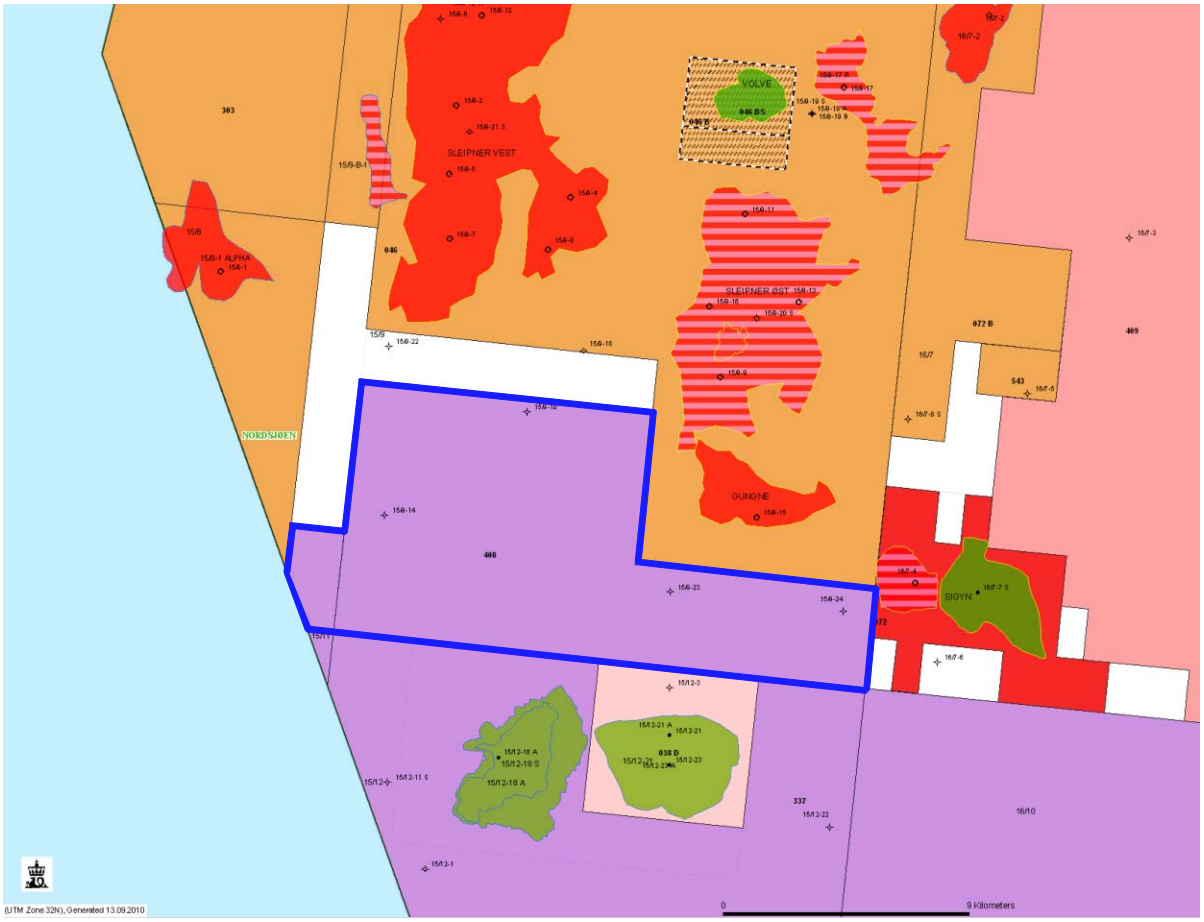
Relinquishment Report

PL 408



DETNORSKE

30. September 2010

1 INTRODUCTION

1.1 License owners

The license was originally awarded to:

Pertra ASA (Det norske oljeselskap ASA) (70% and operator)

Altinex Oil AS (Norwegian Energy Company AS) (partner and 30%)

The present license owner after 16.02.2009 are:

Det norske oljeselskap ASA (100%)

1.2 Award and work program

The license PL 408 was awarded 16.02.2007 for an initial period of 2+2+1 years following APA 2006. The license area included parts of the Blocks 15/8 and 15/9 (Fig. 1.1).

Work obligations included:

- By 16.02.2009: Reprocessing of 3D seismic within license area and decide on DoD
- By 16.02.2011: Drill 1 exploration well and decide on DoC (BoV)

The reprocessed 3D seismic is named PR07M01, and is available as near-, far- and full offset cubes as well as 5 angle stack cubes. In addition, the reprocessed seismic was used to generate seismic inversion products like Acoustic Impedance (Ip), Shear Impedance (Is), Poissions Ratio (PR), RhoLambda, RhoMu and Vp/Vs cubes.

The highest ranked prospect in the license, Skardkollen, was drilled and completed 03.01.2010 by well 15/9-23. This commitment well was dry. A second non-commitment well on the Paleocene Storkinn-prospect was completed 10.06.2010. Both wells were dry, and was drilled with the semi-submersible rig 'Bredford Dolphin'.

After the two dry wells on the Skardkollen and Storkinn prospects, there are no commercial basis for applying for DoC (BoV), and Det norske will surrender the total license acreage, effective from 01.01.2011.

1.3 License meetings

Combined Management Committee and Exploration Committee meetings have been arranged 06.03.2007, 19.11.2007, 21.08.2008 and 17.12.2008.

An Exploration Committee meetings were arranged 23.10.2008.

After Noreco's transfer of their 30% participation share to Det norske 13.02.2009, the only remaining partner with 100% participation interest, no license meetings have been arranged.

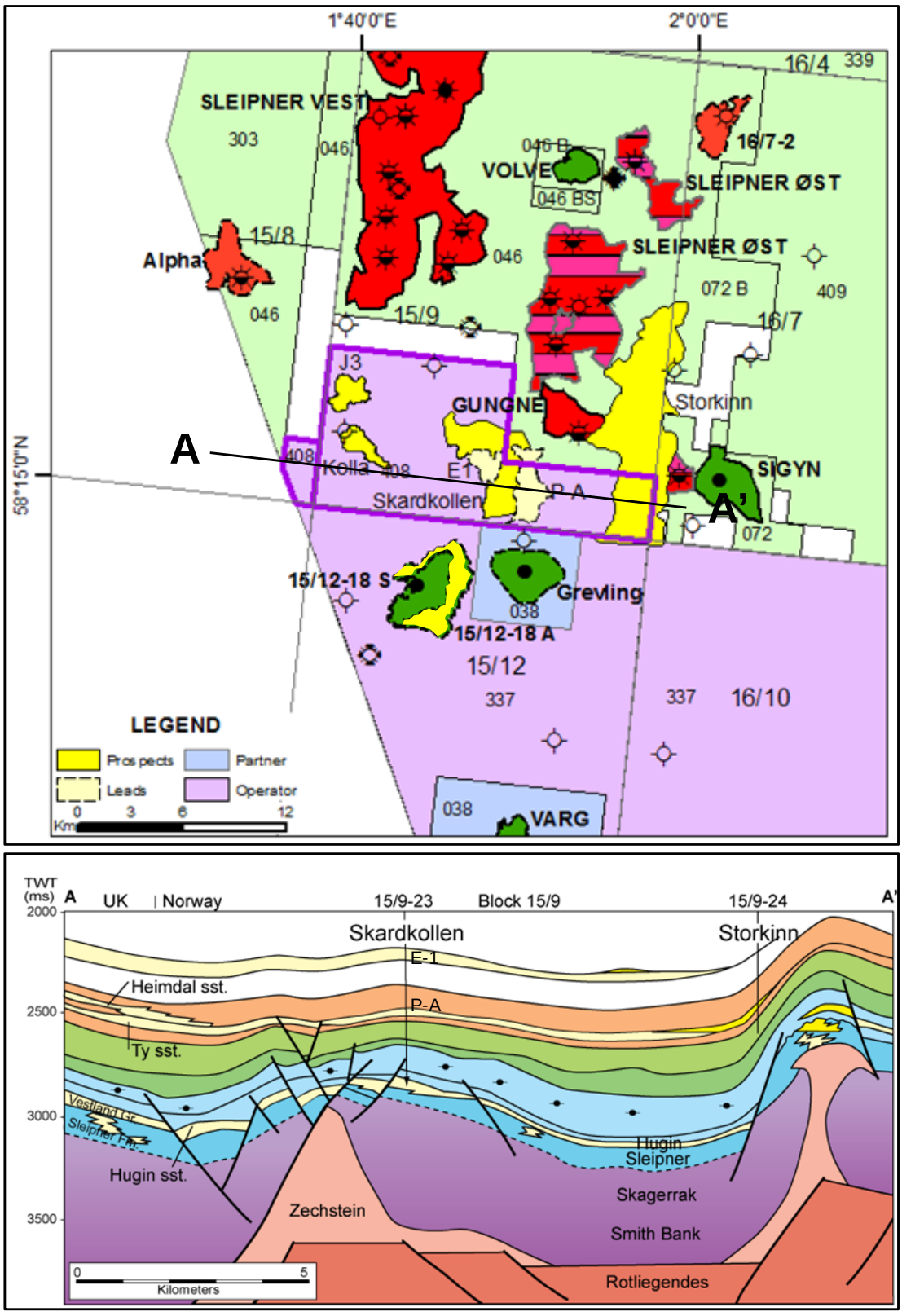


Figure 1.1 The location map of PL 408 with predrill prospects and intersection illustrating the main prospects

1.4 Pre-drill prospectivity

The mapped prospects in the license were all based on the established Paleocene, Middle Jurassic and Triassic play models of the area. The license acreage is structurally complicated, and characterized by collapsed salt-ridges in between Triassic pods, becoming structural highs where grounded on the lower Permian Rotliegendes. The structural highs appear to have been eroded in Early Upper Jurassic, leaving little or no preservation of the main reservoir unit, the Hugin Formation, which is well developed with high thicknesses further north at the Sleipner West Field.

The main prospect, the Middle Jurassic-Triassic Skardkollen Base Case model was defined by a 3-way closure with fault seal to the east, and with a significant stratigraphical upside. Top- and base seal was Heather-/Draupne shales and Triassic mudstones, respectively. Main risk was associated with source-migration and reservoir development. Secondary and tertiary targets were the Ty- and Frigg Formations, named P-A and E-1.

The Paleocene Storkinn prospect was purely a stratigraphical trap within the Ty Formation, constituting a potentially prospective pinch-out of the Sleipner East Field producing reservoir unit. Top- and base seal was Lista shales and Cretaceous chalk, respectively. Main risk here was regarded to be reservoir presence and quality.

The other prospects named Kolla and J3 within the license are smaller 4-way closures, partly drilled, with absent Hugin Formation and poor reservoir potential within the Middle Jurassic Sleipner Formation.

PL 408					**GROSS RECOVERABLE RESERVES / RESOURCES**					
					Low		Base		High	
CATEGORY	**RESERVOIR LEVEL**	**HC**	**RF (%)**	**POS[5] (%)**	**Oil (MSm^3)**	**Gas (GSm^3)**	**Oil (MSm^3)**	**Gas (GSm^3)**	**Oil (MSm^3)**	**Gas (GSm^3)**
PROSPECTS										
Skardkollen[1]	Hugin/Sleipner/Tr.	oil	27,5	42	2,9		4,4		6,0	
Skardkollen strat.[2]	Hugin (50m gross)	oil	38	21	14,9		28,0		43,2	
J3	Sleipner	oil	35	21	0,7		1,0		1,2	
Kolla	Sleipner	oil	35	23	0,6		0,8		1,1	
Storkinn[3]	Paleocene	gas	70	39		39.3		45.2		51.3
P-A[4]	Paleocene	gas	70	16		1,2		1,2		1,2
E-1	Frigg	gas	70	17		0,6		0,8		1,1

1) 92% inside PL 408, 2) 83% inside PL 408, 3) 22% inside PL 408, 4) 88% inside PL 408, 5) Pre-Grevling Risking

Table 1.1 Pre-drill Prospect Summary with recoverable reserves and POS (probability of success)

2 DATABASE

2.1 Seismic database

The coverage of the seismic 3D data in the database is shown in Fig. 2.1. The reprocessed 3D seismic survey PR07M01 covers the entire license within southern parts of the Blocks 15/8 and 15/9. As mentioned, the survey contains near-, far-, full offset cubes and 5 angle stack cubes. In addition, the reprocessed seismic was used to generate seismic inversion products like Acoustic Impedance (Ip), Shear Impedance (Is), Poissions Ratio (PR), RhoLambda, RhoMu and Vp/Vs cubes.

An extended site-survey was acquired early June 2009 across the Skardkollen and Storkinn well locations, the latter in south-eastern part of PL 408.

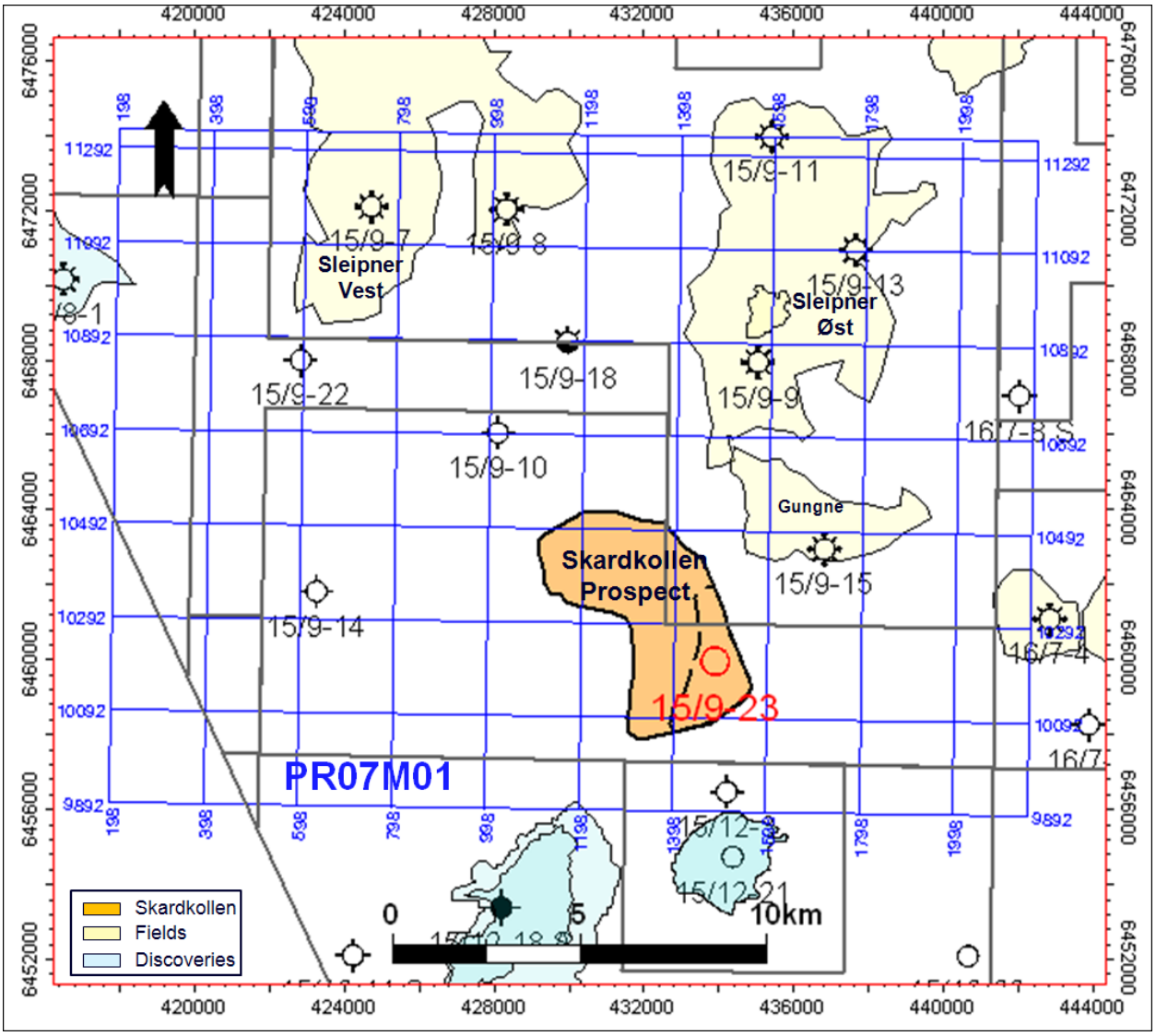


Fig. 2.1 Seismic data coverage PL 408 and the surrounding area

A list of seismic surveys in the common data base is given in Table 2.1.

Survey name	Survey type	Survey status	Seismic class
PR07M01	3D	License	Final mig.
DN0903*	2D	License	Final mig.

Table 2.1 Seismic surveys in common database (*Site Survey)

2.2 Well database

The Fig. 2.2 shows the wells in the license area. All key wells with Paleocene, Middle Jurassic- and Triassic sandstones in the area are included.

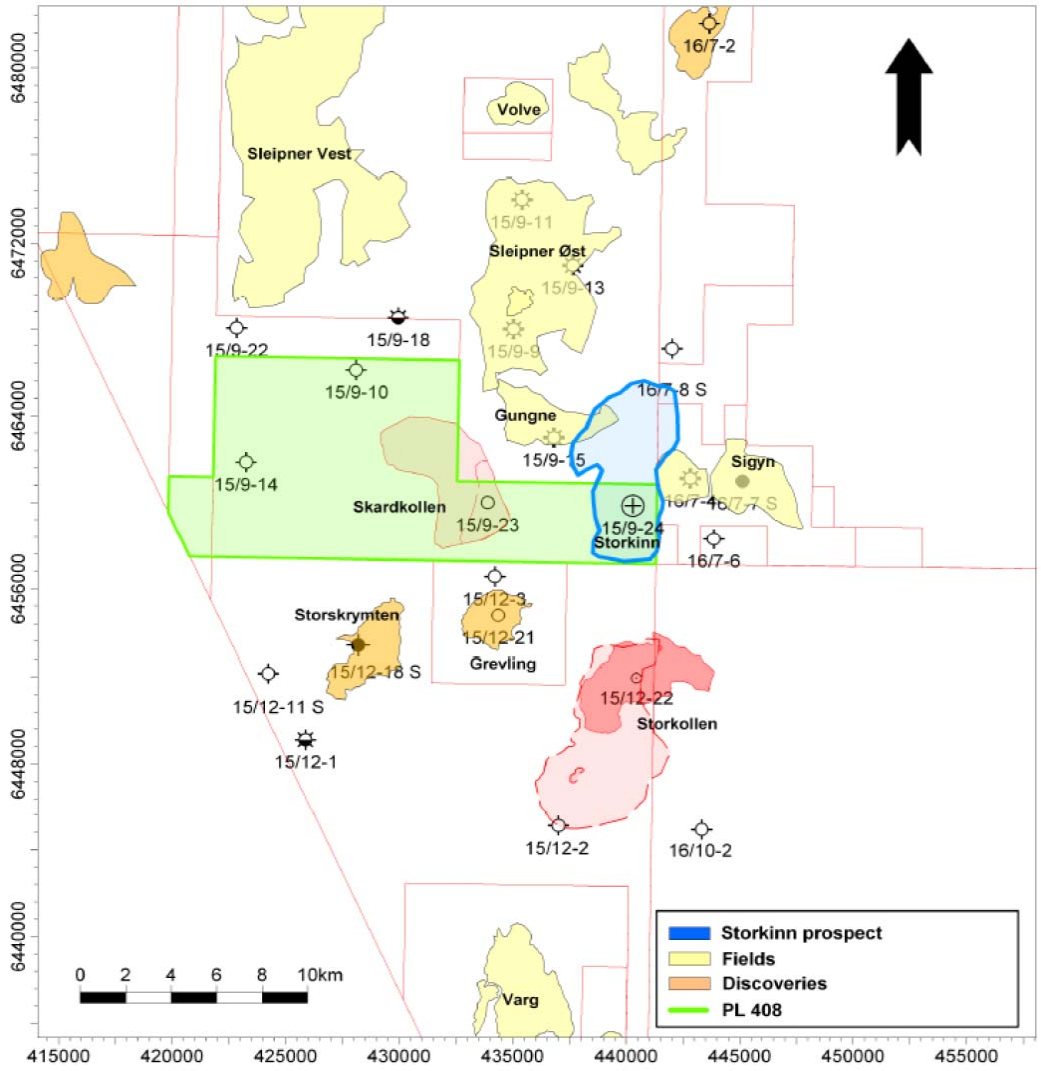


Figure 2.2 Well data base PL 408 (Skardkollen commitment- and Storkinn wells)

The list of wells in the common database is presented in Tables 2.2 and 2.3.

Well	Year drilled	Water depth (m)	TD (MD m RT) / Fm	Final well report available	Composite.las avaiable
15/9-10	1981	98	3288/Smith Bank	Y	Y
15/9-14	1982	101	3563/Smith Bank	Y	Y
15/9-15	1982	83	3200/Smith Bank	Y	Y
15/9-18	1984	97	3622/Triassic	Y	Y
15/12-3	1980	86	4450/Rotliegend Gp.	Y	Y
15/12-18 S & A	2007	90	3520/Permian	Y	Y
15/12-21	2009	86	3311/Late Triassic	N	
16/7-4	1982	78	2781/Triassic	Y	Y

Table 2.2 Wells in common database PL 408 (Skardkollen commitment-well)

Well	Year drilled	Water depth (m)	Total depth mMD RT/Fm	Final Well Report	Composite data (.las)
15/9-9	1981	83	3044 / Early Permian	Y	Y
15/9-13	1982	81	3282 / Early Permian	Y	Y
15/9-15	1982	83	3200 / Smith Bank	Y	Y
15/9-23	2009	84.5	3225 / Skagerrak	N/A	Y
15/12-3	1980	86	4450 / Rotliegend	Y	Y
15/12-18 S & 18 A	2007	90	3520 / Permian	Y	Y
15/12-21	2009	86	3311 / Skagerrak	N/A	Y
16/7-4	1982	78	2781 / Triassic	Y	Y
16/7-6	1997	78	2725 /Skagerrak	Y	Y
16/7-7 S	1997	78	2994 /Skagerrak	Y	Y
16/7-8 S	2003	80	2900 /Skagerrak	Y	Y

Table 2.3 Wells in common database PL 408 (Storkinn-well)

2.3 Special studies

Several studies have been performed:

Petrophysical re-evaluation (Det norske 2008-2009)

Biostratigraphic-chronostratigraphic-paleogeographical correlations Jurassic & Tertiary (Det norske 2008-2009)

Sedimentological core description of Gungne well 15/9-15 (AGR 2009)

Basin Modeling (Exploro 2008-2009)

Reprosessering (CGG Veritas/PSS Geo 2007-2008)

Merging av 3D seismic (PSS Geo 2008)

Inversjon - Relativ AI og Simultaneous Elastic (CGG Veritas 2008)

Forward modeling (Det norske 2007 - 2009)

Fluid substitutions (Det norske 2007 - 2008)

Rock Physics volumes (Det norske /Envison 2008 - 2009)

- Fluid modeling
- Lithological classifications

AVA (angle variable analysis) (Det norske 2009)

3 SKARDKOLLEN EXPLORATION WELL 15/9-23

3.1 Predrill prospect evaluation

The Skardkollen prospect was defined by a 3-way closure with fault seal to the east, and with a significant stratigraphical upside (Fig. 3.1). The latter with prognosed Hugin-sandstones onlapping base seal of tight Triassic mudstones to the north. Well 15/9-23 was planned to be drilled near the apex of Skardkollen, and main reservoir targets was prognosed as the Middle Jurassic Hugin- and Sleipner Formations. Additional reservoir potential was expected in Late Triassic sandstones of the Skagerrak Formation. The Hugin Formation, constituting the best reservoir properties, is of shallow marine shoreface origin. Whereas Sleipner- and Skagerrak Formations are of continental, fluvial origin. Additional reservoir targets were the shallower Ty- and Frigg Formations of Paleocene and Eocene age, respectively.

Prior to making the nearby Grevling discovery, the main risk assessed on the Skardkollen 'twin-structure', prognosed to contain the same reservoir units, was associated with source-migration. The apex at Skardkollen top Hugin reservoir was mapped at 2940mMSL. With a closing contour of 3070m, a base case oil column of 130m was expected. The stratigraphical upside contained a gross oil column of 300m. An AVO-anomaly/DHI had been observed at the mapped top Heather-/Hugin Formation level in syn-rift collapsed areas, where the prognosed Hugin Formation was expected to thicken as early syn-rift onlap-fill. The AVO was prognosed to indicate either presence of porous/low velocity sandstones, possibly filled with hydrocarbons, or organic rich shales as found in the Draupne Formation of the area.

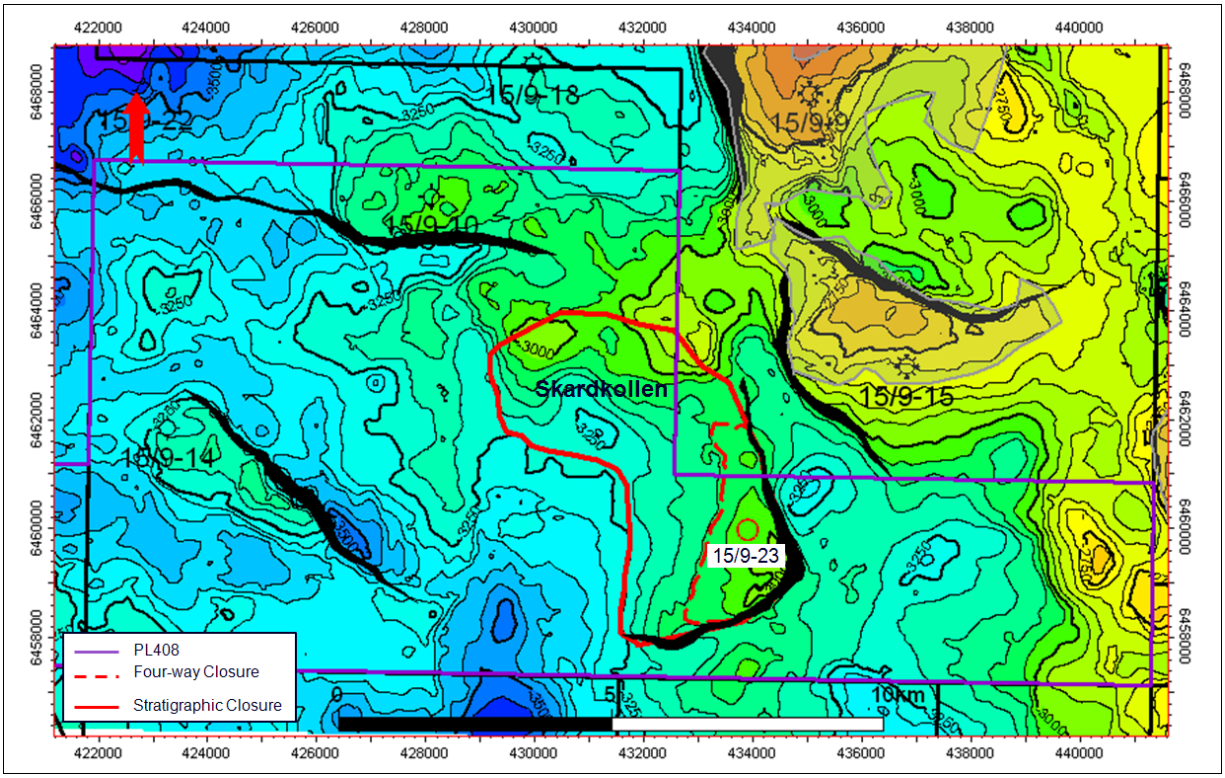


Figure 3.1 Skardkollen structure map at top Middle Jurassic reservoir

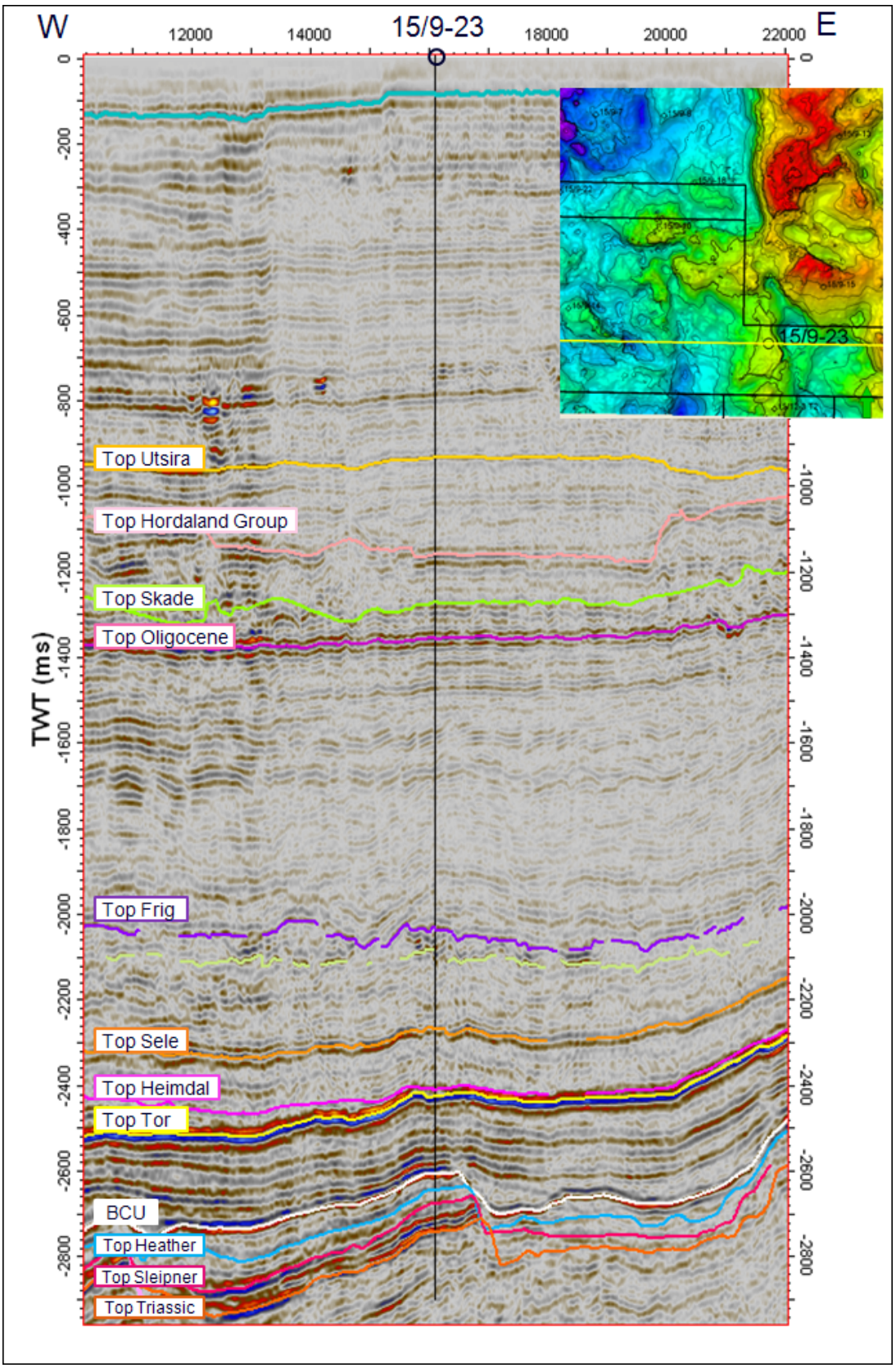


Figure 3.2 Seismic line crossing the Skardkollen prospect (all stratigraphical levels)

The Skardkollen prospect had 3-way a base case volume estimate of 4.4 MSm^3 recoverable oil. Low case was 2.9 MSm^3 and high case was 6.0 MSm^3. The probability of success was estimated to 42%. Source-migration and reservoir development was considered to be the main risks (Ptrap = 0.80, Preservoir = 0.72, Psource = 0.72).

3.2 Well 15/9-23 Skardkollen

3.2.1 Objectives

The main objective of well 15/9-23 was to prove hydrocarbons in Middle Jurassic and Late Triassic reservoir rocks. The well was located in a position not to leave commercial volumes up dip.

3.2.2 Well results

Reference for details is the Final Well Report (completed).

The prognosed Hugin Formation was absent, and the well penetrated Sleipner- and Skagerrak Formations with lithofacies poorer than expected. The Vestland Group primary target was penetrated at 3087.5 mMD.RKB (3062.3 mTVD.MSL), which was 45.5m deeper than anticipated. The well was TD'd 56m into the Triassic Skagerrak Formation at a depth of 3225 mMD.RKB (3199.7 mTVD.MSL). The well was dry, with no hydrocarbon shows identified. Additionally, higher overpressures than prognosed was proven, possibly explaining lacking migration due to stratigraphical and/or structural compartmentalization (Fig. 3.2).

The DHI mentioned in chapter 3.1 turned out to be caused by Lower Draupne Formation organic rich shales, one of the scenarios mentioned pre-drill. Hence, the Top Heather-/Hugin Formations had been mapped one sequence too shallow, explaining the 45.5m deep incoming of the Vestland Group (Fig. 3.4).

The Paleocene Ty Formation secondary target in the lowermost Rogaland Group (P-A prospect) proved excellent water bearing sandstones with a gross thickness of 24m. Pore pressure measurements proved 105 bar depletion relative to normal hydrostatic, which most likely is related to nearly two decades of production from the same stratigraphical unit at Sleipner East (Fig. 3.3). The depletion proves laterally continuous sandstones semi-regionally at lower Paleocene level in the area.

The Eocene Frigg Formation (E-1 prospect), the shallowest target, was also proved to be water bearing.

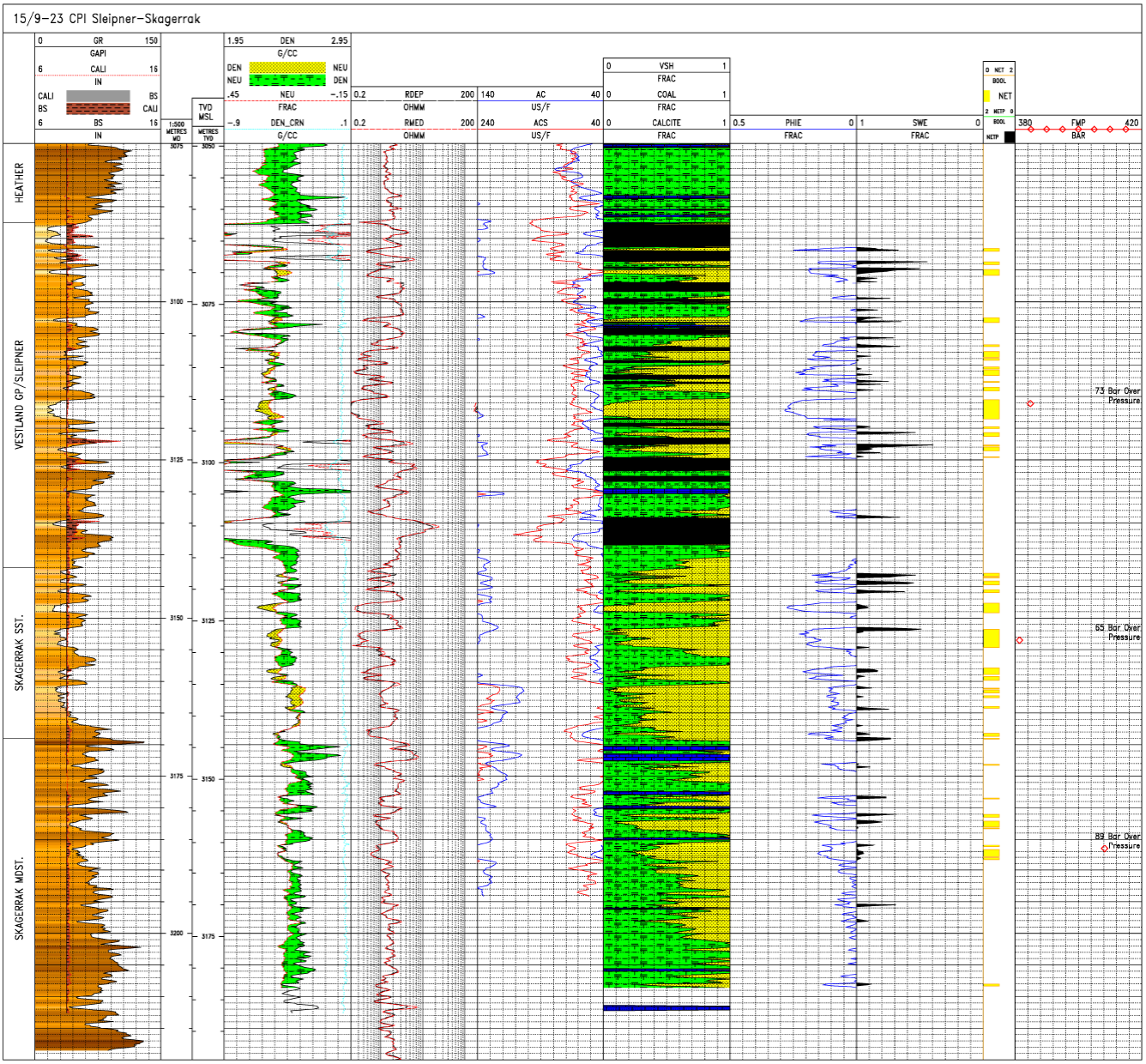


Figure 3.2 Well 15/9-23 Jurassic-Triassic primary reservoir section - CPI-log

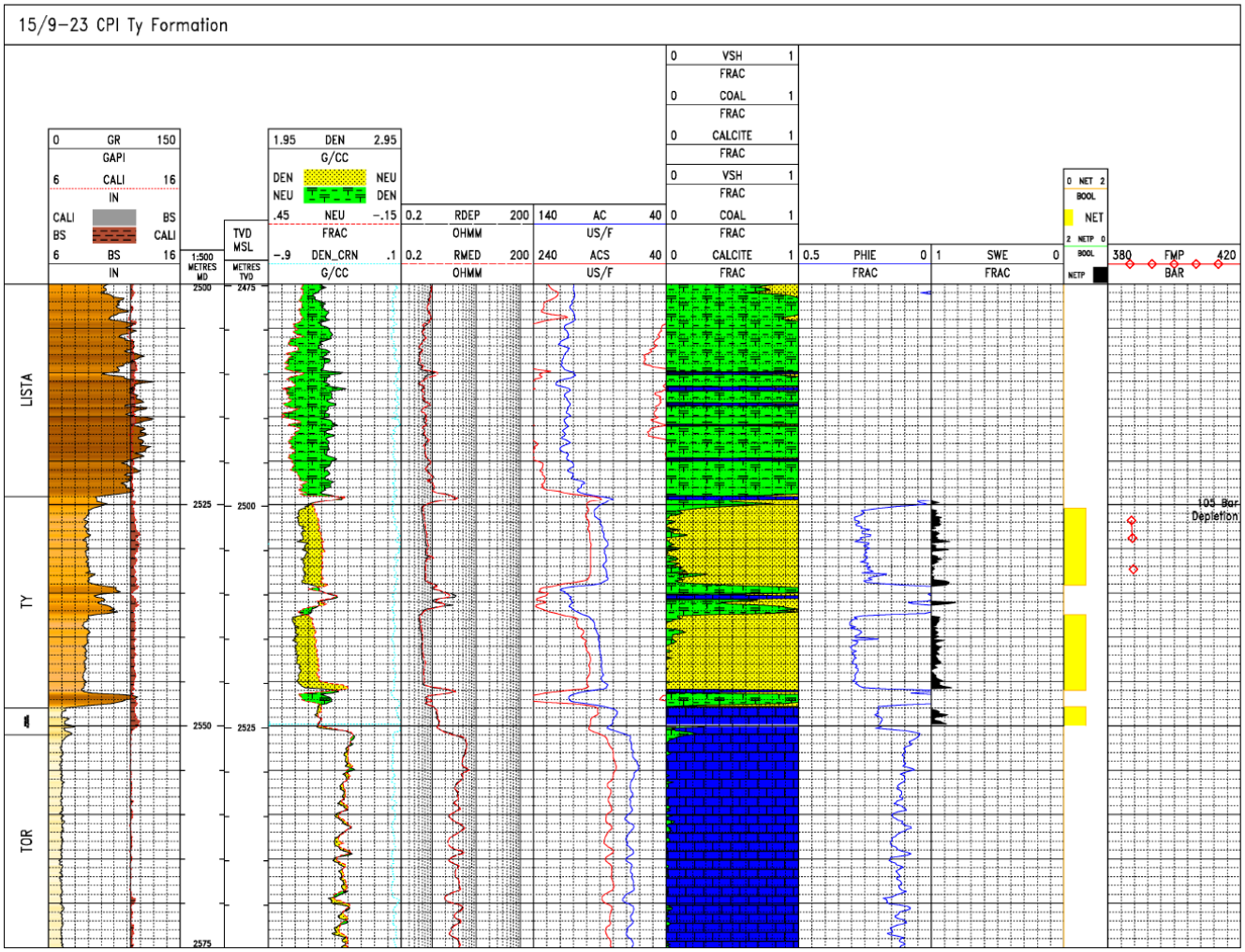


Figure 3.3 Well 15/9-23 Lower Paleocene secondary reservoir section - CPI-log

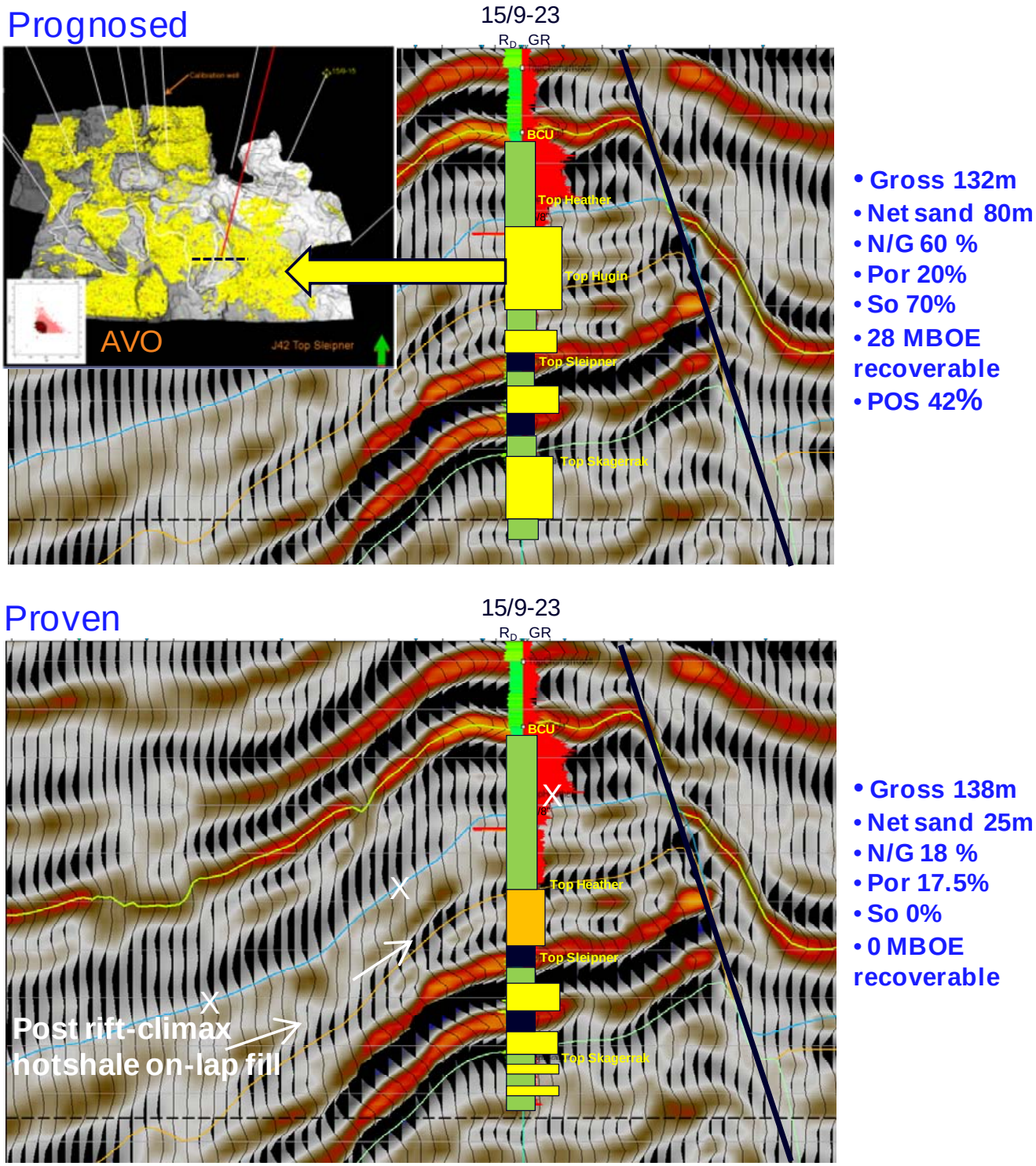


Figure 3.4 Well 15/9-23 Prognosed vs. Actual lithology on W-E seismic section through Jurassic-Triassic

4 STORKINN EXPLORATION WELL 15/9-24

4.1 Predrill prospect evaluation

The Storkinn prospect is located in the south-eastern corner of Block 15/9. It was defined by a combined structural/stratigraphical trap in the Heimdal-/Ty Formations, south-east and updip of the Sleipner East Field (Fig. 4.1). A modest Paleocene isopach anomaly exists in the area of the prospect, which could consist of submarine fan lobes representing the distal parts of the Ty Formation depositional system of Sleipner East, as seen in the previous Skardkollen well 15/9-23.

Main risk for Storkinn was related to adequate presence and quality of sand. Secondly, trap and seal was another obvious risk element for this stratigraphical pinch-out prospect. The apex at Storkinn represented by top Heimdal/Ty reservoir was mapped at 2190mMSL. With a closing contour of 2417m, a total base case oil column of 227m was expected.

A subtle increased amplitude/DHI within the thin Heimdal/Ty-interval could be observed at a depth corresponding to the gas-water contact at Sleipner East, which subsequently defined the base case contact at Storkinn of 2417 mTVD.SS.

The Storkinn strat-trap prospect had its Base Case volumes reduced after the detection of 105 bar pressure depletion, hence changed PVT input, at the same stratigraphical level as Skardkollen to the west (cf. Table 1.1). The latest Base Case volume without gas recycling/re-injection was estimated to 13.0 MSm^3 o.e. recoverable, mainly gas, of which now 27% would be located within PL 408. Correspondingly, gross volumes for low case was 9.2 MSm^3 and high case was 17.4 MSm^3. The probability of success was unchanged at 39%. Reservoir development/ quality and lateral seal was considered to be the main risks (Ptrap = 0.72, Preservoir = 0.63, Psource = 0.86).

4.2 Well 15/9-23 Storkinn

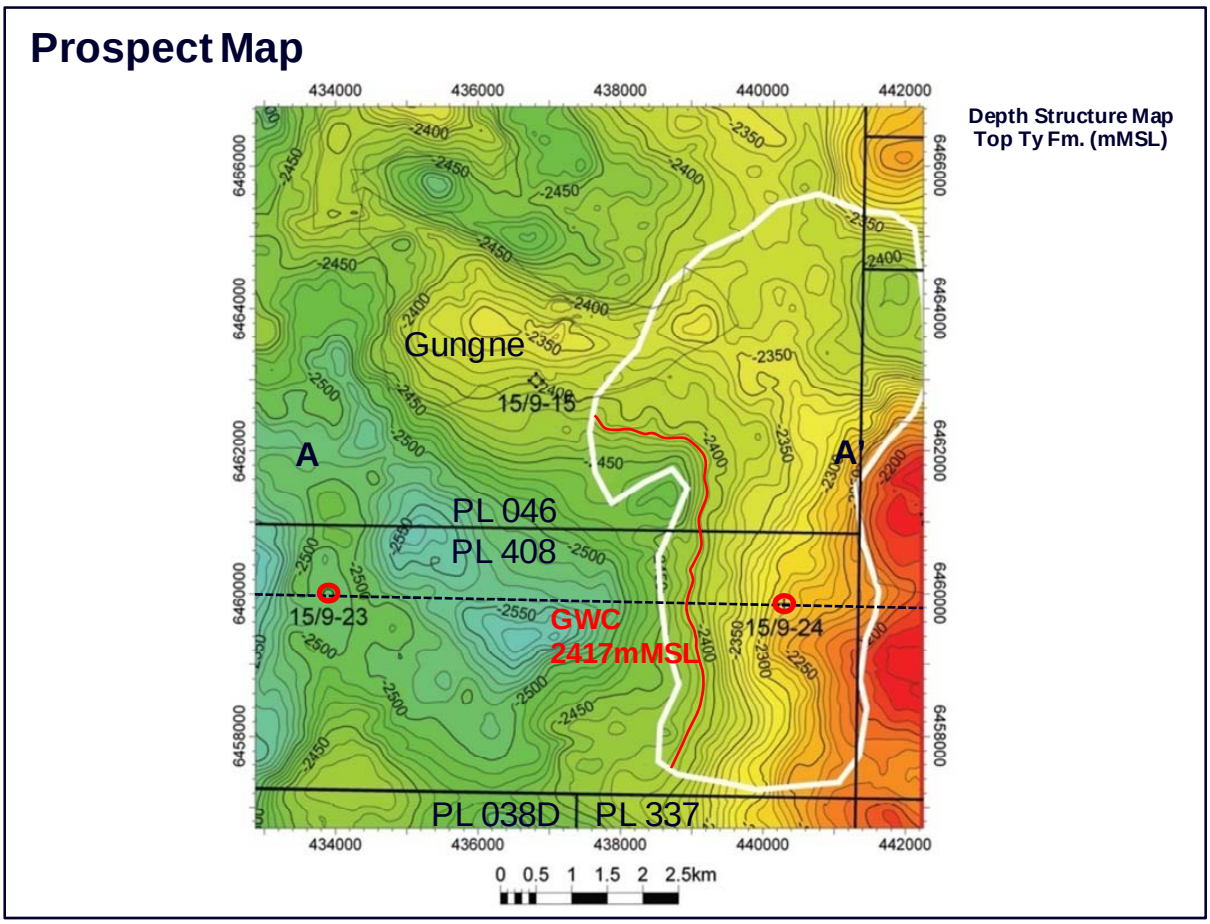
4.2.1 Objectives

The main objective of well 15/9-24 was to prove hydrocarbons in the Lower Paleocene Heimdal-/Ty Formations reservoir rocks. The well was located in a position not to leave commercial volumes up dip.

4.2.2 Well results

Reference for details is the Final Well Report (in preparation).

The prognosed Heimdal-/Ty Formation was absent, and the well was TD'd 77m into the Shetland Group at a depth of 2400 mMD.RKB (2374.7 mTVD.MSL). No hydrocarbon shows were indentified from cuttings nor drill-gas (Fig. 4.2).



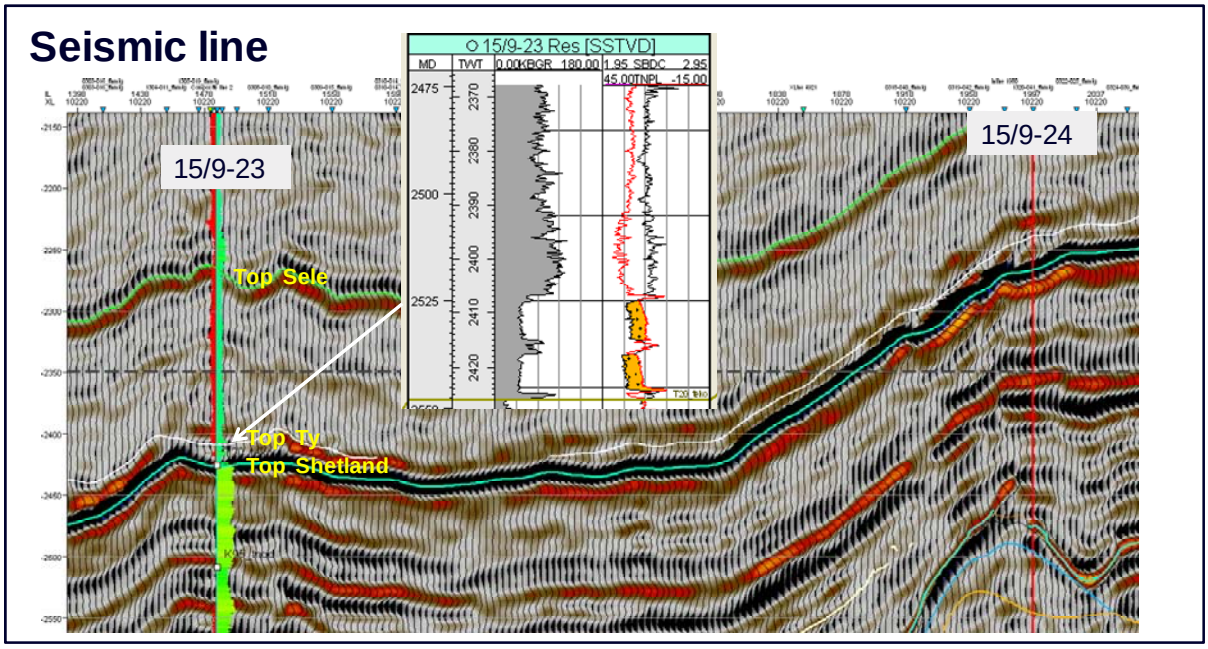


Figure 4.1 Storkinn structure map at top Ty reservoir and seismic line W-E

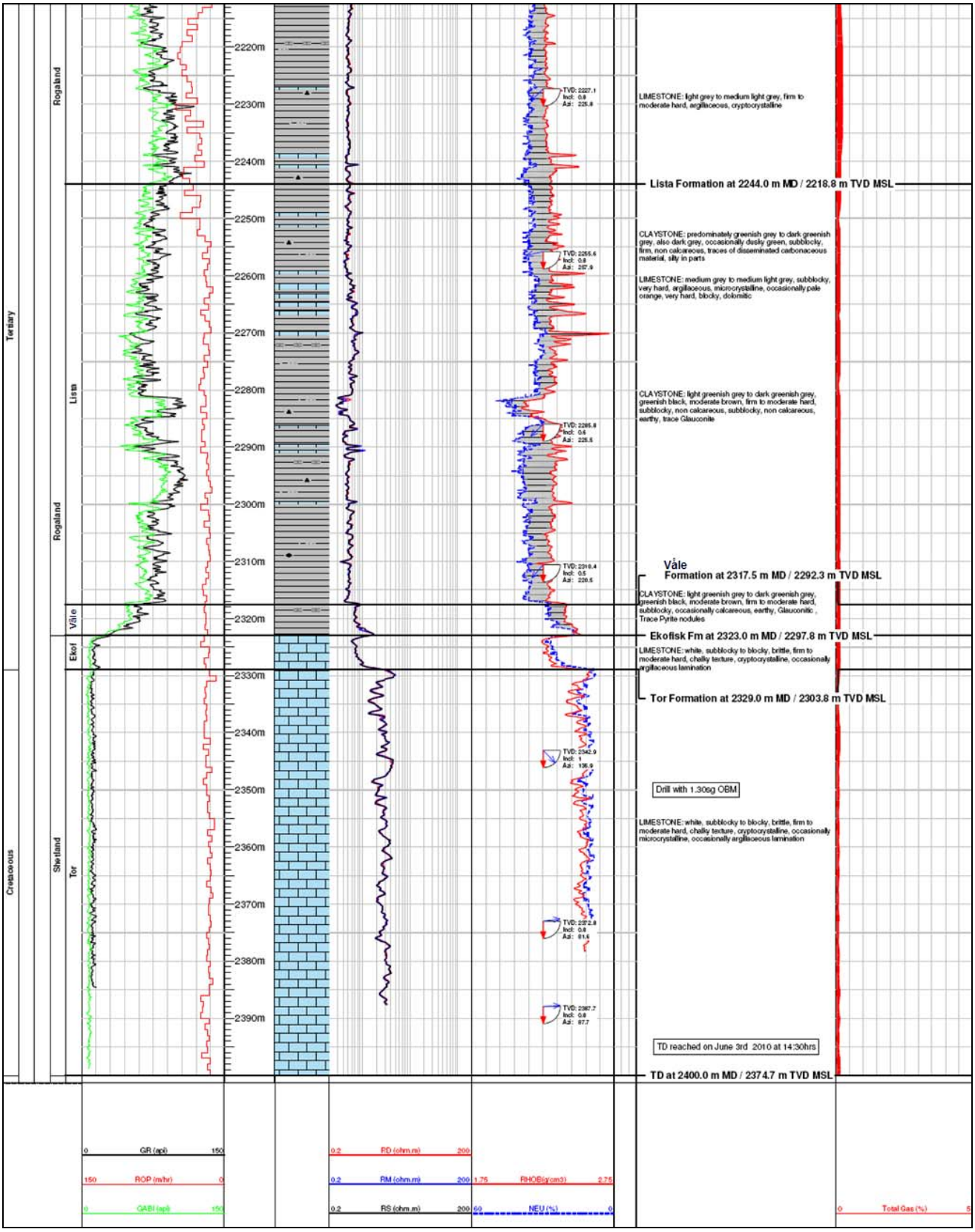


Figure 4.2 Storkinn well 15/9-24 TD-section from Composite Log

5 REMAINING PROSPECTIVITY

After the drilling of the Skardkollen well 15/9-23, showing close stratigraphical affinities to the wells 15/9-10 and 15/9-14, it seems evident that the shallow marine Hugin Formation is absent across most of PL 408. The acreage, constituting a local high on the northern side of the Ling depression, appears to have limited to no accomodationspace for this Callovian unit, compared with in particular the Sleipner West terrace. This is also indicated by a relatively thin and coal rich Sleipner Formation. The remaining prospects J3 and Kolla are small closures with sub-commercial volumes (Fig. 5.1 and Table 5.1).

Although excellent Ty-sand was penetrated in lowermost Paleocene in the Skardkollen well 15/9-23, the lateral equivalent at the Storkinn stratigraphical prospect in well 15/9-24 contained claystones. Consequently, no other mapped Paleocene prospects remains within PL 408.

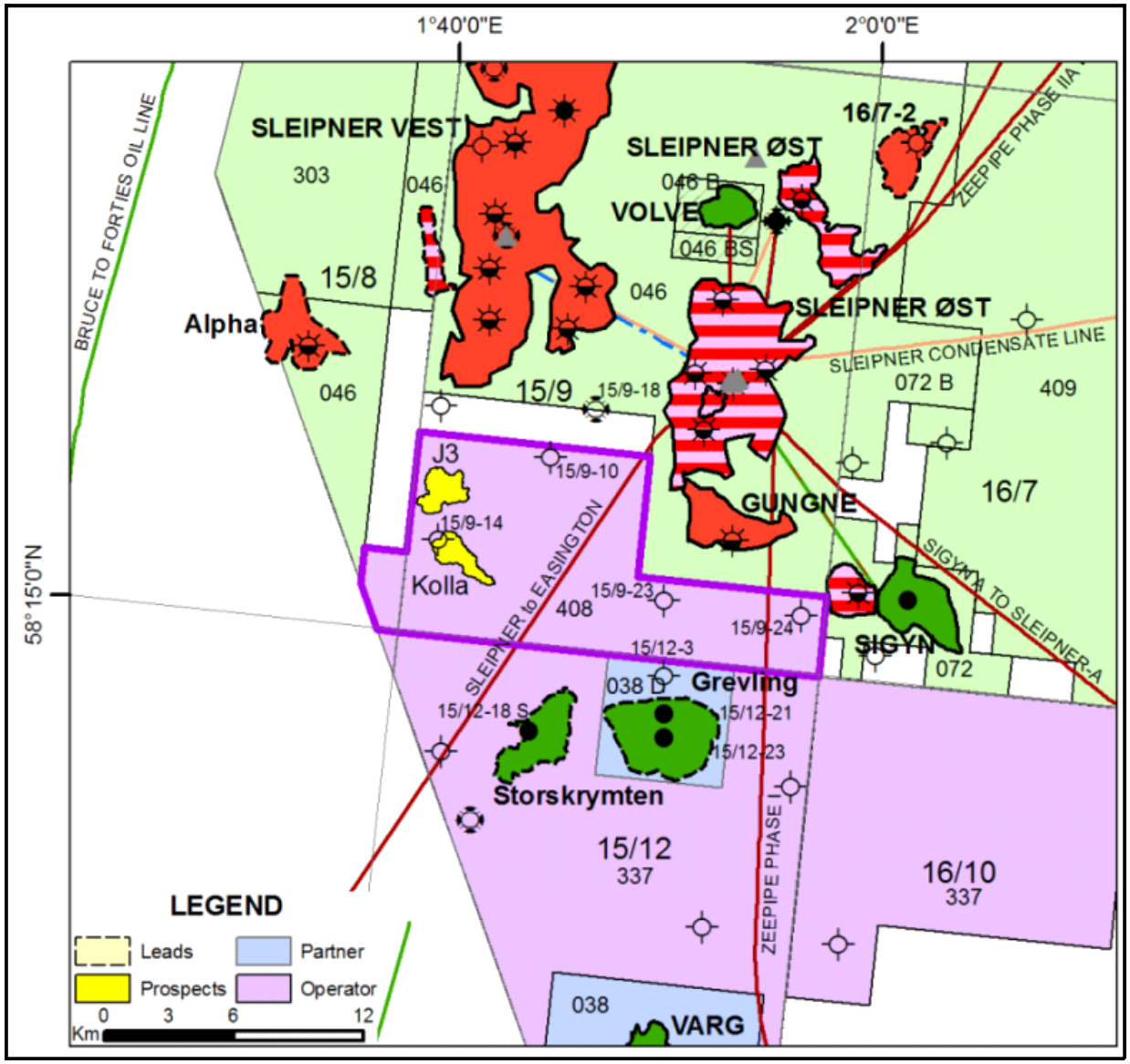


Figure 5.1 PL 408 Remaining prospects

PL 408					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										
J3	Sleipner	oil	35	21	0,7		1,0		1,2	
Kolla	Sleipner	oil	35	23	0,6		0,8		1,1	

Table 5.1 PL 408 Remaining prospects with recoverable reserves and POS

Due to limited potential and sub-commercial volumes, the entire PL 408 acreage are relinquished by Det norske oljeselskap ASA, the only remaining participant. The surrender is effective from 01.01.2011.