

PL 993 Lapse report

Part of blocks 33/5 & 6



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1 History of the production licence

Summary

PL 993 (Figure 1.1) was awarded as part of the 2018 APA round, 1 March 2019. The initial period was set to 7 years (2+2+2+1), of which the first decision, decision to drill or drop, is due on 1 March 2021.

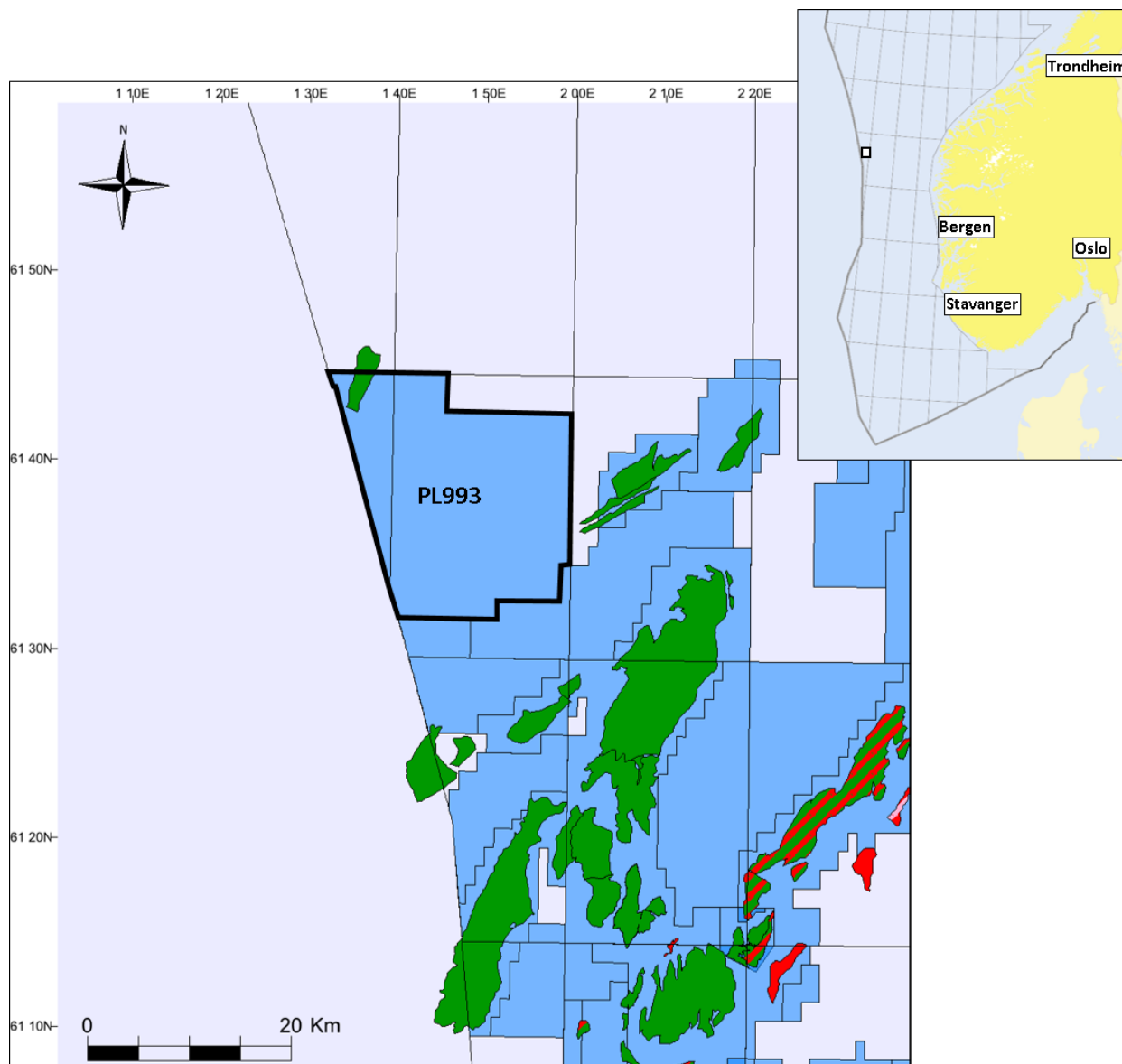


Figure 1.1 PL 993 location map
Part of blocks 33/5 and 33/6

Participants

Suncor Energy Norge AS is the operator (50%), with partners Neptune Energy Norge AS (30%) and Petoro AS (20%).

Work Commitment

The work commitment of purchasing 3D seismic has been fulfilled. The reprocessing was exempted by NPD due to good 3D seismic quality of the purchased data.

Licence Meetings

MC meetings were held at least once a year as agreed by the licence group at the first EC/MC meeting on 25 April 2019, in accordance with JOA article 2.1.

Meetings held during the licence term are listed below:

1. ECMC start-up meeting on 25/04/2019 at Suncor office in Stavanger
2. ECMC meeting on 03/12/2019 at Suncor office in Stavanger
3. EC meeting to discuss special studies on 14/01/2020 at Suncor office in Stavanger
4. EC meeting to discuss geophysical study results on 01/10/2020 on Teams
5. EC meeting to discuss geological study results on 13/10/2020 on Teams
6. ECMC meeting on 19/11/2020 on Teams

Reason for licence lapse

Re-evaluation of Jabba prospect led to a decrease in hydrocarbon volume estimates from 108 MMbbl to 71 MMbbl in the P50 estimate. The geological chance of success remains at 18% with slightly different risk number for each risk factor in comparison to the previous risk estimate.

The current reserves and risk estimates do not qualify for a drill decision.

2 Database overview

2.1 Seismic data

The common seismic database for PL 993 (Table 2.1) includes CGG18M01 that was purchased as part of the work program. The seismic data were processed in 2018 and incorporated the latest processing technology such as full waveform inversion down to Top Shetland. The quality of the data is very good, also for detailed seismic interpretation, and exemption from reprocessing was given by NPD.

Table 2.1 Seismic database

Seismic Survey	NPDID	Survey Type	Survey Year	Status	Comment
CGG18M01		3D	2014-2016	Multiclient	Merges of 3D surveys: CGG15007 and CGG16001 (Reprocessed: 2017-2019)
PCR06M01		3D	2006	Public	Merges of 3D surveys: MN9601 and ST9406 (Reprocessed 2006-2007)
SUN13001	7789	3D	2013	Public	
NSR08-41193		2D	2008	Multiclient	NSR08
NSR08-21196		2D	2008	Multiclient	NSR08
NSR08-12400		2D	2008	Multiclient	NSR08

Three regional 2D lines were purchased for structural reconstruction study.

2.2 Well data

All well data in the vicinity of the licence, both in the UK and Norwegian sector, have been released and therefore no wells needed to be purchased/traded for the common database.

Wellbores that have been used in the evaluation of the licence prospectivity are listed in Table 2.2.

Table 2.2 PL 993 well database

Key Wells	Completion Year	NPDID	Key Wells	Completion Year	NPDID
33/2-2 S	2015	7630	34/7-19	1991	1838
33/5-1	1979	103	34/7-20	1992	1967
33/5-2	1981	405	34/7-27	1998	3214
33/6-1	1979	406	34/7-28	1998	3282
33/6-2	1997	2873	34/7-32	2001	4423
33/6-3 S	2012	6835	34/7-34 A	2009	6080
33/9-8	1977	413	UK211/07-1	1976	
33/9-10	1978	415	UK211/08-1	1977	
33/9-11	1978	416	UK211/08a-2	1987	
33/9-13 S	1987	1028	UK211/08b-3	1989	
33/9-14	1988	1226	UK211/12-2	1974	
33/9-15	1992	1810	UK211/12a-10	1979	
33/9-16	1993	1801	UK211/13-1	1974	
33/9-17	1994	2114	UK211/13-2	1975	
33/9-19 S	1996	2830	UK211/13-3	1975	
33/9-19 A	1996	2872	UK211/13-5 A	1977	
33/9-20 S	2006	4143	UK211/13-6	1978	
34/4-2	1980	228	UK211/13-7	1978	
34/4-3	1982	423	UK211/13a-8	1984	
34/4-4	1983	41	UK211/13a-9	1986	
34/4-5	1984	37	UK211/13a-10	1987	
34/4-6	1986	875	UK211/14-1	1985	
34/4-8	1994	1908	UK211/14-2	1986	
34/4-9 S	1997	2931	UK211/14-3	1989	
34/4-10 R	2000	4051	UK211/14-4	1990	
34/4-11	2010	6227	UK211/14-5	2001	
34/4-12 S	2010	6283	UK211/14-6	2001	
34/4-12 A	2010	6216	UK211/17-1	1977	
34/4-13 S	2011	6442	UK211/18-3	1973	
34/4-14 S	2015	7660	UK211/18-5	1974	
34/7-3	1984	442	UK211/18-9	1975	
34/7-4	1984	455	UK211/18a-17	1978	
34/7-6	1985	465	UK211/18a-18	1978	
34/7-7	1985	525	UK211/18a-21	1980	
34/7-13	1998	1233	UK211/18a-23	1981	
34/7-15S	1990	1544	UK211/19-2	1975	

The well data have been used for:

- Seismic-well tie
- Sedimentology and stratigraphy study for reservoir presence and effectiveness
- Structural reconstruction

3 Results from geological and geophysical studies

Several proprietary and in-house studies have been performed as part of the licence work to evaluate the prospectivity in PL993. The studies are described below with the integration of the findings at the end:

- **Structural Restoration (Terractiva, 2020)**

The objective of the study was to de-risk the presence of reservoir and its provenance by study the structural evolution near the Jabba prospect. The study concluded that erosional sediments from the Makrell High could be deposited in the Penguin Ridge within the Draupne Fm.

- **Sedimentology and Biostratigraphy (Skolithos 2020, APT 2019)**

The objective of the study was to de-risk the reservoir presence, by building a reliable geological model for the Jabba prospect, based on a consistent review of the stratigraphy in adjacent wells and mapping of facies within a structural and chronostratigraphic context.

The study concluded that reservoir within Jabba was likely to be slope apron complex and associated turbidites fed from multiple entry points from the Makrell Horst deposited within Late Oxfordian to Early Kimmeridgian.

- **Oil typing and cuttings analysis (APT and Rockwash, 2019)**

The objective of the studies was to de-risk the base seal of the Jabba prospect by oil correlation study and cutting analysis.

An oil correlation study with the aim to understand the relationship among oil shows and discoveries in the Marulk Basin was performed. The study concluded that there is a difference between the oil-family in the Beta Discovery compared to well 33/5-2. This could indicate local charge from source rock within the slump blocks, which is a positive indicator with respect to base seal in Jabba.

The objectives of the cutting analysis study was to evaluate if the Heather succession in the 33/5-2 well was in-situ. The study concluded that the Heather Fm was in-situ, the base and lateral seal of the Jabba prospect was therefore de-risked.

- **Seismic Inversion & Rock Physics (Ikon, 2020)**

A seismic inversion study was performed to de-risk the reservoir presence. Two types of inversion, Extended Elastic Impedance (EEI) inversion and Joint Impedance Facies Inversion (Ji-Fi) were performed in a limited area near the Jabba prospect. Both inversion methods concluded high chance of sand presence in Jabba.

- **Colored Inversion (Suncor, 2020)**

The study was performed to better interpret the prospectivity. The results show better definition of the Jabba's prospectivity.

- **Spectral Decomposition (Suncor, 2020)**

The objective of the study was to help define the depositional model for the Jabba prospect. Multiple color blend products were generated using different combinations of seismic frequencies. The analysis of the study indicates that the shape of the geological feature could fit a depositional model of an apron fan.

The integration between the geological and geophysical studies resulted in a solid and consistent tectonostratigraphic evaluation of the prospective intervals within the licence. Part of the Tithonian Upper Jurassic section is likely to have Intra Draupne sand deposited. There is seal risk associated to the depositional model established. Further inversion study helped delineate the prospectivity within the licence.

4 Prospect update report

The geological concept of Jabba prospect changed considerably between what was applied in APA 2018 and the PL993 final evaluation. The main changes of the prospect involve the slight change of the area or outline of Jabba and its depositional model. The leads applied in APA 2018 were Yoda, Luke, Epsilon and Outsider. Upper Jurassic Yoda and Luke leads became one lead which is called Yoke. Triassic Epsilon lead still exists while Triassic Outsider lead was not considered any longer due to lack of trap definition. A new Upper Jurassic lead was identified SE of Jabba and named Leia. The outlines of the original and the evaluated Jabba prospect along with the leads are illustrated in Figure 4.1.

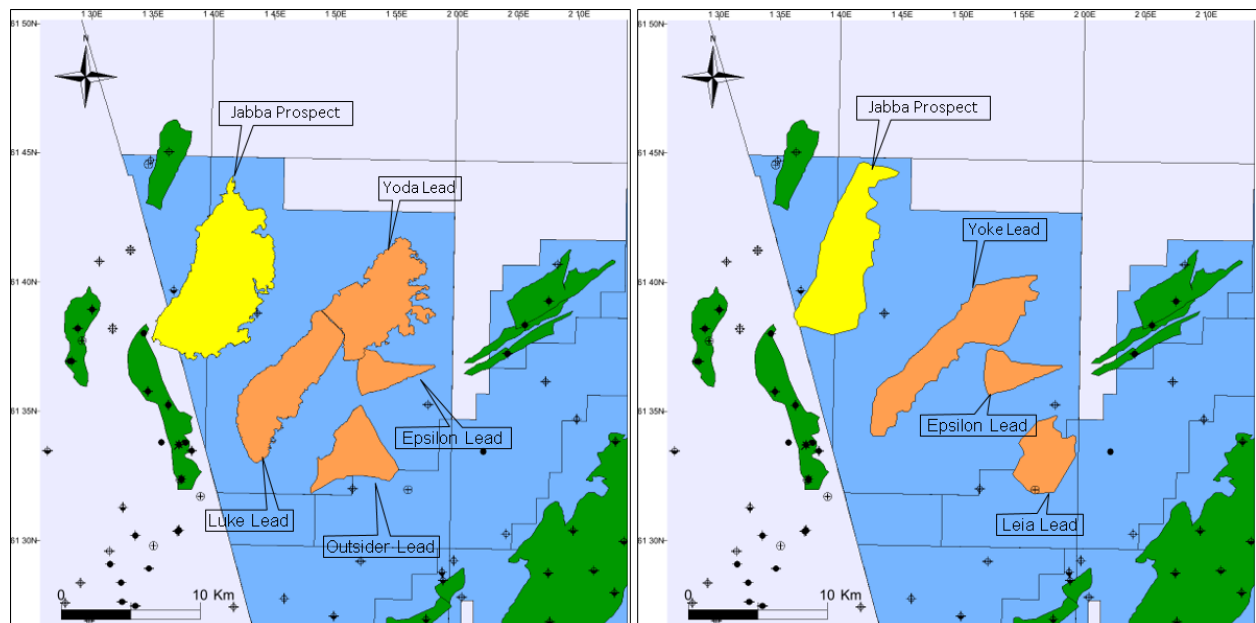


Figure 4.1 Prospectivity in PL 993

Jabba prospect and the leads for the APA 2018 application are on the left figure. The right figure shows a revised prospect and lead outlines post licence evaluation, 2020.

Jabba prospect

The trap definition for Jabba has slightly changed after re-interpretation. Colored inversion (Figure 4.2) suggests that the crest of Jabba is about 200m deeper than before, approximately at 3800m. The colored inversion gives a good trap definition of the pinch outs of Jabba onto different directions. Overall, Jabba is still a stratigraphic trap with lowest closing contour in NE and small deltas formed locally in the distal part (Figure 4.3). Figure 4.4 illustrates how Jabba sand pinches out to the east.

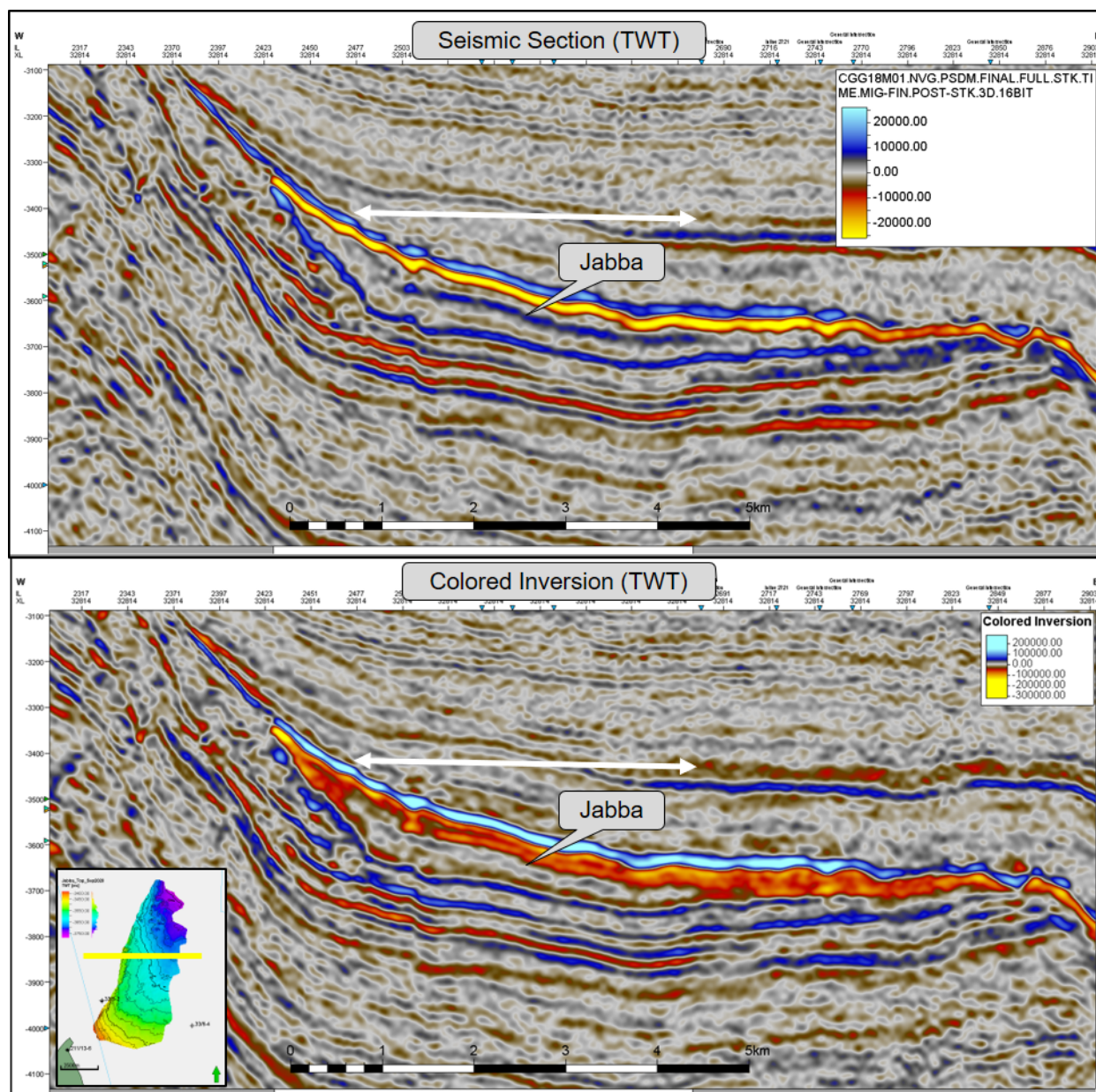


Figure 4.2 Colored Inversion vs CGG18M01 Seismic Section in TWT

Colored Inversion gives better trap, reservoir and seal definition in Jabba.

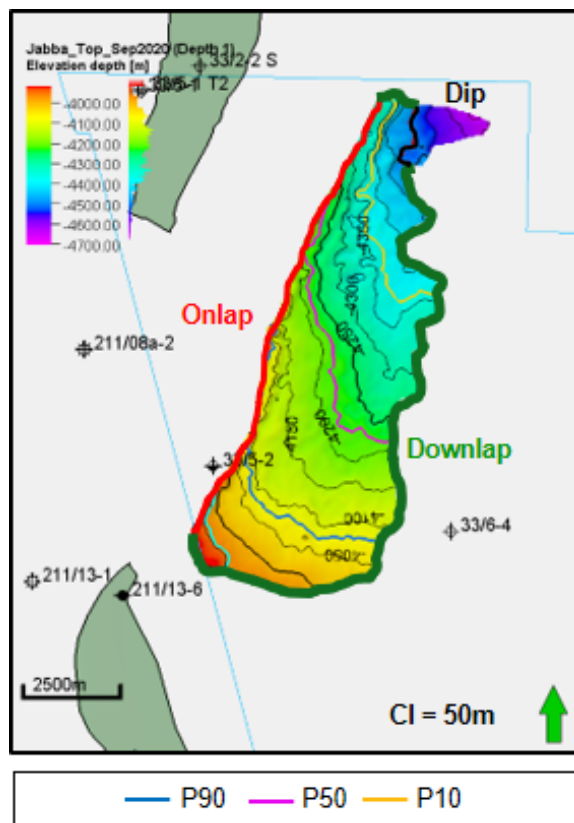


Figure 4.3 Intra Draupne sand Depth Map

The map shows where the sand pinches out and dips.
The crest is in SW that is at 3800m depth.

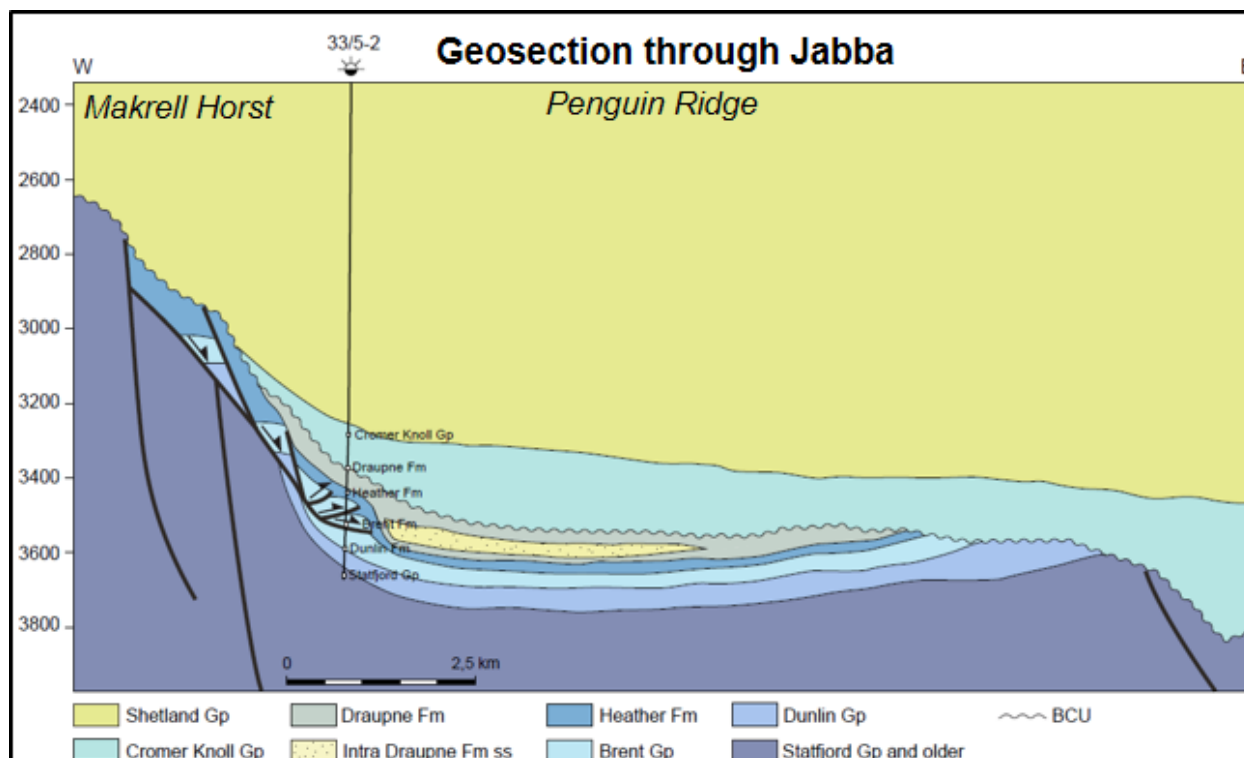


Figure 4.4 Geosection through Jabba prospect

The new interpretation of Jabba is a pinch out towards the Makrell Horst and also towards the East.

The new reservoir depositional model for Jabba is slope apron complex and associated turbidites with entry points coming off the eastern part of Makrell Horst, (Figure 4.5) whereas the previous depositional model led towards hyperpycnal flow with entry points from the south of Makrell Horst. The change of model was due to key findings from spectral decomposition study (Figure 4.6) and Skolithos' sedimentology study results (3 Results from geological and geophysical studies). None of the wells in the adjacent area have penetrated such reservoir. With mid-point depth of the reservoir approximately around 4000m, the reservoir is considered deep and predicted to have high risk on reservoir effectiveness.

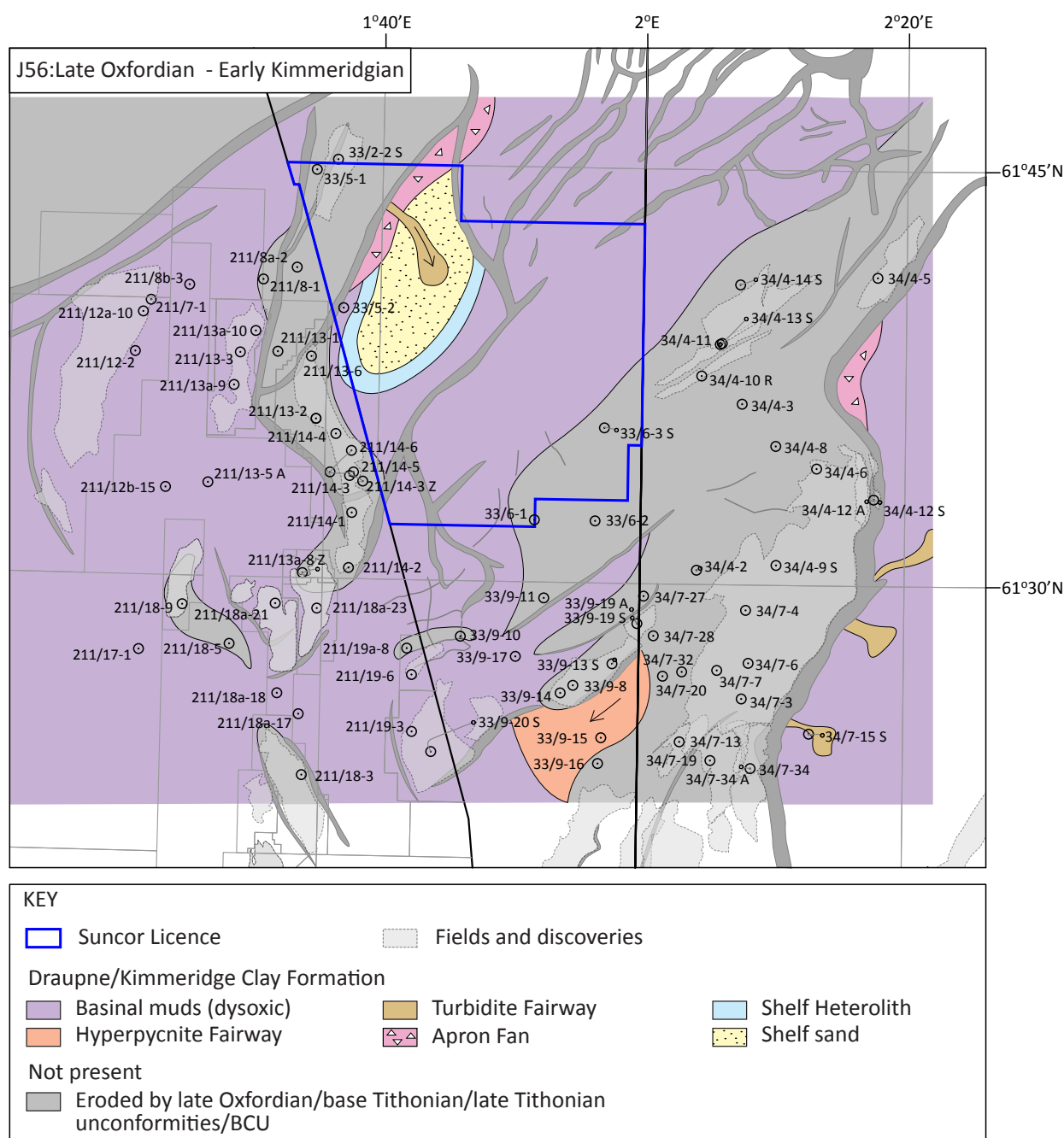


Figure 4.5 Depositional environment of Jabba

Depositional model of Jabba within the Late Oxfordian to Early Kimmeridgian

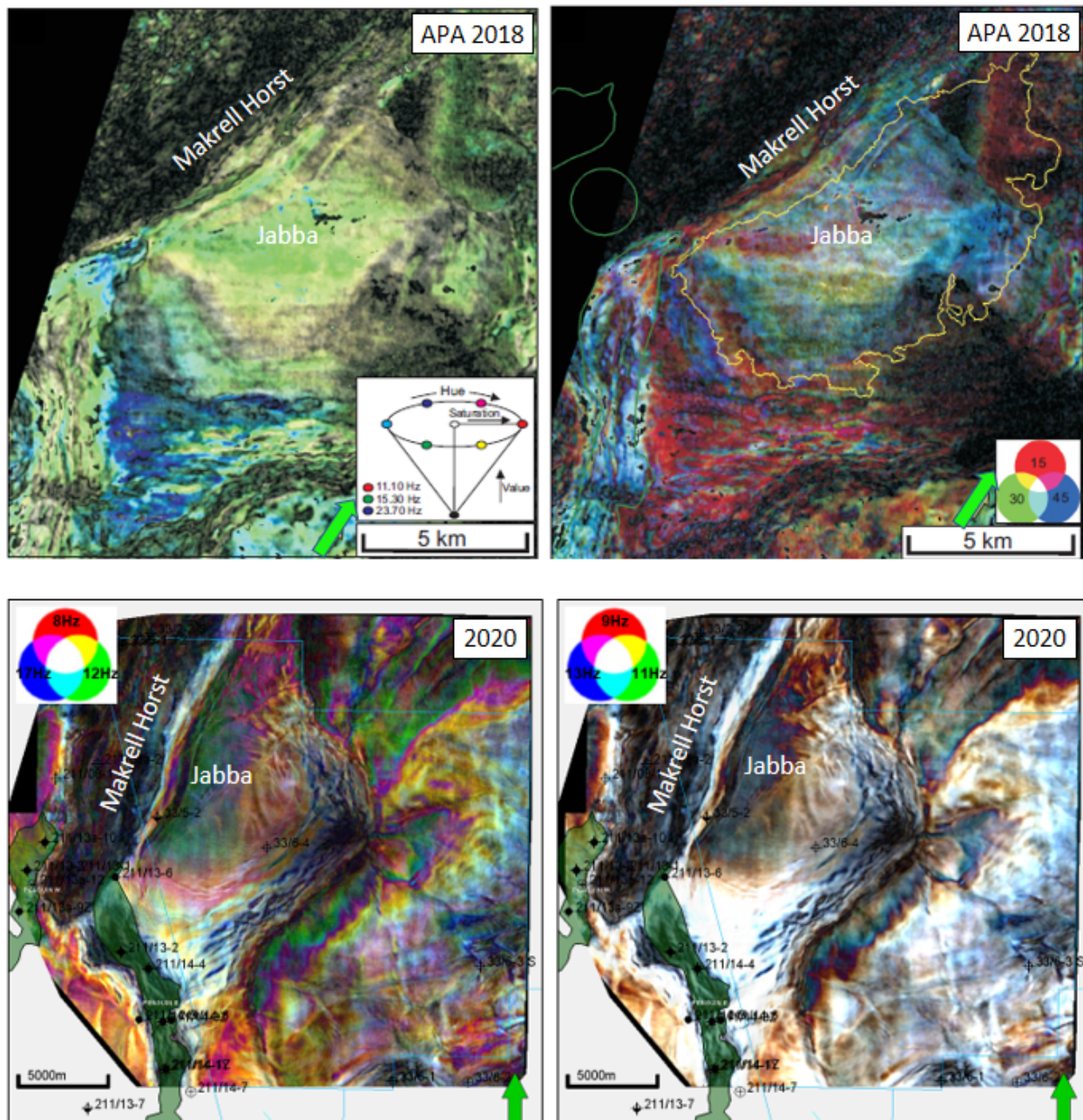


Figure 4.6 Spectral decomposition study

The two upper figures show the spectral decomposition analysis using PCR06M01 3D dataset. The figures indicated a potential lobe in Jabba with entry points in the south of Makrell Horst. The two lower figures show recent spectral decomposition results using CCG18M01 3D dataset. The lobate feature initially shown have now disappeared. The anomaly at Jabba has now been interpreted as slope apron complex and associated turbidites

The seal risk on Jabba has decreased due to enhanced seismic and better definition between sand and shale. However, the risk still remains moderate, as the new depositional model allows for multiple reservoir entry points. This increases the risk of effective side seal.

Charge and migration has low risk. The nearby 33/5-2 well is organic rich Upper Jurassic shales, and the prospect is likely encased in oil mature Draupne Fm shales. In addition, in-situ Heather Fm shales below the Jabba prospect could contribute to charge

The risks recently assessed in the licence have slightly changed. The main risks are now (side) seal and reservoir effectiveness. The seal risk on Jabba has decreased due to enhanced seismic and better

definition between sand and shale. However, the risk still remains moderate, as the new depositional model allows for multiple entry points (Figure 4.5) of the sediment coming from the eastern part of Makrell Horst feeding Jabba sand. This increases the risk of effective side seal. The reservoir effectiveness risk is high due to great burial depth, that could cause high degree of compaction and cementation of the hetero-lithic reservoirs.

Table 4.1 summarizes the updated risk and resource assessment.

Table 4.1 Revised prospect data

Table 4: Discovery and Prospect data (Enclose map)									
Block 33/5 & 33/6		Prospect name	Jabba	Discovery/Prosp/Lead	Prospect	Prosp ID (or New!)	NPD will insert value	NPD approved (Y/N)	
Play name NPD will insert value		New Play (Y/N)		Outside play (Y/N)					
Oil, Gas or O&G case:	Oil	Reported by company	Suncor Energy Norge	Reference document	PL 993 Lapse Report			Assessment year	2020
This is case no.:	1 of 1	Structural element	Penguin Ridge	Type of trap	Stratigraphic	Water depth [m MSL] (>0)	310	Seismic database (2D/3D)	3D
Resources IN PLACE and RECOVERABLE Volumes, this case		Main phase			Associated phase				
		Low (P90)	Base, Mode	Base, Mean	High (P10)	Low (P90)	Base, Mode	Base, Mean	High (P10)
In place resources	Oil [10 ⁶ Sm ³] (>0.00)	6.48	29.20	34.10	68.50				
	Gas [10 ⁹ Sm ³] (>0.00)								
Recoverable resources	Oil [10 ⁶ Sm ³] (>0.00)	2.45	11.40	14.00	29.20				
	Gas [10 ⁹ Sm ³] (>0.00)					0.33	1.56	2.05	4.44
Reservoir Chrono (from)	Tithonian	Reservoir litho (from)	Intra Draupne Fm	Source Rock, chrono primary	Tithonian	Source Rock, litho primary	Draupne Fm	Seal, Chrono	Draupne Fm
Reservoir Chrono (to)	Tithonian	Reservoir litho (to)	Intra Draupne Fm	Source Rock, chrono secondary	Oxfordian	Source Rock, litho secondary	Heather Fm	Seal, Litho	Heather Fm
Probability [fraction]									
Total (oil + gas + oil & gas case) (0.00-1.00)	0.18	Oil case (0.00-1.00)	1.00	Gas case (0.00-1.00)	0.00	Oil & Gas case (0.00-1.00)	0.00		
Reservoir (P1) (0.00-1.00)	0.48	Trap (P2) (0.00-1.00)	0.70	Charge (P3) (0.00-1.00)	0.90	Retention (P4) (0.00-1.00)	0.60		
Parameters:	Low (P90)	Base	High (P10)	Comments					
Depth to top of prospect [m MSL] (> 0)	3887	3887	3887						
Area of closure [km ²] (> 0.0)	1.0	11.0	24.0						
Reservoir thickness [m] (> 0)	20	45	90						
HC column in prospect [m] (> 0)	179	328	483						
Gross rock vol. [10 ⁹ m ³] (> 0.000)	0.200	0.600	1.200						
Net / Gross [fraction] (0.00-1.00)	0.30	0.60	0.85						
Porosity [fraction] (0.00-1.00)	0.10	0.13	0.16						
Permeability [mD] (> 0.0)	50.0	150.0	500.0						
Water Saturation [fraction] (0.00-1.00)	0.20	0.30	0.40						
Bg [Rm3/Sm3] (< 1.0000)									
1/Bo [Sm3/Rm3] (< 1.00)	0.63	0.71	0.81						
GOR, free gas [Sm ³ /Sm ³] (> 0)									
GOR, oil [Sm ³ /Sm ³] (> 0)	86	143	200						
Recov. factor, oil main phase [fraction] (0.00-1.00)	0.26	0.41	0.56						
Recov. factor, gas ass. phase [fraction] (0.00-1.00)									
Recov. factor, gas main phase [fraction] (0.00-1.00)									
Recov. factor, liquid ass. phase [fraction] (0.00-1.00)									
For NPD use:									
Temperature, top res [°C] (>0)	130				Innrapp. av geolog-init:	NPD will insert value	Registrert - init:	NPD will insert value	Kart oppdatert
Pressure, top res [bar] (>0)	600				Dato:	NPD will insert value	Registrert Dato:	NPD will insert value	Kart dato
Cut off criteria for N/G calculation	1.Vshale<=0.4	2.Porosity>=0.10	3.					Kart nr	NPD will insert value

Yoke Lead

Yoke was previously interpreted as Yoda and Luke separated by a fault. Using the new dataset, they are now evaluated as one lead. The trap is stratigraphic and the reservoir is Upper Jurassic Intra Draupne turbidites. The seal is interpreted to be Draupne and Heather shales. The charge and migration are in-situ. The crest is at ~4400m and is likely to be HPHT. The main risk defined is reservoir effectiveness

Epsilon Lead

The Epsilon lead is a downfaulted block with Statfjord Gp reservoir. Crest is at 4100m and the main risk is fault seal.

Leia Lead

The Leia lead was identified through licence work. The trap is stratigraphic with crest at ~3500m and reservoir is Upper Jurassic Intra Draupne sandstone. The lead is located downflank of the 33/6-2 well (shows in Intra Draupne sst) and seismic mapping shows likely communication between Leia and 33/6-2, hence a very high seal risk.

5 Technical evaluation

A complete technical evaluation regarding economical value and possible development solution is not performed due to low probability of geological success, combined with moderate volumes for the Jabba prospect.

6 Conclusion

The Jabba prospect were re-evaluated based on interpretation of the latest CGG18M01 3D data along with the integration of the geological and geophysical studies performed during the licence period.

The geological chance of success of the Jabba prospect is 18%, which is regarded too risky to justify a drill decision. Seal and reservoir effectiveness are considered the key risk elements. The possibility that Jabba is sourced from multiple entry points in Makrell Horst infers a high risk of seal. Reservoir burial depth at 4000m in Jabba is likely to cause low porosity and permeability, therefore high risk of reservoir effectiveness.

The partnership is aligned that no more technical work can be performed on the existing data to further de-risk the Jabba prospect.

The trap is now better defined from the re-evaluation of the seismic.

Three leads have been identified with high risk associated.

Due to low probability of geological success, combined with moderate volumes, the partnership is aligned on a drop decision in PL 993.