PL1122
Status Report

ConocoPhillips

wintershall dea

vår energi

AkerBP

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1 History of the production licence

Production license 1122 is located over the Revfallet fault zone between the Sør High and the Dønna Terrace in the Norwegian Sea Fig. 1.1 .The license consists of parts of block 6507/7 and 6507/8 and was awarded on 19.02.21. The main prospect within the license is Seagull which is shown on the map in Fig. 1.1

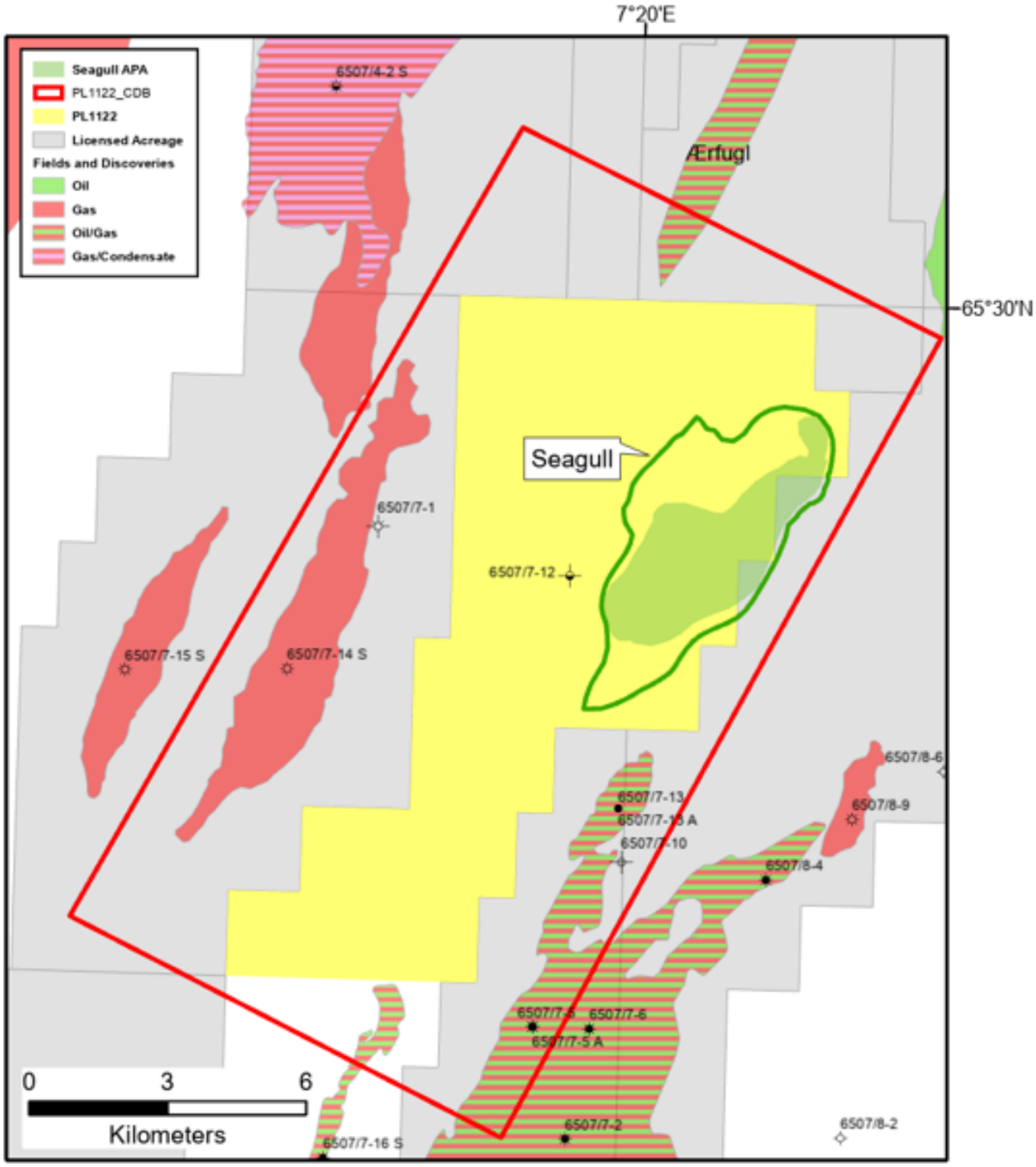

Fig. 1.1 Seismic Database Production License 1122 in yellow with the Seagull prospect outlined in green. Common seismic database outlined in red

The partnership in PL1122 at the time of lapse consists of:

- ConocoPhillips Skandinavia AS 40% (Operator)
- Vår Energi ASA 20%
- Wintershall DEA Norge AS 20%
- Aker BP ASA 20%

The 2 year work program leading to a drill-drop decision by 19.02.2023 included acquiring and/or reprocessing modern 3D seismic and G&G studies.The G&G studies in the work program included a Rock physics study, 2D seismic forward modelling, Reservoir quality study, Basin modelling and Seal analysis (see 3 Results of Geological and Geophysical studies).

The license meetings held are summarized in Table 1.1.

Table 1.1 License Meetings

Year	DD.MM	Meeting
2021	27.04	Exploration/Management Committee License Kick-off meeting
2021	27.10	Exploration Committee Work Meeting
2021	13.12	Exploration/Management Committee License Year End
2022	02.06	Exploration/Management Committee License Mid Year
2022	05.10	Exploration Committee Work Meeting
2022	08.12	Exploration/Management Committee License Year End

The Seagull prospect was re-evaluated during the license work program but did not meet the criteria for drilling an exploration well, mainly due to limited volumes. The PL1122 license unanimously agreed to drop the license.

2 Database

2.1 Seismic Database

The seismic database used in the license is outlined in red as shown in Fig. 1.1 and listed in Table 2.1. Several seismic datasets are available in the area and the PL1122 license established a common database where PGS16909NWS broadband data was chosen as the primary dataset covering the license and key offset wells. PGS16909NWS, also referred to as PGS PSDM "Pure" reprocessing, is a regional 3D depth migration and merge of the four PGS broadband surveys: MC3D-HVG2011, MC3D-HVG2012, MC3D-HVG2013 and PGS14005. PGS16909NWS was reprocessed/conditioned for the PL1122 license by Sharp reflection using the PsPro software and is referred to as PGS16909NWS COP R21 Conditioning.

Table 2.1 Seismic Database

Dataset Name	Original surveys	NPDID	Status	Data Type	Processing Type
PGS16909NWS COP R21 Conditioning	PGS16909NWS	None	Not released	Full stack, angle stacks and gathers	PSDM
PGS16909NWS	MC3D-HVG2011, MC3D-HVG2012, MC3D-HVG2013, PGS14005	None	Not released	Full stack, angle stacks and gathers	PSDM
MC3D-HVG2011	Unique	7379	Not released	Full stack, angle stacks and gathers	PSTM
MC3D-HVG2012	Unique	7616	Not released	Full stack, angle stacks	PSTM
MC3D-HVG2013	Unique	7900	Not released	Full stack, angle stacks	PSTM
PGS14005	Unique	8054	Not released	Full stack, angle stacks and gathers	PSTM

2.2 Well database

Table 2.2 Well Database Wells in bold with an asterix * are key wells for the Seagull evaluation

Well	NPDID wellbore	Year	Well Content	TD (mTVD)	TD Age	Well tie	Rock Physics	Reservoir quality	HGMT
6506/3-1	4344	2001	Dry	3662	Late Cretaceous	x		x	x
6506/5-1S	8961	2020	Gas	3166	Early Cretaceous	x		x	
6506/6-1	4122	2000	Gas	5474	Early Jurassic	x		x	
6506/6-2	6960	2013	Dry	3365	Early Cretaceous	x		x	x
6506/9-1*	5980	2009	Gas	5660	Early Jurassic	x	x	x	x
6507/1-1	4955	2004	Dry	3745	Late Cretaceous	x		x	
6507/2-1	911	1986	Oil Shows	4475	Late Jurassic	x		x	
6507/2-2	1840	1992	Gas/Condensate	3953	Early Jurassic	x		x	x
6507/2-3	2299	1994	Oil shows	3970	Late Jurassic	x		x	x
6507/2-4	5685	2008	Gas/Condensate	3600	Early Cretaceous	x		x	x
6507/2-5 S	8775	2019	Gas	4147	Early Jurassic	x		x	
6507/3-9 S	6951	2012	Gas	2946	Early Cretaceous	x		x	
6507/3-12	8097	2017	Gas	3450	Early Jurassic	x		x	x
6507/4-1	9110	2020	Gas	4985	Early Cretaceous	x		x	
6507/4-2 S	9251	2021	Oil/Gas/Condensate	4399	Early Jurassic	x	x	x	x
6507/5-3*	4059	2000	Gas	3000	Early Cretaceous	x	x	x	x
6507/5-6 S	6321	2010	Gas	2907	Late Cretaceous	x		x	
6507/5-8	8379	2018	Gas	3689	Early Cretaceous	x		x	x
6507/7-1*	138	1984	Gas shows	4818	Early Jurassic	x	x	x	x
6507/7-11 S	3131	1997	Dry	3744	Early Jurassic	x	x	x	
6507/7-12*	3812	1999	Oil shows	3974	Late Jurassic	x	x	x	x
6507/7-14S*	6367	2010	Gas	4477	Early Jurassic	x	x	x	x
6507/7-15S*	6730	2012	Gas	4552	Early Jurassic	x	x	x	x

3 Results of Geological and Geophysical studies

The work program for PL1122 included geological and geophysical studies conducted over a period of 2 years. The main studies performed are summarized below.

Conditioning of the PGS16909NWS Gathers: Seismic conditioning was carried out during 2021 with the aim to enhance the vertical and horizontal resolution to increase the confidence of mapping top reservoir, and amplitude preservation to maintain relative trace amplitudes for amplitude and AVO analysis. The input to the conditioning was the PGS16909NWS Raw PSDM gathers (time) and the final outputs were full stacks, angle stacks and gathers. The conditioning was carried out in PsPro by Sharp Reflections. The result of the gather conditioning showed a final dataset with good gather flatness and preservation of the primaries, in addition there is increased resolution, improved S/N ratio and improved preservation of the amplitudes with offset.

Seismic interpretation: The PGS16909NWS COP R21 conditioned dataset has been used for detailed stratigraphic mapping of the Top and Base Lysing Fm. and for amplitude/AVO analysis. The Top Lysing Fm. is mapped on a peak reflector (increasing AI) and the Base Lysing Fm. is best defined on a peak reflector on the extended far offset stack (ang 20-50). The seismic mapping of the Top and Base Lysing Fm. is tied to the offset wells such as 6507/7-1 & 6507/7-12. Between the mapped Top and Base Lysing reflectors there is a mappable trough that pinches out in all directions. The edges of the stratigraphic trap of Seagull is picked where this trough pinches out. The trough represents the high porous Lysing Fm. and the peak reflector above represents a lower porous Lysing Fm. The structural dip line in Fig. 3.1 highlights key seismic reflectors mapped on the extended far stack.

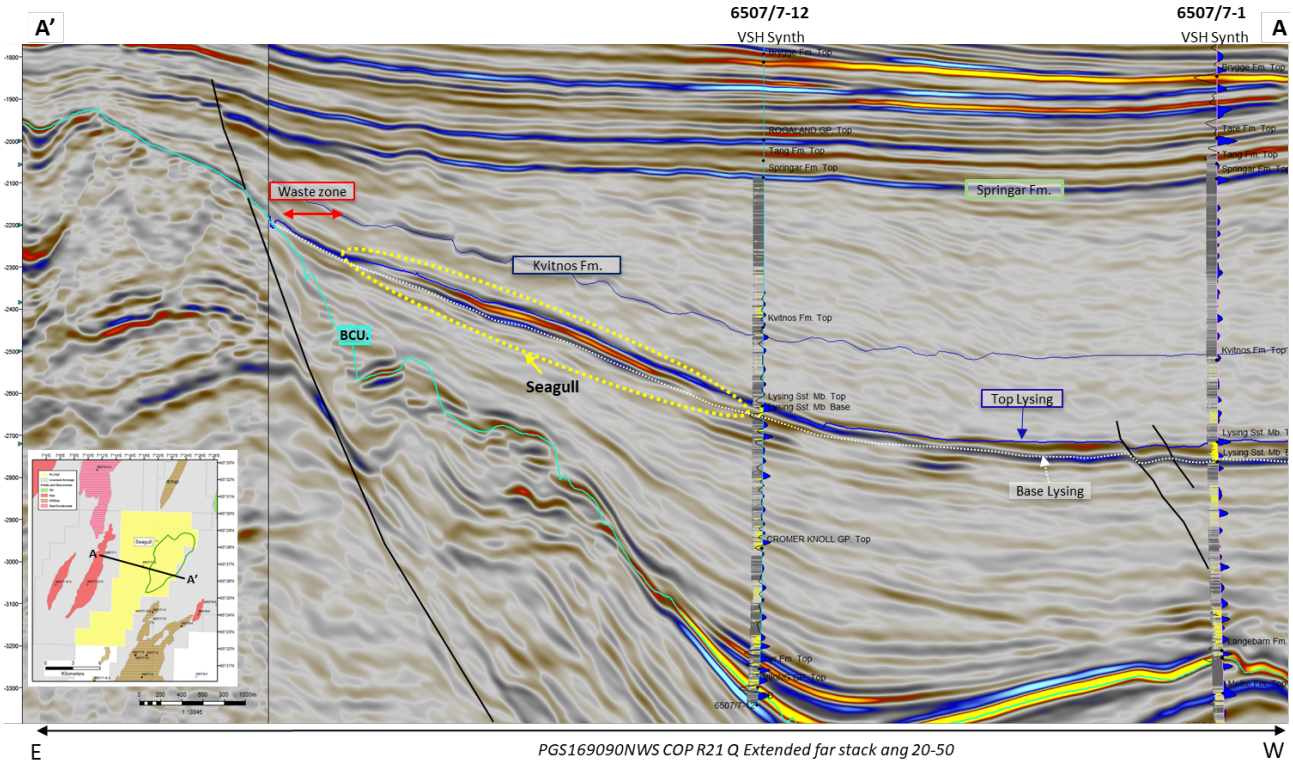

Fig. 3.1 Seismic tie line - PGS16909NWS COP R21 Conditioning extended far stack

Reservoir Quality evaluation: A detailed reservoir quality study was conducted to assess the sedimentary facies and reservoir quality in the Lysing Fm. Uplift of the Nordland Ridge and erosion supplied coarse clastic sediments to the terraces and basin where the sediments were deposited as gravity flows. Mainly turbidites but also debrites and locally reworking by traction currents. The presence of sand in the mapped Lysing Fm. wedge is regarded low risk, but since Seagull is not part of the proven sand fairway on the Dønna and Halten Terrace, and the proximity to the Sør Heigh hinterland, there is a risk that the reservoir can be dominated by debrites of low reservoir quality. Fig. 3.2

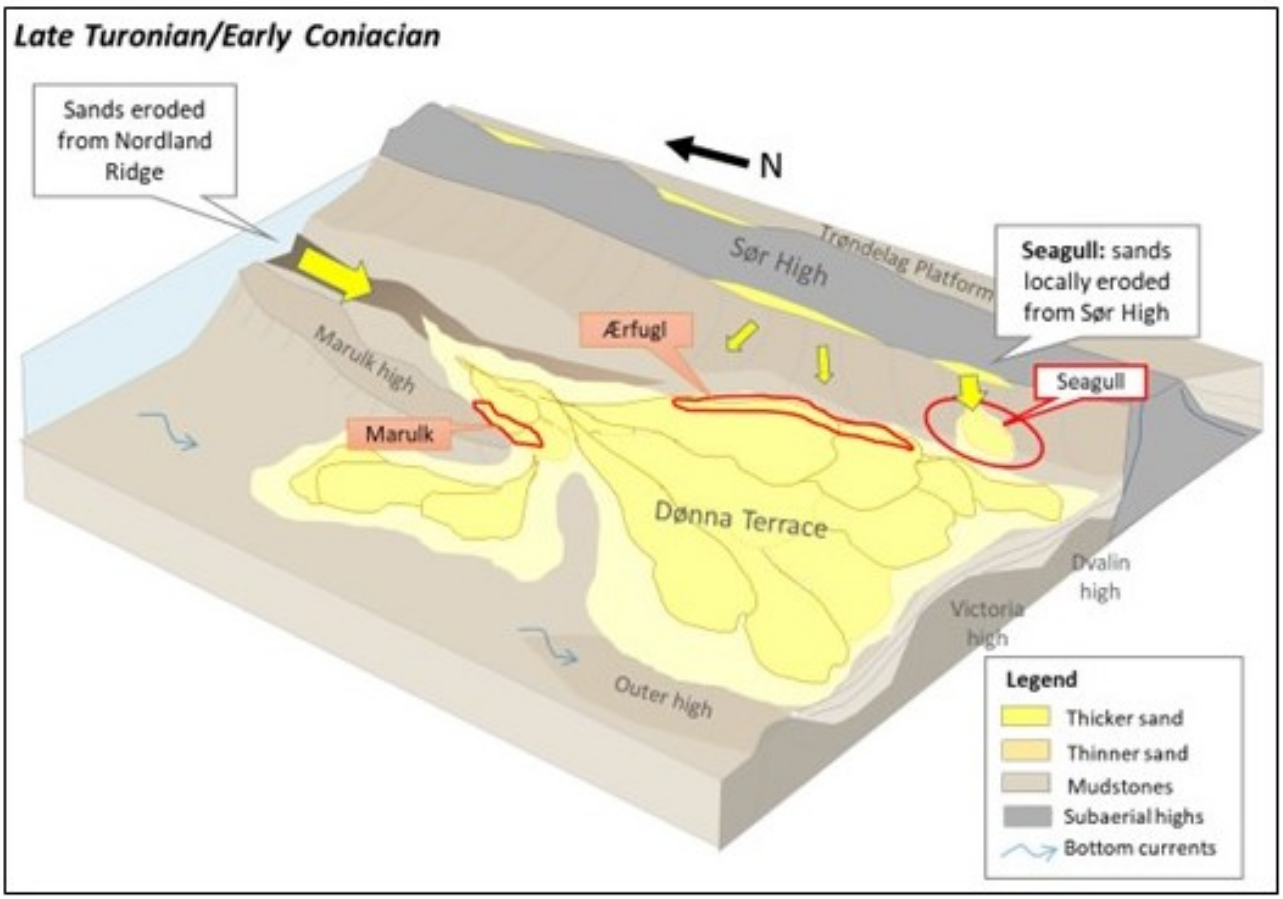

Fig. 3.2 Depositional model for the Lysing Fm.

IKON Rock physics study: The scope of the work was to investigate the rock physics properties of the Lysing Fm. sandstone and the surrounding shales (Kvitnos and Blaalange Fm. shales) and furthermore to determine the rocks sensitivities to lithology and fluid variations. Petrophysical evaluation was carried out on the wells 6507/4-2S, 6507/7-1, 6507/7-12, 6507/5-3, 6507/7-11S, 6507/7-15 & 6506/9-1 using standard IKON workflows. Elastic log data was reviewed and elastic log conditioning was performed from Kvitnos Fm. to Cromer Knoll Gp. The conditioned logs were used as the basis of a rock physics and synthetic seismic AVO study. The result of the study showed that the fluid sensitivity of the Lysing Fm. is moderate to high. The primary factors controlling the fluid response are the net-to-gross and porosity of the sandstone intervals. Brine saturated Lysing Fm. is a weak positive reflection event that decreases in amplitude with offset (Class I/IIp). When hydrocarbon saturated the Lysing Fm. is a weak positive to negative reflection event that becomes a higher amplitude negative reflection at far offsets (Class II/IIp).

Amplitude Analysis: Seismic amplitude/AVO analysis was carried out on the PGS16909NWS COP R21 Conditioning with the objective to determine lithology and/or fluid content in the Lysing Fm. The observed amplitudes and AVO response at Seagull differ from the amplitudes observed at the gas condensate Lysing Fm. in the 6507/5-3 well and the water wet Lysing Fm. in the 6507/7-12. There are no oil discoveries

in the Lysing Fm. in the vicinity that can be calibrated to the observations at Seagull.The amplitudes and gradient at Seagull fall closer to high porous water wet Lysing Fm. and the variations in amplitude seen over the prospect is believed to be controlled by the reservoir quality and thickness and not by fluid saturation.

Basin model update: At the time of APA application the semi-regional HGMT modelling showed that there are two potential drainage areas for Seagull: 1) small local oil prone area directly below the prospect and 2) the higher maturity drainage area west north west of Ærfugl. Given that the Lysing Fm. is moderate to highly sensitive to fluids a gas/gas condensate saturation are expected to be determined by the amplitude/AVO analysis if present. There were no indications of a gas/gas condensate Lysing Fm. from the amplitude /AVO analysis and no gas cap, hence the charge from the higher maturity drainage area from west/north west was disregarded. Oil charged vertically from the oil prone Spekk Fm. below was thus regarded as the primary charge scenario for Seagull.

Seal Analysis: The Kvitnos Fm. forms the Top Seal for Seagull with the Blålange Fm. as a bottom seal. Both shale sequences are currently over pressured, but the magnitude of excess pressure is modelled to be less than in the Lysing reservoir. This remains an uncertainty due to thinning towards, and onlap of Cretaceous sequences onto the Sør high. Potential exists for Lysing sands and the Kvitnos shale to lose pressure towards the low pressure sink of the Sør High (downwards or laterally across the BCU). Top seal is modeled to be strong and can hold a significant oil column. However, at the pinch out edge, the Blålange Fm bottom seal is thin and the lateral distance to the Sør High is short. This results in a significant bottom and lateral seal and retention risk.

4 Prospect Update

The target prospect in the PL1122 license is the Cretaceous Seagull prospect located ~12 km to the north of the Heidrun Field.

At the time of APA application the Seagull prospect was characterized as a 26% POS opportunity with key risk being trap and seal. The outline of the Seagull prospect at time of APA application is shown in Fig. 1.1 . The seismic interpretation at this time showed that Seagull was a stratigraphic pinch out trap with a crest at around 2280 m with a mean hydrocarbon-water contact at 2743 m towards the west. The prospect was defined as an amplitude prospect where a soft amplitude, with class 2-3 AVA response, was mapped updip of the water wet 6507/7-12 well representing a potential oil-water contact. Table 4.1

Table 4.1 APA Resource Potential

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)						
Seagull	P	1) Gas	0.45	1.38	2.61	2.33	4.70	7.39	0.13*	89.0	Lysing Fm/Upper Cretaceous	2280	Heidrun	13
		2) Oil	1.82	3.42	5.36	0.29	0.56	0.88	0.09*					
		3) Oil	4.02	6.68	9.67	0.65	1.09	1.61	0.04*					

*0.26 is the combined Probability of Discovery

The present re-evaluation characterize the Seagull prospect as stratigraphic pinch out trap of 18% POS with key risk being seal and Hydrocarbon Generation, Migration and Timing (HGMT). The resource potential has decreased since the APA 2020 evaluation. This reduction is mainly controlled by column height distribution and the lowering of the N/G distribution. The combined seal & trap risk is similar to the 2020 evaluation, whereas the HGMT risk increased due as the updated evaluation only considers an oil case given there is no amplitude support for gas in the reservoir. Table 4.2

Table 4.2 New Resource Potential

Discovery/ Prospect/ Lead name	D/ P/ L	Case (Oil/Gas/ Oil&Gas)	Unrisked recoverable resources						Probability of discovery (0.00 - 1.00)	Resources in acreage applied for [%] (0.0 - 100.0)	Reservoir		Nearest relevant infrastructure	
			Oil [10^6Sm^3] (>0.00)			Associated Gas [10^9Sm^3] (>0.00)					Litho-/ Chrono-stratigraphic level	Reservoir depth [m MSL] (>0)	Name	Km (>0)
			Low (P90)	Base (Mean)	High (P10)	Low (P90)	Base (Mean)	High (P10)						
Seagull	P	Oil	0.45	3.49	7.72	0.10	0.79	1.76	0.18	91.2	Lysing Fm/Upper Cretaceous	2180	Heidrun	13

Trap: The prospect outline is defined by the pinch out edges of the mappable trough between the Top and the Base Lysing reflector. Stratigraphically it is tied to several offset wells in the area. The crest is mapped at ~2180 m and the downdip pinch out edge is mapped at ~2825 m. There is uncertainty on the position of the ultimate crest as there is risk of thin sub-seismic sand-lag up dip and outside the mapped pinch out edge. The seismic line in Fig. 3.1 shows the extended far offset stacks (ang 20-50) where the soft reflector defining the pinch out trap is highlighted in yellow. The soft reflector is pinching out in all directions and before reaching the Jurassic fault degradation complex defined below the BCU marker. Large column is required to fill the trap. The trap is confined within Cretaceous shales.

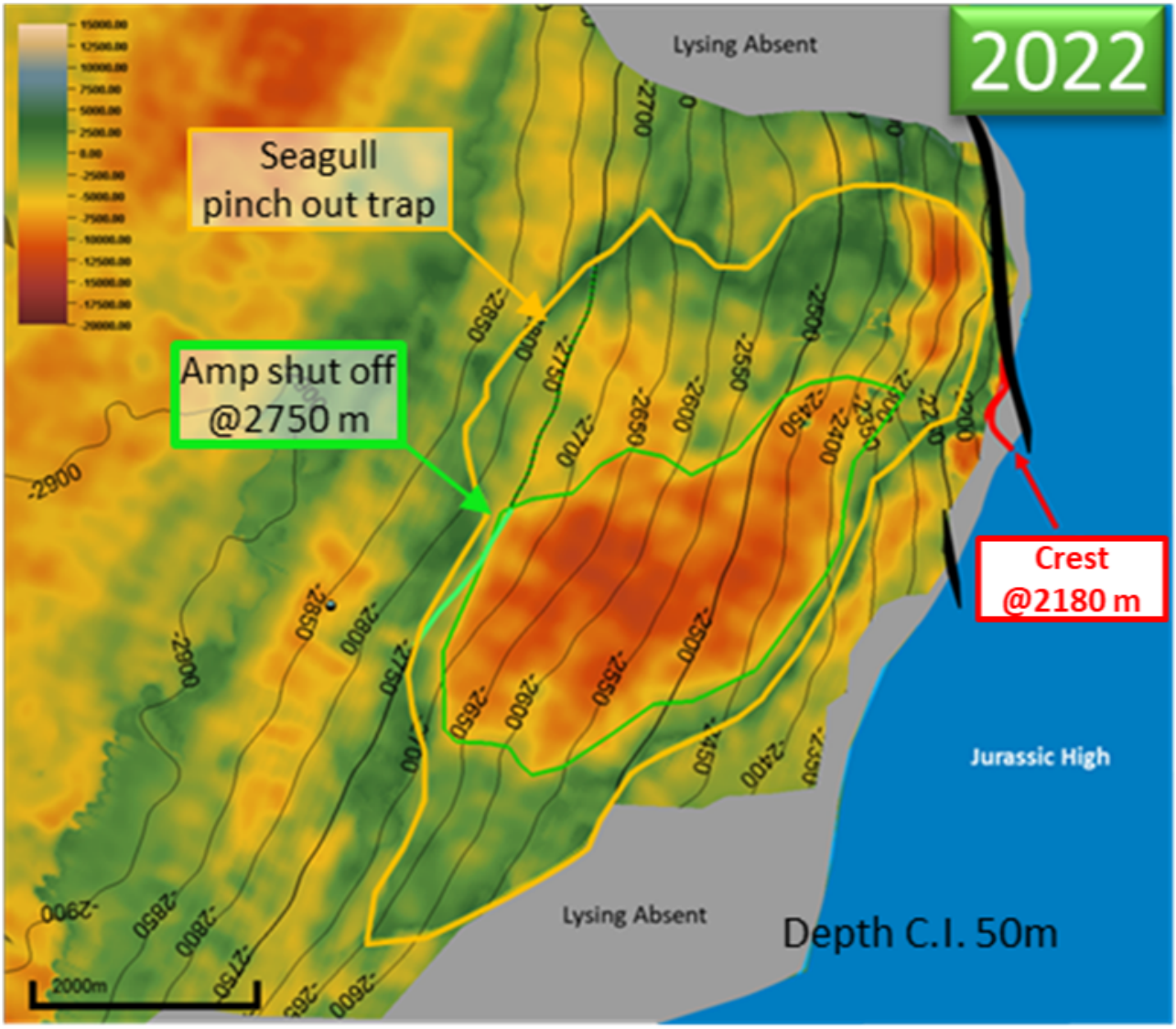

Fig. 4.1 Seagull pinch out trap The Seagull trap is displayed on a Top Lysing sst. depth map with contour increments of 50 m. The color scale is the minimum amplitude extracted on the extended far stack(20-50 deg) in a window of 10 ms below Top Lysing sst.

Seal & Retention: The top seal is modelled to be strong and can hold a significant oil column. With a hydrodynamic model seal where its assumed that the Lysing Fm. at Seagull is connected to the overpressured basinward Lysing Fm., large columns will be limited. At the pinch out edge, the Blålange Fm. bottom seal is thin and the lateral distance to the Sør High is short. This results in a significant bottom and lateral seal retention risk. The timing of charge is also affecting the column heights where Seagull could hold larger columns pre-Naust deposition compared to present day. The current top seal modelling indicates trap can hold a P50 oil column of 348 m. However, if oil and gas, modelling suggests the trap can hold a P50 gas column of 100m, and P50 oil column of 240m. There are no amplitudes at the crest of the trap thus the likelihood of a gas cap is very small. A pure oil case was therefore considered for the volumes and risk assessment.

HGMT & Source: The base case model for Seagull is direct charge from oil prone source rock below the prospect. The fetch area produces sufficient volumes to fill Seagull. However, a low migration efficiency to Seagull could limit or prevent charge. In addition there is potential for poorer source rock quality near Seagull that could create a charge limited situation. Thus, the HGMT risk of the prospect was regarded relatively high in addition there are no nearby oil discoveries in the Lysing Fm. other than the oil shows in the Aptian in the 6507/7-12 well.

Reservoir: Since the rock physics study and amplitude analysis showed that a gas phase in the Seagull prospect was unlikely (Fig. 4.2), the reservoir quality was based on a net reservoir cut-off for an oil case. The evaluation of core porosity-permeability show that while a 0.1 mD cut-off for a gas case give 10% porosity cut-off, 1 mD cut-off for oil cases results in 15% porosity cut-off (Fig. 4.3). This resulted in a significant reduction in N:G and a small increase in porosity compared with previous studies (See Fig. 4.4). Volumetrics were run on the mapped pinchout, but the main sand depocenter is interpreted to be within the isopach thick (Fig. 4.5).

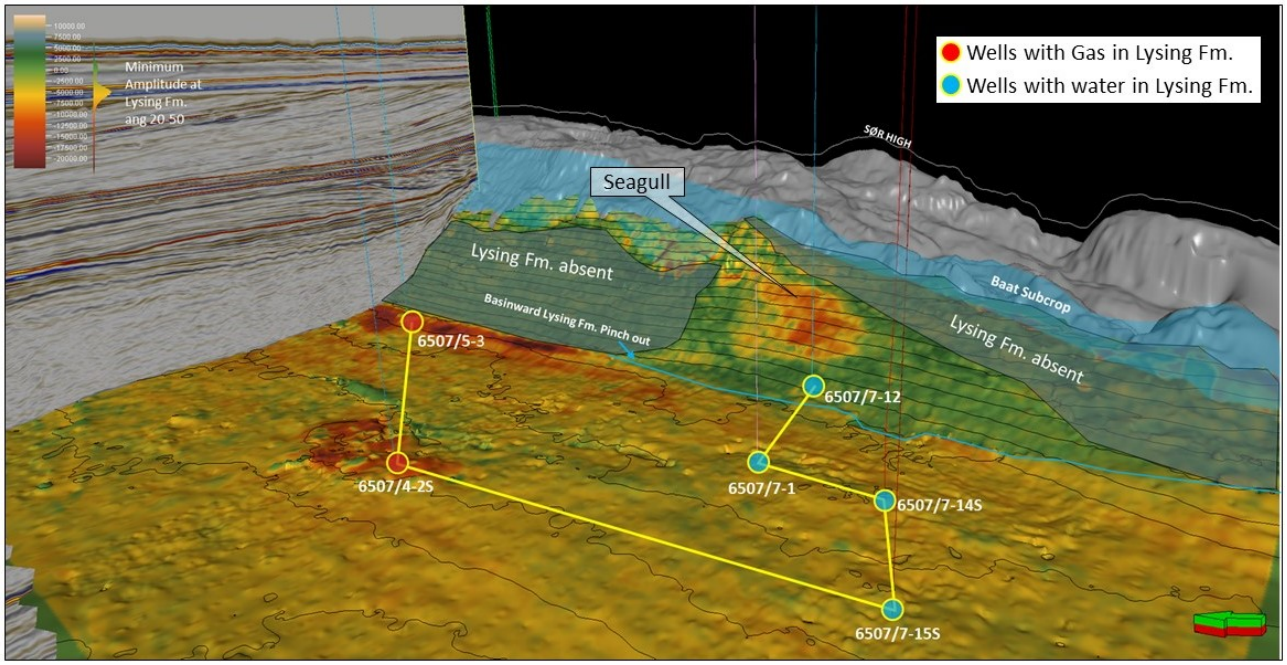

Fig. 4.2 Minimum Amplitude at Lysing Fm. 20-50 degrees angle. A well log correlation is shown on Fig. 4.4

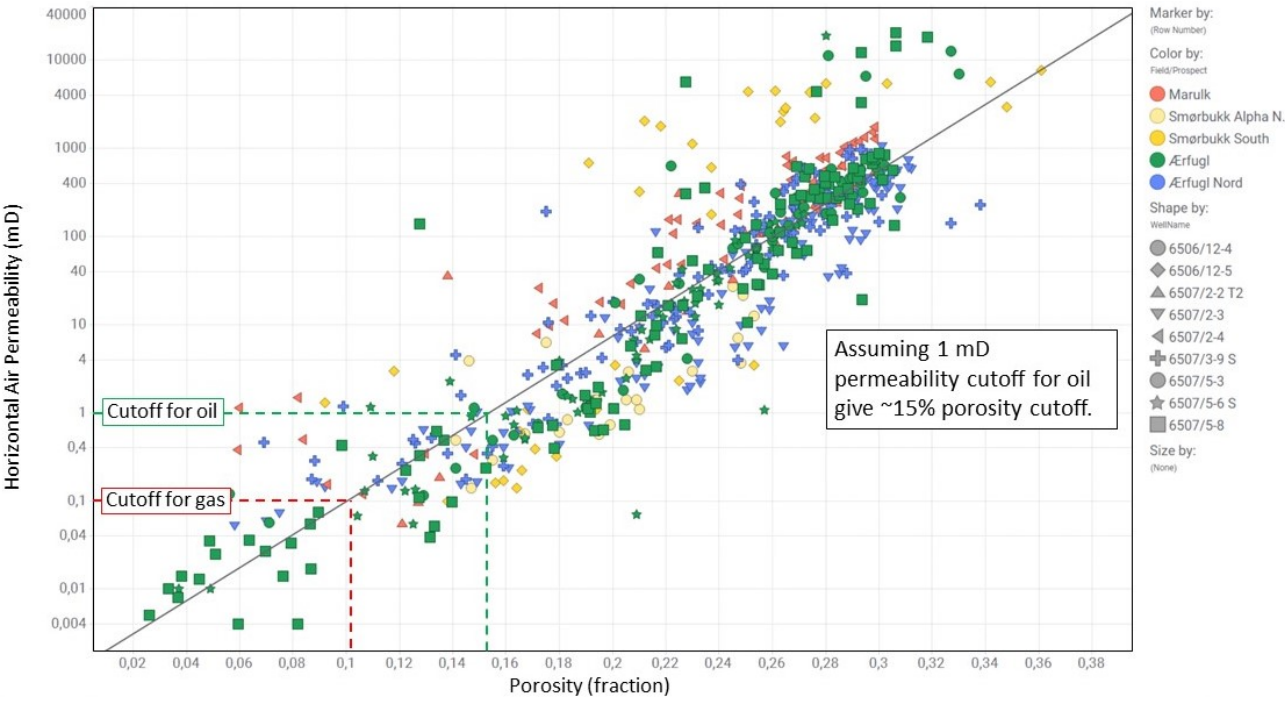

Fig. 4.3 Cross-plot of Lysing Fm. Core porosity-permeability.

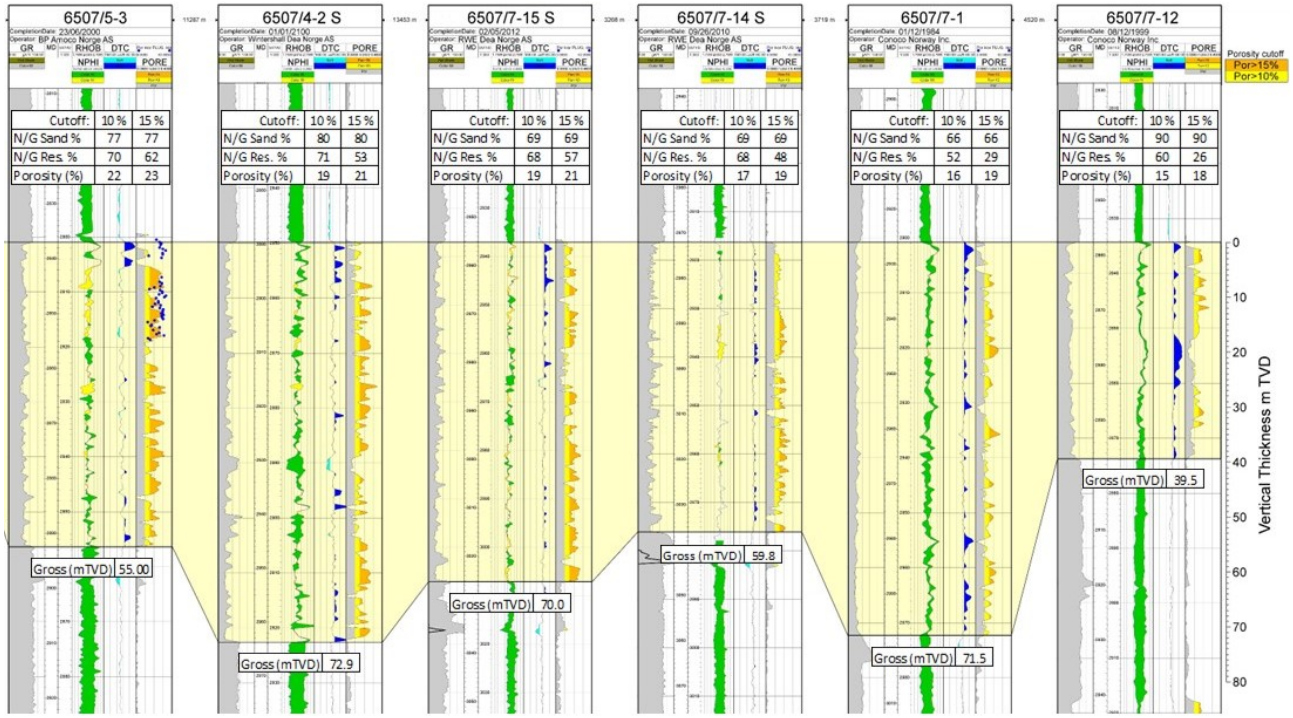

Fig. 4.4 Correlation of the Lysing Fm. Net/Gross and Porosity for 10% porosity cutoff vs. 15% porosity cutoff are shown. The well locations are shown on Fig. 4.2

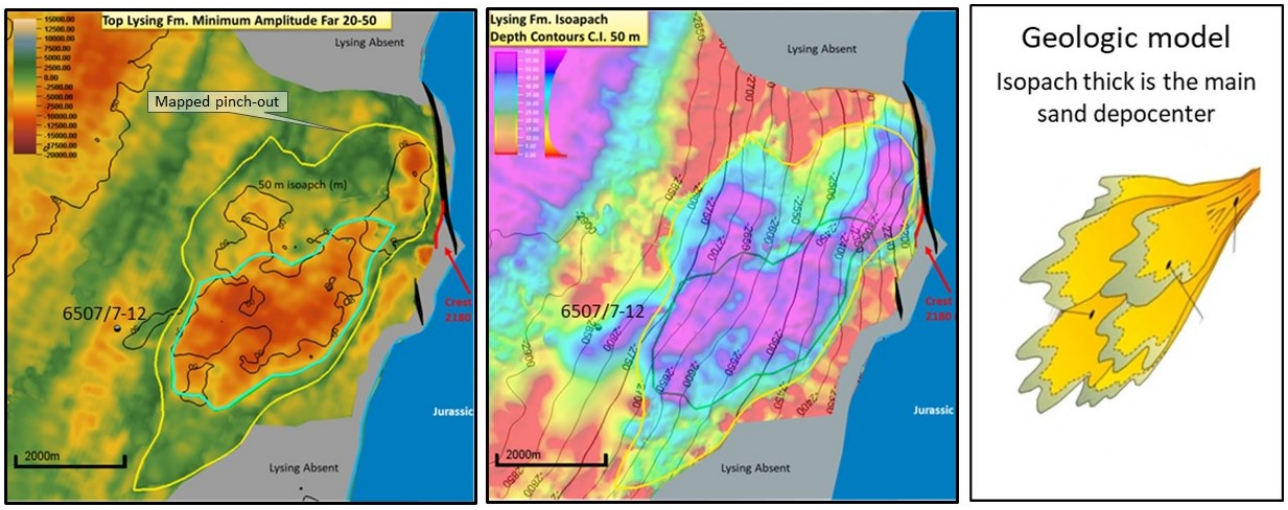

Fig. 4.5 Geological model for the Seagull prospect.

Amplitude Expectations: There is a strong amplitude and AVO signature at the Lysing Fm, but only with minor structural conformance. The observed amplitude/AVO pattern seems to represent depositional features rather than fluid effects and cannot support running a gas condensate case or a gas cap/oil leg case. The amplitude shut-off around 2850 m is not very likely to be a fluid contact with the seal & column height analysis (Fig. 4.1 &Fig. 4.2)

5 Technical Evaluations

Potential development solution have not been further investigated since the detailed interpretation of the Seagull prospect has resulted in small resource potential with high risk.

6 Conclusions

The work program in the PL1122 license has been fulfilled and the geological and geophysical studies have concluded that the recoverable hydrocarbon volume for Seagull is too low and the risk is too high to warrant an exploration well. The PL1122 partners have agreed to relinquish the license.