Relinquishment Report PL1047

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1 License history

PL1047 covers parts of areas in Block 30/4,5,7 and 8, located in the central part of the Viking graben, between the Frigg, Martin Linge and Oseberg fields, see Fig. 1.1. Structurally the area covers the southern part of the Rungne and north-western part of the Fensal sub-basins.

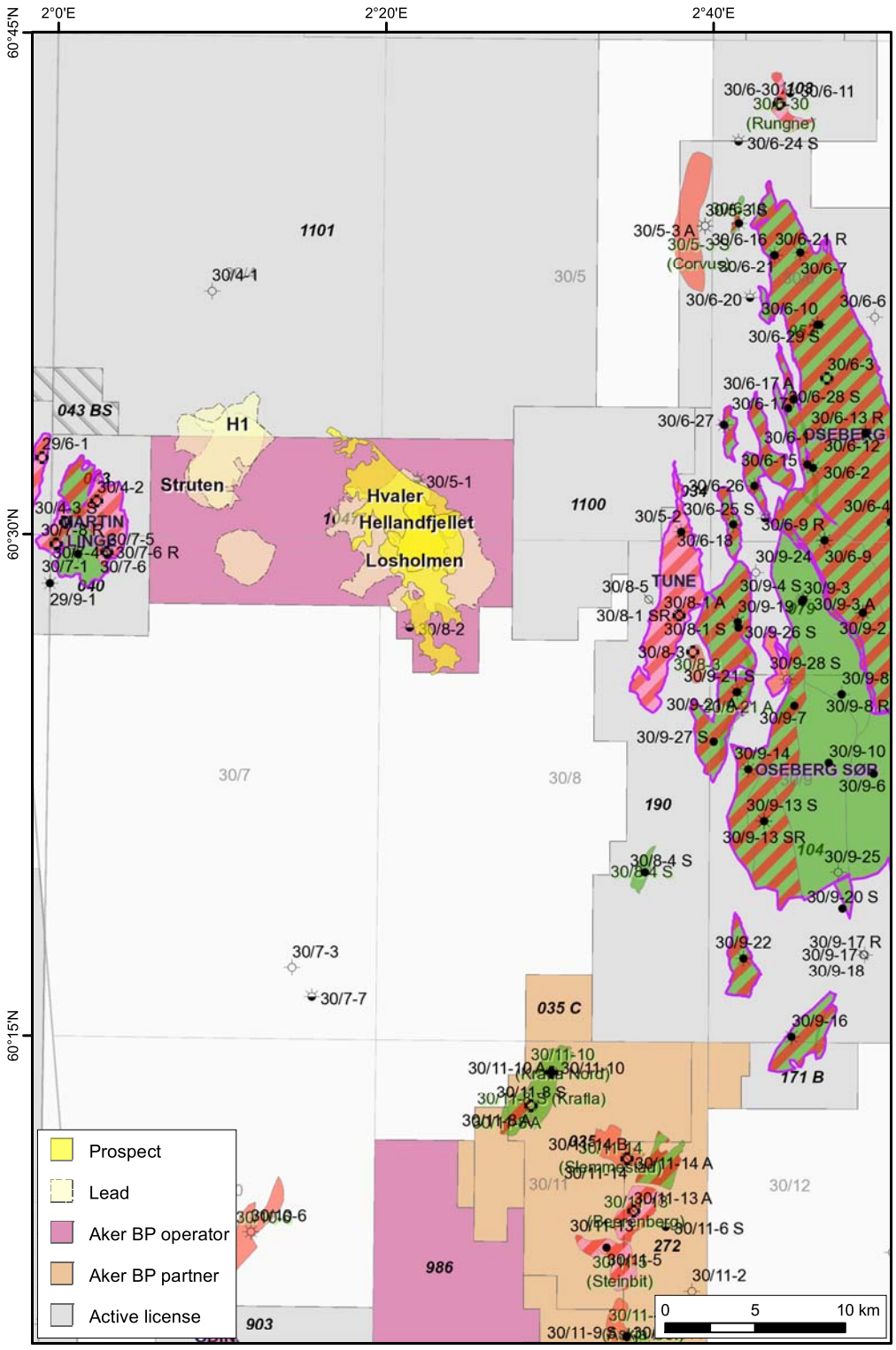

Fig. 1.1 PL1047 Location Map

The license was awarded to Aker BP ASA (Operator 40%), ConocoPhillips Skandinavia AS (20%), Concedo AS (20%) and Pandion Energy AS (20%) on 14.02.2020 with the initial 2-year phase ending on 14.02.2022 with a drill or drop decision. In December 2020, Pandion Energy AS farmed out and transferred their 10% owner ship interest to ConocoPhillips Skandinavia AS. The current licensees consist of Aker BP ASA (Operator 40%), ConocoPhillips Skandinavia AS (30%), Concedo AS (20%) and Pandion Energy AS (10%).

At the time of APA19 application, the Paleocene level Hvaler prospect was identified as a main potential. The license was awarded over all stratigraphic levels.

The initial 2-year work program consisted of acquire and reprocess modern 3D-seismic, EM feasibility study, and geology and geophysics studies. All work commitments have been fulfilled.

MC meetings were held at least once and EC meetings twice a year, in accordance with JOA article 2.1. These meetings were combined ECMC meetings and in addition several EC work sessions have been organized. Below is a list of the meetings held during the licence term:

- 2020, May 08th, ECMC Startup meeting
- 2020, November 10th, ECMC meeting
- 2021, March 23rd, EC work meeting
- 2021, June 29th, EC work meeting
- 2021, August 16th, EC work meeting
- 2021, November 29th, ECMC meeting

The prospectivity in the licence has been thoroughly evaluated. The main prospect Hvaler represents a moderate risk and limited volume potential Paleocene opportunity. EM, AV0 and inversion work is inconclusive and has consequently not resulted in sufficient de-risking of the prospect. The technical work has not been able to reduce the uncertainty related to seal and volumes are below minimum economic threshold, hence, no drilling candidates have been identified. The PL1047 license group has therefore decided to relinquish the licence.

2 Database

2.1 Seismic data

The common seismic database consists of parts of CGG's multiclient 3D survey CGG18M01. The dataset is a broadband acquisition from 2016 and it was processed with the most modern and advanced processing techniques in 2018. A sub-cube of CGG18M01 was also reprocessed by the licence applying the Petrotrace CRAM technology. The seismic database outline agreed in the licence is shown in Fig. 2.1 and listed in Table 2.1. In addition, all relevant public data has been used for the technical evaluation.

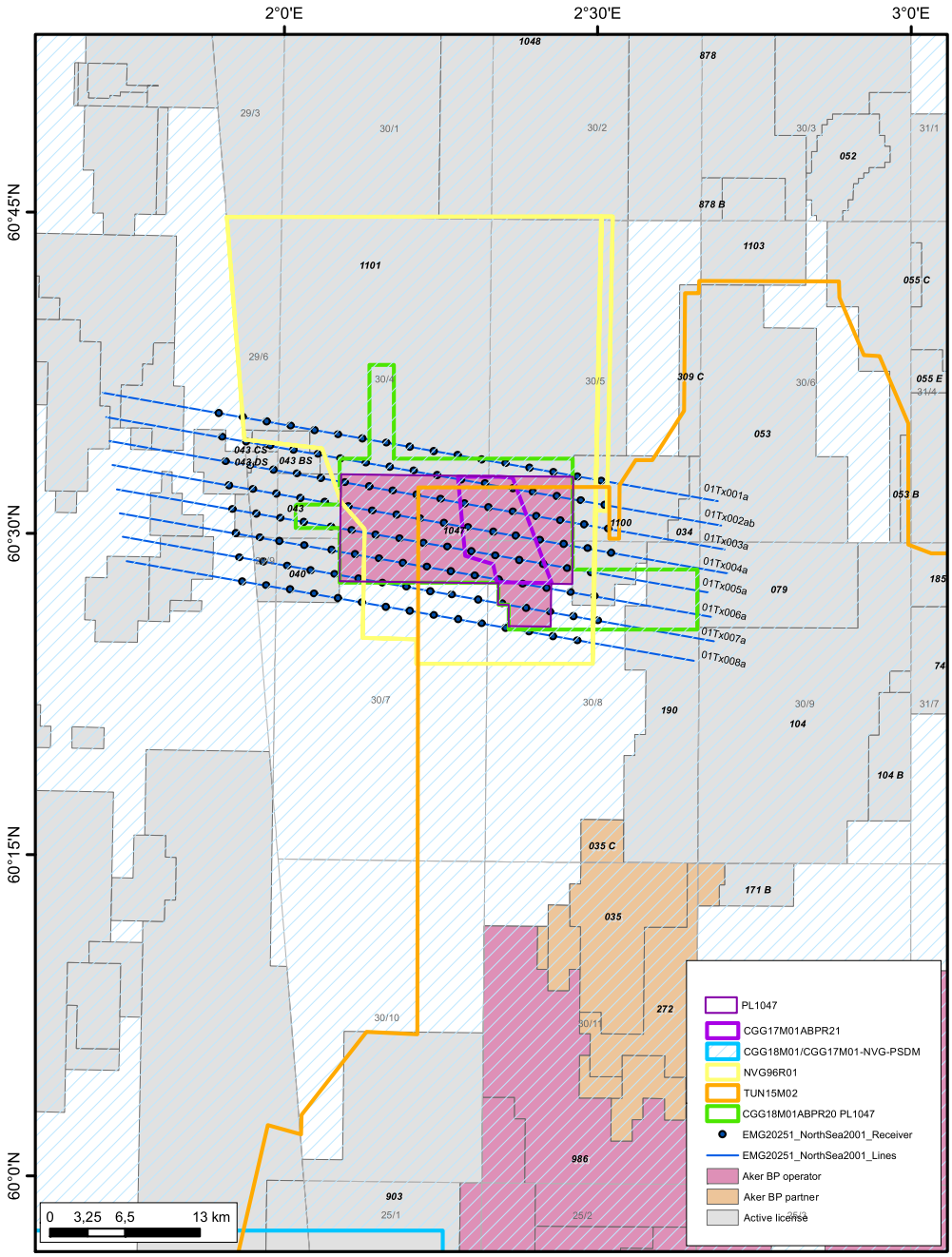

Fig. 2.1 PL1047 Common Seismic and EM database Map

Table 2.1 PL1047 Common Seismic database

Survey name	Type	Vintage	Operator / Owner	Diskos survey ID/NPDID	Public
*CGG18M01/CGG17M01-NVG-PSDM	3D	2018	CGG	10085396007	No
*CGG18M01ABPR20	3D	2020 (internal conditioning)	Aker BP	10085396007	No
CGG17M01ABPR21	3D	2021 (CRAM reprocessing)	Aker BP	10085394196	No
TUN15M02	3D	2015	Pandion Energy	10085393936	Yes
NVG96R01	3D	2001	Equinor	39487161	Yes

** CGG18M01 common database area 322 Km ^{2}*

2.2 CSEM data

The licence partners have also purchased and analysed CSEM data covering the licence area; the common CSEM database covers 8 lines of EMGS's multiclient survey EMG20251 (NorthSea2001) is shown in Fig. 2.1 and Table 2.2

Table 2.2 PL1047 Common CSEM database

*Survey name	Line Name	Type	Vintage	Operator / Owner	NPD/Diskos survey ID	Public
EMG20251	01Tx001a	3D	2020	EMGS	9094	No
EMG20251	01Tx002ab	3D	2020	EMGS	9094	No
EMG20251	01Tx003a	3D	2020	EMGS	9094	No
EMG20251	01Tx004a	3D	2020	EMGS	9094	No
EMG20251	01Tx005a	3D	2020	EMGS	9094	No
EMG20251	01Tx006a	3D	2020	EMGS	9094	No
EMG20251	01Tx007a	3D	2020	EMGS	9094	No
EMG20251	01Tx008a	3D	2020	EMGS	9094	No

**EMGS Project name NorthSea2001*

Table 2.3 PL1047 Common Well Database

Wells	Drilling operator	Year (completed)	Total depth (MD)	TD Formation	Oldest penetrated age	Contents	Discovery/Field	NPDID	Key wellls	2 year released
30/4-1	BP Norway Limited U.A.	1979	5454	DRAKE FM	EARLY JURASSIC	DRY		377		Yes
30/4-2	BP Norway Limited U.A.	1980	4775	HEGRE GP	TRIASSIC	GAS/CONDENSATE	30/7-6 Martin Linge	378		Yes
30/5-1	A/S Norske Shell	1972	4124	ÅSGARD FM	EARLY CRETACEOUS	GAS SHOWS		379	X	Yes
30/5-2	Norsk Hydro Produksjon AS	1996	4076	DRAKE FM	EARLY JURASSIC	OIL/GAS	30/8-1 S Tune	2886		Yes
30/7-2	Norsk Hydro Produksjon AS	1975	2591	JORSALFARE FM	LATE CRETACEOUS	OIL/GAS	30/7-2 Martin Linge	385		Yes
30/7-3	Norsk Hydro Produksjon AS	1976	4044	RØDBY FM	EARLY CRETACEOUS	DRY		386		Yes
30/7-7	Norsk Hydro Produksjon AS	1979	5127	STATFJORD GP	LATE TRIASSIC	GAS SHOWS		390		Yes
30/8-2	Norsk Hydro Produksjon AS	1996	2405	JORSALFARE FM	LATE CRETACEOUS	OIL SHOWS		2723	X	Yes
30/8-3	Norsk Hydro Produksjon AS	1998	3720	DRAKE FM	EARLY JURASSIC	GAS/CONDENSATE	30/8-3	3246		Yes
30/8-4 S	StatoilHydro Petroleum AS	2009	4210	NESS FM	MIDDLE JURASSIC	OIL	30/8-4 S	5974		Yes
30/11-8 A	Statoil Petroleum AS	2011	4475	DRAKE FM	MIDDLE JURASSIC	OIL/GAS/CONDENSATE	30/11-8 A	6611		Yes
30/11-8 S	Statoil Petroleum AS	2011	4043	DRAKE FM	EARLY JURASSIC	OIL/GAS/CONDENSATE	30/11-8 S (Krafla)	6540		Yes

2.3 Well Data

The reference wells used in the geological and geophysical evaluation of the prospects and leads are listed in Table 2.3 and shown on the map in Fig. 2.2.

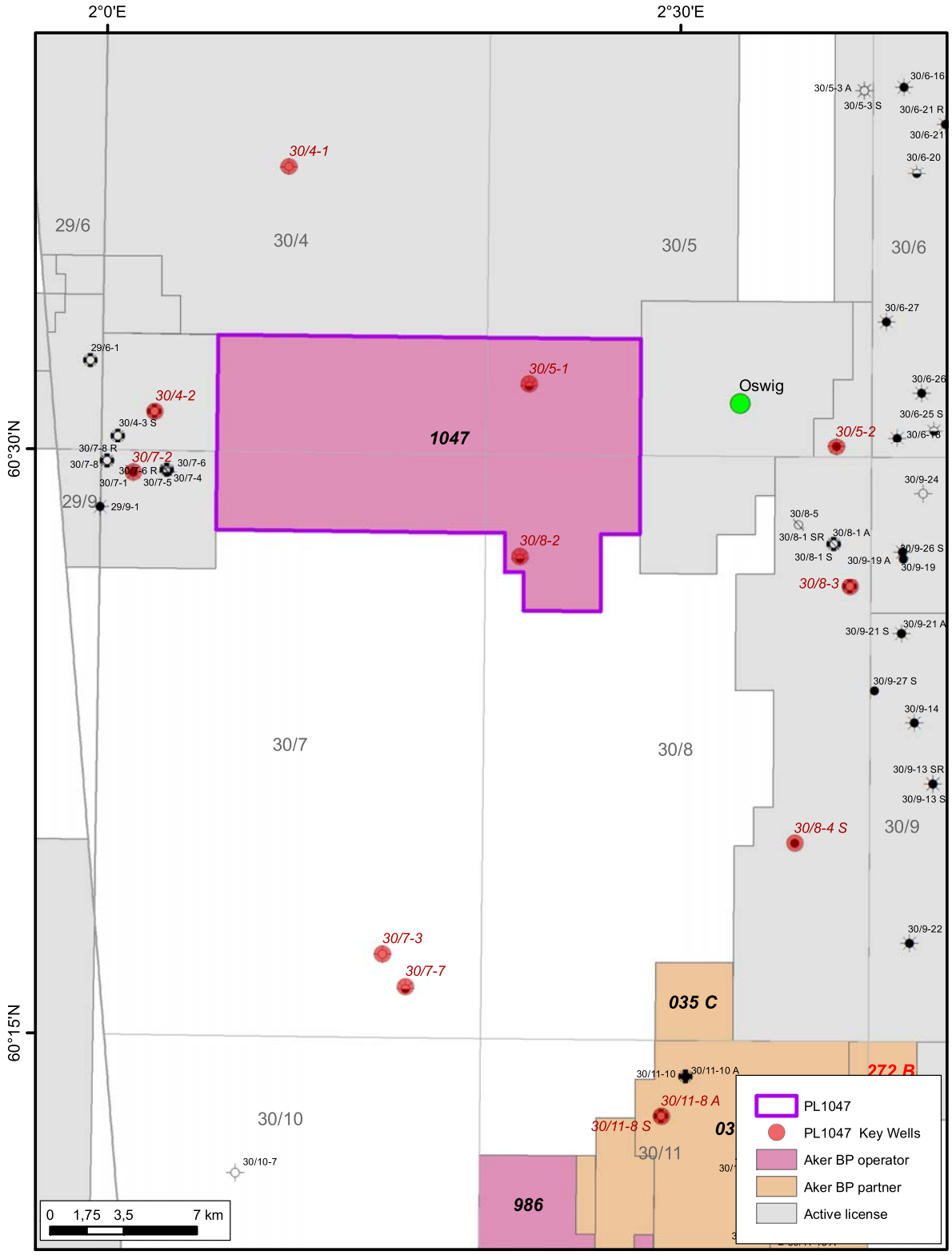

Fig. 2.2 PL1047 Common Well database Map

3 Geological and geophysical studies

The following Geological and Geophysical studies were undertaken in the license evaluation:

Targeted geophysical studies

- Internal seismic post-stack conditioning of CGG18M01 common database area.
- Reprocessing PetroTrace (CRAM) on target area, aiming to improve seismic resolution and update the velocity model.
- Frequency decomposition and generation of RGB-blend volumes for seismic attribute analysis
- Structured deployment of geophysical rock property analysis and seismic inversion feasibility in order to improve understanding relating to the seismic data quality.
- Probabilistic AVA seismic inversion feasibility and scenario forward seismic modelling, aiming to evaluate seismic resolution and reservoir thickness, along with the associated uncertainties based on the observed seismic response.

CSEM Study

[redacted]

Geochemical Study

Geochemical analysis of core and cuttings samples from well 30/8-2 and 30/5-1 to investigate shows, oil families and evaluate the degree of biodegradation. The results from the studies have confirmed the migration of oil into the well locations, the first charge into the Hermod Fm sandstones in 30/8-2 was likely biodegraded. Some sandstone stringers show evidence for mixing of the biodegraded oil with a fresh non-biodegraded oil charge from a recent migration event.

Petroleum System Analysis Study

In-house petroleum system modelling studies were completed to increase understating of migration, timing and key uncertainties and to better understand the hydrocarbon phase risk. The model was calibrated to available well data. The Paleocene carrier beds in the Hermod Fm. were implemented from the frequency decomposition and RGB-blend interpretation. Oil migration and subsequent biodegradation as observed in the 30/8-2 well were reproduced. Thus, the study supports the mature source rock setting with proven oil migration into the Paleocene level. Modelling suggest that the 30/8-2 well is located in a potential paleo-closure, which spilled northwards to the Hvaler prospect location due to changes in paleo-water depth.

Other G&G work

- Gross depositional environment (GDE) studies and reservoir evaluations to assess reservoir quality in the license. Integration of the geophysical and geological studies to further investigate the likelihood of effective reservoir distribution system for Hvaler prospect. The potentially reservoir prone depositional systems were identified, the Hermod Fan is built up of numerous channel and splay complexes and much more dendritic than lobate or sheet-like in nature.
- Regional petrophysical studies and well analysis to support geophysical and geological studies.
- Play based evaluation update for additional prospective plays within the license.

- Biostratigraphy review of relevant wells to evaluate possible missing stratigraphy in Paleocene level.
- Volumetric and risking assessments.
- Evaluation of all prospective levels in license.

4 Prospect update

The Hvaler Prospect is defined as a stratigraphic pinch-out trap within a 4-way dip closure between the 30/8-2 and 30/5-1 wells, where the key uncertainty has been identified as seal definition and the degree of biodegradation. Reservoir was believed to be the Hermod Fm. with possible similar quality as seen in the well 30/8-2. Seismic attributes analysis of Hermod Fm. level partially supports the updated reservoir model. Basin modelling indicated mature source rock setting with proven migration into the Paleocene and model supported gas and oil as a the most likely phase at Hvaler. Geochemical analysis on core material from the 30/8-2 well indicated, the first charge was likely biodegraded and later mixed with recent influx. Top seal is a high uncertainty with potential presence of gas cloud to the northern apex area. The summary of the Hvaler prospect is shown in Fig. 4.1 and Table 4.1. Hvaler has been evaluated as a gas over oil case. An oil-only case is not evaluated due to the much higher probability for gas or multi-phase charge in the Martin Linge/Oseberg area.

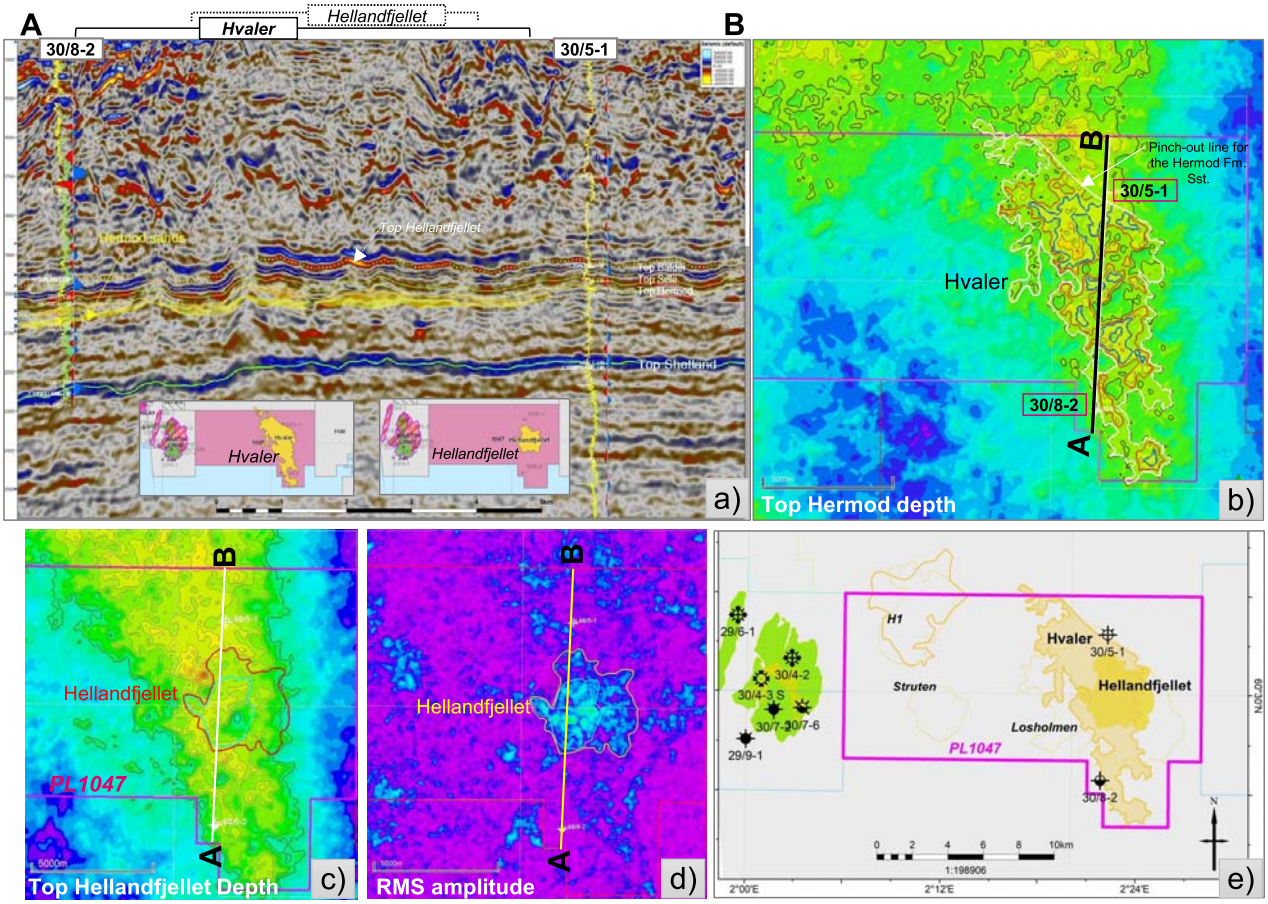

Fig. 4.1 PL1047 prospectivity overview *a) Seismic profile crossing Hvaler and Hellandfjellet prospect b) Top Hermod Fm. reservoir depth map wiith Hvaler prospect outline c) Top Hellandfjellet reservoir depth map with outline d) Hellandfjellet reservoir RMS amplitude e) Prospects and leads outline*

Hvaler at the time of APA application award compared to final licence evaluation, the base case hydrocarbon recoverable reserves have decreased from 3.5 to 2.46 x 10^6 Sm^3 OE total resources due to the refinement of interpretation on new seismic data, updated prospect outline and less hydrocarbon column height. However, the resulting probability of discovery has increase from 17% to 27 %, hence a minor update in the trap risk.

Table 4.1 Hvaler Prospect Table 5

Table 5: Prospect data (Enclose map)

Block	30/4,5,7 & 8	Prospect name	Hvaler	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil&Gas	Reported by company	Aker BP	Reference document				Assessment year	2021
This is case no.:	1 of 1	Structural element	Rungne Sub-Basin	Type of trap	4-way & pinch-out	Water depth [m MSL] (>0)	100	Seismic database (2D/3D)	3D
Resources IN PLACE and RECOVERABLE		**Main phase**				**Associated phase**			
Volumes, this case		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10^6 Sm^3] (>0.00)	1,96	2,61	5,49	10,83	0,00	0,00	0,01	0,01
	Gas [10^9 Sm^3] (>0.00)	0,02	0,03	0,04	0,06	0,13	0,18	0,38	0,76
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	0,76	1,00	2,28	4,61	0,00	0,00	0,00	0,00
	Gas [10^9 Sm^3] (>0.00)	0,01	0,02	0,02	0,03	0,05	0,06	0,16	0,32
Reservoir Chrono (from)	Thanetian	Reservoir litho (from)	Hermod fm	Source Rock, chrono primary	Kimmeridgian	Source Rock, litho primary	Draupne fm	Seal, Chrono	Thanetian
Reservoir Chrono (to)	Thanetian	Reservoir litho (to)	Lista fm	Source Rock, chrono secondary	Callovian	Source Rock, litho secondary	Heather fm	Seal, Litho	Sele fm
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,27	Oil case (0.00-1.00)	0,27	Gas case (0.00-1.00)	0,27	Oil & Gas case (0.00-1.00)	0,27		
Reservoir (P1) (0.00-1.00)	0,80	Trap (P2) (0.00-1.00)	0,48	Charge (P3) (0.00-1.00)	0,70	Retention (P4) (0.00-1.00)	1,00		

Parametres:	Low (P90)	Base	High (P10)
Depth to top of prospect [m MSL] (> 0)		1990	
Area of closure [km^2] (> 0.0)	4,7	9,9	17,0
Reservoir thickness [m] (> 0)	24,5	33,8	44,7
HC column in prospect [m] (> 0)	42	48	55
Gross rock vol. [10^9 m^3] (> 0.000)	0,405	0,466	0,529
Net / Gross [fraction] (0.00-1.00)	0,35	0,42	0,50
Porosity [fraction] (0.00-1.00)	0,22	0,25	0,28
Permeability [mD] (> 0.0)			
Water Saturation [fraction] (0.00-1.00)	0,27	0,22	0,17
Bg [Rm3/Sm3] (< 1.0000)	0,0057	0,0056	0,0054
1/Bo [Sm3/Rm3] (< 1.00)	0,86	0,84	0,82
GOR, free gas [Sm^3/Sm^3] (> 0)			
GOR, oil [Sm^3/Sm^3] (> 0)	61	70	78
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,35	0,41	0,48
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,35	0,41	0,48
Recov. factor, gas main phase [fraction] (0.00-1.00)	0,38	0,46	0,54
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0,35	0,41	0,48
Temperature, top res [°C] (>0)	75		
Pressure, top res [bar] (>0)	200		
Cut off criteria for N/G calculation	1.	2.	3.

Comments:

Mean values have here been used as the base case for the input parameters.

In the petrophysical evaluation of the reservoir parameters for the reference wells, the Thomas Stieber (1975) method was utilised for most of the wells. This method utilises cut-offs for net res fraction and porosity. (Net res fraction is the fraction of the desired facies that is of reservoir quality; net reservoir rock/ net sand).

Gross rock volume is calculated down to the maximum spill point.

Retention (P4) after accumulation, is part of the trap risk.

For NPD use:					
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Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
				Kart nr	NPD will insert value

Hellandfjellet the secondary prospect in the license (Fig. 4.1 and Table 4.2), the Eocene injectite target is an amplitude constrained stratigraphic 3-way pinch-out trap with down dip spill to SE. Geological and geophysical studies downgraded reservoir presence (key risk) for this prospect. The amplitude anomaly is believed to be a lithology effect rather than hydrocarbon indicator. No depth consistent amplitudes are observed.

Other leads H1 (Hermod Fm.), Losholmen (Utsira Fm.), Struten (Hordaland Gp.), Skade Fm. level and Upper Jurassic opportunities have been investigated but considered as very high-risk potential due to [redacted]

Table 4.2 Hellandfjellet Prospect Table 5

Table 5: Prospect data (Enclose map)

Block	30/5 & 30/8	Prospect name	Hellandfjellet	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name	NPD will insert value	New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil&Gas	Reported by company	Aker BP	Reference document				Assessment year	2021
This is case no.:	1 of 1	Structural element	Rungne subbasin	Type of trap	Pinch-out (Stratigra	Water depth [m MSL] (>0)	100	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)	4,04	6,44	8,36	13,66	0,00	0,00	0,00	0,01
	Gas [10^9 Sm^3] (>0.00)	0,01	0,01	0,09	0,23	0,28	0,43	0,58	0,96
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	1,46	2,32	3,77	6,66	0,00	0,00	0,00	0,00
	Gas [10^9 Sm^3] (>0.00)	0,00	0,00	0,04	0,10	0,10	0,17	0,26	0,47
Reservoir Chrono (from)	Ypresian	Reservoir litho (from)	Balder fm	Source Rock, chrono primary	Kimmeridgian	Source Rock, litho primary	Draupne fm	Seal, Chrono	Priabonian
Reservoir Chrono (to)	Lutetian	Reservoir litho (to)	Intra Balder fm ss	Source Rock, chrono secondary	Callovian	Source Rock, litho secondary	Heather fm	Seal, Litho	Grid fm
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,14	Oil case (0.00-1.00)	0,14	Gas case (0.00-1.00)	0,14	Oil & Gas case (0.00-1.00)	0,14		
Reservoir (P1) (0.00-1.00)	0,32	Trap (P2) (0.00-1.00)	0,63	Charge (P3) (0.00-1.00)	0,70	Retention (P4) (0.00-1.00)	1,00		

Parametres:	Low (P90)	Base	High (P10)
Depth to top of prospect [m MSL] (> 0)		1890	
Area of closure [km^2] (> 0.0)	5,7	8,5	11,5
Reservoir thickness [m] (> 0)	22,4	29,1	35,3
HC column in prospect [m] (> 0)	67	73	80
Gross rock vol. [10^9 m^3] (> 0.000)	0,205	0,335	0,478
Net / Gross [fraction] (0.00-1.00)	0,25	0,38	0,51
Porosity [fraction] (0.00-1.00)	0,26	0,29	0,31
Permeability [mD] (> 0.0)			
Water Saturation [fraction] (0.00-1.00)	0,37	0,32	0,27
Bg [Rm3/Sm3] (< 1.0000)	0,0057	0,0056	0,0054
1/Bo [Sm3/Rm3] (< 1.00)	0,86	0,84	0,82
GOR, free gas [Sm^3/Sm^3] (> 0)			
GOR, oil [Sm^3/Sm^3] (> 0)	61	70	78
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,32	0,43	0,53
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,32	0,43	0,53
Recov. factor, gas main phase [fraction] (0.00-1.00)	0,32	0,43	0,53
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0,32	0,43	0,53
Temperature, top res [°C] (>0)	70		
Pressure, top res [bar] (>0)	190		
Cut off criteria for N/G calculation	1.	2.	3.

Comments:

Mean values have here been used as the base case for the input parameters.

In the petrophysical evaluation of the reservoir parameters for the reference wells, the Thomas Stieber (1975) method was utilised for most of the wells. This method utilises cut-offs for net res fraction and porosity. (Net res fraction is the fraction of the desired facies that is of reservoir quality; net reservoir rock/ net sand).

Gross rock volume is calculated down to the maximum spill point.

Retention (P4) after accumulation, is part of the trap risk.

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

5 Technical evaluation

A complete technical evaluation regarding economical value and possible development solution is performed for Hvaler prospect. The most likely host infrastructure for the Hvaler prospect was considered to be the Oseberg Field center located around 25 km to the east. The recoverable volume in Hvaler (mean case 15 MMBOE) is clearly sub-economic and resulted in a negative ENPV.

6 Conclusion

The main prospect, Hvaler (Hermod Fm.) has been thoroughly evaluated through EM, AVO modelling, rock physics, seismic inversion feasibility, geochemical, petroleum system analysis study and technical & economical assessment. The main conclusions from these studies support reservoir presence and HC migration into the prospect, however, top seal is remains as the major risk factor for Hvaler. The technical economical assessment resulted in a negative ENPV.

Secondary prospect Hellandfjellet (Eocene Balder Fm) represents a high-risk prospect with moderate resource potential, de-risking and maturation to a viable drilling candidate has not been succeeded. Other shallow level leads are considered very high-risk opportunities due to lack of geophysical support.

All work commitments on the license have been fulfilled, and the prospectivity within the licence showed very low potential and the partnership is aligned on a negative drill decision. Therefore, the partnership unanimously recommends the relinquishment of PL1047.

7 References