Relinquishment Report PL907

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1 License history

PL907 is located on the northern flank of the Cod Terrace and faulted western margin of the Jæren Terrace. The license area of 492 km^2 covers parts of blocks 7/7, 8, 10 and 11 and includes the existing discovery 7/8-3 (Krabbe) and the shut down Mime field. The license was awarded to Aker BP ASA (40% and operator), Wellesley Petroleum AS (20%), Petoro AS (20%) and Maersk Oil Norway AS (20%) on 02.03.2018 with the initial 3-year phase ending on 02.03.2021 with a Drill or Drop decision. Work program during the initial 3-year phase was reprocessing of 3D seismic and acquiring of 3D seismic. The work program for the 3-year initial phase is regarded fulfilled by the acquisition of the multiclient 3D seismic datasets PGS16008 and PGS18M08CGR. During the license period there have been several adjustments to the partnership. Total E&P Norge AS came in as partner with 20% working interest on 14.05.2018 after Total E&P Norge AS acquired Maersk Oil Norway AS in 2018. Total E&P Norge AS later farmed out of the license and transferred their 20% interest to the operator Aker BP ASA on 30.11.2018. The current licensees consist of Aker BP ASA (60% and operator), Wellesley Petroleum AS (20%) and Petoro AS (20%).

The following PL907 Advisor Committee (AC) Management Committee (MC) and Exploration Committee (EC) meetings have been held:

- 15.03.2018 EC/MC meeting
- 12.06.2018 EC work meeting and core viewing
- 22.11.2018 EC/MC meeting
- 28.01.2019 EC core workshop
- 28.02.2019 EC/MC meeting
- 23.06.2019 AC meeting
- 19.11.2019 AC/MC meeting
- 23.04.2020 MC meeting
- 15.06.2020 EC work meeting
- 18.09.2020 EC work meeting
- 02.12.2020 EC/MC meeting

The license work in PL907 can be divided into two main focuses, the evaluation of the 7/8-3 (Krabbe) discovery and the evaluation of other prospectivity in the license.

Krabbe is an oil discovery with reservoir in the Upper Jurassic Ula fm. P_{50} resource estimate for Krabbe is 2,50 mill OE. Studies were conducted to evaluate the potential of tying the Krabbe discovery back to the Ula field and produce it as a satellite to Ula. Due to the limited resource base in Krabbe and the estimated long-tailed production profile, the Krabbe tie back case was not able to carry the required capex associated to a development case while meeting the Aker BP investment hurdles (e.g. break-even below 35 USD/BBL). The license partnership unanimously decided to stop the development project after recommendations by the operator in the 23.04.2020 MC meeting.

Several prospects are identified and de-risked as a part of PL907. The main focus for the evaluation of remaining prospectivity has been on maturing prospects in the under-explored intra-Triassic stratigraphy, upper Jurassic Ula fm and the Paleocene Fortis fm. Learnings and observations from the nearby UK fields such as Judy, Heron, Pierse, Lomond, Everest and Arran have been incorporated in the maturation of Triassic and Paleocene prospects. The key observation relevant for Triassic has been the recognition that regionally extensive shales, such as the Julius Mudstone, have the potential to form effective intra-Triassic top-seals to trap

hydrocarbons within structural-stratigraphic closures. The primary prospect in the license is the Triassic Fire Ant prospect. The Fire Ant Structure is the Triassic structure with the most favourable location for hydrocarbons migrating into it and it contain the most attractive volumes. There are several similar follow-up opportunities which share the same geological model with Fire Ant and would have been significantly de-risked with a success at Fire Ant. Also the location and possibility to target the Paleocene Bull Ant prospect as a secondary objective for a potential exploration well made Fire Ant specially attractive. After the initial license phase, the remaining exploration prospectivity in PL907 is a combination of prospects with low volume potential and high risks. The license partnership unanimously decided to drop the license in front of the Drill or Drop deadline in the 08.12.2020 EC/MC meeting.

2 Database

2.1 Seismic data

The common seismic database in PL907 consist of two surveys, the PGS18M08CGR which was planned, acquired and processed by PGS in cooperation with the PL907 license and PGS16008. More detail about PGS18M08CGR is described in 3 Geological and geophysical studies. A summary of the license common seismic database is listed in Table 2.1 and spatial coverage of the surveys are shown in Fig. 2.1.

Table 2.1 Common Seismic Database

Survey	Type	Year	Status
PGS16008	3D	2016	MultiClient
PGS18M08CGR	3D	2018	MultiClient

Fig. 2.1

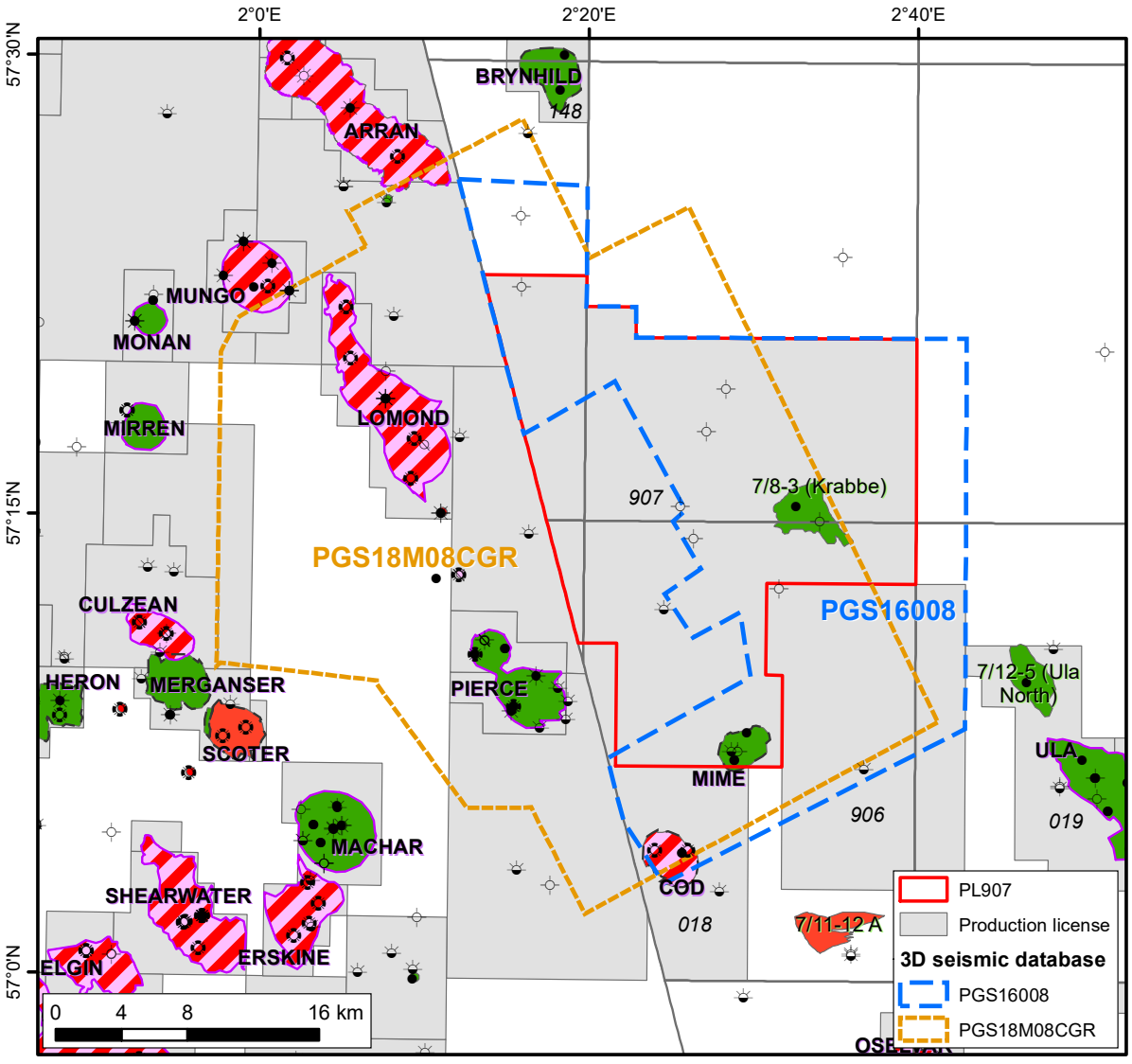

Fig. 2.1 Common Seismic Database

2.2 Well Data

The common well database is listed in Table 2.2 and location of wells are shown in Fig. 2.2.

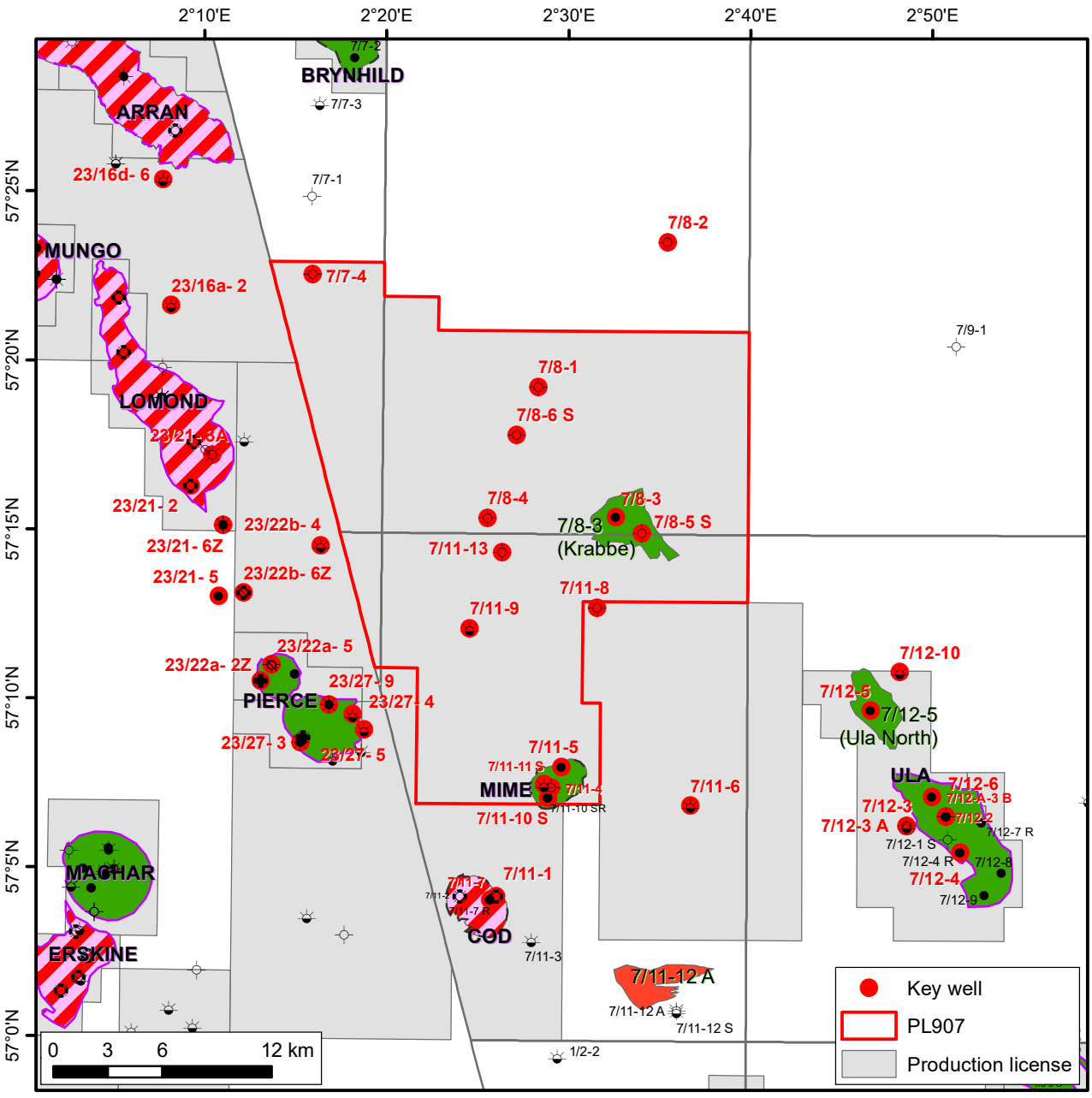

Fig. 2.2 Common Well Database

For UK wells only data and studies publicly available at OGA website (http://data-ogauthority.opendata.arcgis.com/) are included in the common database and only 2 year released data are included for the Norwegian wells younger than 20 years with the exception of well 7/8-5 S that was drilled by Talisman Energy Norge AS in 2005. For 7/8-5 S the completion report is not publicly released and it contains a discussion of pressure data and possible oil water contacts in the Krabbe Discovery in addition to information on fluid samples taken in 7/8-5 ST2. The information obtained from this report were important for the evaluation of Krabbe since the pressures and

fluid sampling influences the OWC range and petrophysical evaluation of both wells 7/8-3 and 7/8-5 ST2. Therefore non-public data from the 7/8-5 S well was included in the common well database.

Table 2.2 Common Well Database

Wellbore name	Compl. year	TD Strat.	Content	HC level (Formation)	Drilling operator	Field / Discovery
23/16a-2*	1988		Oil shows			
23/16d-6*	1994		Oil shows			
23/21-2*	1974		Gas/ Condensate		Chrysaor Limited	Lomond
23/21-3A*	1984		Oil		Chrysaor Limited	Lomond
23/21-5*	2008		Oil	Forties Fm	Chrysaor Limited	
23/21-6Z*	2008		Gas/ Condensate		Chrysaor Limited	
23/22a-2Z*	1990		Oil		Britoil Limited	Pierce
23/22a-5*	2007		Oil/Gas		Shell U.K. Limited	Pierce
23/22b-4*	1992		Shows		Eni Uk Limited	
23/22b-6Z*	2013		Gas/ Condensate		Conocophillips (U.K.) Limited	
23/27-3*	1987		Oil/Gas		Shell U.K. Exploration & Production Limited	Pierce
23/27-4*	1978		Oil shows			
23/27-5*	1983		Oil shows			
23/27-9*	1997		Oil/Gas		Shell U.K. Exploration & Production Limited	Pierce
7/7-4**	2007	Ekofisk Fm	Dry		BG Norge AS	
7/8-1	1969	Gassum Fm	Dry		Phillips Petroleum Company Norway	
7/8-2	1973	Zechstein Gp	Dry		Phillips Petroleum Company Norway	
7/8-3	1983	Zechstein Gp	Oil	Ula Fm	Conoco Norway Inc.	Krabbe
7/8-4	1985	Smith Bank Fm	Dry		Conoco Norway Inc.	
7/8-5 S***	2006	Skagerrak Fm	Dry		Talisman Energy Norge AS	Krabbe
7/8-6 S	2012	Tor Fm	Dry		LOTOS Exploration and Production Norge AS	
7/11-1	1968	Zechstein Gp	Gas/ Condensate	Intra Balder Fm Ss Forties Fm	Phillips Petroleum Company Norway	Cod
7/11-4	1969	Tor Fm	Dry		Phillips Petroleum Company Norway	Mime
7/11-5	1982	Smith Bank Fm	Oil	Ula Fm	Norsk Hydro Produksjon AS	Mime
7/11-6	1984	Smith Bank Fm	Shows		Norsk Hydro Produksjon AS	
7/11-7	1983	Zechstein Gp	Oil	Forties Fm Ula Fm	Phillips Petroleum Company Norway	Cod
7/11-8	1983	Smith Bank Fm	Dry		Norsk Hydro Produksjon AS	
7/11-9	1986	Smith Bank Fm	Shows		Norsk Hydro Produksjon AS	
7/11-10 S	1990	Smith Bank Fm	Oil	Ula Fm	Norsk Hydro Produksjon AS	Mime
7/11-11 S**	2007	Smith Bank Fm	Oil Shows	Ula Fm	Talisman Energy Norge AS	Mime
7/11-13**	2012	Skagerrak Fm	Dry		Det norske oljeselskap ASA	

7/12-2	1976	Gassum Fm	Oil	Ula Fm Gassum Fm	BP Norway Limited U. A.	Ula
7/12-3	1977	Ula Fm	Dry		BP Norway Limited U. A.	Ula
7/12-3 A	1977	Zechstein Gp	Oil Shows		BP Norway Limited U. A.	Ula
7/12-4	1977	Bryne Fm	Oil	Ula Fm	BP Norway Limited U. A.	Ula
7/12-5	1981	Zechstein Gp	Oil	Ula Fm	BP Norway Limited U. A.	Ula North
7/12-6	1981	Skagerrak Fm	Oil	Ula Fm Skagerrak Fm	BP Norway Limited U. A.	Ula
7/12-10	1991	Skagerrak Fm	Oil Shows		BP Norway Limited U. A.	Ula North
7/12-A-3 B**	2010		Oil	Ula Fm Skagerrak Fm	BP Norge AS	Ula

* *For UK side use data and studies publicly available at OGA website (http://data-ogauthority.opendata.arcgis.com/)*

** *Only 2 year released data included in Common Well Database*

*** Non-public data included in the Common Well Database

3 Geological and geophysical studies

The license work in PL907 can be divided into two main focuses, the evaluation of the 7/8-3 (Krabbe) discovery and the evaluation of other prospectivity in the license.

Krabbe evaluation

Work performed in the evaluation of Krabbe:

- G&G work:
  - Seismic interpretation (new seismic)
  - Geophysical studies
  - Biostratigraphy study
  - Core description and depositional model
  - Geomodelling – static and dynamic modelling
- Drilling and well
- Facilities with the evaluation of tie-back solution to the Ula field
- Financial evaluation
- DG1 documentation

Geophysical Evaluation Krabbe

The seismic interpretation of the Krabbe Discovery was performed on the seismic dataset PGS16008. Over the bulk of the Krabbe structure the confidence in the seismic interpretation is moderate to high, whereas the interpretation over the margins of the discovery is more uncertain. One of the key questions for understanding the volume potential of the discovery is to understand where and how the Ula formation is pinching out. To achieve a better control on the seismic interpretation and the mapping of the Ula Formation in particular, a thorough geophysical work was performed. The work included:

- Detailed analysis of seismic well ties for well 7/8-3, 7/8-5 ST2, 7/8-4, 7/8-11 and 7/11-13. The purpose has been to sort, systematize and understand the observed variations in seismic response and understand how these variations relate to variations in stratigraphy and lateral extent of the Ula Formation.
- Wedge modelling: Wedge models based on both wells 7/8-3 and 7/8-5 ST2, in order to investigate tuning effects and seismic response where the Ula Formation or the Farsund Formation are pinching-out.
- Bluing: Performed to increase seismic resolution at target level. This volume formed a support volume for seismic interpretation.
- Coloured Inversion: Performed to better visualize Ula sand package.
- Full Bandwidth AVO Inversion: Performed to delineate Ula sandstone distribution

A potential upside area was identified to the west of the Krabbe Discovery. However, based on the geophysical studies listed above, it seems unlikely that the Ula sandstone is present in this upside area, unless the Ula sandstone is thinner than the seismic resolution.

Biostratigraphy study

A joint license study with PL 906 was performed for the Ula Formation in the area. This work was undertaken by RPS Ichron. This study shows that the Ula Fm in wells 7/8-3 and 7/8-5S is of Kimmeridgian to Volgian age (J62-J64, Partington et al. 1993), where J62 is only preserved in the lower 2m. Well 7/8-5.

Core description and depositional model

A joint license study with PL 906 was performed for the Ula Formation in the area. The study showed that the basal Ula Formation in well 7/8-3 represents a transgressive unit establishing a marine depocentre at the well location. Above this the core study showed that an offshore bar complex to shoreface formed the depositional setting for the bulk of the Ula Formation in the area. In this setting the main inhibiting factor of reservoir quality along the Ula Trend is the presence of quartz cements (i.e. quartz overgrowths), which in part is due to the often-significant burial depths of the reservoir sections (c. 3.5 -3.9 km in the Ula Field area and >4 km in the Tambar-Gyda area). However, there is the potential for excellent porosity preservation in the Ula Formation. One important mechanism is the dissolution of sponge spicules. The presence of dissolved sponge spicules are not proved in well 7/8-3 but other wells in the area show that this is an important mechanism in preserving porosities. In well 7/8-3, carbonate cement is also abundant, but is more likely to represent baffles rather than barriers.

Remaining prospectivity

The main focus for the evaluation of remaining prospectivity has been on maturing prospects in the under-explored intra-Triassic stratigraphy, upper Jurassic Ula fm and the Paleocene Fortis fm:

- G&G work:
  - Follow up and contribute to the planning, acquisition and processing of the multiclient PGS18M08CGR seismic dataset
  - Seismic interpretation and mapping
  - Geophysical studies
  - Depositional model and GDE
  - Petroleum system modelling
  - Volume and risk assessment
- Technical-economic evaluation

Seismic Acquisition and processing

The PL907 license group decided to acquire (buy) the multiclient 3D seismic dataset PGS16008 for geophysical studies, detailed mapping and semi-regional mapping related to the development evaluation on Krabbe. Due to diving activities when acquiring the PGS16008 dataset, there was a data hole in the survey in the location where the main prospects of PL907 were located. The license group therefore agreed with PGS to acquire new broadband multiclient 3D seismic dataset over the western part of the license to fill in the data hole and extend the broadband survey to cover the UK fields Pierce and Lomond. The agreement also included that AkerBP had the rights to review processing tests and provide input to PGS regarding both the processing flow for the processing and advice on processing parameters. This cooperation turned out to be very useful in terms of combining geological and geophysical expertise from both parties to get as good data as possible on the target intervals. PGS started to acquire the dataset in 2018, but due to bad weather and new diving operations on the UK side, the planned 2018 acquisition was not finished. Evaluations were taken to either complete acquisition in 2019 or reprocess and merge in older datasets to cover the area not covered by the new acquisition. Since the main prospects of PL907

were covered by the new acquisition, and with sufficient migration aperture to get good data over the prospects, PGS and Aker BP agreed to go for the solution of merging in old datasets to get the agreed seismic coverage. The final data was delivered May 2020 and incorporated to the mapping and de-risking of the prospects within the license.

Petroleum System Modelling

Petroleum system modelling has been performed to calculate charge and volume history for the respective prospects. Two different temperature models were used, one 39°C/km based on DSTs from Krabbe, Mime and Brynhild and one based on a 35°C/km plus scalar. Calibration to R_0 maps and results from wells further to the east favoured the latter model. Different source rock thicknesses were applied, one model with constant 25 m thickness and one model based on isopach values for the Upper Jurassic shales. Minimum and maximum fetch areas for the respective prospects were then used to calculate charge and volume history, resulting in 8 different charge and volume outcomes per prospect. These outcomes were used in assessing the source and migration risk for the prospects. Results from the modelling based on 35°C/km are summarized in .

Table 3.1 Charge and volume history *Charge and volume history for the prospects in PL907 based on a 35deg C/km plus scalar temperature model*

Geothermal gradient: 35°C/km + scaler 0.98-1.15								
Prospect	**Reservoir Age**	**Fetch Area**	**Fetch Area (km2)**	**Source**	**Oil (MMBLS)**	**Gas (BCF)**	**Gas (boe)**	**GOR (scf/bbl)**
Bulldog Ant	Paleocene	Min	13.75	Mandal 25 m	20.25	4.35	0.75	214.69
Bulldog Ant	Paleocene	Max	16.95	Mandal 25 m	23.12	5.08	0.88	219.83
Bulldog Ant	Paleocene	Min	13.75	Mandal Isopach	51.06	10.16	1.75	198.98
Bulldog Ant	Paleocene	Max	16.95	Mandal Isopach	52.94	10.64	1.83	201.05
Bull Ant	Paleocene	Min	55.75	Mandal 25 m	122.99	43.34	7.47	352.33
Bull Ant	Paleocene	Max	106.51	Mandal 25 m	111.47	39.42	6.80	353.59
Bull Ant	Paleocene	Min	55.75	Mandal Isopach	294.24	122.89	21.19	417.67
Bull Ant	Paleocene	Max	106.51	Mandal Isopach	258.47	110.70	19.09	428.31
Green Tree Ant	Jurassic	Min/Max	4.29	Mandal 25 m	0.33	0.08	0.01	252.36
Green Tree Ant	Jurassic	Min/Max	4.29	Mandal Isopach	0.66	0.17	0.03	255.74
Ghost Ant	Jurassic	Min/Max	4.15	Mandal 25 m	0.76	0.41	0.07	547.13
Ghost Ant	Jurassic	Min/Max	4.15	Mandal Isopach	3.65	2.14	0.37	586.52
Black Ant	Triassic	Min	4.17	Mandal 25 m	8.37	1.87	0.32	223.92
Black Ant	Triassic	Max	10.16	Mandal 25 m	24.43	5.57	0.96	228.03
Black Ant	Triassic	Min	4.17	Mandal Isopach	17.43	3.79	0.65	217.64
Black Ant	Triassic	Max	10.16	Mandal Isopach	42.18	9.23	1.59	218.79
Fire Ant	Triassic	Min	3.69	Mandal 25 m	7.37	1.50	0.26	203.05
Fire Ant	Triassic	Max	21.73	Mandal 25 m	43.86	22.12	3.81	504.29
Fire Ant	Triassic	Min	3.69	Mandal Isopach	15.43	3.02	0.52	195.48
Fire Ant	Triassic	Max	21.73	Mandal Isopach	120.95	74.68	12.88	617.47
Sugar Ant	Triassic	Min	6.25	Mandal 25 m	16.20	6.91	1.19	426.49
Sugar Ant	Triassic	Max	19.81	Mandal 25 m	51.79	25.67	4.43	495.58
Sugar Ant	Triassic	Min	6.25	Mandal Isopach	42.63	20.26	3.49	475.18
Sugar Ant	Triassic	Max	19.81	Mandal Isopach	159.84	90.17	15.55	564.17

4 Prospect update

The main focus for the evaluation of remaining prospectivity has been on maturing prospects in the under-explored intra-Triassic stratigraphy, upper Jurassic Ula fm and the Paleocene Fortis fm.

Intra-Triassic

The under-explored intra-Triassic stratigraphy has been matured by applying learnings from the Triassic fields in the UK sector. The key observation has been the recognition that regionally extensive shales, such as the Julius Mudstone, have the potential to form effective intra-Triassic top-seals to trap hydrocarbons within structural-stratigraphic closures. During the license period the intra-Triassic stratigraphy has been correlated from wells and into the prospects with higher confidence than in the application for award due to better seismic data. Also structural evolution, traps and geometries of the prospects have been interpreted with higher confidence as well as the HC fetch areas and migration routes into the prospects.

The Fire Ant prospect has been the main focus due to the most attractive combined volume and risk estimates. The Fire Ant prospect has reservoir in Early to Middle Triassic Judy and Bunter aged sandstones. The prospect is predominantly structural in nature, defined by a structural culmination on the western margin of a prominent Triassic high. The presence of intra-formational seal in the Triassic stratigraphy has been proven to work in Triassic accumulations in the UK sector and Fire Ant is interpreted to be a prospect consisting of an upper and lower segment separated by an intra-formational seal.

The main changes for the Fire Ant prospect relative to the assessment prior to application for reward is that new mapping lead to a significant reduction in the GRV and reservoir quality. The new maps revealed a steeper structure than first anticipated in addition to more structural deformation close to the western bounding fault. Mapping also showed thinning of the Judy and Bunter aged sandstones in the up-dip direction on the Fire Ant structure. This is interpreted to be caused by gradual rotation of the Triassic pod during deposition of the sandstones. As the fluvial systems tends to follow topography, the thicker and cleaner sands are expected to be deposited towards the depocenter where the Intra Triassic package is thicker rather than where it thins. New mapping of the HC fetch areas and migration routes into the Fire Ant prospect and the updated petroleum system modelling (3 Geological and geophysical studies) resulted in increased risk for hydrocarbons migrating into the structure where fire Ant is sitting. Fire Ant is dependent on local small kitchen areas with torturous and possibly heterogenous, both in terms of it's inherent depositional setting and minor faults and fractures creating baffles and barriers along the migration routes from the kitchens to the Fire Ant structure. In sum this indicates thinner and poorer reservoir sandstones on a more deformed structure at the location of the Fire Ant prospect, which reduced the estimated volumes in the current assessment relative to the APA 2017 assessment as well as higher risk on reservoir quality and hydrocarbon charge. Final volumes for the Fire Ant prospect are 2,45 - 7,76 - 14,5 * 10^6 Sm^3 OE inplace (P_{90} - P_{mean} - P_{10}) and 0,66 - 2,47 - 4,82 * 10^6 Sm^3 OE recoverable resources (P_{90} - P_{mean} - P_{10}). The probability of success is 0.19. The prospect data are summarized in Table 4.1.

Table 4.1 Fire Ant Prospect Data

Table 4: Discovery and Prospect data (Enclose map)

Block	7/7	Prospect name	Fire Ant	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	Aker BP	Reference document	PL907 Relinquishment Report			Assessment year	2021
This is case no.:	1 of 1	Structural element	Cod Terrace	Type of trap	1.1 Fault-dependen	Water depth [m MSL] (>0)	80	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)	1.44	2.08	3.89	7.39	0.00	0.00	0.00	0.00
	Gas [10^9 Sm^3] (>0.00)	0.00	0.00	0.00	0.00	0.28	0.44	0.77	1.46
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	0.36	0.57	1.24	2.48	0.00	0.00	0.00	0.00
	Gas [10^9 Sm^3] (>0.00)	0.00	0.00	0.00	0.00	0.07	0.12	0.25	0.49
Reservoir Chrono (from)	Anisian	Reservoir litho (from)	Smith Bank fm	Source Rock, chrono primary	Kimmeridgian	Source Rock, litho primary	Mandal fm	Seal, Chrono	Carnian
Reservoir Chrono (to)	Carnian	Reservoir litho (to)	Skagerrak fm	Source Rock, chrono secondary		Source Rock, litho secondary		Seal, Litho	Skagerrak 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)	0.00	Oil & Gas case (0.00-1.00)	0.00		
Reservoir (P1) (0.00-1.00)	0.50	Trap (P2) (0.00-1.00)	0.54	Charge (P3) (0.00-1.00)	0.50	Retention (P4) (0.00-1.00)	1.00		

Parametres:	Low (P90)	Base	High (P10)
Depth to top of prospect [m MSL] (> 0)	3715	3715	3715
Area of closure [km^2] (> 0.0)	0.9	1.9	3.3
Reservoir thickness [m] (> 0)	141	215	288
HC column in prospect [m] (> 0)	230	304	385
Gross rock vol. [10^9 m^3] (> 0.000)	1.895	4.046	4.859
Net / Gross [fraction] (0.00-1.00)	0.30	0.40	0.50
Porosity [fraction] (0.00-1.00)	0.14	0.16	0.19
Permeability [mD] (> 0.0)			
Water Saturation [fraction] (0.00-1.00)	0.40	0.35	0.30
Bg [Rm3/Sm3] (< 1.0000)			
1/Bo [Sm3/Rm3] (< 1.00)	0.65	0.61	0.57
GOR, free gas [Sm^3/Sm^3] (> 0)			
GOR, oil [Sm^3/Sm^3] (> 0)	150	200	250
Recov. factor, oil main phase [fraction] (0.00-1.00)	0.21	0.30	0.40
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0.21	0.30	0.40
Recov. factor, gas main phase [fraction] (0.00-1.00)			
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)			

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.

Temperature, top res [°C] (>0)	160			For NPD use:					
Pressure, top res [bar] (>0)	650			Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert	NPD will insert value
Cut off criteria for N/G calculation	1. Vcl < 0.5	2. PHIE > 0.1	3.	Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato	NPD will insert value
								Kart nr	NPD will insert value

Upper Jurassic

Two Jurassic prospects are evaluated in PL907, the Ghost Ant prospect and the Green Tree Ant prospect. Both prospects are located on the eastern flank of the Cod Terrace and have reservoir in Upper Jurassic shallow marine Ula Formation. The prospects are reliant on Ula Formation sands being preserved at the crest of salt diapirs and located between grounded Triassic pods. Regional understanding, learnings and knowledge form the Ula field and the evaluation of the Krabbe discovery that shears the same depositional model has been applied to the Upper Jurassic prospect evaluation. Important observations are also linked to the Brynhild accumulation to the north that shares many similar features, including a salt cored structure an intra-pod setting with an Ula Formation depositional valley and a stratigraphic trap.

The Ghost Ant Prospect has been the Upper Jurassic prospect with highest volume and risk potential. The prospect is a combination structural and stratigraphic trap which lies adjacent to the Fire Ant Triassic High and separated from it by a likely sealing fault. The structure is salt cored with a sequence of Upper Jurassic Farsund, Mandal and Ula Formation sandstones prognosed. The trap is created via down-thrown fault seal to the east, up-thrown fault seal to the west and stratigraphic pinchout to the north, with a limited independent 4 way dip closure.

New seismic mapping gave more insight to the structuration and possible sediment fill in the Upper Jurassic intra-pod. Area of potential Upper Jurassic Ula fm sandstones are reduced relative to the APA2017 assessment. The prospect is divided into a northern and southern part separated by Triassic sediments or salt. The seismic facies of the northern part indicate a classic infill above a collapsed diapir giving high probability of Ula fm sandstones being present, while the southern part is more wedge shaped and can also be interpreted as Triassic fluvial infill. The reservoir sands are located close to or in contact with the underlying salt. This may lead to high salinities in the fluids and become a challenge for production as seen in the Mime field and as evaluated for the Krabbe discovery. Due to indications of limited resources in the Ghost Ant prospect a direct volume comparison based on volume divided on area in the 7/8-3 (Krabbe) discovery was performed rather than a full volume assessment. The reservoir thickness is estimated to be less in the Ghost Ant prospect than in Krabbe indicating that the direct volume comparison is optimistic. The volume estimate for the Ghost Ant prospect is 4,9 $* 10^6$ Sm^3 OE recoverable resources with a probability of success at 0.25. This is not viewed as an attractive opportunity and no further de-risking was performed on the Ghost Ant prospect. The Green Tree Ant prospect is less prominent than the Ghost Ant prospect and was not further pursued after finishing the evaluation of the Ghost Ant prospect. The prospect data are summarized in Table 4.2.

Table 4.2 Ghost Ant Prospect Data

Table 4: Discovery and Prospect data (Enclose map)

Block	7/7	Prospect name	Ghost Ant	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	Aker BP	Reference document	PL907 Relinquishment Report			Assessment year	2020
This is case no.:	1 of 1	Structural element	Cod Terrace	Type of trap	1.1 Fault-dependent	Water depth [m MSL] (>0)	80	Seismic database (2D/3D)	3D
Resources IN PLACE and RECOVERABLE		**Main phase**				**Associated phase**			
Volumes, this case		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10^6 Sm^3] (>0.00)	2.62	2.62	2.62	2.62				
	Gas [10^9 Sm^3] (>0.00)					0.11	0.11	0.11	0.11
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	0.75	0.75	0.75	0.75				
	Gas [10^9 Sm^3] (>0.00)					0.03	0.03	0.03	0.03
Reservoir Chrono (from)	Oxfordian	Reservoir litho (from)	Ula fm	Source Rock, chrono primary	Volgian	Source Rock, litho primary	Mandal fm	Seal, Chrono	Volgian
Reservoir Chrono (to)	Volgian	Reservoir litho (to)	Ula fm	Source Rock, chrono secondary	Kimmeridgian	Source Rock, litho secondary	Farsund fm	Seal, Litho	Farsund fm
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0.25	Oil case (0.00-1.00)	0.25	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)	0.56	Charge (P3) (0.00-1.00)	0.80	Retention (P4) (0.00-1.00)	1.00		
Parametres:	Low (P90)	Base	High (P10)	*Comments: Due to indications of limited resources in the Ghost Ant prospect a direct volume comparison based on volume divided on area in the 7/8-3 (Krabbe) discovery was performed rather than a full volume assessment.*					
Depth to top of prospect [m MSL] (> 0)	3715	3715	3715						
Area of closure [km^2] (> 0.0)	1.4	1.4	1.4						
Reservoir thickness [m] (> 0)									
HC column in prospect [m] (> 0)									
Gross rock vol. [10^9 m^3] (> 0.000)									
Net / Gross [fraction] (0.00-1.00)									
Porosity [fraction] (0.00-1.00)									
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)									
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)									
GOR, free gas [Sm^3/Sm^3] (> 0)									
GOR, oil [Sm^3/Sm^3] (> 0)									
Recov. factor, oil main phase [fraction] (0.00-1.00)									
Recov. factor, gas ass. phase [fraction] (0.00-1.00)									
Recov. factor, gas main phase [fraction] (0.00-1.00)									
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)				For NPD use:					
Temperature, top res [°C] (>0)	155			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)	675			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. Vcl < 0.5	2. PHIE > 0.1	3.					Kart nr	NPD will insert value

Paleocene

The Paleocene Forties sandstones represents a mature play in the area. The Bull Ant prospect is evaluated within the license area. Bull Ant is sitting on or close to the eastern pinch out line of the Fortis Sand and share many similarities with the fields and discoveries along depositional strike to the north and west, specially the UK Arran field is regarded as an important analogue.

The Bull Ant Prospect is a 4-way structure with an upside potential with stratigraphic trap where the Forties sandstones are pinching out to the east. The Bull Ant prospect shares many similarities with discoveries along depositional strike to the north west (e.g. Arran and Everest fields). Its favourable position directly above the Fire Ant Prospect was seen as positive with the possibility for it to be a stacked target for an exploration well in combination with Fire Ant.

New seismic mapping has been performed with the aim of mapping out the sand fairway for the Paleocene turbidite system. Thickness anomalies on the Paleocene isochron maps correlates well with presence of sandstones. This has been used in combination with reflectivity data, colour inverted data as well as impedance volumes to best identify the sand fairways. Results of the fairway mapping give low probability of finding reservoir sands in the Bull And prospect. If sand is present, heterogeneous distal or fringe facies is expected with stacked cycles of varying reservoir quality.

Results from petroleum system modelling shows good possibility for sufficient hydrocarbon expulsion into the Paleocene interval, but migration of hydrocarbon into the area of Bull Ant is regarded less likely. It is seen as a challenge to migrate hydrocarbons perpendicular to the reservoir fairway trend, specially when there are indications of a hydrodynamic system tilting the hydrocarbon contact in Pierse in the north-westward direction. The structural spill point of Pierce is interpreted to be in the direction of Bull Ant, but pre-production spillage was interpreted to the northwest due to the hydrodynamic spill [1].

Updated volume and risk assessment gives volumes of 1,8 – 4,22 – 7,24 * 10^6 Sm^3 OE inplace (P_{90} - P_{mean} - P_{10}) and 0,62 – 1,48 – 2,57 * 10^6 Sm^3 OE recoverable (P_{90} - P_{mean} - P_{10}) with a probability of success at 0.12. Specially risk for reservoir presence and migration has increased, relative to APA2017 assessment, based on the arguments above leading to the reduced probability of success. The prospect data are summarized in Table 4.3.

Table 4.3 Bull Ant Prospect Data

Table 4: Discovery and Prospect data (Enclose map)

Block	7/7	Prospect name	Bull Ant	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	Aker BP	Reference document	PL907 Relinquishment Report			Assessment year	2021
This is case no.:	1 of 1	Structural element	Cod Terrace	Type of trap	1.2 Anticlinal traps	Water depth [m MSL] (>0)	80	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)	1.59	2.52	3.64	6.30				
	Gas [10^9 Sm^3] (>0.00)					0.23	0.37	0.55	0.94
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	0.54	0.86	1.27	2.21				
	Gas [10^9 Sm^3] (>0.00)					0.08	0.13	0.19	0.33
Reservoir Chrono (from)	Danian	Reservoir litho (from)	Lista fm	Source Rock, chrono primary	Volgian	Source Rock, litho primary	Mandal fm	Seal, Chrono	Thanetian
Reservoir Chrono (to)	Thanetian	Reservoir litho (to)	Sele fm	Source Rock, chrono secondary	Kimmeridgian	Source Rock, litho secondary	Farsund fm	Seal, Litho	Sele fm
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)	0.24	Trap (P2) (0.00-1.00)	0.72	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)	2895	2895	2895
Area of closure [km^2] (> 0.0)	2.3	5.0	8.7
Reservoir thickness [m] (> 0)	15	20	25
HC column in prospect [m] (> 0)	40	48	55
Gross rock vol. [10^9 m^3] (> 0.000)	0.100	0.114	0.126
Net / Gross [fraction] (0.00-1.00)	1.00	1.00	1.00
Porosity [fraction] (0.00-1.00)	0.13	0.16	0.19
Permeability [mD] (> 0.0)			
Water Saturation [fraction] (0.00-1.00)	0.35	0.30	0.25
Bg [Rm3/Sm3] (< 1.0000)	0.0000	0.0000	0.0000
1/Bo [Sm3/Rm3] (< 1.00)	0.70	0.68	0.67
GOR, free gas [Sm^3/Sm^3] (> 0)			
GOR, oil [Sm^3/Sm^3] (> 0)	124	150	176
Recov. factor, oil main phase [fraction] (0.00-1.00)	0.30	0.35	0.40
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0.30	0.35	0.40
Recov. factor, gas main phase [fraction] (0.00-1.00)			
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)			
Temperature, top res [°C] (>0)	105		
Pressure, top res [bar] (>0)	390		
Cut off criteria for N/G calculation	1. Vcl < 0.5	2. PHIE > 0.1	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

Significant efforts were made to mature the Krabbe discovery past DG1. Several drainage concepts were evaluated in depth through static and dynamic modelling and uncertainty analysis. Depletion, water injection, gas injection and WAG combined with a range of well concepts were concepts tested. Unfortunately, none of these could be proved economically viable to justify progressing the project towards concept select and DG2.

For the reminding prospectivity in the license no development planning was undertaken. On account of the relatively low volume and high geological risk these opportunities were not considered attractive drill candidates and it was apparent that no development realisation would result a commercially viable or attractive outcome.

6 Conclusion

The work carried out in PL907 can be divided into two phases:

- Evaluation of the Krabbe discovery
- Evaluation of the exploration potential in the license

The project of tying the Krabbe discovery back to the Ula field was stopped at DG1 with the conclusion of uneconomic development due to the limited resource base in Krabbe and the estimated long-tailed production profile.

The remaining exploration prospectivity in PL907 is a combination of prospects with low volume potential and high risks.

All work commitments on the licence have been fulfilled, and with no expectation for an economically viable development case of the Krabbe discovery or identification of a drill-worthy prospect candidate, the partnership unanimously
recommends the relinquishment of PL907.

7 References

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References

1 Moss et al. (2003), Millennium Atlas p. 770.