



**SPIRIT
ENERGY**

**RELINQUISHMENT REPORT OF PL 1067 IN
BLOCKS 6503/1, 2 & 4 AND 6603/10**

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1 KEY LICENSE HISTORY

Summary

PL 1067 is located within the entirety of blocks 6503/1, 2 & 4 and 6603/10 on the Rån Ridge, Norwegian Sea (Fig. 1.1) and was awarded on 14th February 2020 through APA 2019 to the license partnership:

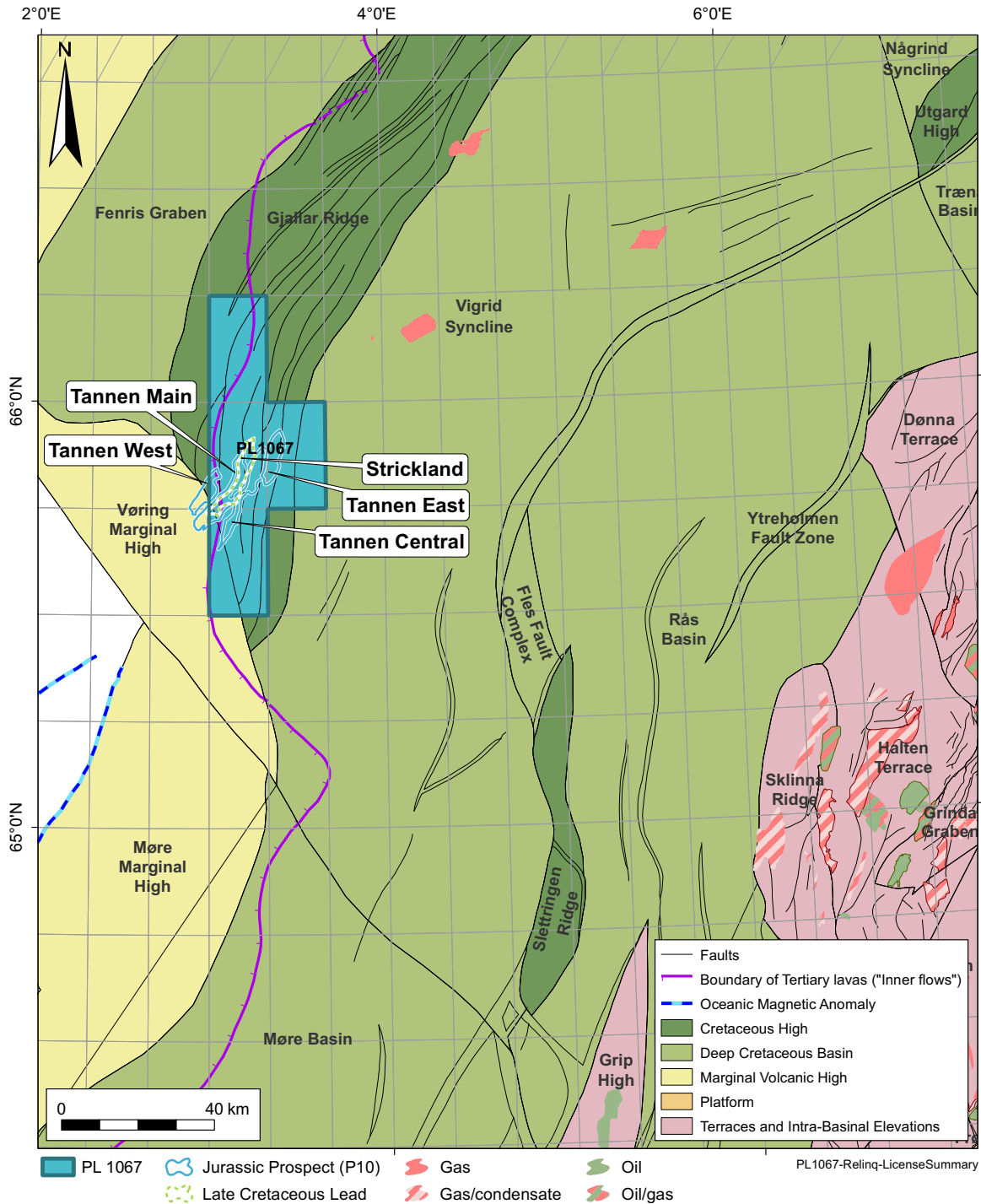


Fig. 1.1 PL 1067 License Summary Map.

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- Spirit Energy Norway AS: 40% (Operator)
- Equinor Energy AS: 30%
- Wintershall Dea Norge AS: 30%

Overview of Meetings

All meetings held in the license are summarised in Table 1.1. Presentation material and minutes from the EC and MC meetings can be found on L2S.

Table 1.1 PL 1067 License Meetings.

Date	Meeting	Comments
24.04.2020	ECMC #1	Establishment of the license, work programme and 2020 budget
20.08.2020	EC Work Meeting	Work meeting to discuss an analogue reservoir quality study, previously defined in the optional budget for phase 1
03.12.2020	ECMC #2	Final results of the 1D & 2D temperature modelling study, 2020 year end budget, proposed 2021 budget
26.04.2021	EC Work Meeting	Final results of the analogue reservoir quality study presented to the partnership

Work Programme

The work commitments for the license and work periods were:

Phase 1; within 1 year from award (by 14th February 2021)

- G&G studies
- Decision to acquire existing 3D seismic with optional reprocessing of 3D seismic, or drop

Phase 2; within 3 years from award (by 14th February 2023)

- Acquire and/or reprocessing of 3D seismic
- Drill or drop

The phase 1 work programme has involved two key geological studies that have been used to assess the potential reservoir quality remaining within the as yet unproven, potential Jurassic and Cretaceous reservoirs on the Rån Ridge. A 1D and 2D temperature modelling study was carried out in order to understand the observed temperature profiles from already existing deepwater Norwegian Sea wells and applying the range of potential burial histories and heatflows to a 2D transect through the Rån Ridge and PL 1067 prospects. The results of which, were then used directly along with analogue Jurassic and Cretaceous Norwegian Sea reservoirs to model the effects on reservoir quality using the Touchstone reservoir quality software.

Following completion of these studies the volume and risk of the prospects within PL 1067 have not been updated. This is due to the main reason for relinquishment outlined below.

Relinquishment

The license partnership unanimously decided to relinquish PL 1067 in February 2021. As such it is not the results of the G&G studies that have, in the end chiefly informed this relinquishment decision. It is rather that frontier, deep-water exploration licences such as PL 1067 would only be able to yield a development very far out into the future, and as such the risk-reward ratio is deemed to be too high within the frontier prospectivity in PL 1067 to allow the license partnership to make the significant investment in high quality 3D seismic data that is clearly needed in order to progress this license to a drill or drop decision.

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2 DATABASE

Seismic Database

Regional as well as prospect mapping, analysis and screening of the license area was primarily carried out using released and licensed long offset MNR 2D seismic data. For select key MNR lines, the broadband reprocessed Clari-Fi Totus (CFI) version from 2013 has been used. In addition, all released 2D datasets in the area have been utilized for structural mapping, with the GRS99 and GRSI99 surveys being the most useful. A series of 3D seismic datasets have been used in the more peripheral areas tying in various exploration wells and verifying the regional mapping from 2D data. An overview of the 2D and 3D seismic datasets used is shown in Fig. 2.1. Regarding the agreed license common database, it was decided to only include released 2D and 3D datasets, including the released 2D MNR lines and not any of the broadband reprocessed versions.

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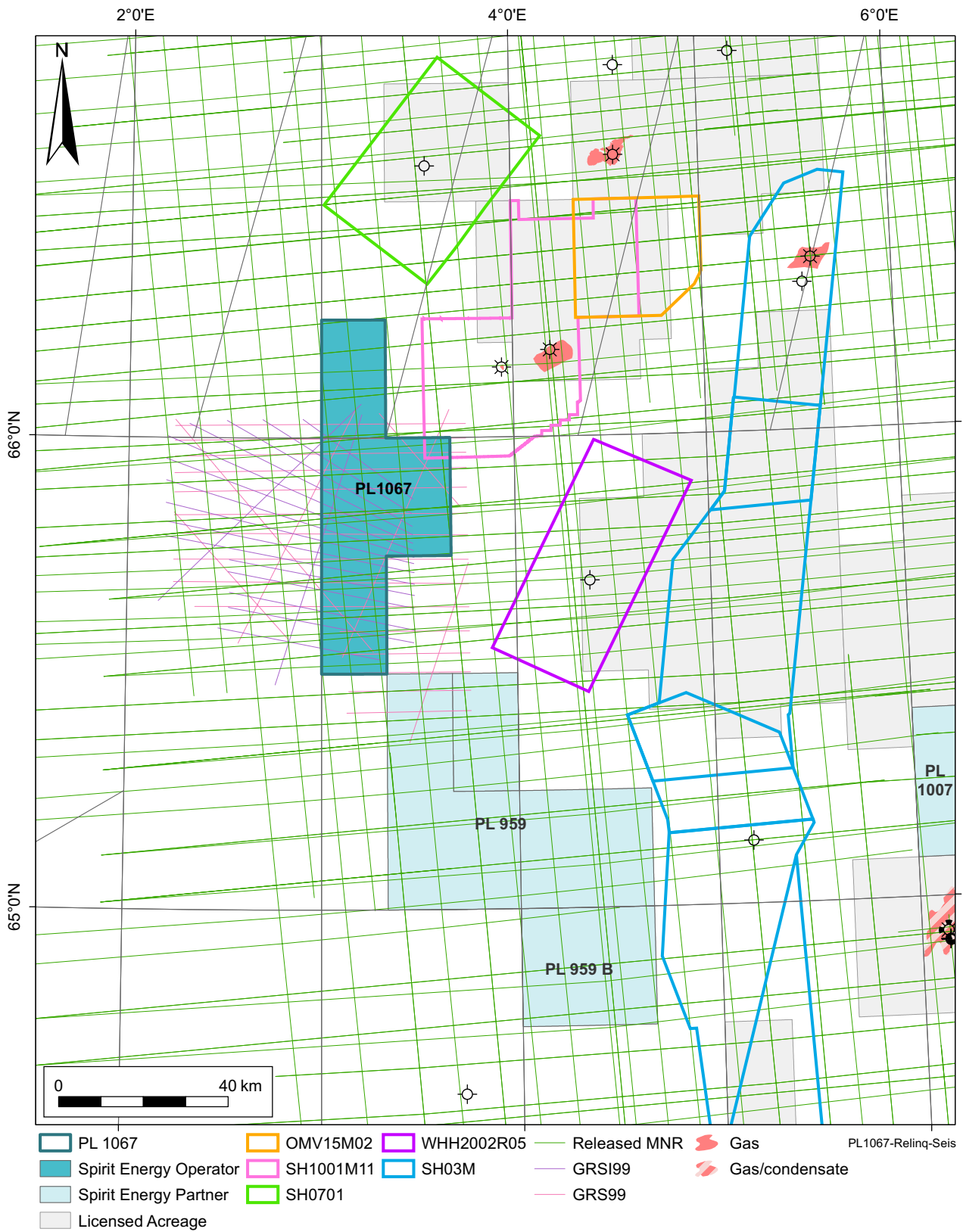


Fig. 2.1 Seismic Database. Summary of the 2D & 3D seismic datasets used to define the prospectivity within PL 1067.

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Well Database

A set of 44 wells from the Norwegian Sea were used in the PL 1067 common database. All of these wells are publically available and no special reports are included (Table 2.1).

Table 2.1 Well Database.

Well UWI	Name	Year Completed	TD (m MD)	TD Lithostratigraphic Fm
6405/7-1	Ellida	2003	4300	Lysing
6406/1-1		2001	5057	Åre
6406/1-2	Sklinna Sør	2003	4500	Red Beds
6406/2-1	Lavrans	1995	5292	Åre
6406/2-2	Lavrans	1996	5367	Åre
6406/2-3	Kristin	1997	5258	Åre
6406/2-5	Kristin	1997	5439	Åre
6406/2-6	Ragnfrid	1998	5263	Åre
6406/5-1		2002	4692	Tilje
6406/9-1	Linnorm	2005	5080	Åre
6406/9-2	Linnorm	2007	5348	Åre
6407/1-6 S	Rodriguez	2013	4250	Ror
6504/5-1 S	Gemini	2007	4193	Lange
6505/10-1	Helland Hansen	1998	5028	Lange
6506/6-1	Victoria	2000	5491	Åre
6506/6-2	Albert	2013	3366	Lange
6506/9-1	Victoria	2009	5664	Åre
6506/9-2 S	Fogelberg	2010	4805	Åre
6506/9-3	Smørbukk Nord	2013	4692	Åre
6506/9-4 S*	Fogelberg	2018	4738	Tofte
6506/9-4 A	Fogelberg	2018	4497	Tofte
6506/11-1		1988	4679	Åre
6506/11-3		1992	4350	Not
6506/11-6	Kristin	1998	5275	Åre
6506/11-7	Morvin	2001	4978	Åre
6506/11-8	Morvin	2006	4990	Tilje
6506/11-9 S	Cooper	2012	5330	Åre
6506/11-10	Iris/Hades	2018	4536	Ror
6506/12-1		1995	5097	Åre
6506/12-3	Smørbukk Sør	1985	4360	Tilje
6506/12-3		1985	4457	Åre
6506/12-6	Smørbukk	1986	4741	Åre
6507/5-2	Skarv	1999	3897	Åre
6507/5-3	Ærfugl	2000	3000	Lange
6507/7-11 S	Heidrun SW	1997	3749	Åre
6507/11-14 S	Dvalin	2010	4534	Tilje
6507/11-15 S	Dvalin	2012	4567	Tilje
6603/5-1 S	Dalsnuten	2010	5254	Lange
6603/12-1	Gro	2009	3830	Springar
6604/10-1	Gro	2010	3715	Springar
6605/8-1	Stetind	2005	4513	Lange
6608/10-2	Norne	1992	3678	Åre
6608/10-8	Urd (Stær)	2002	2652	Åre

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6707/10-3 S	Ivory	2014	4789	Lange
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Studies

The following studies are included in the common license database:

1. Northeast Greenland Petroleum Systems (GEUS, 2009) - The study, carried out by the Geological Survey of Denmark and Greenland describes elements of petroleum systems in Northeast Greenland. The main focus is placed on the distribution, quality and characteristics of petroleum source rocks known from onshore geological fieldwork. The Upper Paleozoic to Mesozoic succession in central East Greenland is the most important outcrop analogue to understand the stratigraphy and hydrocarbon potential of the offshore basins on the Northeast Greenland shelf and other areas in the North Atlantic, including shelf areas off northern Norway. Some of the results from this study have been used in the temperature modelling study carried out in 2020 in PL 1067.
2. Nanok-1 Core Well, Northeast Greenland (GEUS, 2012) - This report presents the core data package of the Nanok-1 core drilled in eastern Hold with Hope, Northeast Greenland in 2011. The Nanok-1 drill site is situated at Knudshoved, on the east coast of Hold with Hope. The main target of the drilling was the Campanian to Upper Cenomanian interval of the Fosdalen Fm. The primary objectives were to investigate reservoir quality, source rock potential and preliminary caprock properties of the drilled interval. Some of the results from this study have been used in the temperature modelling study carried out in 2020 in PL 1067.

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3 REVIEW OF GEOLOGICAL FRAMEWORK

Geological Setting

The license area is located across the Rån Ridge at the southern end of the Gjallar Ridge in the Vøring Basin. The axis of the Vøring Basin runs NE-SW through the northern part of the Norwegian Sea. The western part of the basin area is dominated by the Gjallar Ridge parallel to the basin. The Gjallar Ridge comprises a series of tilted fault blocks with faults dipping predominantly to the northwest. The Rån Ridge is the southernmost extension of the Gjallar Ridge structural high, offset by the Jan Mayen Fracture Zone system. The four Tannen Prospects (Tannen Main, Central, East and West) are located on the Rån Ridge and are interpreted to be pre-BCU Jurassic aged prospects. The Strickland Lead is identified at Lysing Fm level as a large low relief 3-way dip closure, located vertically above the Tannen Main Prospect.

Geological Studies

Reservoir presence and quality is the key risk in the prospectivity defined within PL 1067. As such, no wells have penetrated Jurassic stratigraphy in the Vøring Basin and no wells in the vicinity of the Gjallar Ridge have penetrated the Lysing Fm. Given the high geothermal gradient interpreted from the well data in 6603/5-1 S (Dalsnuten) there is also a significant risk that Jurassic and Cretaceous reservoirs that may have been deposited over the Rån Ridge have experienced high temperatures over geological time that have reduced the reservoir quality to sub-commercial levels. Consequently, it was decided amongst the license partners that the first year of G&G studies would focus on understanding the burial and geothermal history of the Vøring Basin and apply these results to potential analogue Jurassic and Cretaceous reservoirs from elsewhere in the Norwegian Sea. The aim of these studies was to ascertain as to whether any geological scenarios existed that could preserve Jurassic and/or Cretaceous reservoir quality at the currently mapped depth of burial for the Tannen Prospects and the Strickland Lead. A brief summary of these studies is provided below.

A Regional Geochemistry and Geothermal Appraisal of the Deepwater Norwegian Sea Margin (IGI Ltd)

The overall aim of the study was to appraise and quantify the effects of different processes on the present-day and past thermal regimes of the Norwegian Sea deepwater margin, and to provide a unified model that explains the lateral variations in the measured geothermal gradients and surface heat fluxes. For this, a series of data analysis was carried out, which included:

1. Construction of a geochemical database for the study area and review of the source rock geochemistry
2. Review of hydrocarbon geochemistry with particular focus on the most likely source(s) for oils and gases
3. Construction and calibration of 1D models for fifteen (15) selected drilled wells in different structural domains of the margin
4. 2D modelling of a southern Vøring Margin transect (crossing the Rån Ridge PL 1067 prospects and lead), extending between the continental shelf and oceanic basement

Reservoir Quality Study (Touchstone, Geocosm LLC)

The overall aim of this project was to assess the potential for retention of reservoir quality for the PL 1067 area prospects where a key risk is considered to be the potentially high temperature thermal regime and its subsequent enhancement of diagenesis; specifically quartz cementation and illitisation.

To constrain this risk, a forward modelling (Touchstone) study of diagenesis was undertaken in order to test the effects of different thermal histories upon potential reservoir sandstones. For such a modelling study

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core analysis and petrographic data from sandstones analogous to those expected at the prospect location are used together with a range of 1D thermal models (see study above). These were used to build and calibrate models of the response of sandstone reservoirs to thermal regimes through geological time.

In the PL 1067 license the two potential reservoir zones (Jurassic and Cretaceous) were both assessed. In the absence of any nearby wells with Jurassic reservoir or Lysing Fm reservoir penetrations the analogue samples were selected from relevant, available cored intervals from Norwegian Sea wells with potential reservoir sandstones. Separate calibrated models were built using 1D thermal models for the relevant intervals and wells and these models were then used to predict the reaction of reservoir sandstones to different thermal histories at the prospect and lead locations (2D transect created in the geothermal study detailed above).

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4 PROSPECT UPDATE

At the time of relinquishment the Tannen Main Prospect has been evaluated as the main prospect as it has the highest mean recoverable volumes of the four Tannen Prospects. Tannen Central, East and West represent follow-up prospects in addition to the Cretaceous Strickland Lead (Fig. 4.1).

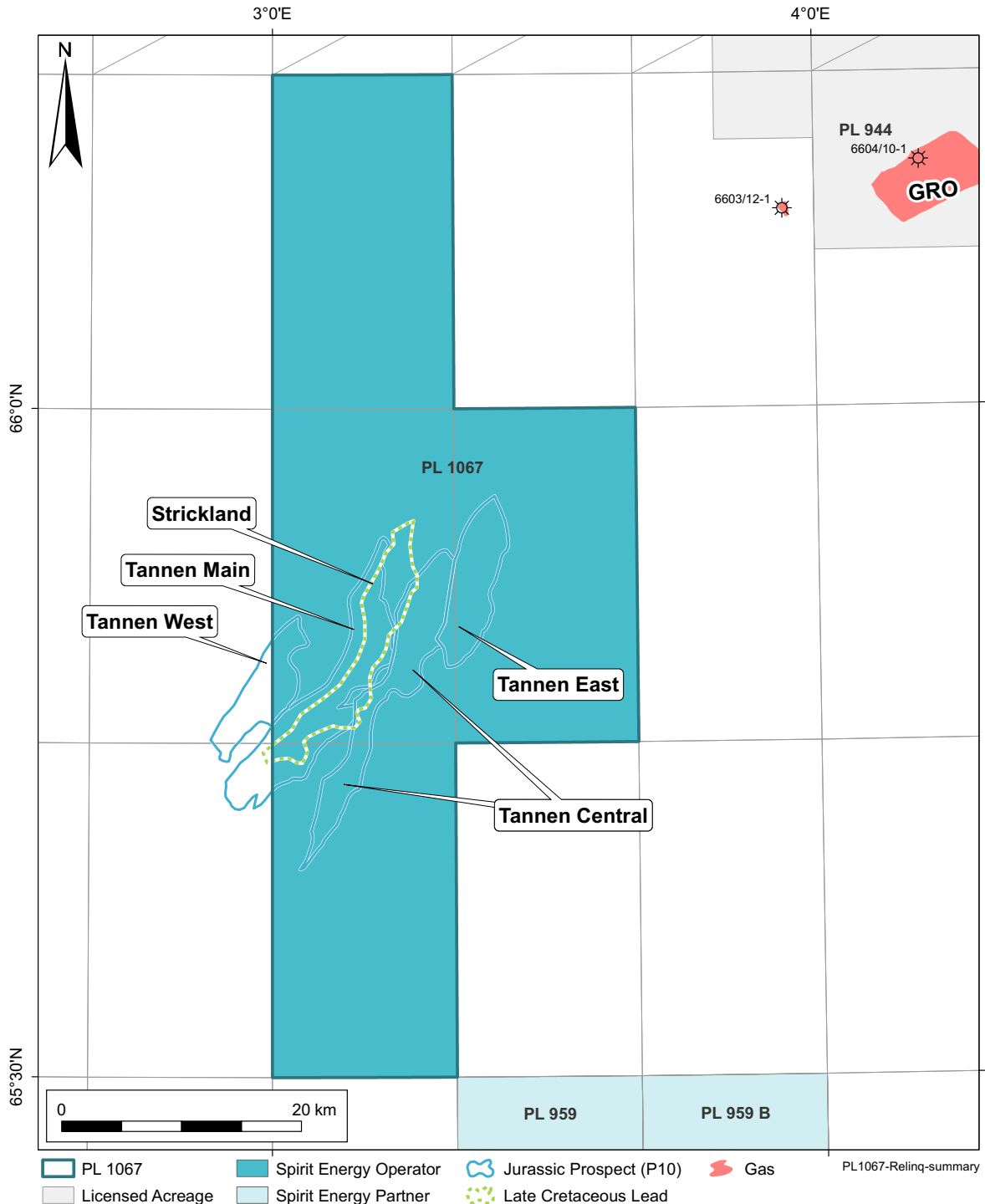


Fig. 4.1 PL 1067 Prospect Summary Map.

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The four Tannen Prospects are located on the Rån Ridge in approximately 1450 m water depth. The clear unconformity seen on the eastern side of Rån Ridge is assigned to the BCU and is simultaneously taken to represent the top reservoir, as the Viking Gp is thought to be condensed or absent at the crest of the structure.

Fig. 4.2 shows the depth map of BCU/top reservoir in the license area. The Tannen Prospects comprise four NE-SW elongated fault blocks downfaulted to the west within the larger Rån Ridge structure (Fig. 4.3 & Fig. 4.4). The greater Rån Ridge is bounded by a large fault system on the western and northern side with a steeply dipping unfaulted flank towards the east. Towards the south, the interpretation becomes highly questionable due to poor seismic imaging below the Cretaceous due to sill intrusions and Paleocene basalts. 3D seismic data is necessary to further mature the Tannen Prospects through detailed fault interpretation and horizon mapping to potentially increase the confidence in reservoir presence and the overall geometry of the prospects.

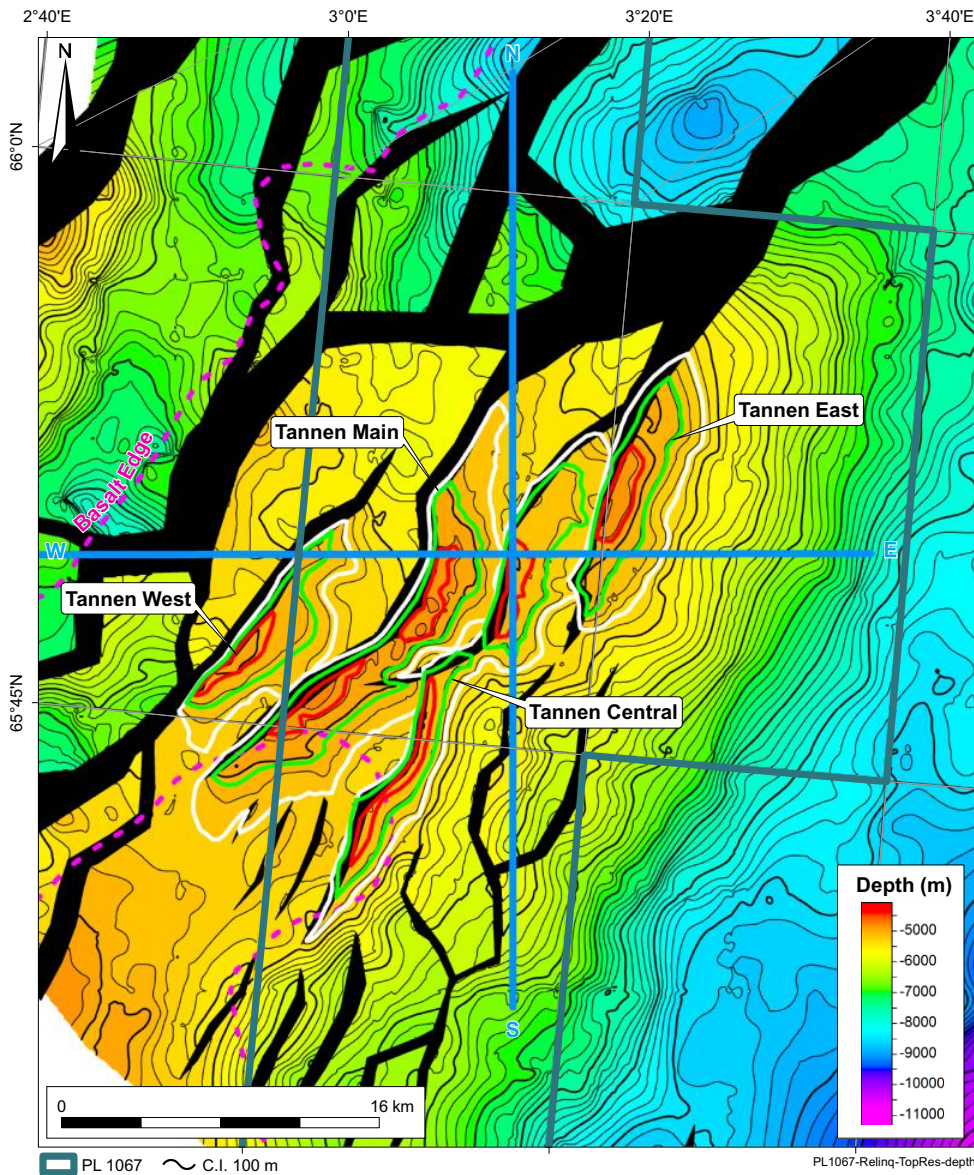


Fig. 4.2 Tannen Prospects Top Jurassic Reservoir Depth Map. Red=P90, green=P50 & white=P10 outlines.

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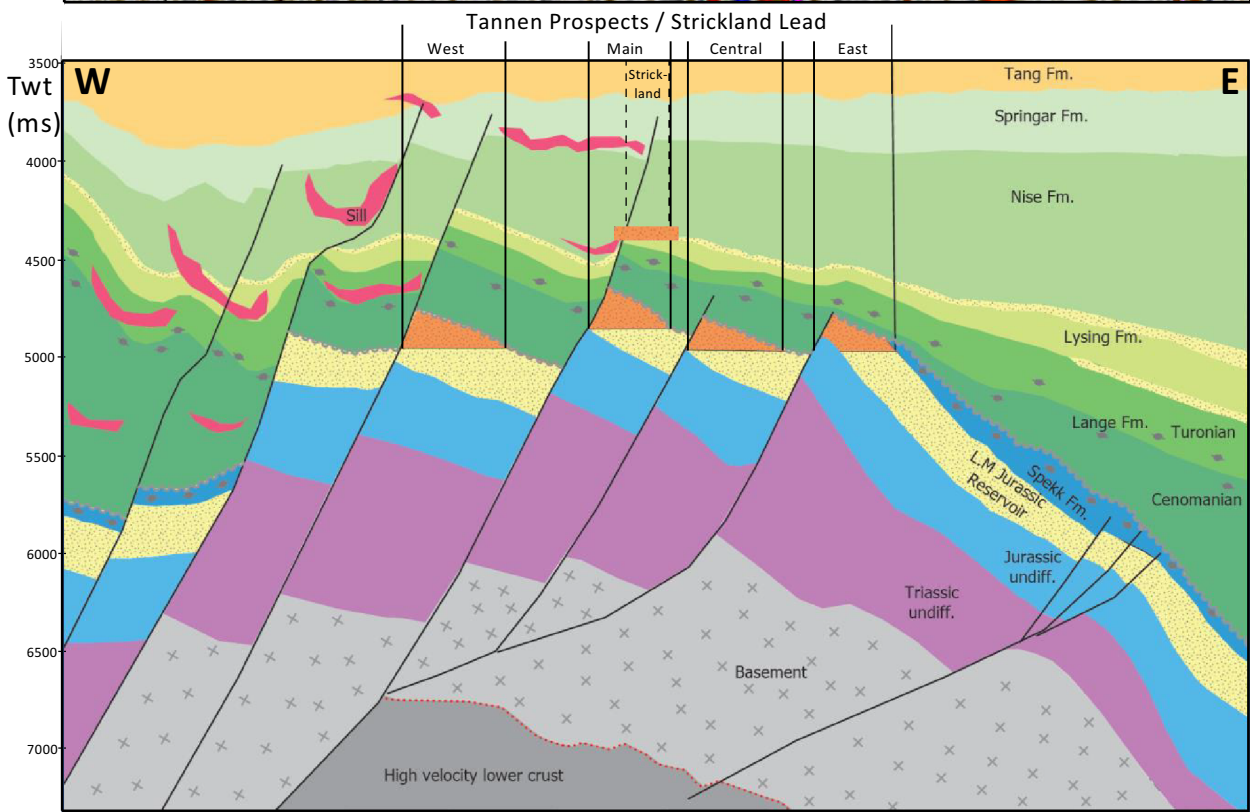
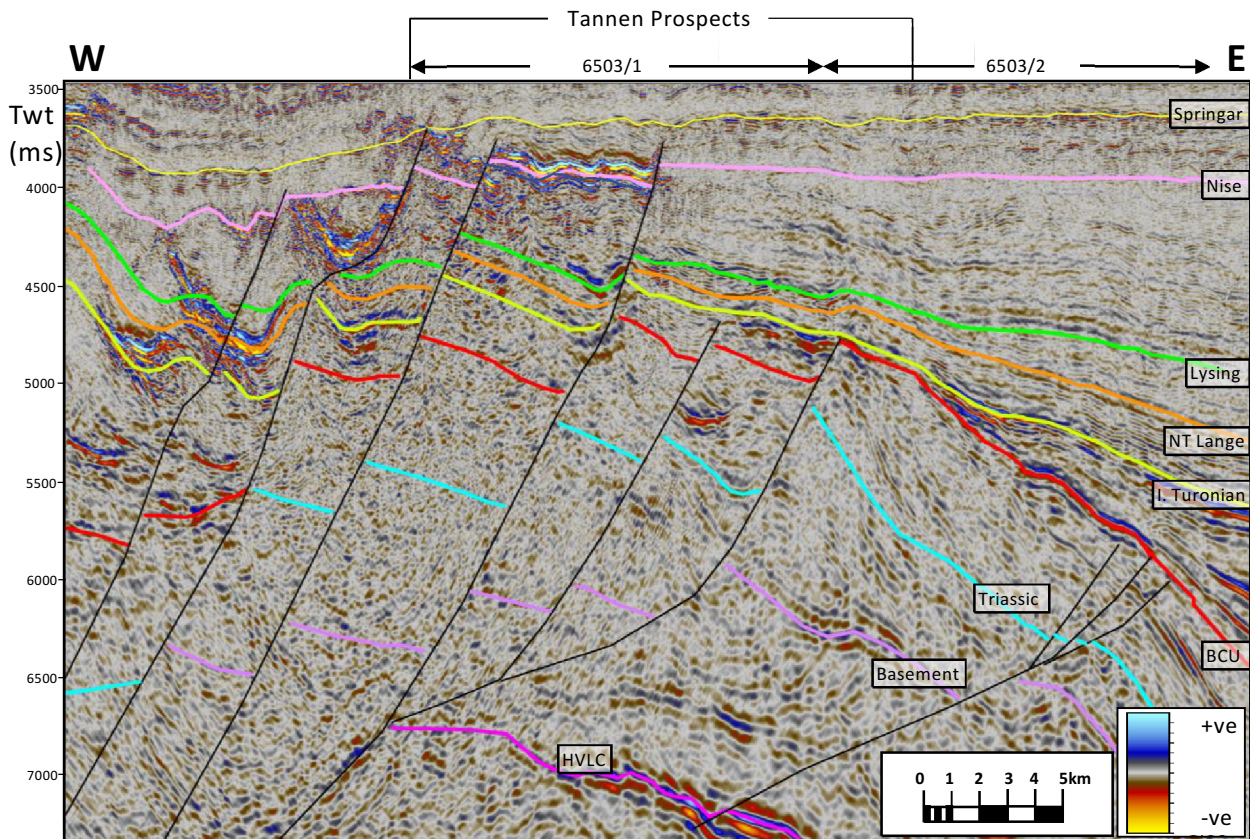


Fig. 4.3 E-W Seismic Line Illustrating the Tannen Prospects & Strickland Lead.

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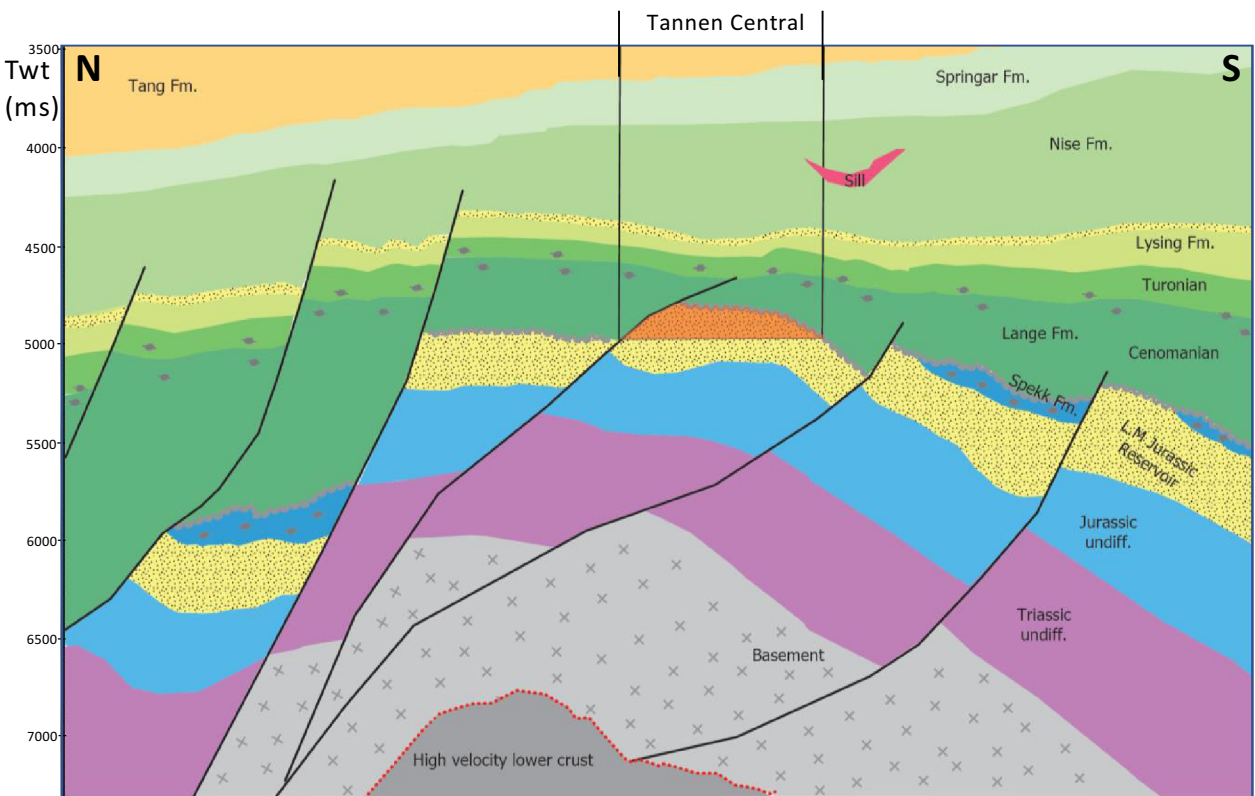
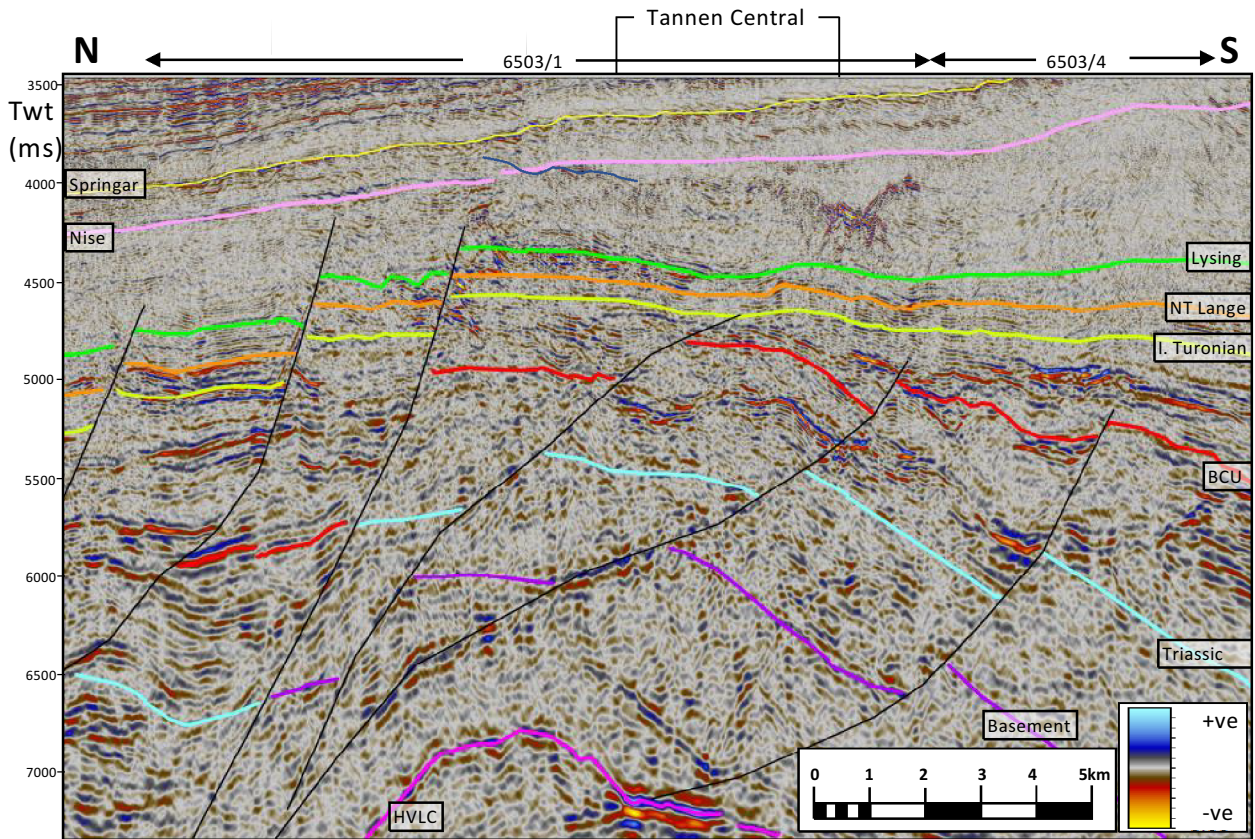


Fig. 4.4 N-S Seismic Line Illustrating the Tannen Central Jurassic Prospect.

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The age of the sub-BCU sediments is uncertain. An undifferentiated Middle Jurassic reservoir section akin to the Tilje, Tofte, Ile and Garn Fms is currently assumed. This carries a play risk as it is not clear how time equivalent sands of Jurassic age correlate across the Norwegian - East Greenland conjugate margin.

At a first glance, the estimated max burial depth of ~3300 m below seafloor looks encouraging for reservoir quality. However, wells drilled in the outer Vøring region have proven a much higher temperature gradient of >50° C/km compared with the Halten Terrace for example. Based on this the Tannen reservoir temperature is estimated at 165°-190° C which puts reservoir quality at risk. The two key geological studies carried out in the PL 1067 license (3 Review of Geological Framework) have demonstrated that there are specific geological scenarios of burial history, geothermal gradient through time and deposition of reservoir quality facies that could have occurred over the Rån Ridge that would allow for the preservation of commercially producible reservoir quality.

A preliminary basin modelling study carried out for the licensing round application has demonstrated that gas is the most likely hydrocarbon phase for the Tannen Prospects (70:30 phase risk in favour of gas vs. oil). Three source rock levels are considered, the Late Jurassic Spekk Fm, the Albian-Aptian and the Cenomanian-Turonian intra-Lange Fm intervals. The deeper buried source rocks are modelled to have passed through the oil window when the seal was in place on the Tannen Structure (90 Ma). A late large gas charge is modelled up until the early Miocene time. As such, access to charge and charge volume is seen as low risk for these prospects. The presence of oil in Tannen cannot be ruled out, as the modelled source rocks will have produced significant quantities of oil, due to the kerogen types expected to be present, prior to the main gas charge.

Risking of the Tannen Prospects has identified reservoir presence and quality as the key risk, including a 60% play risk and a 70% reservoir quality risk (total = 42%). Secondary risks include a charge & migration risk of 60% (due to none of the modelled source rocks having been penetrated by wells in the area) and a trap risk of 80% and a retention risk of 80%. Hence the COSg for each of the Tannen Prospects is 16%.

The recoverable resource range for Tannen Main (gas case) is 2 (P90) – 32 (Pmean) – 79 (P10) GSm³ gas (Table 4.1).

The Strickland Lead is identified at Lysing Fm level as a large low relief 3-way dip closure, located vertically above the Tannen Main Prospect (Fig. 4.5). The Gemini Well (6504/5-1 S) to the southeast is the nearest well to have reached the Late Cretaceous Lysing Fm interval. There the formation is shaled out with only very thin sand stringers developed. 3D seismic data is needed to evaluate if Lysing Fm sands could have entered the area from another direction and a thicker reservoir section could be present within the Strickland Lead.

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Table 4.1 Tannen Main Prospect Gas Case.

Block	6503/1 & 4	Prospect name	Tannen Main	Discovery/Prospect/Lead	Prospect	Prospect 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	Spirit	Reference document	APA 2019 - Application for Blocks 6503/1, 2 & 4 (Spirit)			Assessment year	2019
This is case no.:	1 of 2	Structural element	Rån Ridge	Type of trap	Structural	Water depth [m MSL] (>0)	1450	Seismic database (2D/3D)	2D
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)								
	Gas [10 ⁹ Sm ³] (>0.00)	4.44	2.14	61.40	149.30				
Recoverable resources	Oil [10 ⁶ Sm ³] (>0.00)								
	Gas [10 ⁹ Sm ³] (>0.00)	2.07	0.63	32.01	78.85				
Reservoir Chrono (from)	Pliensbachian	Reservoir litho (from)	Tilje Fm	Source Rock, chrono primary	Oxf-Ryazanian	Source Rock, litho primary	Spekk Fm	Seal, Chrono	E.Cretaceous
Reservoir Chrono (to)	Bathonian	Reservoir litho (to)	Garn Fm	Source Rock, chrono secondary	Apt-Albian	Source Rock, litho secondary	Lange Fm	Seal, Litho	Lange-Lysing Fms
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0.16	Oil case (0.00-1.00)	0.05	Gas case (0.00-1.00)	0.11	Oil & Gas case (0.00-1.00)	0.00		
Reservoir (P1) (0.00-1.00)	0.70	Trap (P2) (0.00-1.00)	0.80	Charge (P3) (0.00-1.00)	0.60	Retention (P4) (0.00-1.00)	0.80		
Parametres:		Low (P90)	Base	High (P10)	Probability Total has been calculated as follows: (Prospect Specific Risk * Play Risk), where Prospect Specific Risk = 0.27 and Play Risk = 0.6.				
		A hydrocarbon phase risk of 0.70 (gas) and 0.30 (oil) has been applied.							
Depth to top of prospect [m MSL] (> 0)	4690	4740	4790						
Area of closure [km ²] (> 0.0)	8.0	28.0	84.0						
Reservoir thickness [m] (> 0)	50	197	400						
HC column in prospect [m] (> 0)	130	292	460						
Gross rock vol. [10 ⁹ m ³] (> 0.000)	0.303	3.734	9.135						
Net / Gross [fraction] (0.00-1.00)	0.30	0.50	0.70						
Porosity [fraction] (0.00-1.00)	0.10	0.15	0.20						
Permeability [mD] (> 0.0)	3.0	30.0	300.0						
Water Saturation [fraction] (0.00-1.00)			0.30						
Bg [Rm3/Sm3] (< 1.0000)	0.0036	0.0033	0.0030						
1/Bo [Sm3/Rm3] (< 1.00)									
GOR, free gas [Sm ³ /Sm ³] (> 0)									
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)	0.30	0.50	0.75						
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)									
For NPD use:									
Temperature, top res [°C] (>0)	165			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)	600			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 < 0.5	2. Phi > 0.1	3.					Kart nr	NPD will insert value

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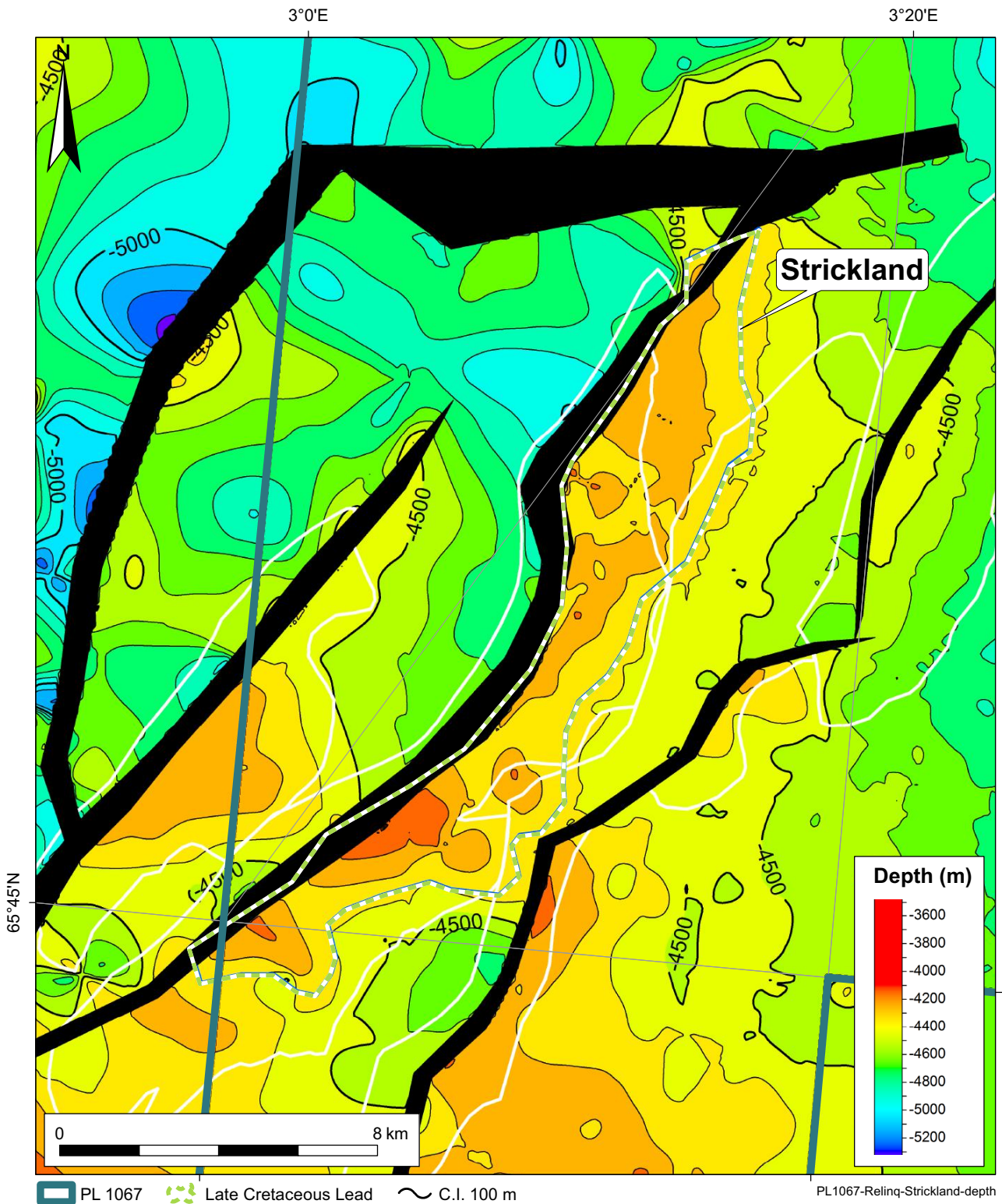


Fig. 4.5 Strickland Lead Top Lysing Fm Reservoir Depth Map. Underlying Jurassic prospects P10 outlines are shown in white.

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5 TECHNICAL EVALUATIONS

There is currently no infrastructure located in the Vøring Basin anywhere close to the Rån Ridge. A subsea template development connected to a SPAR platform with a gas export pipeline to either the Åsgard or Heidrun Fields (similar to the Aasta Hansteen and Polarled development solution) is the currently assumed development scenario. The Aasta Hansteen Field on the Nyk High is the most recent development analogue. The Tannen Prospects are 190 km northwest of the Åsgard Field and 200 km west of the Heidrun Field.

The drainage strategy expected for the Tannen Prospects gas case is production of the gas with voidage replacement supported by downflank natural water influx. The expected recovery is based on a 150 bar abandonment reservoir pressure required to flow the gas to the Åsgard or Heidrun Field.

The Tannen Prospects lie in a frontier area with a limited number of nearby wells and discoveries and with no producing fields in the area. No wells have penetrated the Jurassic play, and no wells have discovered commercially producible reservoir in the Lysing Fm play in the Vøring Basin. A number of uncertainties in estimating production profiles exist, including the ones summarised below:

- Uncertainty regarding the fluid phase. A gas case is most likely (70%), but oil may be present
- Depending on whether gas or oil is present, different Increased Recovery measures will be evaluated
- Reservoir rock properties including permeability, initial water saturation, lateral and vertical heterogeneity and connectivity of sandstones
- Reservoir fluid parameters (viscosity, fluid composition, gas-oil ratio and formation volume factor)
- Aquifer strength in supporting reservoir pressure as the gas is produced

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6 CONCLUSIONS

The license partnership has fulfilled the work commitments of G&G studies in phase 1 of the license work programme.

The conclusion of the two G&G studies, in combination with the regional tectonic mapping and analogue reservoir and source rock studies carried out on the Jurassic and Cretaceous by GEUS on Greenland suggests that viable commercially producible reservoirs could possibly exist at the depths of the Tannen Jurassic Prospects and the Strickland Lead.

This is plausible in a scenario where reservoir quality facies have been deposited over the Rån Ridge within the interpreted Jurassic and/or Cretaceous section and also if the base case burial history and geothermal gradient scenario for the Rån Ridge modelled in the temperature study is the reality.

However, the G&G studies have not changed the risk-reward picture for the license area, the Rån Ridge prospects still represent a high risk (Tannen Main COSg = 16%), high reward (Tannen Main mean recoverable gas = 32 GSm³) frontier area. When including play risk, the reservoir presence & quality risk remains the key risk at 42% with charge & migration the secondary risk at 60%. With a long expected timeframe towards potential first production that would also represent a high CO₂ footprint development the risk-reward ratio is seen as being too high within the PL 1067 prospects to allow the license partnership to make the significant investment in high quality 3D seismic data that is clearly needed in order to progress this license to a drill or drop decision.

The license partnership has unanimously decided to relinquish PL 1067 in its entirety.