Relinquishment Report PL356

Document last updated 13-03-2013 10:39 CET

Relinquishment Report PL356

List of figures

List of tables

1 INTRODUCTION

1.1 License owners

Det norske oljeselskap ASA (50 %)
Repsol Exploration Norge AS (40 %)
Petrolia Norway AS (10 %)

1.2 Award and work program

The license was awarded on the 6th January 2006 for an initial period of 6 years following APA Licensing Round 2005 and applies to all formations. The initial period was later extended to 7 years. Work obligations include:

- Aquire 3D seismic within 3 years
- Drill or Drop decision within 3 years, was made December 2008
- Prepare a BOV within 3+1 yars, extended to 2013
- Prepare a plan for development within 1 years

The main prospect, Ulvetanna (Fig. 1.1 and Fig. 1.2), was drilled in august 2012. The well was plugged & abandoned as a dry well.

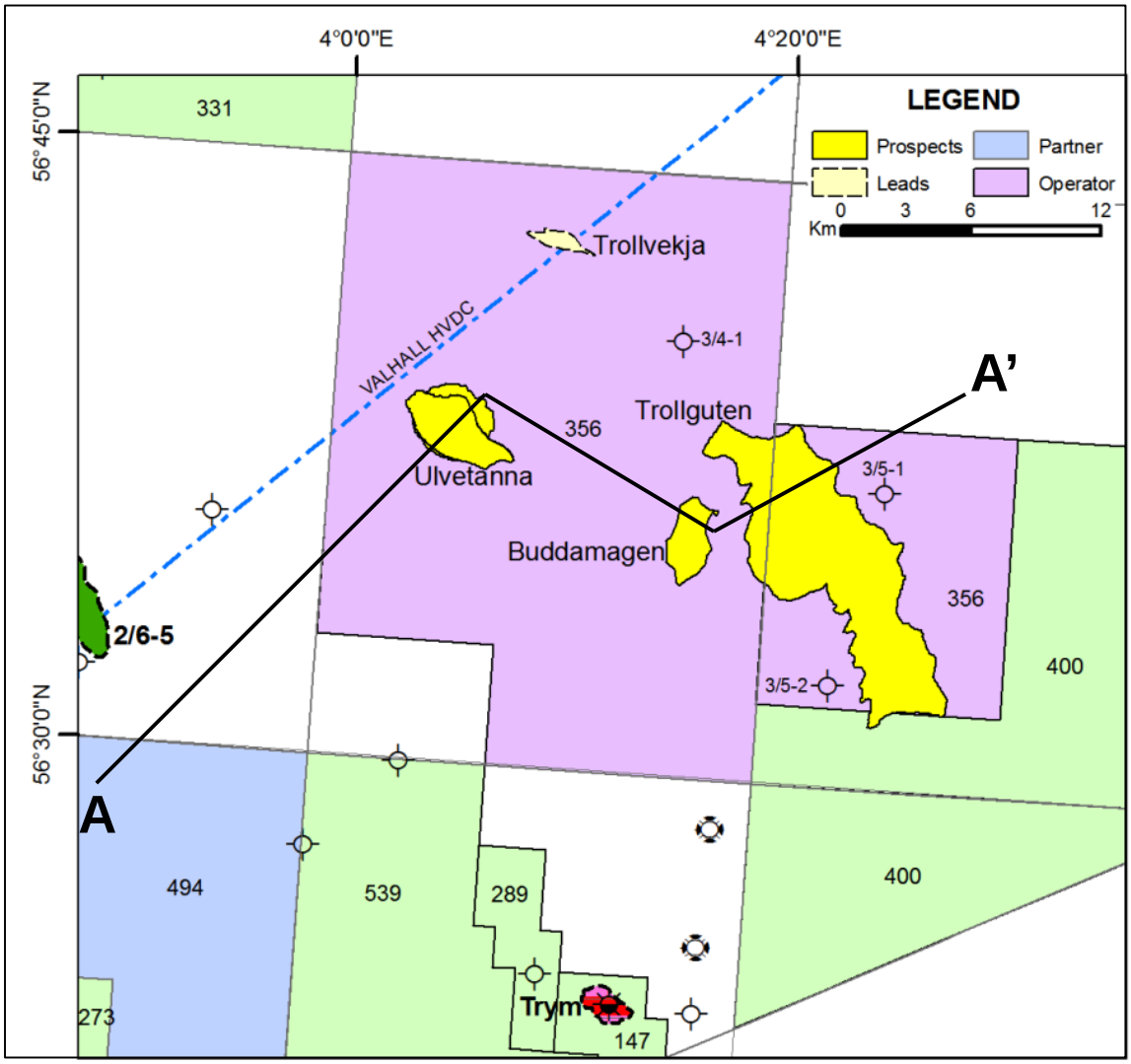

Fig. 1.1 PL356 licence area with position of geoseismic section indicated

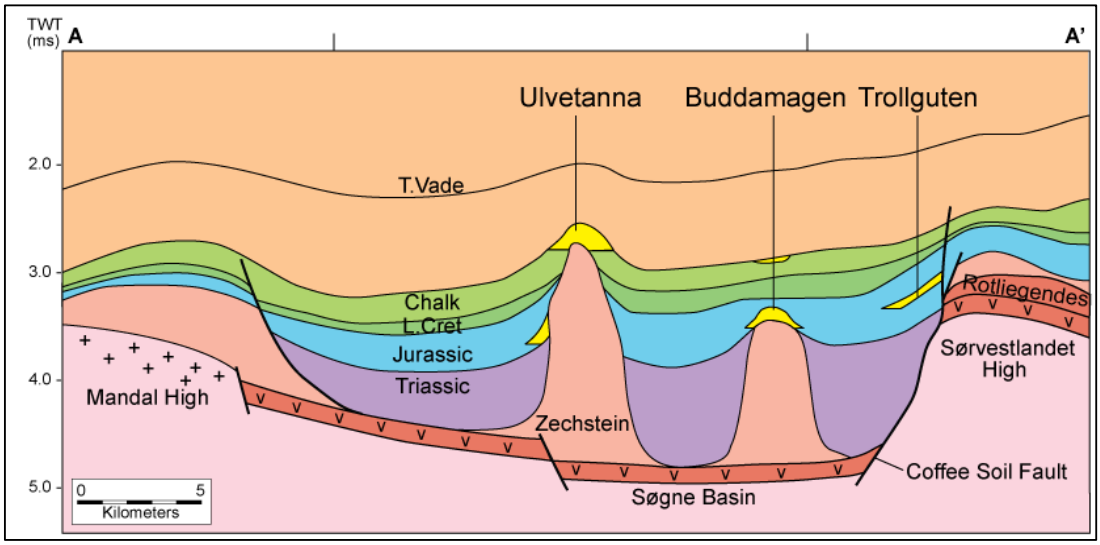

Fig. 1.2 Geoseismic section across the Søgne Basin with the Ulvetanna and Buddamagen structures

1.3 PL356 pre-drill prospectivity

As part of the 2005 APA license application, a number of prospects and leads were identified within the proposed license area. The main play model for the prospects are the NKU-3 Tor Formation, the NJL JM-4 Bryne Formation and the NJU 3 Eldfisk Formation, all proven in fields in the Central Graben or in the Danish Tail End Graben.

Reservoirs of Tor Formation have potentially high porosities and are present in almost all wells semiregionally. Reservoirs of Eldfisk Formation have good parametres and are especially found in vicinity to the Coffee Soil fault. Analogues for Bryne Fm reservoirs are found to the south with fair parametres.

Structural traps for the main prospects in this license are salt induced anticlines and the stratigraphical traps are Eldfisk Formation turbiditic fans.

Migration from Mandal, Farsund and Bryne Formation shales and coals is believed to work in the main part of the Søgne Graben, and is believed to be mature in the depth window from 2900 m to 5700 m. The main uncertainty for prospects in PL356 is whether hydrocarbons have been generated and has migrated into the prospects.

A table showing the expected recoverable reserves for all of the prospects and leads prior to drilling the first well in the license, is presented below, in Table 1.1.

Table 1.1 Summary of estimated recoverable reserves

PL 356					**GROSS RECOVERABLE RESERVES / RESOURCES**					
					Low		Base		High	
CATEGORY	**RESERVOIR LEVEL**	**HC**	**RF (%)**	**POS (%)**	**Oil (MSm3)**	**Gas (GSm^3)**	**Oil (MSm^3)**	**Gas (GSm^3)**	**Oil (MSm^3)**	**Gas (GSm^3)**
PROSPECTS										
Ulvetanna	Chalk	oil	32	35	11		22		40	
	M.Jurassic	oil	40	25	4,9		7,6		11,0	
Buddamagen	Chalk	oil	25	30	2,2		3,3		4,8	
	M. Jurassic	oil	40	20	7,4		10,7		14,8	
Trollguten	U. Jurassic	oil	40	8	16,6		27,8		53,8	
LEAD										
Trollvekja	U.Jurassic	oil								

2 DATABASE

2.1 Seismic database

The seismic coverage of the license area is listed in Table 2.1 and shown in Fig. 2.1.

Table 2.1 Seismic database

Survey	Length /Area	Operator
DNO-0601	500 km2	DNO
SH9302 3D	540 km2	Shell
ST8716	761 km	Statoil
SH8709	320 km	Shell
ANO78-2	1598 km	Amoco
ANO-80-2	1209 km	Amoco
ANO-9204	156 km	Amoco
ST8630	307 km	Statoil
EL8180	1020 km	Elf
NS	594 km	
NDBRE96	137 km	TGS Nopec
NSR04	37 km	TGS Nopec
CGME96	198 km	TGS Nopec
G 4-4-91	639 km	Geco

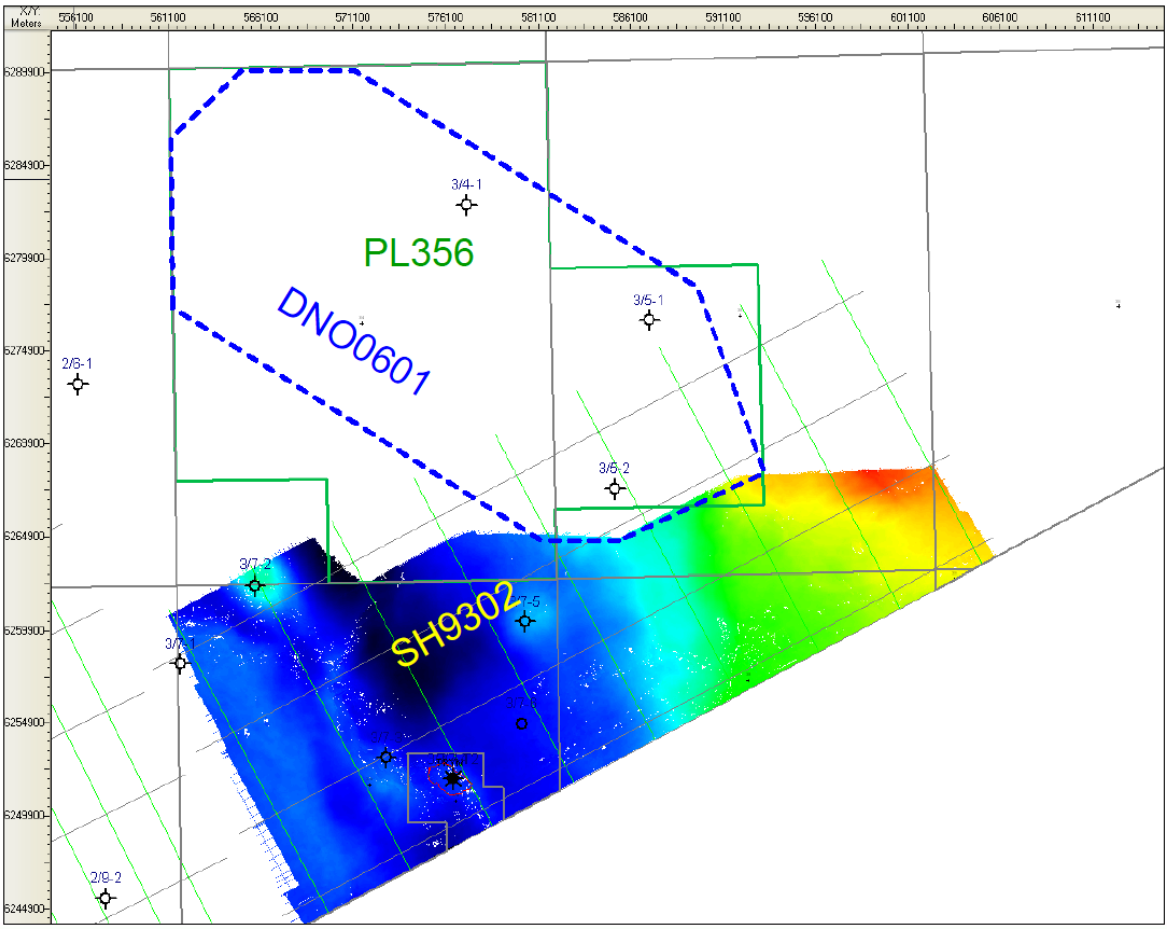

Fig. 2.1 3D Seismic coverage of license area

The 3D seismic dataset DNO-0601 has been aquired and is merged with SH9302 in the South. Additionally, open 2D seismic lines were added to the common database and were aligned to match the main survey. The DNO-0601 dataset provides good regional coverage, has offset data, and is of good quality.

2.2 Well data

Table 2.2 shows the wells in the common license database. The wells are also presented in Fig. 2.2 which includes information on hydrocarbon shows and reservoir information.

The closest tie well to 3/4-2 S Ulvetanna well is the 3/4-1, but there are several basin placed wells to the south in Søgne Basin.

Relevant wells for evaluation of the Ulvetanna structure are the 2/6-4S and Lulita field wells.

Table 2.2 Common well database

Søgne Basin wells	
2/2-1	3/7-1
2/2-4	3/7-2
2/3-1	3/7-3
2/3-3	3/7-4
2/3-3	3/7-5
2/3-4	3/7-6
2/6-1	3/7-7
2/6-4s	9/10-1
2/6-5	9/11-1
3/4-1	Lulita wells
3/5-1	Lulu wells
3/5-2	Harald wells

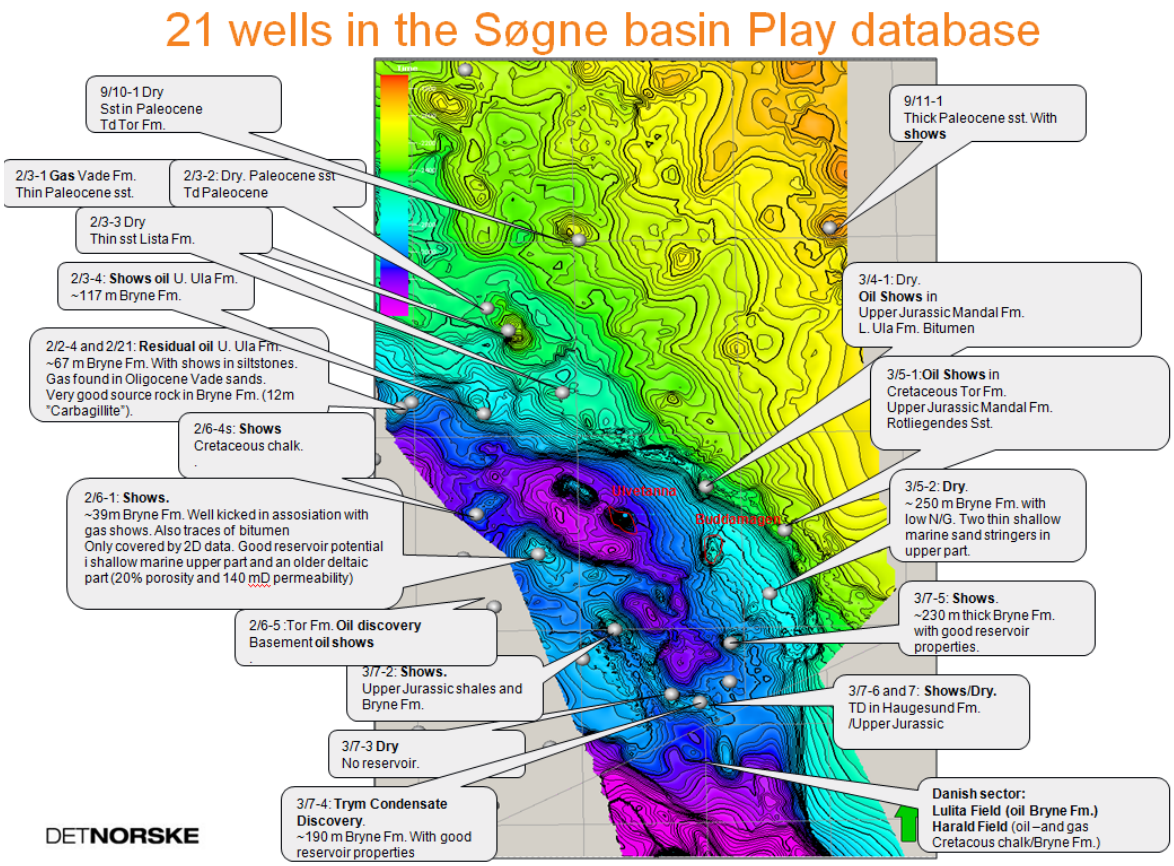

Fig. 2.2 Map of wells in common database

2.3 Special studies

The 3D seismic dataset DNO-0601 was acquired by the license group as part of the work program. This dataset, with full, near, mid and far offset stacks, has been utilised in the following Det norske in-house studies:

- Seismic inversion
- Geomodel

Other in-house studies performed:

- Facies mapping

External work for the PL356 license share holders are:

- Chronostrat study by Sven Bäckström, 2006
- Biostrat study of 3/5-2 by APT, 2006
- Rock Physics study at PSSGeo in 2006; Calculate a compound petrophysical interpretation for the 3/4-1, 3/5-1, 3/5-2 and 3/7-6, predict shear wave and make a feasibility study
- KIBSYN; source rock potential study by Det norske, GEUS, Exploro / Tronsd Brekke and APT, 2011
- The license arranged a field trip to Spain in 2012

3 ULVETANNA EXPLORATION WELL 3/4-2S

3.1 Ulvetanna pre-drill prospect evaluation

The Ulvetanna structure is a four way closure over a salt induced anticline. In area it covers 8,6 km^2. It lies in the Søgne Basin in quadrant 3. The potential reservoir consists of fractured Ekofisk- and Tor formations. The depth to the crest was mapped to 2450 mMSL and the spill points are estimated to lie at 2915 mMSL for Tor Formation and 2828 for Ekofisk Formation. The potential recoverable resources was 22,6 MSm^3 of oil equivalents, with a probability of discovery of 22 %. The probability of encountering chalk reservoir was considered good, while migration and reservoir quality were considered the main risk. Paleocene claystones were prognosed as the top seal.

A top reservoir depth map is shown in Fig. 3.1.

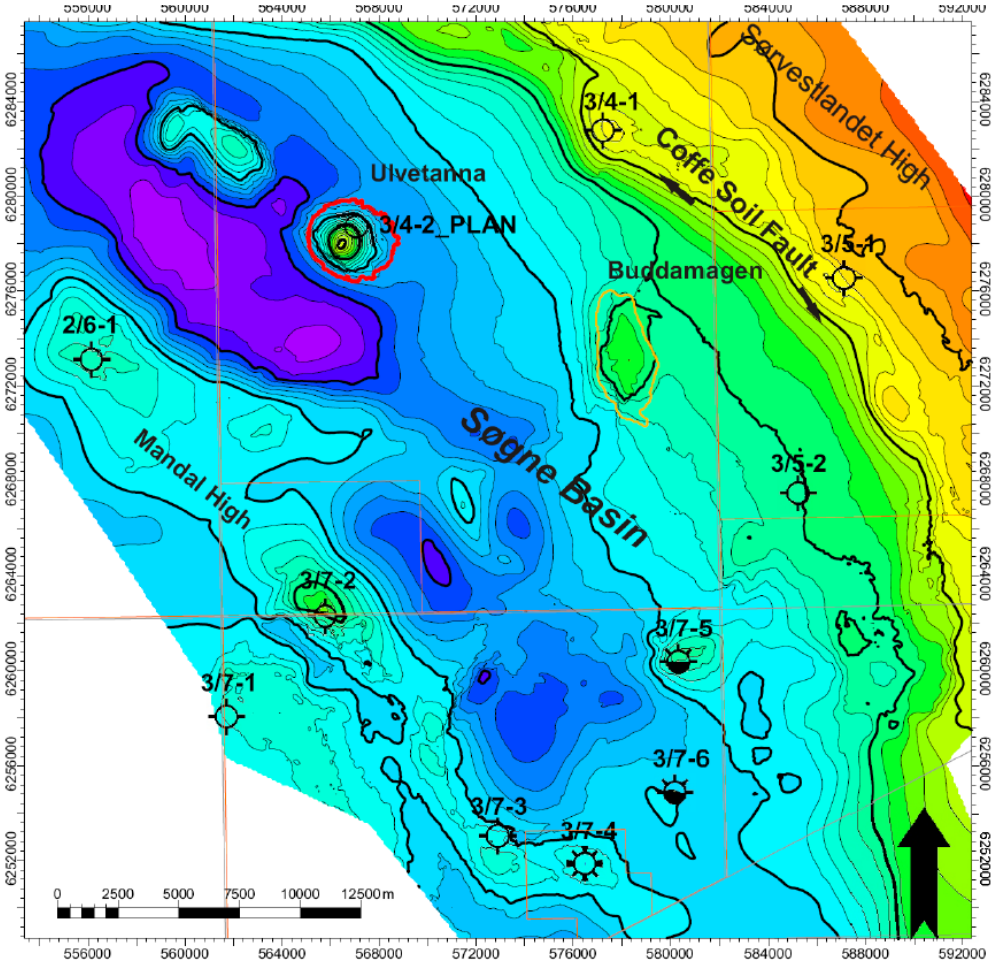

Fig. 3.1 Top Chalk reservoir depth map

3.2 Well 3/4-2S

3.2.1 Objectives

Exploration well 3/4-2S was the first well to be drilled in PL356. The main objective was to investigate the hydrocarbon potential of the Middle-Late Jurassic Mandal, Farsund, Haugesund and Bryne Formations. The Ekofisk and Tor formations were expected to provide the main reservoir.

The Ulvetanna structure is a salt dome situated within the Søgne Basin. The Ulvetanna Prospect is a four way dip closure. It's high angle flanks makes depth conversion a challenge.

The probability of a discovery was calculated to be 32 % with the highest risk associated with migration from the basin. The Ulvetanna prospect was estimated to be the one prospect best situated in regards to expectancy of mature source and short migration way in the license.

After getting the results form the KIBSYN (migration and source study), the migration pathway from the basin was not interpreted in detail as the Ulvetanna structure sists within the source area. It was planned to drill into Upper Jurassic source rock in the dry case to get a good data point for the source potential of the basin.

An optional sidetrack was planned down flank to identify a possible OWC in case of a discovery. In case of a discovery a 7'' liner would be run to facilitate acid stimulation and a well test (DST).

After completion of the well program, the plan was to permanently plug and abandone the well.

3.2.2 Well results

The Shetland Group Ekofisk Formation was penetrated at 2643mMD RT, the primary reservoir level Tor Formation was observed at 2700mMD RT, while the potential secondary target Hod Formation was found at 2767mMD RT. Both targets were found to be water bearing and had very poor porosity and permeability values.

Drilling continued further down into the Jurassic Mandal and Farsund Formations before TD was set at 2961mMD RT. Three wireline logging runs was then performed to obtain sidewall cores in the 8 1/2" section.

Based on the drilling and formation evaluation results, 3/4-2 S Ulvetanna was then permanently plugged and abandoned.

The rig Maersk Guardian was on contract 50 days.

The prognosed stratigraphy versus actual is presented below (Fig. 3.2) and CPI logs for the well are shown in Fig. 3.3.

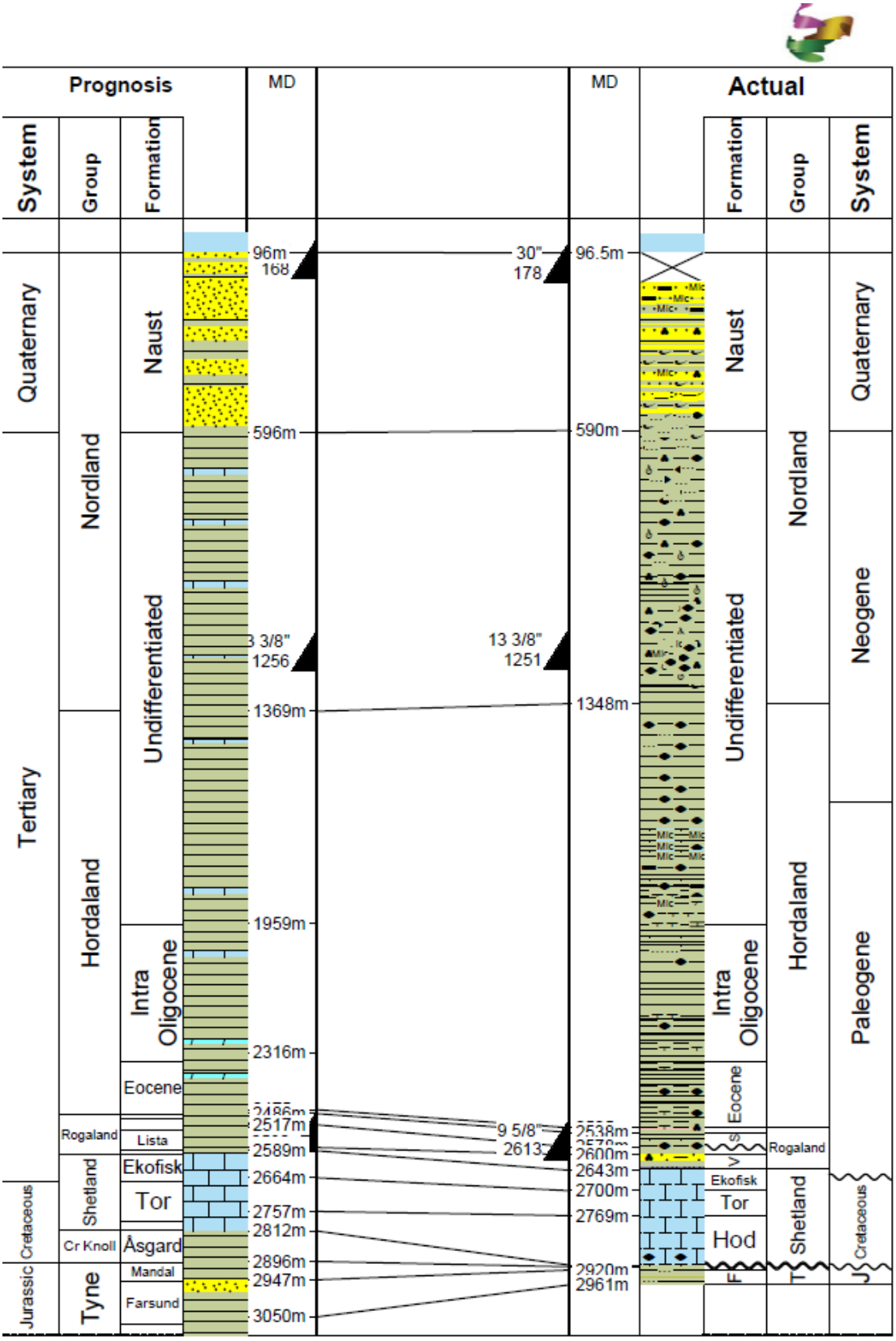

Fig. 3.2 Prognosed vs. actual stratigraphy, seabed toTD

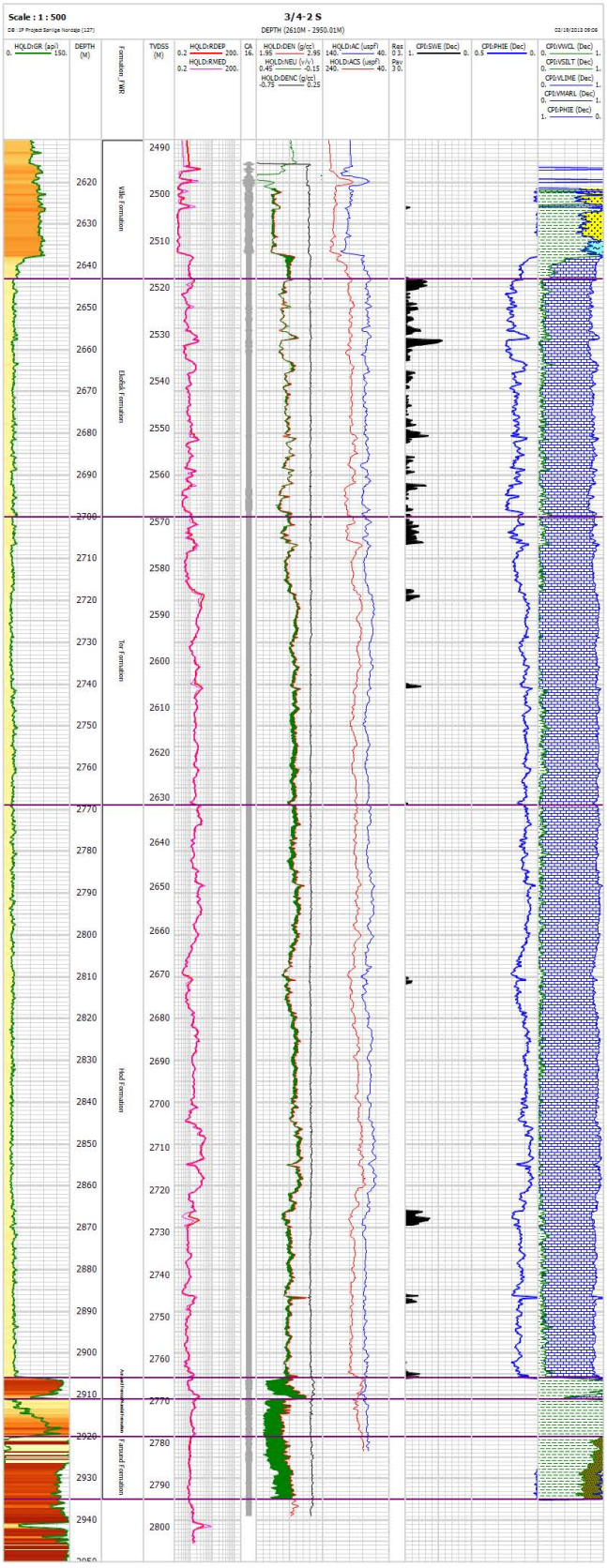

Fig. 3.3 CPI log for well 3/4-2S

The exploration well (3/4-2S) proved Ulvetanna prospect to be dry.

4 REMAINING PROSPECTIVITY

After getting the Ulvetanna results it was clear that the carbonate reservoir was poor, and the license does not see any remaining prospectivity here. Another find is that the Ulvetanna well penetrated the better source rock of all the Søgne Basin wells, but at the penetrated depth it was not mature.

The most prospective part of the license is believed to be Upper and Middle Jurassic sands which lie chronostratigraphicly more or less within the source. Several prospects and leads have been identified at top Bryne and top Eldfisk level, which are the formations expected to constitute the main reservoirs in this basin. Upside potential exist for the Ula Formation level.

A map of the remaining prospectivity within the Søgne Basin can be seen in Fig. 4.1

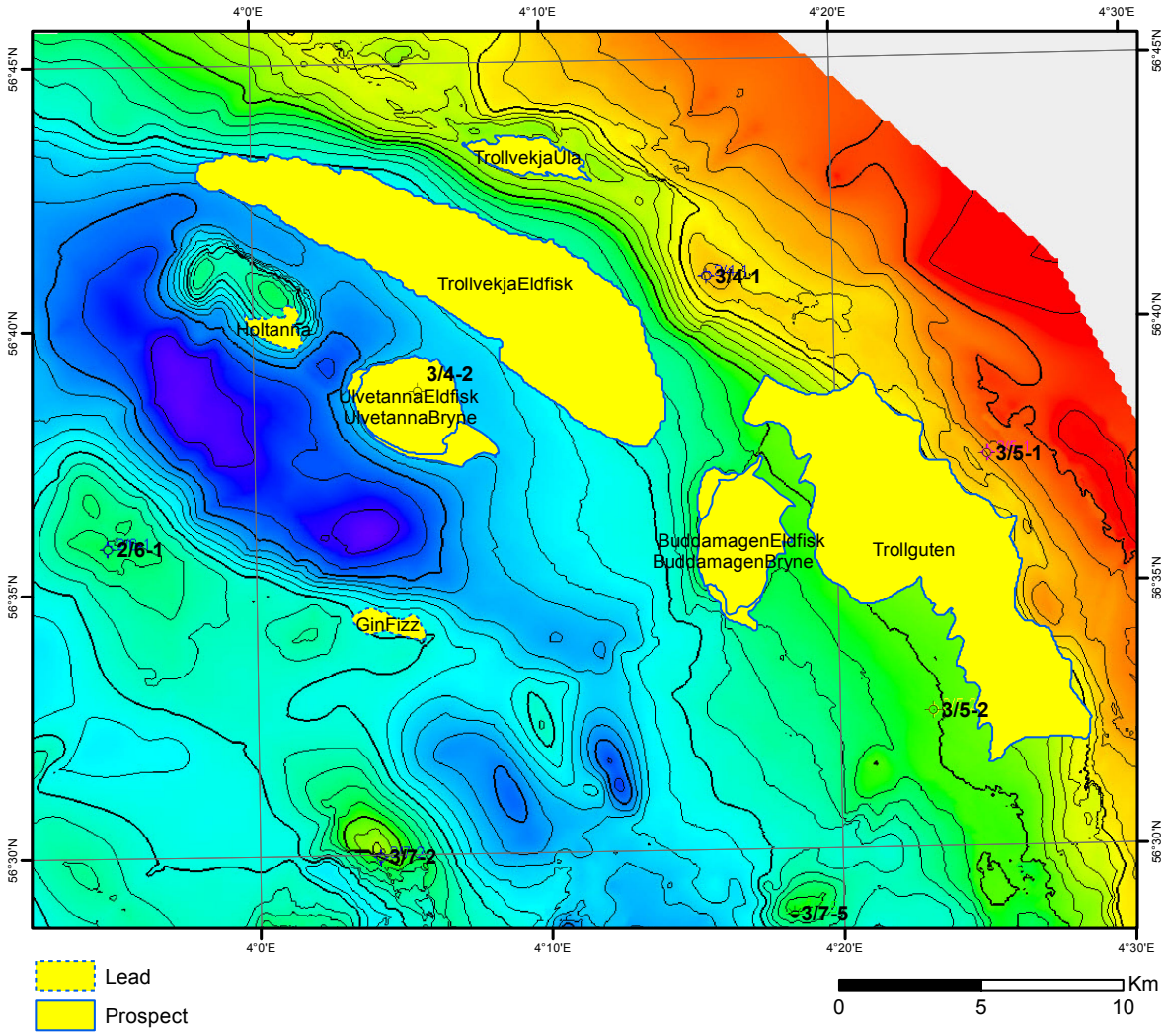

Fig. 4.1 Remaining prospectivity within the license area

The calculated volumes of each prospect is displayed in Table 4.1. The minimum economic volume for a full field development is calculated to be just below 15 MSm³ of oil, making most of the prospects uneconomic. The prospects that would be of interrest have a high risk.

Table 4.1 Summary - remaining prospectivity

PL 356					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										
Byddamagen Eldfisk	Eldfisk Fm	Oil	0,4	0,21	3		5		7	
Buddamagen Bryne	Bryne Fm	Oil	0,4	0,2	7		11		16	
Ulvetanna Eldfisk	Eldfisk Fm	Oil	0,4	0,2	4		6		8	
Ulvetanna Bryne	Bryne Fm	Oil	0,4	0,15	4		6		9	
Trollvekja Eldfisk	Eldfisk Fm	Oil	0,4	0,14	23		36		53	
Trollvekja Ula	Ula Fm	Oil	0,4	0,2	5		6		8	
Trollguten	Eldfisk Fm	Oil	0,4	0,03	13		26		50	
Holtanna	Bryne Fm	Oil	0,4	0,12	0		2		7	
Gin Fizz	Bryne Fm	Oil	0,4	0,12	0		2		9	

The lisence group judge the remaining prospectivity to be of high risk and low potential, therefore the partnership relinquish PL365.