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## **PL723 Status Report - Licence Surrender**

Reference is made to our letter to MPE dated 07.06.2016 (Ref. 871250) regarding the surrender of Production licence 723. This report gives a summary of the PL 723 licence which was surrendered after the partnership reached a unanimous decision to drop the licence at the Drill or Drop deadline 21.06.2016.

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## 1. Key licence history

Production licence 723 is located in the Hoop area on the Bjarmeland Platform in the Barents Sea and consist of Blocks 7323/3, 7423/12 and 7424/10 with a total area of 856.71 km<sup>2</sup>. (Fig.1)

The PL723 was awarded to GDF Suez (now Engie E&P Norge AS) on the 21.06.2013 (22. Round) together with three additional licence partners that have remained unchanged during the licence period.

- Engie E&P Norge AS 35% (OP)
- ConocoPhillips Skandinavia AS 25%
- OMV (Norge) AS 20%
- Petoro AS 20%

The original licence commitments were to purchase all 3D data available within the licence area at the time of award, to reach a drill or drop decision by 21.06.2015 and to complete a well by 21.06.2017 if a drill decision was made. The initial licence expiry date was 21.06.2018.

Due to delays in the seismic reprocessing project the Partnership was in 2014 granted a 1 year extension to the drill or drop deadline and the subsequent deadlines: new approved DoD date 21.06 2016, complete potential exploration well by 21.06.2018 and initial licence expiry date 21.06.2019.

The licence partnership reached a unanimous decision to surrender the licence at the drill or drop deadline 21.06.2016 based on the conclusion that PL 723 does not contain prospects with an acceptable combination of risk, volume and commercial potential that can justify drilling an exploration well.

### 1.1 Licence Meetings

Seven combined Exploration Committee and Management Committee meetings have been held as well as eight additional exploration work meetings.

A licence field trip to Svalbard to study geological analogues was held 14-19<sup>th</sup> August 2014.

Date	Licence Meetings
22.08.13	EC/MC Meeting #1
25.11.13	EC/MC Meeting #2
13.06.14	EC/MC Meeting #3
25.11.14	EC/MC Meeting #4
24.06.15	EC/MC Meeting #5
11.11.15	EC/MC Meeting #6
21.04.16	EC/MC meeting #7

Date	Licence Work Meetings
10.12.13	Work meeting - Reprocessing
23.10.14	Work meeting - CSEM
22.01.15	Work meeting - Reprocessing
24.02.15	Work meeting - Special geophysics
20.04.15	Work meeting - Reprocessing
30.04.15	Work meeting - Special geophysics
28.09.15	Work meeting - Special geophysics
08.12.15	Work meeting -Triassic prospectivity

## 2. Database

A common licence database was established and expanded during the evaluations. 14 offset wells were in the final database (Table 1 A). Well 7324/2-1 Apollo (traded by the Operator in 2015) was a key data point and both the 3D seismic and CSEM data covered this well location. The final 3D database consist of the TGS multi-client seismic available within the licence at the time of award (HFCW11) and a 3D tie to the 7324/2-1 Apollo well location (Fig.1). The 3D's were merged and reprocessed by the licence group (High Res, GWE Broadband and PSTM reprocessing cubes) and finalised in Q3 2015. Additional data included in the database: 5 blocks of EMGS multi-client CSEM data (CSEM was 3D inverted by the licence), a narrow 3D swath of P-Cable ultra-high resolution seismic, and a selection of 2D seismic lines (Table 1 B).

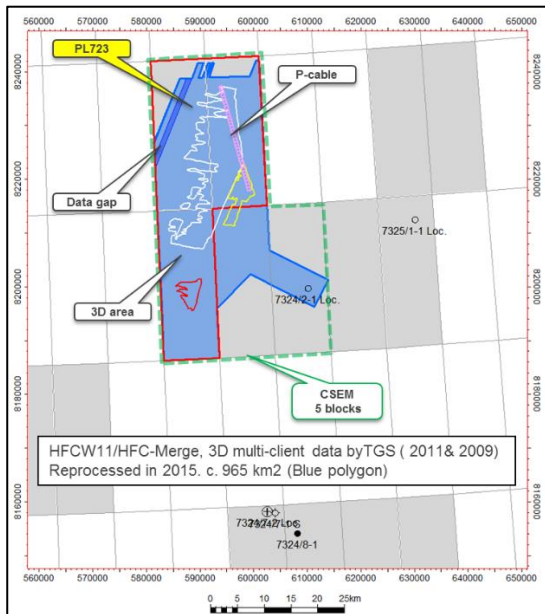
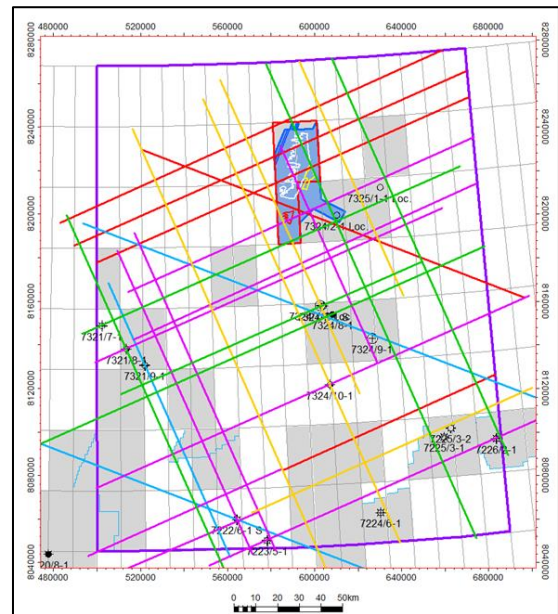


Fig.1 A) 3D seismic, P-cable and CSEM database. Both 3D and CSEM tie to 7324/2-1 Apollo well. (With original 22. Round prospect outlines)



B) Offset wells and 2D NBR seismic database (additional released 2D seismic is also in the database)

Well Name	NPD ID	Geophysical survey	NPD ID	Type of Survey	Market availability	Comments
7220/8-1 (Skrugard)	6484	TGS HFCW11 (HFC-MERGE)	7424	3D seismic	Multi-client	952 km2
7222/6-1S (Obessum)	5755	TGS HFC09 (HFC-MERGE)	0	3D seismic	Multi-client	42.3 km2 (tie to Apollo)
7223/5-1 (Obessum Appraisal)	5960	3D_GDF_SUEZ_NORGE_HFC_MERGE	0	3D seismic	Licence	Repro. & Merge of above surveys, 1020 km2
7224/6-1 (Arenaria)	5835	P-cable SEN1201-A3	7666	3D seismic	Multi-client	13.3 km2
7224/7-1 (Samson Dome)	1245	EMGS BSMC (2012)	7559	CSEM	Multi-client	
7225/3-1 (Norvarg 1)	6587	EMGS BSTEN01 (2010)	7191	CSEM	Multi-client	
7226/2-1 (Ververis)	5807	TGS NBR06	4365	2D seismic	Multi-client	6 Selected lines
7321/7-1 (Fingerdjupet Basin)	1284	TGS NBR07	4451	2D seismic	Multi-client	5 Selected lines
7321/8-1 (Fingerdjupet Basin)	1070	TGS NBR08	4573	2D seismic	Multi-client	10 Selected lines
7321/9-1 (Fingerdjupet Basin)	1339	TGS NBR09	0	2D seismic	Multi-client	3 Selected lines
7324/10-1 (Alpha Structure)	1411	TGS NBR10	7219	2D seismic	Multi-client	5 Selected lines
7324/7-1S (Wisting 2)	7222	Fugro BARE05	0	2D seismic	Multi-client	Repro. of vintage data
7324/8-1 (Wisting 1)	7221	Various released vintage surveys	0	2D seismic	Released data	
7324/2-1 (Apollo)	7481					

Table 1. A: List of offset wells in common database. B: List of geophysical surveys in common database

### 3. Review of Geological and Geophysical studies

For the 22. Round evaluations, the main prospectivity was defined in shallow Realgrunnen structural traps with upside potential in Triassic leads. (Fig. 2A). Hydrocarbon charge was considered to be from oil-prone Kobbe/Steinkobbe Fm based on IKU shallow boreholes at the Svalis Dome and regional models suggesting anoxic deep water facies in this area. The local Hekkingen Fm is not mature, but long distance migration from mature Hekkingen Fm source rocks in the Fingerdjupet Sub-basin could represent an alternative charge. The total Cenozoic erosion in the area is estimated to be approximately 1800m, which is partly caused by pre-glacial erosion and partly by Quaternary glacial erosion.

Since award, new data have been interpreted and analysed and several studies have been performed. The main activities have been related to enhancing the seismic data quality by 3D reprocessing, and re-interpreting these data by integrating the seismic with offset wells and new well data drilled in the vicinity. Geological models have been updated based on new well information and the performed studies. A study on tectonic development and fault geometry was carried out by the Operator. A hydrocarbon migration study was also conducted in the licence area by building on a regional Barents Sea hydrocarbon source study by Exploro. Detailed quantitative geophysical studies were carried out: 3D seismic inversion, AVO studies, CSEM resistivity modelling and 1D, 2.5D and 3D CSEM inversions. For the final conclusions the reprocessed seismic attributes were evaluated in combination with CSEM data for the Jurassic and Upper Triassic intervals.

Eight wells have been drilled in the greater Hoop area since licence award and these have increased the understanding and changed some of the original geological assumptions. (Engie, as operator have full access to the Apollo well and to the released data from Wisting and Wisting Alternative. The other evaluations are based on public well information and seismic analysis at the well locations.) Firstly the Wisting discovery (7324/8-1) proved that the shallow Realgrunnen reservoirs could retain hydrocarbons despite recent episodes of erosion and uplift and that oil is generated in the area. The well found reservoir in both Stø Fm, a thin Nordmela Fm and in the upper Fruholmen Fm. The wells 7325/1-1 Atlantis and 7324/9-1 Mercury showed that gas is also generated in the area and that oil migration may be limited to restricted areas, perhaps confined to the area around the Maud basin. The closest analogue well 7324/2-1 Apollo, was classified as a dry well but did contain small amounts of residual gas in the Realgrunnen. The well found considerably thinner Realgrunnen reservoir than Wisting and only had reservoir in the Stø Fm (21m gross / 16m net). The reason for failure is most likely leakage as indicated by overburden analysis but lack of sufficient charge is also a possible explanation. All the recent Realgrunnen discoveries in the area have shown CSEM anomalies whereas none of the dry wells have such an anomaly. Well 7324/8-2 Bjaaland was classified as a dry well but contained residual hydrocarbons. [REDACTED]

The expected thickness of the source rock with oil potential within the Kobbe/Steinkobbe Fm around PL723 has been reduced both by seismic analysis and based on the results of the drilled Kobbe section in 7324/7-1S and other offset wells.

The additional data and new studies have led to changes compared to the initial evaluation, concluding on reduced prospectivity within the licence. The main reasons are a significantly thinner Realgrunnen reservoir section, reduced potential for thick oil prone Steinkobbe/Kobbe source rocks in the PL723 area and a more limited extent of the seismic indications of hydrocarbons within the Realgrunnen prospects. [REDACTED]



## 4. Prospect update

At the time of award in 2013, three Realgrunnen prospects (Maya, Lama and Acan) and two Triassic leads (Cali & Peru) were defined, with the Maya Realgrunnen prospect having the main volume potential. The Maya structure is a low relief structural closure at many stratigraphic levels ranging from Early Cretaceous to Carboniferous so in theory any reservoir within these intervals could potentially be prospective and were consequently interpreted and evaluated. (Fig. 2 and 3)

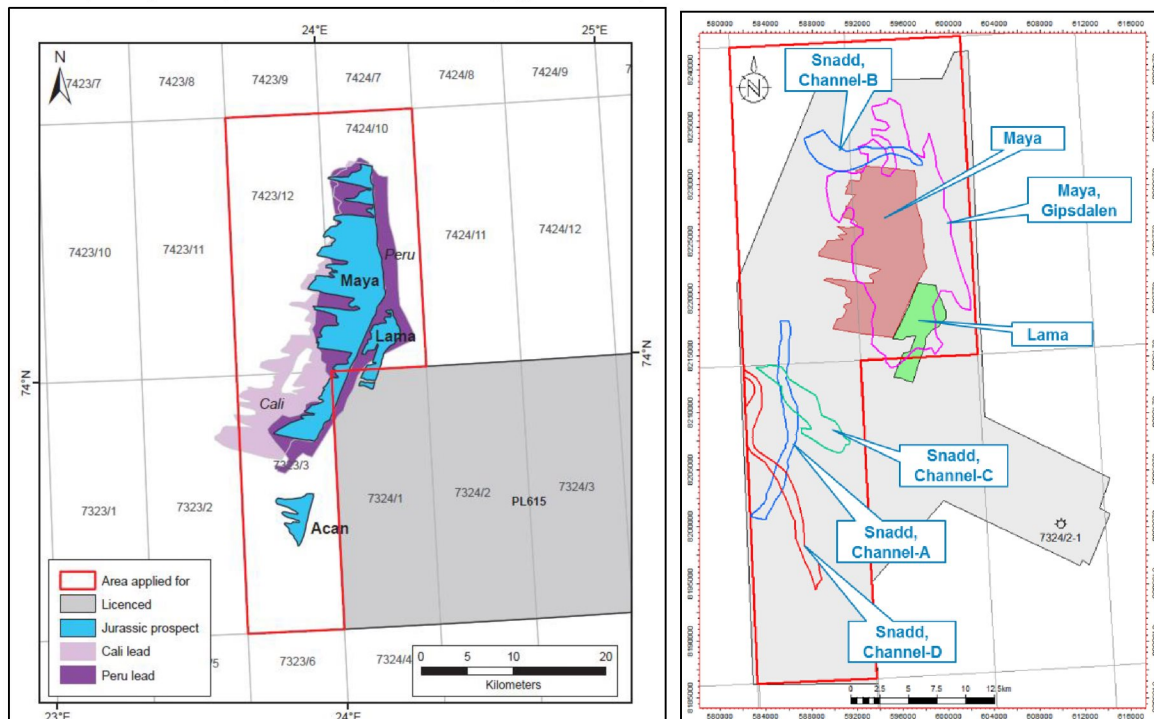


Fig. 2A): Overview of prospects and leads at time of award

B): Overview of prospects and leads in 2016

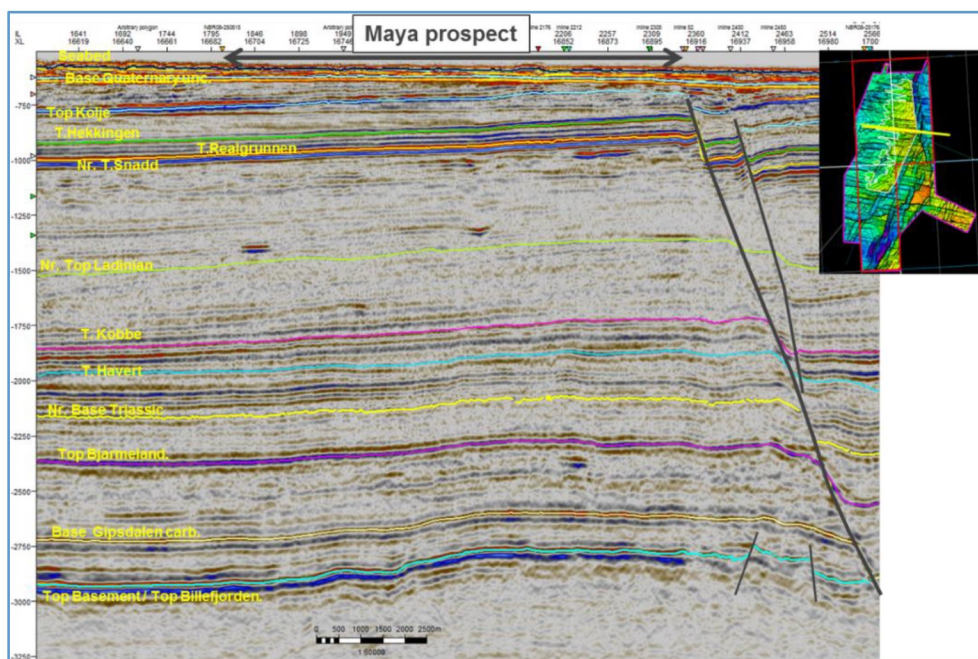


Fig. 3 Seismic line showing the main Maya structure and key regional horizons.

### Maya prospect:

The Maya prospect is a shallow structural trap at Realgrunnen level with abundant internal faulting in approximately E-W and SW-NE directions. The structural definition was confirmed by 3D data and also the likely presence of Stø Fm reservoir based on correlations to the Apollo well and seismic inversion results. The structure is divided into several fault compartments that may have varying fluid contacts. Based on offset data, both oil and gas cases could occur, but only an oil case could potentially be commercial due to small gas volumes and lack of gas infrastructure. (Fig.2B, 4 & 5)

Compared to the 22. Round evaluation, the volumes have been reduced mainly due to a thinner Realgrunnen reservoir and a more restricted prospective area based on seismic indications of hydrocarbons. The recoverable resources will be very dependent on the chosen development concept since pressure maintenance is necessary to achieve a decent recovery factor. The probability of success for an oil case has been reduced due to charge / migration issues

The key risks for Maya are seal/retention and charge/migration. The risking procedure was performed by calculating an initial *a priori* geological chance of success and upgrading this due to the seismic indications of hydrocarbons. Modelling shows that the detectability of CSEM anomalies will be strongly dependant on hydrocarbon saturation. (Appendix 1 Table shows revised parameters and volumes)

### Lama prospect:

Lama is a relatively small structure just east of the Maya prospect. The structural trap is well defined and it is likely to have porous Stø Fm reservoir present. This structure is also segmented by internal faulting. The key risks are seal/retention and charge/migration with a higher risk on migration than Maya due to a more complex migration pathway up-dip of Maya. Volumes have been reduced mainly due to thinner reservoir potential than in the initial evaluation. Although there are seismic indications of hydrocarbon presence, the complex migration pathway have reduced the probability of finding commercial hydrocarbons. (Fig. 2B, 4& 5, Appendix 2 Table shows revised parameters and volumes.)

### Acan prospect (22. Round):

This fairly small Realgrunnen prospect defined for the 22. Round was rejected. The structural trap is still valid, and in addition the migration modelling suggest that the structure is located in a migration shadow. (Fig. 2A and Fig. 5).

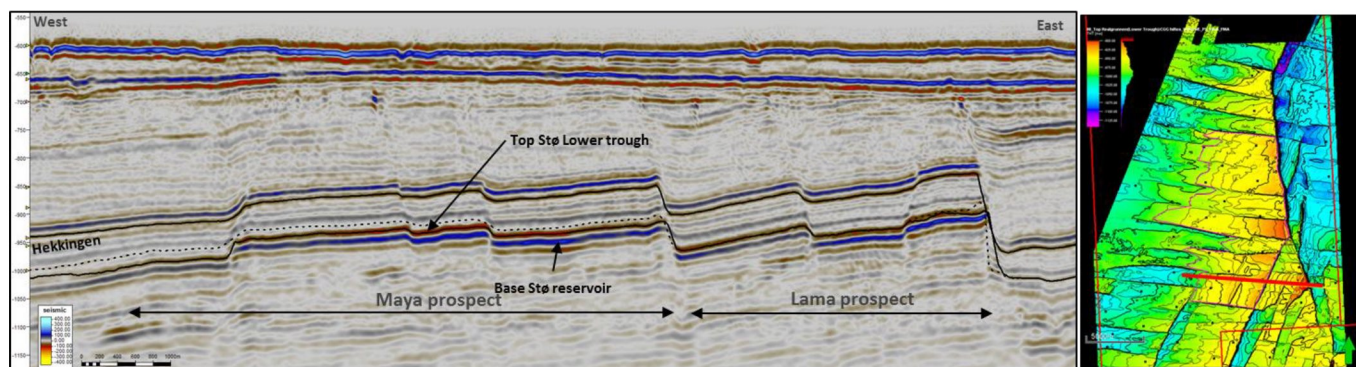


Fig. 4 Seismic line showing the Maya prospect and the Lama prospect



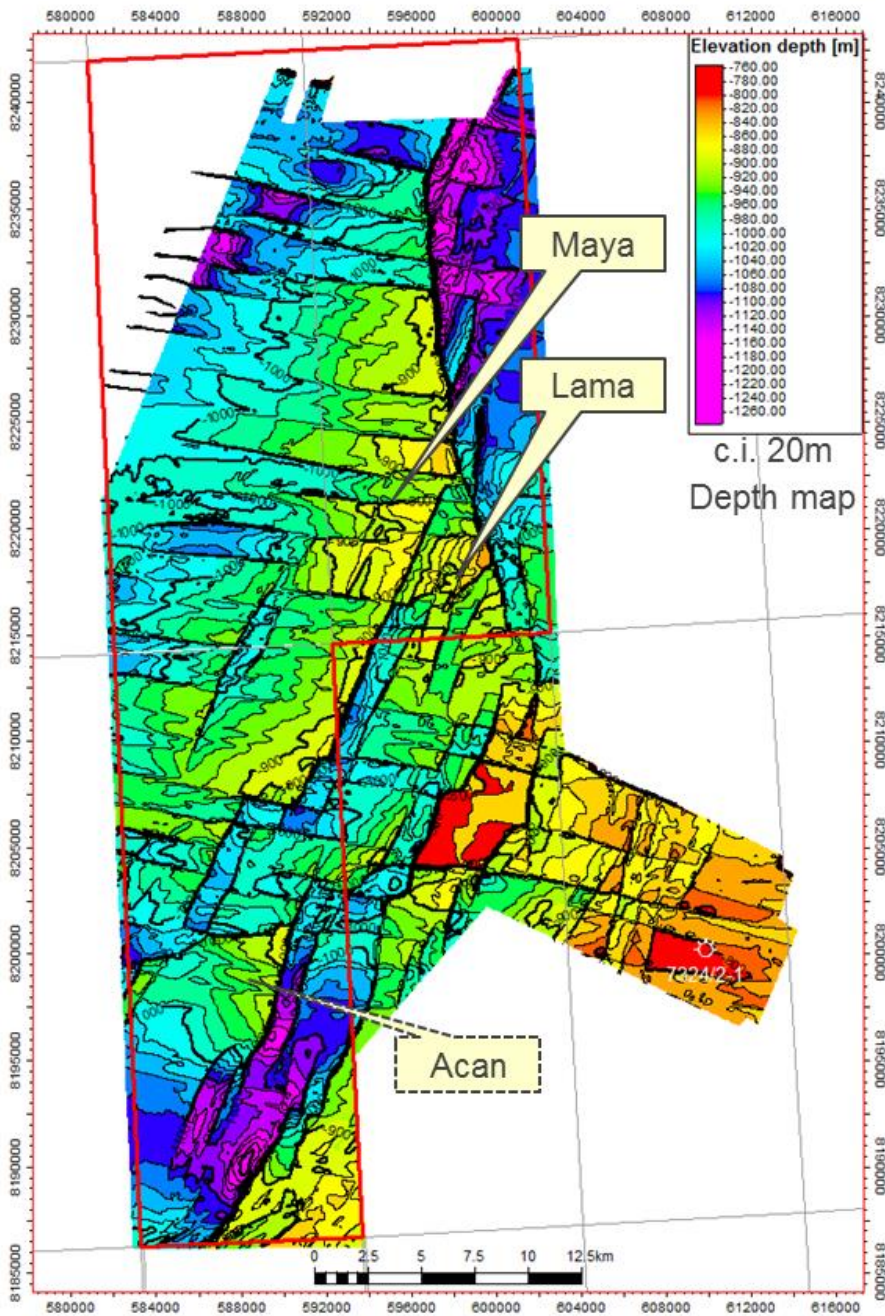


Fig. 5 Top Realgrunnen depth map

#### Cali lead (22. Round):

This intra Snadd lead was rejected on the grounds of very little reservoir potential within the structural closure. The main broader Carnian channel bodies, which have the best expected reservoir properties, are located outside of this structural closure. Within the closure there are mostly narrow channels imaged on the seismic, this is suggesting a low lateral net to gross and probably poor reservoir quality with low porosity and low permeability. (Fig. 2A).

**Peru lead (22. Round):**

This 3-way fault bounded Kobbe Fm. lead situated below the Maya prospect is a valid closure but was rejected due to very low reservoir potential based on offset wells, regional models and seismic indications. (Fig. 2A).

**Intra Snadd upside potential:**

Within the Snadd Formation, four main Carnian channels with a potential structural–stratigraphic trapping mechanism in parts of the channel body have been evaluated. The individual main channels bodies vary in width from c. 800m - 2000m and the thickness is estimated to 10-30m. There is little potential for stacked channels. The main risks associated with all these Intra Snadd channels are lateral seal due to other thinner crossing channels and possible overbank sediments, reservoir quality and charge/migration into such isolated sand bodies as well as a hydrocarbon phase risk. (Fig. 2B and Fig. 6A & B). [REDACTED]

[REDACTED]

**Channel A** - is a meandering channel located in the western part of the licence and is of early Carnian age. Part of the channel is crossing over a low relief high area and it has a structural closure in an N-S direction and relies on a pure stratigraphic lateral sealing along the channels edges. The channel body is now faulted and segmented along its path. Max area of closure is 16 km<sup>2</sup>, volume potential is 1 - 6 MSm<sup>3</sup> recoverable oil.

**Channel B** - is a meandering channel located in the northern part of the licence and is of early Carnian age. Part of the channel is crossing the northernmost part of the Maya closure and has a structural closure in an E-W direction and relies on a pure stratigraphic lateral sealing along the channels edges. The channel body is now quite faulted along its path. Max area of closure is 12km<sup>2</sup>, volume potential is 1 - 5 MSm<sup>3</sup> recoverable oil.

**Channel C** - is of earliest Carnian age and meanders through the central part of the licence. The western part crosses a low relief structural high area with a fault bounding to the SE, it has a structural closure in a NW-SE direction and relies on a pure stratigraphic lateral sealing along the channels edges. The channel body is now faulted along its path. The continuation of the same channel is present at the 7324/2-1 Apollo well location but the well was not deep enough to test this interval. Max area of closure is 17km<sup>2</sup>, volume potential is 1.5 - 7 MSm<sup>3</sup> recoverable oil.

**Channel D** – this late Carnian channel is located in the western part of the licence parallel to Channel A. The channel meanders across a low relief high area and has a structural closure in an N-S direction and relies on a pure stratigraphic lateral sealing along the channels edges. The channel body is now heavily faulted along its path. Max area of closure is 15 km<sup>2</sup>, volume potential is 0.5 - 6 MSm<sup>3</sup> recoverable oil.



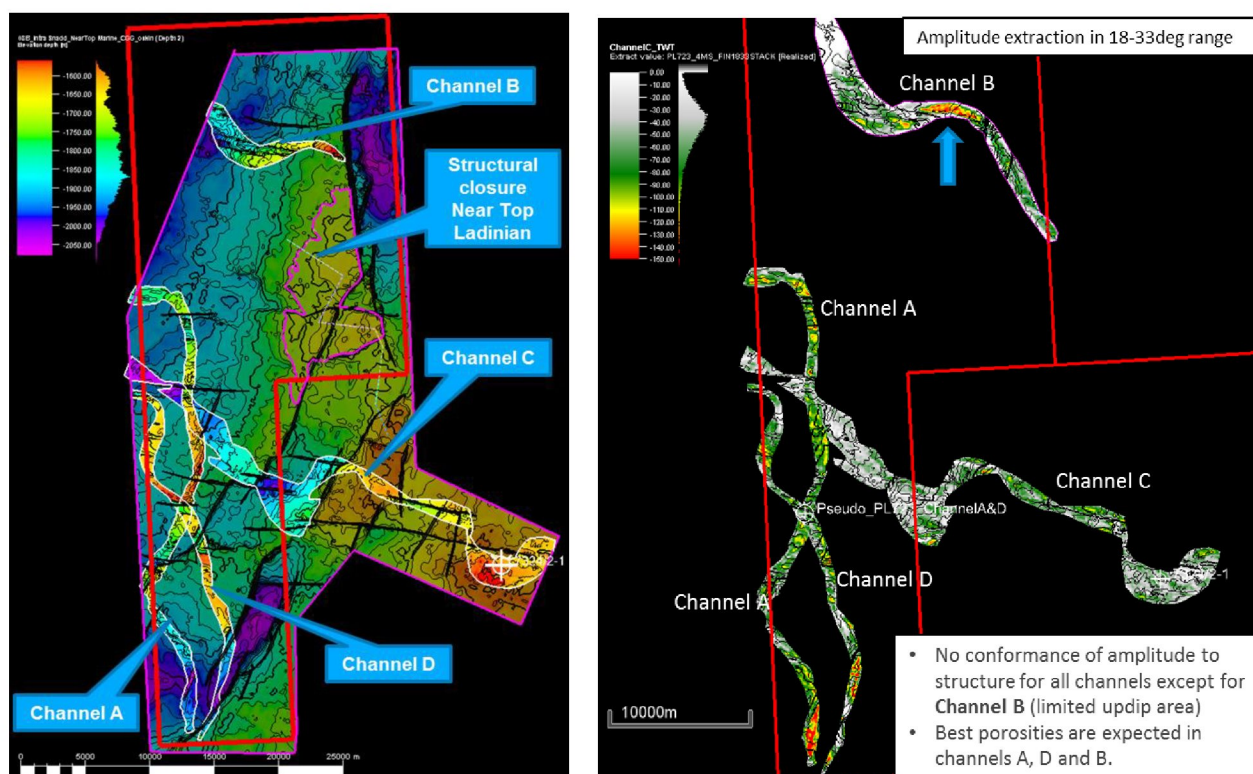


Fig. 6 A) Four main Carnian channels on Intra Snadd depth map B) Amplitude extraction at main Carnian channels A-D

### Maya Gipsdalen lead:

A large, fairly low relief structural closure is present at the Permian - Carboniferous interval below the Maya prospect (Fig. 3 and Fig. 7). Successful carbonate discoveries have been made on the Loppa High, and a similar carbonate play may extend regionally outside the Loppa High trend. The warm water carbonates of the Gipsdalen Group may have potential for preserving porosity and develop secondary porosity even at deep burial, however there are indications that the PL723 area was deposited in a deeper water setting and therefore have reduced initial reservoir potential compared to the Loppa High. The structure is also very deeply buried with the crest at c. 3800 m present day, which is approximately twice as deep as the Alta discovery and when accounting for Cenozoic erosion the max burial at the Gipsdalen Group is estimated to be more than 5600m.

Reservoir potential may be linked to the presence of dolomite because porosity tend to decreases more slowly with depth than for limestones, however the degree of dolomitisation is unknown. Charge and migration for this play is unproven and would need to be derived from potential source intervals within the early Permian – Carboniferous interval in order to migrate to the structure. The closure is interesting due to its size (c.150km<sup>2</sup>), but the high risk and many uncertainties with regards to both reservoir presence and quality, seal and hydrocarbon charge makes it classified as a high risk lead.

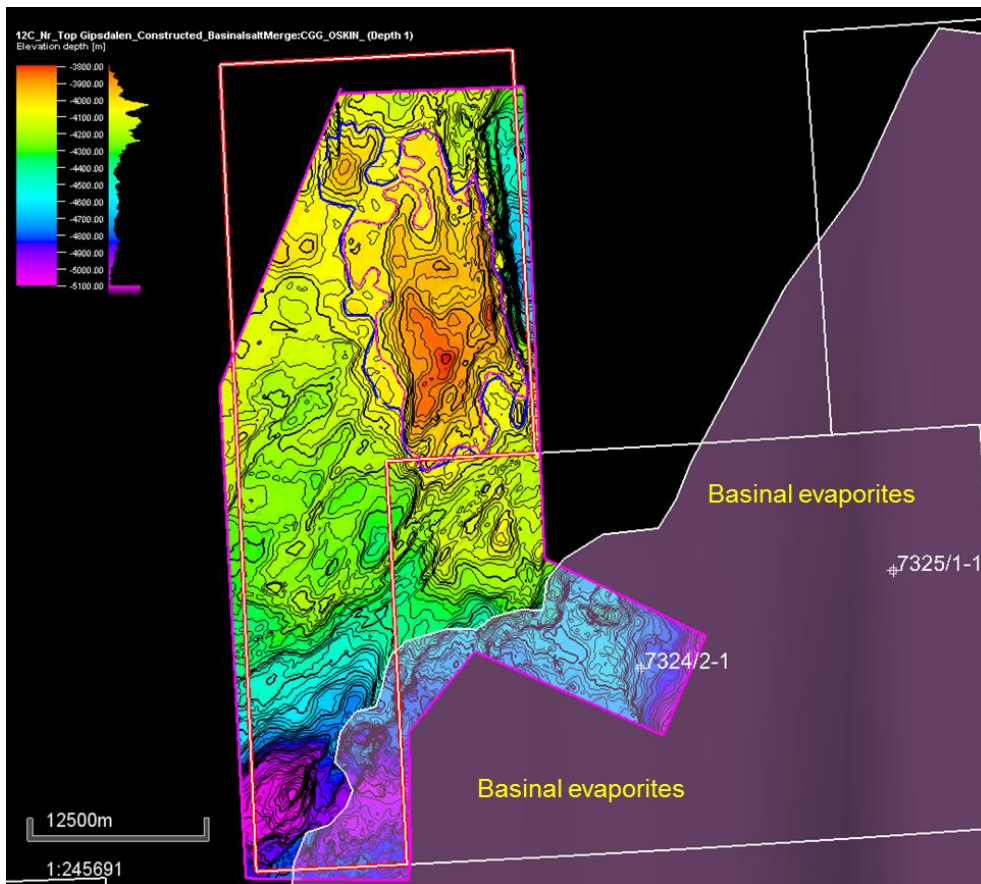


Fig. 7 Near Top Gipsdalen depth map, lead outlined in pink colour.

## 5. Technical evaluations

Conceptual development scenarios were evaluated for a combined development case for the Realgrunnen Maya and Lama prospects. Only an oil case was considered for development due to very small gas volumes and no gas infrastructure in the vicinity. There are several development challenges: shallow low pressure and low temperature reservoir at 450m below seabed, thin reservoir section of c. 20m and segmentation by multiple faults. In addition there are technical challenges of drilling horizontal production wells, feasibility of water injection with such a thin overburden with abundant faults as well as logistics and climate issues in this remote area of the Barents Sea.

A stand-alone development case with a full process FPSO of 13000 Sm<sup>3</sup>/day capacity and seabed boosting was considered. (Fig. 8). Several reservoir engineering concepts were looked into, but only a "high technology case" assuming both water injection and horizontal production & injection wells could potentially give a commercial case. These are both unqualified technologies in such shallow reservoirs at present.

During the technical evaluations, the Wisting horizontal appraisal well was successfully drilled, increasing the probability that also horizontal production wells can be drilled and completed at such shallow reservoir depths. The technical feasibility of performing water injection in such shallow reservoirs still remains highly uncertain and represents environmental challenges.

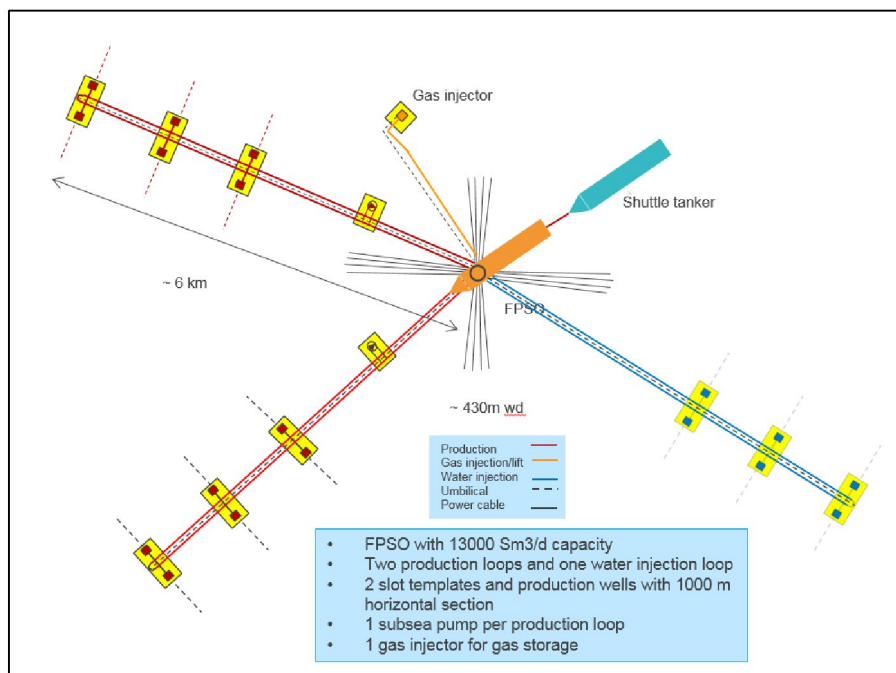


Fig. 8 "High technology development concept" for a 28 MSm<sup>3</sup> rec. oil case in Realgrunnen.

## 6. Conclusions

The work programme for PL723 has been fulfilled. The 3D seismic has been enhanced by reprocessing, where both high resolution, broadband and conventional PSTM seismic cubes were generated. Additional electro-magnetic data (CSEM) were included in the licence database and evaluated in combination with the seismic. Eight new wells have been drilled to the east and south-east in the greater Hoop area since the licence award in 2013, providing increased understanding of the area. The key nearby well 7324/2-1 Apollo was traded and included in the database and used for detailed quantitative geophysical calibrations and geological evaluations. These evaluations have resulted in reduced volumes and increased risk.

Although the main Realgrunnen prospect (Maya) shows some seismic indications of hydrocarbon presence in parts of the structure, [REDACTED]

[REDACTED] Stratigraphic levels from Cretaceous to Carboniferous were interpreted and evaluated. The additional upside potential in Carnian fluvial channels and the Permo-Carboniferous lead, currently have very high risk and limited commercial potential.

Based on the evaluations, the partnership concluded that PL 723 does not contain prospects with an acceptable combination of risk, volume and commercial potential that can justify drilling an exploration well.

The Partnership decided to surrender the licence at the Drill or Drop decision gate 21.06.2016.

## 7. Appendix



## Appendix 1

*Maya prospect data*

Block  Play name	7233.3;7423.12;7424.10	Prospect name New Play (Y/N)	Maya	Discovery/Prospect/Lead Outside play (Y/N)	Prospect	Prospect ID (or New!)	NPD approved (Y/N)	
	NPD will insert value	Oil&Gas	Reported by company Engine E&P Norge AS	Reference document			NPD will insert value	
Oil, Gas or O&G case:		Structural element	Hoop	Type of trap	Structural	Water depth [m MSLL] (>0)	450	Assessment year Seismic database (2D/3D)
This is case no.:		2016						
3D								
Resources IN PLACE AND RECOVERABLE								
Volumes, this case								
In place resources								
Oil [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Associated phase	Base, Mode	High (P10)
Gas [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	32.20	74.20	77.00	125.40	0.15		0.41	1.40
Oil [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	2.50	3.40	3.90	16.70	1.30		3.40	7.10
Gas [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	8.40	21.40	23.20	40.20	0.05		0.12	0.43
Gas [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	1.20	2.60	4.03	8.90	0.34		0.99	2.20
Toarcian	Reservoir litho (from)	Silt fm	Source Rock, chrono primary	Anisian	Source Rock, litho primary	Steinkobbe	Callowan- Tifonian	
Bathonian	Reservoir litho (to)	Silt fm	Source Rock, chrono secondary	Kimeridgian	Source Rock, litho secondary	Hekkingen	Euglen- Hektingen	
Probability [fraction]								
0.18	Oil case (0.00-1.00)	0.00	Charge (P3) (0.00-1.00)	0.30	Oil & Gas case (0.00-1.00)	0.62		
0.80	Total (oil + gas + oil & gas case ) (0.00-1.00)	0.90	Trap (P2) (0.00-1.00)	0.50	Retention (P4) (0.00-1.00)	0.50		
Low (P90)	Base	High (P10)	Comments - Expected success case fluid is oil with a small gas cap. Area of closure is based on seismic amplitudes. A complex DHI procedure was used for the riskings taking into account both the seismic indicators and the parameters in this table are adjusted to give approximately the same total values (P oil discovery =0.17). The recovery factor is valid for a "High technology case development" assuming both horizontal producers and water injection, but for cases without pressure maintenance the recovery factor would be approx. 90% lower. The gas cap would not be produced.					
836	Depth to top of prospect [in MSLL] (> 0)	850						
40.0	Area of closure [km²] (> 0.0)	68.0						
17	Reservoir thickness [m] (> 0)	21						
70	HC column in prospect [m] (> 0)	90						
1.612	Gross rock vol. [10 <sup>6</sup> m³] (> 0.000)	1.982						
0.80	Net / Gross [fraction] (0.00-1.00)	0.70						
0.18	Porosity [fraction] (0.00-1.00)	0.20						
	Permeability [mD] (> 0.0)	500.0						
0.15	Water Saturation [fraction] (0.00-1.00)	0.25						
0.007471	Bg [Rn3Sm3] (< 1.0000)	0.008894						
0.77	1Bo [Sm3/Rn3] (< 1.00)	0.87						
8333	GOR, free gas [Sm³/Sm³] (> 0)	12500						
26	GOR, oil [Sm³/Sm³] (> 0)	50						
0.20	Recov. factor, oil main phase [fraction] (0.00-1.00)	0.30						
0.20	Recov. factor, gas ass. phase [fraction] (0.00-1.00)	0.30						
0.40	Recov. factor, gas main phase [fraction] (0.00-1.00)	0.53						
0.20	Recov. factor, liquid ass. phase [fraction] (0.00-1.00)	0.30						
25	Temperature, top res [°C] (>0)		Imrapp. av geodog-init.	Registrar - init.	NPD will insert value	NPD will insert value	Kart updatort	NPD will insert value
86	Pressure, top res [bar] (>0)	Dato.	Dato.	Registrar Dato.	NPD will insert value	NPD will insert value	Kart dato	NPD will insert value
Cut off criteria for N/G calculation								



## Appendix 2

Lama prospect data

Block	Play name	7323.3.7432.12.7434.10	Prospect name New Play (Y/N)	Lama	Discovery/Prospect/Lead Outside play (Y/N)	Prospect	Prosp ID (or New)	NPD will insert value	NPD approved (Y/N)
Oil, Gas or O&G case:		Oil&Gas	Reported by company	Engie E&P Norge AS	Reference document	Structural	Water depth [m MSL] (>0)	450	2016
This is case no.:			Structural element	Hoop	Type of trap				3D
Resources IN PLACE and RECOVERABLE									
Volumes, this case									
Main phase									
Low (P90)									
Oil [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	11.30	Base, Mode	19.80	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
Gas [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	0.27	0.47	1.39	3.53	0.42	0.02	0.04	0.11	0.31
Oil [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	2.87	5.54	5.95	9.53	0.00	0.00	0.89	0.90	1.67
Recoverable resources	Gas [10 <sup>6</sup> Sm <sup>3</sup> ] (>0.00)	0.13	0.25	0.73	1.88	0.11	0.26	0.03	0.09
0.53								0.29	0.53
Reservoir Chrono (from)									
Reservoir Chrono (to)	Reservoir Chrono (to)	Reservoir litho (from)	Sto fm	Source Rock, chrono primary	Anislen	Source Rock, litho primary	Steinkobbe	Seal, Chrono	Callovian-Tithonian
Reservoir Chrono (to)									
Reservoir Chrono (to)									
Reservoir Chrono (to)									
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