PL985 Relinquishment

Relinquishment Report PL985

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1 History of the production license

PL985 is located in the North Sea, consisting of block 25/5, 25/6, 25/8 and 25/9 to the North east of the Jotun development. The distance to shore is approximately 120 km. The licence was awarded on the 11th March 2019, as part of APA2018.

The licence JV consists of Vår Energi 30%, AkerBP 30%, Pandion 20% & Petoro 20%.

The licence obligation of acquire new 3D seismic has been fulfilled.

Application for extend deadline to 1st March 2022

The original deadline for the drill and drop decision was 1st March 2021. It was applied for an extension to the deadline in order to complete an extensive reprocessing job and geological and geophysical analysis based on the repossessed seismic dataset. The extended deadline was set to 1st March 2022.

Application for extend deadline to 1st March 2023

Summary from the letter sent to the authorities: PL 985 has completed the technical and economical assessment of the licence prospectivity. PL 985 is a prospective PL with two main prospects identified: Thoreau and Hemingway and potential upside (Meyer and London leads). The Thoreau multi-targets prospect (Hugin Fm., Upper and Lower Statfjord GP. targets) is a segmented structure closure which holds the largest potential in PL 985. As standalone, the prospect has marginal negative value, but it is strategically located only 10 km from Ringhorne North (25/8-23S) upcoming drilling target in PL 956 in Q3/Q4 2023. The outcome of the drilling campaign in PL 956 will impact the technical and economical assessment of the Thoreau and the Hemingway prospects. In view of holistic development of the area, PL 985 JV unanimously request one year extension of the drill or drop. The licence drill or drop decision was extended 01/03/2023 to 01/03/2024.

Application for extend deadline to 1st June 2024

Summary from the letter to the authorities: In view of holistic development of the area and given the delayed drilling activity in PL 956, (25/8-23 S originally plan in Q3/Q4 2023) PL 985 JV unanimously request 3 months extension of the drill or drop and in case of positive outcome of the Ringhorne North an extra extension will be requested to fully integrate the well results.

Application for extend deadline to 1st December2024

PL985 JV has completed the technical and economical assessment of the licence prospectivity. PL 985 is a prospective PL with two main prospects identified: Thoreau and Hemingway, and two potential upsides (Meyer and London leads). The Thoreau mulit-target prospect (Hugin Fm, Upper and Lower Statfjord Gp targets) is a segmented structural closure straddling between PL985 and PL956, holding the largest potential in PL985.
As a stand-alone, the Thoreau prospect has marginal negative value, but it is strategically located only 10km from the Ringhorne North well (25/8-23S, 23A and 23B), which was just completed. The outcome of the drilling will impact the technical and economical assessment of the prospects. The Ringhorne North well targeted the Ty, Statfjord, Skagerrak and the Basement, and the studies post-drill will provide new insight on potential migration scenarios from the west and north, affecting both Thoreau and Hemingway evaluations. Ringhorne North well is a discovery, and with the proximity to the Thoreau prospect,
synergy in a development scenario must be evaluated. Since the drilling of the Ringhorne North well was delayed and did not finish until end Q1 2024, an unanimously PL985 JV request 6 (six) months extension of the drill or drop to be able to evaluate the holistic development of the area and to fully integrate the well results.

The final drill or drop deadline for the licence is 1st December 2024. The licence group decided to drop the licence in ECMC meeting held in November 2024.

Overview of meetings held

- 2019/04 MC-EC meeting Kick-off meeting
- 2019/11 MC-EC meeting
- 2020/02 EC workmeting seismic reprocessing
- 2020/06 EC workmeeting Hemingway prospect status
- 2020/11 MC-EC meeting
- 2021/06 EC workmeeting Status on latest Petroleum System Modelling
- 2021/11 MC-EC meeting
- 2022/10 EC workmeeting Thoreau Prospect
- 2022/11 MC-EC meeting
- 2023/06 MC meeting
- 2023/10 EC workmeeting
- 2023/11 MC meeting
- 2024/09 EC workmeeting Trap Seal analysis Thoreau Prospect
- 2024/11 MC-EC meeting Recommendation to drop license

Brief substantiation for surrender/lapse/expiration

Prospectivity identified within the licence has sizable volume potential but with extremely low chance of success. The main risks associated to the prospect are trap seal and migration.

Vår Energi, as the operator of PL985 recommends dropping the licence in its entirety. All work commitments are fulfilled.

An overview of current prospects and leads in the licence is shown in Fig. 1.1

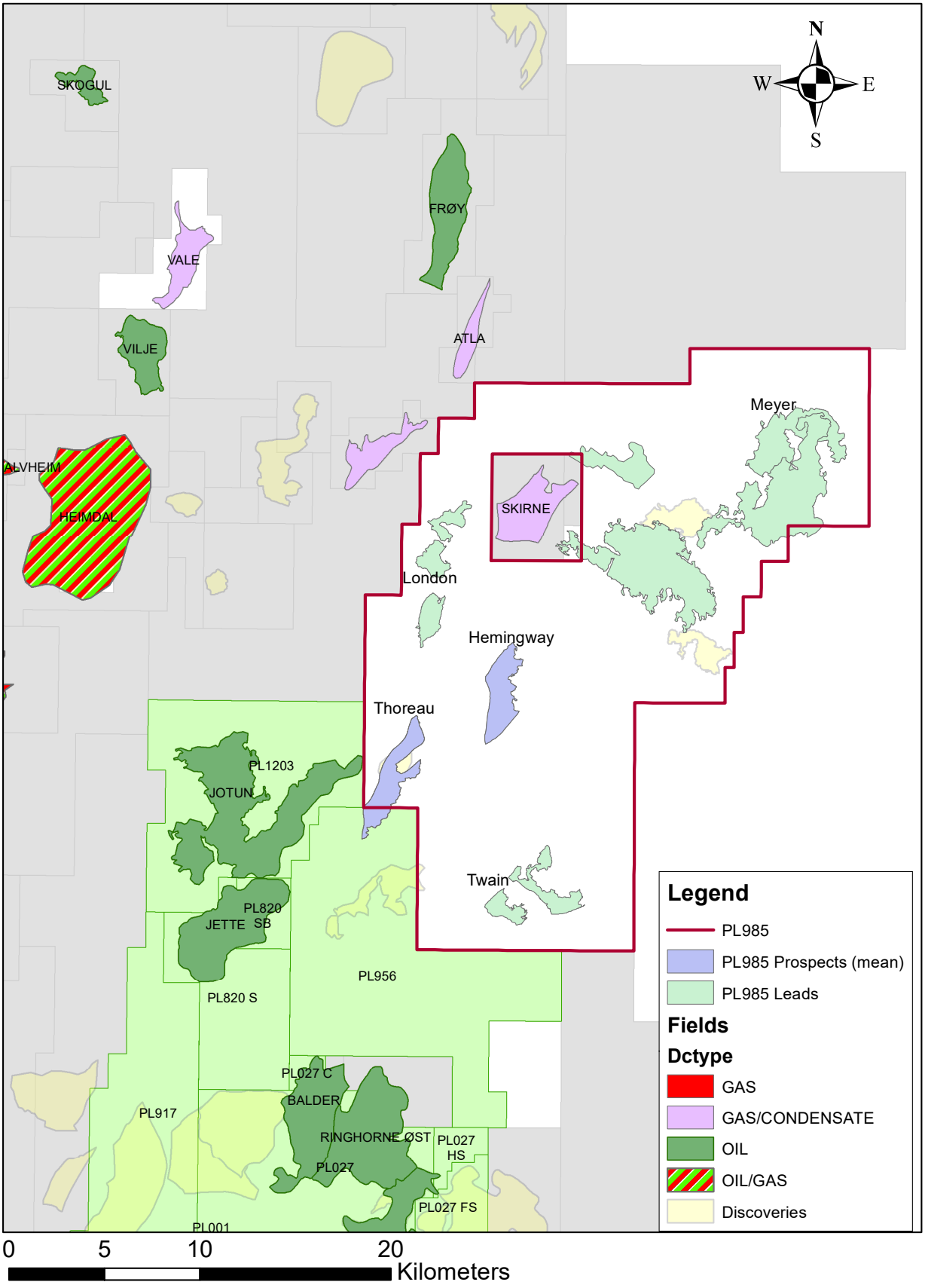

Fig. 1.1 PL985 with current prospects and leads.
Licences in green colour is operated by Vår Energi. PL 985 is outlined in red polygon.

2 Database overviews

2.1 Seismic data

PL985 work commitment is to acquire 3D broad band seismic. The licence has already acquired PGS16M01 broad band seismic over part (350 km2) of the licence (Fig. 2.1). There are no specific size requirements in connection with the licence purchase of broad band seismic from the authorities.

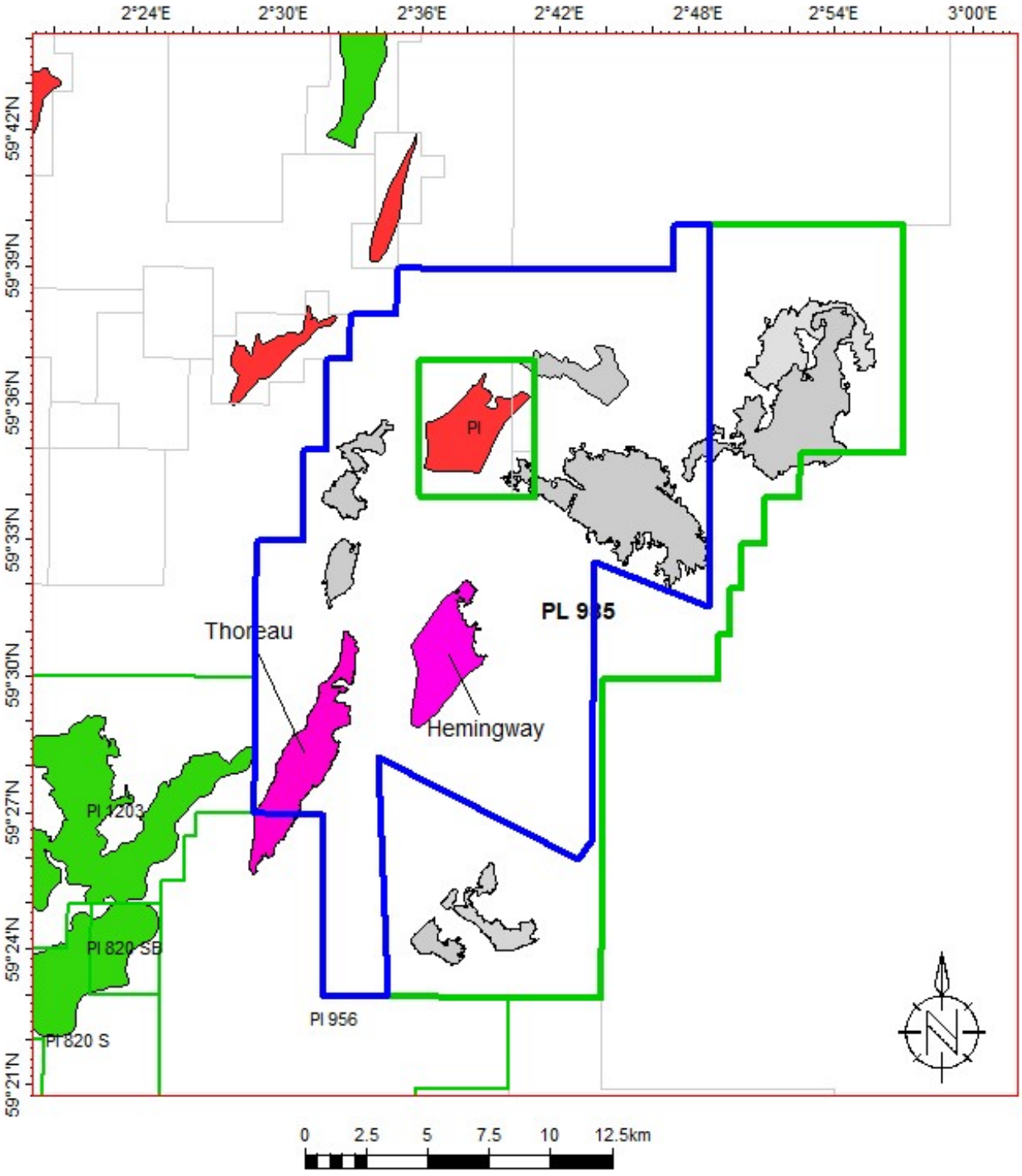

Fig. 2.1 Seismic database
PGS16M01 shown in blue polygon.

Table 2.1 Seismic database

Survey	TYPE	Domain	Owner/ Operator	Year	Dataset	NPDID	Entitelment	Area (km2)
PGS16M01	3D	Time and depth	PGS	2016	Full + Angle Offset	-	Purchase	350
ST9707	3D	Time	Statoil	1997		-	Public	302
TUN15M02	3D	Time	Pandion	2016		-	Public	528
TO06R06M1205	3D	Time	Total	2006		-	Public	205
TO1301MR01	3D	Time	Total	2013		-	Public	429
UHN98	3D	Time	Hydro	1998		-	Public	115

2.2 Well data

The PL985 common well database is shown in Fig. 2.2 and in Table 2.2. Key wells are marked in yellow on the map.

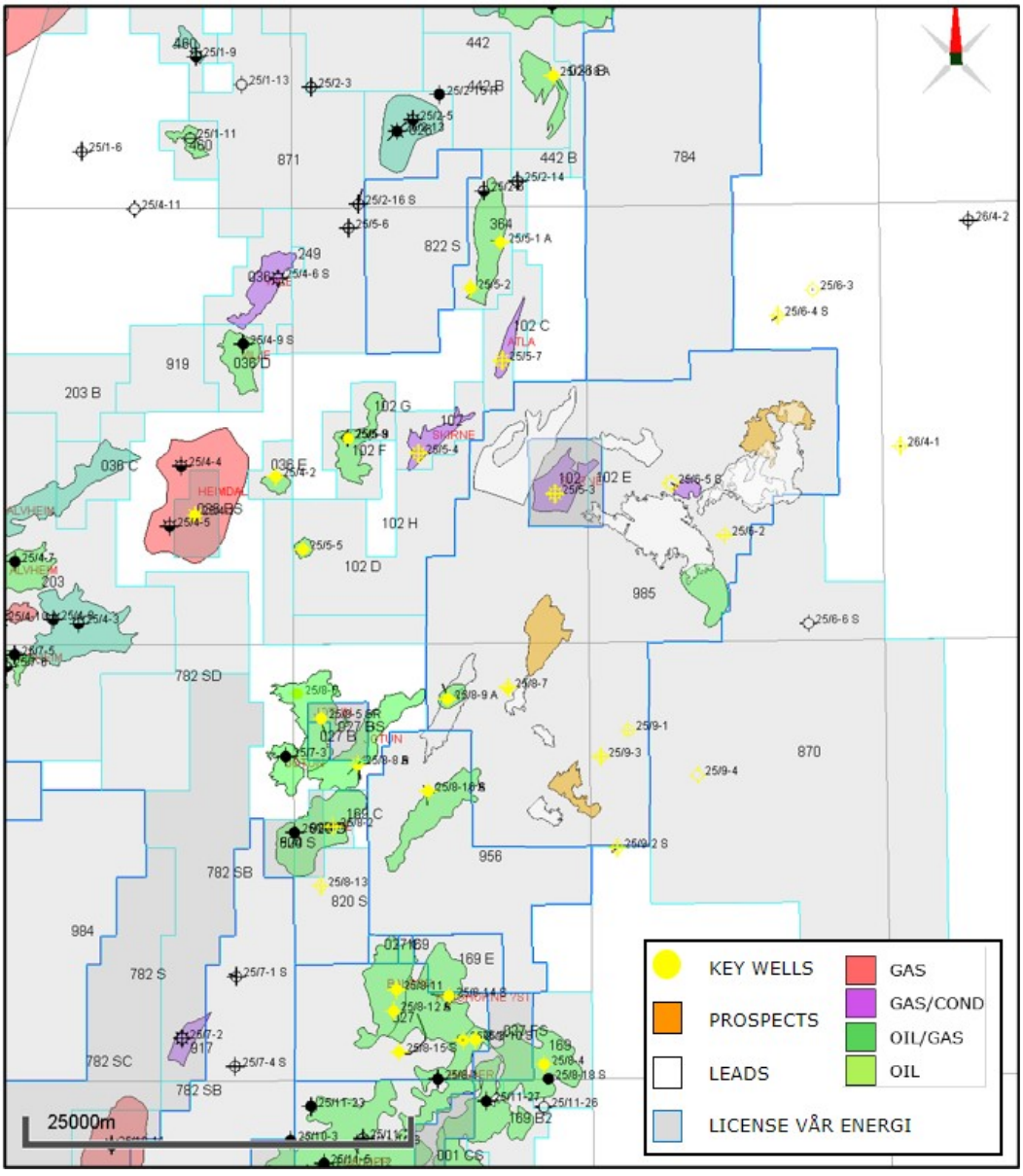

Fig. 2.2 Map of wells used in the licence, key wells marked in yellow.

Table 2.2 Well database

Well	Discovery	Year	NPDID
25/4-1	Heimdal	1972	359
25/4-2	Trine	1973	360
25/8-2		1975	363
25/8-3	Ringhorne	1981	364
25/6-1		1985	524
25/5-1 A	Frøy	1987	1131
25/5-2	Frøy	1987	1346
26/4-1		1987	1046
25/5-3	Frøy	1989	1488
25/5-4	Skirne	1990	1691
25/5-5	Tir	1990	2661
25/6-2		1992	1949
25/8-4	D-struktur	1992	1986
25/8-5 S	Jotun	1994	2390
25/8-6	Jotun	1995	2573
25/8-7		1995	2612
25/8-8 A	Jotun	1995	2690
25/8-8 B	Jotun	1995	2696
25/8-8 S	Jotun	1995	2646
25/9-1		1995	2476
25/8-10 S	Ringhorne	1997	3062
25/8-11	Ringhorne	1997	3209
25/8-5 SR	Jotun	1997	3192
25/8-9		1997	2988
25/8-9 A		1997	3025
25/6-3		1999	3885
25/8-12 A	Ringhorne	1999	3772
25/8-12 S	Ringhorne	1999	3771
25/8-13		2001	4438
25/8-14 S		2003	4805
25/9-2 S		2003	4735
25/8-15 S		2004	5000
25/8-16 A	Eitri	2009	6128
25/8-16 S	Eitri	2009	6082
25/9-3		2009	6189
25/5-7	Alta	2010	6423
25/6-4 S		2012	6507
25/5-9	Trell	2014	7345
25/9-4		2014	7299
25/6-5 S	Skirne Øst	2015	7662
25/2-18 A	Langfjellet	2016	8043

3 Results of geological and geophysical studies

Seismic reprocessing

A seismic reprocessing workflow was applied to PGS16M01 as a part of the common database. The aim was to improve seismic interpretation and to enhance AVO seismic data analysis. The reprocessed seismic improved the definition of the top and base of the two prospect Thoreau and Hemingway. The new data gave some additional support to the Thoreau as seismic response soft anomaly with some AVO support.

Geological and Geophysical Studies

- Facies analysis based on core studies, GDE maps indicated the Thoreau Prospect is located in a prolific area in regard to reservoir presence and effectiveness
- Provenance studies used to identify possible sand source areas applied to depositional model interpretations
- Fault seal analysis reveals complex juxtapositions of the reservoir to water bearing reservoir in the Hugin Fm proven by the well 25/8-9.
- AVO analysis, far offset Upper Statfjord Gp anomaly structurally conform in the North, but not observed in all part of the structure.

Basin Modelling

An updated semi-regional model was based on updated mapping and geochemical analysis with samples from cuttings and cores of selected/relevant wells. The study was conducted over several years, and is calibrated to recent wells nearby. The final part of the study focused specifically on the Thoreau Prospect and concluded following:

- *Cross fault migration necessary to fill the Upper Statfjord Gp reservoir in the Thoreau Prospect.*
- *Ongoing migration and charge into Thoreau, would likely result in gas filled to spill*
- *Dynamic setting, limit late gas charge, the oil over gas more likely*
- *Slightly underfilled gas over oil in all structure is most likely scenario*
- *Eocene to Miocene migration is mostly oil*
- *Gas accumulation in northern part of Thoreau Prospect first before spill and fill gas in south*
- *Gas over oil in northern part of the Thoreau Prospect first before spill and fill the south*
- *Only hydrocarbon accumulation in the south of the Thoreau Prospect is very unlikely (spills from north)*

The Hemingway Prospect was dependent on migration via Thoreau Prospect. This was not very likely, as the bain model indicated Thoreau Prospect was most likely underfilled.

EM feasibility Study

The EM feasibility study indicated a Tertiary anomaly may result in an EM anomaly. The target for the Hemingway and Thoreau prospects are in deeper stratigraphy. It was concluded EM was not a technology that could de-risk the prospects.

4 Prospect update report

An overview of Prospects and Leads in the licence are shown in (Fig. 4.1) and summarised in Table 4.1.

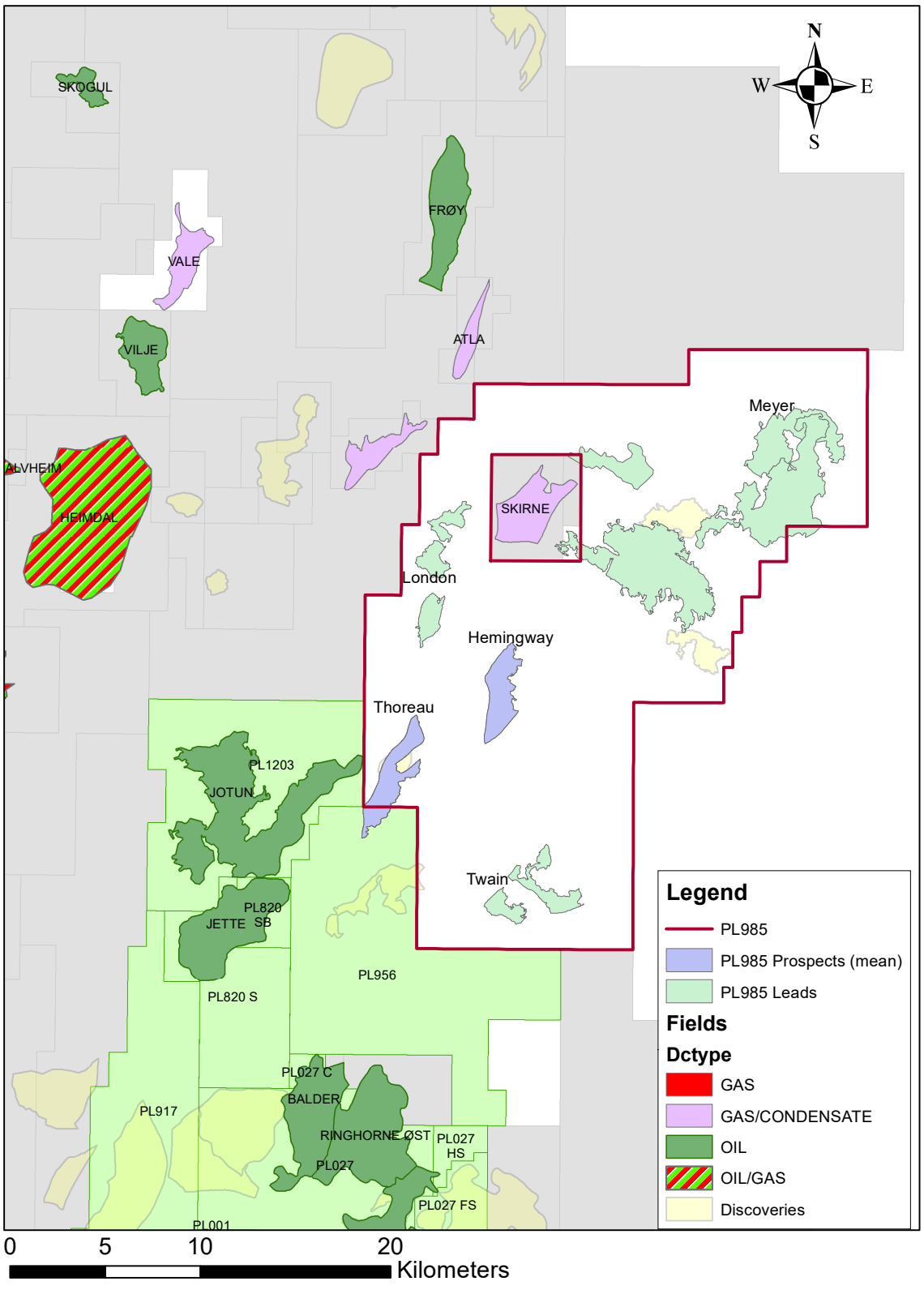

Fig. 4.1 Map with outlines of resource potential in PL985.

Table 4.1 Prospect and Lead Table.

Prospects	**Main target**	**CASE 1 HIIP (MBOE)**	**CASE 2 HIIP (MBOE)**	**POS (%)**	**Main risk**
Thoreau Oil/Gas	U. Statfjord Gp.	170	28	11/13	Trap & Migration
Thoreau Gas/ Cond.	U. Statfjord Gp.	52	9	11/13	Trap & Migration
Hemingway	Hugin Fm	31		10	Trap & Migration
Lead	**Main Target**	**HIIP (MBOE)**		**POS (%)**	**Main risk**
London	Hugin Fm	84			Trap
Meyer	Ty Fm	69			Charge
Twain	Statfjord Gp.	2.3			Charge

4.1 Hemingway Prospect

Hemingway is is a down-thrown trap with main target in the Hugin Fm reservoir. PL985 JV has purchased PGS16M01 - 3D broadband data as a fulfilment of licence commitment which covers Hemingway and Thoreau prospects. The quality of seismic is generally good. This has been used to interpret the Hemingway prospect. The Top Hugin Fm depth map is displayed in Fig. 4.2 and a composite line North to South is displayed in Fig. 4.3. The NPD table 5 for the Hemingway Prospect is in Fig. 4.4.

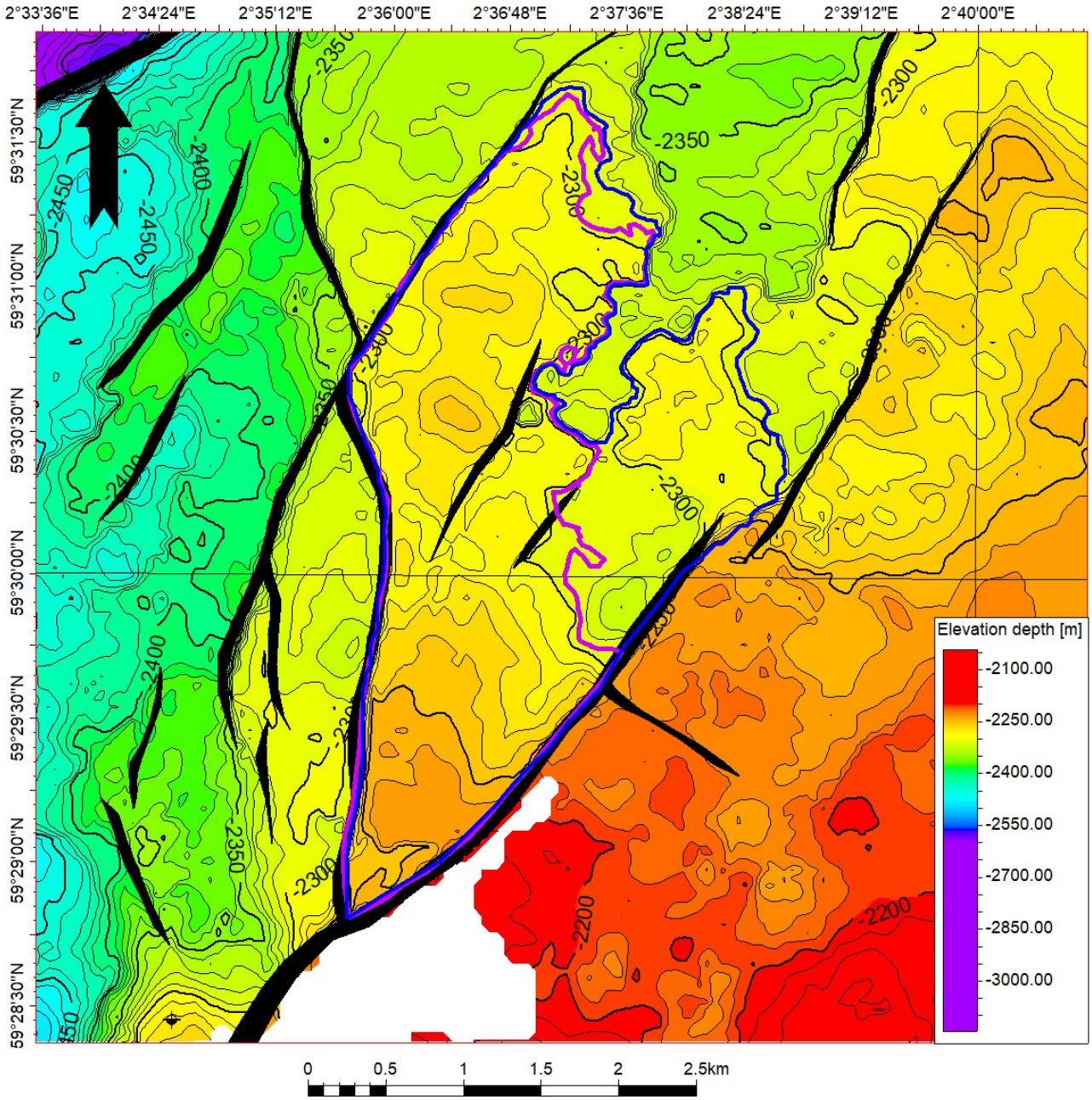

Fig. 4.2 Top Hugin Fm Depth map with outline of the Hemingway Prospect.
The purple polygon represent P90 outline and the blue polygon represent the P10 outline. The P10 volume has a higher risk on retention due to the relay ramp to the east. The P90 volume is independent on the relay ramp and has a more robust closure.

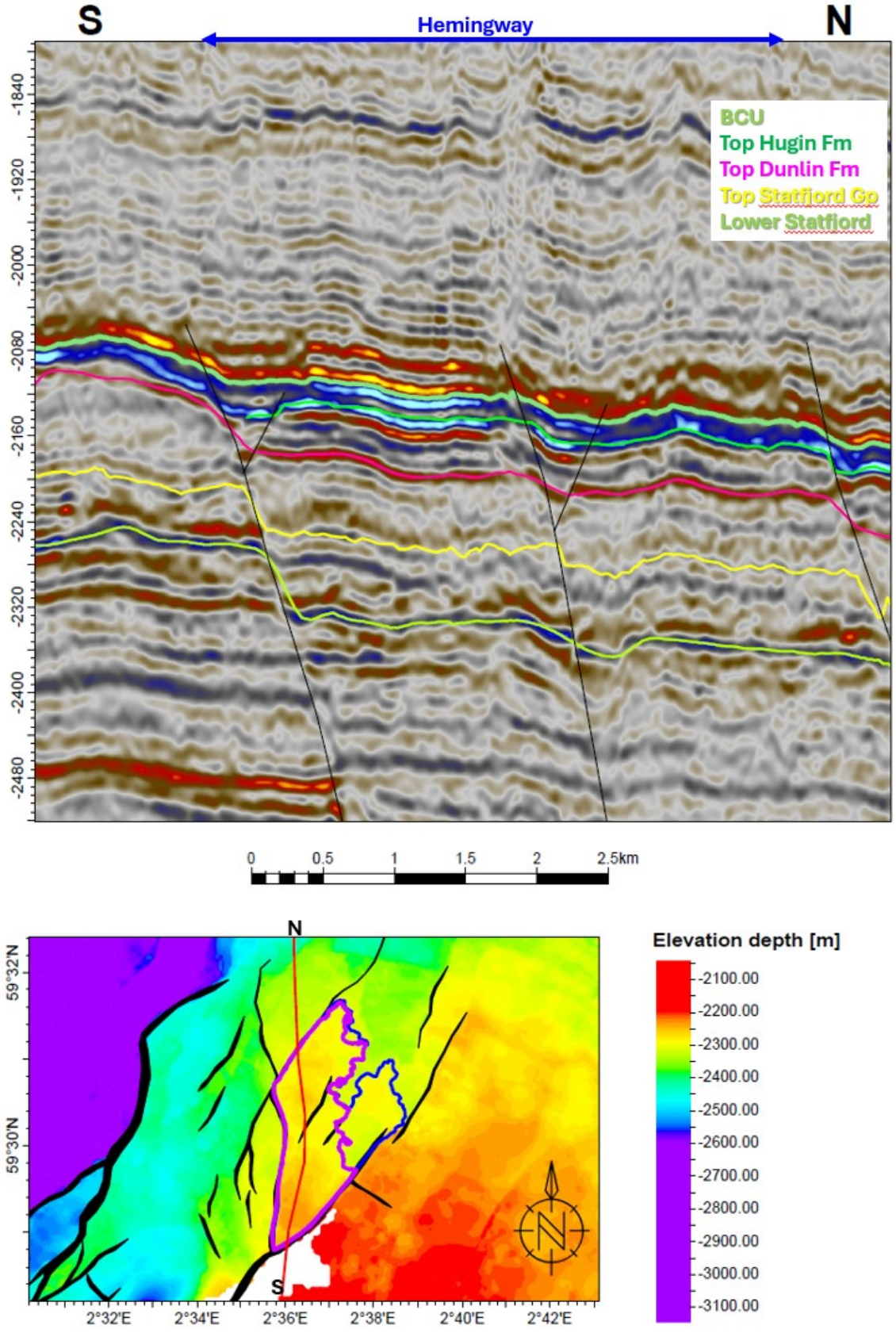

Fig. 4.3 Seismic composite line South to the North, Hemingway Prospect
Hemingway Prospect is a down thrown trap with main reservoir in the Hugin Fm. Blue polygon represent the P10 outline and the purple polygon represent the P90 outline.

Table 5: Prospect data (Enclose map)

Block	25/8 & 25/5	Prospect name	Hemingway	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil&Gas	Reported by company	Vår Energi	Reference document				Assessment year	2024
This is case no.:	1 of 1	Structural element	Utsira High	Type of trap	Down-thrown trap	Water depth [m MSL] (>0)	123	Seismic database (2D/3D)	3D
Resources IN PLACE and RECOVERABLE		**Main phase**				**Associated phase**			
Volumes, this case		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10^6 Sm^3] (>0.00)	1,64	3,37	4,01	7,32	0,16	0,34	0,41	0,77
	Gas [10^9 Sm^3] (>0.00)	0,08	0,12	0,18	0,77				
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	0,49	1,01	1,20	2,20	0,05	0,10	0,12	0,23
	Gas [10^9 Sm^3] (>0.00)	0,02	0,04	0,05	0,23				
Reservoir Chrono (from)	Callovian	Reservoir litho (from)	Hugin	Source Rock, chrono primary	Tithonian	Source Rock, litho primary	Draupne	Seal, Chrono	Kimmeridgian/Tithonian
Reservoir Chrono (to)	Callovian	Reservoir litho (to)	Hugin	Source Rock, chrono secondary		Source Rock, litho secondary		Seal, Litho	Heather/Draupne
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,11	Oil case (0.00-1.00)		Gas case (0.00-1.00)		Oil & Gas case (0.00-1.00)			
Reservoir (P1) (0.00-1.00)	0,89	Trap (P2) (0.00-1.00)	1,00	Charge (P3) (0.00-1.00)	0,40	Retention (P4) (0.00-1.00)	0,30		
Parametres:	Low (P90)	Base	High (P10)	*Comments*					
Depth to top of prospect [m MSL] (> 0)		2229							
Area of closure [km^2] (> 0.0)	2,0	3,7	6,1						
Reservoir thickness [m] (> 0)	11	24	47						
HC column in prospect [m] (> 0)	41	55	78						
Gross rock vol. [10^9 m^3] (> 0.000)	24,460	53,660	95,280						
Net / Gross [fraction] (0.00-1.00)	0,44	0,80	0,90						
Porosity [fraction] (0.00-1.00)	0,20	0,23	0,27						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,16		0,50						
Bg [Rm3/Sm3] (< 1.0000)	0,0050	0,0040	0,0040						
1/Bo [Sm3/Rm3] (< 1.00)	0,82	0,76	0,70						
GOR, free gas [Sm^3/Sm^3] (> 0)									
GOR, oil [Sm^3/Sm^3] (> 0)	50	70	90						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,30	0,30	0,30						
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,30	0,30	0,30						
Recov. factor, gas main phase [fraction] (0.00-1.00)									
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)				For NPD use:					
Temperature, top res [°C] (>0)	83			Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert	NPD will insert value
Pressure, top res [bar] (>0)	235			Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
Cut off criteria for N/G calculation	1.	2.	3.					Kart nr	NPD will insert value

Fig. 4.4 NPD table 5 Hemingway Prospect

Trap

Structurally, the Hemingway prospect is dependent on a combination trap which includes four trap components:

- The northern, western, and southwestern limits of the prospect are defined by down-to-north, down-to-west and down-to-southwest normal faults respectively. Vestland Gp in the footwall belonging to the Hemingway prospect is juxtaposed to Upper Jurassic and Lower Cretaceous shales of the Viking and Cromer Knoll GPs in the hanging-wall.
- The eastern outline of the Hemingway prospect is defined by a down-to-west normal fault, with a maximum displacement of 50-70 meters. Along this fault, Vestland Gp is juxtaposed to Dunlin Gp shales in the footwall. There could be potential silty layers in the Dunlin Gp, reported from some wells nearby (e.g., 25/8-9). The result of FSA shows even if Dunlin is silty, Hugin to Dunlin juxtaposition has capacity to hold large column.
- The P10 outline of the Hemingway prospect includes a relay ramp in the fault to the East. At this location Hugin FM may exist on the footwall, if it does and the faults are splayed in the relay ramp, there will be increased risk of leakage through the fault related to P10 volumes. Hugin self-juxtaposition will not have capacity to hold a large column.

The trap size and trap integrity is regarded as one of the key risks for the Hemingway prospect. Most wells show hydrostatic pressures both west and east of the boundary fault. An exception to this is the well 25/8-9, five km southwest of the Hemingway prospect, yielding 10 bar overpressure, suggesting that at least parts of the fault system are sealing.

Reservoir

The main reservoir intervals in the Hemingway prospect are the Hugin and Sleipner Fms, belonging to the Middle Jurassic Vestland Gp. The reservoir facies of the Sleipner Fm are continental in character, whereas Hugin Fm is shallow marine shoreface deposits. The reservoir thickness in the Hemingway Prospect for Hugin Fm is in the range of 15-70 meters. And reservoir thickness of Sleipner FM Based on nearby wells 10-50 meters, Hugin and Sleipner Fm seems to be evenly distributed within the Vestland Gp where Vestland Gp is up to 20-30 meters thick. In wells drilled in graben settings, including wells 25/8-9 and 25/5-3, Vestland Gp reaches thicknesses in the range of 60-90 meters, and Hugin Fm is seen to thicken relative to Sleipner Fm. This suggests that where Vestland Gp thickens within the Hemingway prospect, this thickness increase is expected to be slightly in favour of Hugin Fm. This is important to try and quantify due to the

slightly poorer reservoir qualities in the Sleipner Fm compared to the Hugin Fm in nearby wells, which further affects the gross reservoir parameters (e.g., N/G, porosity). To quantify the amount of GRV of the Hemingway prospect belonging to Hugin formation, additional work was performed on the post-migration gathers. By an additional radon de-multiple process and de-noise, we were able to identify the top Hugin Fm at the Skirne gas/condensate discovery. The formation is seen as a dim near offset, with soft brightening at the far offsets. Due to the decrease in thickness, both for the shale above and the Hugin reservoir, the top Hugin is not seismic visible within the Hemingway prospect.

The Statfjord Gp is an upside in the Hemingway prospect, and the expected reservoir facies are fluvial channel infill sandstones, deposited in alluvial plain, as described in Play description. Good reservoir qualities are demonstrated in several wells in and around the licence.

Seal

The top seal of the Hemingway prospect for Hugin formation is Upper Jurassic Heather and Draupne shales, base and lateral seal is the Lower Jurassic shales of the Dunlin Gp. In Sleipner FM top seal could be an issue as there is some thin layers of shale within the Sleipner however it will depend on lower part of Hugin Fm. For Statfjord GP the seal is shales belonging to the Dunlin Gp.

Charge

Mature Upper Jurassic Heather and Draupne Fms are present in the deep Volve and Vana sub-basin west of the Heimdal Terrace and Utsira High. Discoveries within Jurassic reservoirs are documented in wells located north, west, and south of the prospect. In addition, hydrocarbon shows were detected in the Vestland Gp in well 25/8-7, located less than two km south of the Hemingway prospect. Several attempts have been made to model migration into the Hemingway prospect. Minor changes in Hugin Fm subregional structural interpretation result in significant changes of HC charge of the Hemingway prospect. The newest mapping has led to significant changes in the charge story of Hemingway. The drainage area of the Hemingway is in a migration shadow; however, hydrocarbons are available for filling of the prospect in Vestland GP. The HC migration modelling indicates some flow just west of the prospect, which can explain the shows in the 25/8-7 well.

As there is some uncertainty to the structural mapping, a possible HC charge and filling route into Hemingway is across the Thoreau structure at the Hugin Fm level (given trap is sealing). And there is a low chance to fill the Hemingway prospect to Statfjord GP.

4.2 Thoreau Prospect

The Thoreau prospect is located near the southern boundary of PL985 license, main target is Statfjord GP FM which includes Upper and Lower Statfjord horizons. The PL985 JV has the latest surveys covering the prospect: PGS16M01 - 3D broadband data. Vår Energi interpreted relevant horizons on both surveys, to be consistent with regional interpretation Top Upper Statfjord have been interpreted in soft reflector (decrease in acoustic impedance). Structure map with prospectivity is displayed in Fig. 4.5, and profile showing cross-sections of prospects in Fig. 4.6.

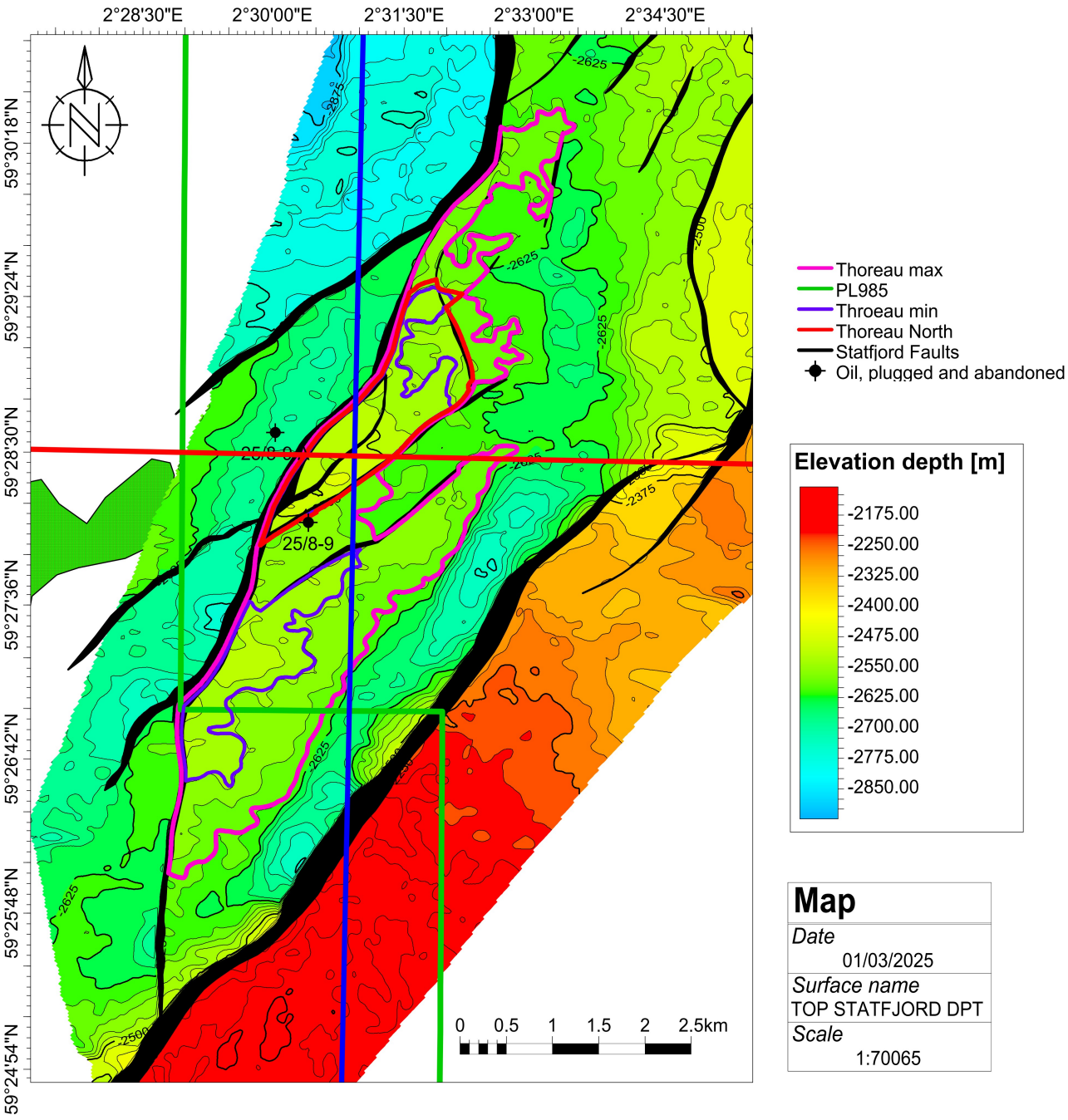

Fig. 4.5 Top Statfjord Gp depth map
The Thoreau Prospect polygon is outlined in pink (max case total structure), purple (min case total structure) and red (only North). Location of Inline 37144 is in red and Crossline 133888 is in blue. The spill is to the north-northeast and to the south.

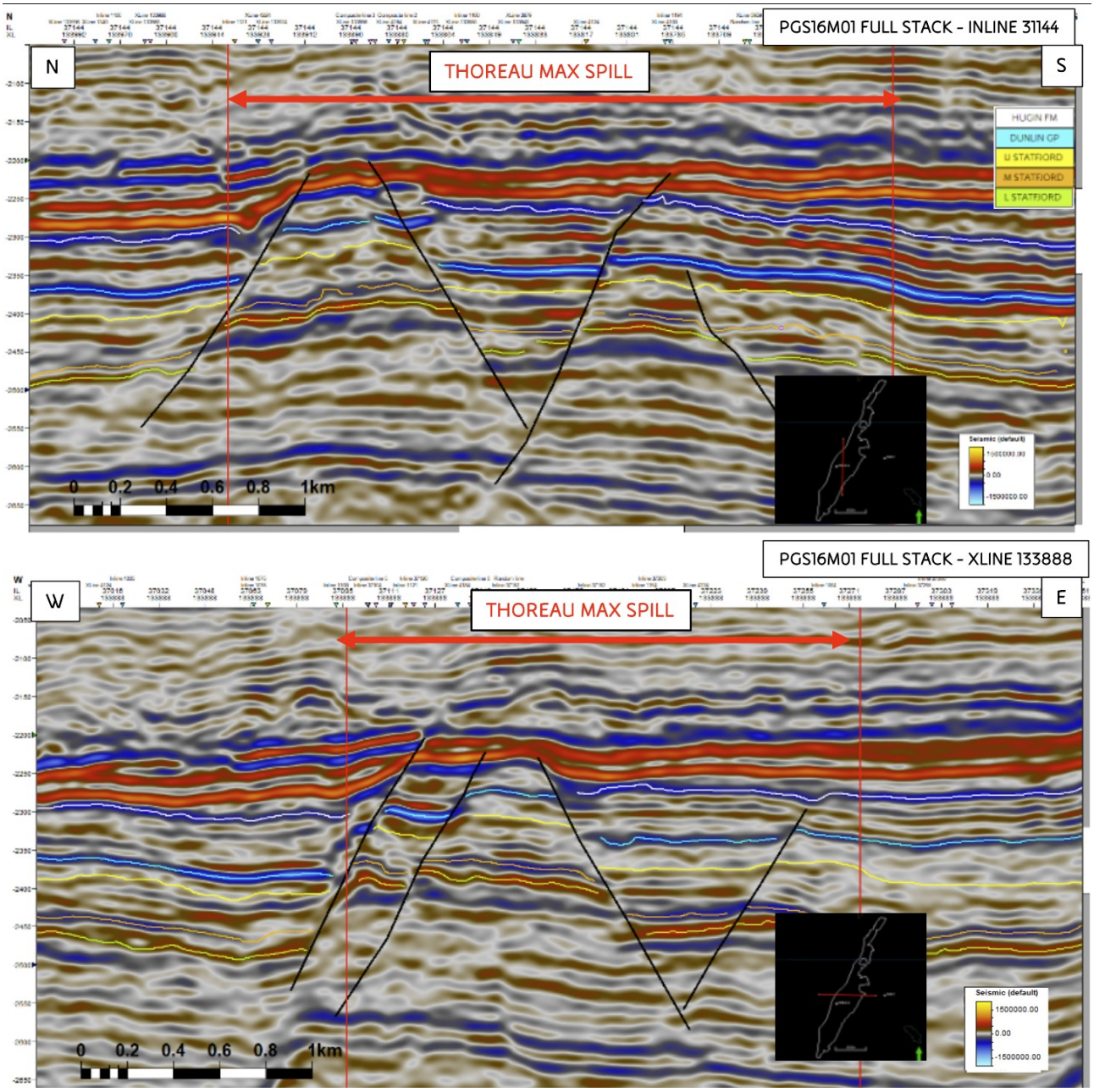

Fig. 4.6 Seismic inline and crossline defining the Thoreau Prospect
Location of inline 37144 and crossline 133888 is given in Fig. 4.5.

Trap

The Thoreau trap is defined on the mapped Top Upper Statfjord horizon with a maximum closure at 2596 m and apex at 2470 m. The Thoreau structure is a large, rotated fault block with a SW-NE trending subtle graben dividing it in the middle (Fig. 4.5 and Fig. 4.6). The volume calculation for the gross rock volume was considered in two cases:

- Case 1 the total structure (big case), shown in the pink outline on the structure map.
- Case 2 only the northern segment (limited smaller case), the part north of the subtle graben marked in red polygon on the structure map.

The 25/8-9 in well is drilled in the subtle graben, did not test the Statfjord GP target (Thoreau prospect) but TD'ed in the Vestlandet Gp stratigraphically above. Upper Statfjord reservoir is juxtaposed to Vestland Gp (Hugin and Sleipner reservoir) across this fault.

The trap is dependent on lateral fault seal, juxtaposition of the Upper Statfjord reservoir to permeable layers which increase the risk of leakage:

1. From the northern segment towards the graben the Upper Statfjord reservoir is juxtaposed to the water bearing Sleipner Fm, drilled by the 25/8-9 well (Fig. 4.7).
2. The crest of the structure, the Upper Statfjord reservoir is juxtaposed to the Hugin Fm to the west. Hugin Fm consist of very good reservoir properties, high porosity and high permeability. No closure for the Hugin in this area, the structure climbs to the south southwest (Fig. 4.8).

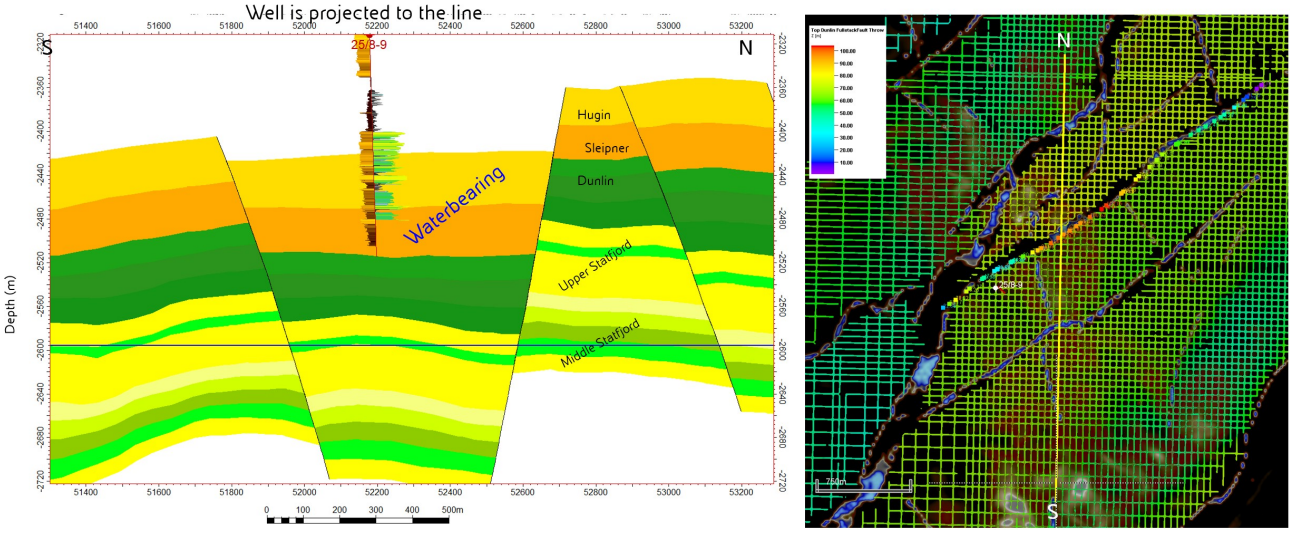

Fig. 4.7 Lateral trap seal risk, inline north to south from structural model.
Upper Statfjord reservoir in the northern segment is juxtaposed to the Sleipner Fm reservoir to the south. The well 25/8-9 proved water bearing heterogeneous reservoir in Sleipner Fm. Location map to the right.

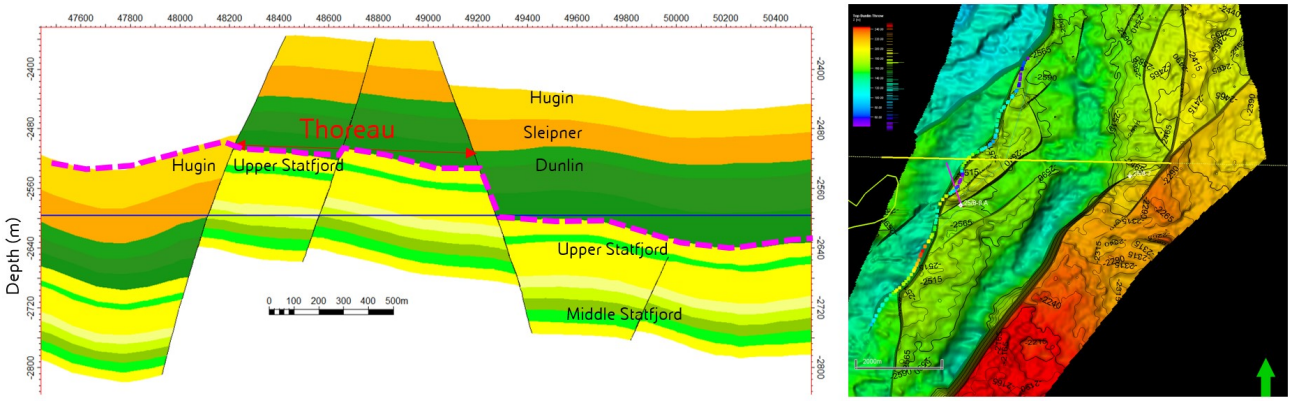

Fig. 4.8 Lateral fault seal risk, crossline from the structural model.
Upper Statfjord Gp reservoir is juxtaposed to the permeable Hugin Fm reservoir to the west, no closure for the combined structure in this area. The combined structure Top Hugin Fm and Top Statfjord Gp is marked in dotted pink line on the cross-section. Location map to the right.

Reservoir

The target in Thoreau prospect is the Upper Triassic-Lower Jurassic Statfjord Gp, and the expected reservoir facies is fluvial channel infill sandstones, deposited on an alluvial plain. Good reservoir qualities are demonstrated for the Statfjord interval in several wells in and around the licence area.

Hugin Fm target has limited upside potential because the 25/8-9 has been drilled reaching Hugin Fm in the graben and well result shows water wet reservoir with good properties, thickness 45m good porous sands.

The Statfjord Gp S10 unit is the uppermost Statfjord unit also referred to as the Nansen Formation. S10 represents an upper shoreface shallow marine environment. Estuarine/tidal and wave dominated facies associations have been interpreted from logs and cores. The Ringhorne East Field is dominated by the S10/Nansen Fm unit. The northernmost part of the Ringhorne West Statfjord Field (fault segment 3) is dominated by the presence of the S10 unit as demonstrated by the Nese well (25/8-C-19 AT2) and the well 25/8-C-1.

Seal

The top seal for the Upper Statfjord reservoir is shales belonging to the Dunlin Gp. Wells 25/6-1, 25/5-3, 25/8-2 and 25/8-5 S demonstrate significant thicknesses of Dunlin shale above the Statfjord Gp. reservoir and this are considered to represent a reliable top seal over the reservoir.

At the crestal part of the structure, a small horst (Fig. 4.9).

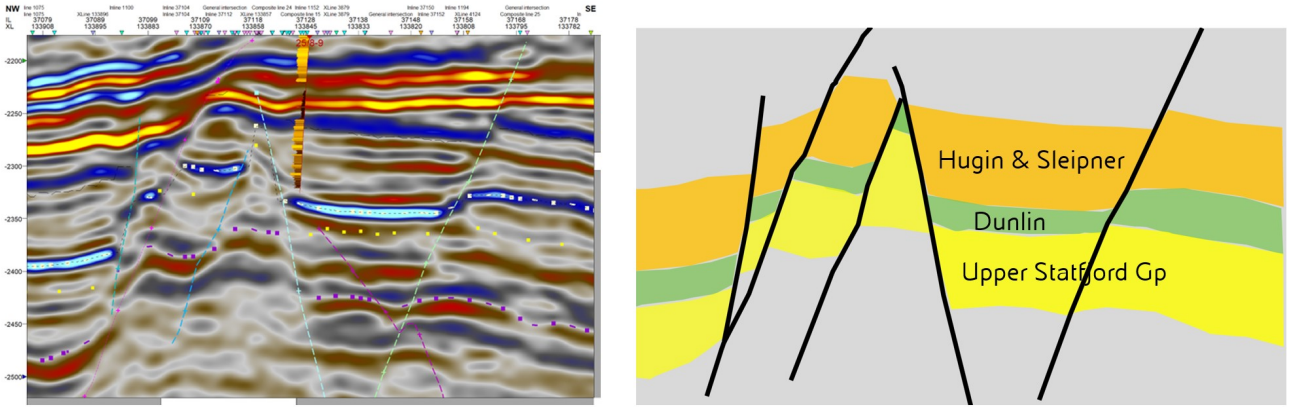

Fig. 4.9 Risk of top seal illustrated on the seismic line and the geosection..
Seismic line to the left is from northwest to southeast cross the crestal part of the prospect, simplified geosection to the right. Notice the interpretation of the Lower Statfjord, clearly defining a small horst. The Dunlin Gp shale (top seal), is not observed at the top of the crest. Missing top seal increases the risk of working top seal for the prospect.

Charge

The proximity to established fields towards west and south proves a working charge system. The Statfjord play is proven by the nearby Ringhorne Field. The kitchen area for the Thoreau prospect at the Statfjord Gp. level is located to the northwest. There does not seem to be any direct communication between the Upper Jurassic Draupne and Heather source and the Statfjord Gp. within the drainage area of the Thoreau prospect. The charge model for the Thoreau prospect at the Statfjord Gp. level depends on cross fault migration concept in the northern part of the Thoreau prospect. It depends on hydrocarbons expelled from Upper Jurassic to a Hugin Fm carrier rock, which is juxtaposed to the Upper Statfjord reservoir in the northern part of the basin. Migration study concluded:

- Cross fault migration necessary to charge the Thoreau Prospect
- Ongoing migration and charge into Thoreau, would result in gas filled to spill.
- With dynamic charge setting (both delimited in time and volume) since Eocene times may yield oil traps with gas caps. During Eocene to Miocene the charge is mostly oil
- Slightly underfilled gas over oil in all structure is the most likely outcome
- Cross fault migration charges the Thoreau prospect at its northern edge. Thus, the HC migration and spill passes from the northern anomaly to southern one before eventually spilling out of the trap at it southern limits, which means only southern part of the prospect is not very likely

Volume cases Thoreau Prospect

Two fluid cases were calculated for the Thoreau Prospect. It was considered 80% chance for the structure filled with gas over oil, and 20% chance it was filled with gas condensate. Volume is calculated for both fluid cases in Case 1, the total structure (Fig. 4.10 and Fig. 4.11) and in Case 2, the northern part only (Fig. 4.12 and Fig. 4.13).

Table 5: Prospect data (Enclose map)

Block	25/8, 25/5	Prospect name	Thoreau (big)	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil&Gas	Reported by company	Vår Energi	Reference document				Assessment year	2024
This is case no.:	1 of 2	Structural element	Utsira High	Type of trap	Structural	Water depth [m MSL] (>0)	123	Seismic database (2D/3D)	3D
Resources IN PLACE and RECOVERABLE		**Main phase**				**Associated phase**			
Volumes, this case		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10^6 Sm^3] (>0.00)	17,49	22,84	23,61	30,99	0,03	0,07	0,07	0,13
	Gas [10^9 Sm^3] (>0.00)	0,13	0,24	0,28	0,48	1,86	2,71	2,80	3,88
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	8,75	11,42	11,81	15,50	0,93	1,36	1,40	1,94
	Gas [10^9 Sm^3] (>0.00)	0,07	0,12	0,14	0,24	0,47	0,68	0,70	0,97
Reservoir Chrono (from)	Carnian	Reservoir litho (from)	Up. Statfjord Gp	Source Rock, chrono primary	Tithonian	Source Rock, litho primary	Draupne	Seal, Chrono	Pliensbachian-Toarcian
Reservoir Chrono (to)	sinemunian	Reservoir litho (to)	Up. Statfjord Gp	Source Rock, chrono secondary		Source Rock, litho secondary		Seal, Litho	Dunlin Gp
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,08	Oil case (0.00-1.00)	0,80	Gas case (0.00-1.00)	0,20	Oil & Gas case (0.00-1.00)			
Reservoir (P1) (0.00-1.00)	1,00	Trap (P2) (0.00-1.00)	1,00	Charge (P3) (0.00-1.00)	0,50	Retention (P4) (0.00-1.00)	0,21		
Parametres:	Low (P90)	Base	High (P10)	*Comments: This is Case 1, the total structure representing North and South part of the Thoreau structure. It is 35% chance for case 1, the total structure. Lateral fault seal risk is 0,3, chance of leakage to other reservoirs juxtaposed to the main reservoir in the crestal part. Top seal risk is set to 0,7, chance of top seal breach in the crestal part du to a horst with tentative seal missing at the top. In total this result in 0,21 chance of retention. It is 80% chance for the fluid case Oil & Gas.*					
Depth to top of prospect [m MSL] (> 0)		2470							
Area of closure [km^2] (> 0.0)	7,2	8,4	9,9						
Reservoir thickness [m] (> 0)	40	70	95						
HC column in prospect [m] (> 0)	105	114	126						
Gross rock vol. [10^9 m^3] (> 0.000)	0,210	0,260	0,340						
Net / Gross [fraction] (0.00-1.00)	0,60		0,75						
Porosity [fraction] (0.00-1.00)	0,22	0,25	0,30						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,15	0,25	0,40						
Bg [Rm3/Sm3] (< 1.0000)	0,0044	0,0042	0,0040						
1/Bo [Sm3/Rm3] (< 1.00)	0,82	0,73	0,66						
GOR, free gas [Sm^3/Sm^3] (> 0)	4000	5200							
GOR, oil [Sm^3/Sm^3] (> 0)	71		169						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,50	0,50	0,50						
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,50	0,50	0,50						
Recov. factor, gas main phase [fraction] (0.00-1.00)	0,50	0,50	0,50						
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0,50	0,50	0,50	For NPD use:					
Temperature, top res [°C] (>0)	91			Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert	NPD will insert value
Pressure, top res [bar] (>0)	235			Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
Cut off criteria for N/G calculation	1. Vsh<=0,35	2.PHIE>=0,1	3. Sw<=0,6					Kart nr	NPD will insert value

Fig. 4.10 Table 5, Case 1 Total structure, oil with gas cap.
It is 35% chance for the total structure, and a 80% chance for the oil/gas fluid case.

Table 5: Prospect data (Enclose map)

Block	25/8, 25/5	Prospect name	Thoreau (big)	Discovery/Prosp/Lead		Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Gas	Reported by company	Vår Energi	Reference document	0			Assessment year	2024
This is case no.:	2 of 2	Structural element	Utsira High	Type of trap	Structural	Water depth [m MSL] (>0)	123	Seismic database (2D/3D)	
Resources IN PLACE and RECOVERABLE		**Main phase**				**Associated phase**			
Volumes, this case		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10^6 Sm^3] (>0.00)					1,01	137,00	1,40	1,85
	Gas [10^9 Sm^3] (>0.00)	4,66	6,24	6,44	8,50				
Recoverable resources	Oil [10^6 Sm^3] (>0.00)								
	Gas [10^9 Sm^3] (>0.00)								
Reservoir Chrono (from)	Carnian	Reservoir litho (from)	Up. Statfjord Gp	Source Rock, chrono primary	Tithonian	Source Rock, litho primary	Draupne	Seal, Chrono	Pliensbachian-Toarcian
Reservoir Chrono (to)	sinemunian	Reservoir litho (to)	Up. Statfjord Gp	Source Rock, chrono secondary	0	Source Rock, litho secondary	0	Seal, Litho	Dunlin Gp
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,02	Oil case (0.00-1.00)	0,80	Gas case (0.00-1.00)	0,20	Oil & Gas case (0.00-1.00)	0,00		
Reservoir (P1) (0.00-1.00)	1,00	Trap (P2) (0.00-1.00)	1,00	Charge (P3) (0.00-1.00)	0,50	Retention (P4) (0.00-1.00)	0,21		
Parametres:	Low (P90)	Base	High (P10)	*Comments: This is Case 1, the total structure representing North and South part of the Thoreau structure. It is 35% chance for case 1, the total structure. Lateral fault seal risk is 0,3, chance of leakage to other reservoirs juxtaposed to the main reservoir in the crestal part. Top seal risk is set to 0,7, chance of top seal breach in the crestal part du to a horst with tentative seal missing at the top. In total this result in 0,21 chance of retention. It is 20% chance for the fluid case Gas / condensate.*					
Depth to top of prospect [m MSL] (> 0)		2470							
Area of closure [km^2] (> 0.0)	7,1	8,4	9,9						
Reservoir thickness [m] (> 0)	40	70	95						
HC column in prospect [m] (> 0)	105	114	126						
Gross rock vol. [10^9 m^3] (> 0.000)	0,210	0,260	0,330						
Net / Gross [fraction] (0.00-1.00)	0,60		0,75						
Porosity [fraction] (0.00-1.00)	0,22	0,25	0,30						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,15	0,25	0,40						
Bg [Rm3/Sm3] (< 1.0000)	0,0044	0,0042	0,0040						
1/Bo [Sm3/Rm3] (< 1.00)									
GOR, free gas [Sm^3/Sm^3] (> 0)	4000		5200						
GOR, oil [Sm^3/Sm^3] (> 0)									
Recov. factor, oil main phase [fraction] (0.00-1.00)									
Recov. factor, gas ass. phase [fraction] (0.00-1.00)									
Recov. factor, gas main phase [fraction] (0.00-1.00)									
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)				For NPD use:					
Temperature, top res [°C] (>0)				Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert	NPD will insert value
Pressure, top res [bar] (>0)				Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
Cut off criteria for N/G calculation	1. Vsh<=0,35	2.PHIE>=0,1	3. Sw<=0,6					Kart nr	NPD will insert value

Fig. 4.11 Table 5, Case 1 Total structure, gas / condensate.
It is 35% chance for the total structure, and 20% chance for the gas/condensate fluid case.

Table 5: Prospect data (Enclose map)

Block	25/8, 25/5	Prospect name	Thoreau (North)	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil&Gas	Reported by company	Vår Energi	Reference document				Assessment year	2024
This is case no.:	1 of 2	Structural element	Utsira High	Type of trap	Structural	Water depth [m MSL] (>0)	123	Seismic database (2D/3D)	3D
Resources IN PLACE and RECOVERABLE		**Main phase**				**Associated phase**			
Volumes, this case		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10^6 Sm^3] (>0.00)	2,74	3,72	3,86	5,21	0,01	0,02	0,03	0,04
	Gas [10^9 Sm^3] (>0.00)	0,29	0,44	0,46	0,65	0,29	0,44	0,46	0,65
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	0,14	0,19	0,19	0,26	0,00	0,00	0,00	0,00
	Gas [10^9 Sm^3] (>0.00)	0,01	0,02	0,02	0,03	0,01	0,02	0,02	0,03
Reservoir Chrono (from)	Carnian	Reservoir litho (from)	Up. Statfjord Gp	Source Rock, chrono primary	Tithonian	Source Rock, litho primary	Draupne	Seal, Chrono	Pliensbachian-Toarcian
Reservoir Chrono (to)	sinemurian	Reservoir litho (to)	Up. Statfjord Gp	Source Rock, chrono secondary		Source Rock, litho secondary		Seal, Litho	Dunlin Gp
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,08	Oil case (0.00-1.00)	0,80	Gas case (0.00-1.00)	0,20	Oil & Gas case (0.00-1.00)			
Reservoir (P1) (0.00-1.00)	1,00	Trap (P2) (0.00-1.00)	1,00	Charge (P3) (0.00-1.00)	0,50	Retention (P4) (0.00-1.00)	0,21		

Parametres:	Low (P90)	Base	High (P10)
Depth to top of prospect [m MSL] (> 0)		2470	
Area of closure [km^2] (> 0.0)	1,4	1,7	2,0
Reservoir thickness [m] (> 0)	40	70	95
HC column in prospect [m] (> 0)	105	114	126
Gross rock vol. [10^9 m^3] (> 0.000)	0,210	0,260	0,340
Net / Gross [fraction] (0.00-1.00)	0,60		0,75
Porosity [fraction] (0.00-1.00)	0,22	0,25	0,30
Permeability [mD] (> 0.0)			
Water Saturation [fraction] (0.00-1.00)	0,15	0,25	0,40
Bg [Rm3/Sm3] (< 1.0000)	0,0044	0,0042	0,0040
1/Bo [Sm3/Rm3] (< 1.00)	0,82	0,73	0,66
GOR, free gas [Sm^3/Sm^3] (> 0)	4000	5200	
GOR, oil [Sm^3/Sm^3] (> 0)	71		169
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,50	0,50	0,50
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,50	0,50	0,50
Recov. factor, gas main phase [fraction] (0.00-1.00)	0,50	0,50	0,50
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0,50	0,50	0,50
Temperature, top res [°C] (>0)	91		
Pressure, top res [bar] (>0)	235		
Cut off criteria for N/G calculation	1. Vsh<=0,35	2.PHIE>=0,1	3. Sw<=0,6

Comments: This is Case 2, the North structure representing the Northern part of the Thoreau structure. It is 65% chance for case 2, the Northern structure. Lateral fault seal risk is 0,3, chance of leakage to other reservoirs juxtaposed to the main reservoir in the crestal part. Top seal risk is set to 0,7, chance of top seal breach in the crestal part du to a horst with tentative seal missing at the top. In total this result in 0,21 chance of retention. It is 80% chance for the fluid case Oil & Gas.

For NPD use:					
Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert	NPD will insert value
Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
				Kart nr	NPD will insert value

Fig. 4.12 Table 5, Case 2 North Structure, oil with gas cap.
It is 65% chance for the North Structure, and 80% chance for the oil/gas fluid case.

Table 5: Prospect data (Enclose map)

Block	25/8, 25/5	Prospect name	Thoreau (North)	Discovery/Prosp/Lead		Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Gas	Reported by company	Vår Energi	Reference document	0			Assessment year	2024
This is case no.:	2 of 2	Structural element	Utsira High	Type of trap	Structural	Water depth [m MSL] (>0)	123	Seismic database (2D/3D)	
Resources IN PLACE and RECOVERABLE		**Main phase**				**Associated phase**			
Volumes, this case		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10^6 Sm^3] (>0.00)					0,17	0,23	0,24	0,33
	Gas [10^9 Sm^3] (>0.00)	0,79	1,06	1,10	1,48				
Recoverable resources	Oil [10^6 Sm^3] (>0.00)								
	Gas [10^9 Sm^3] (>0.00)								
Reservoir Chrono (from)	Carnian	Reservoir litho (from)	Up. Statfjord Gp	Source Rock, chrono primary	Tithonian	Source Rock, litho primary	Draupne	Seal, Chrono	Pliensbachian-Toarcian
Reservoir Chrono (to)	sinemurian	Reservoir litho (to)	Up. Statfjord Gp	Source Rock, chrono secondary	0	Source Rock, litho secondary	0	Seal, Litho	Dunlin Gp
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,02	Oil case (0.00-1.00)	0,80	Gas case (0.00-1.00)	0,20	Oil & Gas case (0.00-1.00)	0,00		
Reservoir (P1) (0.00-1.00)	1,00	Trap (P2) (0.00-1.00)	1,00	Charge (P3) (0.00-1.00)	0,50	Retention (P4) (0.00-1.00)	0,21		

Parametres:	Low (P90)	Base	High (P10)
Depth to top of prospect [m MSL] (> 0)		2470	
Area of closure [km^2] (> 0.0)	1,4	1,7	2,0
Reservoir thickness [m] (> 0)	40	70	95
HC column in prospect [m] (> 0)	105	114	126
Gross rock vol. [10^9 m^3] (> 0.000)	0,210	0,260	0,330
Net / Gross [fraction] (0.00-1.00)	0,60		0,75
Porosity [fraction] (0.00-1.00)	0,22	0,25	0,30
Permeability [mD] (> 0.0)			
Water Saturation [fraction] (0.00-1.00)	0,15	0,25	0,40
Bg [Rm3/Sm3] (< 1.0000)	0,0044	0,0042	0,0040
1/Bo [Sm3/Rm3] (< 1.00)			
GOR, free gas [Sm^3/Sm^3] (> 0)	4000		5200
GOR, oil [Sm^3/Sm^3] (> 0)			
Recov. factor, oil main phase [fraction] (0.00-1.00)			
Recov. factor, gas ass. phase [fraction] (0.00-1.00)			
Recov. factor, gas main phase [fraction] (0.00-1.00)			
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)			
Temperature, top res [°C] (>0)			
Pressure, top res [bar] (>0)			
Cut off criteria for N/G calculation	1. Vsh<=0,35	2.PHIE>=0,1	3. Sw<=0,6

Comments: This is Case 2, the North structure representing Northern part of the Thoreau structure. It is 65% chance for case 1, the total structure. Lateral fault seal risk is 0,3, chance of leakage to other reservoirs juxtaposed to the main reservoir in the crestal part. Top seal risk is set to 0,7, chance of top seal breach in the crestal part du to a horst with tentative seal missing at the top. In total this result in 0,21 chance of retention. It is 20% chance for the fluid case Gas / condensate.Gas / condensate case is deemed negative, as such no recoverables calculated.

For NPD use:					
Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert	NPD will insert value
Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
				Kart nr	NPD will insert value

Fig. 4.13 Table 5, Case 2 the North Structure, gas / condensate case.
It is 65% chance for the North Structure, and 80% chance for the gas/condensate.

4.3 Leads

Twain

Twain has been downgraded to a lead within the partnership due to limited volumes (see Fig. 4.1). Twain is defined with reservoir in the Statfjord Gp. The Twain trap is defined on the mapped Statfjord horizon with a maximum closure area of 3.6 km2 and apex at 2150 m depth. The structural 3-way fault dependent and located on a narrow northeast trending horst block continuing the structural grain in a down dip position relative to the Ringhorne field in the south. To the northwest and southeast, Twain is defined by the down-to-NW and down-to-SE normal faults of the horst system, respectively.

The main reservoir of the Twain prospect is the Upper Statfjord Gp, and the expected reservoir facies is fluvial channel infill sandstones, deposited on an alluvial plain, as described in Play description. Good reservoir qualities are demonstrated for the Statfjord interval in several wells in and around the license area. The 25/9-3 well penetrated a gross Statfjord interval of 115 meters with a N/G of 0.6 with an average porosity of 0.24. However, this includes the shaly intra-Statfjord Gp, whereas the overlying parts of Statfjord Gp, corresponding to the reservoir interval in Twain, is expected to be mostly sandy. This is also seen further north in the 25/6-1 well, where Upper Statfjord Gp tends to be sandier compared to the Lower Statfjord.

The top seal is shales belonging to the Dunlin Gp. Although seismic mapping shows juxtaposition of Statfjord Gp against Dunlin Gp across all bounding faults, Dunlin is a proven seal in the area. Twain has its structural filling from N-NE, and is dependent upon long migration, any fill must have gone through the Thoreau prospect Statfjord GP reservoir and many some complex migration route through passing Upper to Lower Statfjord. This is proved dry by the well, with some shows. Gas is the most likely fluid phase in this lead.

Meyer

The Meyer lead is defined as a 4-way closure within the Paleocene Ty FM located in the northern part of the area (see Fig. 4.1).

The Meyer Lead is a mapped 4-way closure on Top Ty FM level. The reservoir in the Meyer lead is the Lower Paleocene Ty Fm. Marine turbidite fan deposits is the expected reservoir facies. The northern part of the Utsira High was most likely a northward plunging structural high during the Early Paleocene time, based on a dramatic thinning of the Ty Fm south of the Meyer structure, where the 25/6-1 well only penetrated 10 m Ty Fm sandstone close to pinch-out. However, based on seismic mapping, we expect reservoir thicknesses between 40-70 m in the Meyer structure, like what is drilled in the 26/4-1 well east of the structure (76m Ty Fm). Effective top seal is proven by the encasing shales in Lista and Sele Fms. The maximum prospect area of Meyer is 9 km2, corresponding to the 2162 m depth contour at which the prospect will spill towards the south. The apex of the structure is 2122 m TVDSS, though velocity challenges add some uncertainty, including mud diapirs and Injectites in the overburden.

Based on the petroleum system model, the previous Meyer model is to be filled with oil by continuing migration from either Langfjellet and/or Frøy in the North, where faults reactivated in the Cenozoic are believed to act as hydrocarbon conduits from the carrier in Hugin and Sleipner Fms into the Ty Fm. The oil properties are therefore same as observed in the Frøy Field and the Langfjellet discovery (25/2-18). A recently updated version is a gas filled Meyer with the gas coming from the Jurassic layers further to the North, the strata being linked by a faulted zone. As the filling history shows, the Meyer can have filled with oil in the past, but the liquid phase is now replaced by gas. The volumetric are quite uncertain here, this model also predicts filling in Ty Fm in 25/6-1 and -2 wells, which very shaly/silty here, but also reported without shows.

5 Technical assessment

Given Thoreau's high-risk, high-reward potential, a technical and economic assessment was conducted to determine how its development could integrate into a larger area solution. The reservoir in question is Upper Statfjord, with an anticipated recovery factor of approximately 50%, based on production data from wells in the Ringhorne East field. The oil characteristics are expected to be similar, with a gas-oil ratio (GOR) of around 120 Sm3/Sm3.

The proposed development involves one or two four-slot templates connected to the Jotun FPSO through a newly constructed 25 km pipeline. The plan includes multilateral wells with the option for gas lift, and water injection may be implemented later if needed, although a strong aquifer is assumed to be present.

Due to the project's very high risk, the economic outlook remains marginal.

6 Conclusion

Following a full G&G evaluation, the main prospect from the APA19 Application (Hemingway) has been downgraded. The two main risks for the Hemingway prospect are trap seal in the relay ramp to the east and complex long distance migration route.

The Thoreau Prospect defined after the APA19 application has also been downgraded. The main risks for the Thoreau Prospect are trap seal (reservoir is juxtaposed to waterbearing Hugin Fm reservoir proven by well above the prospect) and complex long distance migration route.

The leads have not been upgraded to drillable prospect following thorough G&G studies.

No other prospects have been identified in the licence area.