PL 966 – Licence status report

Summary

The prospectivity of PL966 is summarised based on seismic interpretation and extensive investigation of seismic attributes/AVO responses. Extensive geophysical studies have been the main part of the work programme, in addition to incorporation of well results in the neighbouring licences.

The focus has been on the Triassic play, chasing combined structural/stratigraphic traps with Upper Triassic Carnian fluvial sandstones as reservoir. Critical factor is trap definition and geophysical support for oil accumulations. The Middle Jurassic play is not considered prospective in this area due to shallow burial depth and hydrocarbon phase being gas with low volume potential.

The conclusions of the G&G studies are that it is difficult to de-risk oil accumulations as there is no geophysical support for oil phase, and the volume potential does not defend a well commitment as of today. The PL966 partners have therefore decided to let the licences expire at the first decision gate for the licence at 22.06.2021.

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1 Licence history

Licence: PL966

Awarded: 22.06.2018

License period: Initial period; 22.06.2018 – 22.06.2026

License group:

Equinor Energy AS	70% (Operator)
Aker BP ASA	30%

License area (initial): 3810,813 km^2

Work programme:

- Within 3 years; carry out G&G studies.
- Decision on reprocessing and/or acquire (purchase) 3D seismic or decide to drill an exploration well or drop (22.06.2021).
- If decision to reprocess/acquire new seismic is taken, the licence shal decide to drill an exploration well or drop within 5 years from licence award (22.06.2023).
- The exploration well is to be drilled within 5 years from licence award (22.06.2023) or 7 years if reprocessing/3D acquisition has taken place (22.06.2025).

Meetings held:

13.09.2018	MC startup meeting
07.12.2018	MC/EC work meeting
19.03.2019	EC work meeting, geophysical work status
03.12.2019	MC meeting, yearly status & way forward
11.06.2020	EC work meeting, geophysical work status
18.11.2020	MC meeting, yearly status & way forward
07.06.2021	MC meeting, relinquishment io the licence

Work performed: Seismic interpretation and modeling. Seismic data conditioning. Integration of machine learning concepts and seismic inversion in the workflow of fluid prediction of seismic data. Prospect evaluation of Jurassic and Triassic play levels. Field development studies targeting the commerciality of Triassic prospectivity.

Reason for surrender: The licence partners have decided to relinquish the licence after the work programme 1st decision gate (seismic or drop, 22.06.2021). The Middle Jurassic play is not considered prospective in this area due to shallow burial depth and hydrocarbon phase being gas with low volume potential. Results of extensive geophysical work conclude that it is difficult to de-risk Triassic oil accumulations as there is no geophysical support for oil phase, and the volume potential does not defend a well commitment as of today.

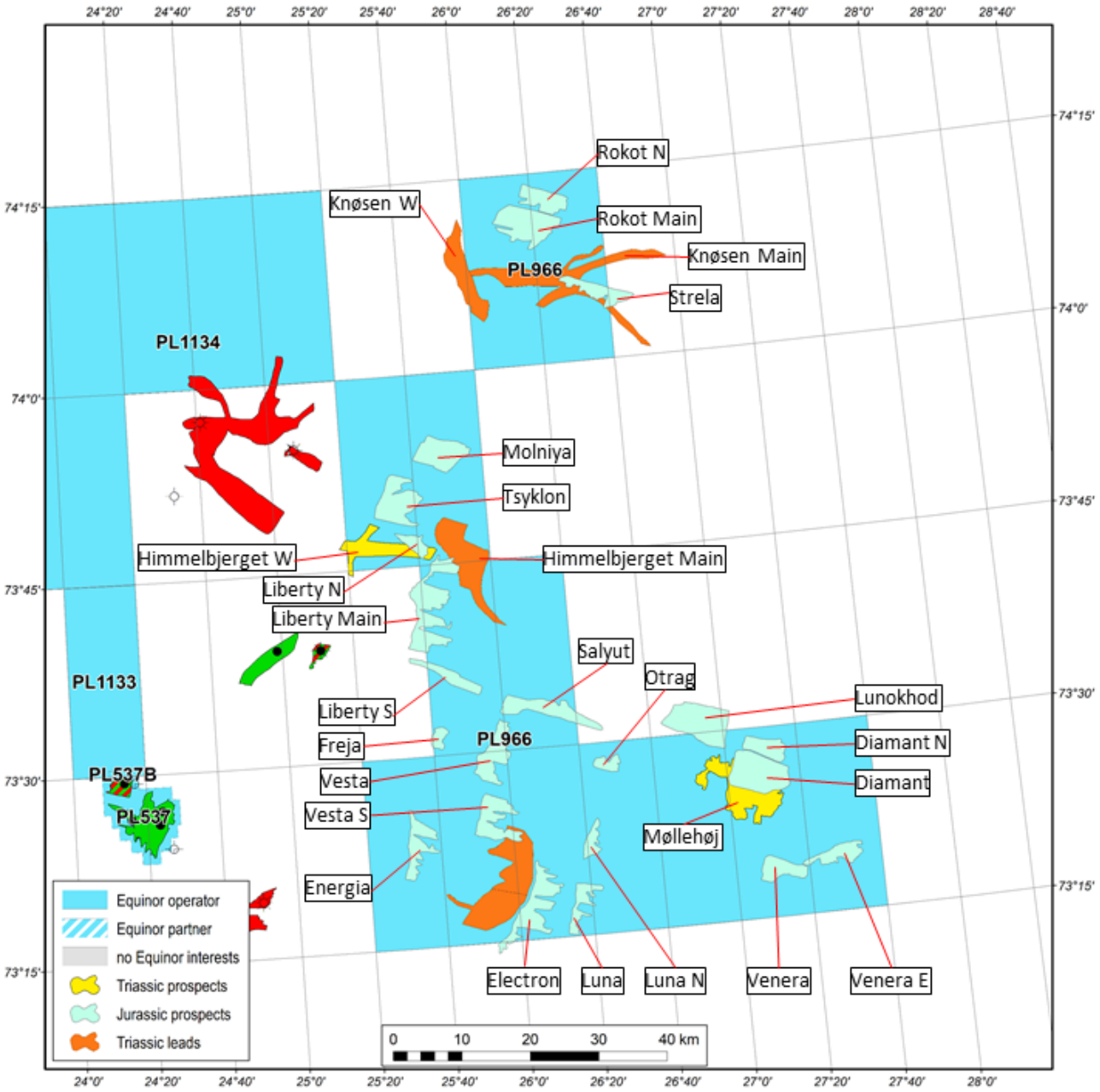

Figure 1. PL966 prospect map.

2 Database overview

2.1 Seismic data

PL966 is covered by 3D surveys HFCE14 (TGS14002 NPDID 7988, multiclient data), Hjalmar15 (TGS15003 NPDID 8220, multiclient data), parts of HFC09 (TGS0901 NPDID 7060, multiclient data), and HFCE11 (Hoop 11 NPDID 7424, multiclient data), acquired by TGS between 2009-2015. Equinor has been working in close collaboration with TGS to continuously improve the seismic data quality in the area. The underlying seismic data have been broadband reprocessed in close collaboration between Equinor and TGS in several stages between 2014 and 2016 using TGS's Clari-Fi (CFI) technology. The latest broadband processing results includes the multiple 3D surveys above and are consistently processed and merged into one super-merge cube (HOOP_3D). The HOOP_3D common seismic database in the licence (Figure 2) consists of full stack, angle stacks, and pre-stack gathers.

The full stack and angle stacks have been balanced inhouse in time, phase and amplitude to ensure consistency and ease interpretation across different seismic surveys in the Barents Sea. The reference survey used for this balancing task was the zero-phased NBR08 2D survey.

2.2 CSEM data

CSEM data is not a part of the PL966 common database.

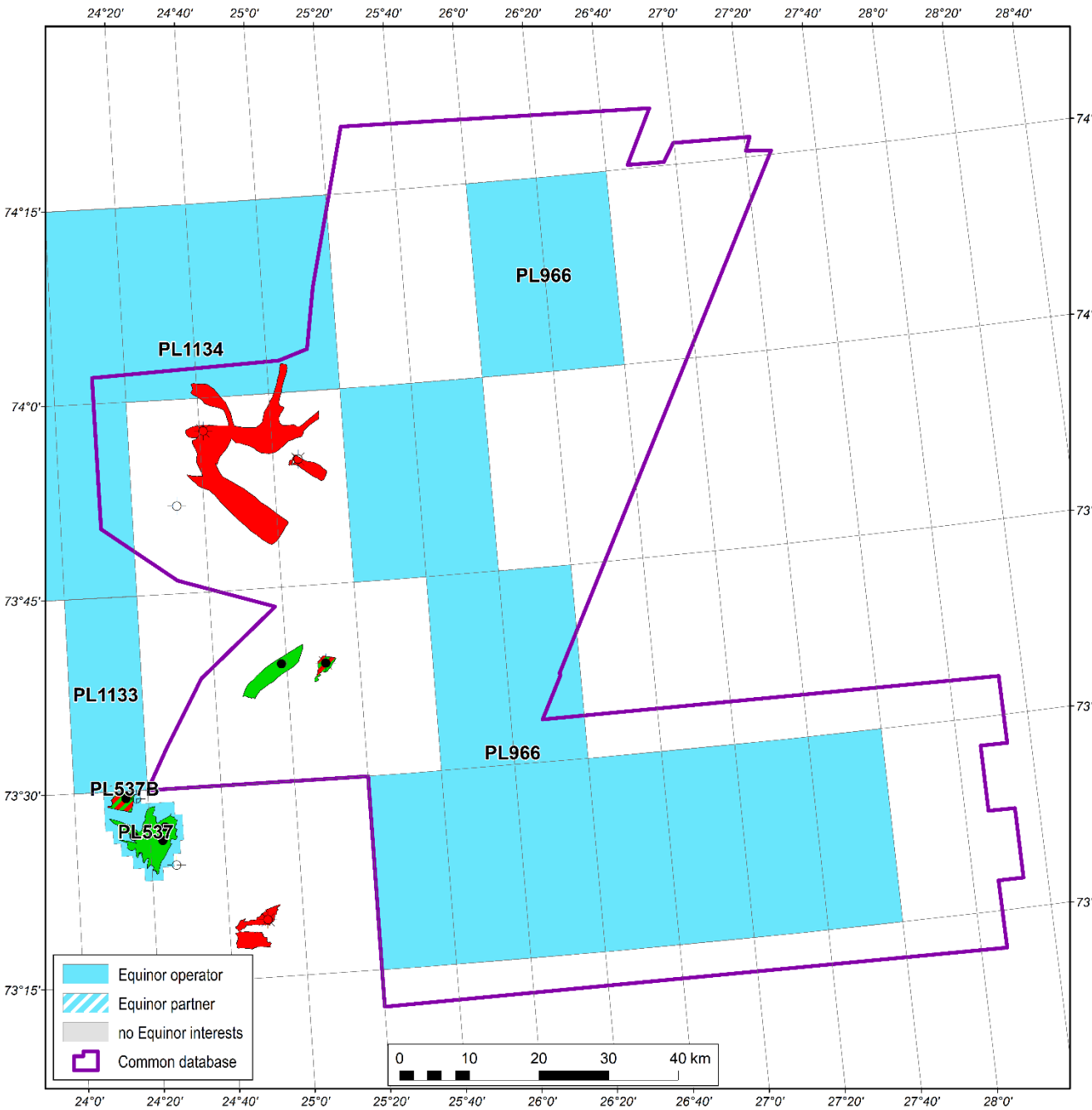

Figure 2: Common 3D seismic database PL966. Survey HOOP_3D is outlined in purple.

2.3 Well data

All wells shown in Figure 1 and Figure 2 are released, and PL966 has therefore access to all public data from these. Wells 7325/4-1 (Gemini Nord, NPDID 8211) and 7324/6-1 (Sputnik¸ NPDID 8741) were drilled in the

neighbouring PL855 (now relinquished) in 2017 and 2019, respectively (Statoil 2018 and Equinor ASA 2019). These are such the most relevant wells for the evaluation of PL966. A brief summary is given below.

The Gemini Nord well targeted a smaller segment within a large rotated fault block. The Realgrunnen Subgroup reservoir was the main target. The well TD'ed in the Snadd Formation. The well encountered gas in the Stø Formation, and oil in a thin sandstone in the Triassic Snadd Fm. Good oil shows were present in the Fruholmen Fm. The well is classified as a non-commercial gas and oil discovery and was permanently plugged and abandoned.

Well 7324/6-1 was drilled on the Sputnik prospect. The purpose of the well was to test the hydrocarbon potential in the Late Carnian interval (Carn03) in the Snadd formation of Middle to Late Triassic.age. The prospect was a direct follow-up of the small oil volume encountered in 7325/4-1 at similar stratigraphic depth. A secondary objective of the well was to clarify whether there was an oil leg present below the depth of the gas-water contact encountered in Well 7325/4-1 (Stø Fm), as well as testing two secondary targets in the Early to Middle Carnian interval of the Snadd Fm (Carn02 & Carn01). The well TD'ed at 1600 meters (MD), 50 m below the base of sand in the deepest secondary target (Carn01).

The Stø Formation was found to be water bearing with a reservoir thickness of 18,5 meter. The reservoir quality is good. 58 meters of gross reservoir was found water bearing in the Carn03 (main target). Reservoir quality is however seen to be poor. In Carn02, a 16 m thick oil column was proven in the well position. The reservoir is 25,5 m thick, with poor to moderate quality.

3 Results of geological and geophysical studies

7325/4-1 and 7324/6-1 have provided important data increasing the understanding of the prospectivity of the area, briefly summarised in subsections below.

Source and Migration

The early to Middle Triassic Steinkobbe Formation source rocks are the main source for hydrocarbons in the Hoop area. The source rock has a mixed marine and terrestrial kerogen composition and is of good to excellent quality. At present it is oil to gas mature in the area.

Reservoir Quality

The Middle Jurassic Stø Formation constitutes the main reservoir within the Realgrunnen Subgroup and was the main target in the Gemini Nord Well, and a secondary target in the Sputnik Well. The Stø Fm was cored in both wells, and excellent reservoir properties were present.

The Late to Middle Triassic succession has reservoir potential at several intervals within the PL966. However, the reservoir quality is challenging. All the main reservoir intervals (Carn03 – Carn01) penetrated by 7324/6-1 have reasonable porosity, but the permeability is moderate to poor. The poor to moderate reservoir quality, together with the low hydrocarbon saturation is the main risk for the Triassic play in the PL966.

Trap and Seal

Traps at the Jurassic Play level are faulted horst blocks in a platform setting sealed vertically by the Fuglen and Hekkingen formations mud rocks. Laterally some horsts may be sealed by younger lower Cretaceous mud

rocks. In addition to the live gas (Gemini Nord, Stø Fm) and oil columns (Gemini Nord and Sputnik; Snadd Fm), good oil shows have been found in the Gemini Nord (Fruholmen and Snadd Fms) and Sputnik wells. This proves migration of oil to this reservoir level. The Realgrunnen Subgroup has been shown to be normally pressured in all wells.
The traps of Ladinian to Carnian channel sandstones are structural with a stratigraphic contribution as tested in both the Sputnik Well (7324/6-1) and the Intrepid-Eagle Well (7324/3-1). Top seal is commonly marine influenced transgressive mudrocks whereas lateral seal is attributed to muddy floodplain facies. The Sputnik Well encountered slightly under pressured reservoirs at this level such that a strong vertical pressure barrier is considered proven.

Geophysical studies
Seismic data have been analysed regarding attributes, amplitudes and AVO responses, both absolute and relative. In addition, extensive geophysical special studies have been the main part of the work programme for the licence (see subsections below). Hydrocarbons are proven to be visible on seismic in both for the Jurassic reservoirs and partly for the Triassic reservoirs.

The geophysical work program was designed to mitigate the two main challenges in the licence: trap definition and the complex geophysical support for any significant oil accumulations within the Snadd Formation reservoir sandstones. The large number of possible stratigraphic and fault-bounded traps with highly variable thickness and net-to-gross, are challenging to assess in detail using conventional mapping techniques. The approach tested out in PL966 included automated machine generated learning, automated de-tuning of the seismic channel response, seismic inversion and classification. The proposed workflow was supported by on-going research projects within Equinor.

The main take-aways from the geophysical work programme are briefly summarised in subsections below.

Petrel Pcube+ plug-in: Both Aker BP and Equinor decided to develop this plugin and it was decided that PL966 should take lead on this software implementation. Proposed cost-split for this was 50-50 between AkerBP and Equinor, since this was a software development. The plug-in was successfully developed, and allows now for a better parameterization in the de-tuning of the seismic amplitude response.

PCube+/ PCube classic pre-stack seismic inversion: Both type of these inversion algorithms have been run in PL966, targeting the Triassic play. Inversion results at the Intrepid Eagle and Sputnik wells indicate that the inversion is sensitive to reservoir quality. It is however difficult to distinguish between fluid effect and reservoir quality effect / thickness effect due to the nature of the reservoir distribution, with reservoir in narrow channels, and the low dip of the area / structures.

Seismic data conditioning: The first inversion results revealed that the seismic data still suffers from remaining multiples in the target zone. The data needed better conditioning before they could be run through the inversion process. This was achieved by applying a harsh radon on the gathers. An area of approximately 11 000 km^2 was run through an internal reprocessing project.

Machine learning (other): In addition, several other geophysical tools have been tested out; seismic attribute ranking (Cegal) and Neural Network Classification (Petrel).

Self-Organizing Maps (SOM): was used as a mean to combine multiple seismic attributes into a classification volume, which could be further interpreted in terms of geological facies and potentially of fluid anomalies. Encouraging results provided better maps of sand distribution in these fluvial systems than single seismic attributes but did unfortunately not help with hydrocarbon accumulations identification.

All in all, results: Machine learning gives an additional input into the evaluation of PL966. Fairly good results with predicting lithology and porosity were achieved (with good match at the well locations). Prediction of fluids and fluid phase is challenging. The results from various predictions should be taken as a quality, not quantity evaluation. Confidence of estimations decreases with the distance from the well data (training dataset/validation dataset).

4 Prospect update report

Prospectivity status at the time of licence award:

The Carnian Møllehøi prospect (Triassic play) was the licence primary prospect when the licence was awarded. Six additional leads were defined in the same play, with significant volume potential (Figure 3, Table 1). The Møllehøj prospect located 80 km east of the Wisting and Hanssen oil discoveries represented a possible stand-alone development. The prospect is mapped as a stratigraphic/down-faulted trap on the Top Early Carnian channels horizon. The Snadd Formation channels in the area of the primary prospect show a strong seismic amplitude response, indicating thick and laterally extensive reservoir development.

Within PL966, a large number of Realgrunnen Subgroup closures were been identified at the time of licence award. 22 of these low-relief three-way dip closures identified represented secondary prospects (Figure 4, table 1). The structures are associated with depth-conformant seismic amplitude anomalies. However, the volume potential within each mapped closure is small, and detailed analysis of the seismic amplitudes calibrated to nearby discoveries, indicates that the most likely filling is gas. At these shallow depths, gas is not economic. The Jurassic potential has therefore never been a driver for PL966.

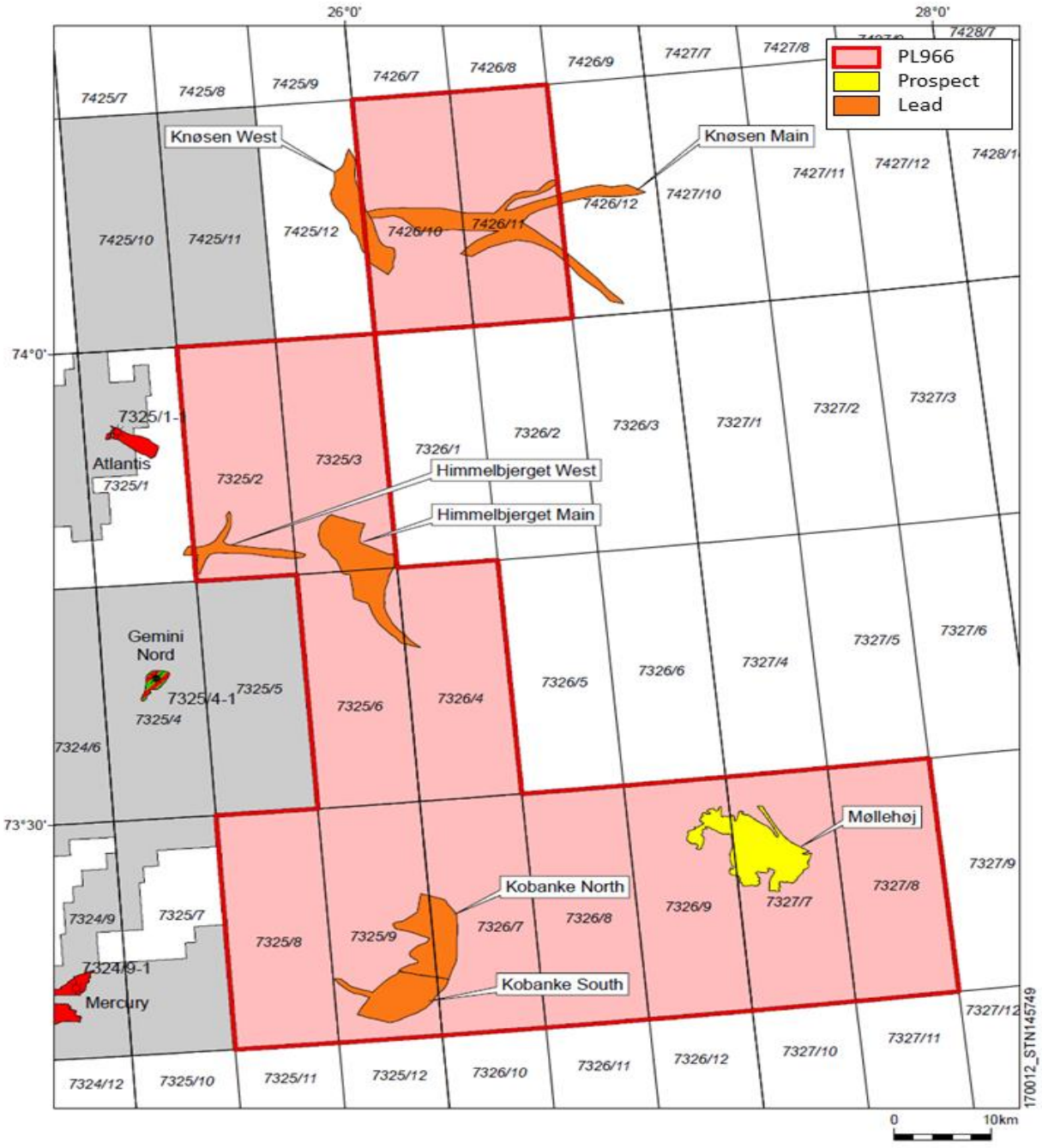

Figure 3: PL966 location map, Snadd Formation prospect and leads, at the time when the licence was awarded.

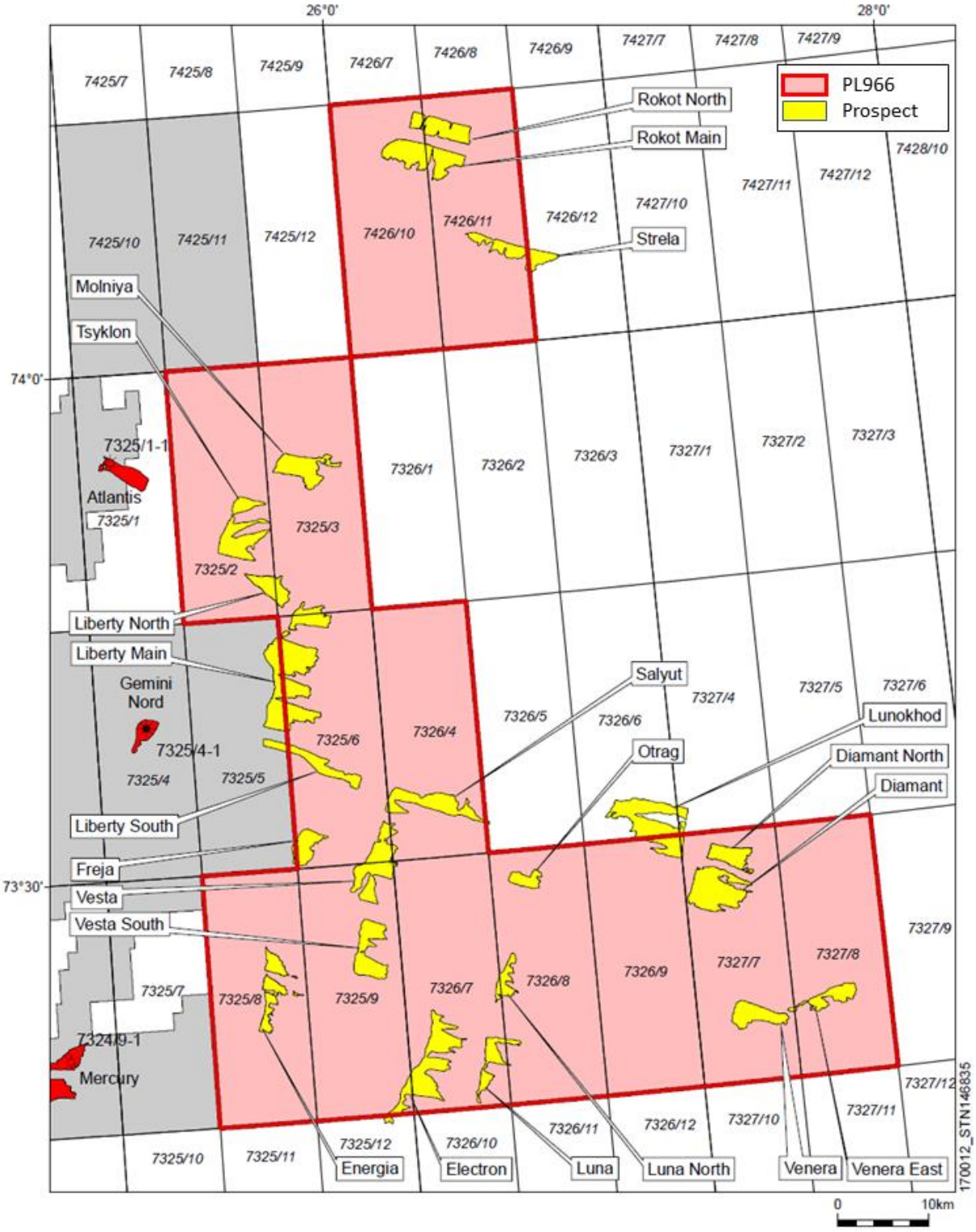

Figure 4: PL966 location map, Realgrunnen Subgroup prospects, at the time when the licence was awarded.

Discovery/ Prospect/ Lead name [1]	D/ P/ L [2]	Case (Oil/ Gas/ Oil&Gas) [3]	Unrisked recoverable resources [4]						Probability of discovery [5] (0.00 - 1.00)	Resources in acreage applied for [%] [6] (0.0 - 100.0)	Reservoir		Nearest relevant infrastructure [8]	
			Oil [10⁹Sm³] (>0.00)			Gas [10⁹Sm³] (>0.00)					Litho-/ Chrono-stratigraphic level [7]	Reservoir depth [m MSL] (>0)	Name	Km (>0)
			Low (P90)	Base (Mean)	High (P10)	Low (P90)	Base (Mean)	High (P10)						
Møllehøj	P	Oil	10.65	26.20	49.44	0.94	2.36	4.51	0.06	100.0	Snadd Fm/Upper Triassic	1475		
		Gas	0.04	0.11	0.20	3.79	6.16	17.01	0.04	100.0	Snadd Fm/Upper Triassic	1475		
Tsyklon	P	Oil	2.44	6.82	12.32	0.16	0.50	0.96	0.07	100.0	Stø Fm/Jurassic	801		
		Gas	0.00	0.02	0.03	0.58	1.46	2.55	0.29	100.0	Stø Fm/Jurassic	801		
Liberty North	P	Oil	1.02	2.66	4.36	0.07	0.19	0.34	0.06	100.0	Stø Fm/Jurassic	822		
		Gas	0.00	0.01	0.01	0.27	0.57	0.92	0.29	100.0	Stø Fm/Jurassic	822		
Molniya	P	Oil	2.36	6.16	10.75	0.15	0.45	0.83	0.12	100.0	Stø Fm/Jurassic	823		
		Gas	0.00	0.01	0.03	0.54	1.30	2.21	0.26	100.0	Stø Fm/Jurassic	823		
Liberty Main	P	Oil	11.84	26.40	43.31	0.71	1.91	3.53	0.06	69.0	Stø Fm/Jurassic	793		
		Gas	0.02	0.06	0.11	2.70	5.72	9.21	0.33	69.0	Stø Fm/Jurassic	793		
Liberty South	P	Oil	1.44	5.05	9.00	0.09	0.37	0.71	0.07	75.0	Stø Fm/Jurassic	824		
		Gas	0.00	0.01	0.02	0.29	1.07	1.95	0.28	75.0	Stø Fm/Jurassic	824		
Freja	P	Oil	1.81	4.22	7.23	0.11	0.31	0.58	0.06	100.0	Stø Fm/Jurassic	801		
		Gas	0.00	0.01	0.02	0.41	0.90	1.54	0.29	100.0	Stø Fm/Jurassic	801		
Vesta	P	Oil	5.53	9.85	14.53	0.32	0.71	1.19	0.06	100.0	Stø Fm/Jurassic	841		
		Gas	0.01	0.02	0.04	1.24	2.13	3.05	0.25	100.0	Stø Fm/Jurassic	841		
Energia	P	Oil	2.11	6.56	11.15	0.13	0.47	0.89	0.19	100.0	Stø Fm/Jurassic	752		
		Gas	0.00	0.02	0.03	0.48	1.47	2.50	0.35	100.0	Stø Fm/Jurassic	752		
Vesta South	P	Oil	1.47	6.80	13.28	0.09	0.50	1.05	0.10	100.0	Stø Fm/Jurassic	850		
		Gas	0.00	0.02	0.03	0.31	1.43	2.79	0.23	100.0	Stø Fm/Jurassic	850		
Salyut	P	Oil	4.60	8.41	12.43	0.27	0.61	1.05	0.12	86.0	Stø Fm/Jurassic	872		
		Gas	0.01	0.02	0.03	1.04	1.81	2.66	0.26	86.0	Stø Fm/Jurassic	872		
Electron	P	Oil	4.68	11.89	19.47	0.31	0.87	1.56	0.05	98.0	Stø Fm/Jurassic	911		
		Gas	0.01	0.03	0.05	1.16	2.60	4.18	0.25	98.0	Stø Fm/Jurassic	911		
Luna	P	Oil	2.30	4.80	7.39	0.14	0.35	0.62	0.14	100.0	Stø Fm/Jurassic	942		
		Gas	0.00	0.01	0.02	0.51	1.04	1.61	0.21	100.0	Stø Fm/Jurassic	942		
Luna North	P	Oil	1.00	2.80	4.95	0.06	0.20	0.39	0.14	100.0	Stø Fm/Jurassic	939		
		Gas	0.00	0.01	0.01	0.22	0.61	1.07	0.20	100.0	Stø Fm/Jurassic	939		
Otrag	P	Oil	1.66	2.88	4.21	0.10	0.21	0.35	0.17	100.0	Stø Fm/Jurassic	936		
		Gas	0.00	0.01	0.01	0.38	0.63	0.91	0.22	100.0	Stø Fm/Jurassic	936		
Lunokhod	P	Oil	8.51	14.91	21.79	0.52	1.08	1.81	0.09	27.0	Stø Fm/Jurassic	903		
		Gas	0.01	0.03	0.06	1.95	3.22	6.31	0.28	27.0	Stø Fm/Jurassic	903		
Diamant	P	Oil	3.04	7.15	11.71	0.19	0.51	0.90	0.11	100.0	Stø Fm/Jurassic	950		
		Gas	0.00	0.02	0.03	0.72	1.57	2.55	0.31	100.0	Stø Fm/Jurassic	950		
Diamant North	P	Oil	1.18	3.44	6.16	0.07	0.25	0.48	0.15	100.0	Stø Fm/Jurassic	933		
		Gas	0.00	0.01	0.02	0.27	0.73	1.30	0.25	100.0	Stø Fm/Jurassic	933		
Venera	P	Oil	3.21	5.82	8.58	0.19	0.42	0.72	0.12	100.0	Stø Fm/Jurassic	1019		
		Gas	0.00	0.01	0.02	0.74	1.26	1.84	0.22	100.0	Stø Fm/Jurassic	1019		
Venera East	P	Oil	0.52	2.45	5.07	0.03	0.18	0.39	0.09	100.0	Stø Fm/Jurassic	1031		
		Gas	0.00	0.01	0.01	0.11	0.43	1.09	0.27	100.0	Stø Fm/Jurassic	1031		
Rokot North	P	Oil	3.61	5.97	8.82	0.20	0.43	0.71	0.06	100.0	Stø Fm/Jurassic	605		
		Gas	0.00	0.01	0.02	0.81	1.30	1.85	0.21	100.0	Stø Fm/Jurassic	605		
Rokot Main	P	Oil	3.51	7.79	13.31	0.21	0.57	1.05	0.06	100.0	Stø Fm/Jurassic	635		
		Gas	0.01	0.02	0.03	0.81	1.67	2.71	0.29	100.0	Stø Fm/Jurassic	635		
Strela	P	Oil	0.69	3.39	7.22	0.04	0.25	0.56	0.06	62.0	Stø Fm/Jurassic	602		
		Gas	0.00	0.01	0.02	0.16	0.71	1.47	0.29	62.0	Stø Fm/Jurassic	602		
Kobanke South	L	Oil								100.0	Snadd Fm/Upper Triassic	1355		
Kobanke North	L	Oil								100.0	Snadd Fm/Upper Triassic	1369		
Himmelbjerget West	L	Oil								85.0	Snadd Fm/Upper Triassic	1253		
Himmelbjerget Main	L	Oil								100.0	Snadd Fm/Upper Triassic	1343		
Knøsen West	L	Oil								24.0	Snadd Fm/Upper Triassic	1041		
Knøsen Main	L	Oil								76.0	Snadd Fm/Upper Triassic	1016		

Table 1: Resource potential, PL966, at the time when the licence was awarded.

Prospectivity status, relinquishment:

The updated resource potential in PL966 at the time of relinquishment is given in Table 2 and shown in Figure 1.

Jurassic potential:

The results of 7324/6-1 and 7325/4-1 do not change the view of the Jurassic prospectivity; the likelihood for doing small gas discoveries is high. Remaining prospectivity within PL966 after these two wells has been

related to finding oil, which could be tied back to the Wisting development. Several smaller Jurassic closures with seismic DHIs exist. Most of them are however evaluated to contain gas, or low saturation gas, and are such not commercial. The Jurassic play is therefore not seen as commercial within the PL966 area.

Triassic potential:
Different approaches described in the geophysical work programme were worked hard to evaluate the Triassic potential in PL966. Critical factor is trap definition and geophysical support for oil accumulations.

Himmelbjerget West prospect:
The oil discovery in 7324/6-1 (Triassic, Carn02 level) resulted in that the Himmelbjerget West lead was matured to a prospect. 7324/6 proved a 16 meter oil column in the well in a low relief structure within the channel facies in poor reservoir. The Himmelbjerget West prospect capture the upside/follow-up potential of Carn02 oil discovery but was not brought forward to a drill decision due to insufficient volume potential. The geophysical studies performed have not been able to predict the hydrocarbon phase of the prospect.

Møllehøj prospect:
The re-evaluation of the prospect has not changed the definition of the prospect; it is mapped as a stratigraphic/down-faulted trap on the Top Early Carnian channels horizon. A minor 4-way closure exists, but to make attractive volumes, the stratigraphic/down-faulted trap component need to work. Even the P90 column requires this component to work. The results of the G&G studies conclude that it is difficult to de-risk oil accumulations as there is no geophysical support for oil phase. Based on the total risk picture, the prospect is not seen as a valid drilling candidate.

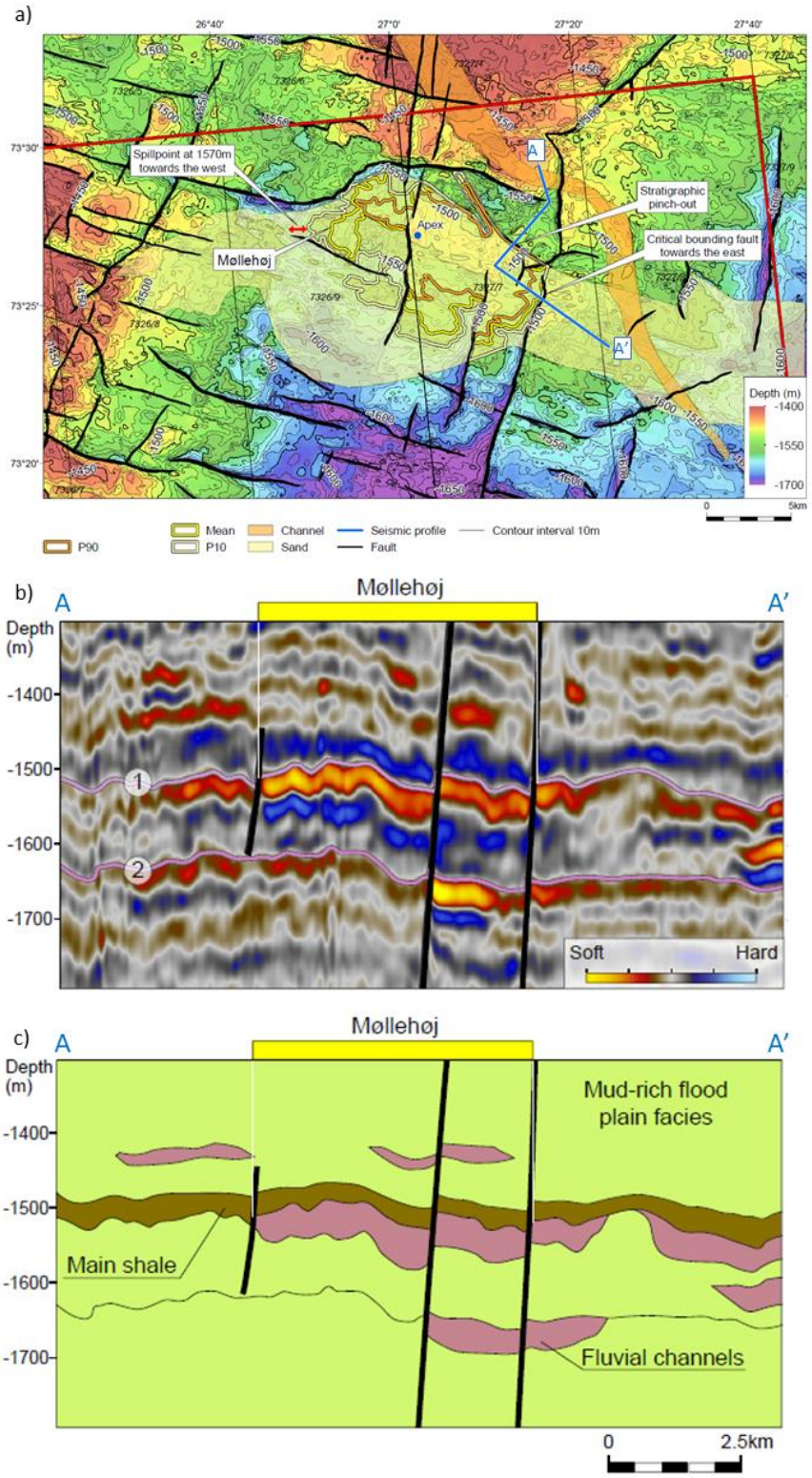

Figure 5: Critical trap elements Møllehøj. a) Top Early Carnian channels depth structure map, illustrating the critical trap elements for the Møllehøj prospect, b) HOOP_3D fluid stack random line, c) Geoseismic section.

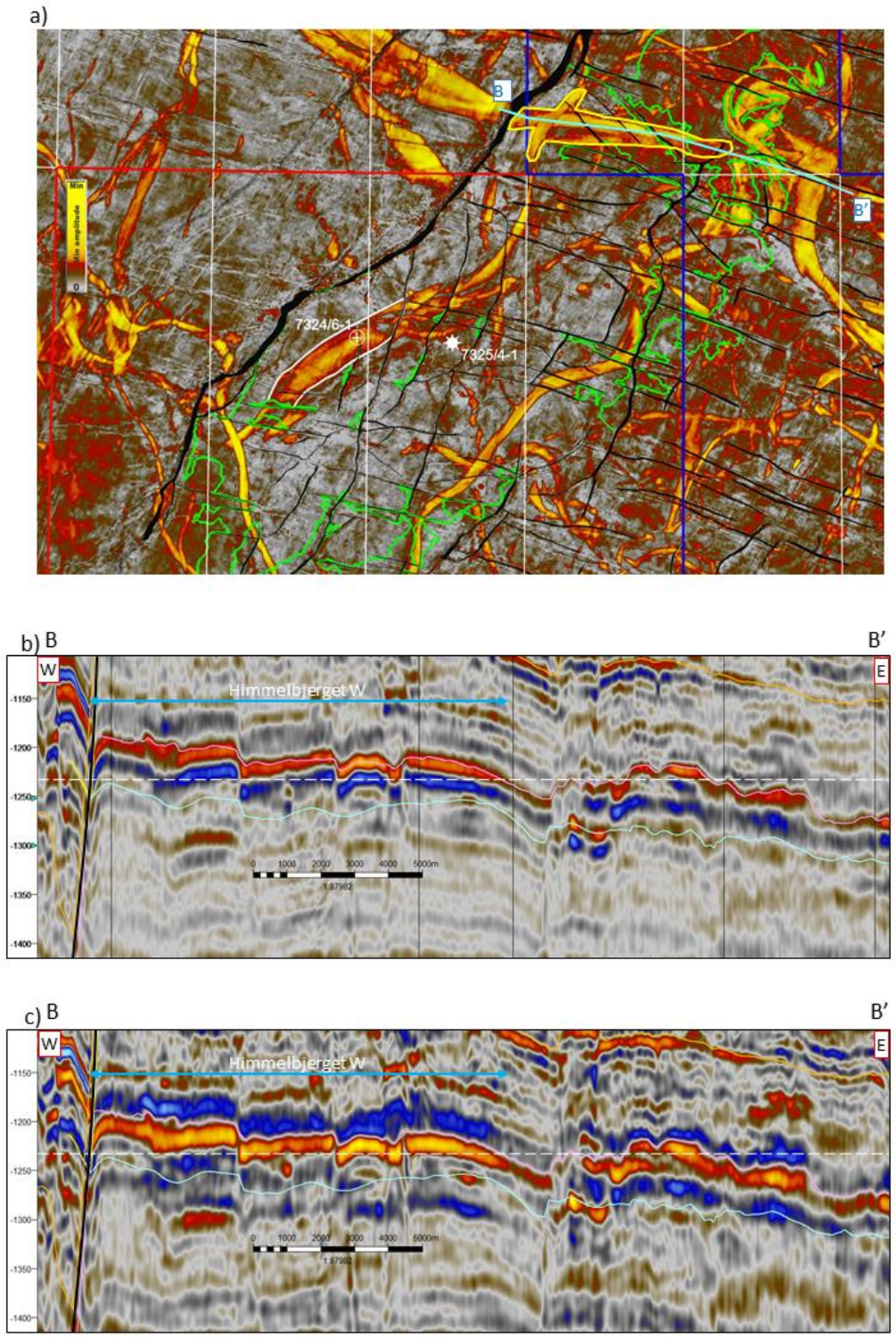

Figure 6: Himmelbjerget West prospect. a) Carn02 minimum amplitude, Hoop 3D, full offset (30 ms around horizon), b) Random line (Hoop 3D, full offset) along the W-E trending channel constituting the Himmelbjerget West prospect c) Random line (Hoop 3D, fluid stack) along the W-E trending channel constituting the Himmelbjerget West prospect.

			Unrisked rec resources									
			Oil (10^6 Sm^3)			Gas (10^9 Sm^3)						
Prospect/Lead name	P/L	Case (Oil/gas)	Low (P90)	Base (Mean)	High (P10)	Low (P90)	Base (Mean)	High (P10)	Probability of discovery (0.0 - 1.0 %)	Resources in PL966	Litho/Chrono-strat level	Reservoir depth (m MSL)
Møllehøj	P	Oil	10,65	26,20	49,44	0,94	2,36	4,51	0,06	100,0	Snadd Fm/Upper Triassic	1475
		Gas	0,04	0,11	0,20	3,79	6,16	17,01	0,04	100,0	Snadd Fm/Upper Triassic	1475
Himmelbjerget West	P	Oil	5,80	9,50	13,50	0,80	1,20	2,40	0,12	100,0	Snadd Fm/Upper Triassic	1253
		Gas	0,00	0,01	0,01	1,20	2,80	4,30	0,08	100,0	Snadd Fm/Upper Triassic	1253
Tsyklon	P	Oil	2,44	6,82	12,32	0,16	0,50	0,96	0,07	100,0	Stø Fm/Jurassic	801
		Gas	0,00	0,02	0,03	0,58	1,46	2,55	0,29	100,0	Stø Fm/Jurassic	801
Liberty North	P	Oil	1,02	2,66	4,36	0,07	0,19	0,34	0,06	100,0	Stø Fm/Jurassic	822
		Gas	0,00	0,01	0,01	0,27	0,57	0,92	0,29	100,0	Stø Fm/Jurassic	822
Molniya	P	Oil	2,36	6,16	10,75	0,15	0,45	0,83	0,12	100,0	Stø Fm/Jurassic	823
		Gas	0,00	0,01	0,03	0,54	1,30	2,21	0,26	100,0	Stø Fm/Jurassic	823
Liberty Main	P	Oil	11,84	26,40	43,31	0,71	1,91	3,53	0,06	69,0	Stø Fm/Jurassic	793
		Gas	0,02	0,06	0,11	2,70	5,72	9,21	0,33	69,0	Stø Fm/Jurassic	793
Liberty South	P	Oil	1,44	5,05	9,00	0,09	0,37	0,71	0,07	75,0	Stø Fm/Jurassic	824
		Gas	0,00	0,01	0,02	0,29	1,07	1,95	0,28	75,0	Stø Fm/Jurassic	824
Freja	P	Oil	1,81	4,22	7,23	0,11	0,31	0,58	0,06	100,0	Stø Fm/Jurassic	801
		Gas	0,00	0,01	0,02	0,41	0,90	1,54	0,29	100,0	Stø Fm/Jurassic	801
Vesta	P	Oil	5,53	9,85	14,53	0,32	0,71	1,19	0,06	100,0	Stø Fm/Jurassic	841
		Gas	0,01	0,02	0,04	1,24	2,13	3,05	0,25	100,0	Stø Fm/Jurassic	841
Energia	P	Oil	2,11	6,56	11,15	0,13	0,47	0,89	0,19	100,0	Stø Fm/Jurassic	752
		Gas	0,00	0,02	0,03	0,48	1,47	2,50	0,35	100,0	Stø Fm/Jurassic	752
Vesta South	P	Oil	1,47	6,80	13,28	0,09	0,50	1,05	0,10	100,0	Stø Fm/Jurassic	850
		Gas	0,00	0,02	0,03	0,31	1,43	2,79	0,23	100,0	Stø Fm/Jurassic	850
Salyut	P	Oil	4,60	8,41	12,43	0,27	0,61	1,05	0,12	86,0	Stø Fm/Jurassic	872
		Gas	0,01	0,02	0,03	1,04	1,81	2,66	0,26	86,0	Stø Fm/Jurassic	872
Electron	P	Oil	4,68	11,89	19,47	0,31	0,87	1,56	0,05	98,0	Stø Fm/Jurassic	911
		Gas	0,01	0,03	0,05	1,16	2,60	4,18	0,25	98,0	Stø Fm/Jurassic	911
Luna	P	Oil	2,30	4,80	7,39	0,14	0,35	0,62	0,14	100,0	Stø Fm/Jurassic	942
		Gas	0,00	0,01	0,02	0,51	1,04	1,61	0,21	100,0	Stø Fm/Jurassic	942
Luna North	P	Oil	1,00	2,80	4,95	0,06	0,20	0,39	0,14	100,0	Stø Fm/Jurassic	939
		Gas	0,00	0,01	0,01	0,22	0,61	1,07	0,20	100,0	Stø Fm/Jurassic	939
Otrag	P	Oil	1,66	2,88	4,21	0,10	0,21	0,35	0,17	100,0	Stø Fm/Jurassic	936
		Gas	0,00	0,01	0,01	0,38	0,63	0,91	0,22	100,0	Stø Fm/Jurassic	936
Lunokhod	P	Oil	8,51	14,91	21,79	0,52	1,08	1,81	0,09	27,0	Stø Fm/Jurassic	903
		Gas	0,01	0,03	0,06	1,95	3,22	6,31	0,28	27,0	Stø Fm/Jurassic	903
Diamant	P	Oil	3,04	7,15	11,71	0,19	0,51	0,90	0,11	100,0	Stø Fm/Jurassic	950
		Gas	0,00	0,02	0,03	0,72	1,57	2,55	0,31	100,0	Stø Fm/Jurassic	950
Diamant North	P	Oil	1,18	3,44	6,16	0,07	0,25	0,48	0,15	100,0	Stø Fm/Jurassic	933
		Gas	0,00	0,01	0,02	0,27	0,73	1,30	0,25	100,0	Stø Fm/Jurassic	933
Venera	P	Oil	3,21	5,82	8,58	0,19	0,42	0,72	0,12	100,0	Stø Fm/Jurassic	1019
		Gas	0,00	0,01	0,02	0,74	1,26	1,84	0,22	100,0	Stø Fm/Jurassic	1019
Venera East	P	Oil	0,52	2,45	5,07	0,03	0,18	0,39	0,09	100,0	Stø Fm/Jurassic	1031
		Gas	0,00	0,01	0,01	0,11	0,43	1,09	0,27	100,0	Stø Fm/Jurassic	1031
Rokot North	P	Oil	3,61	5,97	8,82	0,20	0,43	0,71	0,06	100,0	Stø Fm/Jurassic	605
		Gas	0,00	0,01	0,02	0,81	1,30	1,85	0,21	100,0	Stø Fm/Jurassic	605
Rokot Main	P	Oil	3,51	7,79	13,31	0,21	0,57	1,05	0,06	100,0	Stø Fm/Jurassic	635
		Gas	0,01	0,02	0,03	0,81	1,67	2,71	0,29	100,0	Stø Fm/Jurassic	635
Strela	P	Oil	0,69	3,39	7,22	0,04	0,25	0,56	0,06	62,0	Stø Fm/Jurassic	602
		Gas	0,00	0,01	0,02	0,16	0,71	1,47	0,29	62,0	Stø Fm/Jurassic	602
Kobanke South	L	Oil								100,0	Snadd Fm/Upper Triassic	1355
Kobanke North	L	Oil								100,0	Snadd Fm/Upper Triassic	1369
Himmelbjerget Main	L	Oil								100,0	Snadd Fm/Upper Triassic	1343
Knøsen West	L	Oil								24,0	Snadd Fm/Upper Triassic	1041
Knøsen Main	L	Oil								76,0	Snadd Fm/Upper Triassic	1016

Table 2: Resource potential, status at relinquishment.

5 Technical evaluation

Valuation of the Himmelbjerget West prospect was done as part of the 7324/6-1 (Sputnik) post well evaluation and related to the Sputnik up-side evaluation. The development solution for Himmelbjerget West has been assumed as a tie-back to Wisting FPSO which is approx. 50 km away. The drainage strategy is production with water injection. With the assumed development solution and a P(oil) of 12 % the Expected Value is negative. Other Himmelbjerget segments have poorer resource density than Himmelbjerget West and cannot be seen to have the potential to form the resource basis of an area development of several prospects/segments.

6 Conclusion

The licence partners have unanimously decided to let the licences expire at the first decision gate for the licence at 22.06.2021 (reprocess, new seismic, drill well or drop). This is due to limited remaining prospectivity (high chance of discovering gas in the Jurassic play) and lack of commerciality for the oil possibilities in PL966.

References

Statoil, 2018. Final Well Report, Exploration Well NO 7325/4-1 and NO 7325/4-U-1, Gemini Nord. 120 pp.
Equinor, 2019. Final Well Report, NO 7324/6-1, Sputnik. PL855. 155 pp.

Appendices

1. NPD form no 4, Møllehøj prospect, oil case
2. NPD form no 4, Møllehøj prospect, gas case
3. NPD form no 4, Himmelbjerget West prospect, oil case
4. NPD form no 4, Himmelbjerget West prospect, gas case

Digital deliveries:

1. Prospect data (NPD form 4) of the Møllehøj and Himmelbjerget West prospects
2. Shapefile of PL966 prospects and leads (same outlines as in Figure 1)

Table 4: Discovery and Prospect data (Enclose map)

Block	7327/7	Prospect name	Møllehøj	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	Equinor	Reference document				Assessment year	2021
This is case no.:	1 of 2	Structural element	Bjarmeland Platform	Type of trap	Stratigraphic	Water depth [m MSL] (>0)	405	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)	38,18	44,09	90,85	169,77				
	Gas [10^9 Sm^3] (>0.00)					3,43	4,18	8,17	15,16
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	11,10	11,57	27,29	50,65				
	Gas [10^9 Sm^3] (>0.00)					0,99	1,21	2,45	4,58
Reservoir Chrono (from)	Upper Triassic, Carnian	Reservoir litho (from)	Snadd Fm	Source Rock, chrono primary	Anisian/Olenekian	Source Rock, litho primary	Kobbe/Klappmyss Fr	Seal, Chrono	Upper Triassic, Carnian
Reservoir Chrono (to)	Upper Triassic, Carnian	Reservoir litho (to)	Snadd Fm	Source Rock, chrono secondary	Ladinian/Induan	Source Rock, litho secondary	Snadd/Havert Fm	Seal, Litho	Snadd Fm
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,10	Oil case (0.00-1.00)	0,58	Gas case (0.00-1.00)	0,42	Oil & Gas case (0.00-1.00)			
Reservoir (P1) (0.00-1.00)	0,97	Trap (P2) (0.00-1.00)	0,18	Charge (P3) (0.00-1.00)	0,54	Retention (P4) (0.00-1.00)	1,00		
Parametres:	Low (P90)	Base	High (P10)	*Comments: Retention (P4) is included in Trap (P2).*					
Depth to top of prospect [m MSL] (> 0)		1475							
Area of closure [km^2] (> 0.0)	34,3	53,0	77,3						
Reservoir thickness [m] (> 0)	38	56	75						
HC column in prospect [m] (> 0)									
Gross rock vol. [10^9 m^3] (> 0.000)	0,537	1,197	2,242						
Net / Gross [fraction] (0.00-1.00)	0,52	0,65	0,76						
Porosity [fraction] (0.00-1.00)	0,21	0,24	0,26						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,35	0,40	0,45						
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)	0,77	0,81	0,85						
GOR, free gas [Sm^3/Sm^3] (> 0)									
GOR, oil [Sm^3/Sm^3] (> 0)	80	90	100						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,25	0,30	0,35						
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,25	0,30	0,35						
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)	42			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)	155			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

Appendix 1: NPD form no 4, Møllehøj prospect, oil case

Table 4: Discovery and Prospect data (Enclose map)

Block	7327/7	Prospect name	Møllehøj	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:	Gas	Reported by company	Equinor	Reference document	0			Assessment year	2021
This is case no.:	2 of 2	Structural element	Bjarmeland Platform	Type of trap	Stratigraphic	Water depth [m MSL] (>0)	450	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)					0,10	0,11	0,25	0,47
	Gas [10^9 Sm^3] (>0.00)	7,34	9,87	17,57	33,31				
Recoverable resources	Oil [10^6 Sm^3] (>0.00)					0,04	0,06	0,11	0,20
	Gas [10^9 Sm^3] (>0.00)	3,75	5,10	9,28	17,83				
Reservoir Chrono (from)	Upper Triassic, Carnian	Reservoir litho (from)	Snadd Fm	Source Rock, chrono primary	Aniasian/Olenekian	Source Rock, litho primary	Kobbe/Klappmyss Fr	Seal, Chrono	Upper Triassic, Carnian
Reservoir Chrono (to)	Upper Triassic, Carnian	Reservoir litho (to)	Snadd Fm	Source Rock, chrono secondary	Ladinian/Induan	Source Rock, litho secondary	Snadd/Havert Fm	Seal, Litho	Snadd Fm
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,10	Oil case (0.00-1.00)	0,58	Gas case (0.00-1.00)	0,42	Oil & Gas case (0.00-1.00)	0,00		
Reservoir (P1) (0.00-1.00)	0,97	Trap (P2) (0.00-1.00)	0,18	Charge (P3) (0.00-1.00)	0,54	Retention (P4) (0.00-1.00)	1,00		
Parametres:	Low (P90)	Base	High (P10)	*Comments: Retention (P4) is included in Trap (P2).*					
Depth to top of prospect [m MSL] (> 0)		1475							
Area of closure [km^2] (> 0.0)	34,3	53,0	77,3						
Reservoir thickness [m] (> 0)	38	56	75						
HC column in prospect [m] (> 0)									
Gross rock vol. [10^9 m^3] (> 0.000)	0,537	1,197	2,242						
Net / Gross [fraction] (0.00-1.00)	0,52	0,65	0,76						
Porosity [fraction] (0.00-1.00)	0,21	0,24	0,26						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,35	0,40	0,45						
Bg [Rm3/Sm3] (< 1.0000)	0,0057	0,0062	0,0069						
1/Bo [Sm3/Rm3] (< 1.00)									
GOR, free gas [Sm^3/Sm^3] (> 0)	57874	70423	89920						
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)	0,45	0,53	0,62						
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0,35	0,43	0,52	For NPD use:					
Temperature, top res [°C] (>0)	42			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)	155			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

Appendix 2: NPD form no 4, Møllehøj prospect, gas case

Table 4: Discovery and Prospect data (Enclose map)

Block	7325/2	Prospect name	Himmelbjerget West	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	Equinor	Reference document				Assessment year	2021
This is case no.:	1 of 2	Structural element	Hoop Fault Complex	Type of trap	Stratigraphic	Water depth [m MSL] (>0)	450	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)	29,84	45,82	47,13	65,89				
	Gas [10^9 Sm^3] (>0.00)					2,75	4,20	4,98	7,54
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	5,83	8,35	9,43	13,41				
	Gas [10^9 Sm^3] (>0.00)					0,75	1,23	1,50	2,39
Reservoir Chrono (from)	Upper Triassic, Carnian	Reservoir litho (from)	Snadd Fm	Source Rock, chrono primary	Aniasian/Olenekian	Source Rock, litho primary	Kobbe/Klappmyss Fr	Seal, Chrono	Upper Triassic, Carnian
Reservoir Chrono (to)	Upper Triassic, Carnian	Reservoir litho (to)	Snadd Fm	Source Rock, chrono secondary	Ladinian/Induan	Source Rock, litho secondary	Snadd/Havert Fm	Seal, Litho	Snadd Fm
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,20	Oil case (0.00-1.00)	0,60	Gas case (0.00-1.00)	0,60	Oil & Gas case (0.00-1.00)			
Reservoir (P1) (0.00-1.00)	0,33	Trap (P2) (0.00-1.00)	0,61	Charge (P3) (0.00-1.00)	1,00	Retention (P4) (0.00-1.00)	1,00		
Parametres:	Low (P90)	Base	High (P10)	*Comments: Retention (P4) is included in Trap (P2).*					
Depth to top of prospect [m MSL] (> 0)									
Area of closure [km^2] (> 0.0)	21,2	26,5	31,6						
Reservoir thickness [m] (> 0)	28	33	39						
HC column in prospect [m] (> 0)									
Gross rock vol. [10^9 m^3] (> 0.000)	0,400	0,608	0,815						
Net / Gross [fraction] (0.00-1.00)	0,66	0,75	0,84						
Porosity [fraction] (0.00-1.00)	0,19	0,22	0,25						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,42	0,46	0,50						
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)	0,86	0,87	0,88						
GOR, free gas [Sm^3/Sm^3] (> 0)									
GOR, oil [Sm^3/Sm^3] (> 0)	73	106	140						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,17	0,20	0,23						
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)	42			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)	155			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

Appendix 3: NPD form no 4, Himmelbjerget prospect, oil case

Table 4: Discovery and Prospect data (Enclose map)

Block	7325/2	Prospect name	Himmelbjerget West	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:	Gas	Reported by company	Equinor	Reference document	0			Assessment year	2021
This is case no.:	2 of 2	Structural element	Hoop Fault Complex	Type of trap	Stratigraphic	Water depth [m MSL] (>0)	450	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)					0,03	0,04	0,04	0,06
	Gas [10^9 Sm^3] (>0.00)	3,72	5,47	6,02	8,38				
Recoverable resources	Oil [10^6 Sm^3] (>0.00)					0,01	0,01	0,01	0,01
	Gas [10^9 Sm^3] (>0.00)	1,85	2,60	3,02	4,28				
Reservoir Chrono (from)	Upper Triassic, Carnian	Reservoir litho (from)	Snadd Fm	Source Rock, chrono primary	Aniasian/Olenekian	Source Rock, litho primary	Kobbe/Klappmyss Fr	Seal, Chrono	Upper Triassic, Carnian
Reservoir Chrono (to)	Upper Triassic, Carnian	Reservoir litho (to)	Snadd Fm	Source Rock, chrono secondary	Ladinian/Induan	Source Rock, litho secondary	Snadd/Havert Fm	Seal, Litho	Snadd Fm
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,20	Oil case (0.00-1.00)	0,60	Gas case (0.00-1.00)	0,60	Oil & Gas case (0.00-1.00)	0,00		
Reservoir (P1) (0.00-1.00)	0,33	Trap (P2) (0.00-1.00)	0,61	Charge (P3) (0.00-1.00)	1,00	Retention (P4) (0.00-1.00)	1,00		
Parametres:	Low (P90)	Base	High (P10)	*Comments: Retention (P4) is included in Trap (P2).*					
Depth to top of prospect [m MSL] (> 0)									
Area of closure [km^2] (> 0.0)	21,2	26,5	31,6						
Reservoir thickness [m] (> 0)	28	33	39						
HC column in prospect [m] (> 0)									
Gross rock vol. [10^9 m^3] (> 0.000)	0,400	0,608	0,815						
Net / Gross [fraction] (0.00-1.00)	0,66	0,75	0,84						
Porosity [fraction] (0.00-1.00)	0,19	0,22	0,25						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,35	0,40	0,45						
Bg [Rm3/Sm3] (< 1.0000)	0,0091	0,0100	0,0111						
1/Bo [Sm3/Rm3] (< 1.00)									
GOR, free gas [Sm^3/Sm^3] (> 0)	117326	139119	168533						
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)	0,45	0,50	0,55						
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0,08	0,13	0,18	For NPD use:					
Temperature, top res [°C] (>0)	42			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)	155			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

Appendix 4: NPD form no 4, Himmelbjerget West prospect, gas case