



PL 1019 – Licence status report

Summary

PL1019 is situated on the Northern Gjallar Ridge of the western Vøring Basin margin. The license was awarded through APA 2018, with the Late Cretaceous Kjerag prospect being the main prospect. The Kjerag prospect is a large 4-way dip structure (115 km²), approximately 400 m below TD of the 6704/12-1 Gjallar well. The license has been scanned for amplitude anomalies at all levels, resulting in two additional prospects (Nupen and Gjallar Updip) and two leads (Keipen and Elgen).

The prospectivity in PL1019 has been evaluated on good quality reprocessed seismic data, and no further derisking potential has been identified. Prospect maturation has led to lower probability of success for the main prospect, the Kjerag prospect. Evaluation of the remaining prospectivity indicates low volume potential or low probability of success.

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1 Licence history

PL1019 is located within block 6704/12 and 6705/10 (part) on the north Gjallar Ridge. PL1019 was awarded through APA 2018, with the Late Cretaceous Kjerag prospect as the main prospect in the license. A one year extension of the drill or drop deadline was applied for and granted by OED on 24.01.2020. During the license period, several prospects have been evaluated and matured, but no drilling candidates have been identified.

Licence: PL1019

Awarded: 01.03.2019

License period: Expires 01.03.2025
Initial period: 6 years

License group:

Equinor Energy AS	50% (Operator)
Wintershall DEA	20%
OMV	20%
M Vest Energy	10%

License area: 645,767 km²

Work programme: 1 year of G&G, then decide on new 3D seismic or DoD within 01.03.2020. 1 year of extension applied for and approved; DoD decision within 01.03.2021.

Meetings held:

12.04.2019	EC/MC startup meeting
14.10.2019	EC/MC meeting No.2
13.12.2019	EC work meeting
04.03.2020	EC meeting
02.09.2020	EC work meeting
11.11.2020	EC/MC meeting No.3

Work performed:

- Seismic interpretation and prospect screening
- Regional structural mapping on 2D lines
- Trap development
- AVO study
- Optimized velocity model for depth conversion
- Structural interpretation and trap seal study
- Petrophysical re-evaluation of 6704/12-1 Gjallar well

Reason for surrender:

The prospectivity in PL1019 has been evaluated on good quality reprocessed data. Prospect maturation has lowered the probability of success for the main prospect, the Upper Cretaceous Kjerag prospect. Evaluation of the other prospectivity indicates low volume potential or low probability of success. There are numerous indications that the license area has seen considerable amounts of hydrocarbons, however there are no indications of any commercial hydrocarbon accumulation. In summary, no drillable prospect has been identified in the licence.

2 Database overviews

2.1 Seismic data

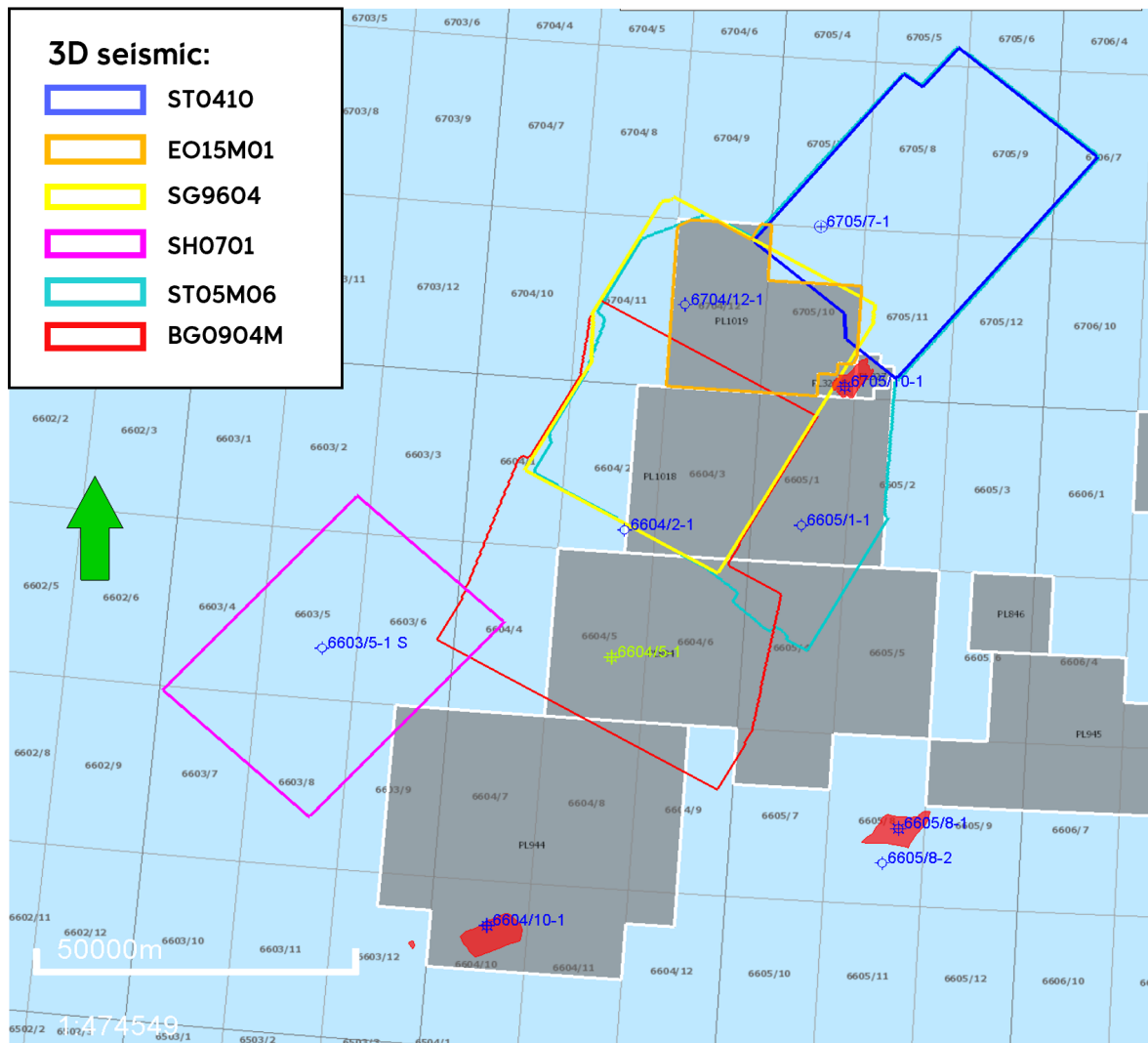


Figure 1: Seismic database

2.2 Well data

	Wellbore name	Prospect/ Field	Year	
K e y	7/12-2	Ula Field	1976	
	7/12-5	Ula Field	1981	
	7/12-6	Ula Field	1981	
	7/12-3A	Ula Field	1977	
	7/12-A08	Ula Field	1988	
	7/12-A13	Ula Field	2012	
	w e l l s	6506/9-2	Fogelberg	2010
		6506/11-7	Morvin	2001
		6507/3-1	Alve	1990
		6507/3-4	Alve	2004
6507/7-14		Dvalin	2010	
6603/5-1		Dalsnuten	2010	
6607/5-1		Amundsen	1987	
6608/10-16		Verdande	2014	
6704/12-1		Gjallar	1999	
6705/7-1		Stordal	2017	
	6604/2-1	Gullris	2011	
	6605/1-1	Obelix	2008	
	6705/10-1	Asterix	2009	
	6605/8-1	Stetind 1	2005	
	6605/8-2	Stetind 2	2008	
	6706/11-1	Vema	1997	

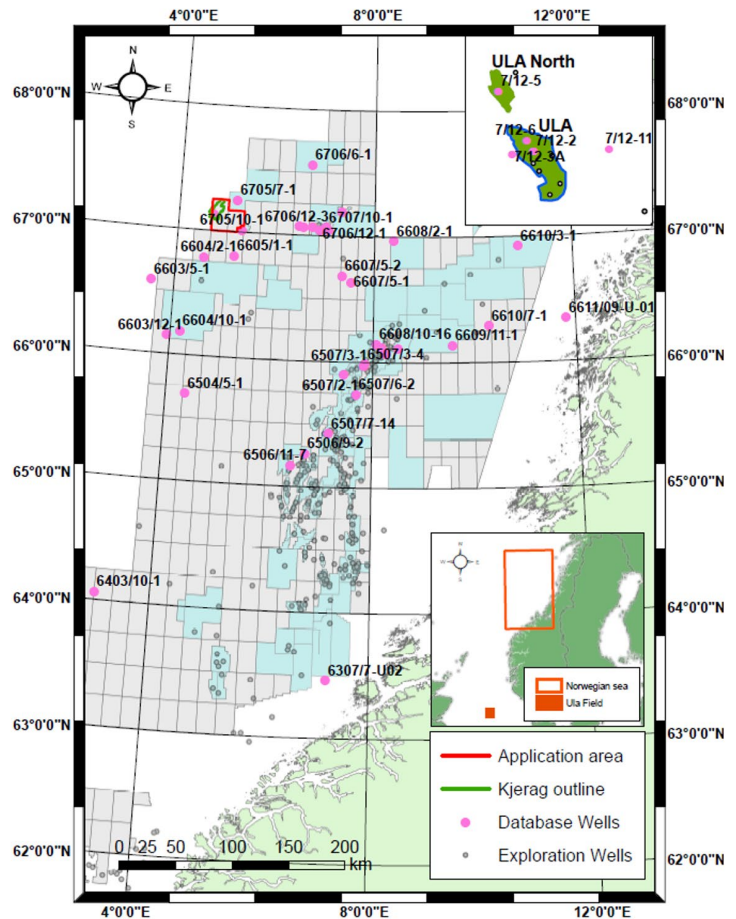


Figure 2: Well database

3 Results of geological and geophysical studies

AVO results:

- Many shallow AVO anomalies observed in the license indicating presence of Hydrocarbons (HC)
- The biggest shallow anomaly (Eocene) is situated directly above the Kjerag structure (Nupen prospect)
 - Indicating leakage of HC from Kjerag structure along the faults
- The most important observation for Kjerag prospect is presence of two small flat spots
 - Situated at the eastern apex of the Kjerag structure
 - Two separate closures with different contact (no communication)
 - AVO anomalies related to flat spots are depth conformed and partially limited by faults. A clear shut-off can be observed on the P-impedance cube (intercept)
 - The presence of flat spots indicates relatively good porosity of the reservoir in the eastern apex area (20% or more?)
- With no other HC indications within the Kjerag structure, this observation is negative for a commercial HC accumulation

Trap seal results:

- Reservoir section in the Kjerag prospect can be correlated to Lysing Fm. in 6705/7-1 Stordal well.
- Preliminary model with ramp-flat detachment and polyphase rifting helps to explain many observations. Largest uncertainties are concluded to be to the west of the Kjerag prospect as a consequence of poor imaging (sills) or lack of good 3D coverage

Gas chimney analysis results:

- No gas chimneys were observed in License PL1019
- Cone shaped mounds at NT Eocene and underlying vertical features indicate hydrothermal vents. Some are observed above high amplitude reflectors indicating volcanic sills
- The chimney cube picks up some of the vents
- The vents are located along faults
- None of the vents seem to be connected to the Kjerag prospect

Sedimentology results:

- Kjerag prospect considered to represent a Late Turonian-Early Coniacian deep-marine play within the Lysing Fm
- Lysing Fm. was previously encountered as a non-functioning reservoir in 6706/11-1 Vema and 6605/8-1 Stetind 1 wells, but the 6705/7-1 Stordal well penetrated 90 m of Lysing Fm. with good reservoir properties, proving a functioning reservoir

4 Prospect update report

The license has been scanned for amplitude anomalies at all prospective levels, using seismic cubes and AVO products.

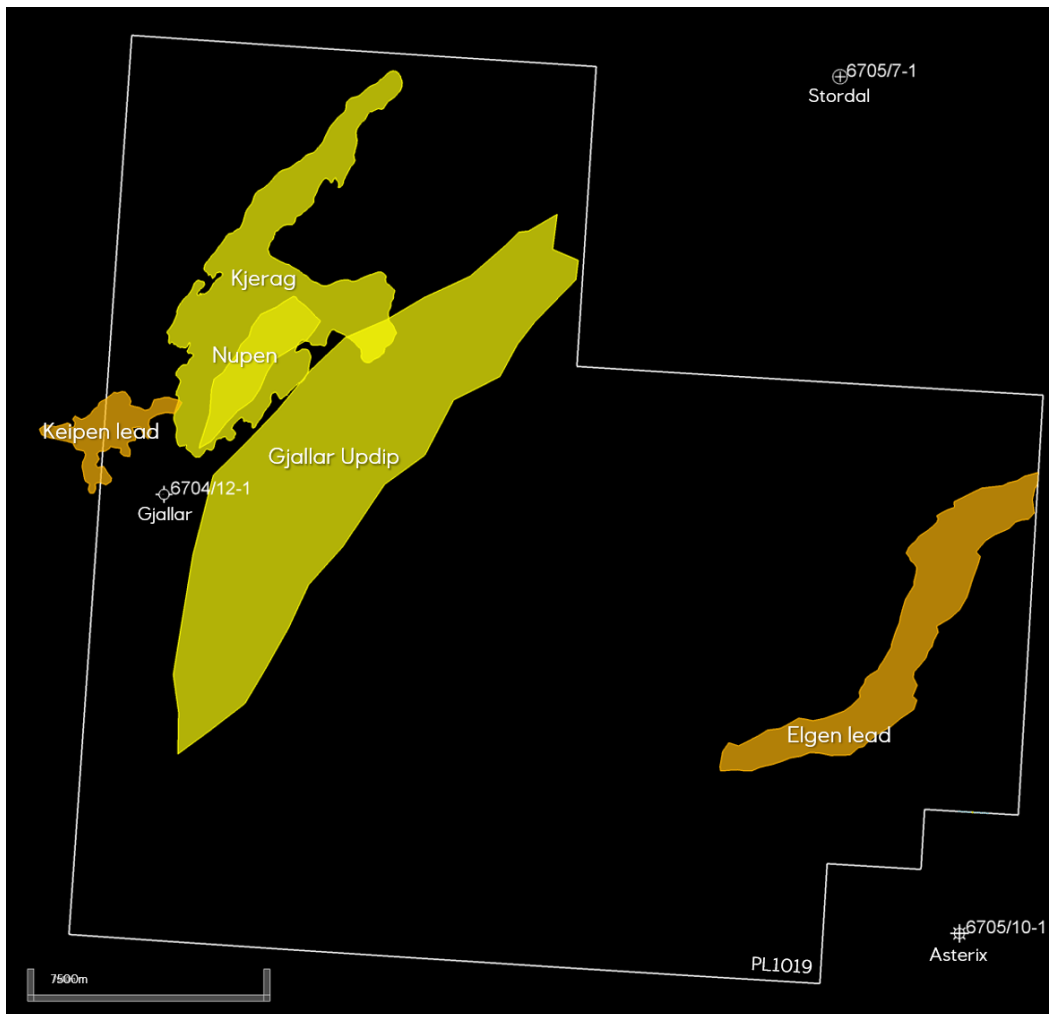


Figure 3: License prospectivity.

The main prospect in the license is the Late Cretaceous Kjerag prospect (Lysing Fm./Coniacian). The structure is approximately 400 m below the TD of the 6704/12-1 Gjallar well. The prospect is defined as a large 4-way dip closure, with a complex and segmented structure (Figure 4). There are some risks related to trap seal, due to possible sand-sand juxtaposition with Nise and Kvitnos Fm, and identified leakage from the structure through faults. The reservoir concept is a deep marine deposit sourced from a westerly Greenland provenance area, represented by a 90 m gross section in the 6705/7-1 Stordal well, 20 km NE of the Kjerag prospect. Apex of top reservoir is at 2300 m TVD BML, and some reservoir risk is therefore associated with burial depth and quartz cementation. A thorough AVO study shows the presence of two small flat spots in the eastern apex of the Kjerag structure. These are two separate closures and they do not share the same contact (no communication). This gives a clear DFI (direct fluid indicator) downgrade for a deeper filling of the Kjerag prospect, but proves good porosity at this depth. No other HC indications have been observed within the Kjerag structure. If gas is present in the main Kjerag structure, it is expected to be visible on seismic data.

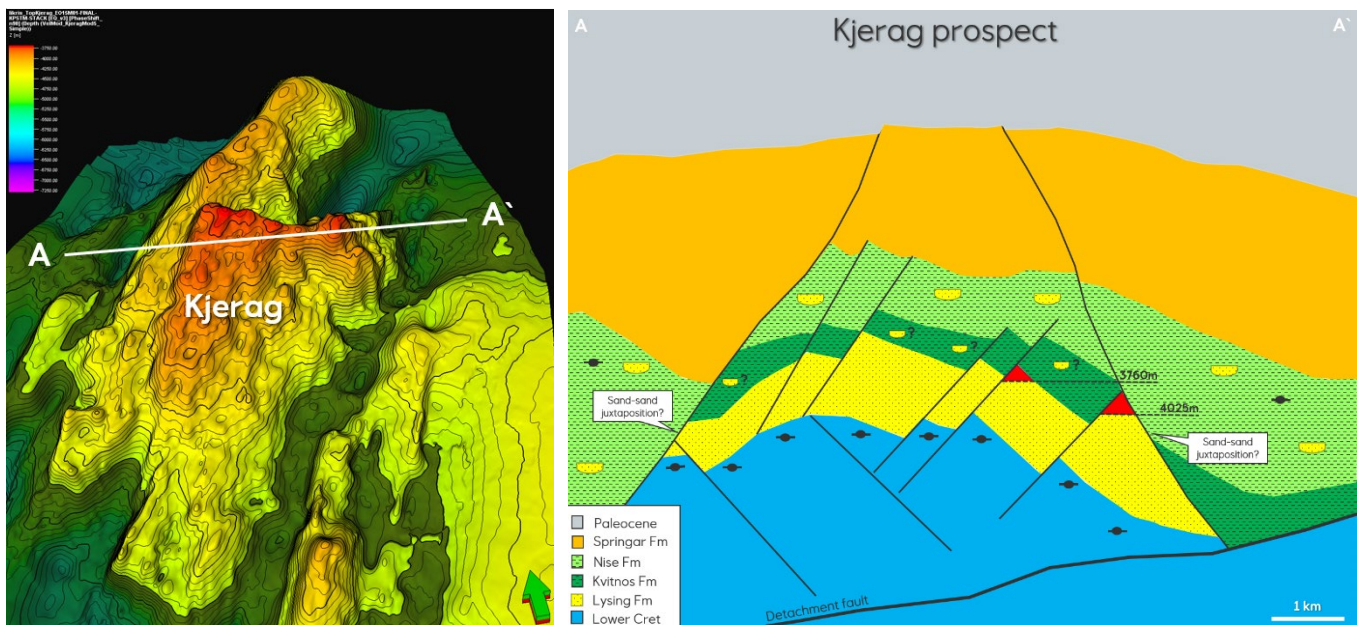


Figure 4: Kjerag prospect top reservoir depth map with maximum structural spill contour, and geo-section through the Kjerag prospect.

The Nupen prospect (Eocene age) has been identified directly above the Kjerag structure. This is the biggest anomaly identified within the license and is probably a result of leakage along faults from the underlying Kjerag structure. The Gjallar well drilled through this stratigraphy, encountering sandstone stringers, but the amplitude anomaly has not been tested. The preliminary volume for the Nupen prospect is mean recoverable 1.9 MSm³ OE. An amplitude anomaly within the same stratigraphy, and a possible extension of the Nupen prospect, is defined as the Keipen Lead. This amplitude anomaly has some lower amplitude response and extends outside the licence to the west.

Within Nise Fm., one prospect (Gjallar Updip) and one lead (Elgen lead) have been identified. Gjallar Updip is a prospect that represents the upside potential of the Gjallar well that was drilled 400 m downflank on the structure. It is a combined structural/stratigraphic trap (2-way dip faulted anticline). Key risks are reservoir quality and seal (trap relies on fault seal and updip stratigraphic pinch out). Updip on structure, the base of the top seal is erosive, which gives a risk for thief sands along the faults. An AVO study has been performed. A patchy fluid response, probably representing small gas hats, in combination with an elevated frequency of faults observed within the structure point to a leakage of the structure.

This indicates that a deeper filling is highly unlikely, and results in a significant DHI downgrade for the larger Gjallar Updip prospect.

Elgen lead is a high amplitude anomaly within the Nise Fm, located NW of the Asterix discovery. AVO study shows that the soft reflector observed within the lead plots as an AVO class IV. Due to a lack of depth conformance the amplitude anomaly is most likely related only to lithology.

Table 1 Volume and risk for prospects in the license. Volumes are given in P90-Mean-P10 (GSm³ OE).

Prospect	Trap Style	Geological classes	Probabilities	Water depth / Reservoir apex
Kjerag	4-way	Slope to basin floor	<ul style="list-style-type: none"> Trap/seal: 0.6 Reservoir: 0.65 Source/migration: 0.9 	1350 m / 3650 m
	In-place resources	Recoverable resources	Pg a priori / DFI downgrade	HC phase split (%)
	0.25 – 6.9 – 19.2	0.15 – 4.4 – 12	35 % / 22 %	100 % gas

Prospect	Trap Style	Geological classes	Probabilities	Water depth / Reservoir apex
Nupen	Structural/stratigraphic	Slope to basin floor	<ul style="list-style-type: none"> Trap/seal: 0.250 Reservoir: 0.6 Source/migration: 0.9 	1350 m / 2370 m
	In-place resources	Recoverable resources	Pg a priori / DFI downgrade	HC phase split (%)
	2 – 3 – 4	1.3 – 1.9 – 2.6	13.5 % / NA	100 % gas

Prospect	Trap Style	Geological classes	Probabilities	Water depth / Reservoir apex
Gjallar Updip	Structural/stratigraphic	Slope to basin floor	<ul style="list-style-type: none"> Trap/seal: 0.3 Reservoir: 0.85 Source/migration: 0.8 	1350 m / 3110 m
	In-place resources	Recoverable resources	Pg a priori / DFI downgrade	HC phase split (%)
	0.4 – 5 – 15	0.1 – 3 – 9.5	20 % / 7 %	100 % gas

5 Technical evaluation

Because the prospect evaluation was stopped at QA level, no QC or economic valuation has been performed for the Kjerag prospect. A rough assumption is that mean inplace resources of 7 MSm³ OE, together with a clear DFI downgrade, will not be sufficient for an economical case for tie-in the Aasta Hansteen.

6 Conclusion

The work programme for PL1019 has been fulfilled. The main prospect (Kjerag prospect) and other prospects have been evaluated within the specified time frame and numerous geological and geophysical studies have been completed. Based on lack of attractive prospects (moderate hydrocarbon volumes and/or high geological risk) the PL1019 partnership agreed to drop the licence.