

# Relinquishment report

PL 988



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# 1 PL988 License history

PL988 was awarded on the 1<sup>st</sup> of March 2019. The operator was Lundin Energy Norway with 40% equity, and partners were DNO Norge and Vår Energi with 30% equity each. The initial period was set to 7 years (2+2+2+1). Work commitments were to reprocess 3D seismic data and to carry out G&G studies within two years prior to a drill or drop (DOD) on 1<sup>st</sup> of March 2021. The work commitments have been fulfilled.

PL988 is located in the eastern part of the Rugne sub-basin on the west flank of the Oseberg High, see Fig. 1.1. One prospect and one lead were identified during the 2018 application round, however based upon re-evaluation of the reprocessed seismic the licence prospectivity were downgraded and it was decided to relinquish the licence in February 2021.

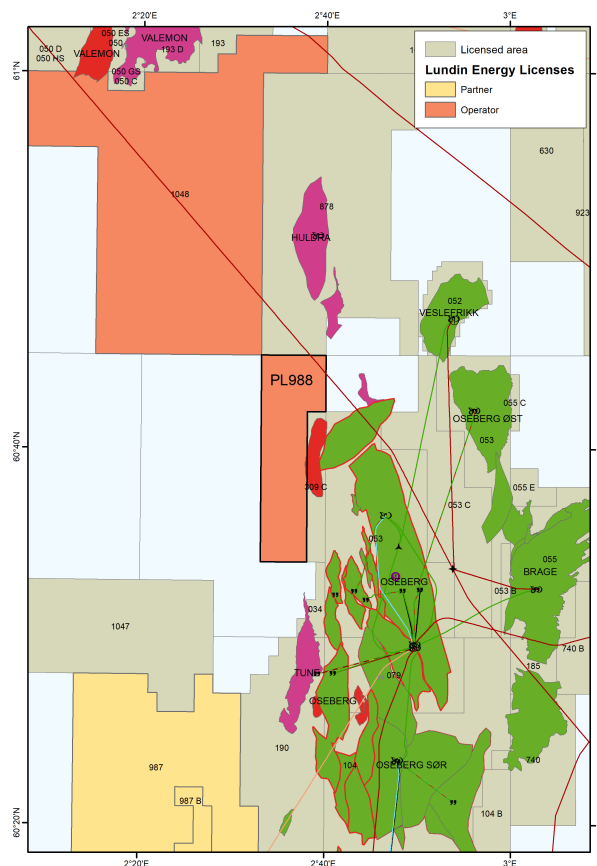


Fig. 1.1 PL988 overview map

Totally four ECMC meetings were held during the two years license period.

- 1 ECMC start-up meeting on the 9<sup>th</sup> of April 2019
- 2 Year end ECMC meeting on the 20<sup>th</sup> of November 2019
- 3 Year end ECMC meeting on the 5<sup>th</sup> of November 2020
- 4 ECMC on 11<sup>th</sup> of February 2021 – proposal to drop the licence



## 2 Data base overview

### 2.1 Seismic data

The common seismic database is shown in figures Fig. 2.1 and listed in . The seismic database consists of part of the prestack-depth migrated CGG18M01. Due to a lot of residual multiples at target level and non-optimal velocity the license decided to carry out a full reprocessing of CGG18M01. The reprocessing improved the seismic data quality and gave an uplift with respect to continuity and improved signal to noise ratio. The reprocessed area is outlined in Fig. 2.1.

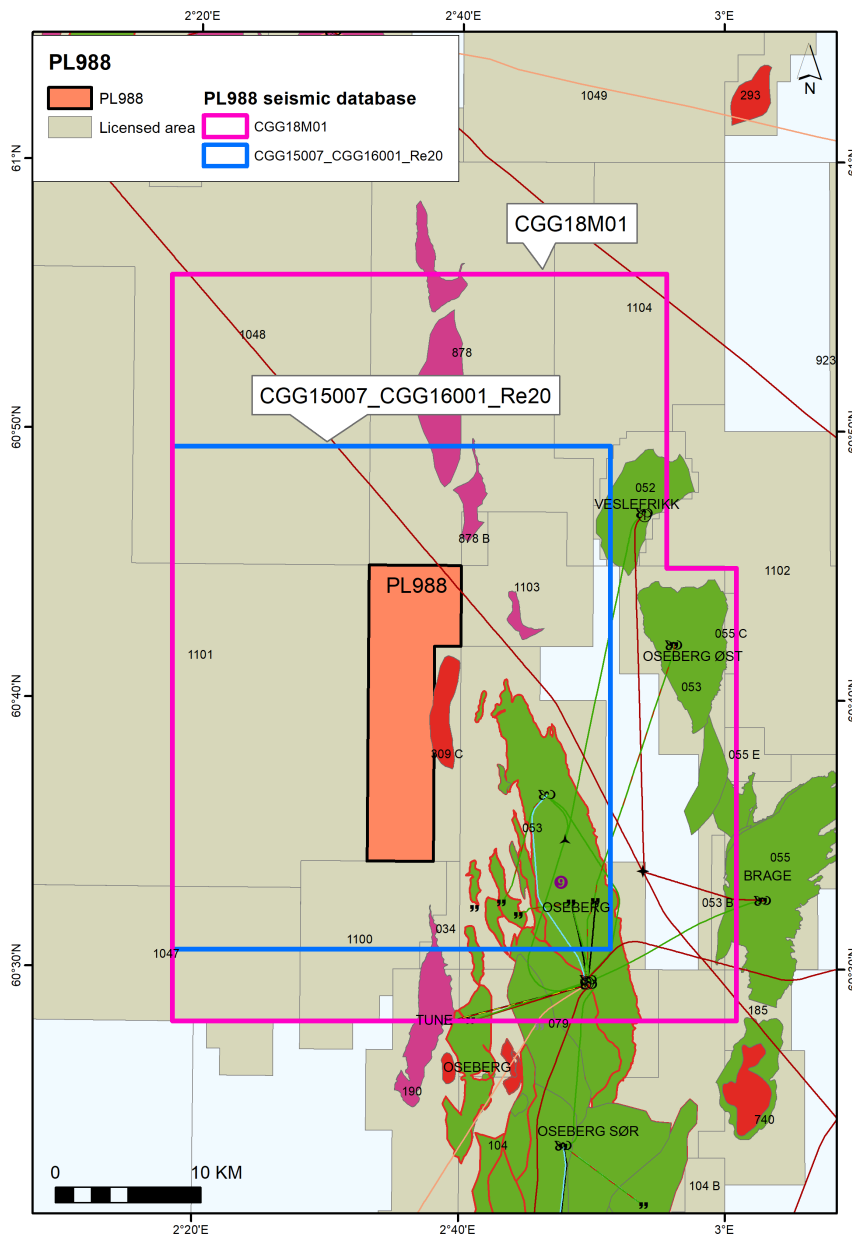


Fig. 2.1 Seismic database and reprocessing area

Table 2.1 Seismic database PL988

Survey	NPD ID	area (sqkm)	marked available	processing year
<b>CGG18M01</b>		1905	yes	2018
underlying surveys: CGG14003	7984		yes	
CGG14006	8128		yes	
CGG15001	8179		yes	
CGG15003	8194		yes	
CGG15004	8195		yes	
CGG15005	8196		yes	
CGG15007	8252		yes	
CGG16001	8332		yes	
<b>CGG15007_CGG16001_Re20</b>	8252 / 8332	1048	yes	2015/2016/2020

### CGG15007 CGG16001 Re20 PL988

The reprocessing focused on 3D deghosting, denoising and demultiple. A velocity model update was carried out using tomographic inversion from Top Rogaland. In summary, the reprocessing resulted in a seismic uplift both with respect to continuity, focus and improved signal to noise.

## 2.2 Well data

The common well database is listed in Table 2.2. The wells have been used for seismic tie, correlation, reservoir property evaluation, geochemical and structural analysis studies.

Table 2.2 PL988 well database

Well	Name	Licence	Operator	Year	TD M TVD	NPDID
30/2-1	Huldra	51	Statoil	1992	4325	72
35/3-5	Agat	41	Saga	1982	4112	433
30/3-9	Canon	52	Statoil	2000	4010	4053
30/3-10 S	Canon	52	StatoilHydro	2009	3962	6045
30/4-1	Rugne Sub-basin	43	BP Norway	1979	5448	377
30/5-1	Rugne Sub-basin	34	Shell	1972	4124	379
30/5-2	Tune	34	Hydro	1996	4076	2886
30/5-3 A	Corvus	309	StatoilHydro	2009	3990	6055
30/5-3 S	Corvus	309	StatoilHydro	2009	3991	6043
30/6-6	Oseberg	53	DNO	1982	3224	39
30/6-7	Oseberg	53	NorskHydro	1982	3236	73
30/6-8	Oseberg	53	NorskHydro	1982	3600	77
30/6-11	Oseberg delta	53	NorskHydro	1983	4001	58
30/6-16	Oseberg	53	NorskHydro	1985	3300	333
30/6-17 A	Oseberg Alpha	53	NorskHydro	1985	2528	894
30/6-17 R	Oseberg Alpha	53	NorskHydro	1986	2528	849
30/6-20	Oseberg	53	NorskHydro	1986	3045	892
30/6-21	Oseberg	53	NorskHydro	1987	3098	1037
30/6-24S	Oseberg	170	NorskHydro	1991	3742	1855
30/6-27	Oseberg	53	NorskHydro	2001	3378	4425
30/6-28 S	Oseberg/Crux/Crimp	53	Statoil	2012	3832	6768
30/7-3	Oseberg	40	Norsk Hydro	1976	4043	386
30/8-2	Oseberg	190	NorskHydro	1996	2405	2723
30/9-10	Oseberg S	104	NorskHydro	1990	3642	1514
30/9-28 S	Oseberg S	104	Statoil	2016	3928	7869
30/11-8S	Krafla	35	Statoil	2011	3844	6540
34/10-18	Oseberg	50	Statoil	1983	3024	23



## 3 Geological and geophysical studies and results

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

- **Petroleum system analysis**

The petroleum populations and charge routes in the licence area have been mapped. Totally 42 core chips or cutting samples were taken from 12 wells adjacent to the licence, in addition 62 oil samples were analysed from Lundin's oil database used for petroleum population mapping. The results show that migration routes in the greater PL988 area can be mapped with confidence.

- **Structural study**

The west Oseberg fault complex comprising the licence area have been studied both with respect to 2D and 3D structural evolution. A 3D back-stripping study concludes that the southernmost part of the license is in a more favourable position to catch footwall-derive erosion products during the Upper Jurassic/Lower Cretaceous. The southern area is also located close to a relay ramp which might provide axial drainage into the graben. However, the possible exposed areas are probably to limited to source significant amount of sand during Upper Jurassic/Lower Cretaceous

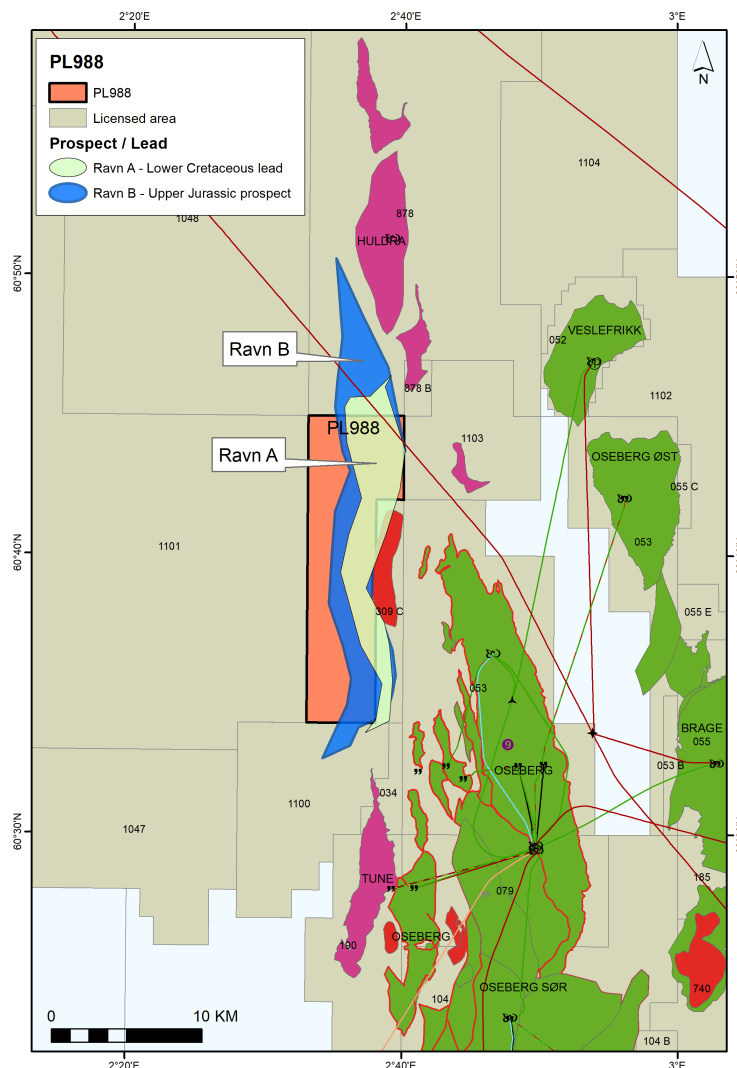
- **Internal seismic processing**

An in-house post stack seismic processing was performed including structurally oriented noise attenuation and inversion based spectral bandwidth enhancement. In addition, relative impedance and relative amplitude cubes were generated. The post stack processing improved noise level and sharpness. However, multiple/imaging issues were not resolved in the post stack domain at the target level around 3sec TWT. A full reprocessing of a subset of NVG data covering PL988 was therefore performed, see section 2.1 Seismic data.

## 4 Prospect update report

### **Prospect update report**

The primary prospectivity From the APA 2018 application is one upper Jurassic prospect, Ravn B, and one lower Cretaceous lead, Ravn A. The outline of the prospectivity is shown in Fig. 4.1, and the resource potential is given in Fig. 4.2.



**Fig. 4.1 PL988 prospectivity**  
Outline of Ravn B prospect and Ravn A lead

Discovery/ Prospect/ Lead name <sup>1</sup>	D/ P/ L <sup>2</sup>	Case (Oil/ Gas/ Oil&Gas) <sup>3</sup>	Unrisked recoverable resources <sup>4</sup>						Probability of discovery <sup>5</sup> (0.00 - 1.00)	Resources in acreage applied for [%] <sup>6</sup> (0.0 - 100.0)	Reservoir		Nearest relevant infrastructure <sup>8</sup>	
			Oil [ $10^9\text{Sm}^3$ ] ( $>0.00$ )			Gas [ $10^9\text{Sm}^3$ ] ( $>0.00$ )					Litho-/ Chrono- stratigraphic level <sup>7</sup>	Reservoir depth [m MSL] ( $>0$ )	Name	Km ( $>0$ )
			Low (P90)	Base (Mean)	High (P10)	Low (P90)	Base (Mean)	High (P10)						
Ravn B	P	Oil	2.57	18.29	37.45	1.47	10.43	21.29	0.15	56.0	Draupne Fm./ Upper Jurassic	3920	Oseberg	5
Ravn A	L	Oil	0.45	5.40	11.34	0.26	3.08	6.47	0.12	74.0	Agat Fm./ Early Cretaceous	3920	Oseberg	5

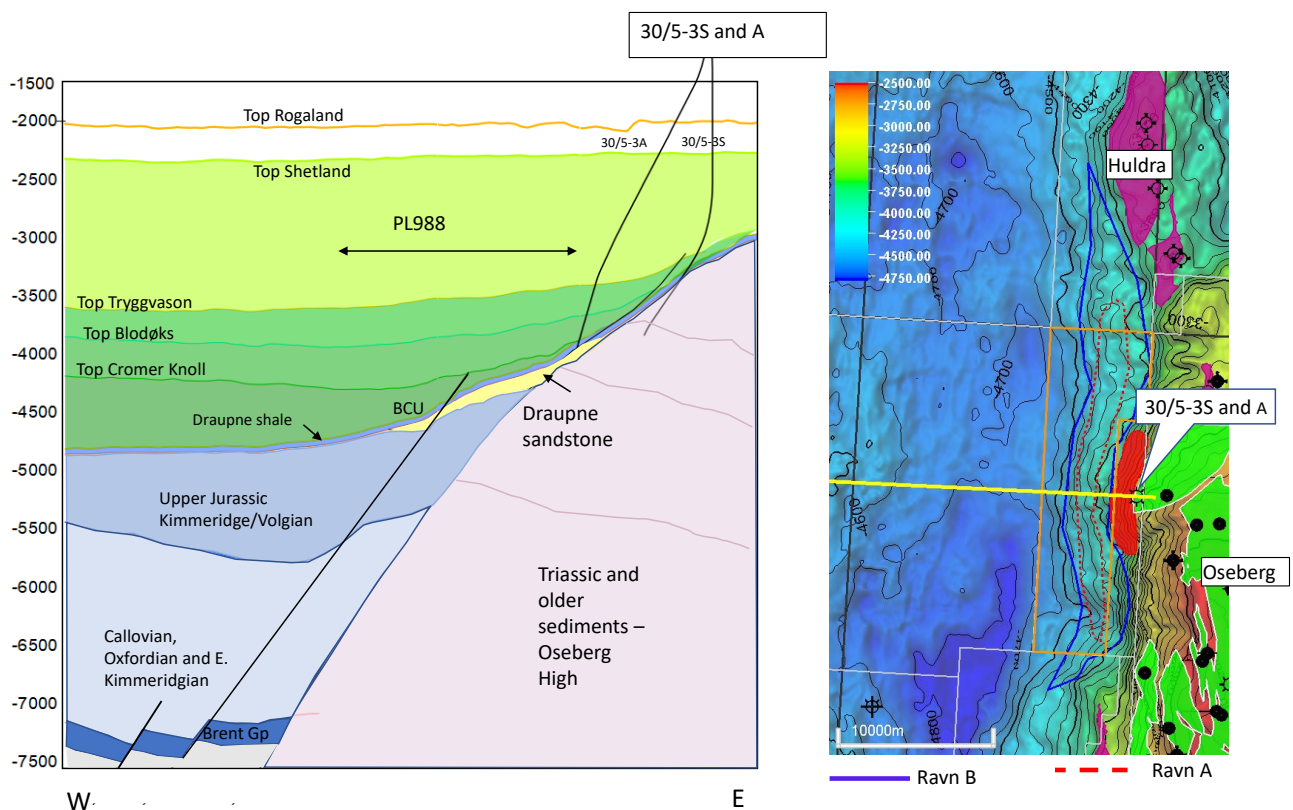
**Fig. 4.2 Resource overview Ravn A and B**  
From the 2018 APA application

### Ravn B prospect

The Ravn B stratigraphic prospect is situated on the west flank of the 16/5-3 Corvus discovery that proved gas in Triassic rocks and unspecified hydrocarbons in Draupne sandstone in a westward sidetrack (30/5-3 A). The prospect is the downflank continuation and expansion of the Draupne sandstone. The depth to the prospect is around 4km. Dip closure is expected towards west and pinchout both northwards against the western Huldra fault and southwards against the northern Tune fault. The reservoir is expected to be Draupne formation proximal sandy fan facies, eroded from the adjacent Oseberg high, with improved properties downflank compared to well 30/5-3 A. The prospect is likely to be sourced from the organic rich marine shales of the Draupne formation

in the Rugne basin. Expected fluid type during the application was a light mature oil with a possible gas cap, as indicated by well 30/5-3 A. Critical factors for the prospect were reservoir presence and fluid composition.

Re-evaluation of the prospect on the reprocessed seismic revealed varying seismic response along the flank – from very transparent with poor seismic continuity to areas where reflectors confidently could be tracked. The relatively poor continuity could be due to structural complexity and limited lateral reservoir extent. The tie to well 30/5-3 A is uncertain, probably due to nearby or crossing faults. Based on rock physics no confident amplitude response has been mapped to support hydrocarbon filling. Neither has RGB blending increased the likelihood of Draupne sandstone being deposited within the originally prospect outline. In addition to trap definition, reservoir will also remain a high risk given the prospect depth below 4000m. Due to the general high risk, the Ravn B prospect has been downgraded to a lead. A geological cross-section and outline of the original Ravn B prospect is given in Fig. 4.3.



**Fig. 4.3 Overview of prospectivity - Ravn**

Geological cross-section with the Draupne sandstone thickening downflank from well 30/5-3A - i.e the original Ravn B concept.

Base Cretaceous depth map with outline of Ravn B and Ravn A.

**Ravn A lead**

The Oseberg fault block to the west was believed to be exposed during lower Cretaceous and acted as a source for sand wedges up to Albian time with time equivalent reservoir sand to Agat in the Q35. However, following remapping of the Cretaceous potential, including RGB blending and attribute mapping, the Cretaceous section remains conceptual in terms of reservoir presence. Thus, it is not possible to upgrade Ravn A to a prospect.

No leads have been identified in Paleocene or Hordaland Gp.

There are no remaining prospects within the license, and hence the resource potential and risk have not been updated.

## 5 Technical evaluation

Since no prospect remains within the licence, a technical evaluation with respect to economical value and possible development solution is not performed.

## 6 Conclusion

The licence commitments are fulfilled. A full a evaluation of the Upper Jurassic Ravn B prospect and the Lower Cretaceous Ravn A lead on reprocessed seismic has concluded that the risk both with respect both to reservoir and trap definition is too high to support a positive drill decision in PL988. The partnership decided to relinquish the area in February 2021.