

Relinquishment report PL369

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1 INTRODUCTION

1.1 License owners

From 06.01.2006:	Talisman Energy Norge AS (O)	40 %
	Wintershall Norge ASA	20 %
	Det norske oljeselskap ASA	20 %
	Petro-Canada Norge AS	20 %
From 17.12.2009:	Det norske oljeselskap ASA (O)	60 %
	Wintershall Norge ASA	40 %

1.2 Award and work program

The PL 369 license was awarded January 6th, 2006 resulting from the APA 2005 round. The work program for the initial period of 6 years included:

- acquire electro- magnetic (SBL) data over the prospects within 4 years
- acquire 250 km high resolution 2D seismic or minimum 150 km² 3D seismic within 4 years
- G&G studies within 4 years
- Drill one exploration well within 4 years
- BOV within 4 years
- PDO within 6 years

The Trow prospect (Fig. 1.1), exploration well 32/2-1, was drilled during June 2008. The well was permanently plugged and abandoned on July 1th 2008 as a dry well. One well was drilled in the area in the mid 80's, well 31/6-3, which encountered sandstones of excellent reservoir quality in the Sognefjord Formation, but only minor traces of hydrocarbons were detected and the well was abandoned as a dry well.

Det norske oljeselskap ASA and Wintershall Norge ASA did not support the operators proposal to relinquish PL369 as it was believed that the license still contained possible

untested commercial potential. The main prospects are shown in (Fig. 1.1 and Fig. 1.2). Two faulted 4-way dip closures are defined, the Varfjellet and Enka prospects.

Wintershall's takeover of Petro-Canada's 20% share and Det norske's takeover as operator and Taliman's 40% share was approved by the Ministry 17th December 2009 as well as a revised work program. The new work program comprised:

- DOD within 06.01.11
- BOV within 06.01.13
- PDO within 06.01.14

The license has fulfilled these obligations and has decided to relinquish PL 369.

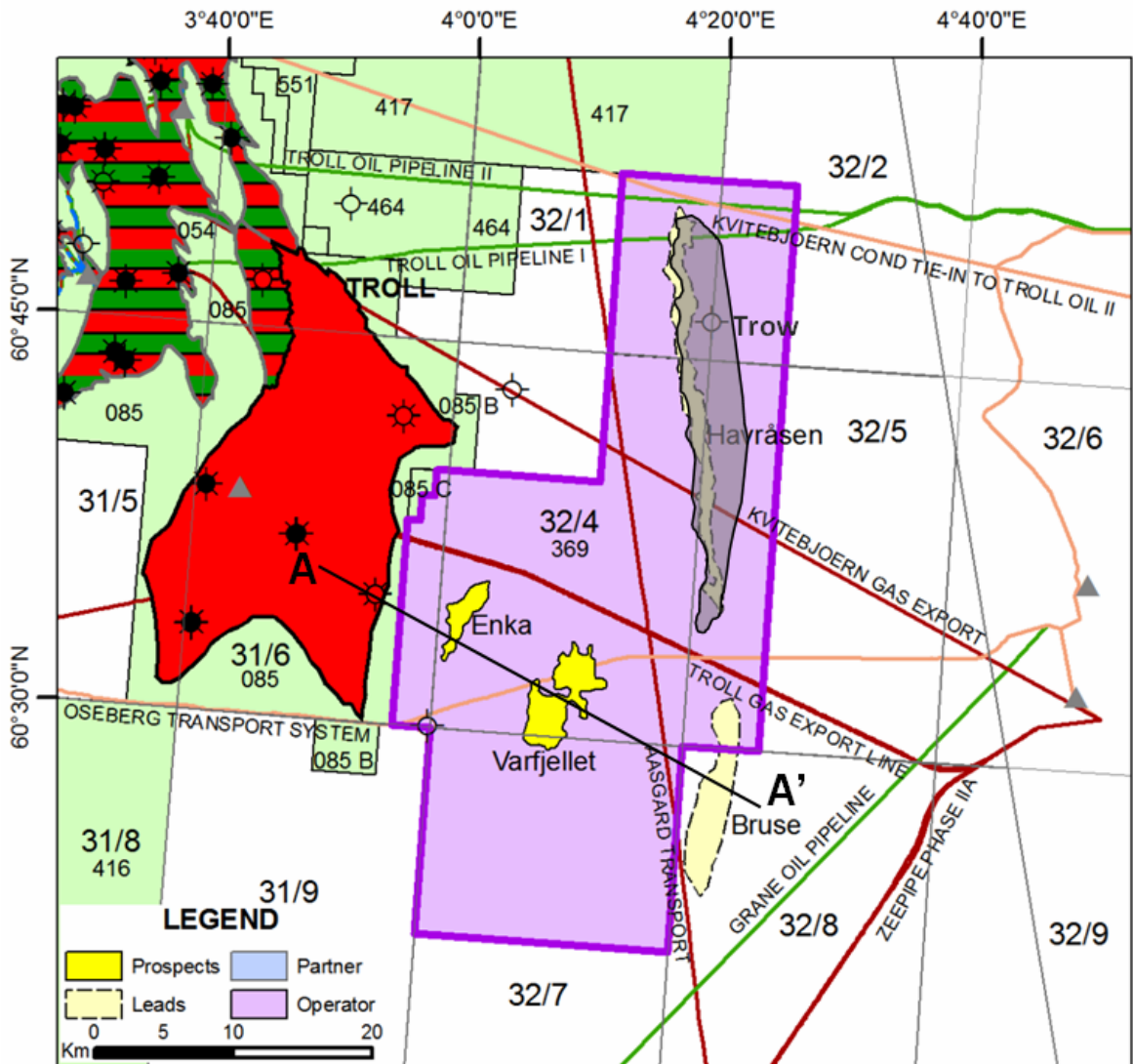


Fig. 1.1 PL369 license area. The black line A-A' indicates the position of geoseismic section.

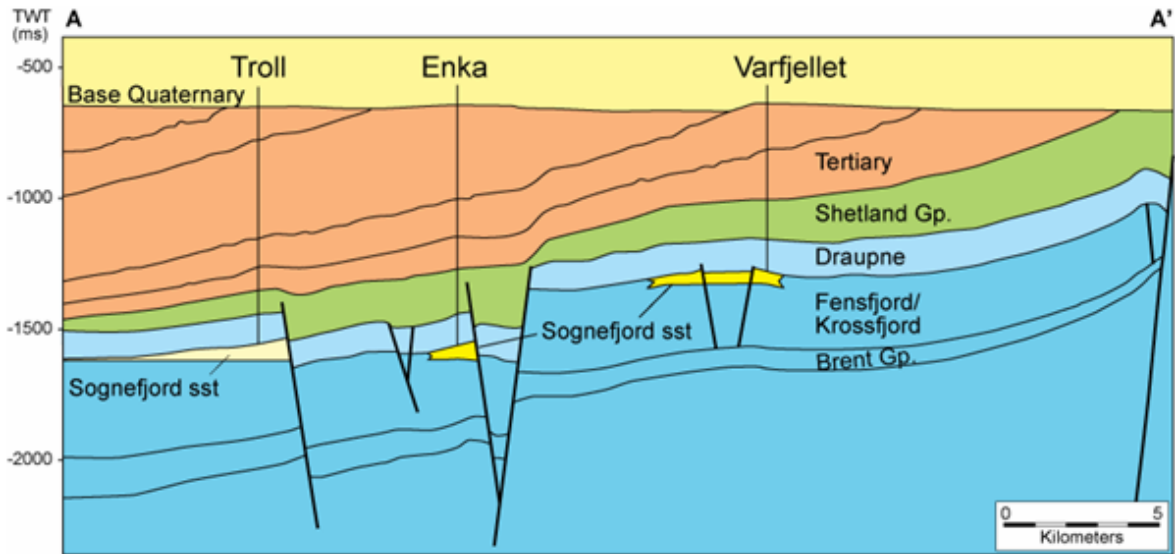


Fig. 1.2 Geoseismic section across PL369. The section A-A' shows, respectively from WNW to ESE, the Troll Field, Enka and Varfjellet prospects.

1.3 PL369 pre-drill prospectivity

As part of the 2005 APA license application, three prospects and a number of leads were identified within the proposed license area. All the prospects were part of the proven Upper Jurassic NPD play model, NJU-1.

This play fairway is largely restricted to the area around the Horda Platform and contains Viking group sandstones which represents a post-Brent shallow marine clastic wedge prograding from east to west. The main reservoir formation for all prospects (Troll, Varfjellet and Enka) in the license area was the Oxfordian - Volgian Sognefjord Formation, which is the reservoir of the adjacent Troll Field and the nearby Brage and Fram fields. One well has been drilled in the application area, 31/6-3, which encountered sandstones of excellent reservoir quality in the Sognefjord Formation, but was dry due to lack of hydrocarbon charge.

The Varfjellet and Nisse prospects are defined by faulted 4-way dip closures. The Troll prospect is a 4-way dip closure with a significant upside potential depending on stratigraphic seal across the Øygarden fault zone. Top seal was provided by the overlying shales of the Heather and Draupne formations. The Upper Jurassic Draupne Formation hot shale is considered to be the main source rock. The Heather Formation (Callovian) also has a hydrocarbon generation potential in the drainage area of Troll.

The main uncertainty for all the prospects in the PL369 area is whether hydrocarbons have migrated towards the area east of the Troll field.

A table showing the expected recoverable reserves (gross) of all three prospects is presented below.

Table 1.1 Prospect summary. Overview of prospects indicating recoverable reserves and POS (probability of success).

PL 369					GROSS RECOVERABLE RESERVES / RESOURCES					
					Low		Base		High	
CATEGORY	RESERVOIR LEVEL	HC	RF (%)	POS (%)	Oil (MSm ³)	Gas (GSm ³)	Oil (MSm ³)	Gas (GSm ³)	Oil (MSm ³)	Gas (GSm ³)
PROSPECTS										
Trow	U. Jurassic	oil	30	18	3,3		19,9		121,1	
Varfjellet (Vette*)	U. Jurassic	oil	35	7	12,0		17,4		23,9	
Enka (Nisse*)	U. Jurassic	oil	35	6	2,5		3,6		5,0	
* former prospect names										

2 DATABASE

2.1 Seismic database

After drilling the Trow prospect and prior to evaluating the remaining prospectivity within the license, the high resolution 2D survey DN0909 was acquired by the license. DN0909 covers both the Varfjellet and Enka prospects and includes near- far- and full offset data. The seismic imaging and resolution provided by this survey improved the interpretation of the PL369 area. Due to some migration noise five key lines over the hydrocarbon migration route and prospects were reprocessed in 2010.

The seismic coverage of the license area is listed in Table 2.1 and displayed in Fig. 2.1. The PGS Norwegian Mega Merge survey provides 3D coverage of the Troll East field. The PL369 area is only covered by 2D data, including the DN0909 high density survey of reasonable quality.

Table 2.1 Seismic database

Survey name	Survey type
DN0909	High density 2D
PGS Mega Merge	3D
ST8116	2D
SH8001	2D
NH8202	2D
MN88-3	2D
SG8043	2D

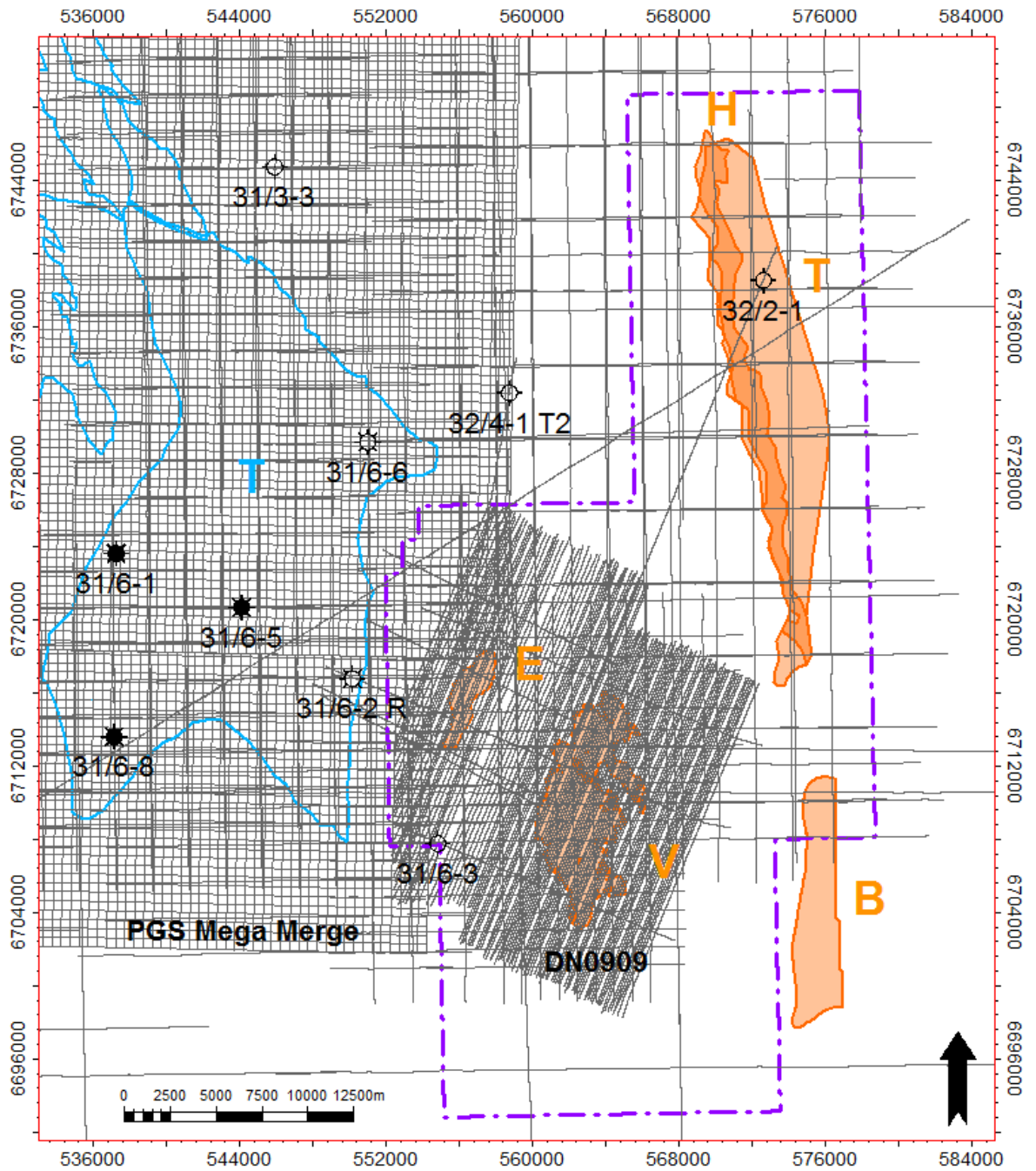


Fig. 2.1 Seismic and well database. T-Troll Field, E-Enka prospect, V-Varfjellet prospect, B-Bruse lead, H-Havråsen lead and T-Trow prospect.

2.2 Well data

Fig. 2.1 shows the wells in the license area as well as the wells closest to the area. Key wells used in the geological and petrophysical evaluation are indicated in Table 2.2. The wells covering the Troll East Field and East of Troll were used as well-ties of both the PGS Mega Merge and DN0909 surveys.

Table 2.2 Well database

Well	Year drilled	Water depth (m)	TD (m)MD	Location/Field
31/3-3	1984	332	2573	NE of Troll
31/6-1	1983	302	4070	Troll
31/6-2 R	1984	303	2235	Troll
31/6-3	1983	301	2250	E of Troll
31/6-5	1984	304	2082	Troll
31/6-6	1984	313	2293	Troll
31/6-8	1985	300	2138	Troll
32/2-1	2008	351	1300	Trow prospect
32/4-1 T2	1996	312	3186	E of Troll
35/11-1	1984	365	3361	N of Troll
35/11-2	1987	372	4025	Vega Sør
35/11-3 S	1989	358	4040	NNW of Troll
35/11-5	1991	355	3769	NNW of Troll
35/11-8 S	1996	361	3624	Fram
35/12-1	1992	351	3020	NNE of Troll

2.3 Special studies

Several special studies have been carried out both in-house and by external parties to address the geological uncertainties of the PL369 prospectivity. These studies include EM data, basin modelling, seismic data analysis of the DN0909 survey and depth conversion.

- A seabed logging (SBL) survey was performed by EMGS in 2006 across the Trow, Varfjellet and Enka prospects.
- Exploro performed a basin modelling study to help understand the migration from the Troll Field towards the east and the regional petroleum systems.
- An amplitude and AVO study was done on reprocessed lines of the DN0909 survey in order to better understand the prospectivity in the license area.
- Aker Geo has performed a depth conversion study based on the DN0909 velocity data. Parallel to this an in-house depth conversion study was performed as a QC as the Varfjellet prospect area is highly sensitive to velocity changes in the overburden.

3 TROW AND VARFJELLET PROSPECTS

3.1 Trow prospect evaluation

The Trow prospect is located East of the Troll Field in the hangingwall of the Øygarden Fault Zone and consists of a structural closure at both the Sognefjord Formation and Brent Group levels (Fig. 3.1 and Fig. 3.2). The primary reservoir consists of the Late Jurassic Sognefjord Formation and the base seal is provided by the shales of the Late Jurassic Draupne Formation. A composite seismic and geological section gives an overview of the Trow prospect (Fig. 3.3 and Fig. 3.4).

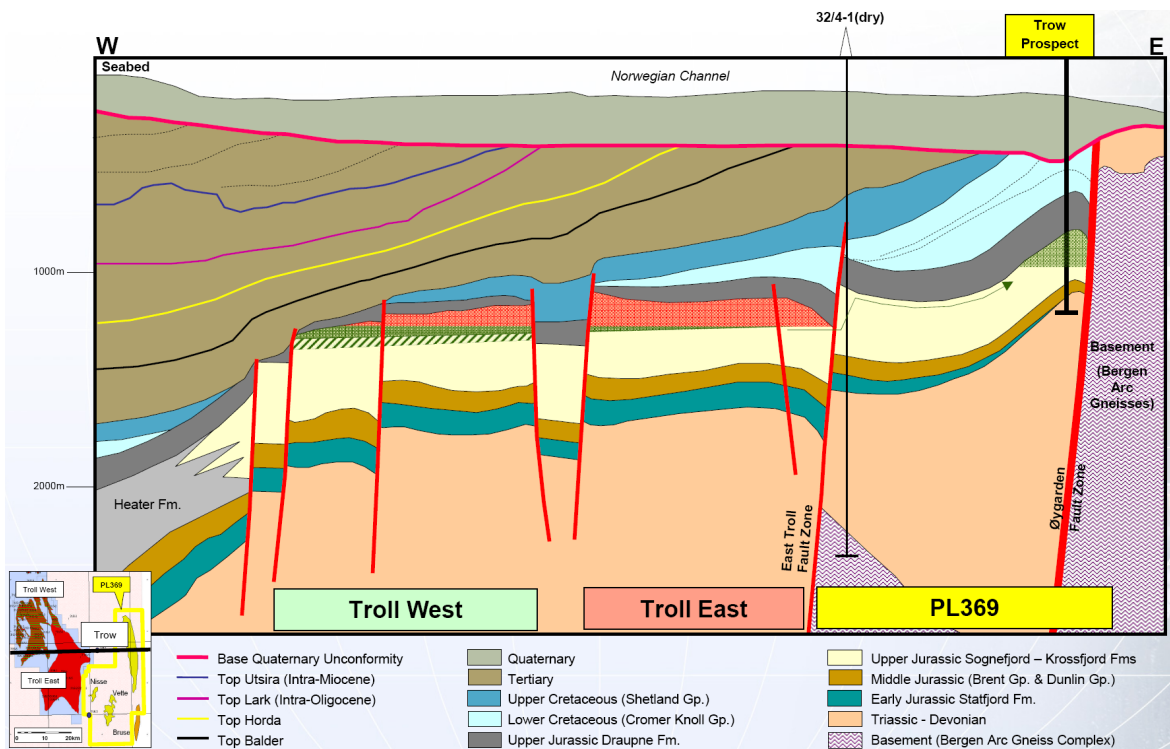


Fig. 3.1 Geological Section W-E over Troll Field and Trow prospect.

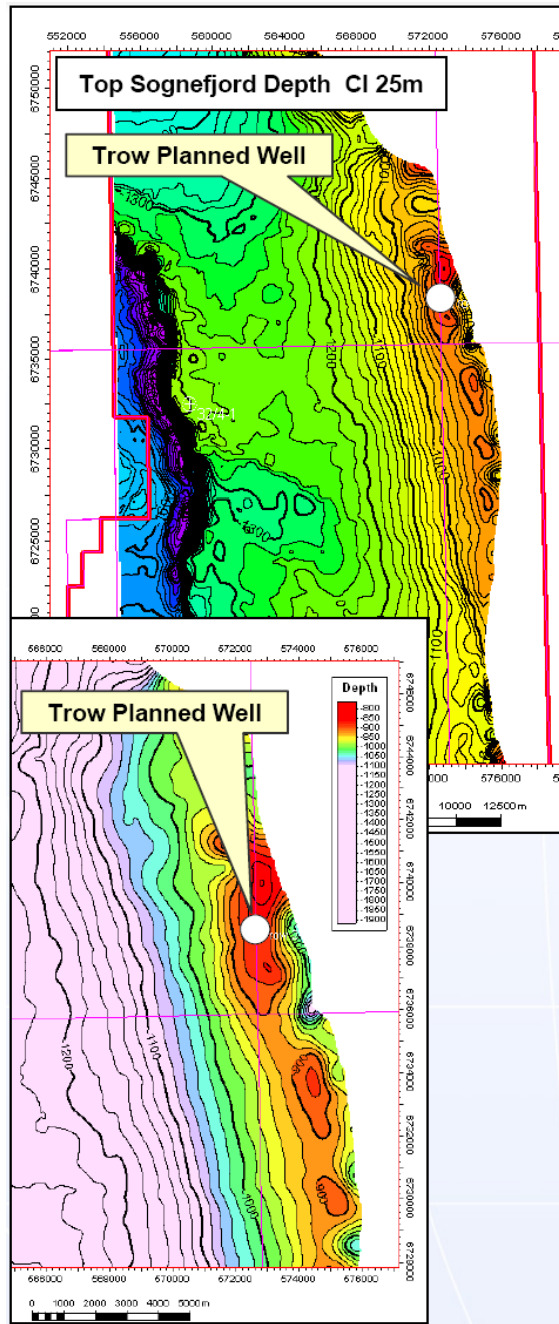


Fig. 3.2 Trow planned well 32/2-1 location. *Top Sognefjord depth map.*

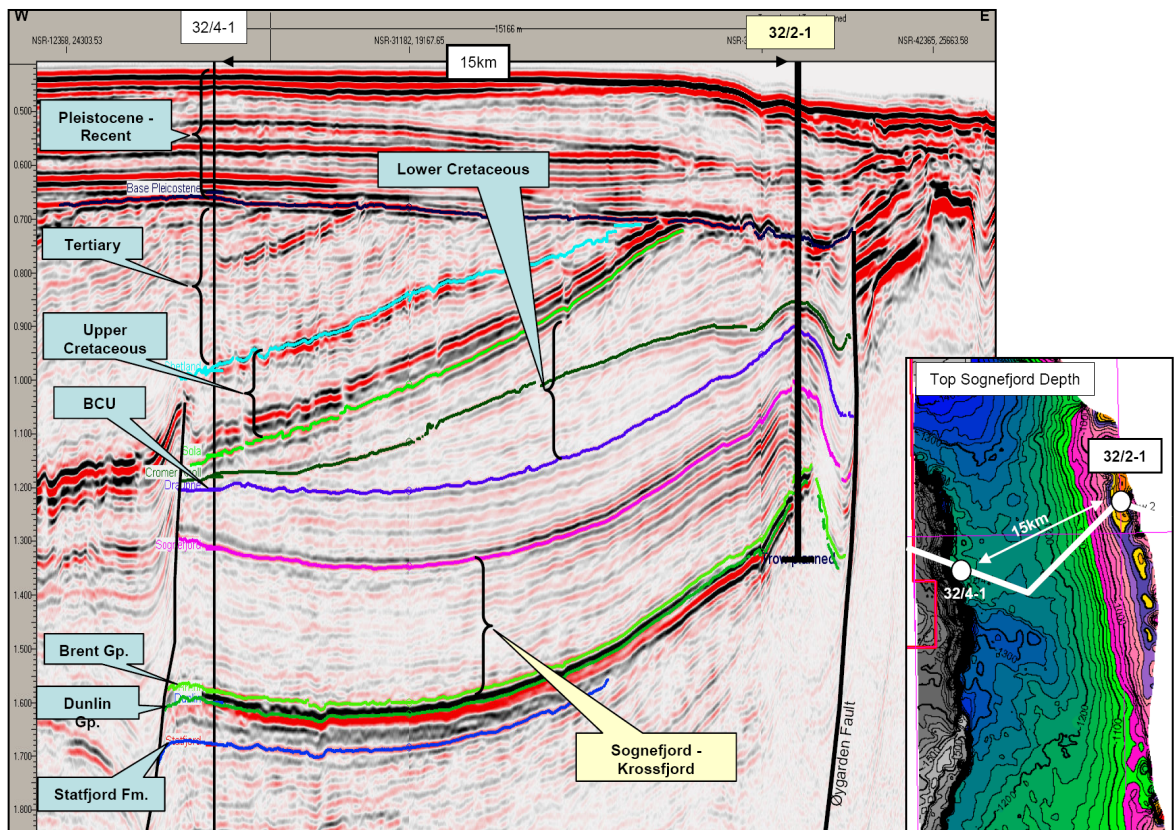


Fig. 3.3 Seismic Section showing the position of Trow well 32/2-1.

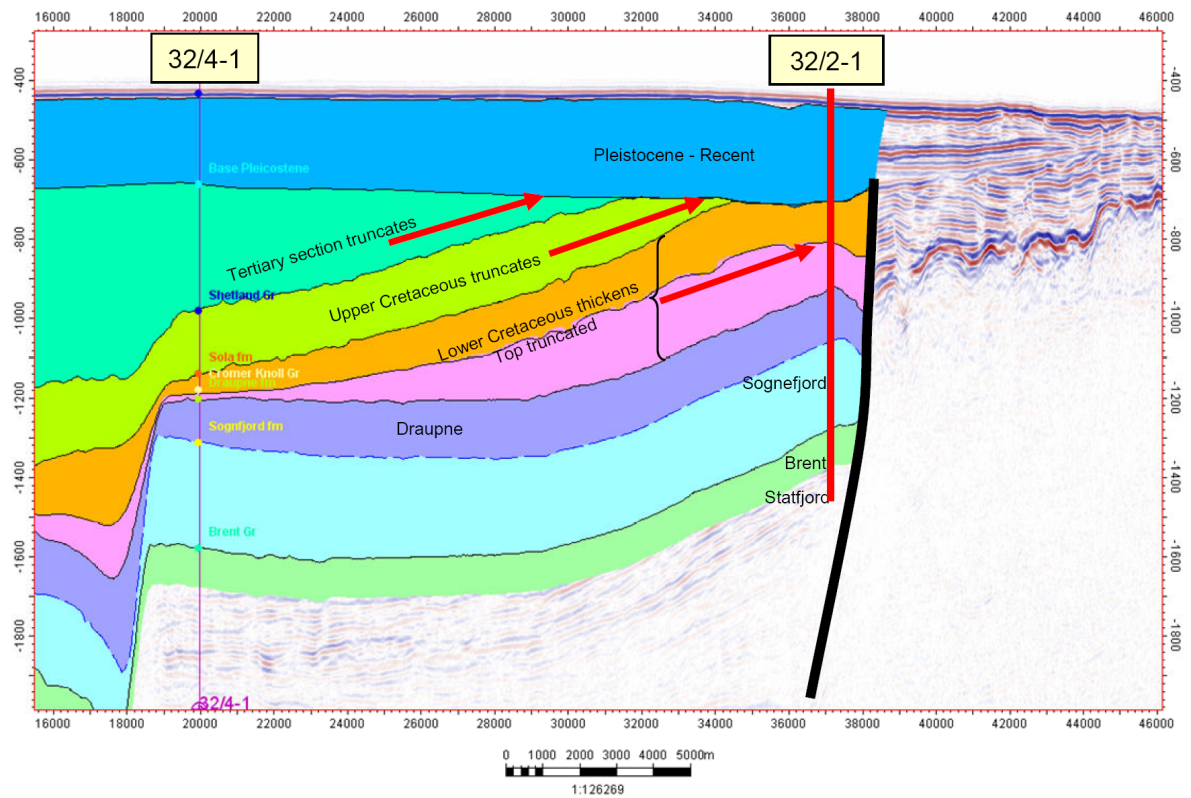


Fig. 3.4 Geological Section showing the position of Trow well 32/2-1.

Local compression has created a roll-over structure into the fault zone, resulting in a small 4-way structural closure at the highest part down to 950m at Sognefjord level. The relief in the 4-way closure is estimated at 73m.

3.2 Well 32/2-1 results

In June 2008 well 32/2-1 was drilled to investigate the hydrocarbon potential of all prospective levels within the Trow prospect. The main objective was to investigate the hydrocarbon potential of the Late Jurassic Sognefjord, Fensfjord and Krossfjord Formations. Secondary targets were the Brent Group and Statfjord Formation.

The probability of discovery was calculated to be 0.18 with the highest risk associated with the migration of hydrocarbons into the prospect.

The proposed versus actual stratigraphy is presented below (Fig. 3.5) together with CPI logs and reservoir parameters (Fig. 3.6). Good quality sands were encountered at the Sognefjord Formation level.

Trow 32/2-1							Formation tops					Formation evaluation		Sampling		
Hole section	m	Lithology	Stratigraphy		Prognosis	Actual	Prognosis	Actual	Thickness	LWD/MWD logs	Wireline logs	Cuttings wet	Gas	Core		
Casing	MD		Chrono	Gp.	Formation	Member	mTVDS	mTVDS							mMDBRT	mMDBRT
36"					Airgap	RT - MSL	NA	42.6	26	26						
30"	425		Quaternary	Nordland	Seabed	Water depth	351.0	351.0	377	377	243	DIR				
9 7/8"														No returns		
17 1/2"			L Cret.	C. Knoll	Sola/Rodby		582.0	594.0	608	620	135	GR-RES-SONIC- -DIR-PWD				
						Asgard		720.0	729.0	746	755		68			
13 3/8"	835		U. Jurassic	Viking	Draupne		796.0	797.0	822	823	61	GR-RES-DEN-NEU-SONIC- PRESSURE-DIR-PWD	None	3m	None	
						Heather		900.0	858.0	926	884					18
						Sognefjord		910.0	876.0	936	902					110
						Fensfjord		990.0	986.0	1016	1012					103
						Krossfjord		1060.0	1089.0	1086	1115					72
8 1/2"			M Jura	Brent	Ness		1160.0	1161.0	1186	1187	41					
						Etive		1165.0	absent	1191						
			L Jura	Dunlin	Drake		1180.0	absent	1206							
						Burton		1205.0	absent	1231						
			L Jura	Statfjord	Amundsen		1230.0	absent	1256							
						Statfjord		1240.0	1202.0	1266	1228	19				
			Trias	Hegre	Lunde		1250.0	1221.0	1276	1247	53					
					TD		1274.0	1274.0	1300	1300						

Fig. 3.5 Proposed vs. actual stratigraphy observed in Trow well 32/2-1.

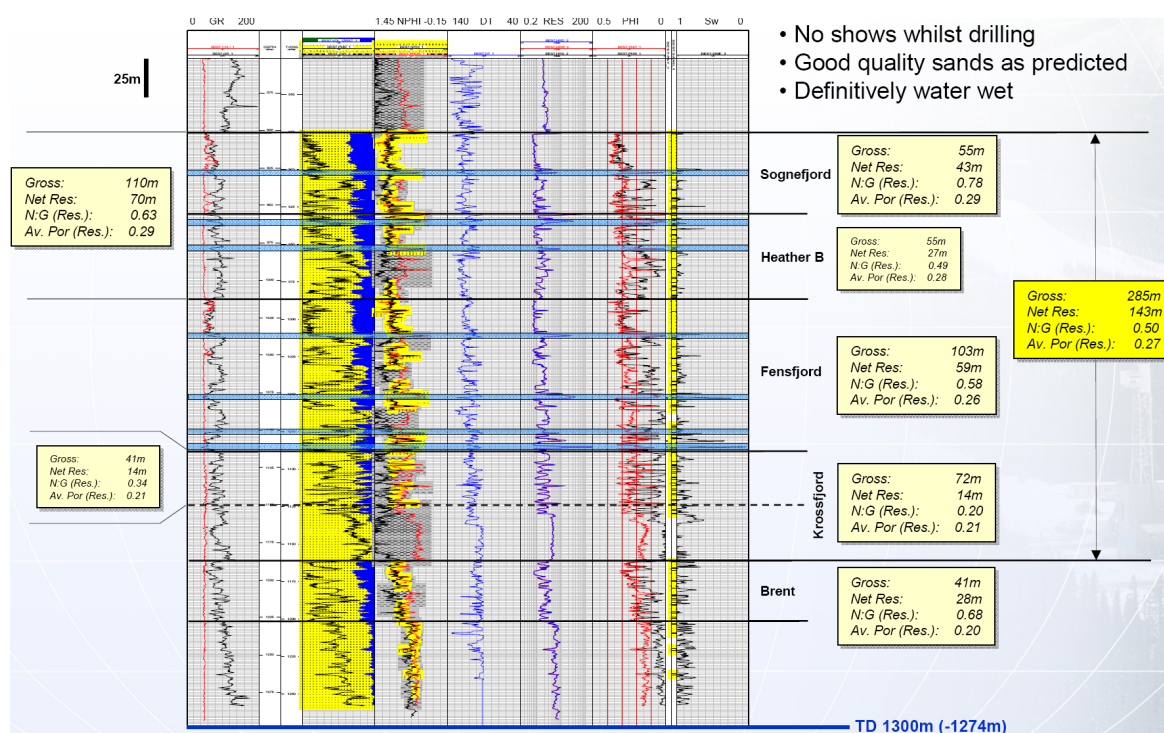


Fig. 3.6 Trow well 32/2-1 CPI logs.

The well was plugged and abandoned as a dry well without hydrocarbon shows.

3.3 Varfjellet prospect evaluation

The Varfjellet prospect is located East of the Troll Field and West of the Øygarden Fault Complex (Fig. 3.7). It is a 4-way closure and the reservoir consists of the Late Jurassic sandstones of the Sognefjord Formation. The base seal is provided by the shales of the Heather Formation, while the top seal consists of the shales of the Draupne Formation. Crossline 4136 and inline 2055 give an overview of the Varfjellet prospect (Fig. 3.8).

The Varfjellet structure is very sensitive to the velocity model used in the depth conversion as it only forms a minor 4-way closure in time. Due to lateral velocity variation associated with the wedge shaped geometry of the overburden, a push down in the east lowers the spill point in this direction and thereby increases the lateral extent of the closure. The velocity field used is based on a semi-regional uplift and erosion model and uncertainty in this model introduces a risk for the prospect.

The Varfjellet and Enka prospects are assumed to be charged with hydrocarbons that have migrated from the Troll East Field (Fig. 3.7). The seismic data over the Varfjellet and Enka prospects do not contain any response that suggests the presence of hydrocarbons in the structures (Fig. 3.8). Extensive seismic data analysis have been performed to unravel any such response with negative results. This is very well in accordance with the observations in well 31/6-3 situated on the migration route from Troll East towards the Enka and Varfjellet prospects. Migration is therefore anticipated to be the main risk related to the prospectivity in this area.

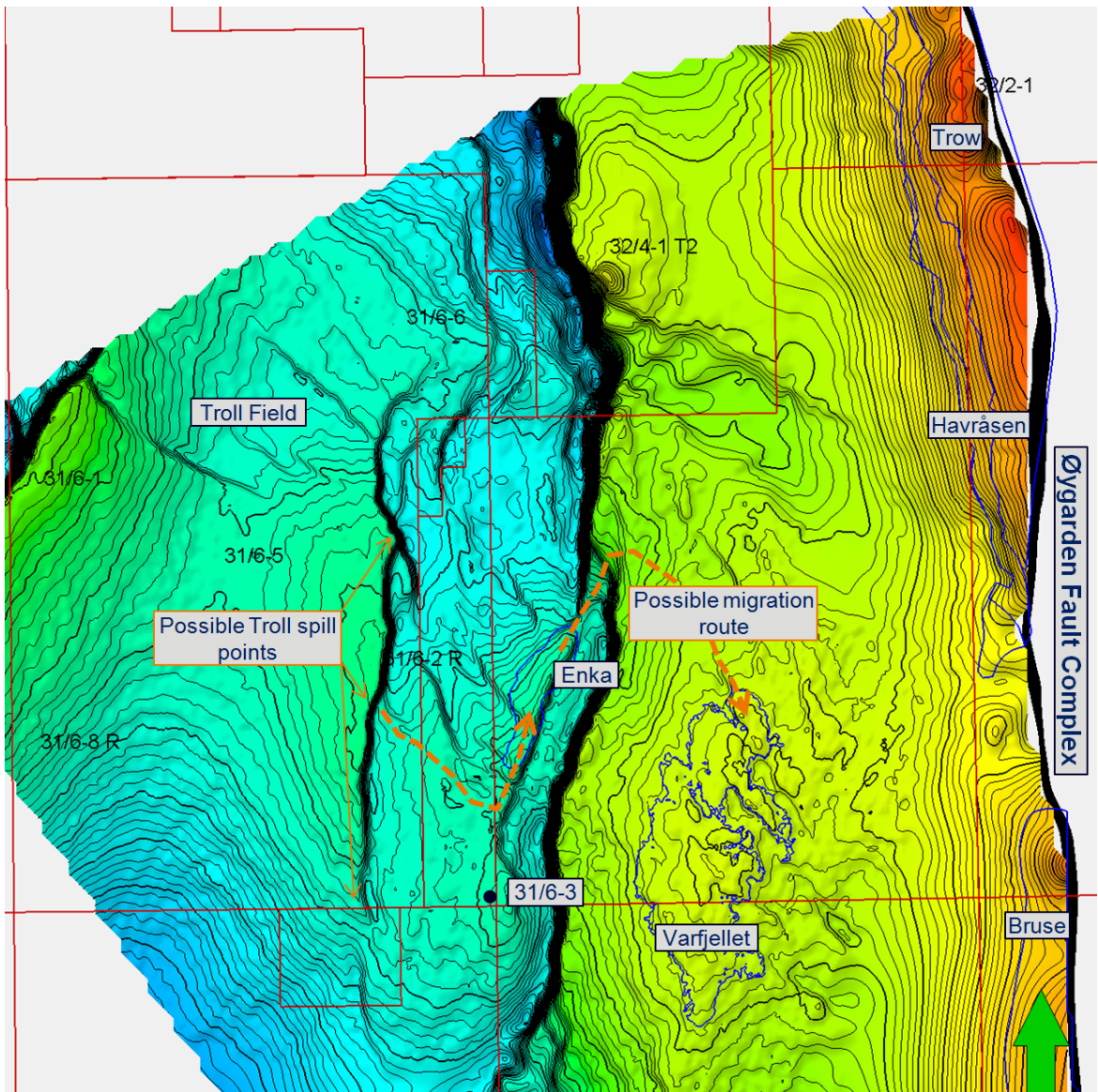


Fig. 3.7 Top Sognefjord depth-structure map. Contour interval is 10m. A possible hydrocarbon migration route from the Troll Field into the Enka and Varfjellet prospects is indicated by an orange dotted arrow.

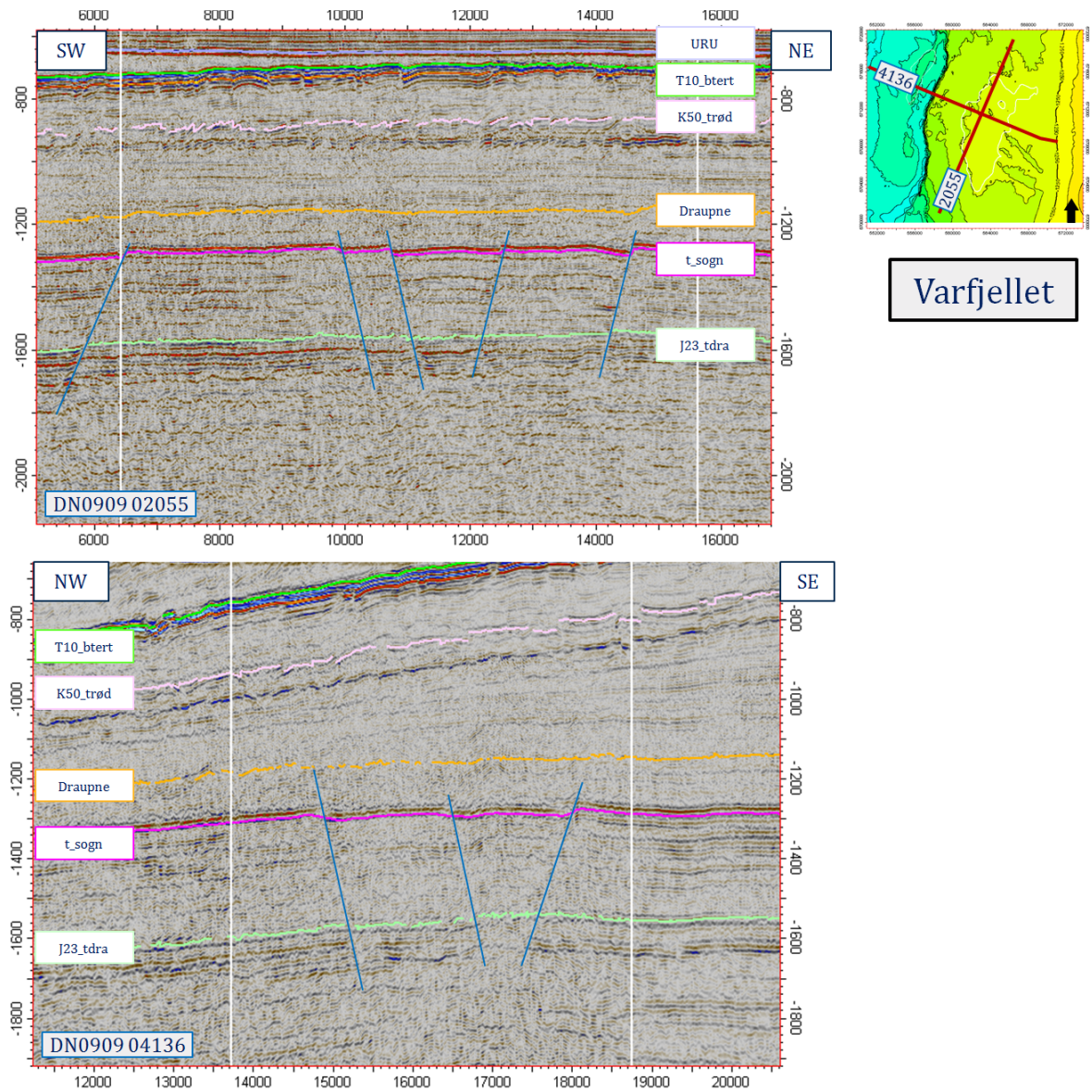


Fig. 3.8 Seismic sections over Varfjellet prospect.

Indications of hydrocarbons over neither the Varfjellet nor Enka prospects have been observed in the seismic data. And as the structure tested by the dry well 31/6-3 appears to be situated on the migration route, migration is the major risk in the prospect area.

4 CONCLUSIONS AND REMAINING PROSPECTIVITY

Both the Varfjellet and Enka prospects are well defined with a very low risk on the presence of good reservoir. The main uncertainty is related to hydrocarbon migration into the structures from the west as the area itself does not have a mature local kitchen. All results so far in our analysis support this conclusion which is further strengthened by the lack of hydrocarbons encountered in well 31/6-3 which was placed in an optimal position for such a migration.

Two leads have been identified in the license area (Fig. 2.1), but are both still very immature. The Havråsen lead is an Early Jurassic stratigraphic pinch-out that is located below the Trow prospect and has not been tested by the 32/2-1 well. A Late Jurassic lead, Bruse, is only partly located in the license area. Further seismic interpretation and understanding of the area would be required in order to mature these leads into prospects.

Based on what has been presented here, the partners in PL369 cannot support a drilling decision and hereby relinquish PL369 to the authorities.