PL844

Relinquishment Report

January 2018

INEOS

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1. License History

License PL844 is located on the Nordland Ridge in the Norwegian Sea and comprise parts of blocks 6609/5, 6609/6, 6609/8 and 6609/9 (Figure 1).

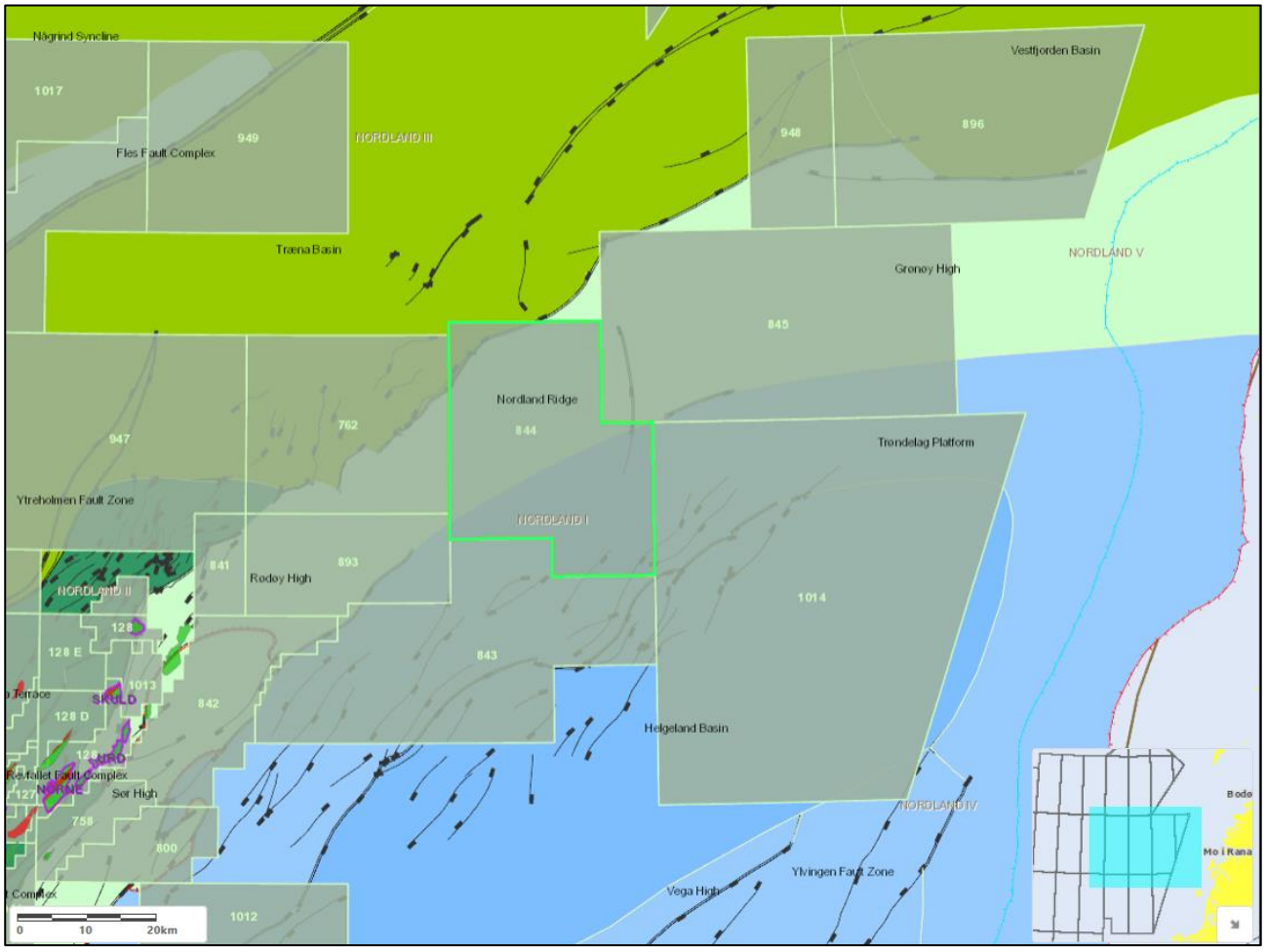


Figure 1. Location of license PL844.

PL844 was awarded 5th February 2016 as a result of the APA 2015 Round application. INEOS E&P Norge AS (then DONG E&P Norge AS) was assigned as Operator with 40% share. Aker BP ASA (then Det norske oljeselskap ASA), Capricorn Norge AS and Petoro AS are the other partners in the license with 20% share each.

Work commitments in PL844 were the following:

- Acquire new 2D seismic over the license
- Optional acquisition of existing 3D seismic or drop decision within 2 years from award
- Drill or drop (DoD) decision within 4 years from award
- Decision to concretize (BoK) or drop within 6 years from award
- Decision to continue (BoV) or drop within 8 years from award
- Decision to submit plan for development (PDO) or drop within 9 years from award

In the first two years of the initial phase the license carried out 2D broadband seismic acquisition and processing (DG16001), seismic interpretation, basin modelling, rock physics expectation modelling and conducted a semi-regional play evaluation. In addition, testing of Full Waveform Inversion (FWI) to derive high resolution velocity models was performed on one of the newly acquired 2D lines. The 2D seismic acquisition, processing and FWI testing was done as a joint venture project with neighbouring license PL845 with INEOS as “Group Shoot” operator. The play evaluation suggested that there could be a substantial potential, but high uncertainty and risk remained. New high quality 3D seismic was deemed necessary to reduce the uncertainty and mitigate the risks.

In Januray 2018 the PL844 license partnership took a unanimous decision to continue the license into the next phase and take on the work commitment to acquire existing 3D seismic data towards a Drill-or-Drop decision in February 2020.

The license partnership acquired (licensed) the multi-client 3D seismic broadband data, which were shot over the Nordland Ridge area by PGS in 2016 (PGS16005NWS), and subsequently decided to carry out 3D seismic data conditioning. These data, together with the newly acquired 2D semi-regional data (DG16001) from the previous license period, legacy 2D and 3D seismic, and well data (including FIS and SATLOG studies), provided the basis for an updated regional understanding. The new semi-regional seismic interpretations resulted in a series of updated maps, which constituted the input for an updated and more prospect focused basin modelling study. The new 3D data enabled detailed prospect mapping (including top/base reservoir, potential HC carrier intervals, and faults) and subsequently resulted in an updated evaluation of the license prospectivity. Three prospects were identified, two in the Triassic Red Beds and one in the Permian Carbonates (Figure 2).

However, based on the results from the G&G work performed on new 2D and 3D seismic data, and disappointing results of recently drilled nearby wells, it was concluded by the license partnership that the area has very low probability of finding commercial hydrocarbon (HC) accumulations trapped within the license area today. The critical issue that was identified is the timing of the main hydrocarbon generation and expulsion, which occurred in Early Cretaceous in the Træna Basin, and the late emplacement of top seal deposited during Late Cretaceous over the Nordland Ridge.

By January 2020 the license partnership have unanimously taken a decision to drop the license by the end of the current period.

The evaluation results were shared within the partnership through a series of meetings and workshops (Table 1). A series of joint meetings were held with PL845 regarding the 2D seismic acquisition and processing (Table 2).

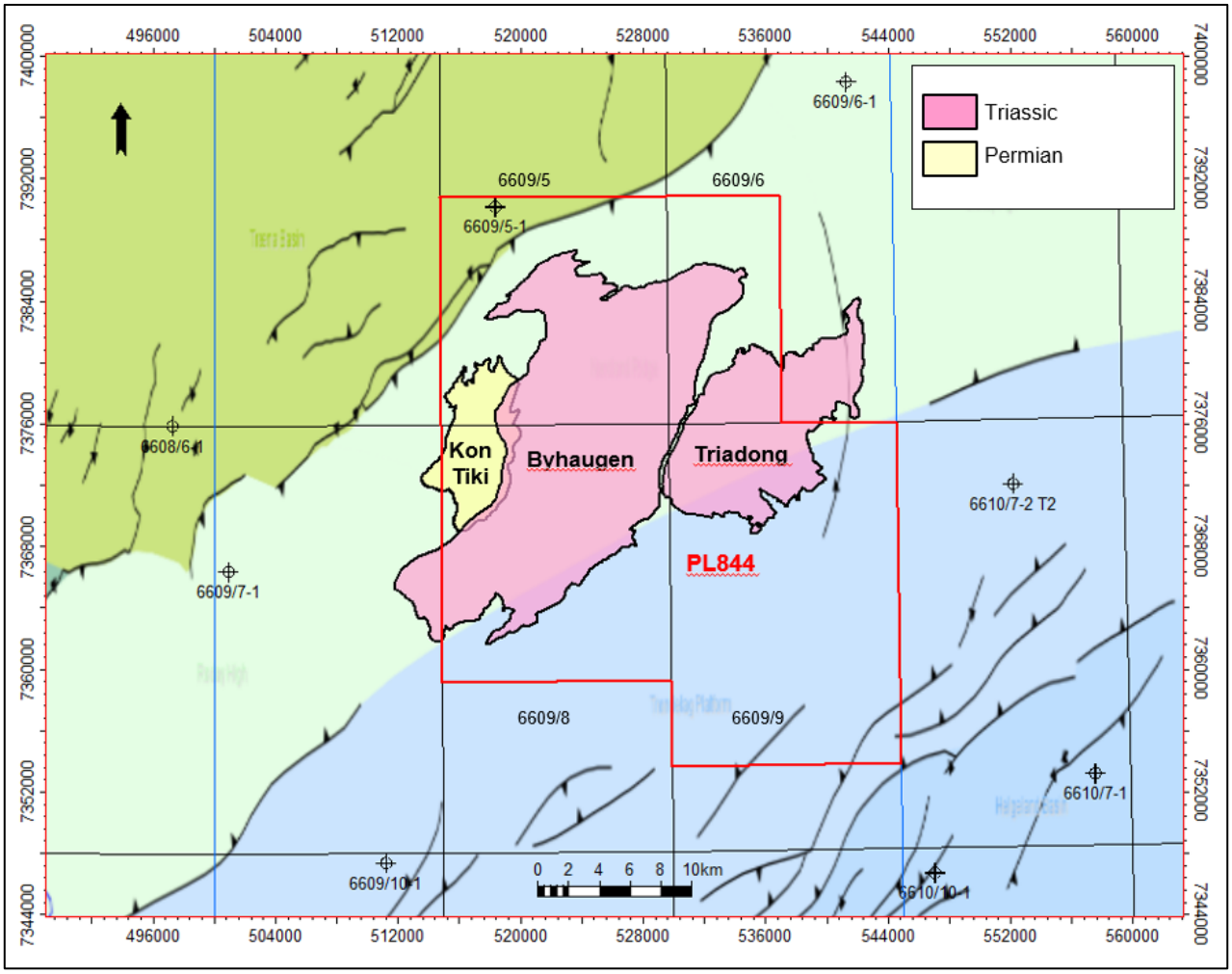


Figure 2. PL844 Prospects inventory.

Meeting	Date
MC/EC No. 1 – License Establishment	10 March 2016
EC Work Meeting – 2D seismic update	13 June 2016
MC/EC No. 2 – End Year Meeting	22 November 2016
MC/EC No. 3 – Mid Year Meeting	13 June 2017
EC Work Meeting – 2D seismic results	12 September 2017
MC/EC No. 4 – End Year Meeting	5 December 2017
MC/EC No. 5 – 3D seismic kick-off	3 March 2018
MC/EC No. 6 – Mid Year Meeting	13 June 2018
EC Work Meeting – PSPro Feasibility kick-off	16 August 2018
EC Work Meeting – PSPro Feasibility results	14 September 2018
EC Work Meeting – PSPro Full Study kick-off	8 November 2018
MC/EC No. 7 – End Year Meeting	27 November 2018
MC/EC No. 8 – Mid Year Meeting	3 September 2019
MC/EC No. 9 – End Year Meeting	26 November 2019

Table 1. License meetings 2016-2019.

Meeting	Date
2D Group Shoot Meeting No. 1	21 April 2016
2D Group Shoot Meeting No. 2	11 May 2016
Clarification meeting with WesternGeco	19 May 2016
2D Group Shoot Meeting No. 3	15 August 2016
Start-up Meeting with WesternGeco	16 August 2016
Wash-up Meetings with WesternGeco	26 & 27 October 2016
2D Group Shoot Meeting No. 4	31 October 2016
Processing Status Meeting with WesternGeco	15 December 2016
2D Group Shoot Meeting No. 5	31 March 2017
2D Group Shoot Meeting No. 6	31 May 2017

Table 2. PL844 and PL845 joint 2D seismic acquisition and processing meetings 2016-2017.

2. Database

The agreed Common Database (CDB) for the license consists of released wells from the Nordland Ridge and Frøya High areas (Table 3), released 2D seismic data (Table 4) and released 3D seismic data (Table 5).

As part of the license work program during the first two years, the license partnership acquired the DG16001 2D seismic survey (NPDID 8377) in co-operation with PL845. The survey consists of 15 2D lines totalling 1283 km. The license partnership subsequently acquired (licensed) 779 km2 of the PGS16005 3D multi-client survey (NPDID 8321) as part of the work program for the next two-year license period. INEOS had committed to a larger 3D area totalling 3555 km2, which were also used in the evaluation. An overview of the 3D seismic data coverage and 2D DG16001 seismic survey is shown in Figure 3.

The following special studies were included in the CDB:

- FIT – Norwegian Sea Phase 2 Outer Flanks – Fluid Inclusion Stratigraphy (FIS) study
- Searcher Geoservices – Norwegian Sea SATLOG Well Database (wells 6608/8-1, 6609/5-1, 6609/6-1 and 6609/7-1) – Mudlog chromatograph and headspace gas analysis

Well	Status	CDB purpose	Completion date	Operator	Formation TD	Content (NPD)
Frøya High area:						
6306/6-1	Released	Rogn analogue	1994.07.05	Statoil	Basement	Dry
6306/6-2	Released	Rogn analogue	2009.11.17	Statoil	Basement	Dry
6407/9-1	Released	Rogn analogue	1984.09.07	Norske Shell	Red Beds	Oil
6407/9-2	Released	Rogn analogue	1985.02.02	Norske Shell	Tilje Fm	Oil
6407/10-4	Released	Triassic analogue	2016.01.19	Lundin	Basement	Dry
6407/12-1	Released	Rogn analogue	1999.07.14	Norske Shell	Garn Fm	Oil
Nordland Ridge area:						
6608/8-1	Released	Strat/Struct/Fluid	1997.03.30	Statoil	Zechstein Gp	Oil shows
6608/8-2	Released	Strat/Struct	2007.11.29	StatoilHydro	Red Beds	Dry
6608/10-12	Released	Strat/Struct/Fluid	2008.12.21	StatoilHydro	Red Beds	Oil
6608/10-12 A	Released	Strat/Struct/Fluid	2009.01.25	StatoilHydro	Åre Fm	Oil
6608/10-14 S	Released	Strat/Struct/Fluid	2010.04.01	Statoil	Åre Fm	Oil/Gas
6608/11-2	Released	Strat/Struct	2000.11.24	Statoil	Grey Beds	Oil
6608/11-4	Released	Strat/Struct/Fluid	2004.05.23	Statoil	Red Beds	Oil
6608/11-5	Released	Strat/Struct	2006.07.14	Statoil	Red Beds	Shows
6608/11-7 S	Released	Strat/Struct	2011.10.24	Rocksource	Red Beds	Dry
6609/5-1	Released	Strat/Struct/FIT	1987.01.05	Statoil	Red Beds	Shows
6609/6-1	Released	Strat/Struct	2007.11.07	Norsk Hydro	Red Beds	Dry
6609/7-1	Released	Strat/Struct/FIT	1983.08.03	Phillips	Basement	Dry
6609/10-1	Released	Strat/Struct/FIT	1983.08.29	Saga	Red Beds	Dry
6609/10-2	Released	Strat/Struct	2009.10.03	Statoil	Grey Beds	Dry
6609/11-1	Released	Strat/Struct/FIT	1983.07.07	Norsk Hydro	Åre Fm	Dry
6610/2-1 S	Released	Strat/Struct/FIT	1996.09.28	Statoil	Red Beds	Shows
6610/3-1 R	Released	Strat/Struct/FIT	1993.12.11	Statoil	Red Beds	Shows
6610/7-1	Released	Strat/Struct/FIT	1983.06.19	Statoil	Red Beds	Shows
6610/7-2	Released	Strat/Struct/FIT	1984.03.28	Statoil	Grey Beds	Dry
6610/10-1	Released	Strat/Struct	2013.02.03	Statoil	Late Triassic	Dry
6710/10-1	Released	Strat/Struct/FIT	2000.10.26	Statoil	Springar Fm	Dry

Table 3. Wells included in the CDB.

Survey	Type	Year	Company	Status
EL-8204	2D Regional	1983	Elf Petroleum Norge AS	Released
GMNR-94	2D Regional	1994	Western Geco AS	Released
GNRM-92	2D Regional	1992	Western Geco AS	Released
GVLO-99	2D Regional	2000	Western Geco AS	Released
IKU-HE-91	2D Regional	1991	Den norske stats oljeselskap AS	Released
IS-HB-01	2D Regional	2001	Inseis AS	Released
MN88-2	2D Regional	1993	Mobil Exploration Norway Inc.	Released
MN9205	2D Regional	1992	Mobil Exploration Norway Inc.	Released
MNT-92	2D Regional	1992	Nopec AS	Released
N1P-94	2D Regional	1994	CGG Norge AS	Released
N2N3T96	2D Regional	1997	Nopec AS	Released
N3-94	2D Regional	1995	Nopec AS	Released
N3RE96	2D Regional	1997	Nopec AS	Released
N6ST-94	2D Regional	1994	Nopec AS	Released
NH8102	2D Regional	1982	Norsk Hydro Produksjon AS	Released
NH8301	2D Detail	1983	Norsk Hydro Produksjon AS	Released
NH9706	2D Regional	1996	Norsk Hydro Produksjon AS	Released
NPD-LOF2-86	2D Regional	1986	Oljedirektoratet	Released
NPD-LOFO-87	2D Regional	1987	Oljedirektoratet	Released
NPD-ML01-72	2D Regional	1972	Oljedirektoratet	Released
NPD-ML-75	2D Regional	1975	Oljedirektoratet	Released
NPD-ML-77	2D Regional	1977	Oljedirektoratet	Released
NPD-NR-83	2D Regional	1983	Oljedirektoratet	Released
NPD-TB01-87	2D Regional	1987	Oljedirektoratet	Released
NPD-TB01-87	2D Regional	1987	Oljedirektoratet	Released
NPD-TB-84	2D Regional	1984	Oljedirektoratet	Released
NPD-TB-85	2D Regional	1985	Oljedirektoratet	Released
NPD-TB-87	2D Regional	1987	Oljedirektoratet	Released
NPD-VØ-81	2D Regional	1981	Oljedirektoratet	Released
NPD-VØRB-86	2D Regional	1986	Oljedirektoratet	Released
NRGS84	2D Regional	1984	Den norske stats oljeselskap AS	Released
PW83	2D Detail	1984	Phillips Petroleum Comp. Norway	Released
SG8374	2D Detail	1984	Saga Petroleum ASA	Released
SG9101	2D Regional	1991	Saga Petroleum ASA	Released
SG9304	2D Detail	1993	Western Geco AS	Released
SH8808	2D Regional	1988	A/S Norske Shell	Released
ST8407	2D Detail	1984	Den norske stats oljeselskap AS	Released
ST8604	2D Regional	1987	Den norske stats oljeselskap AS	Released
ST8604	2D Regional	1991	Den norske stats oljeselskap AS	Released
ST8608	2D Regional	1986	Den norske stats oljeselskap AS	Released
ST8704	2D Regional	1995	Den norske stats oljeselskap AS	Released
ST8708	2D Regional	2001	Den norske stats oljeselskap AS	Released

Table 4. 2D seismic included in the CDB.

Survey	Type	Year	Company	Release dates
EO1003	3D	2010	E.ON	*18.03.2014
EO13002	3D	2013	E.ON	09.05.2016
GNNR99	3D	1999	WesternGeco	18.01.2011
MC3D-DTW2000	3D	2000	PGS NOPEC	21.06.2011
MC3D-NNE2000	3D	2000	PGS NOPEC	22.08.2011
NLGS-95	3D	1995	Statoil	26.06.2007
NLGS-95R02	3D	1995	Statoil	19.07.2010
ST0114	3D	2001	Statoil	24.04.2013
ST01M01	3D	2001	Statoil	12.09.2011
ST01M07	3D	2001	Statoil	28.02.2007
ST07M07	3D	2007	Statoil	*19.04.2013
ST9301	3D	1993	Statoil	29.07.1998
ST9301R00	3D	1993	Statoil	12.09.2011
ST9301R03	3D	1993	Statoil	15.08.2013
ST9404	3D	1994	Statoil	29.07.1998
ST9404R97	3D	1994	Statoil	09.01.2008
ST9604	3D	1996	Statoil	03.07.2000
ST9604R02	3D	1996	Statoil	29.10.2012
WIN12002WIM13	3D	2012	Wintershall	05.12.2016

*Table 5. 3D seismic included in the CDB. *) Surveys are partially released – only formerly licensed area is released.*

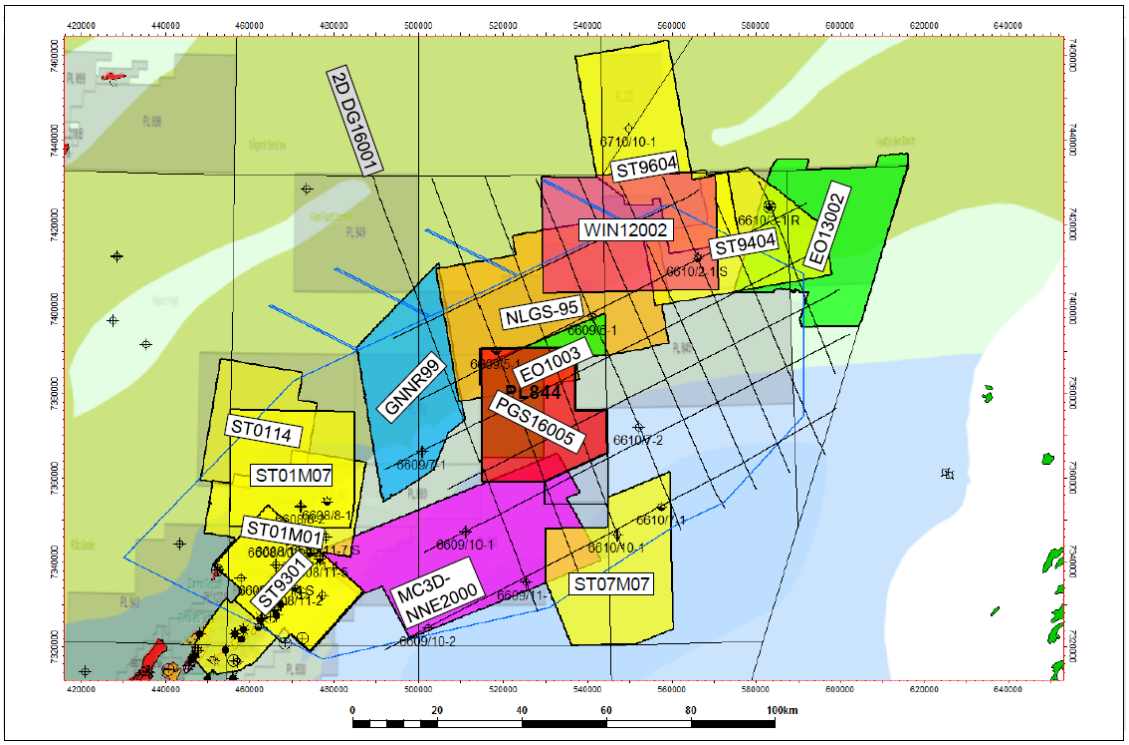


Figure 3. Released 3D seismic data included in the common database, coverage of the 2D seismic DG16001 survey (black lines) and coverage of the 3D seismic PGS16005 multi-client survey within PL844 (dark red polygon). The larger thin blue polygon (unfilled) shows the full coverage of the PGS16005 survey.

3. Results of the Geological and Geophysical studies

The Nordland Ridge is regarded as a frontier/underexplored area with relatively few wells, most of which were drilled in the 1980's. Seismic data covering the area before 2016 consisted of 2D and 3D surveys, generally of moderate to poor quality at the potential reservoir levels (sub-BCU).

The prospects in the license are Triassic Red/Grey Beds and Permian carbonates. They are structurally complex prospects and consists of rotated fault blocks with elements of truncation and fault trapping, as well as down-dip closure. Originally, the potential reservoir was envisaged to be Upper Jurassic shoreface sands analoguous to the Draugen field. The INEOS application submitted in the 2015 APA Round was based on this concept.

HC charge was believed to be provided by lateral migration from organic rich shales of the Spekk Fm. located in the deeper Træna Basin to the west and north. The Permian Ravnefjell Fm. situated below the Nordland Ridge was also considered as a potential HC source with vertical and lateral migration into the prospects. Seal is provided by intra-formational evaporites and shales, or overlying Cretaceous shales. A large scale 3D basin modelling study was carried out using PetroMod. The modelling results showed that potentially very large volumes have been expelled from the Træna Basin downdip from PL844. However, the main expulsion (about 90%) occurred during Early Cretaceous and the remaining expelled during Late Cretaceous – before emplacement of an effective top seal. Mapping of a carrier bed is very uncertain and for the study it was assumed that a continuous carrier bed from the Træna Basin is present, but with significant faulting between the kitchen and prospects. In addition, the reservoir temperature never exceeded 80 degC, hence biodegradation constitutes a high commercial risk for any potential HC accumulation.

The broadband 2D seismic survey (DG16001) was acquired to test the feasibility of improving imaging quality and to provide the basis for an updated play analysis. In particular, imaging of the source rock in the Træna Basin and flanks of the Nordland Ridge was an important objective. Some 2D lines showed promising results, and in 2018 the license group decided to continue the licenses into the next 2-year phase and purchase the broadband 3D seismic survey (PGS16005). Pre-stack data conditioning of the 3D survey was carried out, mainly to target remaining multiple energy and to improve reflection continuity and fault imaging for stratigraphic/structural interpretation. Multiples were effectively attenuated, but some remains are still present in the data. During evaluation and conditioning of the PGS16005 data, it was realized that the seismic indications of Upper Jurassic strata in the seismic data were in fact multiple energy.

Interpretation of the PGS16005 data also resulted in another key change compared to the prior interpretation. The position of the BCU has been shifted deeper off the Nordland Ridge into the Træna Basin. The seismic reflectors previously interpreted as BCU on vintage 2D and 3D data are

now considered to be a complex of intrusive sills. This new interpretation has a negative impact on source rock presence, maturity, timing and tortuosity of migration onto the Nordland Ridge.

Evaluation of the results from the FIS and mud gas analyses showed variable signs of HCs in wells on the Nordland Ridge, including presence of paleo-HC columns in a number of wells, but no convincing evidence of a recent working petroleum system. The negative observations from wells and the updated basin modelling are amplified by the results of wells drilled on the Nordland Ridge during 2019. Three turned out to be dry (6508/1-3 Lynghaug, 6608/11-9 Godalen and 6608/6-1 Vågar) and the fourth (6611/1-1 Toutatis), which is most likely sourced from the Vestfjorden Basin, appears to be an uneconomical discovery. Rock physics evaluation have been performed, but limited well control and large variation in elastic properties results in a wide range of possible amplitude response outcomes. No DHIs have been identified from the seismic data in the prospects.

The main risks for the area are generally trap, reservoir and charge.

The following studies have been performed on evaluation of the prospectivity in the license:

2016-2018

- 2D seismic acqusition and processing, including:
    - In-house seismic data conditioning
    - FWI feasibility testing
- Semi-regional seismic mapping using the new 2D survey in addition to vintage 2D and 3D surveys
- Fluid Inclusion Stratigraphy study evaluation
- Semi-regional basin modelling
- Rock physics expectation modelling
- Play Based Exploration (PBE) evaluation
- Preliminary prospect evaluation with scoping volumes

2018-2020

- 3D seismic acquisition (licensing), including:
    - Pre-stack seismic data conditioning
- Updated semi-regional mapping using new 3D seismic
- Mudlog chromatograph and headspace gas evaluation of four wells
- Basin modelling update
- Detailed horizon and fault interpretation
- Prospect evaluation, volume calculations and risking

4. Prospect Update

An oveview map of the prospects and leads initially identified is shown in Figure 4.

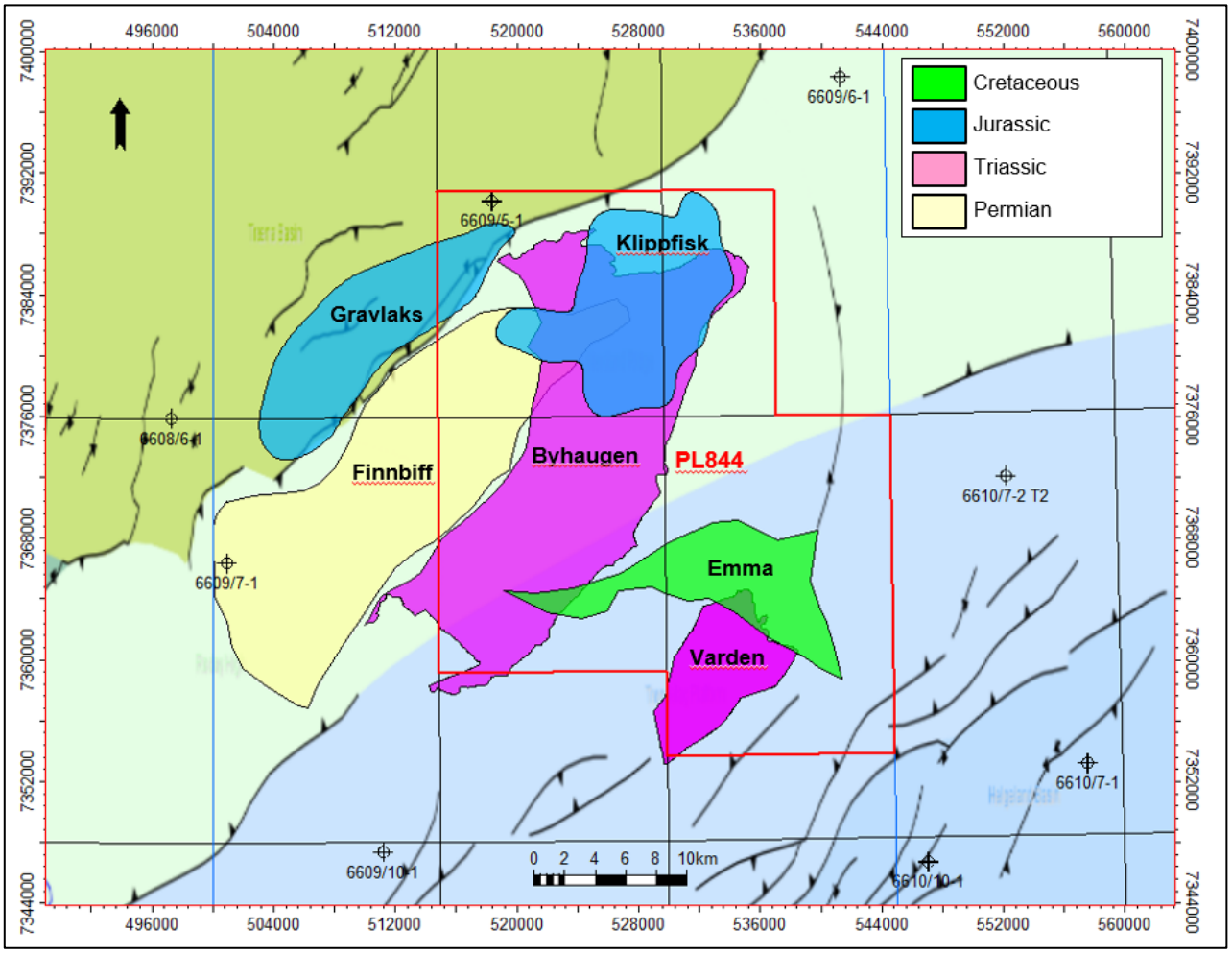


Figure 4. Prospects and leads initially identified by the license partnership.

The application submitted by INEOS in 2015 contained several prospects, envisaged to belong to the Upper Jurassic Rogn play (or equivalent). Two prospects, “Klippfisk” and “Gravlaks” lies within PL844. The Upper Jurassic Rogn play is known from further to the south along the Nordland Ridge. Here the reservoir is found developed between the Upper Jurassic Unconformity (UJU) and the Base Cretaceous Unconformity (BCU), of which the Draugen Field is the most important analogue. The assessment of the play on the Nordland Ridge was very conceptual due to lack of firm data control, but it was believed that local accommodation space after the erosion that created the UJU could have allowed for deposition and preservation of primarily shallow marine sands along the edges of the Nordland Ridge.The main risks for the prospects were regarded as charge and migration. As the play was unproven in this area, play risks existed for reservoir, retention and charge. An additional upside was seen in the Permian, where fractured and karstified reservoirs may be present and

charged by Permian shales analogous to the Ravnefjelled Fm. known from Greenland. The lead “Finnbiff” was identified within the Permian as a relatively large structural closure.

License partners Aker BP and Capricorn provided valuable contributions to the understanding of the license prospectivity by sharing their views and regional understanding. Aker BP had carried a concept similar to the Rogn play in their evaluation, but regarded the potential deposited sands as being of Cretaceous age. The lead “Emma” was located in the southern part of PL844. Capricorn had identified the Triassic Red Beds as potentially being prospective and had defined the prospect “Byhaugen” and the lead “Varden”.

Prior to acquisition and processing of the new 3D seismic survey Klippfisk was recognised as one of the key prospects. However, during processing and conditioning of the seismic data, it was realized that the seismic indications of potential Upper Jurassic (Klippfisk and Gravlaks) and/or Cretaceous reservoirs seen in the seismic data were in fact multiple energy. This left the remaining prospectivity to the Triassic and Permian structures, with some adjustments to the previously defined leads/prospects (Figure 2). Byhaugen was updated after re-mapping on the new 3D seismic data. The Varden lead was abandoned as it was regarded as too risky as long-distance and tortuous migration would be required. Instead, a new defined structure, “Triadong” was evaluated as this is positioned slightly closer to the Træna Basin. Finally, the Permian Finnbiff was re-defined as a smaller closure and subsequently renamed “Kon Tiki”.

4.1 Byhaugen

The Byhaugen prospect consists of rotated fault blocks with Lower Triassic Red Beds at approximately 1900 m below sea-level. The trap configuration consists of dip-closure to the north and south and fault-trapping to the west and east (Figure 5). Top seal is provided by a combination of Triassic intra-formational sealing evaporites/shales and Cretaceous shales where truncated by the BCU (Figure 6 and Figure 7). The prospect is cross-cut by a number of faults which could act as baffles to flow, especially given the likely low N:G nature of the reservoir.

Charge and migration are key issues for the Nordland area as no nearby live HC accumulation have been proven. As the Spekk Fm. is not present over the Nordland Ridge, Byhaugen relies on a mature Spekk source rock in the Træna Basin, and a connected carrier system to allow charge to take place. The required migration path is cross-cut by numerous faults and requires migration through carriers of various stratigraphic levels (Figure 8). The early timing of charge constitutes a large risk in relation to emplacement of the Creaceous shales, which are the ultimate top seal. For migration and charge to work for Byhaugen, a hotelling of HCs is required.

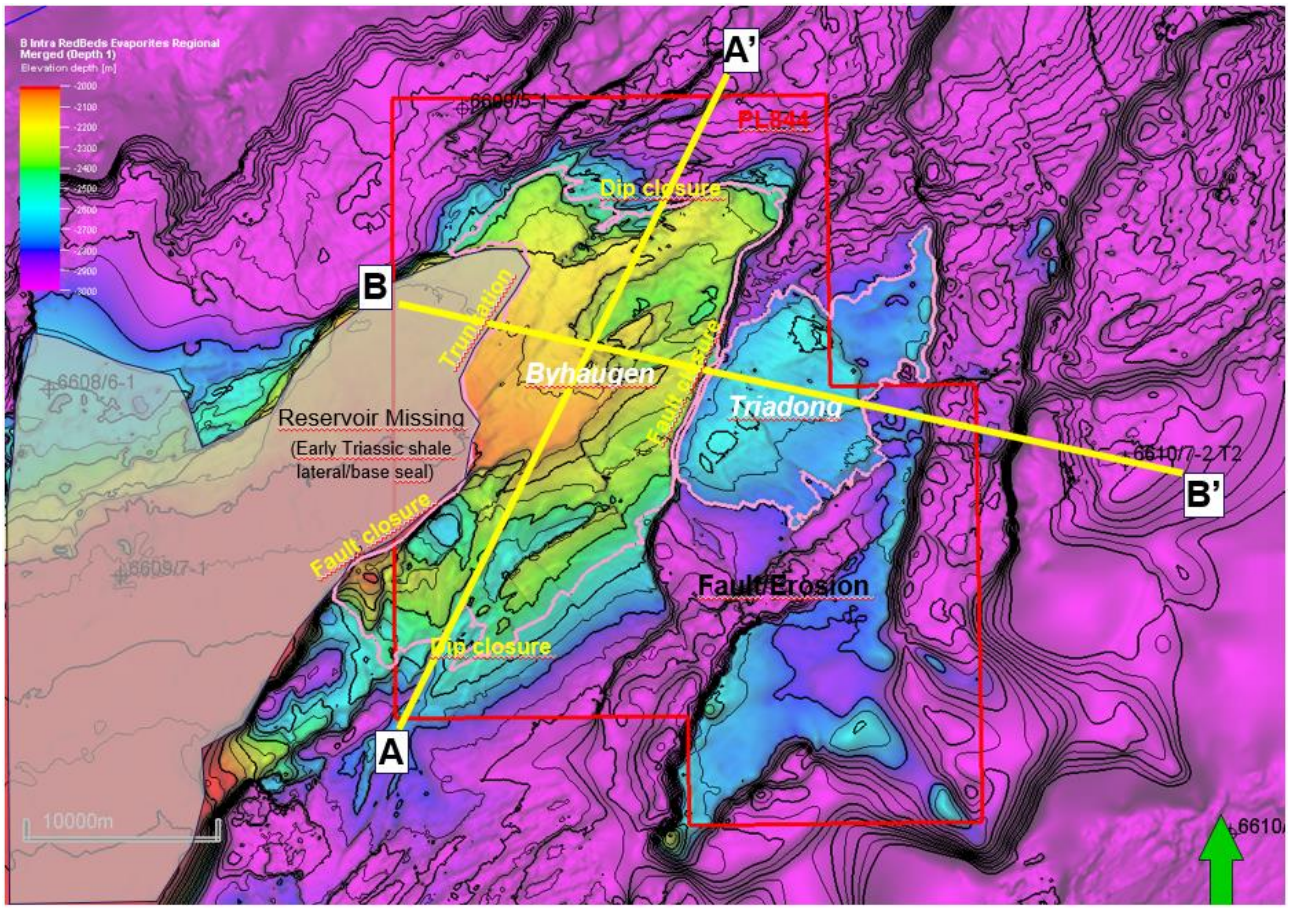


Figure 5. Top reservoir depth structure map showing Byhaugen trap configuration.

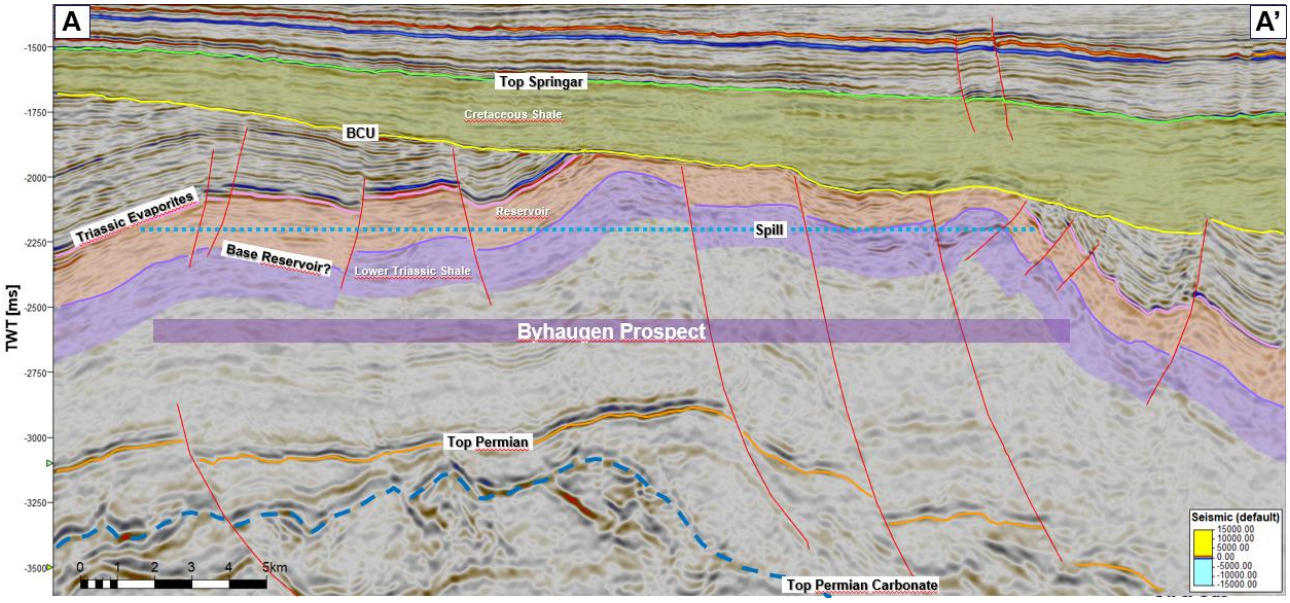


Figure 6. NE-SW seismic section showing Byhaugen prospect configuration.

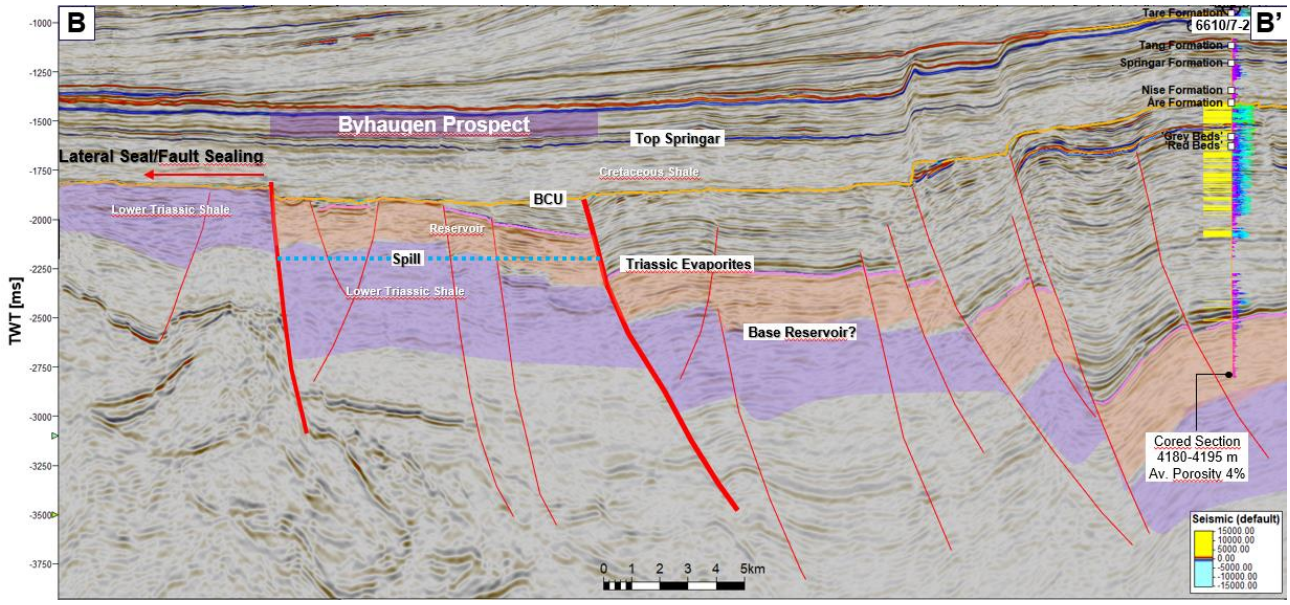


Figure 7. E-W seismic section showing Byhaugen prospect configuration.

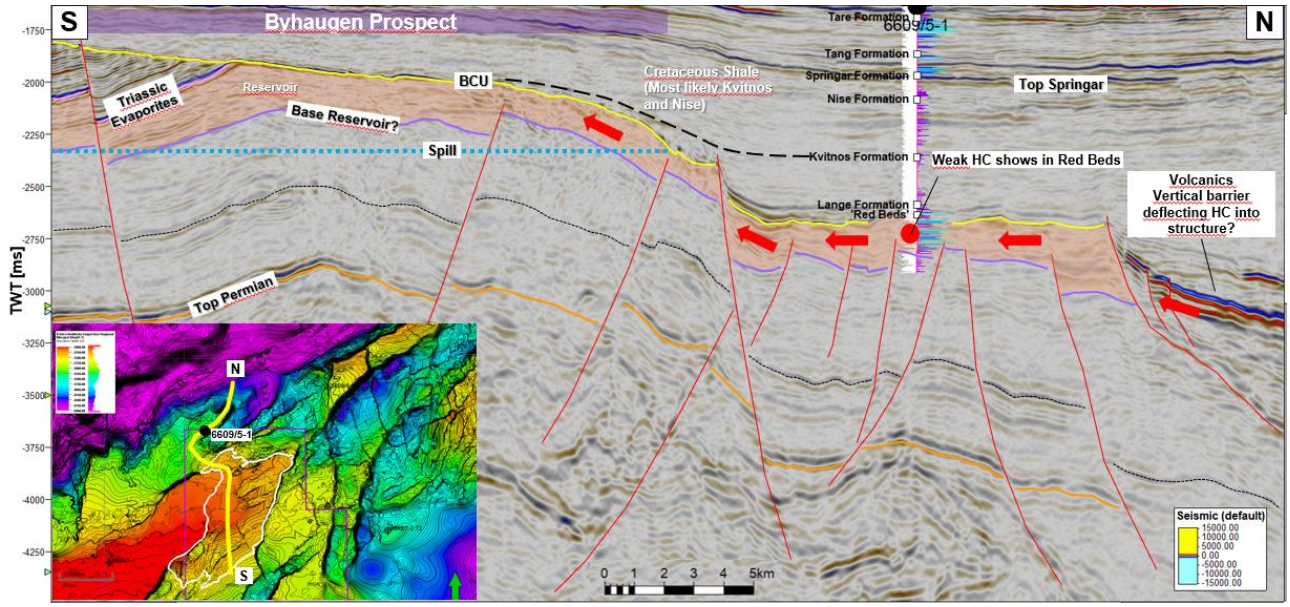


Figure 8. N-S seismic line showing a conceptual migration route into Byhaugen.

Reservoir quality analogues are sparse and have primarily been evaluated from offset wells 6608/8-1, 6609/5-1 and 6610/7-2. The nearest well 6609/5-1 penetrated a Lower Triassic section comprised of interbedded sands and shales. This section belongs stratigraphically to the lower part of the Red Beds below the intra-Triassic evaporite, which have been eroded in this fault block. N:G has been calculated at 27% and with average porosity of 15%. However, 6610/7-2 to the south-east of Byhaugen, exhibits just 4% porosity in a cored section of the target reservoir interval beneath the intra-Triassic evaporite. As a result, reservoir presence and quality in Byhaugen is considered an additional key risk.

The combination of high-risk elements on Byhaugen results in a very low Probability Of Finding Hydrocarbons (POFH) of only 13%. In addition, the HC volume potential of Byhaugen is limited due to low sealing capacity, limiting the HC-water contact and poor reservoir quality. The prospect data for Byhaugen is listed in Table 6.

4.2 Triadong

The Triadong prospect consists of low relief four-way closures below the intra-Triassic evaporite in fault blocks adjacent to Byhaugen, but in a down-faulted position. A larger closure can be mapped in addition to the four-way clusure, resulting in a complex trap configuration (see Figure 5). Like Byhaugen, Triadong contains Lower Triassic “Red Beds” as reservoir and trap is provided by intra-formational sealing evaporites/shales, fault seal (juxtaposed to Byhaugen) and Cretaceous shales where truncation by the BCU occurs (Figure 9 and Figure 10).

Like Byhaugen, Triadong carries high risk on reservoir presence and quality, in addition to migration and charge. The migration route into Triadong being even more tortuous than is the case for Byhaugen. However, the trap validity is sligtly less risky compared to Byhaugen.

The combined risk elements for Triadong results in a POFH of 21% and a volume potential that is less than half of Byhaugen. The prospect data for Triadong is listed in Table 7.

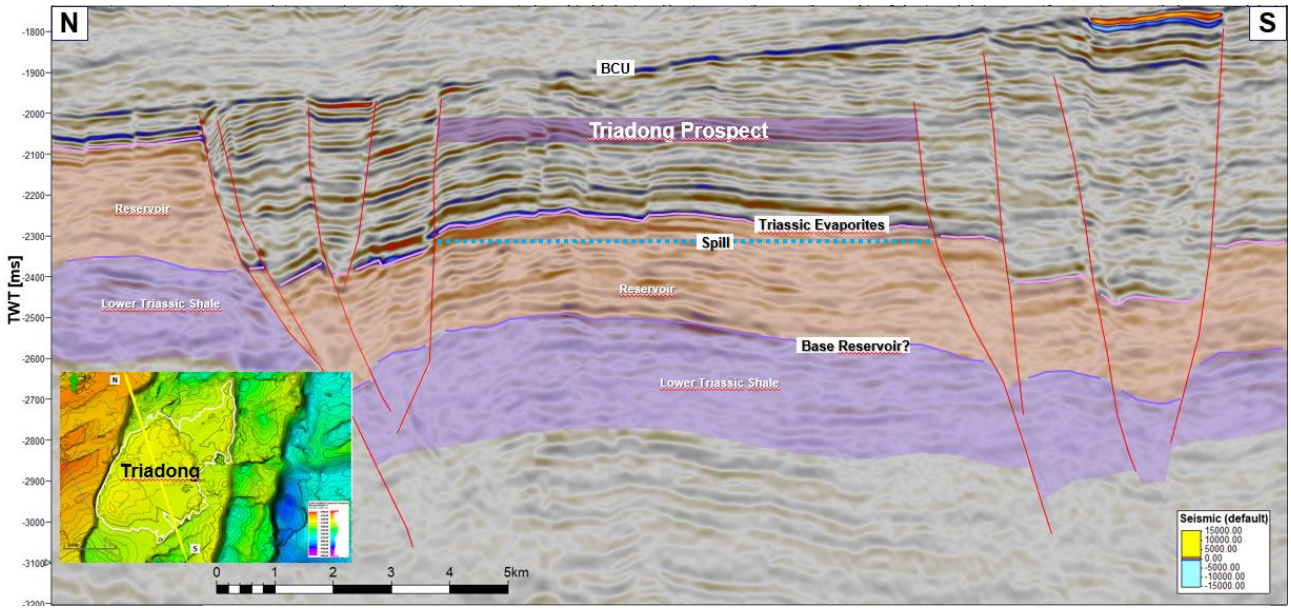


Figure 9. N-S seismic section showing Triadong prospect configuration.

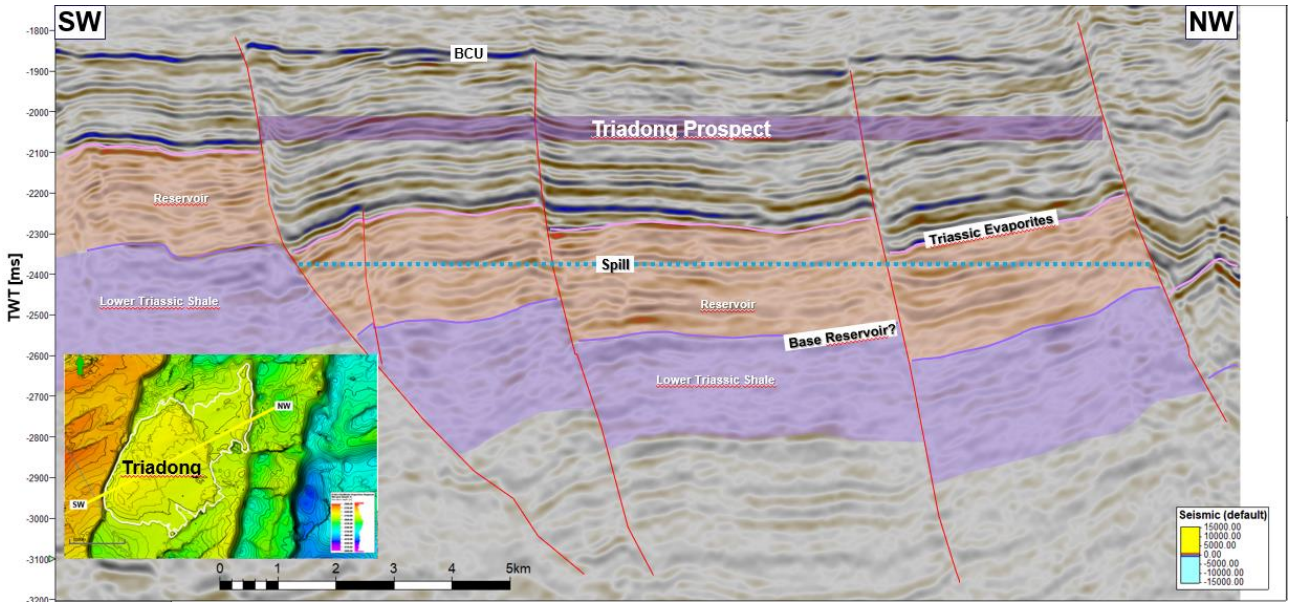


Figure 10. SW-NE seismic section showing Triadong prospect configuration.

Reservoir quality and migration/charge are the key uncertainties for Triadong

4.3 Kon Tiki

The Kon Tiki prospect is believed to be Permian carbonates at a depth of approximately 2500 m. The reservoir is envisaged to be dolomitized platform Carbonate build-ups with preserved intercrystalline porosity, as well as fracture and karst systems. The Carbonate structure is capped by Permian and Lower Triassic shales. Charge could be provided by lateral migration from a Ravnefjellet Fm. equivalent source.

The well 6608/6-1 “Vågar”, which targeted the Permain carbonate play, was drilled in 2019 in the neighbouring license PL762 to the west of PL844. The well encountered Permian carbonate rocks of the Zechstein Gp., which consisted of predominantly tight formations, but a thin interval in the upper part of the section encountered reservoir of intermediate quality. The absence of HCs proved that the structure (updip from Kon Tiki) had received no charge.

An additional risk is the challenging seismic imaging at the depth of the Permian, even with the new 3D seismic data, and alternative interpretations can be made of the Kon Tiki structure. It cannot be excluded that the apparent build-up structures within PL844 are in fact fault rider blocks containing crystalline basement instead of Permian carbonates.

The combined risk elements for Kon Tiki results in a POFH of 12% and a volume potential that is comparable to Triadong. The prospect data for Kon Tiki is listed in Table 8.

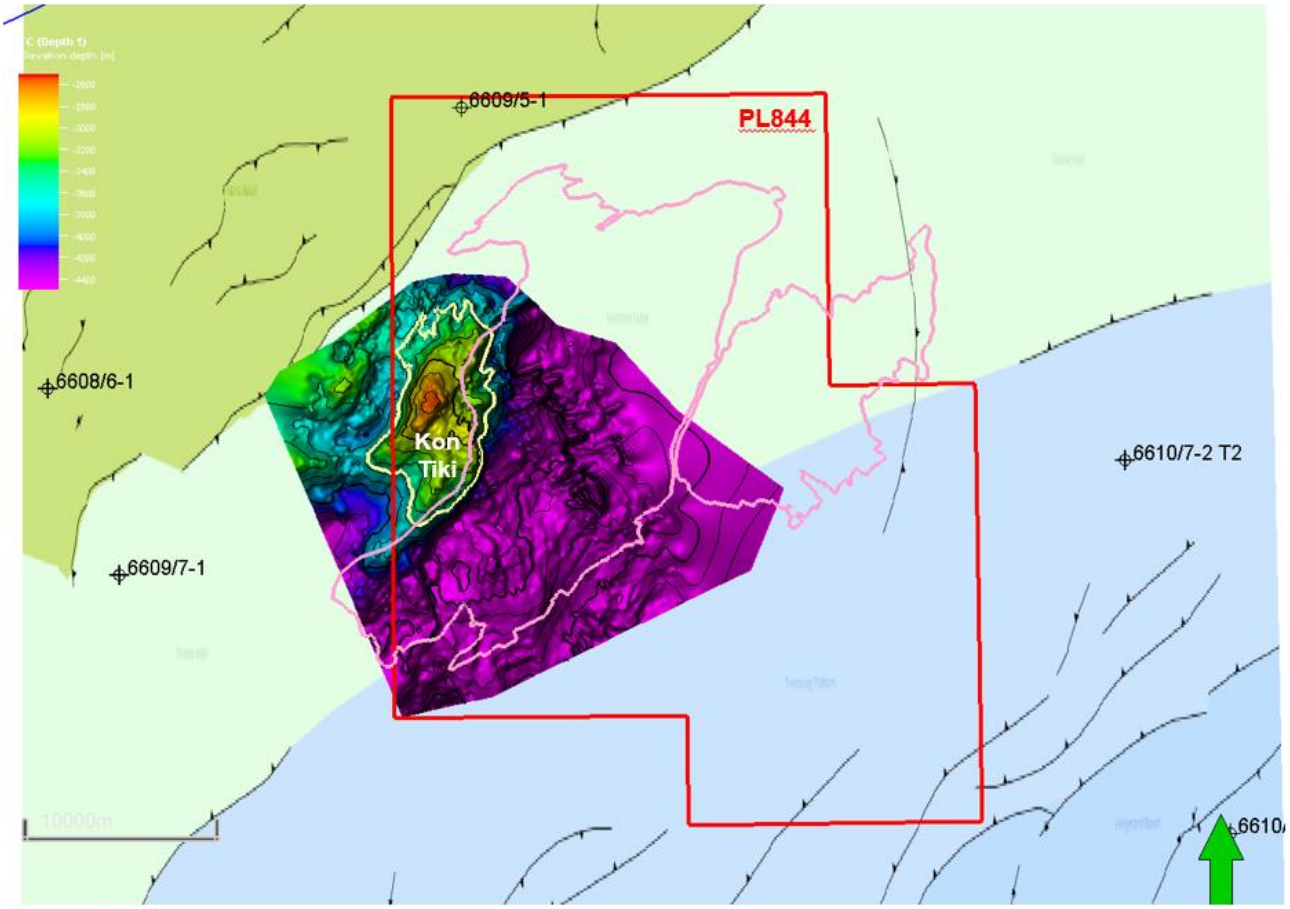


Figure 11. Top Permian depth structure map showing the Kon Tiki prospect.

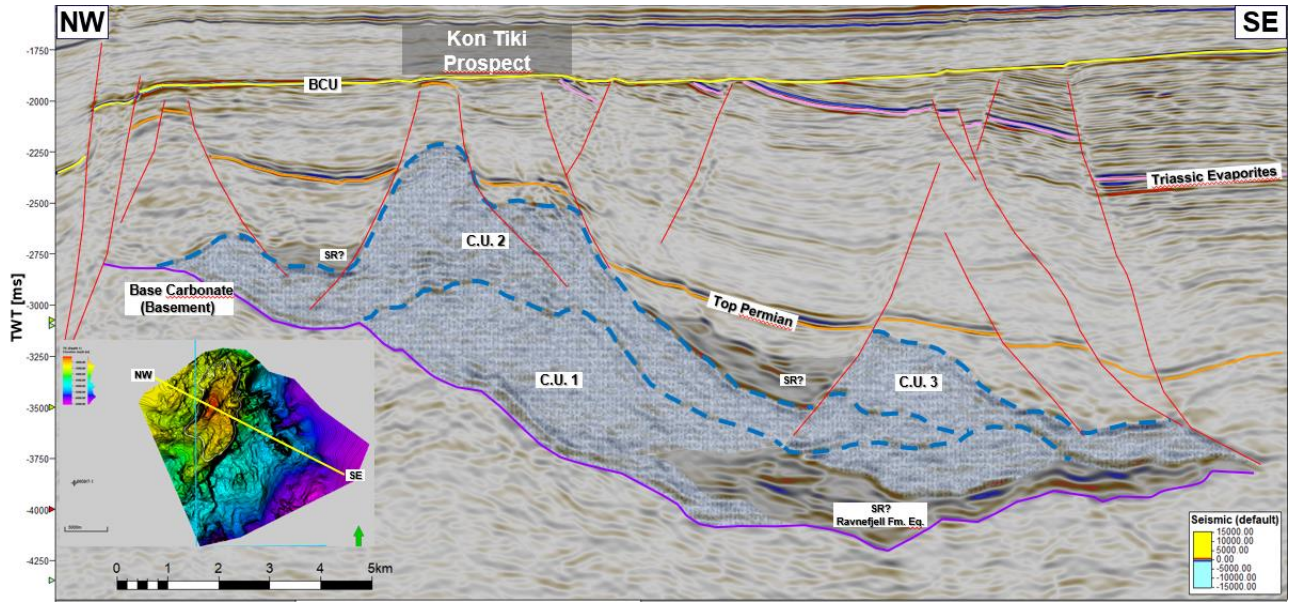
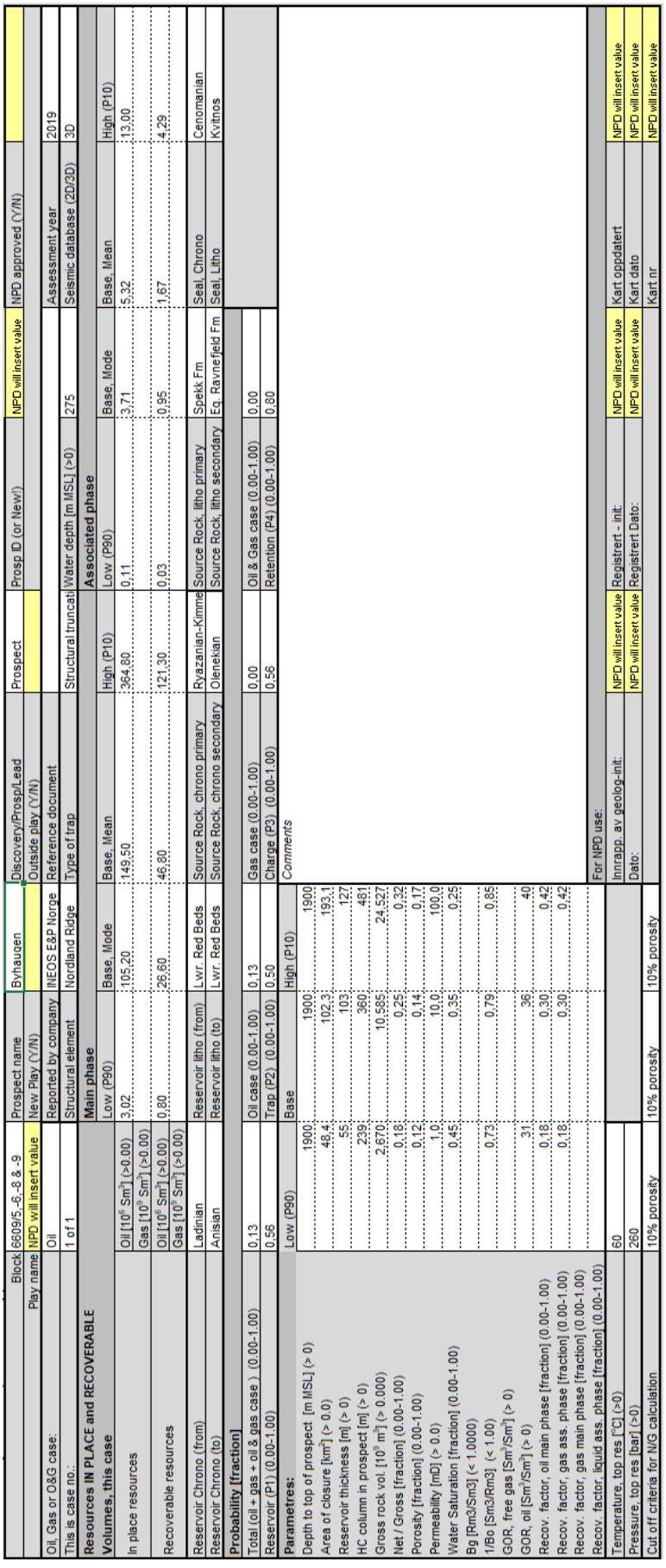


Figure 12. NW-SE seismic section showing the Kon Tiki prospect configuration.



Block	6609/5,-6,-8 & -9	Prospect name	Byhaugen	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	Reported by company	INEOS E&P Norge	Reference document				Assessment year	2019	
This is case no.:	1 of 1	Structural element	Nordland Ridge	Type of trap	Structural truncati	Water depth [m MSL] (>0)	275	Seismic database (2D/3D)	3D	
Resources IN PLACE and RECOVERABLE						**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)	3,02	105,20	149,50	364,80	0,11	3,71	5,32	13,00	
	Gas [10^9 Sm^3] (>0.00)									
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	0,80	26,60	46,80	121,30	0,03	0,95	1,67	4,29	
	Gas [10^9 Sm^3] (>0.00)									
Reservoir Chrono (from)	Ladinian	Reservoir litho (from)	Lwr. Red Beds	Source Rock, chrono primary	Ryazanian-Kimme	Source Rock, litho primary	Spekk Fm	Seal, Chrono	Cenomanian	
Reservoir Chrono (to)	Anisian	Reservoir litho (to)	Lwr. Red Beds	Source Rock, chrono secondary	Olenekian	Source Rock, litho secondary	Eq. Ravnefjeld Fm	Seal, Litho	Kvitnos	
Probability [fraction]										
Total (oil + gas + oil & gas case) (0.00-1.00)	0,13	Oil case (0.00-1.00)	0,13	Gas case (0.00-1.00)	0,00	Oil & Gas case (0.00-1.00)	0,00			
Reservoir (P1) (0.00-1.00)	0,56	Trap (P2) (0.00-1.00)	0,50	Charge (P3) (0.00-1.00)	0,56	Retention (P4) (0.00-1.00)	0,80			
Parametres:	Low (P90)	Base	High (P10)	*Comments*						
Depth to top of prospect [m MSL] (> 0)	1900	1900	1900							
Area of closure [km^2] (> 0.0)	48,4	102,3	193,1							
Reservoir thickness [m] (> 0)	55	103	127							
HC column in prospect [m] (> 0)	239	360	481							
Gross rock vol. [10^9 m^3] (> 0.000)	2,670	10,585	24,527							
Net / Gross [fraction] (0.00-1.00)	0,18	0,25	0,32							
Porosity [fraction] (0.00-1.00)	0,12	0,14	0,17							
Permeability [mD] (> 0.0)	1,0	10,0	100,0							
Water Saturation [fraction] (0.00-1.00)	0,45	0,35	0,25							
Bg [Rm3/Sm3] (< 1.0000)										
1/Bo [Sm3/Rm3] (< 1.00)	0,73	0,79	0,85							
GOR, free gas [Sm^3/Sm^3] (> 0)										
GOR, oil [Sm^3/Sm^3] (> 0)	31	36	40							
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,18	0,30	0,42							
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,18	0,30	0,42							
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)	60			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)	260			Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value	
Cut off criteria for N/G calculation	10% porosity	10% porosity	10% porosity					Kart nr	NPD will insert value	

Table 6. Prospect data for Byhaugen.

	Block	6609/5-6,-8 & -9	Prospect name	Triadong	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	Reported by company	INEOS E&P Norge	Reference document				Assessment year	2019	
This is case no.:		1 of 1	Structural element	Nordland Ridge	Type of trap	Structural truncati	Water depth [m MSL] (>0)	275	Seismic database (2D/3D)	3D	
Resources IN PLACE and RECOVERABLE							**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)	2.20	38.70	54.50	131.80	0.08	1.36	1.94	4.70	
		Gas [10^9 Sm^3] (>0.00)									
Recoverable resources		Oil [10^6 Sm^3] (>0.00)	0.61	10.30	17.20	43.80	0.02	0.37	0.70	1.55	
		Gas [10^9 Sm^3] (>0.00)									
Reservoir Chrono (from)		Ladinian	Reservoir litho (from)	Lwr. Red Beds	Source Rock, chrono primary	Ryazanian-Kimme	Source Rock, litho primary	Spekk Fm	Seal, Chrono	Cenomanian	
Reservoir Chrono (to)		Anisian	Reservoir litho (to)	Lwr. Red Beds	Source Rock, chrono secondary	Olenekian	Source Rock, litho secondary	Eq. Ravnefjeld Fm	Seal, Litho	Kvitnos	
Probability [fraction]											
Total (oil + gas + oil & gas case) (0.00-1.00)		0.21	Oil case (0.00-1.00)	0.21	Gas case (0.00-1.00)	0.00	Oil & Gas case (0.00-1.00)	0.00			
Reservoir (P1) (0.00-1.00)		0.49	Trap (P2) (0.00-1.00)	0.80	Charge (P3) (0.00-1.00)	0.54	Retention (P4) (0.00-1.00)	1.00			
Parametres:		Low (P90)	Base	High (P10)	*Comments*						
Depth to top of prospect [m MSL] (> 0)		2570	2570	2570							
Area of closure [km^2] (> 0.0)		8.4	45.7	87.6							
Reservoir thickness [m] (> 0)		15	49	80							
HC column in prospect [m] (> 0)		40	121	201							
Gross rock vol. [10^9 m^3] (> 0.000)		0.124	2.253	6.878							
Net / Gross [fraction] (0.00-1.00)		0.18	0.25	0.32							
Porosity [fraction] (0.00-1.00)		0.12	0.14	0.17							
Permeability [mD] (> 0.0)		1.0	10.0	100.0							
Water Saturation [fraction] (0.00-1.00)		0.45	0.35	0.25							
Bg [Rm3/Sm3] (< 1.0000)											
1/Bo [Sm3/Rm3] (< 1.00)		0.73	0.79	0.85							
GOR, free gas [Sm^3/Sm^3] (> 0)											
GOR, oil [Sm^3/Sm^3] (> 0)		31	36	40							
Recov. factor, oil main phase [fraction] (0.00-1.00)		0.18	0.30	0.42							
Recov. factor, gas ass. phase [fraction] (0.00-1.00)		0.18	0.30	0.42							
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)		60			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)		260			Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value	
Cut off criteria for N/G calculation		10% porosity	10% porosity	10% porosity					Kart nr	NPD will insert value	

Table 7. Prospect data for Triadong.

Block	6609/5_-6_-8 & -9	Prospect name	Kon Tiki	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	Reported by company	INEOS E&P Norge	Reference document				Assessment year	2019
This is case no.:	1 of 1	Structural element	Nordland Ridge	Type of trap	Structural	Water depth [m MSL] (>0)	275	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)	6,73	38,10	56,80	133,00	0,65	3,72	5,70	13,40
	Gas [10^9 Sm^3] (>0.00)								
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	1,95	11,10	17,10	40,30	0,19	1,07	1,71	4,02
	Gas [10^9 Sm^3] (>0.00)								
Reservoir Chrono (from)	Upr. Permian	Reservoir litho (from)	Carbonates	Source Rock, chrono primary	Olenekian	Source Rock, litho primary	Eq. Ravnefjeld Fm	Seal, Chrono	Olenekian
Reservoir Chrono (to)	Upr. Permian	Reservoir litho (to)	Carbonates	Source Rock, chrono secondary	Olenekian	Source Rock, litho secondary	Eq. Ravnefjeld Fm	Seal, Litho	Upr. Perm. shales
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,12	Oil case (0.00-1.00)	0,12	Gas case (0.00-1.00)	0,00	Oil & Gas case (0.00-1.00)	0,00		
Reservoir (P1) (0.00-1.00)	0,40	Trap (P2) (0.00-1.00)	0,60	Charge (P3) (0.00-1.00)	0,60	Retention (P4) (0.00-1.00)	0,80		
Parametres:	Low (P90)	Base	High (P10)	*Comments*					
Depth to top of prospect [m MSL] (> 0)	2540	2540	2540						
Area of closure [km^2] (> 0.0)	3,5	17,3	36,8						
Reservoir thickness [m] (> 0)	73	113	158						
HC column in prospect [m] (> 0)	2791	3129	3458						
Gross rock vol. [10^6 m^3] (> 0.000)	0,320	1,743	5,116						
Net / Gross [fraction] (0.00-1.00)	0,12	0,18	0,27						
Porosity [fraction] (0.00-1.00)	0,15	0,22	0,32						
Permeability [mD] (> 0.0)	10,0	300,0	1000,0						
Water Saturation [fraction] (0.00-1.00)	0,28	0,25	0,22						
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)	0,73	0,76	0,79						
GOR, free gas [Sm^3/Sm^3] (> 0)									
GOR, oil [Sm^3/Sm^3] (> 0)	74	100	126						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,22	0,30	0,38						
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,22	0,30	0,38						
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)	100			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)	310			Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
Cut off criteria for N/G calculation	10% porosity	10% porosity	10% porosity					Kart nr	NPD will insert value

Table 8. Prospect data for Kon Tiki.

5. Technical Evaluation and Development Plan

In the APA 2015 Application, a technical evaluation and development plan for the Upper Jurassic Rogn play was presented. This assumed development of individual prospects as subsea tie-backs to an FPSO. Produced oil would be fully stabilised at the FPSO and offshore offloaded to shuttle tankers. Produced gas could either be re-injected to the reservoir (low case) or exported via dedicated pipeline (100 km) to the Polarled gas pipeline (base and high cases). The prospects could be supported by gas lift systems, and water injection to support the larger volume outcomes (Figure 13).

This evaluation was updated in late 2017 prior to the 3D-or-Drop decision, and again in late 2019 to assess the economical threshold for a potential discovery to be commercially successful.

Based on the 2019 evaluation of a stand-alone FPSO development concept with oil exported by shuttle tanker and gas re-injection, a field size of more than 150 mmboe is currently required. A tie-in solution to an existing facility (if a neighbouring FPSO existed) requires a field size larger than 80 mmboe.

With the current evaluation, only Byhaugen could have the volume potential for a stand-alone development.

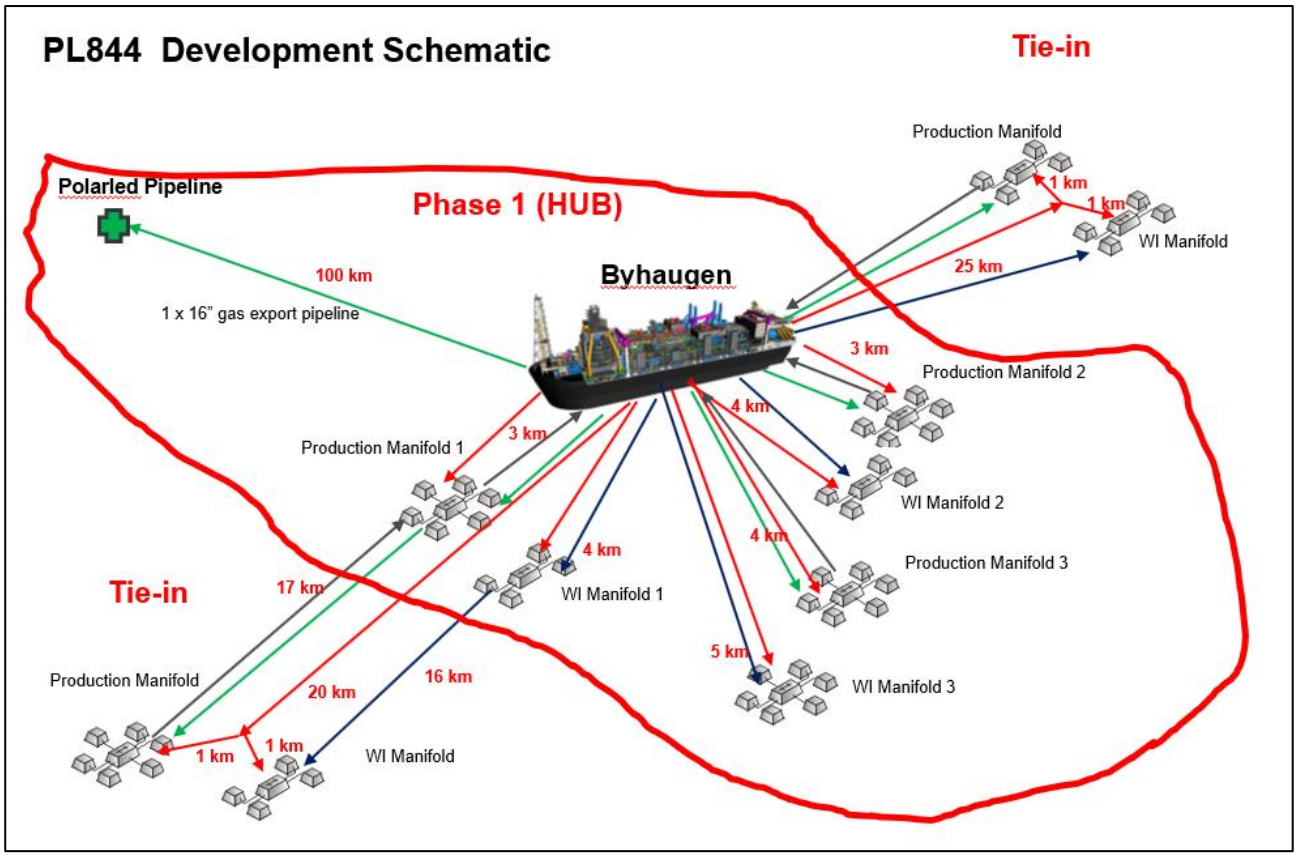


Figure 13. Conceptual development scenario for a Byhaugen size prospect and additional tie-ins.

6. Conclusions

As part of the license work program, the license partnership acquired 1283 km 2D seismic data in co-operation with PL845, and 779 km2 of 3D multi-client data. In addition, INEOS committed to 3555 km2 3D data to evaluate the area.

Acquisition and processing of new 2D and 3D seismic data (DG16001 and PGS16005) have been fundamental for play and prospect evaluation of the PL844 licence. The evaluation has led to a better understanding of the prospectivity of the Nordland Ridge, which includes elimination of the Upper Jurassic Rogn play, better definition of the Triassic prospects, and identification of the Permian carbonate play. The evaluation also revealed challenges with timing of HC charge in relation to top seal emplacement. All of these resulted in increased risk on reservoir, charge and trap, and a limited volume potential of prospects within PL844.

During 2019, four much anticipated wells were drilled in the Nordland Ridge area. Two of these – Lynghaug and Godalen – did not have a direct impact on the PL844 prospectivity, but tested the concept of migration from the adjacent basin onto the high – without success. The two other more proximal wells – Vågar and Toutatis – could have had larger impact had they been successful. Vågar failed to prove effective reservoir in the Permian. Vågar also failed to prove migration, even though it was located in a favourable position to receive charge from either the Spekk Fm. in the Træna Basin or from a Permian source. These failures confirms that there is an apparent timing issue with charge from the adjacent basins, and/or lack of efficient carrier system. Furthermore, the proposed Permian Ravnefjeld equivalent source rock is either not present, or of low quality. The Toutatis well turned out to be a minor discovery, but with uneconomical resources.

The failure of both Vågar and Toutatis effectively removes any expectation of a new potential tie-in host to materialize in the vicinity. Based on these disappointing results of the most recent nearby wells, it was concluded by the license partnership that the identified prospects have very low propability of turning out to be commercial discoveries.

By January 2020 the license partnership have unanimously taken a decision to drop the license by the end of the current period.

The Operator would like to thank the PL844 Partners for their constructive co-operation, and sharing of knowledge and experience from the area.