

Relinquishment Report PL 341

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1 INTRODUCTION

1.1 License Owners

- Det norske oljeselskap ASA (30%), operator
- Wintershall Norge ASA (20%)
- Marathon Oil Norge (12%)
- North Energy ASA (11%)
- GDF SUEZ E&P Norge AS (10%)
- Bayerngas Norge AS (10%)
- Talisman Energy Norge AS (7%)

1.2 Award and Work Program

The PL 341 was awarded on the 17th of December 2004 as an APA 2004 application. It was valid to 17th of December 2008. The license outline and nearby fields and discoveries are shown in Fig. 1.1

The workprogram for this award included:

- G&G studies within 2 years
- Reprocess 3D seismic for the whole area
- Drill or drop decision within 2 years
- DOC within 4 years
- PDO or relinquishment within 5 years

The license bought the WGS-24-12-SV92R00 survey from Statoil. As part of the license obligations the survey was reprocessed by WesternGeco, which is the owner of the survey. The license partners at that time bought the rights to the new offset-stacks and the two PSDM Time and Depth migrated stacks covering the whole license area. The 24/12-5 S well was finished in December 2007 and reported as a dry well. The license applied for an

1.3 Pre-drill Prospectivity

PL341 is situated in the deep Cretaceous Vana sub-basin between the East Shetland platform to the west and the Utsira High to the east, (Fig 1.1) To the north in Block 24/9 oil is found in the two Palaeocene discoveries of Bøyla and Caterpillar, further west on the Heimdal Terrace are the oil and gas discoveries of Draupne, Hanz and Heimdal of middle Jurassic, late Jurassic and Palaeocene time. Within the deep Cretaceous basin hydrocarbons are found in the Gudrun field, Devenick on the UK side and the small discovery in well 24/12-3 S.

The pre-drill prospect volumes are listed in Table 1.1 below.

Table 1.1 Pre-drill prospect volumes

PL341					Gross Recoverable Reserves/Resources					
					Low		Base		High	
Category	Reservoir Level	HC	RF(%)	Pos(%)	Oil (MSm ³)	Gas (MSm ³)	Oil (MSm ³)	Gas (GSm ³)	Oil (MSm ³)	Gas (GSm ³)
Prospects										
Stirby Upper base	U. Jurassic	gc	75/45	52.00	8.30	9.00	11.20	12.20	14.40	15.60
Stirby Upper max	U. Jurassic	gc	75/45	12.00	42.10	45.80	61.00	66.10	80.30	86.80
Stirby Deep	Hugin/Sleipner	gas	70/45	23.00	3.10	18.70	4.30	27.30	6.00	37.80
Linderudkollen	U. Jurassic	gc	75/45	22.00	7.40	8.00	11.10	12.00	14.90	16.10
Hansakollen Upper	U. Jurassic	gc	70/45	18.00	8.20	8.30	10.00	10.20	11.90	12.00
Hansakollen Deep	U. Jurassic	gc	70/40	20.00	10.20	11.60	14.70	16.80	21.00	23.90
Thorkildsen	Heimdal	oil	40	49.00	2.70	N/A	9.40	N/A	20.10	N/A
Spinnern	Heimdal	oil	40	20.00	4.60	N/A	6.80	N/A	9.50	N/A
Haukåsen	Heimdal	oil	40	20.00	3.80	N/A	7.20	N/A	11.60	N/A
Lyderhorn Main	Hermod	oil	40	34.00	2.30	N/A	2.80	N/A	3.40	N/A

The main objective was to determine the size of Palaeocene Thorkildsen Prospect of Heimdal sandstone. The 24/12-3 S well had 2.8 m of oil in the top of the Heimdal fm. It was therefore a big surprise when the appraisal well 24/12-5 S proved to be dry.

The second objective was to test the reservoir quality and presence of hydrocarbons in the stacked reservoirs of the Stirby Prospect (Fig. 1.2). Stirby Deep (Fig. 1.3) was defined as a downfaulted rollover structure in the Middle Jurassic Hugin / Sleipner sandstone and Stirby Upper of intra Draupne turbidite sandstones. At this depth the main risk of the Hugin / Sleipner reservoir were reservoir quality.

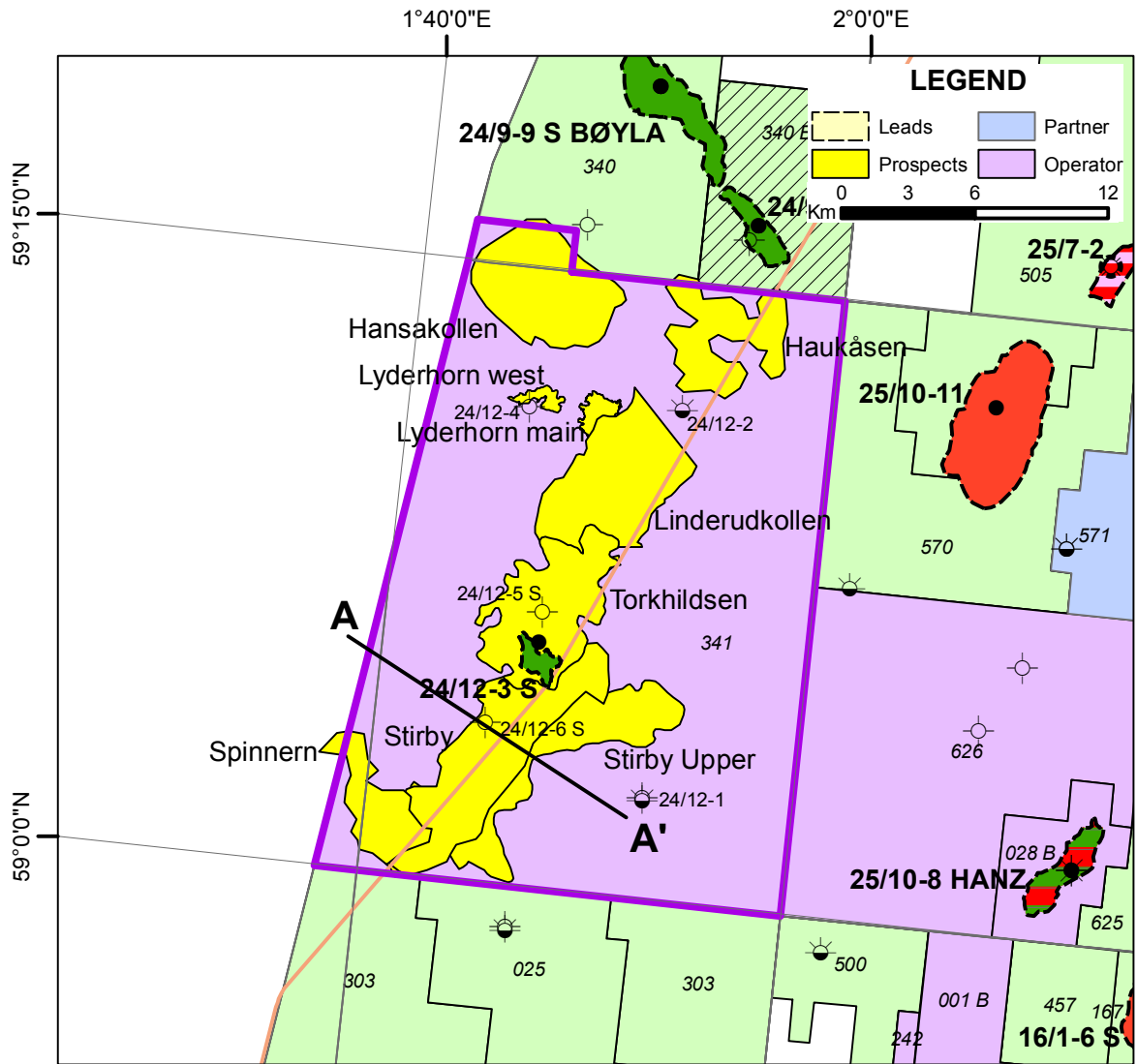


Fig. 1.2 Stirby cross-section

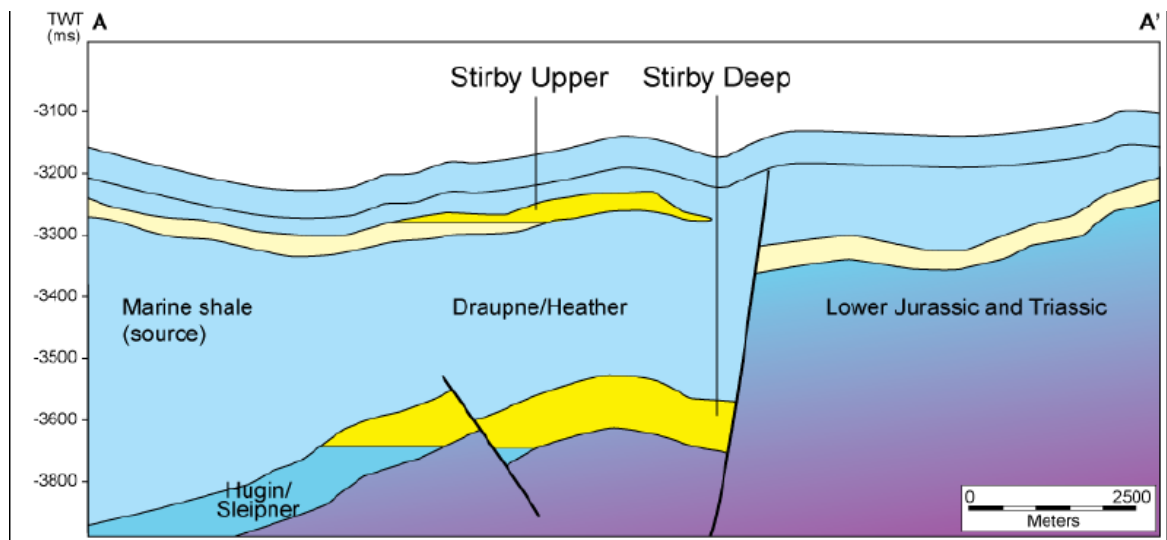


Fig. 1.3 Geomodel of Stirby Deep and Upper

Fig. 1.4

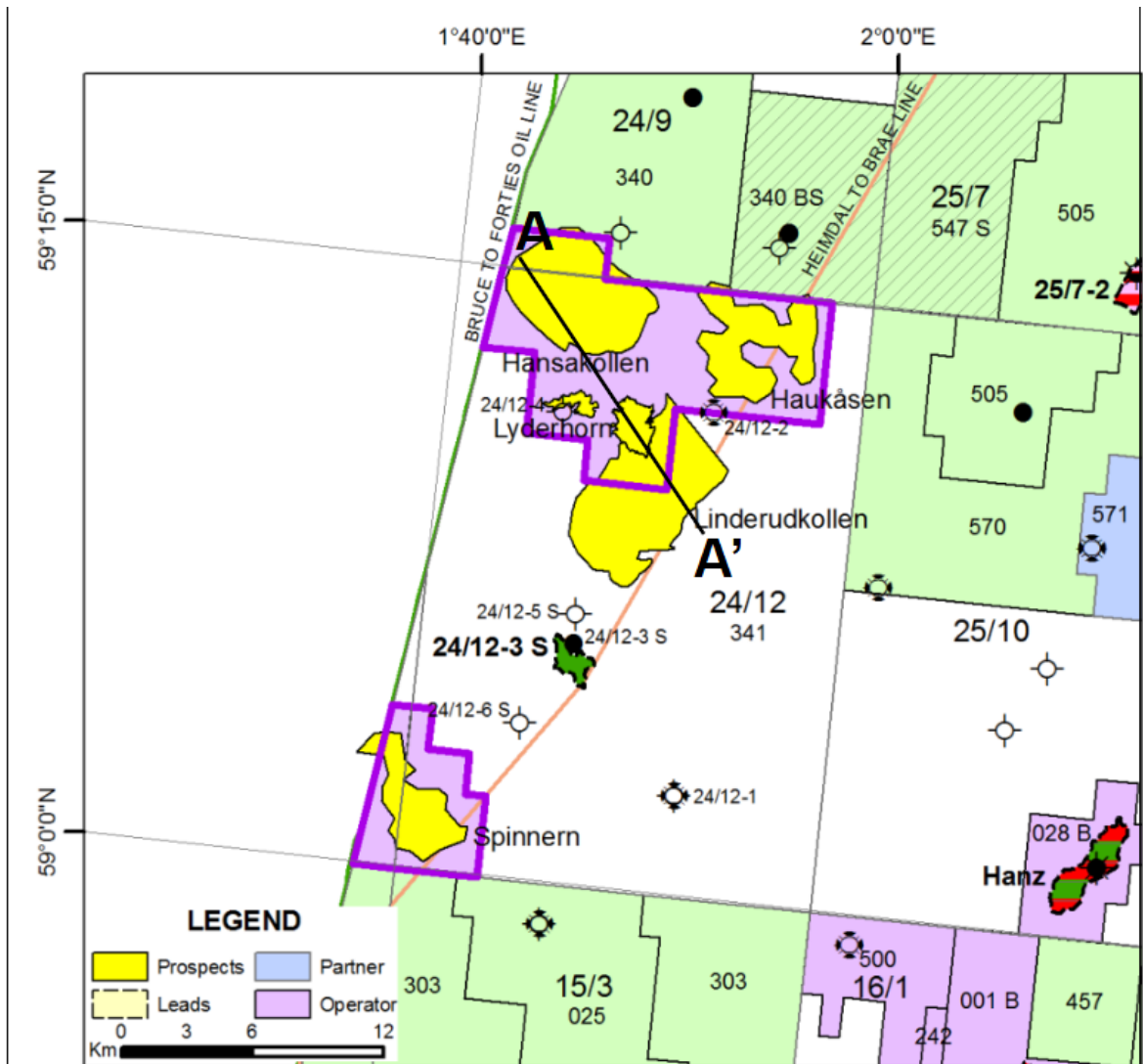


Fig. 1.4 Lyderhorn and Hansakollen cross-section. Shows where the cross-section of the geomodel is located.

Fig. 1.5

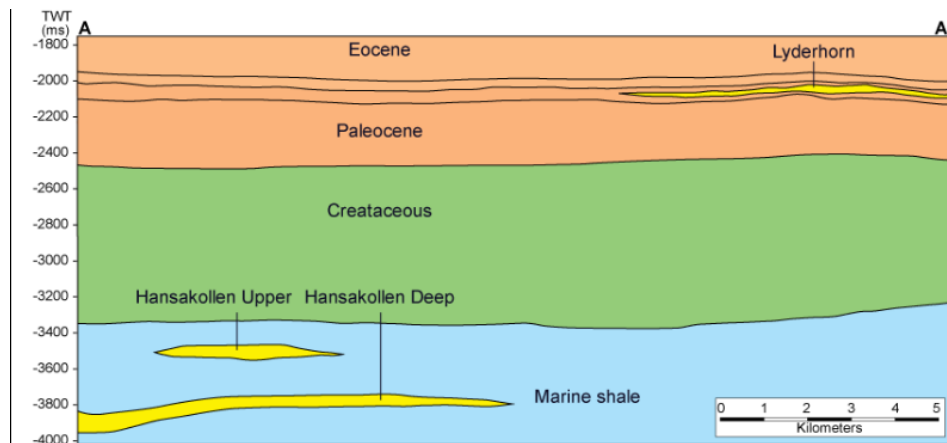


Fig. 1.5 Geomodel of Lyderhorn and Hansakollen. Shows the geological concept of the remaining prospects.

2 DATABASE

2.1 Seismic Database

The license area is fully covered by several 3D (Fig. 2.1) and 2D (Fig. 2.2) seismic surveys of variable quality. All available 2D and 3D surveys have been used for detailed regional interpretation. As part of the license obligation the partners at the time DNO (Det norske oljeselskap ASA), Talisman and Revus (Wintershall) bought WGS-24-12-SV92R00 and the reprocessed WGS-24-12-R06 with offset-stacks and PSDM stacks targeting the Palaeocene. The complete database is listed below in Table 2.1

WGS-24-12-R06, offset-stacks and PSDM full stack coloured inversion were used for seismic interpretation and prospect evaluation on Lyderhorn (Fig. 1.4).

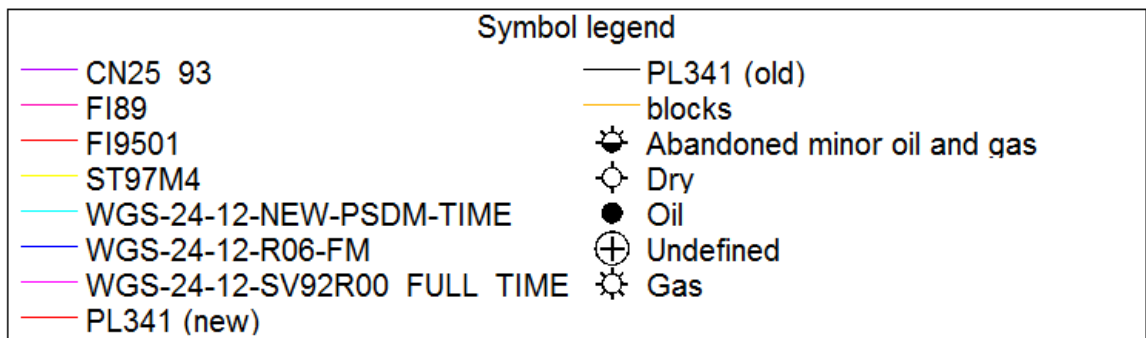
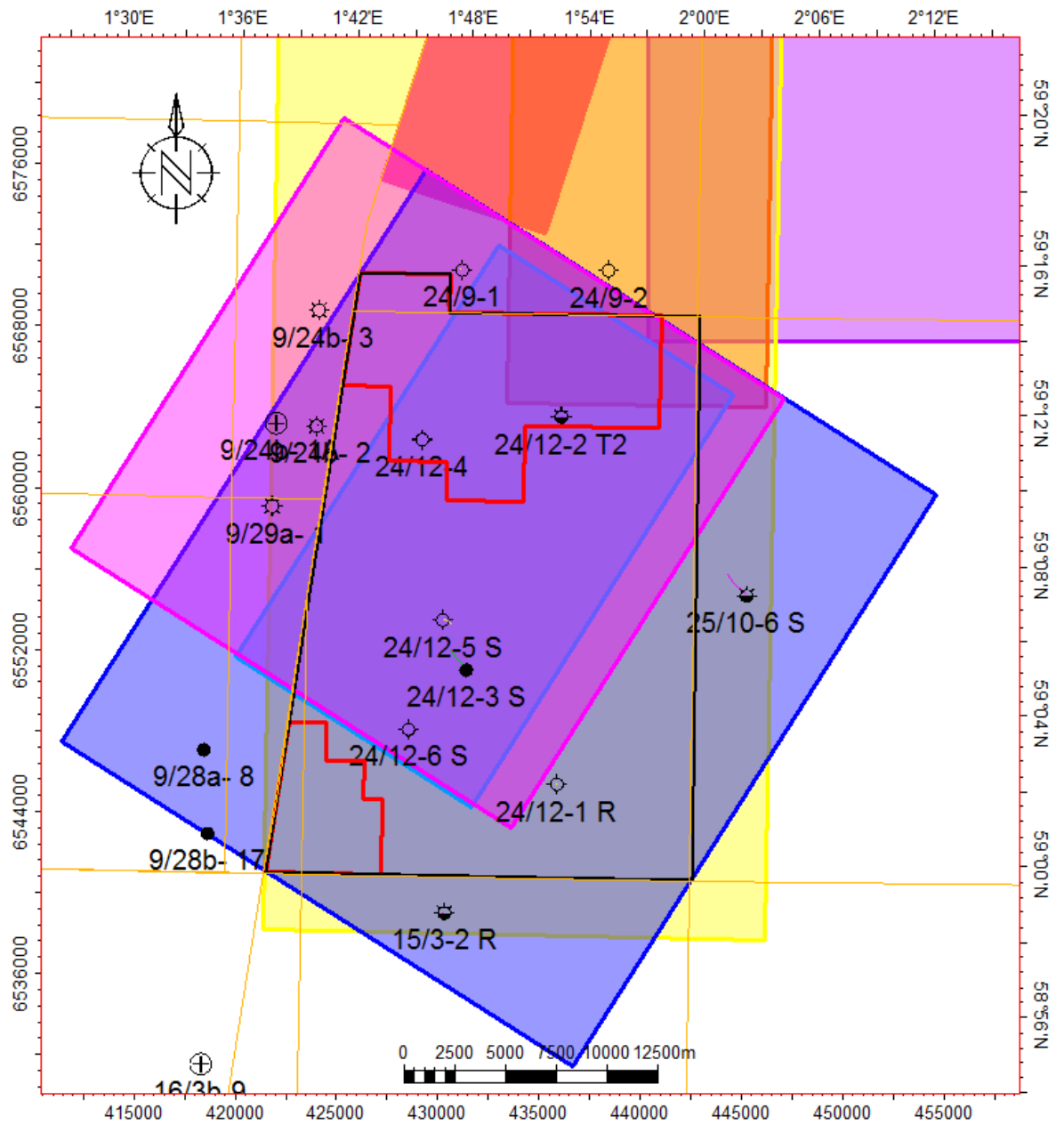


Fig. 2.1 3D seismic surveys in the common database

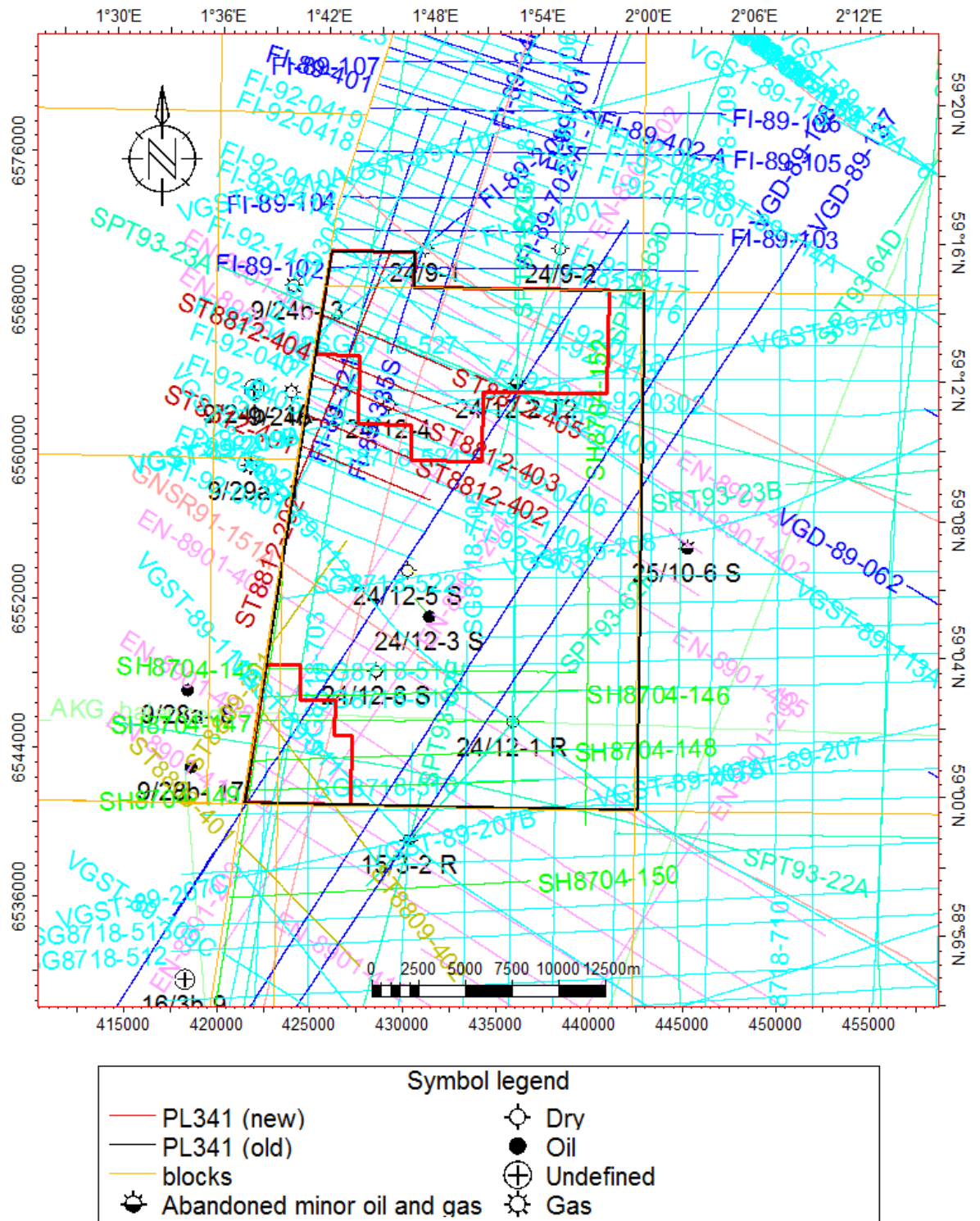


Fig. 2.2 2D seismic surveys in the common database

Table 2.1 Seismic database

Survey Name	Datatype	Survey Status	Seismic Class
CN25_93	3D	Public	Mig Fin
FI89	3D	Public on NCS	Mig Fin
FI9501	3D	Public	Mig Fin
WGS-24-12_SV92R00	3D	Statoil	Near-, full-, far-offset
WGS-24-12-R06	3D	WesternGeco	Near-, full-, far-offset: Fin Mig PSDM: Time and Depth
BPN8802	2D	Public	Mig Fin
EN8901	2D	Public	Mig Fin
FI-89	2D	Public on NCS	Mig Fin
FI92	2D	Public on NCS	Mig Fin
GNSR91	2D	Public	Mig Fin
SG8718	2D	Public on NCS	Mig Fin
SH8704	2D	Public on NCS	Mig Fin
SPT-93	2D	Public	Mig Fin
ST8809	2D	Public	Mig Fin
ST8812	2D	Public	Mig Fin
VG89	2D	Public	Mig Fin
VGST-89	2D	Public	Mig Fin

2.2 Well Data

Fig. 2.3 shows the wells in the common database, the wells are also presented in Table 2.2, which includes well names, TD Formation, location and field or structural element. The 24/12-5 S, 24/12-6 S and 24/12-6S T2 were drilled within the license period.

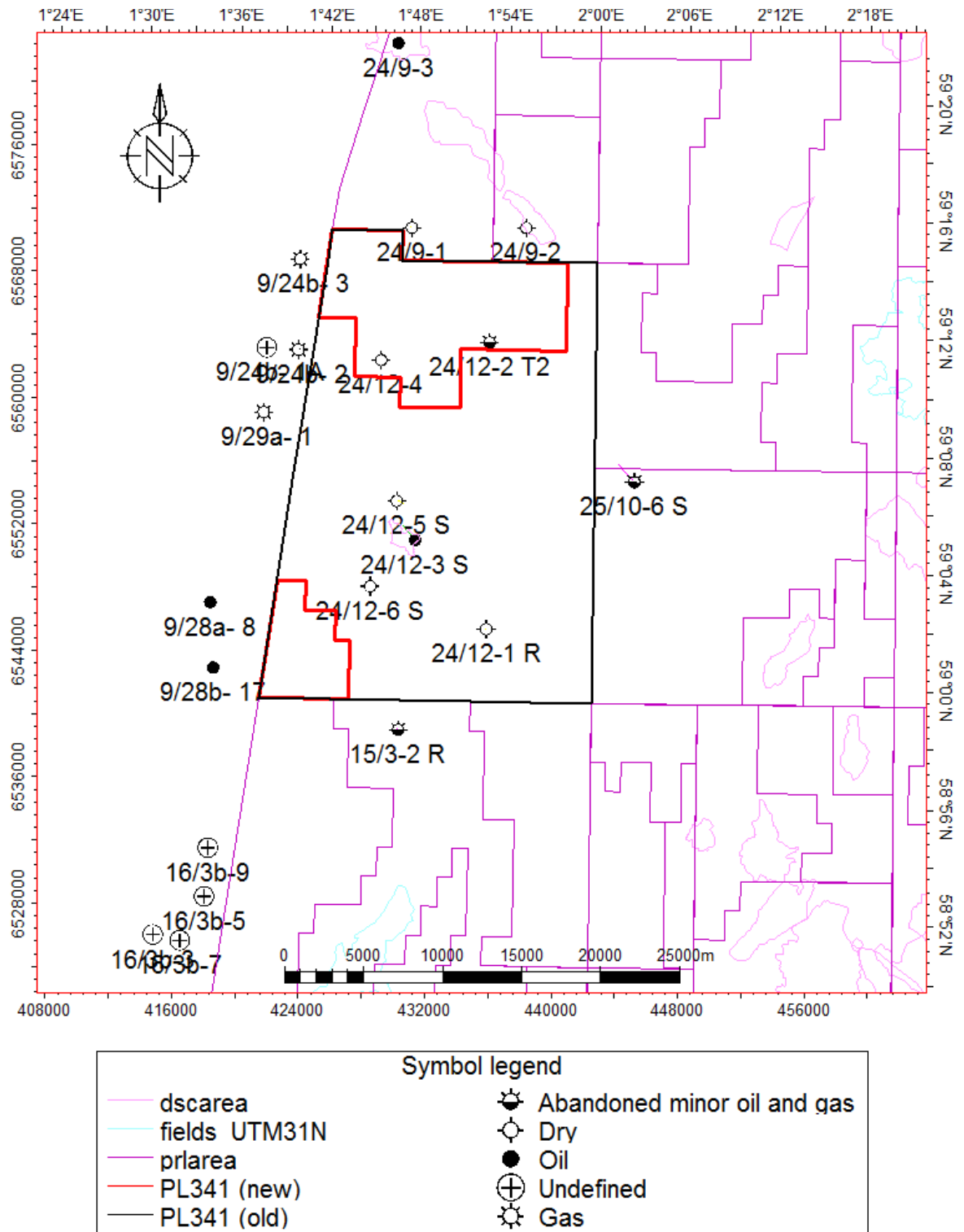


Fig. 2.3 Well database map

Table 2.2 Well database

Well	Year drilled	Waterdepth [m]	TD [MD/Fm]	Result	Location status	Released
15/3-2	1978	110	4258/Draupne Fm	Dry	Deep Cretaceous Vilje Subbasin	1/24/1979
24/9-1	1976	118	4907/Heather Fm	Dry	Deep Cretaceous Vana Subbasin	7/3/1978
24/9-2	1977	118	2743/Tor Fm	Dry	Deep Cretaceous Vana Subbasin	7/22/1977
24/9-3	1981	120	3051/Jorsalfare Fm	Oil in Frigg Fm	Deep Cretaceous Vana Subbasin	4/15/1983
24/9-4	1991	119	2208/Lista Fm	Oil Shows	Deep Cretaceous Vana Subbasin	6/17/1993
24/9-5	1994	122	2860/Jorsalfare Fm	Oil in Intra Balder Fm sst	Deep Cretaceous Vana Subbasin	1/26/1996
24/9-6	1994	123.5	2255/Heimdal Fm	Oil in Intra Balder Fm sst	Deep Cretaceous Vana Subbasin	3/7/1996
24/12-1	1978	112	3966/Sola Fm	Dry	Deep Cretaceous Vana Subbasin	4/9/1980
24/12-1 R	1978	113	4825/Triassic	Oil Shows	Deep Cretaceous Vana Subbasin	8/14/1980
24/12-2	1982	119	5100/Triassic	Shows	Deep Cretaceous Vana Subbasin	1/21/1984
24/12-3 S	1996	118	3058 /Våle Fm	Oil in Heimdal Fm	Deep Cretaceous Vana Subbasin	7/29/1998
24/12-4	2001	115	2265/Heimdal fm	Dry	Deep Cretaceous Vana Subbasin	9/14/2003
24/12-5 S	2007	116	2325/Heimdal Fm	Dry	Deep Cretaceous Vana Subbasin	12/21/2009
24/12-6 S	2010	116	5207/Middle Jurassic	Dry	Deep Cretaceous Vana Subbasin	12/20/2012
24/12-6 S T2	2011	116	5207/Middle Jurassic	Dry	Deep Cretaceous Vana Subbasin	12/20/2012
25/10-6 S	1996	117	4706/Sleipner Fm	Shows	Deep Cretaceous Vana Subbasin	3/22/1998
9/19-2	1976	257	3910/Triassic	Oil in Hugin Fm	Deep Cretaceous Vana Subbasin	
9/19-3	1977	128	4362/Triassic	Gas/Condensate in Sleipner Fm	Deep Cretaceous Vana Subbasin	
9/24B-1A	1983	114	5005/Permian	Shows/Hugin Fm	Deep Cretaceous Vana Subbasin	
9/24B-2	1986	114	5417/Brae Fm	Shows in Brae Fm	Deep Cretaceous Vana Subbasin	
9/24B-3	1988	116	5500/Brae Fm ?	Gas Shows	Deep Cretaceous Vana Subbasin	
9/28A-8	1973	128	4603/U. Devon	Oil/Gas Shows in Paleocene down to Triassic	Deep Cretaceous Vana Subbasin	
9/28B-17	1993	128	5567/U. Jurassic	Oil/Gas Shows in Brae Fm	Deep Cretaceous Vana Subbasin	
9/29A-1	1991	123	5483/U. Jurassic	Gas/Condensate in Brae Fm	Deep Cretaceous Vana Subbasin	
16/3B-5	1985	121	4331/U. Jurassic	Oil in Brae Fm	Deep Cretaceous Vana Subbasin	
16/3B-7	1985	116	4427/U. Jurassic	Oil/Gas in Brae Fm	Deep Cretaceous Vana Subbasin	
16/3B-9	1985	123	4633/U. Jurassic	Oil Shows in Brae Fm	Deep Cretaceous Vana Subbasin	

2.3 Special Studies

Several in-house special studies have been carried out to address the geological uncertainties of the PL 341 prospectivity. These studies include:

- AVO analysis
- AVO modelling
- Spectral decomposition
- Rock physics modelling
- Coloured inversion

The aim of these studies were to compare between modelled seismic response against real seismic response and describe AVO behaviour. The Lyderhorn Prospect shows good AVO response on the offset-stacks like its analogues, the Bøyla and Caterpillar discoveries. This feeder channel is well defined in the seismic but to be able to calculate more realistic volumes it was important to distinguish the main channel from the levées. Spectral decomposition

was used to see differences in sand thicknesses and deposition over the Lyderhorn Prospect. Rock physics modelling show, that phase reversal in parts of the channel may be due to a combination of changes in net to gross sand fraction and presence of hydrocarbons. Clean HC-filled sand in channel is expected to have lower acoustic impedance than more shaly HC-filled levées, when compared to the higher AI in the cap-rock. Brightening seen in the channel may be explained by a high contrast in AI in the reservoir than the shale surrounding the channel. Coloured inversion cubes are used to interpret sands and top reservoir.

3 EXPLORATION WELLS 24/12-5 S & 24/12-6 S

3.1 Well 24/12-5 S

The volume potential was substantial and the P(50) deterministic case that was brought forward by the license for unrisks recoverable resources was 9.4 MMSm³ of oil with a chance of success of 49%. A top reservoir depth map on top Heimdal is shown in Fig. 3.1.

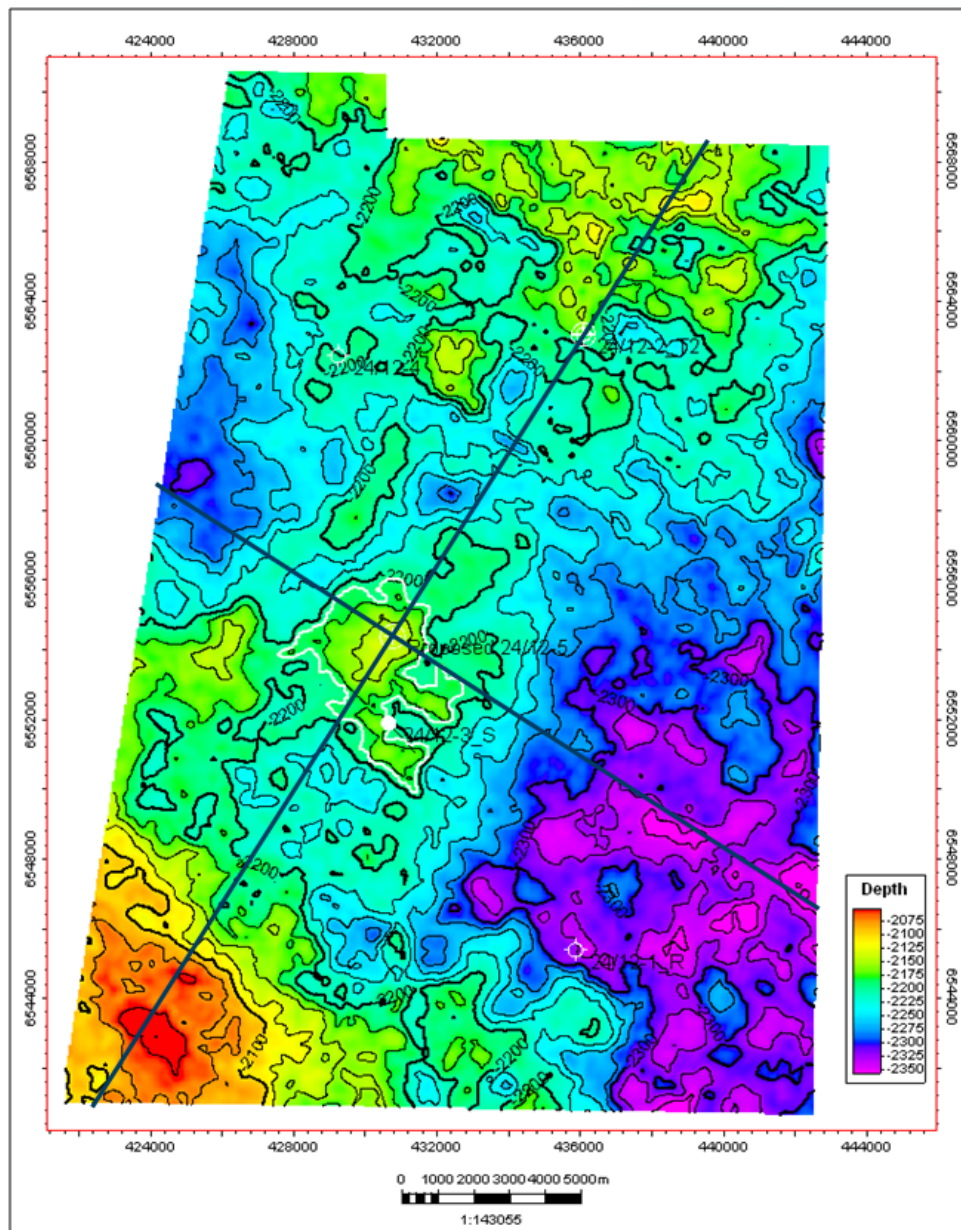


Fig. 3.1 Top Thorkildsen on Heimdal depth map

3.1.1 Objectives

The Thorkildsen Prospect was a four way dip closure at Palaeocene Heimdal level. The definition of the structure was critical to depth conversion, which also described the main risk for the prospect. The 24/12-5 S well was an appraisal of well 24/12-3 S which proved about 3m oil at the edge of the Thorkildsen structure. The Well was drilled deviated from 758 meters. A base case oil column of 34m was prognosed at the well location. The oil column was calculated based upon the oil-water contact found in Well 24/12-3 S, in which the base case top reservoir map coincided with the structural spill. The Heimdal sandstone, which describes the reservoir of the Thorkildsen Prospect, has a continuous extension in the area.

Well 24/12-5 S was planned with a TD of approx 30m into the Heimdal sands, or 30m below a potential OWC. The prognosed depth for TD was 2217m below MSL (2242m TVD MD/2333m MD).

3.1.2 Well Result

The well was drilled deviated to a total depth of 2325.00mMD/2239.08 mMDTVD/ (-2214.08m TVDSS which is 48m into the Heimdal Member. The Heimdal proved to be massive highly porous sandstone, but no hydrocarbons were encountered in the well.

The prognosed stratigraphy versus actual is presented below (Fig. 3.2) together with the CPI log of the well (Fig. 3.3).

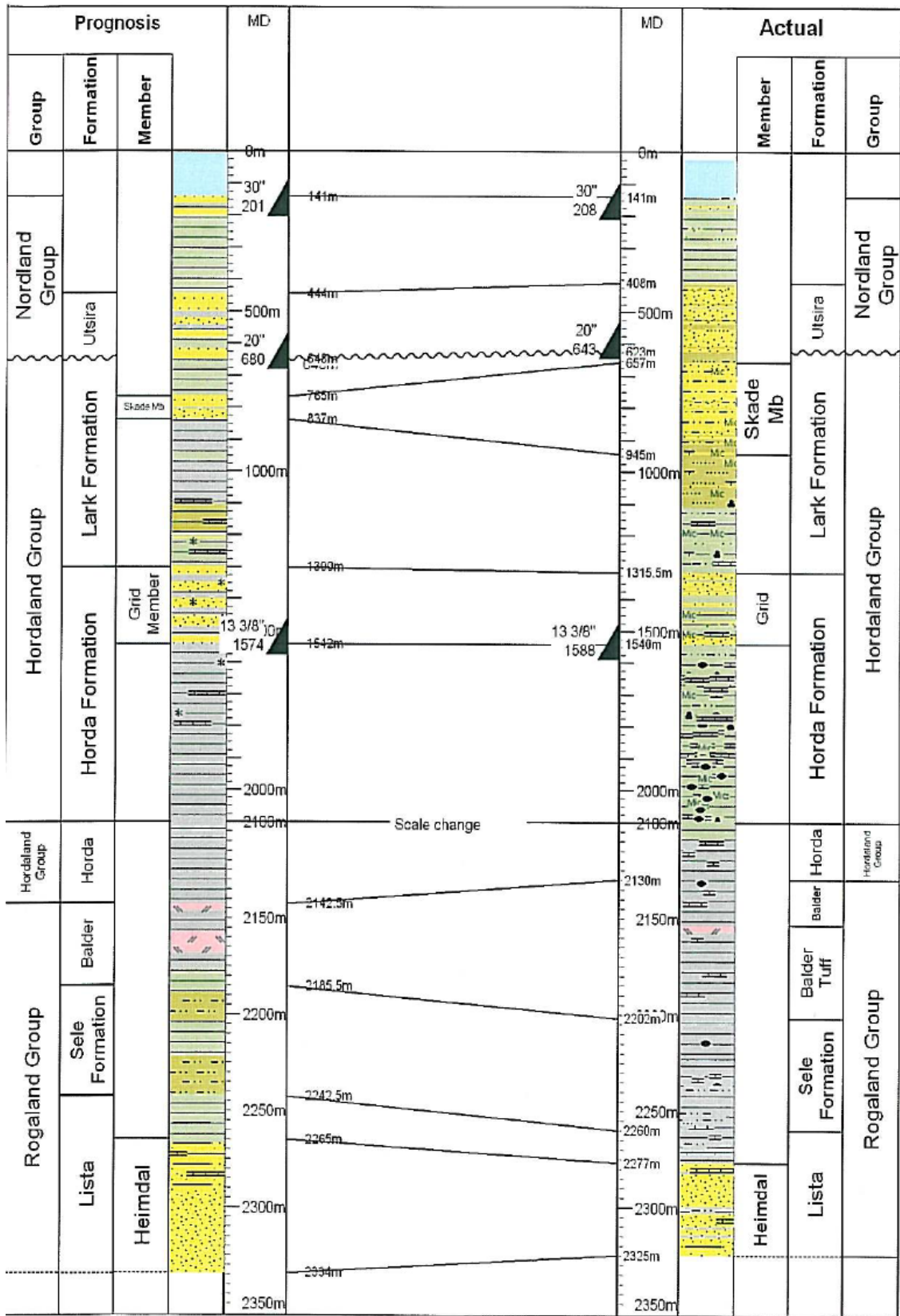


Fig. 3.2 24/12-5 S Prognosis vs. Actual

WELL NAME: 24/12-5S

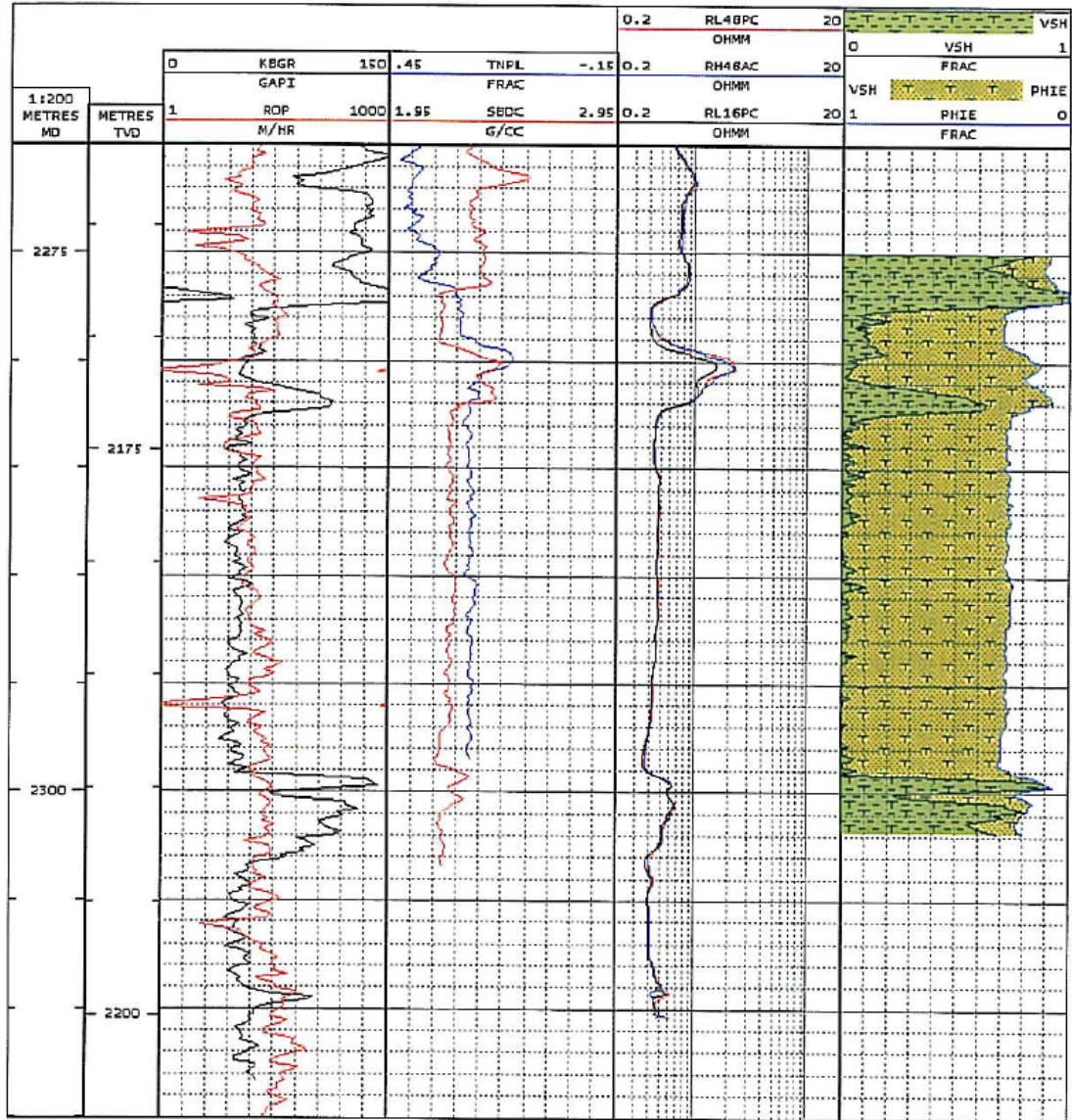


Fig. 3.3 24/12-5 S CPI

3.2 Well 24/12-6 S

The Stirby Prospect was defined as two stacked reservoir units. Stirby Upper was mapped on BCU level and defined as a stratigraphic/structural Intra Draupne turbidite sandstone. Stirby Deep was mapped as a Hugin/Sleipner sandstone roll-over structure. Sands in Stirby Upper were considered to be derived from south/south-west (UK) and deposited as a distal fan on the basin floor. At these depths (4300 m) the main risk is conservation of porosity and permeability. Stirby Deep is a normal faulted four-way closure with reservoir sands deposited in a shallow marine/fluviol environment. Conservation of permeability/porosity is considered as the main risk. The potential recoverable resources were 23.5 MSm³ of wet gas for Stirby Upper and 31.6 MSm³ of dry gas with a probability of discovery of 52% and 23%. A top reservoir depth map on BCU is shown in Fig. 3.4.

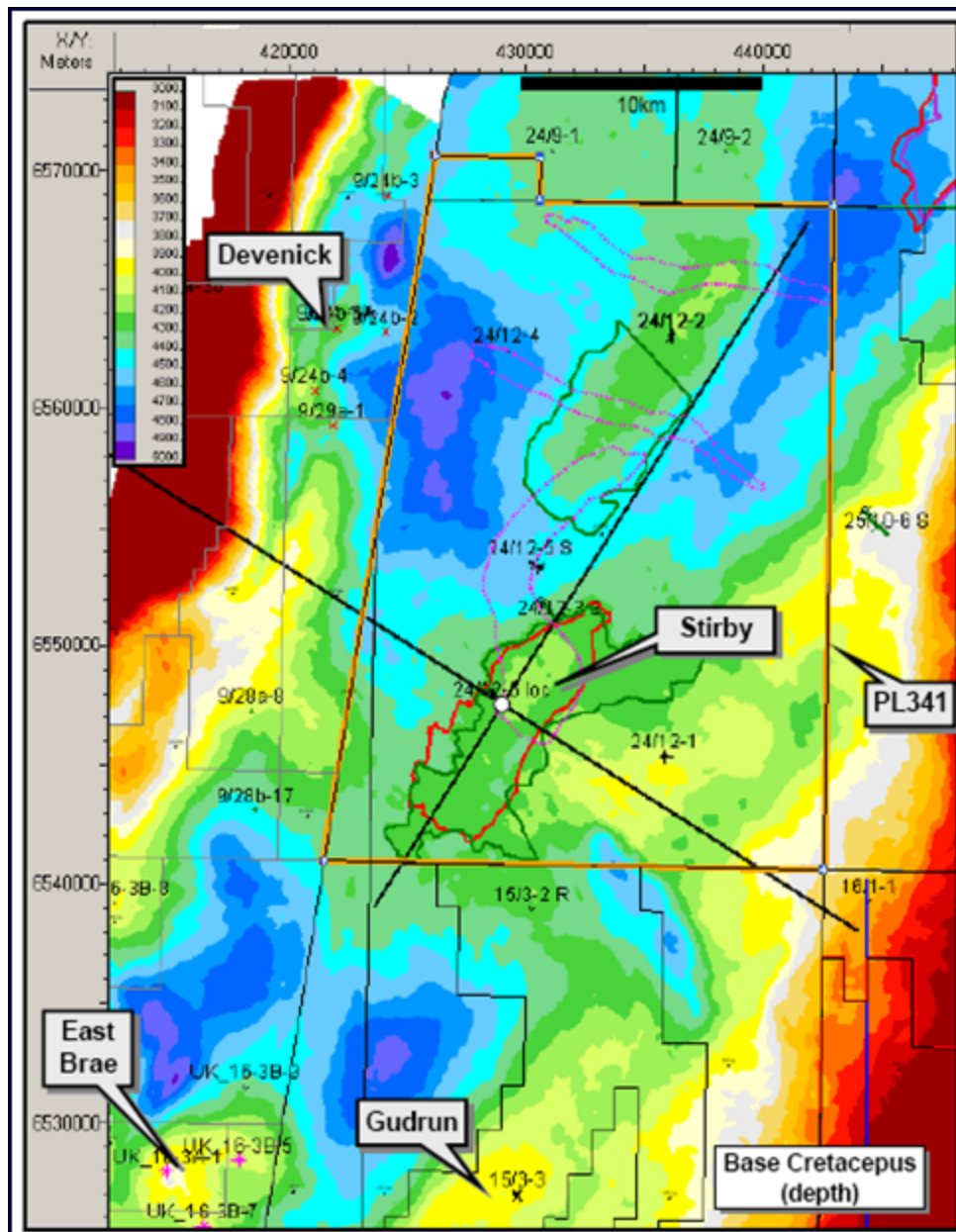


Fig. 3.4 Top Stirby on BCU depth map

3.2.1 Objectives

The objective of Well 24/12-6 S was to test the reservoir and hydrocarbon potential of the Stirby Prospect in PL 341. Stirby was a potential multipay structure. The main prospect was the Late Jurassic intra-Draupne Formation Sandstones (Stirby Upper). If a significant discovery was made in the main target, a 7" liner would be run and a DST performed based on reservoir quality and characteristics. In this scenario, TD would be set when reaching the required setting depth for the 7" liner. If the primary prospect was not present or the intra-Draupne reservoir did not show the anticipated quality, the well would be continued to the secondary target, the Middle Jurassic Hugin / Sleipner Formation sandstones (Stirby Deep). This target would not be tested with a full scale DST. If hydrocarbons were identified in Stirby Deep, the TD would be set to 50mMD RKB below the base of the Hugin / Sleipner sequence. If a thick water filled sand was penetrated in the Stirby Deep target, the well would TD in the Hugin / Sleipner Formation 50m deeper than the top of the sand sequence. Additional targets might also occur between these two main targets in the Heather Formation. These additional targets represented potential reservoir sands derived from the east as encountered in the Gudrun Field to the south. No sidetrack was planned for. After completing of the well program, the well was to be permanently plugged and abandoned.

3.2.2 Well Result

Only rare traces of sand were seen at the expected primary target, the Late Jurassic intra-Draupne sand (Stirby Upper). This part of the well contained organic rich shale with thin beds of limestone. These limestone beds correspond to the strong amplitudes which defined the main target as a basin floor fan in the prognosis. The secondary target, the Middle Jurassic Vestland Group (Stirby Deep), came in 7.8m deeper than prognosed. An upper sandstone, probably belonging to the Hugin Formation, was described as silica cemented. Only one stable pressure point was collected and therefore no gradient defining hydrocarbon or water was obtained. In the lower sandstone just above TD of the well another pressure point reading was obtained, 33 bar lower than the one in Upper sandstone. Scanning evaluation with an MDT tool in the lower sandstone gave the conclusion that this sand was water filled. The fossil content in the two sands, point towards a Bathonian / Bajocian age within a restricted(?) marine environment.

The prognosed stratigraphy versus actual is presented below (Fig. 3.5). CPI logs for Stirby Upper (Fig. 3.6) and Stirby Lower are shown in Fig. 3.7.

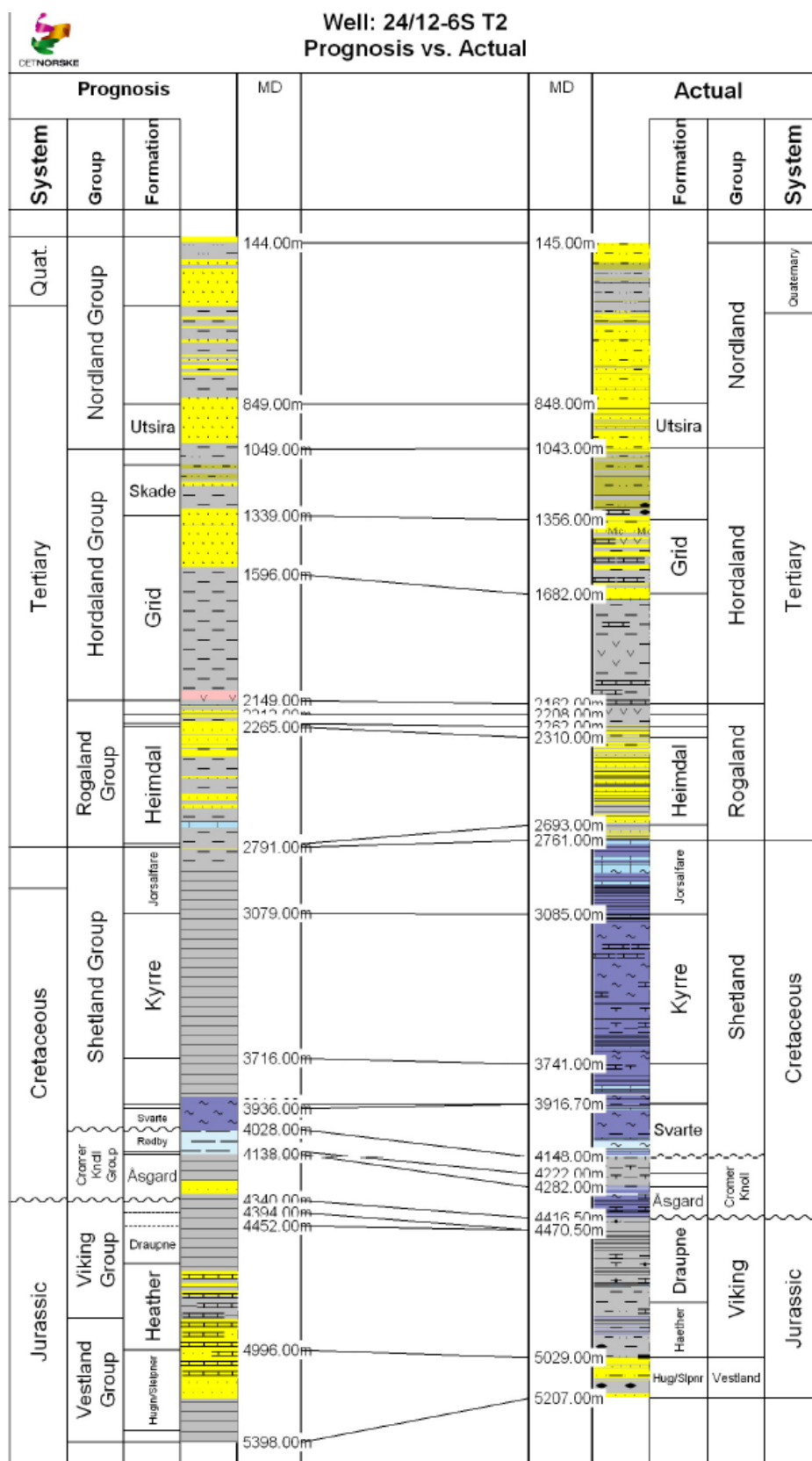


Fig. 3.5 24/12-6 S Prognosis vs. Actual

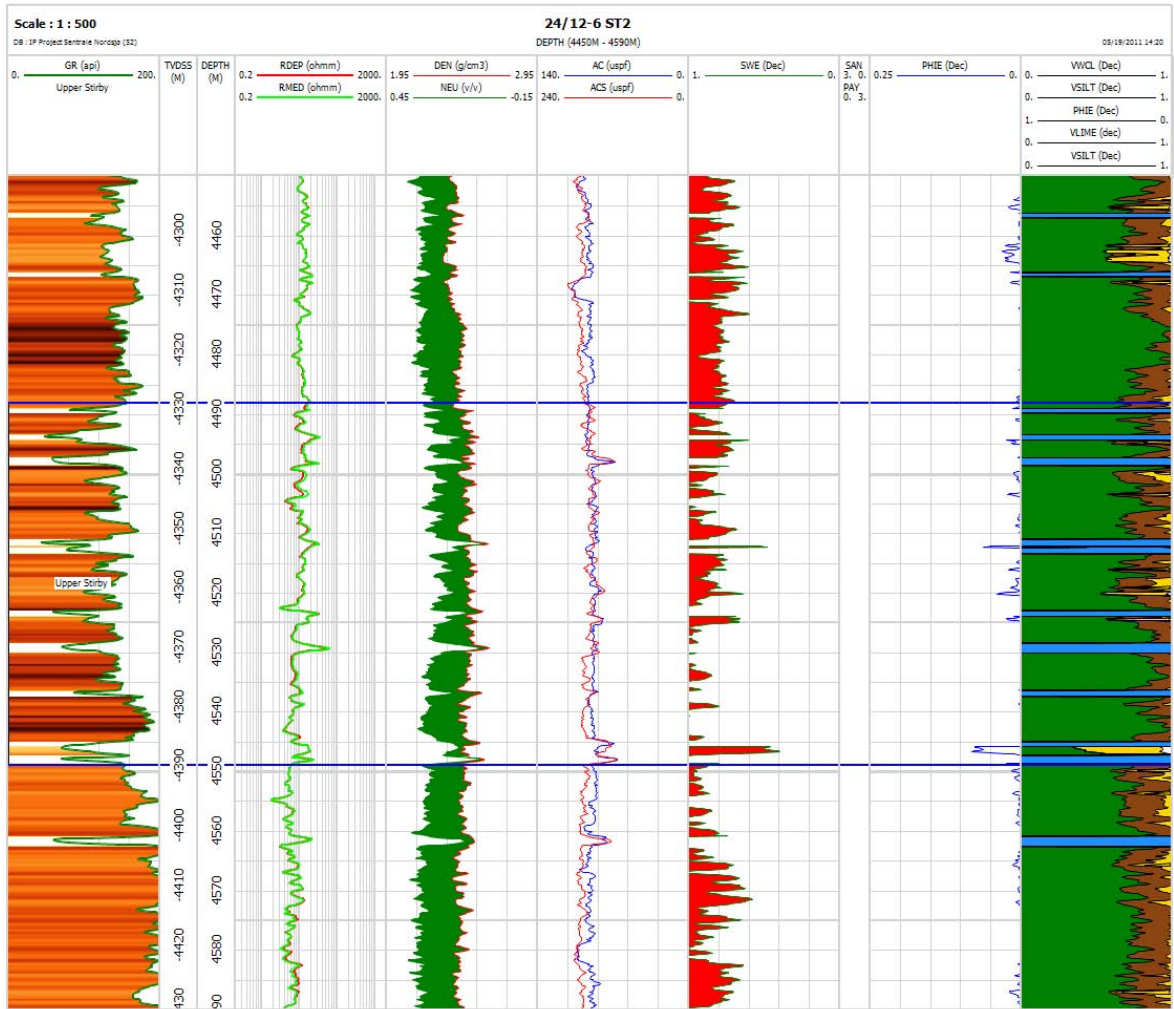


Fig. 3.6 24/12-6 S CPI log for Stirby Upper

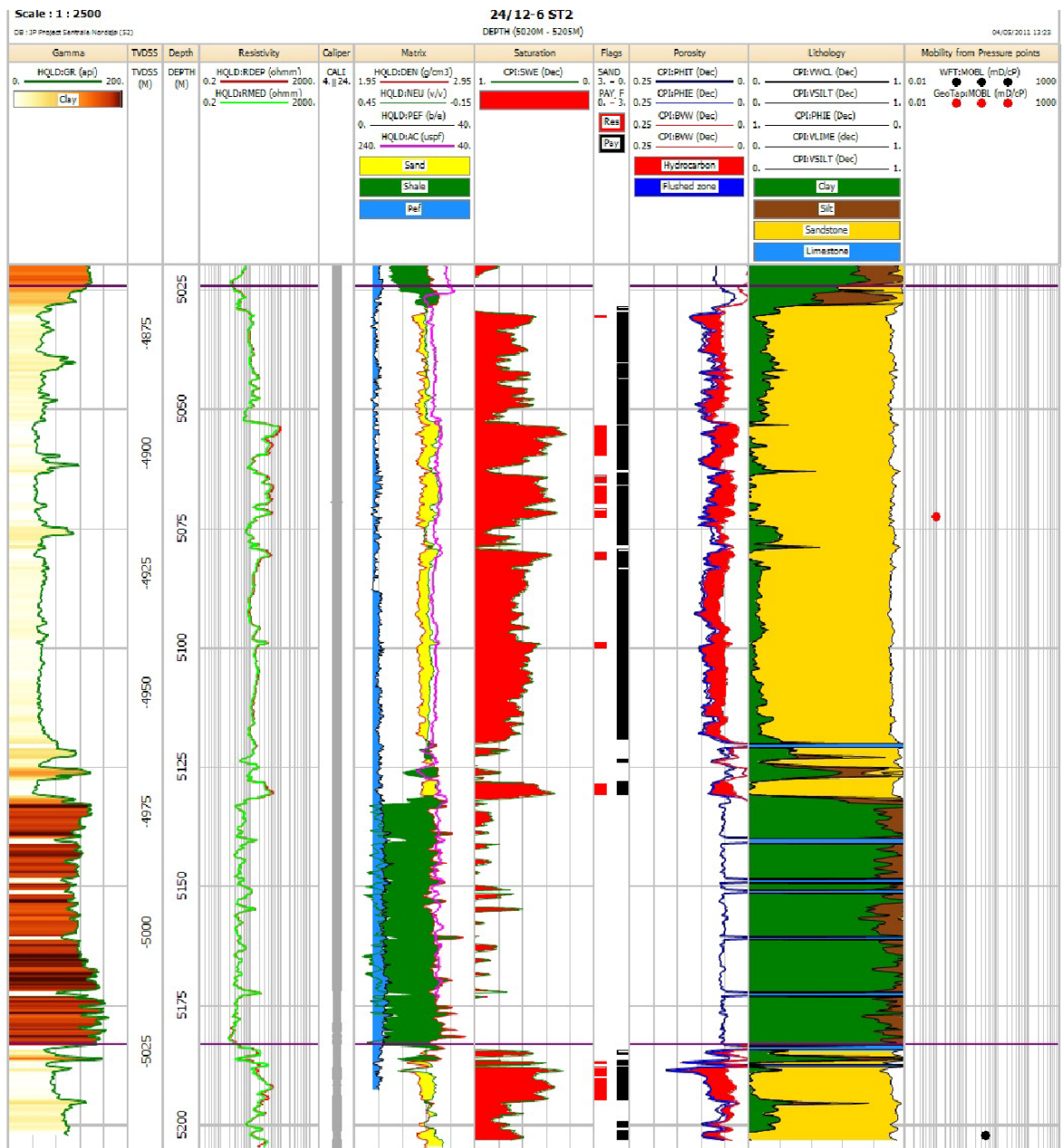


Fig. 3.7 24/12-6 S CPI log for Stirby Lower

4 REMAINING PROSPECTIVITY

After results from the Stirby well and the latest results of the Bøyla and Caterpillar discoveries it seems like the Palaeocene is the main play in the area but there are some possibilities in the Upper Jurassic.

Jurassic

Both Linderudkollen and Hansakollen Deep and Upper are outlined in Fig. 4.1

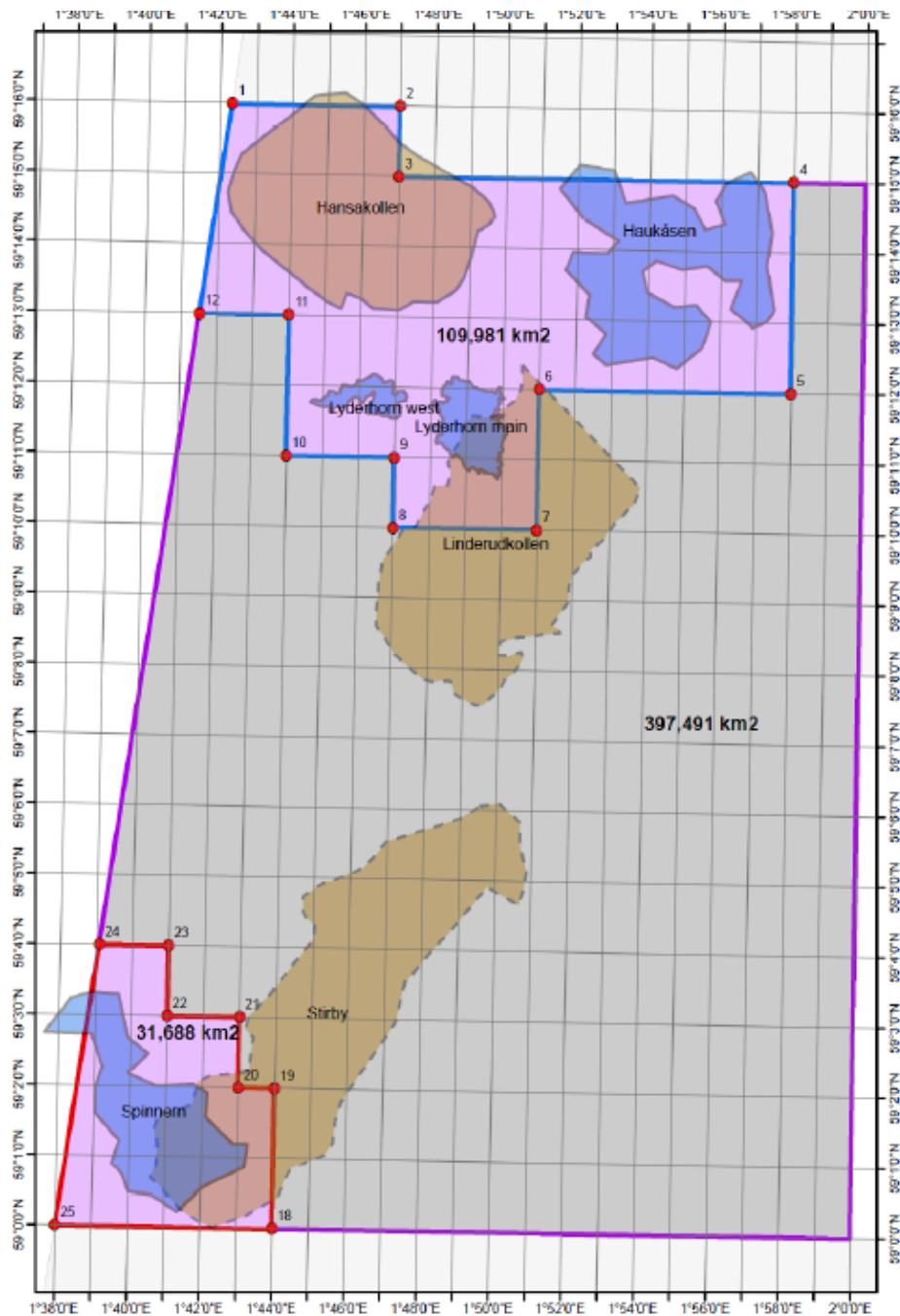


Fig. 4.1 Map of remaining prospects

The main risks are preservation of porosity and permeability at these depths. Prospects of Upper Jurassic need to be of considerable volumes to be economical.

Palaeocene

For the remaining prospects of Palaeocene age, smaller volumes should be economically interesting. Both the Haukåsen and Spinnern prospects were identified in the APA2004, were as Lyderhorn West and Lyderhorn Main were identified on a later stage, using the Bøyla/Caterpillar trend as an analogue. The trend is clearly shown on RMS of the Far-Offset data and on Hermod sand thickness (Fig. 4.2). The remaining prospects with volumes and risks are listed in Table 4.1.

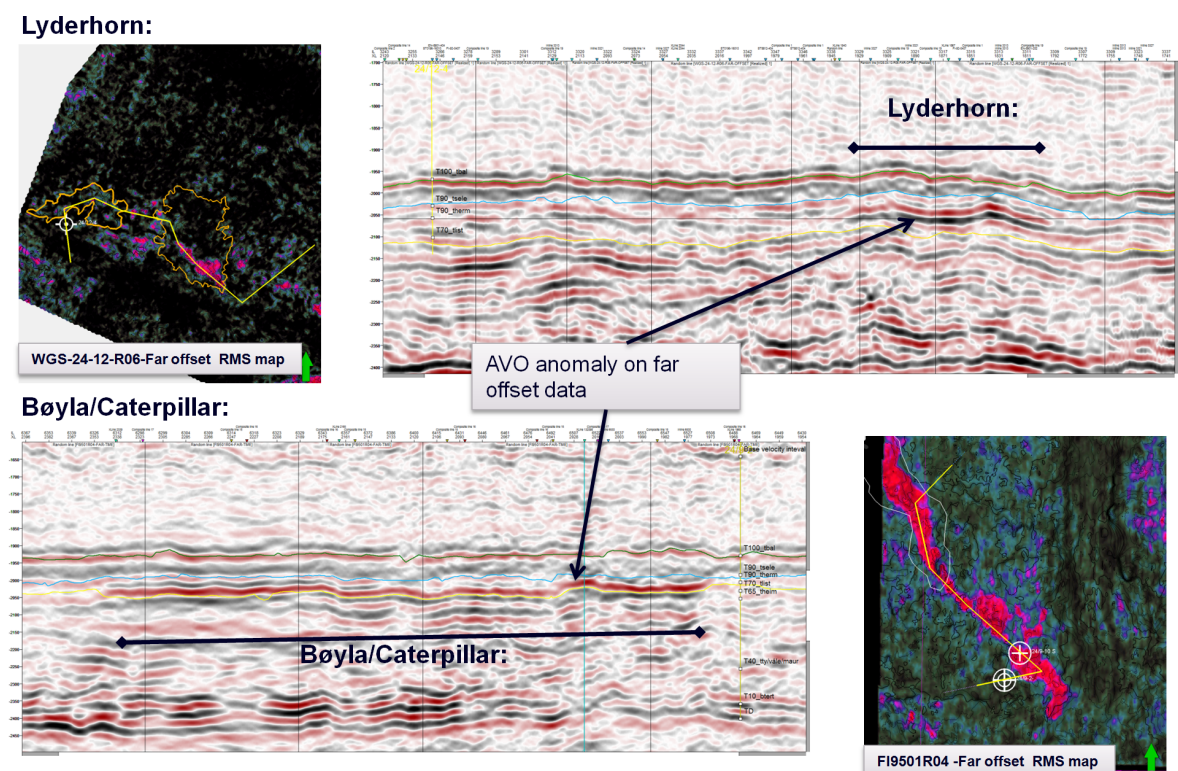


Fig. 4.2 Lyderhorn vs. Bøyla / Caterpillar

Table 4.1 Remaining prospectivity

PL341					Gross Recoverable Reserves/Resources					
					Low		Base		High	
Category	Reservoir Level	HC	RF(%)	Pos(%)	Oil (MSm ³)	Gas (MSm ³)	Oil (MSm ³)	Gas (GSm ³)	Oil (MSm ³)	Gas (GSm ³)
Prospects										
Linderudkollen	U. Jurassic	gc	75/45	22.00	7.40	8.00	11.10	12.00	14.90	16.10
Hansakollen Upper	U. Jurassic	gc	70/45	18.00	8.20	8.30	10.00	10.20	11.90	12.00
Hansakollen Deep	U. Jurassic	gc	70/40	20.00	10.20	11.60	14.70	16.80	21.00	23.90
Spinnern	Heimdal	oil	40	20.00	4.60	N/A	6.80	N/A	9.50	N/A
Haukåsen	Heimdal	oil	40	20.00	3.80	N/A	7.20	N/A	11.60	N/A
Lyderhorn Main	Hermod	oil	40	34.00	2.30	N/A	2.80	N/A	3.40	N/A

The lisencc group have decided to relinquish the lisencc based on the cost of the area fee together with the high cost/low volumes ratio in Upper Jurassic and Palaeocene traps sensitive to depth conversion and to small volumes.