

Status report PL159E

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1 License history

PL159E was awarded to the partnership Statoil Petroleum AS (42% OP), DEA Norge AS (40%) and Capricorn Norge AS (18%) in APA 2014. Date granted 06.02.2015, license location map in Figure 1. The work commitment of *Decision to drill* was not met (unanimous decision in license) 06.02.2018 and the license is to be relinquished. PL159E was awarded as an extension to the larger PL159C to capture a possible upside to the Middle Jurassic Langbein prospect, mainly located in PL159C. The work commitment, *Decision to drill*, was related to this Langbein prospect, the actual well could be drilled in PL159C or PL159E. A one-year postponement of the *Decision to drill* milestone was applied for in order to encompass the results from 6507/3-12 Mim well drilled February/ March 2017. The Middle Jurassic Mim prospect shares geophysical similarities with Langbein. The 6507/3-12 Mim was water bearing in the Middle Jurassic reservoir and had a negative impact on PL159C/E Langbein prospect.

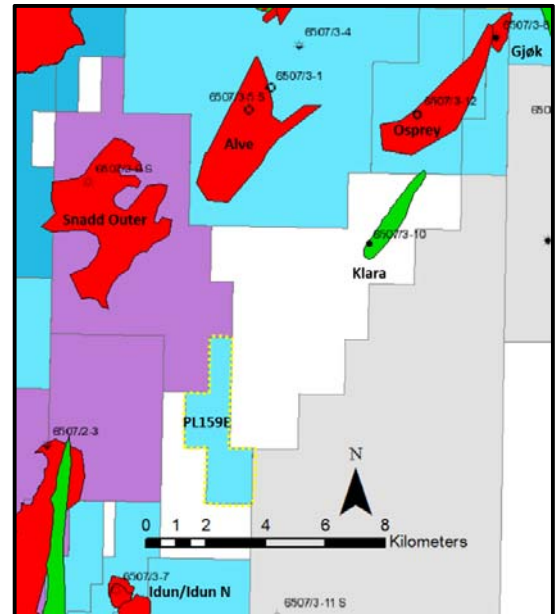


Figure 1: License location map.

The Langbein prospect has been investigated through both geological and geophysical studies and there is no confident definition of a working trap, nor sound geophysical support for hydrocarbon filled reservoir- hence the Decision to drill was negative.

2 Database

2.1 Seismic data

The 3D seismic data set EN0804 and a PSDM set of EN0804 merged with 54km² of BPN0501R08 (for aperture towards South) has been used for the evaluation of the Langbein prospect and was common data base for PL159C/E, see Figure 2.

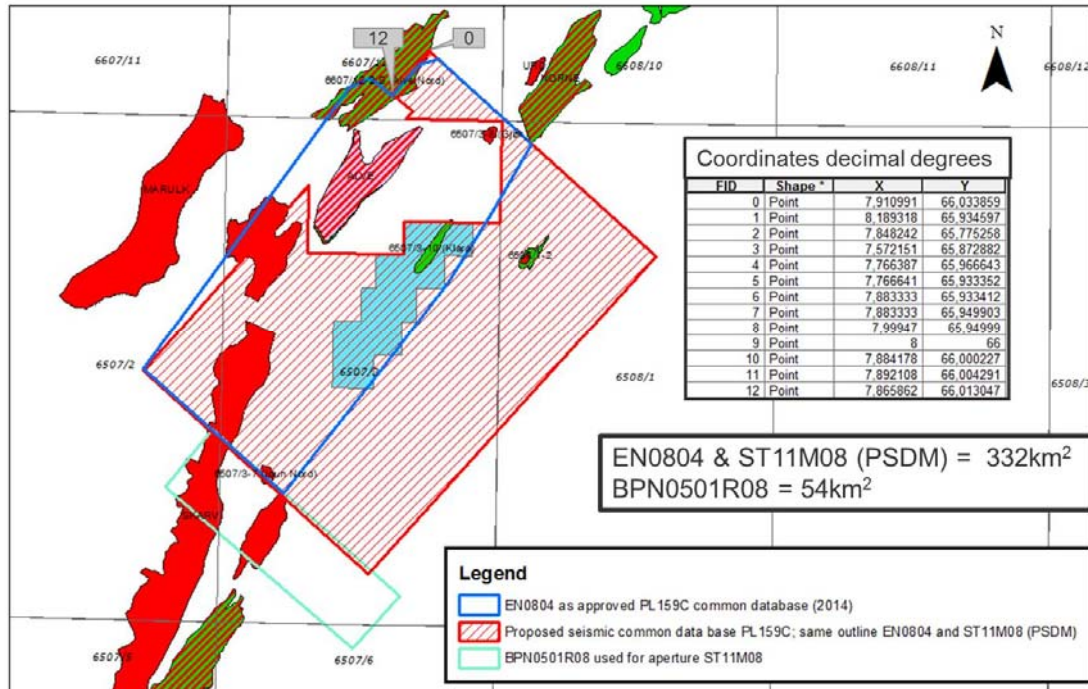


Figure 2: Common seismic database for PL159C and PL159E.

2.2 Well data

Several Middle Jurassic wells in the area has been utilised for the evaluation of the Langbein prospect as seen in table 1 below; most importantly Klara and Mim.

Table 1

Name	Prospect/ field	Year
6507/3-1	Alve	1990
6507/3-3	Idun	1999
6507/3-4	Alve (dry)	2004
6507-3-5S	Alve	2008
6507/3-8	Gjøk	2009
6507/3-7	Idun N	2009
6507/3-10	Klara	2013
6507/3-12	Mim	2017

3 Results from geological and geophysical studies

The apex of Langbein was considered to possibly be a gas hat in PL159C while PL159E was awarded to the same partnership to include what was thought to be the oil leg of Langbein in licensed acreage. The larger Langbein concept is shown in Figure 2.

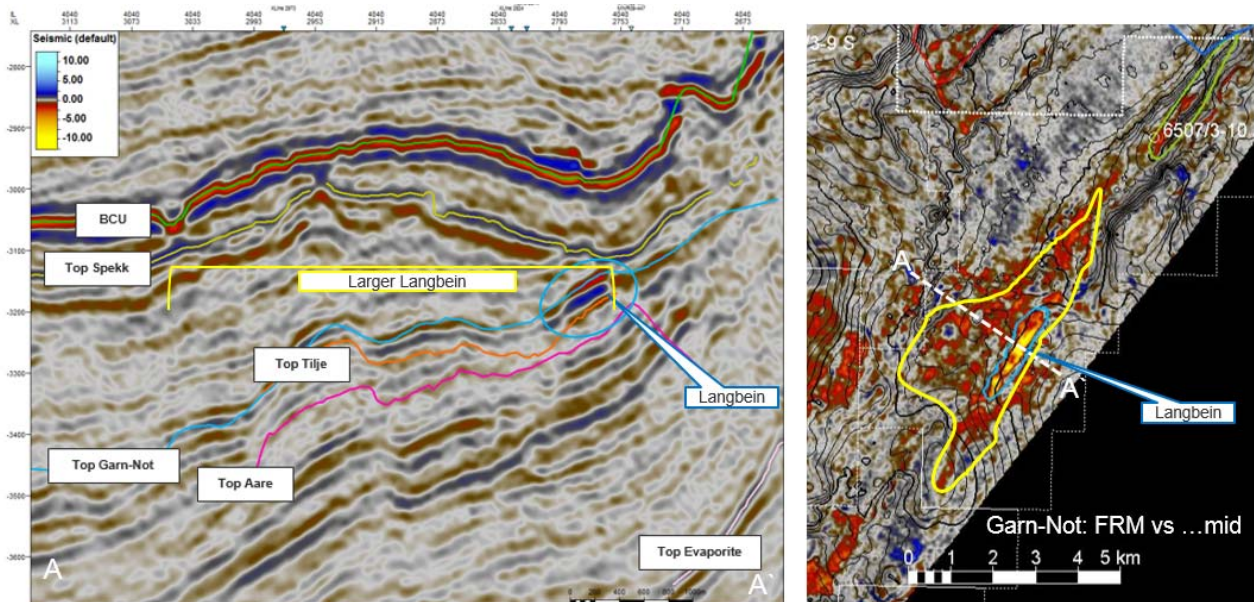


Figure 2: Seismic section through Larger Langbein proposed oil leg with brighter Langbein gas cap (?) apex to the right (East).

The Langbein prospect was a geophysically driven prospect based on the similarities in amplitudes for both discoveries (Klara, Alve, Gjøk and Idun N) and prospects in the area (Mim) as seen in Figure 3.

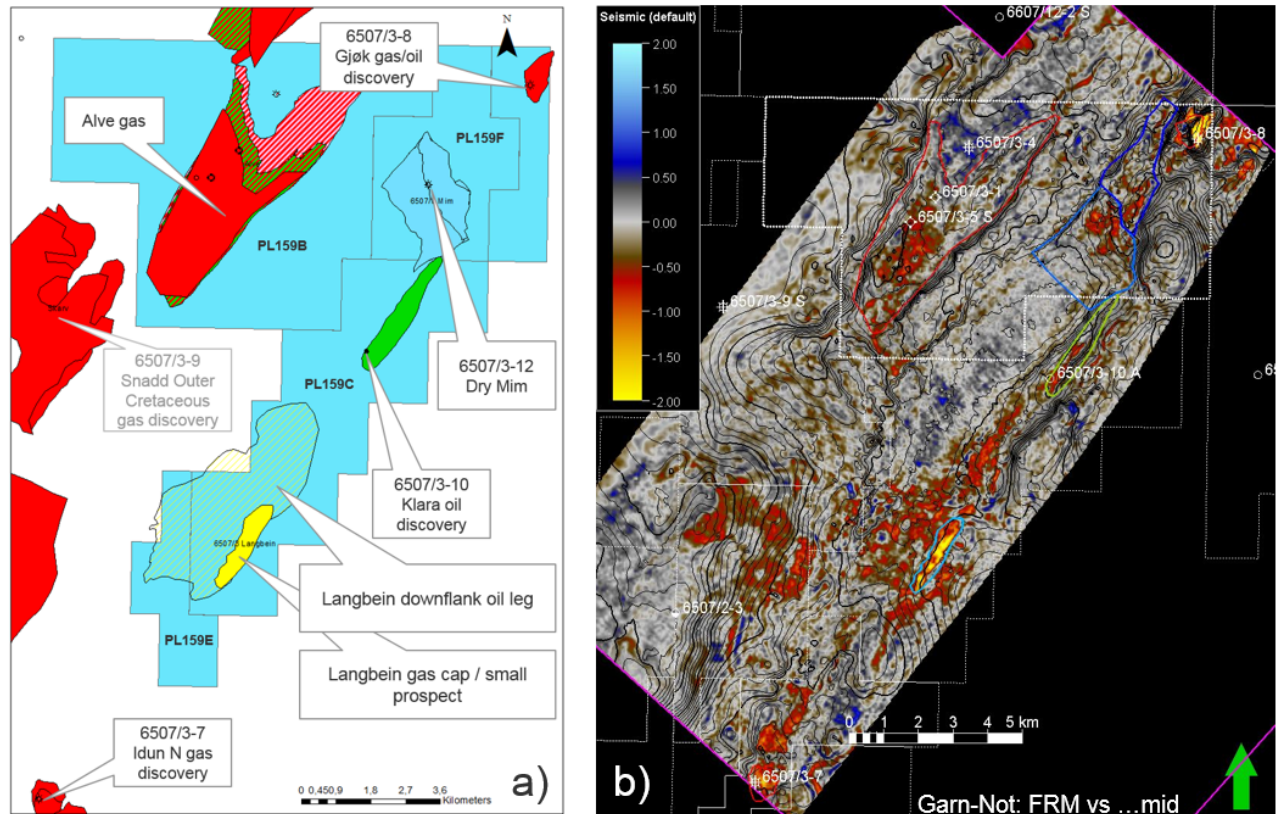


Figure 3a: License overview, Langbein prospect + down-flank proposed oil leg in PL159E. 3b: AVO anomaly regional overview; bright Gjøk (gas), Langbein gas cap (?) and Idun N (gas)- dimmer Alve (gas), Klara (oil), Mim (dry) and Langbein down-flank proposed oil leg.

The Langbein prospect idea was a structural component three- way trap, sealed off by faults from the Klara oil discovery further up-flank towards North.

The structural trap component as well as the amplitude validity has been investigated in PL159C/E.

3.1 Fault investigation

A fault investigation and seal study has been undertaken to establish the main sealing component for the Langbein trap. As seen in Figure 4a and b in order to seal the sandy Garn/Not reservoir package, a fault should have approximately 50m of throw or greater for $SGR > 0,35$. For throws $< 40m$, fault is likely to be leaking. If the reservoir thickness increases, even larger throws are required. This kind of throw has not been identified between Langbein prospect and the Klara oil discovery. In addition, mapped faults do not appear to extend continuously across the structure and have small throws requiring faults to seal via membrane seal as opposed to juxtaposition seal.

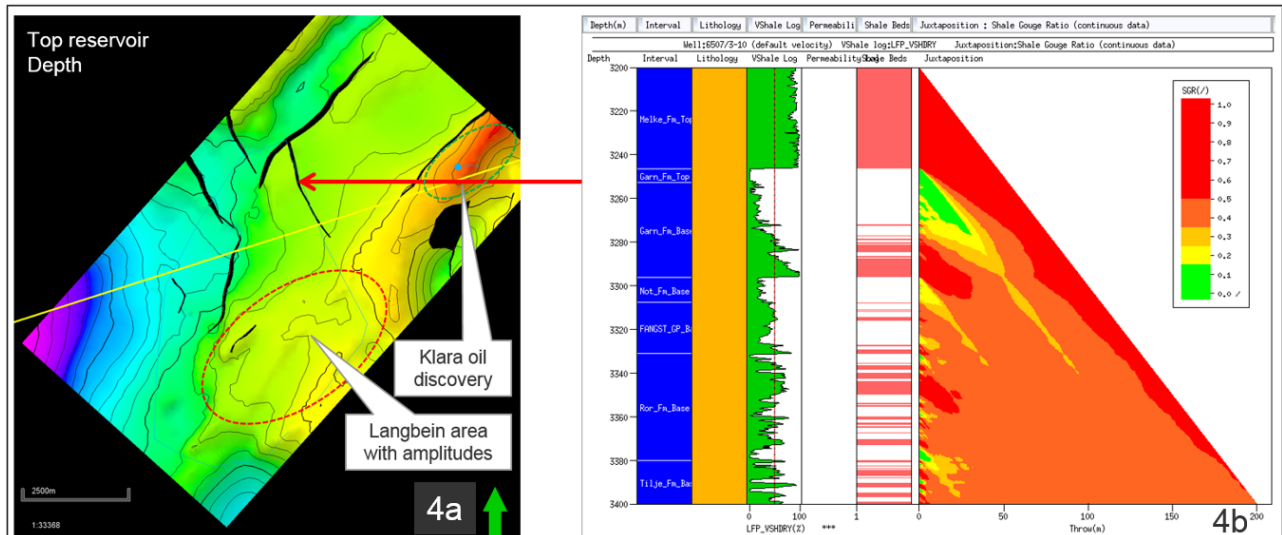


Figure 4a: Top reservoir in depth, main sealing candidate between Langbein and Klara, indicated by red arrow. **3b:** Triangle Plot for 6507/3-10 Well. For mapped fault to the left the fault throw is less than 10m for about half the length and the thickness of Garn/Not Fm. is ~40m. Fault membrane seal is needed as reservoir is juxtaposed on reservoir and mapped throw is too small for this to work with any confidence.

3.2 AVO analysis post Mim (6507/3-12)

The AVO study has compared results from the dry Q1 2017 Mim well (6507/3-12) to observations on Langbein amplitudes based on the idea of apparent similarities in amplitudes pre-well. Mim and Langbein were expected to be similar in AVO response due to having the same reservoir units at similar depths. The greater Langbein postulated oil leg response appeared similar to Mim.

Results from the study shows that there is a high likelihood that an anomalous overlaying rock (seen as a hard response) on Mim, parts of Klara and in area of the Alve well 6507/3-4 (water wet) is contributing to a non-hydrocarbon related response in the underlying seismic amplitudes of the Garn Fm. see Figure 5. This observation together with the non-conformant nature of the amplitude shut-off with depth on Langbein oil leg results in an overall negative conclusion on geophysical support for hydrocarbon filled reservoir.

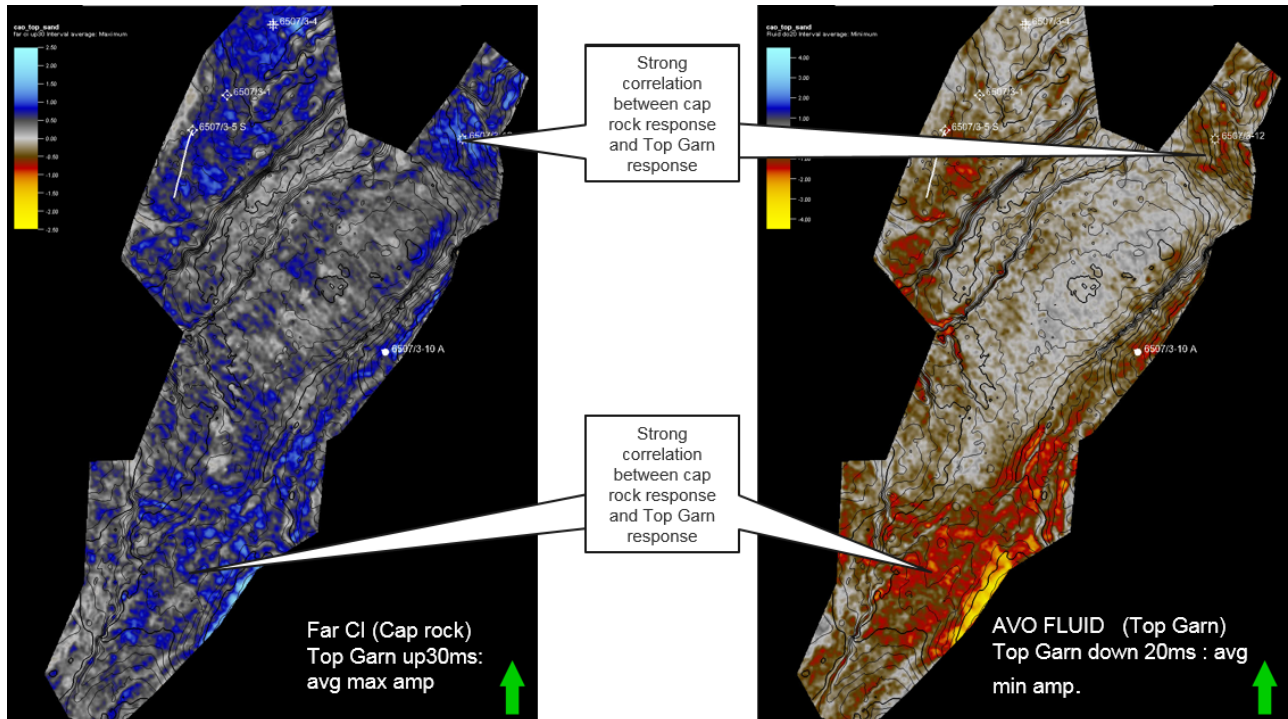


Figure 5: Comparing cap rock effect (hard, bright) to reservoir effect (soft, bright) indicates correlation between the two.

4 Prospect update

Reservoir presence/ quality and source/ migration is more or less proven by the Klara well for the Langbein prospect. But key element; the trap for a hydrocarbon filled large Langbein (gas cap and oil leg), is not identified. No fault with significant through has been identified between Klara OWC and the Langbein prospective area. The Fangst and Båt Groups are not considered likely for stratigraphic traps in this area and pressure cells forming traps is not considered very likely.

Larger Langbein prospect also suffers from an apparent non-conformant amplitude shut off and anti-models are identified from the 2017 AVO study for the 6507/3-12 Mim well.

The larger Langbein prospect as applied for in APA 2015 is not considered a valid prospect model after investigation. The results of the undertaken studies are highly negative for the Langbein down-flank potential. The remaining volume for the Langbein smaller prospect is shown in table 2.

Table 2. Volumes Langbein prospect

Well:	NA		Prospect/discovery name: Langbein prospect						
Undiscovered	Name	Reservoir	In-place res. (MSm ³ oe) 100%, Total Structure			Recoverable res. (MSm ³ oe) 100%, Total Structure			Pg %
			P90	Mean	P10	P90	Mean	P10	
Prospect	Langbein	Garn- Not Formation	0,72	1,22	3,35	0,46	0,72	1,71	29
Comments	Amplitude support for larger accumulation in Langbein not supported by results from dry Mim (6507/3-12)								

5 Conclusion

The undertaken studies do not support the Langbein prospect as a drillable prospect and the license unanimously agreed to *not* Decide to drill. Subsequently PL159E is relinquished.