Relinquishment report

PL 609 C

Lundin Energy Norway

In cooperation with Lundin Energy Norway

wintershall dea

idemitsu

Table of Contents

List of Figures

List of Tables

1 License history

PL609 C is located on the Loppa High, immediately northeast of the Alta discovery in PL609 (Fig. 1.1). The license covers 322 km^2 in blocks 7220/12 and 7221/10.

PL609 C was awarded as part of the 23rd Concession Round on 10th of June 2016 to Lundin Norway AS (40% and operator), Idemitsu Petroleum Norge AS and DEA Norge AS (30% each).

Effective from 30th of November 2020 the PL609 C partnership comprised Lundin Energy Norway AS (55%), Idemitsu Petroleum Norge AS (15%) and Wintershall Dea Norge AS (30%).

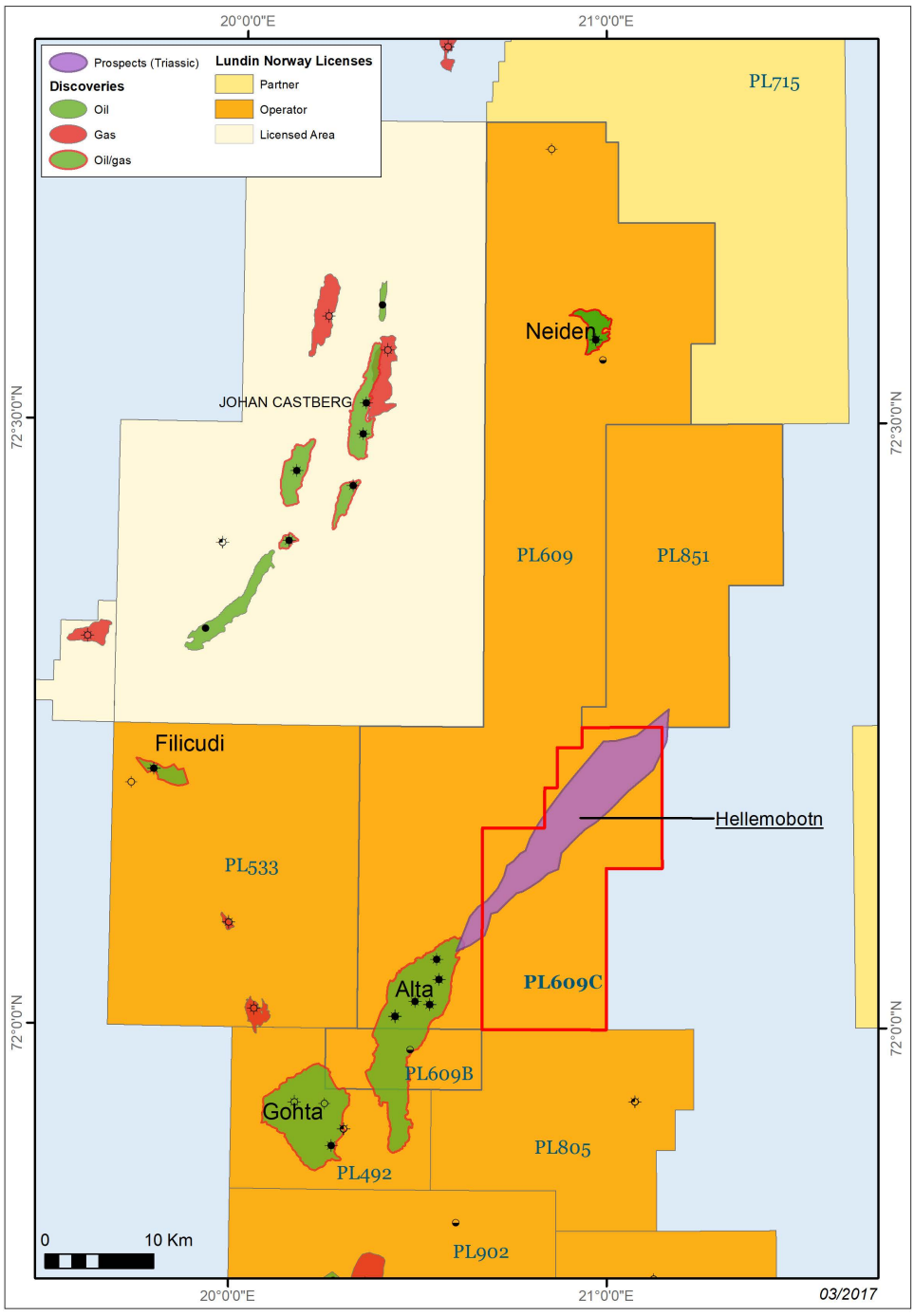

Fig. 1.1 Location map
PL609 C location map at the time of award in 2016. Lundin-operated licenses in orange color

The work commitments comprised G&G studies before a drill-or-drop within 1 year. The license obtained three extensions of the license period so the final deadline for the drill-or-drop decision was 10th of May 2021.

The work commitments in the license have been fulfilled. No drilling candidates has been identified and the license was relinquished as of 11th of May 2021.

The license committe meetings held in the partnership are listed below in Table 1.1.

Table 1.1 License committee meetings

Committee	Date
MC/EC combined	23rd June 2016
EC work meeting	27th October 2017
MC/EC combined	22nd November 2017
MC/EC combined	19th November 2018
MC/EC combined	28th November 2019
MC/EC combined	23rd November 20120
MC/EC combined	10th February 2021

2 Data base overview

2.1 Seismic data

The PL609 C license is fully covered by the DOL14001 multiclient 3D survey. The partnership licensed some 2500 km² of the survey for the 23rd application evaluation and reprocessed the DOL14001 survey together with the SG9810 survey, creating the LN15M02 survey covering multiple licenses on the Loppa High from the Gohta and Alta discoveries in the south and northwards to PL609 C and PL851. Having access to a large, consistent 3D dataset gave the partnership the possibility to tie to multiple wells over a large area.

The license seismic database is listed in the table below and shown in Fig. 2.1.

Table 2.1 Seismic database

Seismic survey	NPD ID	Owner	Area (sqkm)	Survey type	Market available	Multiclient	Processing year
LN15M02:	N/A	PL609	2895	Merge	No	No	2015
DOL14001	8006	TGS	2502	3D (underlying to merge)	Yes	Yes	2014
SG9810	3942	Equinor	393	3D (underlying to merge)	Yes	No	1998

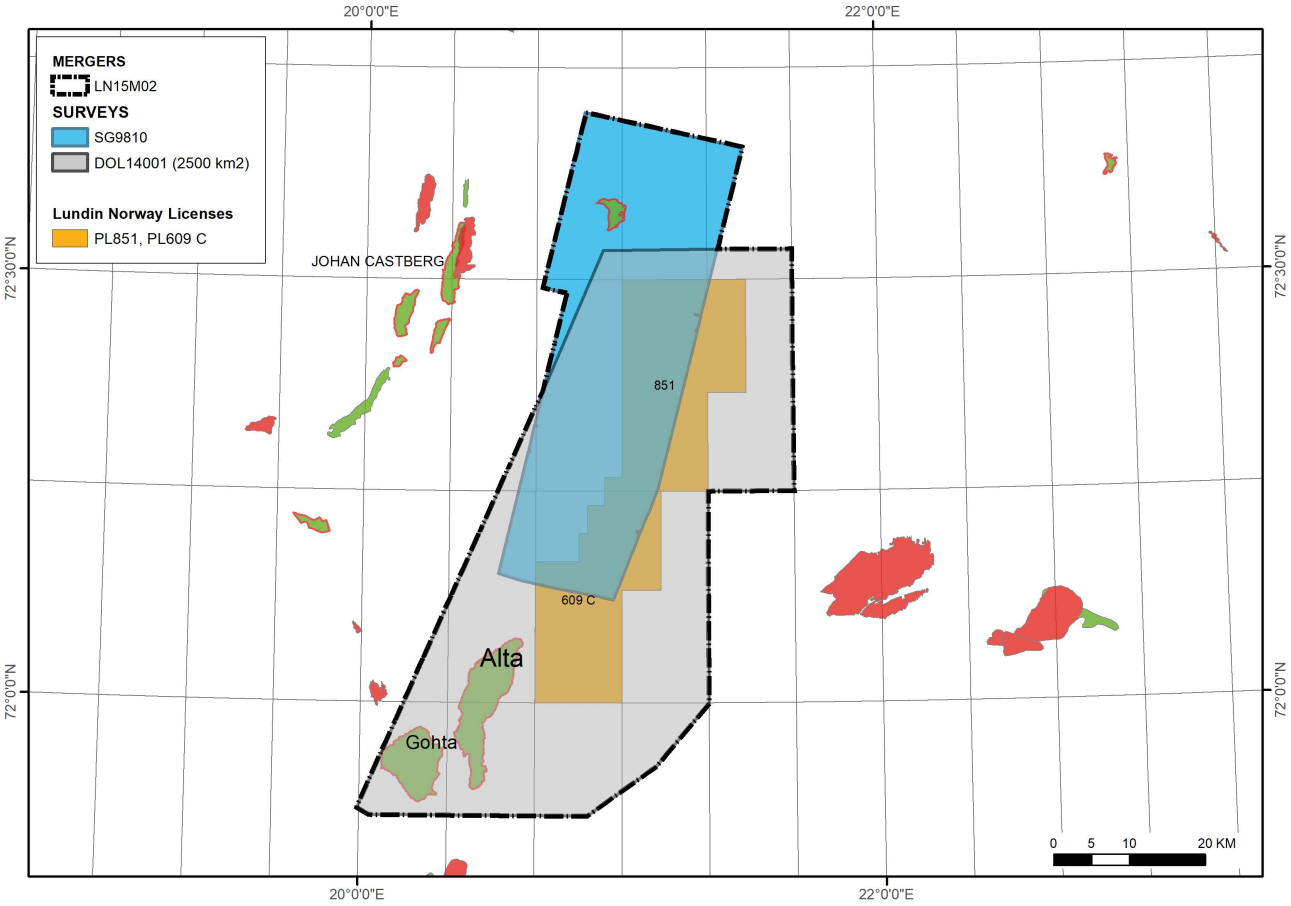

Fig. 2.1 License common seismic database

2.2 Well data

The well database is listed in the table below. The wells have been used for seismic tie, correlation, reservoir property evaluation and geochemical studies.

Table 2.2 PL609 C well database

Wellbore	PL	Wellname	Operator	TD In	Content	TDmd	Year	NPD ID
7120/1-3	492	Gohta I	Lundin	Permian	Oil/Gas	2542	2013	7210
7120/1-4 S	492	Gohta II	Lundin	Late Permian	Gas	2520	2014	7429
7120/1-5	492	Gohta III	Lundin	Permian	Shows	2527	2017	8070
7220/6-2	609	Neiden	Lundin	Middle Triassic	Shows	985	2015	7748
7220/6-2 R	609	Neiden	Lundin	Basement	Oil/Gas	1318	2016	8026
7220/6-3	609	Børselv	Lundin	Carboniferous	Shows	1300	2017	8203
7220/11-1	609	Alta 1	Lundin	Late Carboniferous	Oil/Gas	2251	2014	7503
7220/11-2	609	Alta 2	Lundin	Basement	Gas	2050	2015	7638
7220/11-2 A	609	Alta 2 A	Lundin	Basement	Oil/Gas	2121	2015	7693
7220/11-3	609	Alta 3	Lundin	Permian	Oil/Gas	1922.5	2015	7714
7220/11-3 A	609	Alta 3 A	Lundin	Permian	Oil/Gas	2135	2015	7786
7220/11-3 AR	609	Alta 3 AR	Lundin	Carboniferous	Oil/Gas	2600	2016	7959
7220/11-4	609	Alta 4	Lundin	Carboniferous	Oil/Gas	2282	2017	8126
7220/11-4 A	609	Alta 4 A	Lundin	Carboniferous	Oil/Gas	2392	2017	8226
7220/11-5 S	609	Alta 5 EWT	Lundin	Early Permian	Oil/Gas	3057	2018	8381
7221/4-1	609	Polmak	Lundin	Late Permian	Dry	1570	2020	9009

3 Geological and geophysical studies

Several projects/studies have been performed as part of the evaluation of the license prospectivity:

- **Seismic reprocessing**
  The two 3D surveys DOL14001 and SG9810 were reprocessed and merged by TGS in 2015/2016 on behalf of the partnership. Main focus for the reprocessing project was to increase the resolution in the Permo-Triassic target sequence. The reprocessed dataset showed improved quality versus the vintage datasets.
- **Seismic data conditioning**
  An internal post migration, pre-stack data conditioning sequence was applied to the LN15M02 dataset. The goal was to enhance the stack response and optimize resolution. The pre-stack sequence included CDP gather multiple/noise attenuation and automatic picking to improve the stacking velocity field. Alternative final stacks were produced, with additional noise attenuation and bandwidth optimization processing applied.
- **Petroleum system analysis**
  The petroleum systems on the central Loppa High, including the license area, have been investigated and mapped using geochemical data from offset wells and Svalbard outcrops combined with regional and prospect scale basin models. Oil and source rock analysis and oil-source rock correlations have proven the presence of a Triassic petroleum system on the Loppa High. Basin modelling suggests that significant hydrocarbon charge came from organic rich marine mudstones of Klappmyss/Kobbe fm source rocks located in kitchens down-dip east of the license area.
- **Reservoir development**
  Models for reservoir development within the license area were interpreted based on information from offset wells in the area as well as by the use of tools as GeoTeric for imaging of potential reservoir fairways. A model was developed involving locally derived Permo-Triassic reservoirs sourced from the Loppa High in the west and deposited downflanks within the license area.

4 Prospect update report

The prospectivity identified in the 23rd Round application comprised one Triassic prospect, named Hellemobotn, and three leads, named Kåfjord-, Ballangen- and Salangen leads. The outline of the identified prospectivity at the time of the application is shown in Fig. 4.1.

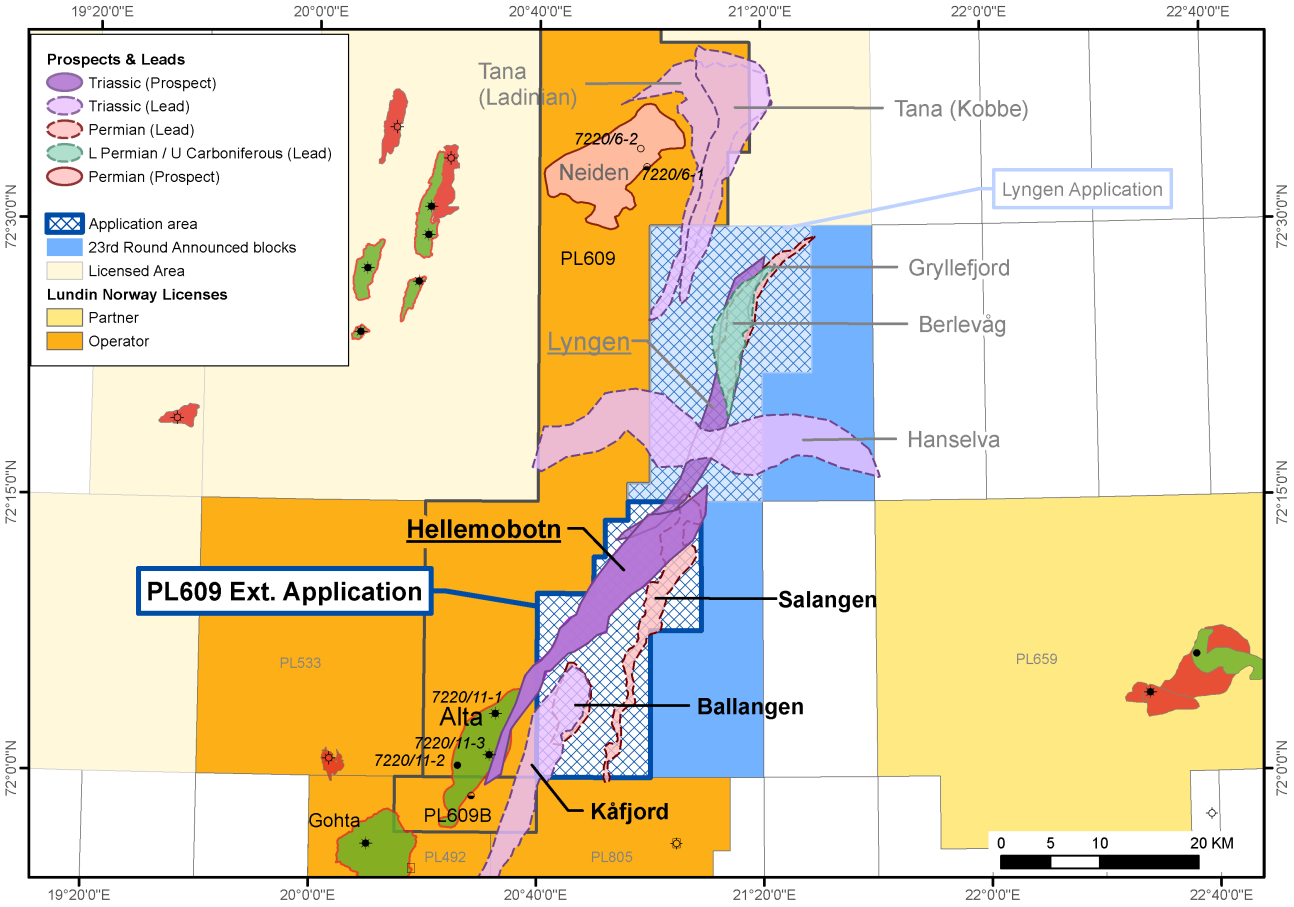

Fig. 4.1 Prospect and lead outlines at the time of 23rd Round application

Hellemobotn prospect

Significant stratigraphically trapped prospectivity was identified along the eastern flank of the Loppa High above and below the Base Triassic unconformity. The Hellemobotn prospect was defined as a Kobbe Fm stratigraphic pinch-out trap with locally derived Lower to Middle Triassic reworked carbonate- and siliciclastic reservoir deposited in a shallow marine environment on the eastern flank of the Loppa High. The trap was believed to be charged from Klappmyss/Kobbe shales deposited in a local anoxic basin down-flank to the east.

Fig. 4.2 and Fig. 4.3 illustrate the Hellemobotn prospect concept at the time of the 23rd Round application, whereas the resource potential from the application is given in Table 4.1.

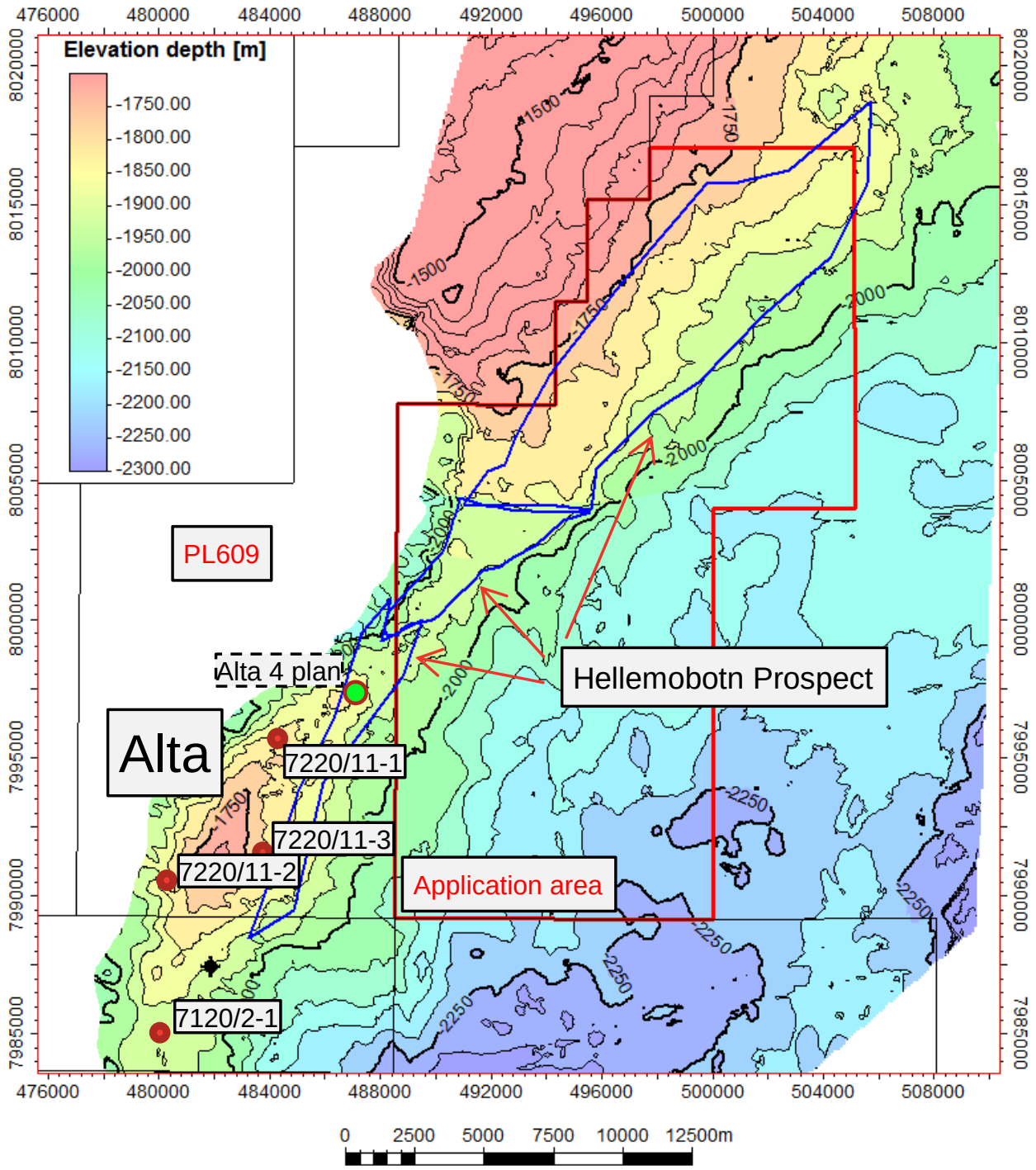

Fig. 4.2 Hellemobotn prospect map from the 23rd Round application
Top Kobbe depth map

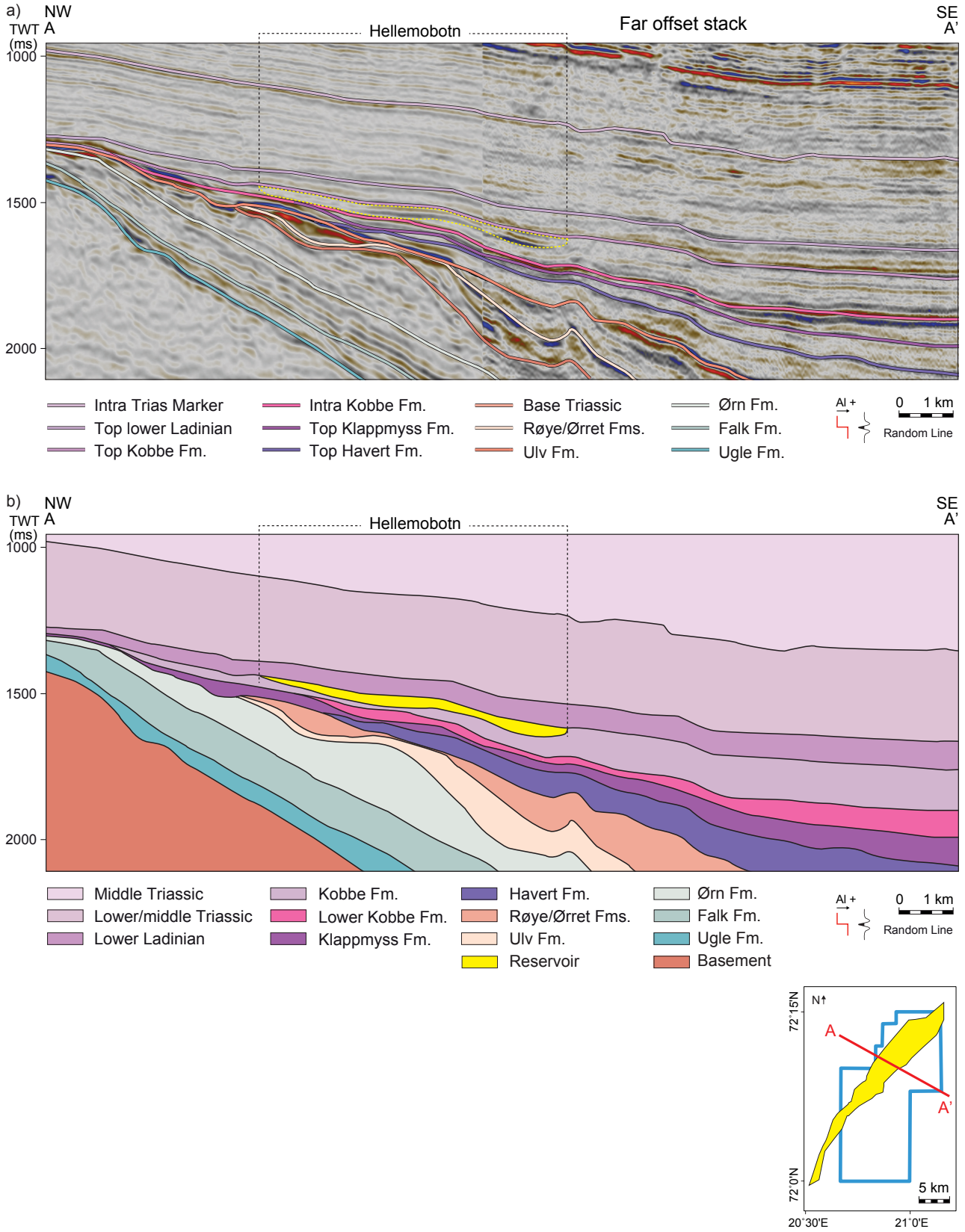

Fig. 4.3 Hellemobotn prospect cross section from the 23rd Round application

Table 4.1 Resource potential from the 23 Round application, NPD Table 2

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 [10^6Sm^3] (>0.00)			Gas [10^9Sm^3] (>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)						
Hellemobotn	P	Oil&Gas	8,90	23,70	41,30	2,90	7,30	12,20	0,16	87,0	Kobbe/Anisian	1750	Snøhvit	75
Kåfjord	L	Oil&Gas	6,00	14,90	25,90						Kobbe/Anisian	2090	Snøhvit	75
Ballangen	L	Oil&Gas	3,40	11,20	21,60						Ørret, Røye/ Permian	2300	Snøhvit	75
Salangen	L	Oil&Gas	5,60	17,60	32,70						Ørret, Røye/ Permian	2300	Snøhvit	75

7221/4-1, Polmak well results and the updated evaluation of the Hellemobotn prospect

The 7221/4-1 well was drilled in 2020 as a shared well between licenses PL609 and PL1027 (Fig. 4.4). All three license partners in PL609 C participated in the Polmak well.

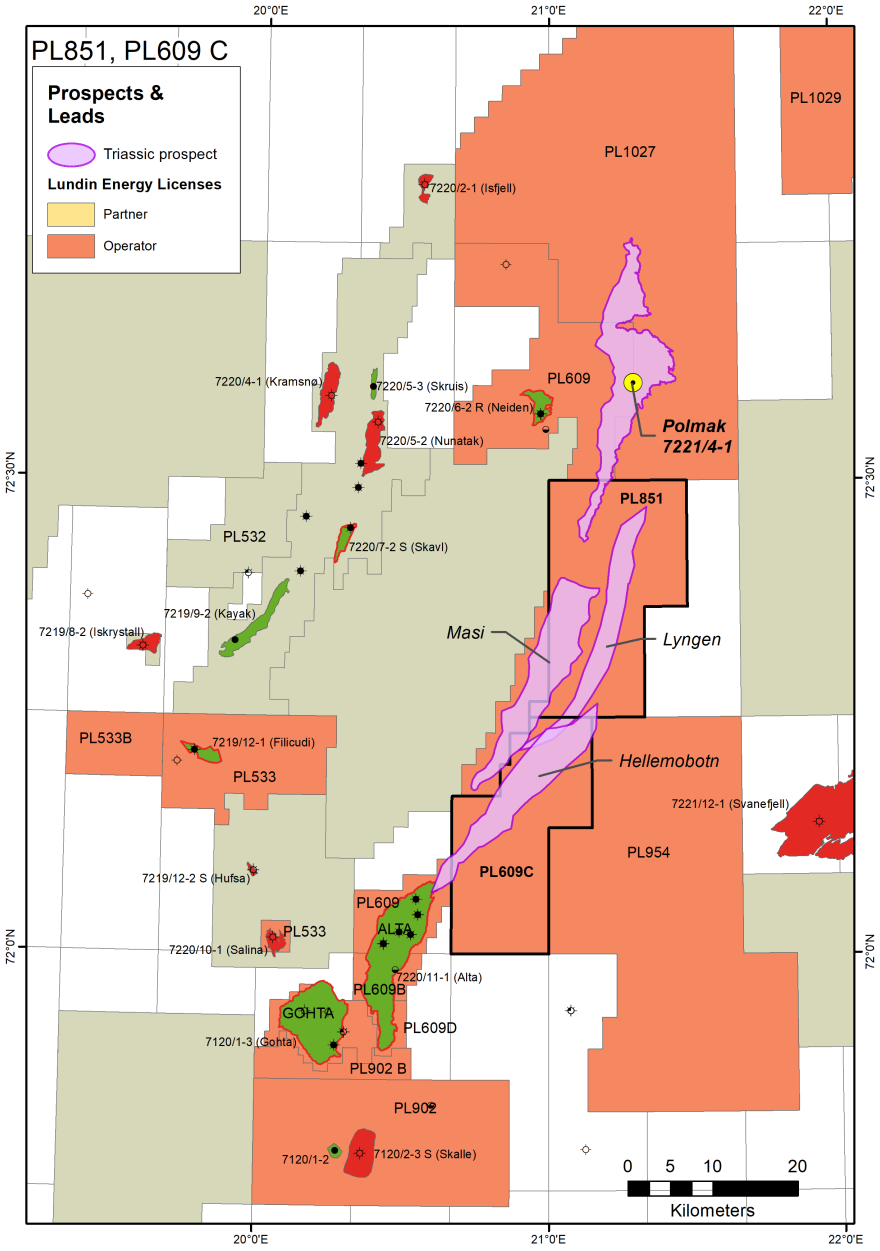

Fig. 4.4 7221/4-1, Polmak well location and PL609 C Hellemobotn prospect

The Polmak prospect (previously named the Tana prospect in the 23rd Application), comprised a stratigraphic trap with primary objectives in Lower Triassic sequences, was an analogous prospect to the Hellemobotn prospect located some 40 km to the south.

7221/4-1 encountered a 6-metre Kobbe Fm sandstone layer with poor reservoir quality. Only traces of petroleum were found and the well was classified as dry.

As a consequence of the disappointing Polmak well results, the input parameters for the Hellemobotn volumetric evaluation have been updated; the reservoir thickness and the hydrocarbon column heights have been reduced. In addition, the risk factors for seal (i.e. base seal and lateral seal) and reservoir quality have increased, resulting in an overall chance of success of 8 %. Hence, the Hellemobotn prospect has been downgraded to a lead with a moderate volume potential.

Based on that evaluation, there was no basis for a drill decision in the license.

Table 4.2 lists the revised Hellemobotn prospect resource potential at the time of relinquishment.

Table 4.2 Hellemobotn prospect data, NPD Table 4

Block	PL609	Prospect name	Hellemobotn	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NDP 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		Reference document				Assessment year	
This is case no.:		Structural element		Type of trap		Water depth [m MSL] (>0)		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)	14,55	34,208	26,557	41,339	2,044	3,32	3,964	6,171
	Gas [10^9 Sm^3] (>0.00)	6,201	10,013	9,356	12,776	1,819	4,276	3,32	5,167
Recoverable resources	Oil [10^6 Sm^3] (>0.00)	5,396	6,542	10,828	17,318	1,104	1,568	2,431	4,058
	Gas [10^9 Sm^3] (>0.00)	3,232	4,988	5,751	8,698	0,675	0,818	1,353	2,165
Reservoir Chrono (from)	Triassic	Reservoir litho (from)	Kobbe Fm	Source Rock, chrono primary		Source Rock, litho primary		Seal, Chrono	
Reservoir Chrono (to)		Reservoir litho (to)		Source Rock, chrono secondary		Source Rock, litho secondary		Seal, Litho	
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0,08	Oil case (0.00-1.00)		Gas case (0.00-1.00)		Oil & Gas case (0.00-1.00)			
Reservoir (P1) (0.00-1.00)	0,4	Trap (P2) (0.00-1.00)	0,32	Charge (P3) (0.00-1.00)	0,9	Retention (P4) (0.00-1.00)	0,7		
Parametres:	Low (P90)	Base	High (P10)	*Comments*					
Depth to top of prospect [m MSL] (>0)	1750	1750	1750						
Area of closure [km^2] (>0.0)		37							
Reservoir thickness [m] (>0)	25	25	25						
HC column in prospect [m] (>0)	130	174	174						
Gross rock vol. [10^9 m^3] (> 0.000)	1,25	1,741	1,741						
Net / Gross [fraction] (0.00-1.00)	0,4	0,5	0,6						
Porosity [fraction] (0.00-1.00)	0,14	0,16	0,18						
Permeability [mD] (> 0.0)									
Water Saturation [fraction] (0.00-1.00)	0,35	0,3	0,25						
Bg [Rm3/Sm3] (< 1.0000)	0,00571	0,00571	0,00571	*Water saturation in oil zone, Sw = 1 - OilSaturation (So)*					
1/Bo [Sm3/Rm3] (< 1.00)	0,7	0,72	0,74						
GOR, free gas [Sm^3/Sm^3] (> 0)	1666,667	2352,941	4000						
Gor, oil [Sm^3/Sm^3] (> 0)	125	125	125						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0,35	0,4	0,45						
Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0,35	0,4	0,45						
Recov. factor, gas main phase [fraction] (0.00-1.00)	0,5	0,6	0,7						
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0,5	0,6	0,7	For NPD use:					
Temperature, top res [°C] (>0)				Innrapp. Av geolog-init:	NPD will insert valu	Registert - init:	NPD will insert valu	Kart oppdatert	NPD will insert value
Pressure, top res [bar] (>0)				Dato:	NPD will insert valu	Registret Dato:	NPD will insert valu	Kart dato	NPD will insert value
Cut off criteria for N/G calculation	1.	2.	3.					Kart nr	NPD will insert value

5 Technical evaluation

A technical evaluation with respect to economical value and possible development solution was not performed since no prospect remains within the license.

6 Conclusion

The work commitments in the license have been fulfilled. Following the disappointing results of the Polmak, 7221/4-1 well, in which all three PL609 C license partners participated, the Hellemobotn prospect has been downgraded to a lead. The volume potential is too small and the risks, both with respect to reservoir and seal/retention, are too high to support a positive drill decision.

The partnership decided unanimously to relinquish the license in May 2021.