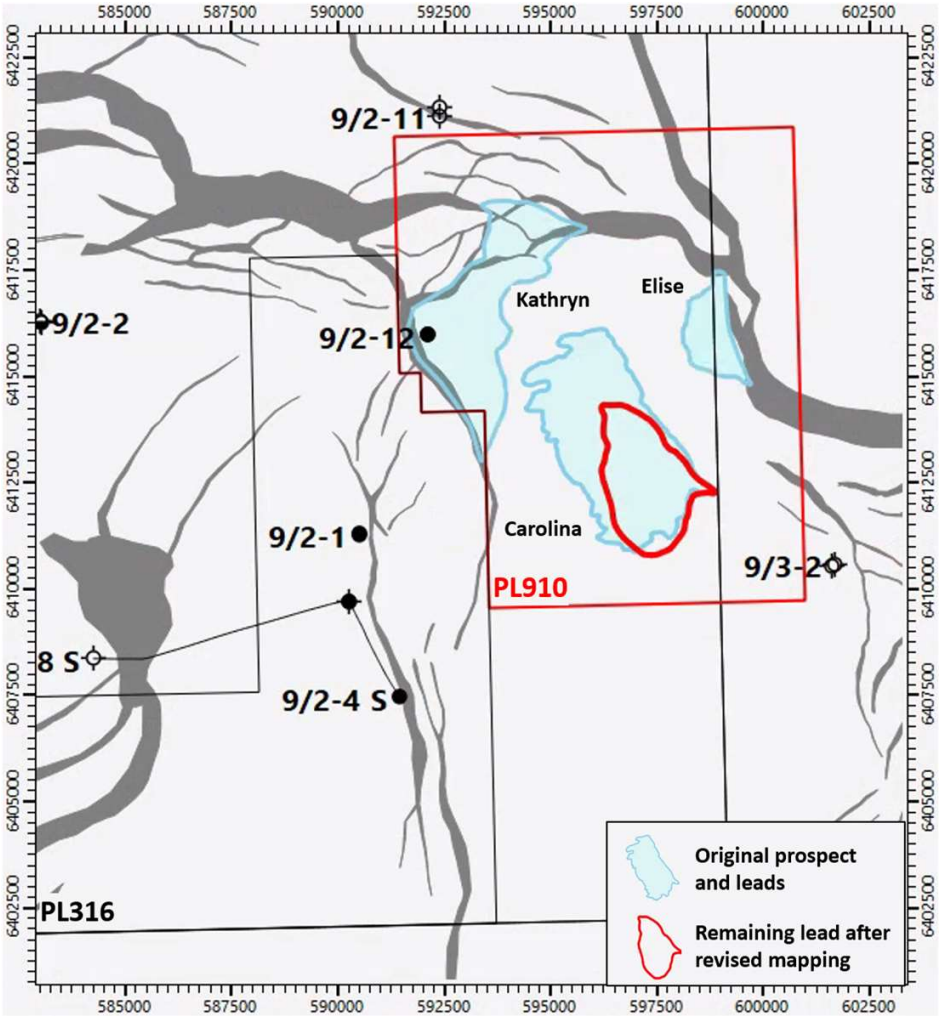
PL910 Status Report



Repsol Norge AS

2020

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1 History of the production license

PL910 was awarded on March 2nd, 2018 as part of the APA 2017 license round to Repsol Norge AS (61.111%) as operator, and LOTOS Exploration and Production Norge AS (22.222%) and OKEA ASA (16.667%) as partners.

Initial work obligations and work periods

Within 1 year or before March 2nd, 2019

- Conduct geological and geophysical studies
- Drill or drop decision

Within 3 years or before March 2nd, 2021

- Drill exploration well
- Concretize (BoK) or drop decision

Within 5 years or before March 2nd, 2023

- Conduct conceptual studies
- Continuation (BoV) or drop decision

Within 6 years or before March 2nd, 2024

- Prepare development plan (PDO)
- Submit PDO or drop decision

Overview of meetings held

- Initial meeting: March 22nd, 2018
- Work meeting: May 30th, 2018
- EC/MC meeting: June 6th, 2018
- EC/MC meeting: October 25th, 2018
- Work meeting: November 5th, 2018
- Work meeting: December 4th, 2018
- Work meeting: February 20th, 2019
- EC/MC meeting: June 13th, 2019
- EC/MC meeting: October 31st, 2019

Grounds for surrender

The license work program was completed by conducting relevant geological and geophysical studies and drilling the 9/2-12 exploration well. Following the evaluation of the well results and completion of the work program, the partnership has concluded that no discovery has been found that can support a positive concretization decision. Based on this, the partnership decided unanimously to surrender the production license.

2 Database overviews

2.1 Seismic data

The seismic database consists of publicly available 2D datasets, multiclient 2D datasets and publicly available 3D datasets within and near the license area. Initially the seismic interpretation of the licence area was carried out on MC3D-EGB2005 3D survey. Detailed structural interpretation over the prospects was carried out on PSDM reprocessed dataset, MC3D-EGBR13. The interpretation of the available 2D surveys was performed in order to better define regional trends, main tectonic phases as well as reservoir and source rock mapping and distribution on a wider area. All the seismic datasets used in the evaluation of the license are shown in Figure 2.1 and listed in Table 2.1.

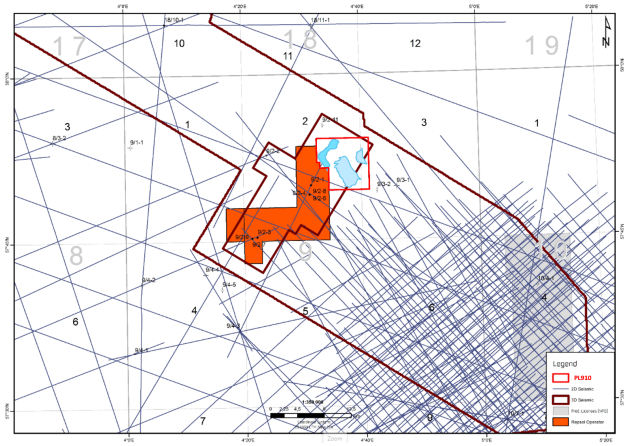


Figure 2.1 Coverage the seismic data used in the licence

Table 2.1 Seismic database

Survey	Year	Type	NPDID
MC3D-EGB2005	2005	3D	4294
MC3D-EGB2005R12-BE-Geotrace	2005/2012 reprocessing	3D	4294
EBSOO	2000	2D	4036
GFR-93	1993	2D	3585
GNSR-91 GC	1991	2D	3391
MN9206-0C	1992	2D	3521
NSR04	2004	2D	4260
SG8726	1987	2D	3023
SH8707	1987	2D	3038
ST8302	1983	2D	2583
ST8606	1986	2D	2896
ST8712	1987	2D	3056
UG97_GC	1997	2D	3897

2.2 Well data

The well database consists of public and non-public wellbores used in the evaluation of the license. Table 2.2 lists all the wellbores used in the license.

Table 2.2 Well database

Well name	Year	Composite logs	Checkshots	Core	Geochemistry	CPI	Pressure Data	NPDID
9/2-1	1987	x	x	x	x	x	x	1038
9/2-2	1987	x	x	x	x		x	1135
9/2-3	1989	x	x	x	x	x	x	1294
9/2-5	1995	x	x	x		x	x	2599
9/2-6S	1996	x		x	x		x	2867
9/2-7S	1997	x		x	x		x	3087
9/2-11	2010	x				x		6341
9/3-1	1986	x	x	x		x	x	921
9/3-2	2005	x			x	x		5173
9/4-1	1968	x			x	x		150
9/4-3	1968	x	x		x			152
9/4-4	1977	x	x		x			305
10/4-1	2015	x				x	x	7724
10/5-1	1976	x	x		x	x		306
10/7-1	1002	x	x	x	x		x	1972
10/8-1	1970	x	x		x	x		175
17/12-1R	1972	x	x		x			514
17/12-2	1973	x	x	x	x			340
18/10-1	1980	x	x	x	x		x	342
18/11-1	1974	x	x	x	x			343

3 Results of geological and geophysical studies

The special studies carried out in the licence area are listed in Table 3.1. The studies which were carried out after the licence was awarded are discussed below.

Table 3.1 List of the studies carried out in the licence

Study name	Year	Company
3D Gravity Modelling of Salt Structures in North Sea Block 9/2	1996	Statoil
Core description and sequence stratigraphy of the Sandnes Fm, Yme field	1998	Statoil
Biostratigraphic Conelation:Yme Field Area	1998	GeoStrata
Geochemical oil-correlation study: Bream, Brisling and Yme Fields	1999	Statoil
Depth and Timing of Neogene Erosion	2003	Globex Norway AS
Basin modelling Egersund Basin	2004	Aceca
Egersund Basin: Rock physics and seismic amplitude modelling	2004	R.P.A
PL316, Egersund Basin fault seal study	2004	Badleys
Regional Play Fairway Evaluation on the Norwegian North Sea	2005	PGL
A stratigraphic reconstruction of Bulk volatile geochemistry from fluid inclusion	2006	F.I.T
Multicomponent kinetics of a source rock from the Tau Fm	2006	Sintef
Pore pressure and vertical migration in the Yme area	2006	Sintef
Yme area petroleum system	2006	Sintef
Egersund basin: Basin modelling Study	2007	PGL
Bulk Kinetics of two samples from well 9/3-2	2007	APT
Technical note on the Jurassic reservoir in the Yme Field	2010	Ichron
Petroleum systems study and structural reconstruction	**2019**	**Repsol**
Fluid inclusion study, well 9/2-12	**2020**	**Repsol**
Geochemistry of the well 9/2-12	**2020**	**Repsol**

Petroleum systems study

New basin modelling study and structural reconstruction was carried out in order to better assess the main risk factors in the Egersund basin area, which were migration, amount of generated hydrocarbons and timing of the structures in relation to migration. The results from the analysis of the three oil samples from Yme field, heat-flow model which took into account crustal thinning, and a new seismic interpretation, were implemented to this study. As a sensitivity, a model where the heat-flow was defined with constant temperature gradient was also tested.

The model with constant temperature gradient suggested that the onset of oil generation took place ~72 Ma ago, whilst the more sophisticated model, which took into account the crustal thinning, suggested that onset of oil generation could have taken place already ~113 Ma.

Proven hydrocarbon volumes in the Yme Field were used for calibration of the parameters in this study.

Geochemistry study of well 9/2-12

The gas analysis showed that methane in the Early Cretaceous, and in the Tau formation was mainly of bacterial origin, respectively ~98 % and ~92 % of total gas. C2+ components are of thermogenic origin. Sandnes and Bryne gases are mixed gases (bacterial + thermogenic) where the thermogenic component is higher. Ethane and propane maturity for Sandnes and Bryne thermogenic component present in the total hydrocarbon gas range between Rc~1,0-1,2%, indicating that this Rc% better reflects the minimum thermal maturity of the source that has generated the thermogenic component of the gas present in Sandnes and Bryne, and for this reason, it can be inferred that gases present in Sandnes and Bryne formations are migrated gases. The results indicate in-situ origin for the gases in the Early Cretaceous, and Tau Formation.

Fluid inclusion stratigraphy study of well 9/2-12

A fluid inclusion stratigraphy (FIS) analysis was performed on a total of 228 cuttings samples in 9/2-12 from 1250-3155 m, with additional support from 6 selected samples for fluid inclusion petrography (FIP) and fluid inclusion microthermometry (FIM). No proximity to pay and mostly sub-anomalous hydrocarbon responses were recorded in the upper section at 1250-2985 m. The deeper section at 2988-3155 m recorded higher concentrations of methane and liquid-range species, suggesting that some natural migrated hydrocarbons are present and contributed from local mature kerogen. Rare petroleum inclusions are identified at 3012 m and 3036-3131 m, indicating petroleum migration at some time. Although proximity to pay indicators are not recorded, presence of upper-moderate gravity light oil inclusions may suggest that some hydrocarbons have been locally or proximally generated. Fluorescence color of dominant oil inclusions recorded in 9/2-12 seems to be consistent with the 38 gravity oil tested in the Yme Field to the west.

Summary

Fluid inclusion stratigraphy analysis (FIS) together with fluid inclusion petrography (FIP) and fluid inclusion microthermometry (FIM) reported the existence of hydrocarbon-bearing fluid inclusions, thus proving that hydrocarbons migrated through the reservoir sandstones of Sandnes and Bryne Formations at the 9/2-12 (Kathryn) well location. Microthermometry data from primary, dust-rim-hosted aqueous fluid inclusions, i.e., located at the detrital quartz grains/cement boundary, suggest the onset of quartz cementation occurred at minimum burial temperatures of ~90°C during the Early Cretaceous (~120 Ma). Presence of secondary (?) hydrocarbon-bearing fluid inclusions would be related to the onset of oil generation and migration through the reservoir during the latest Early Cretaceous (~113 Ma), when minimum reservoir temperatures could be estimated ~T = 95-100°C as per basin modeling reconstruction – no microthermometry data on HC-bearing FIs was acquired.

4 Prospect update report

Prospect and leads

Originally one prospect, "Kathryn" and two, leads "Carolina" and "Elise" were identified in the licence area (Figure 4.1).

The Yme Gamma structure was used as an analogue for the trap in the Kathryn prospect. Common for the prospect and the leads was the Sandnes formation reservoir, the Tau formation source rock and the Egersund formation cap rock. The trap of the Kathryn prospect was defined by a 3-way dip-closure to the south-eastward and hanging wall fault seal to the north and west. On present day maps the Kathryn prospect is in the migration shadow.

Carolina lead was not considered a viable exploration target after the revised mapping, which reduced the closure area from the original 11.7 km^2 to 5.5 km^2 (Figure 4.1). The structure has only about 18 m relief, which would include only the two uppermost poor quality reservoir zones of the Sandnes formation.

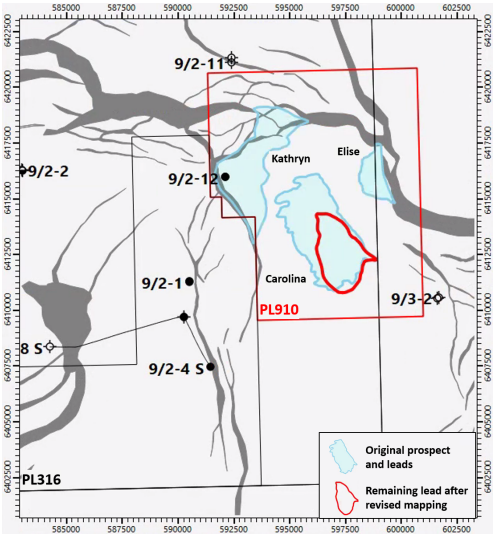


Figure 4.1 Original prospects and remaining lead in the licence area

Local structural reconstruction in the area from Kathryn prospect to the kitchen area showed that present day structural configuration, where the prospect is in migration shadow, was established sometime during the deposition of the Tor formation ~72 to ~66 Ma ago (Figure 4.2). This reconstruction also showed that the Elise lead have been in migration shadow through whole its geologic history.

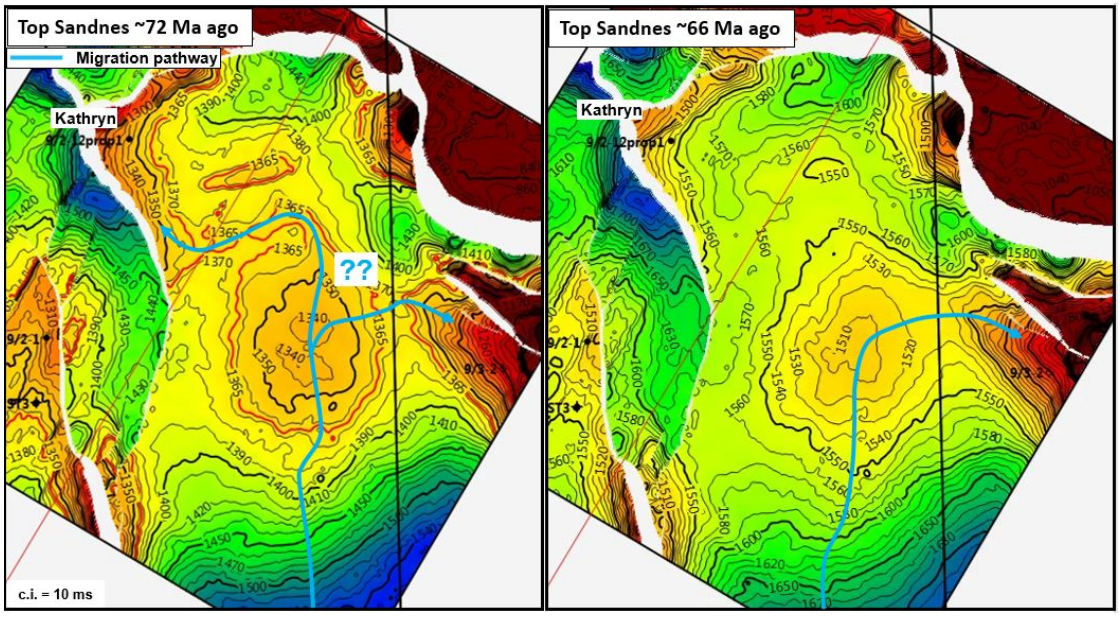


Figure 4.2 Change in migration pathway to Kathryn prospect ~72 to ~66 Ma ago

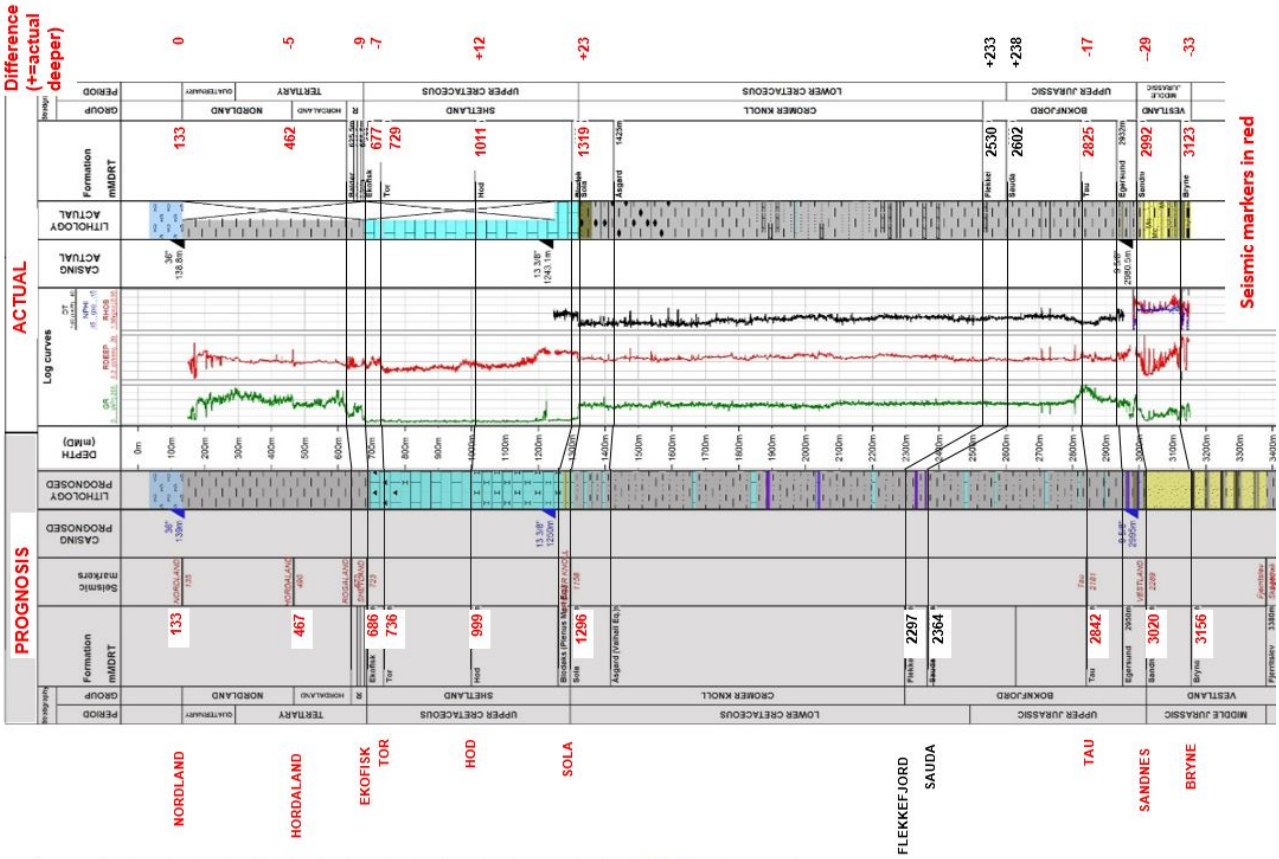
According to the 2019 petroleum systems study, which took into account crustal thinning, the onset of oil generation started ~113 Ma ago. This would leave over 40 Ma time window for expulsion to Sandnes carrier bed and secondary migration.

Well results

The well 9/2-12, which was drilled in the Kathryn structure did not discover hydrocarbons. The lithology in the well was as expected, very similar to the nearest reference well 9/2-1 in the Yme field. The Sandnes reservoir had slightly better reservoir parameters (N/G=0.66, Ø=0.17) than prognosed (N/G=0.53, Ø=13). Depth prognosis of the formation tops was within estimated uncertainty range apart from the Bryne formation, which appeared 3 m outside the range. Flekkefjord and Sauda formations are based on the formation tops with no interpretable seismic response and were not part of the prognosis (Figure 4.3). The geochemical analysis in the 9/2-12 well proved that no oil have migrated to the Kathryn structure.

Possible reasons for failure:

1. There are no faults, which juxtapose the source and carrier bed, hence the primary migration had to take place stratigraphically downward through the laterally homogeneous Egersund formation. Due to this mechanism, there may have appeared significant lag between primary and secondary migration. This factor could not be studied with the available data.
2. The northern shallower part of the Egersund basin did not generate enough oil to increase the pressure in the Tau formation, which is needed to start the primary migration through the Egersund formation.
3. Primary migration was triggered by fracturing during the late Cretaceous tectonic activity or by Miocene uplift, which would have increased the pore pressure in the oil filled source rock. In this case, the migration pathway would already have turned to the north-east, leaving the Kathryn structure in the migration shadow.
4. The fetch area was so small that no oil reached the structures.



Group	Formation	9/2-12 Prognosed tops		Actual tops		Diff	Vertical uncertainty	Picked on
	(m)	MDRT	TVDSS	MDRT	TVDSS	(+/-)		
Nordland	Nordland*	133	99	133	99	0		LWD
Hordaland	Hordaland	467	433	462	428	(-5)		LWD
Rogaland	Balder*	639	605	626	592	(-14)	±25	LWD
	Sele	658	624	647	613	(-12)		LWD
	Lista	666	632	657	623	(-10)		LWD
	Våle	680	646	669	635	(-11)		LWD
Shetland	Ekofisk*	686	652	677	643	(-9)	±25	LWD
	Tor*	736	702	729	695	(-7)	±25	LWD
	Hod*	999	965	1011	977	+12	±25	LWD
	Blodøks	1259	1225	1302	1268	+43		LWD
Cromer Knoll	Sola*	1296	1262	1319	1285	+23	±25	LWD
	Åsgard	1415	1381	1425	1391	+10		LWD
Boknfjord	Flekkefjord	2297	2263	2530	2496	+233		LWD
	Sauda	2364	2330	2602	2568	+238		LWD
	Tau*	2842	2808	2825	2791	(-17)	±60	LWD
	Egersund	2946	2912	2932	2898	(-14)		LWD
Vestland	Sandnes*	3020	2986	2991	2958	(-29)	+80/-30	LWD/Cuttings
	Bryne*	3156	3122	3123	3089	(-33)	+80/-30	LWD/Cuttings
Well TD	In Bryne			3155	3121			
	Fjerritslev	3380	3346	not reached				
Hegre	Skagerrak	3414	3380	not reached				

*Seismic progn.

- Lithology was as prognosed
- The prognosis for Top Flekkefjord FM was 233 m too deep. Difference was caused by thicker Åsgard formation in the Kathryn well location than in the offset wells (9/2-1 and 9/2-11)

Figure 4.3 Well 9/2-12 geologic prognosis vs. actual

5 Technical evaluation

Since the exploration well 9/2-12 did not discover any hydrocarbons in the Kathryn prospect, no technical evaluation has been carried out.

6 Conclusion

The well 9/2-12 drilled in the Kathryn prospect did not discover any hydrocarbons. The revised mapping and structural reconstruction showed that the only other potential exploration targets, Carolina and Elise leads, could not be matured into prospects.

Since no other drillable prospects have been identified, the partnership has unanimously decided to surrender the production licence.