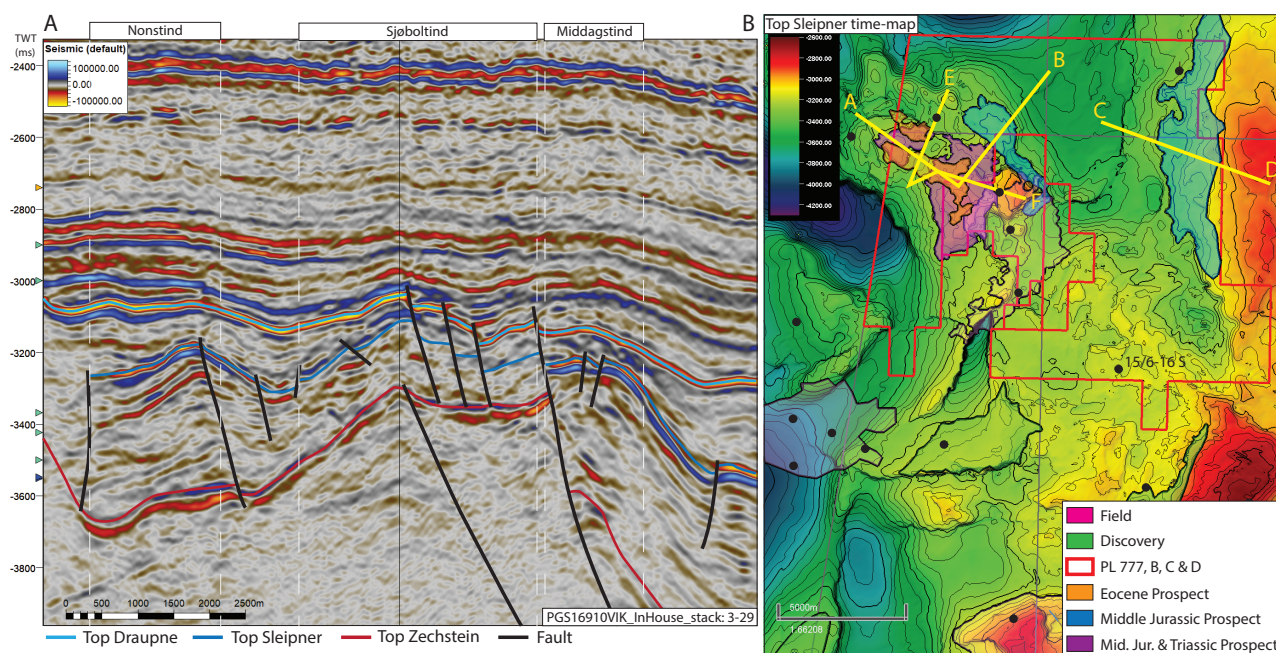


Fig. 3.1 Random seismic line through the Nonstind, Sjøboltind and Middagstind prospects

Middagstind prospect is a downfaulted block relative to the Sjøboltind prospect (Fig. 3.1). The reservoir comprises both the Hugin and Sleipner formation. The main risks are top seal failure due to high overpressure, reservoir quality and presence of Hugin Formation.

Vengetind prospect is located down-dip of a rotated fault block along the eastern part of the license (Fig. 3.2). The reservoir comprises the Hugin and Sleipner formations, which pinches-out and truncates against the overlying BCU, respectively. The main risks are the presence of Hugin Formation and trap geometry.

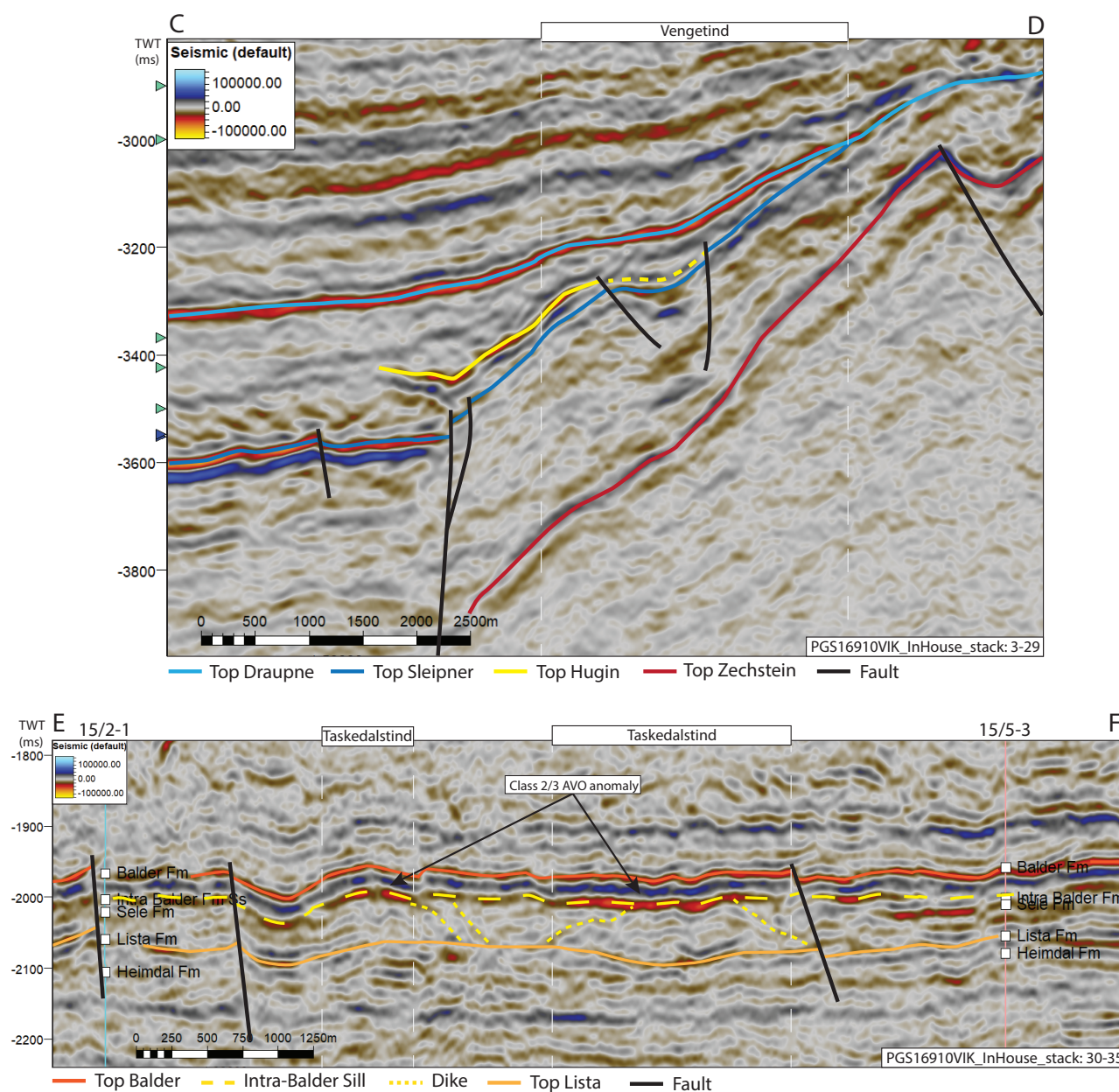


Fig. 3.2 NE-SW seismic line through Vengetind (top) and a random line through Taskedalstind (bottom) *Note the far-offset brightening at reservoir level. See Fig. 3.1 for location of seismic lines.*

Taskedalstind prospect(s) is defined by a Class 2/3 AVO anomaly, abrupt thickness increase in the Balder Formation and distinct drop in V_p/V_s -ratio. The reservoir is interpreted as an injectite complex within the Balder Formation, sourced from the underlying Heimdal and/or Hermod Formation (Fig. 3.2). Neighbouring wells 15/2-1 and 15/5-3 proved water-bearing intra-Balder sandstones. Main risks are migration and trap definition.

Dunkel lead(s) were defined as thickness anomalies in the Ekofisk interval (Fig. 3.3). The reservoir composition is highly uncertain and could be slump deposits of reworked chalk or olistostrome deposits from East Shetland platform. The trap is defined as a stratigraphic trap towards well 15/5-3, which has reported hydrocarbon shows in the Cretaceous interval.

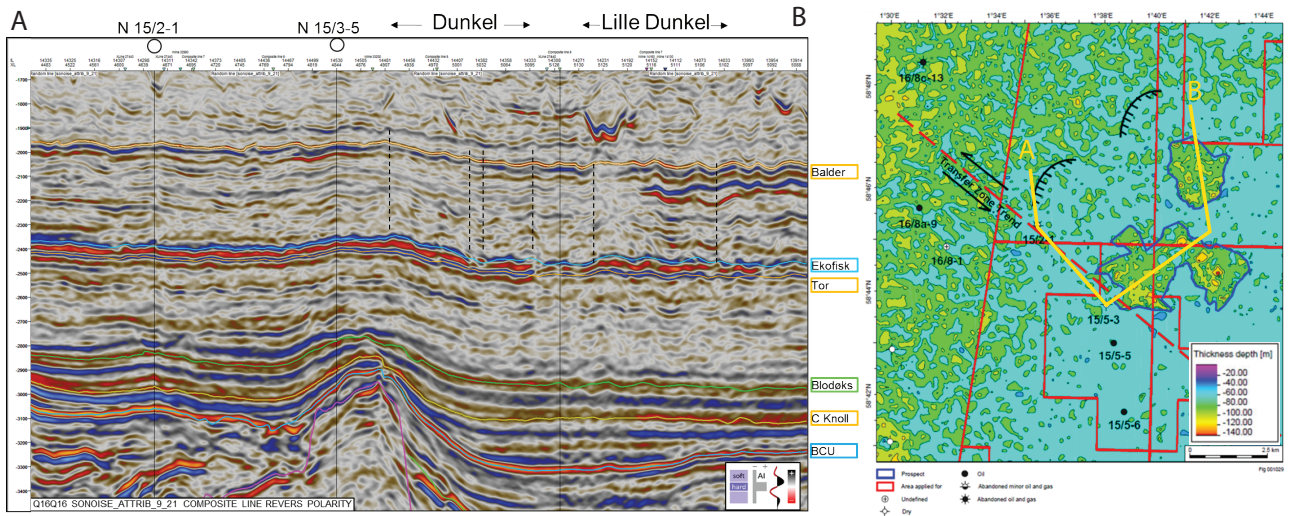


Fig. 3.3 Random seismic line through the Dunkel lead

4 Conclusion

The work program for PL 777, B, C and D has been fulfilled by acquiring 3D seismic data. In addition, exploration well 15/6-16 S was drilled during May to June 2019. The well was dry and a valid test of the Hornet main structure. The well encountered water-bearing Sleipner and Skagerrak formations that comprises very poor reservoir qualities. Furthermore, the absence of Hugin Formation at well location suggest that the Hugin shoreface depositional model is invalid and needs rethinking.

The negative results listed above have downgraded the remaining prospectivity in PL 777, B, C and D.

As the work obligations have been fulfilled, a unanimous decision was made in PL 777, B, C and D to relinquish the license at the BOK gate 06.08.2020.

5 References

ORG Geophysical AS, 2017: Surface Geochemical Survey Report, ORG17100- Sleipner Area

Aker BP ASA, 2019: Well 15/6-16 S Final Well Report. License PL 777

RPS, 2019: Petrographic Analysis of Well 15/6-16 S

Stratum Reservoir (Norway) AS, 2019: Composition Analysis of RDT Samples from Well 15/6-16 S

APT, 2019: Fluid and Gas Analysis Well 15/6-16 S



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