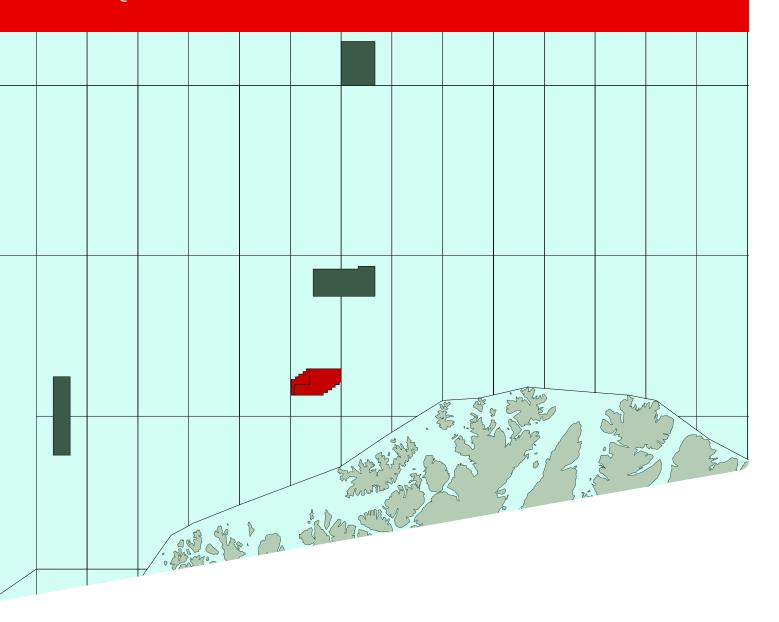
# PL518 & PL518B RELINQUISHMENT REPORT





# PL518 Relinquisment Report

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# 1 Key License History

PL518 and PL518B is located along the Troms-Finnmark Fault Complex on the transition between the Finnmark Platform and the Hammerfest Basin and comprise part of blocks 7121/7,8,9,10,11 &12, Fig. 1.1. Remaining post well prospectivity in the license are the Jurassic Realgrunnen Group Jo prospects and the Triassic Kobbe Formation Neiden prospects, see Fig. 1.2.

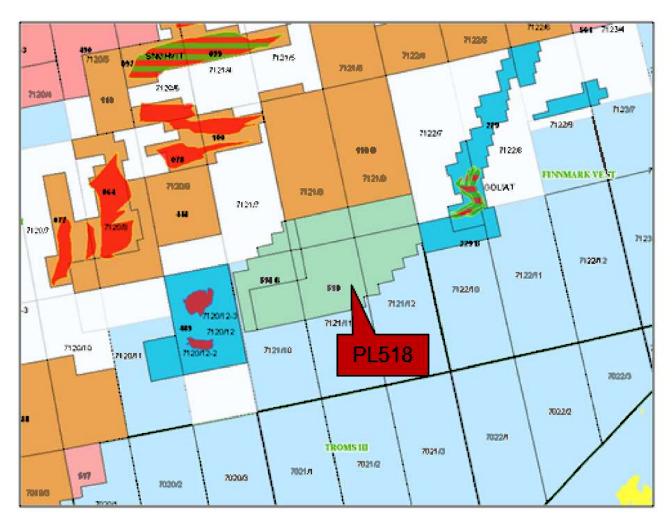


Fig. 1.1 Location map



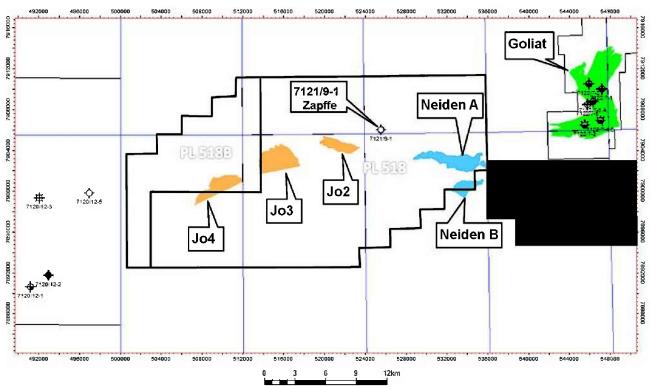


Fig. 1.2 Post Zapffe well (7121/9-1) license inventory

PL518 (part of block 7121/8,9,10,11 &12) was awarded January 23rd 2009 as a result of the APA 2008 application. Dong E&P Norge AS was assigned as operator with 40% share, North Energy AS 30%, Discover Petroleum AS 20% and Sagex Petroleum Norge AS 10%. May 2010 Discover Petroleum AS changed name to Front Exploration and October 2011 Sagex Petroleum Norge AS changed name to Valiant Petroleum Norge AS. October 2012 Dong E&P Norge AS acquired Front Exploration AS and the share increased to 60%.

On February 19th 2010 PL 518B (part of block 7121/7,8,10,11) was awarded as additional acreage with the same ownership. The award was a result of a APA2009 application.

Work commitments in the license were to:

- Acquire 3D seismic covering the entire area Full fold 3D seismic acquired during May and June 2009
- Drill 2 (-1) wells The Zapffe well was completed November 2012
- BOV decision within January 2013 License was relinquished January 2013

An application for dispensation from the second well in the work programme was submitted to the NPD June 29th 2012. This was granted by the authorities July 7th 2012.

October 23<sup>rd</sup> 2012 The Operator, Dong E&P Norge AS, and the Partner, Valiant Petroleum Norge AS, applied to relinquish the license. The Partner, North Energy AS, applied alone for a two year postponement of the BOV November 7<sup>th</sup> 2012. March 14<sup>th</sup> 2013 this application was withdrawn since they failed to identify and secure an approved Operator for the license.



# License meetings

Table 1.1: License meetings 2009-2012

Meetings	Data
MCM&ECM No1	February 18th 2009
MCM&ECM No2	December 9th 2009
ECWM	June 16 <sup>th</sup> 2010
ECWM	September 21st 2010
ECWM	November 2 <sup>nd</sup> 2010
ECM No3	December 6 <sup>th</sup> 2010
MCM No3	December 15 <sup>th</sup> 2010
ECWM	March 10th 2011
ECWM	May 24th 2011
ECM No4	September 15 <sup>th</sup> 2011
MCM No4	November 1 <sup>st</sup> 2011
ECM No5	May 15 <sup>th</sup> 2012
MCM No5	June 14 <sup>th</sup> 2012
ECWM	September 4th 2012

# Reason for relinquishment

Based on the dry Zapffe well (7121/9-1) and the very small size and high risk of the remaining prospectivity the license decided to relinquish PL518 and PL518B.





# 2 Database

All public wells and seismic data in the area have been used in the evaluation. In addition to the DONG operated 3D DG0910, parts of the Eni operated EN0902 and Statoil operated ST09M03 3D's were utilised. BSS01 and HB01-RE 2D lines were used as tie. See table 2.1 and Fig. 2.1.

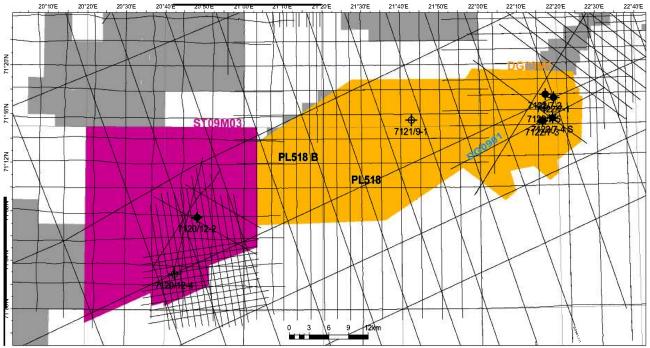


Fig. 2.1 Seismic and well database

Table 2.1: Common database

Well data	2D seismic	3D seismic	EM
7120/1-2	BSS01	DG0910 (license acquired)	EMGS (multi client)
7120/2-2	HB01-RE	EN0902 (southwestern part)	
7120/12-2	FWGS-84	DG09M1 (merged version)	
7120/12-4	ST8418	ST09M03 (eastern part)	
7121/9-1	GFW1-87	DG0901R10 (reprocessed)	
7122/7-1	MN87-6		
7122/7-2	NA-9701		
7122/7-3	NH-8003		
7122/7-4	NPD-TR-82	,	
7122/7-5	NPR-TR-74		
7128/4-1	NPD-TR-77	70	
7128/6-1	NPD-FI-83		
7220/6-1	NPD-FI-84		



Well data	2D seismic	3D seismic	EM
7229/11-1	DG1101 (site survey)		

#### Well

Well 7121/9-1 was drilled by Aker Barents on the Zapffe prospect (see chapter 4 Prospect Update) and spudded October 14th 2011. The operation took 45 days and drilled to TD in Middle Jurassic at 2458 MD RKB. The objective of the well was to test the Lower Cretaceous Knurr Formation and the Upper Jurassic Hekkingen Formation. Secondary target was to secure information about Hekkingen Formation source rock potential and preservation of the Realgrunnen Group. The well encountered the Knurr Formation with considerably thinner reservoir rocks and with poorer reservoir quality than expected. The well was reported as dry.

#### Data sampling:

- Wet and dry cuttings, biostratigraphy sample, geochemical sample and mud sample collected from the  $17 \frac{1}{2}$ " section and below.
- LWD in the entire section. Near bit gamma and resistivity tool used in  $8 \frac{1}{2}$ " hole. Only direction and inclination tool in the 36" hole.
- WL logs run in the entire  $8 \frac{1}{2}$ " section: spectral gamma, density-neutron, high resolution resistivity and sonic (compressional and shear). Also zero offset VSP for seismic calibration run in the  $17 \frac{1}{2}$ " and  $8 \frac{1}{2}$ " hole. Non spectral gamma run in the  $17 \frac{1}{2}$ " section.
- 21 side wall cores (SWC) were recovered from the Knurr and Hekkingen formations.

#### Post well analysis:

- Biostratigraphy performed by Ichron Limited and Fugro Robertson Limited.
- Geochemistry on cuttings and SWC performed by Applied Petroleum Technology (apt).
- Geological and routine core analysis of nine SWC performed by Core Laboratories (Core Lab).

#### 3D seismic

The 3D seismic dataset, DG0901, was acquired by Fugro Geoteam AS during the summer 2009 and covered the entire license (620 km<sup>2</sup>). This survey was pre-stack merged with the southwestern part of EN0702 (320 km<sup>2</sup>) and named DG09M1. PSTM and PSDM processing and reprocessing was performed by CGGVeritas.

Site survey DG1101, acquired by Fugro Geoteam AS, was utilized in the well planning along with a high resolution PSTM version of the 3D named DG0901R10. No shallow hazards were observed.

#### EM data

Multi clinet EMGS 3D EM data was purchased in 2010, reprocessed, and used in derisking of the Zapffe prospect. Pre well 3D constrained inversion derived from well logs, key horizons and earlier





Fig. 2.2 Post well inversion of the EMGS data.. Average Rv in wedge between top Knurr Formation and top Kapp Toscana Group.





### 3 Review of Geological Framework

#### **Late Jurassic - Early Cretaceous framework**

The Hammerfest Basin occupies an intracratonic setting affected by a number of periods of tectonism following the Caledonian Orogeny (Torsvik et al., 2001). The present day structural style is largely the result of Cretaceous and more recent crustal extensions related to the opening of the North Atlantic Ocean (Gabrielsen et al., 1997). The development of the Hammerfest Basin is widely discussed in the literature. The most critical tectonic phase for the Zapffe play was extensional movement in Late Jurassic and Early Cretaceous that created accommodation space for sediments along the Finnmark Platform. The strike slip movement also associated with the Finnmark Platform acted most likely as sediment fairway for the distinctive wedge-shaped packages. The play concept is syn-rift basin floor fans and wedges with stratigraphic trapping away from the main fault.

Tertiary erosion is thought to have removed 1000-1500 m of the overburden in the prospect area.

Several Late Jurassic to Early Cretaceous wedges have been identified seismically and also drilled along the rim of the Hammerfest Basin. Along the margin of the Finnmark Platform well 7019/1-1 is a gas discovery in the Stø and Knurr Formation. 7120/10-2 was dry targeting a clastic wedge in the Knurr Formation. Along the margin of the Loppa High, well 7120/1-2 is an oil discovery in the Knurr Formation but the reservoir quality is poor. The underlying Hekkingen Formation sandstone is dry. Well 7122/2-1 is dry but encountered Knurr Formation reservoir with very good quality. 7120/2-2 has weak oil shows in Knurr Formation and poor reservoir quality.

These wedges are located in a favourable position relative to the source rock. The Hekkingen Formation is in the early to mid maturity window for oil, and located directly below the Upper Jurassic Lower Cretaceous wedges and thus most likely charging them.

A general lithostratigraphic column of the south western Barents Sea is shown in Fig. 3.1.



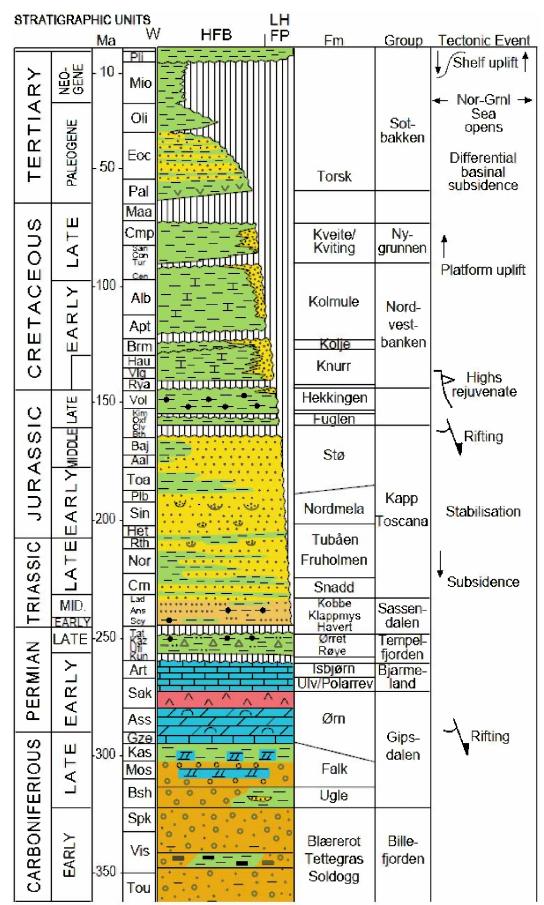


Fig. 3.1 Generalized lithostratigraphic column of the Western Barents Sea



## 4 Prospect Update

#### Pre Zapffe well prospectivity

At the time of application the license inventory comprised the Permo-Carboniferous Tana prospect, the Middle Triassic Neiden prospect, the Mid Triassic-Early Jurassic Q lead and the Lower Cretaceous Epsilon and Ypsilon leads, Fig. 4.1.

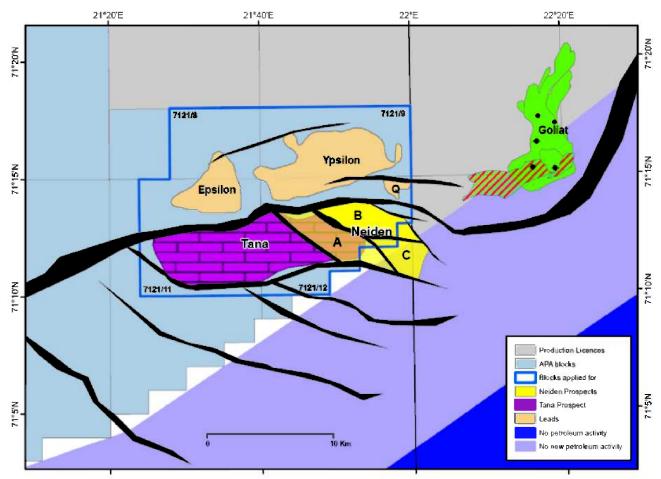


Fig. 4.1 Lisence inventory in the APA 2008 application

Permo-Carboniferous prospect: Tana

The largest prospect (Tana) was thought to be a Permo-Carboniferous carbonate buildup situated on the margin of the Finnmark Fault Zone. This large prospect was identified only on a very sparse 2-D seismic grid. It was this feature that was targeted to be the primary drilling candidate in the licence. It was envisaged that a success in the first well would require further exploration of the prospect and the PL518 partnership, recognising the often complex reservoir distribution within carbonates, was fully prepared to dedicate a further well to the play to provide a more comprehensive picture of its potential. The license acquired 3D seismic (DG09M1) provided a much better image of Tana and the original model of the paleodepositional setting was not supported by the data. The Tana prospect appeared instead to be part of a marginal marine wedge of mixed clastics and carbonates. The dating of this wedge by strontium isotopes from samples from well 7120/12-4 showed that the wedge was definitely of Upper Permian age.



As the Upper Permian is largely developed as a non-reservoir in the Barents Sea (with the exception of a thin spiculitic facies found in well 7128/6-1) this observation was a very discouraging development with respect to expectations concerning reservoir properties. When further investigation revealed that it was not possible to map an updip closure to this wedge and that the ultimate top seal would be Lower Triassic clastics, it was necessary to downgrade Tana from prospect to lead status.

#### Lower Knurr Formation prospect: Zapffe (Ypsilon)

With the downgrade of Tana, the partnership sought to mature other possibilities within the licence. The Lower Cretaceous Knurr Formation had been recognised as a lead at the time of application (named Ypsilon in Fig. 4.1). With the assistance of a better seismic imaging from the new 3D, it was possible to mature a stratigraphically entrapped Lower Knurr wedge, on the hanging wall of the Finnmark Fault. 3D electromagnetic logging showed a resistivity anomaly at the approximate pinchout boundary of this Knurr feature. Additional upside was also recognised in the underlying Hekkingen Formation which, in the most optimistic case, could contain both the local source rock as well as a potential reservoir. The pre-drill understanding of the Knurr prospect is shown as a structural depth map with the EM anomaly draped on the surface of the Knurr formation in Fig. 4.2. The red area represents the high resistivity EM anomaly. This Lower Knurr Formation prospect was named Zapffe.

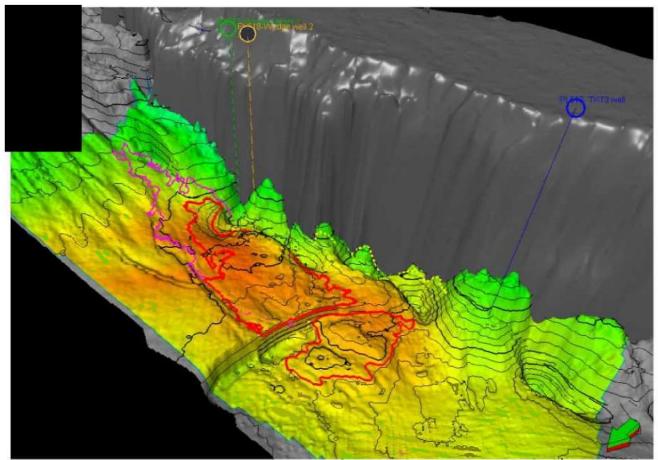


Fig. 4.2 The Lower Knurr Formation Zapffe prospect.. Top Knurr Formation depth map



The Zapffe well was completed in November 2011 and reported dry. The initially attractive EM anomaly turned out to be related to the resistivity of the TOC-rich Hekkingen Formation rather than an accumulation of hydrocarbons. The top Lower Knurr reflector (named top Ypsilon in Fig. 4.3) turned out to be a soft shale. The N/G in this Ypsilon interval is 0.12 and the porosity in the very fine to fine grained massive sandstone units is 14%. The Hekkingen Formation consists of shale/mudstone with limestone stringers. The remaining Knurr and Hekkingen Formation prospectivity was therefore downgraded along the fault.

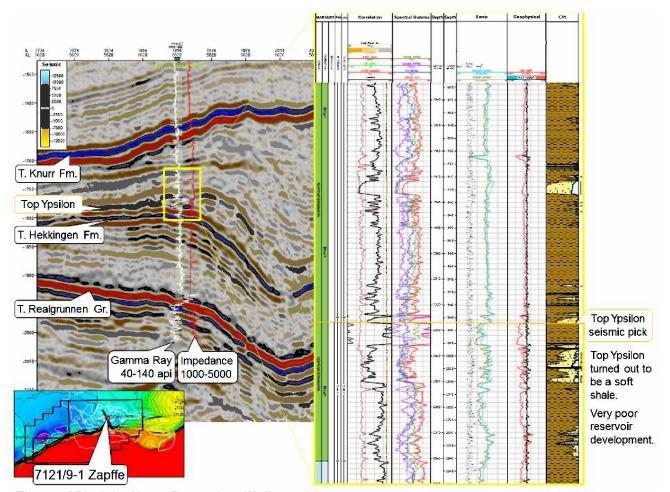


Fig. 4.3 CPI of the Knurr Formation. Well 7121/9-1

#### Post Zapffe well prospectivity

Realgrunnen Group Prospects: The Jo prospects

Three small closures on the hanging wall of the Finnmark Fault Zone were identified at Top Realgrunnen Group. It is anticipated that these closures contain Jurassic reservoirs with some minor upside potential in the Triassic Snadd Formation. Fig. 4.4 shows a map view of the prospects. Fig. 4.5 shows an interpreted seismic line over the prospects illustrating a rather unusual and complex trapping system.

The three Jo prospects share common elements with respect to risk. Their location on the active Finnmark Fault zone lead to downgrading of their likely reservoir quality due to probable cataclasis along the fault. Additionally, the poorer than expected properties of these reservoirs in well 7121/9-1 down-graded the prognosis for reservoir properties in this setting. Adequate charge into these



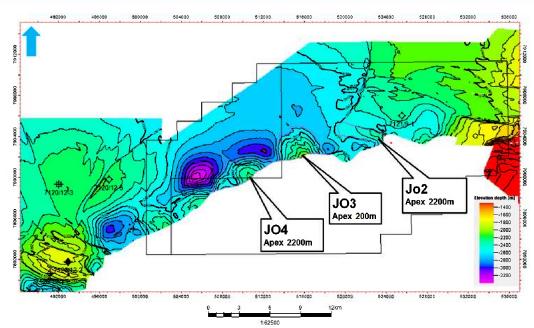


Fig. 4.4 Depth map of top Realgrunnen Group with the Jo prospects

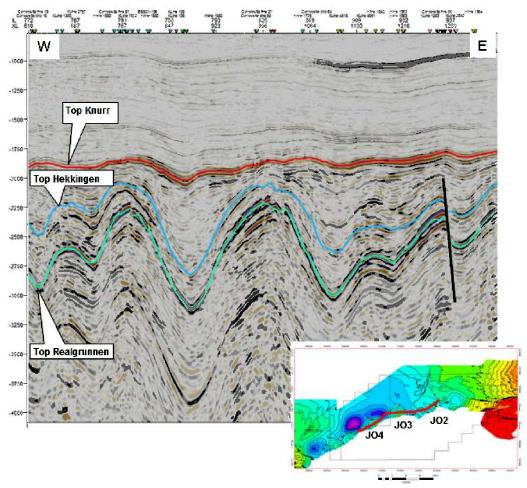


Fig. 4.5 Interpreted seismic profile through the Jurassic Jo prospects

prospects are considered uncertain due to an extremely limited catchment area for the Hekkingen source. Perhaps the most problematic element shared by these prospects is the trap setting. The Goliat Field most likely leaks into the Finnmark Fault and the Alke discovery appears to have a



contact which is consistent with a potential leak-point into the fault. As these prospects rely on a sealing fault it is acknowledged that the risk on retention is very high. Fig. 4.6 shows the volumetric output in terms of in place and recoverable hydrocarbons in MMboe. Even the aggregated calculated resource volumes falls far short of an interesting recoverable oil volume in the Barents Sea.

### Total resources for the Jo Prospects

Segment	In-Place (MMbls) O.E.			Recoverable (MMbls) O.E.			POS
	P90	P50	P10	P90	P50	P10	
Jo3(R+S)	27.1	82	286	7.6	23.8	88.3	0.10
Jo4(R+S)	31.4	91.1	295	8.24	27	91.3	0.10
Jo2(R+S)	24	55.6	103	6.5	15.9	32.5	0.10

### Total resources (Aggregate) of all three Jo Prospects

Jo	In-Place (MMbis) O.E.			Recoverable (MMbls) O.E.			POS
	P90	P50	P10	P90	P50	P10	
	19	85	327	4.3	25	121	0.19

Fig. 4.6 Total resources for the Realgrunnen Group Jo prospects

Kobbe Formation prospect: Neiden

The Neiden fault-assisted dip closures were recognised at the time of the original application (see Fig. 4.1) and were seen as a possible upside potential in the licence. Evaluation shows that only the Neiden A segment provides a closure entirely within the licence (See Fig. 4.7). A seismic line across the crest of Neiden A shows the trapping style (Fig. 4.9). Closer evaluation of the charge route, has revealed that Neiden A has very little chance of success and very limited trap capacity even in the unlikely event of a success. Significant risks are identified for charge and for trap integrity. Fig. 4.8 summarises the volumetric potential of this prospect.



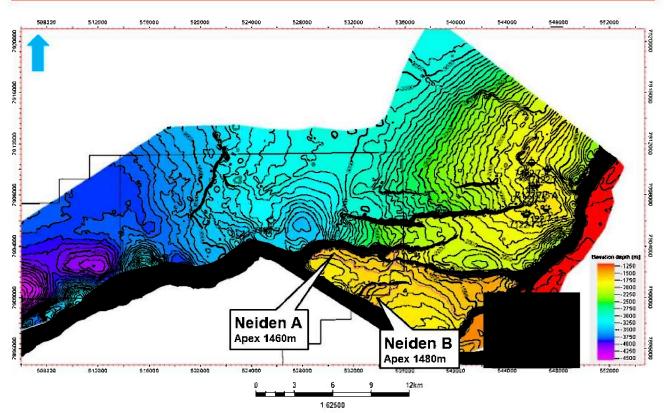


Fig. 4.7 Depth structure map top Kobbe Formation

Segment	<b>In-Place (MMbls)</b> O.E.			Recoverable (MMbls) O.E.			POS	
	P90	P50	P10	P90	P50	P10		
Neiden A	6.2	14.3	36.6	1.8	4.4	12.1	0.05	
Neiden B	8	13.7	24.2	2.2	4.2	8.2	0.05	

Fig. 4.8 Total reserouces for the Kobbe Formaton Neiden prospect



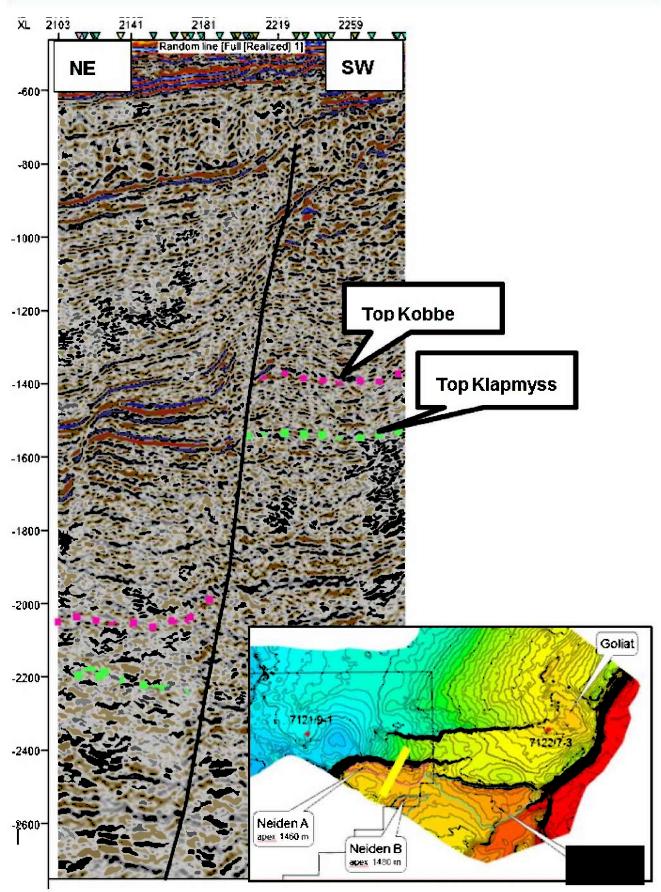


Fig. 4.9 Interpreted seimisc profile showing the Kobbe Formation, Neiden A prospect





### **5 Technical Evaluations**

In the APA 2008 application a technical evaluation of the Tana and Neiden prospects were presented. Due to the limited size and low chance of sucsess after the new 3D evaluation, no further technical/economical studies has been performed, either on the above mentioned prospects or the Jo prospects.





# **6 Conclusions**

The Zapffe well (7121/9-1) testing the potential of the Knurr Formation in the Zapffe prospect was dry and revealed very poor reservoir rocks. Remaining prospectivity in the Realgrunnen Group, the Jo prospects, are very small in size and they have a low chance of success (10 %). The Neiden prospects of the Triassic Kobbe Formation are also very small and has a very low chance of success (5 %). Based on the poor remaining prospectivity the license decided to relinquish PL518 and PL518B October 23rd 2012.

