Relinquishment report PL549S

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1 INTRODUCTION

1.1 Licence owners

- **Det norske oljeselskap ASA (35 %) , operator**
- Svenska Petroleum Exploration AS (25 %)
- Dana Petroleum Norway AS (20 %)
- Bayerngas Norge AS (20 %)

1.2 Award and work program

The PL549S license was awarded 19.02.2010 as an APA 2009 license, valid to 19.02.2020. The license outline and nearby Fields and discoveries are seen in Fig. 1.1. The license is stratigraphical devided to all levels below Top Cretaceous.

The work program for this award included:

- Acquire 3D seismic, G&G studies
- DoD within 19.08.2014
- BOV within 19.02.2018
- PDO within 19.02.2020

Two prospects and two leads have been mapped within PL549S. The Kolsås S and Kikut prospects and Gyrihaugen lead are all Middle Jurassic structural traps where the Tarbert Formation provides the primary reservoir. The northern part of the Kolsås structure was tested by the 30/10-6 discovery well. The Oppkuven lead is interpreted as an Upper Jurassic basin floor fan.

Kolsås S has the largest volumes and has always been considered the main prospect in the license. The Kolsås S prospect is shown by the geoseismic section Fig. 1.2.

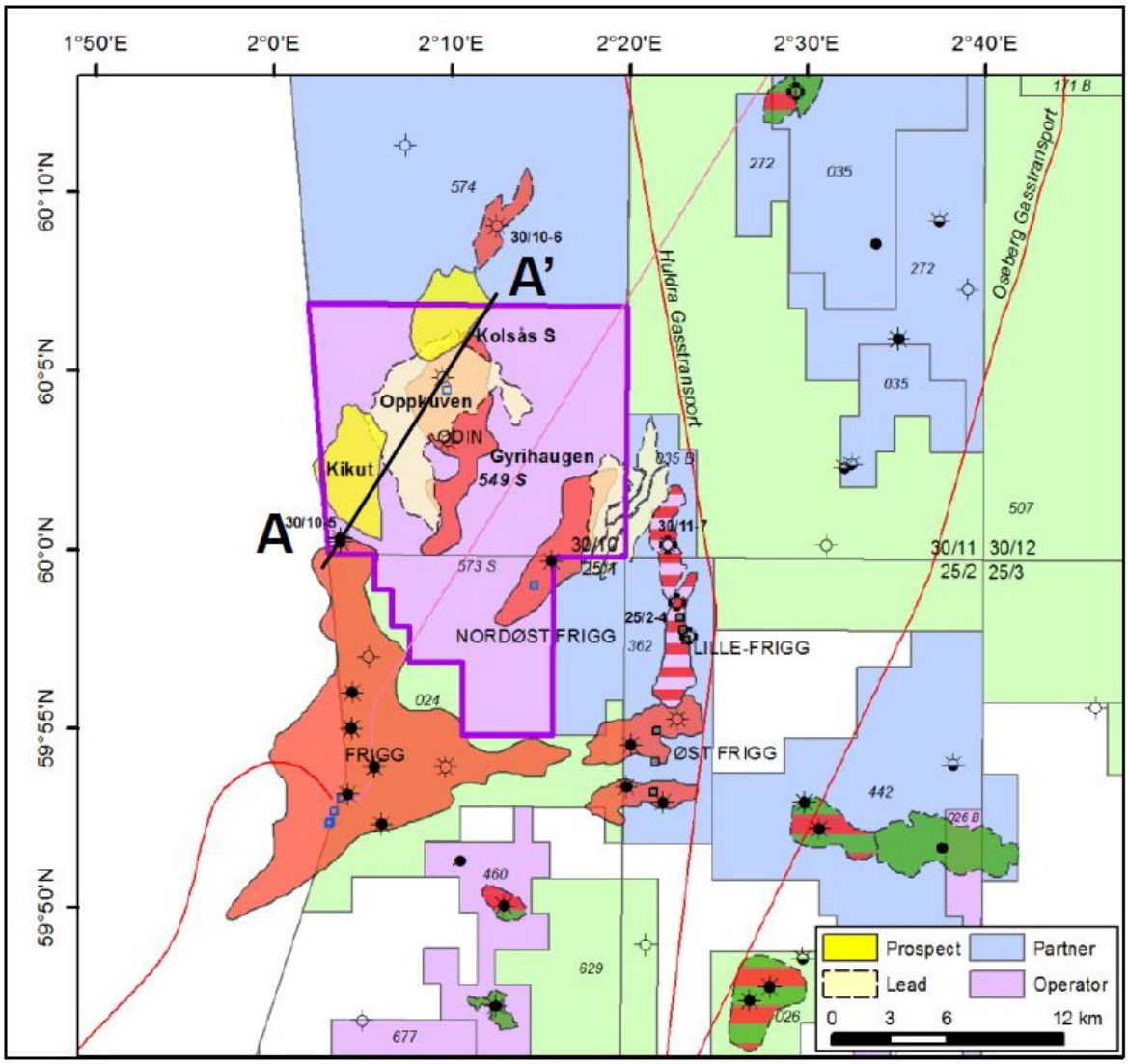

Fig. 1.1 License outline with prospects and leads. *The license outline and nearby Fields and discoveries.*

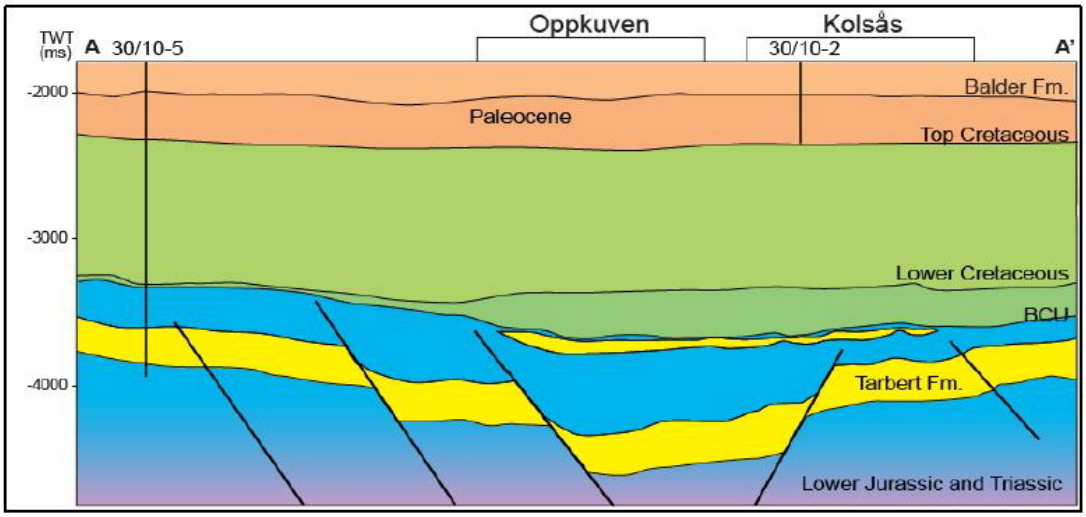

Fig. 1.2 Geoseismic section of the Kolsås S prospect. *Kolsås S, Oppkuven and Kikut prospects along line A-A'.*

1.3 PL549S prospectivity

The main prospect, Kolsås S, is spanning the border between PL574 (ca 30%) and PL549S (ca70%). The main risk for Kolsås S is the reservoir quality because the top of the reservoir is situated at nearly 5000m depth. The seal is also a risk since the overpressure is estimated to be 500 bar. The 30/10-6 well is a HPHT well. Hydrocarbons were encountered in two zones: Zone 1, the upper Tarbert, which produced gas at a rate of 90.000 Sm3/day (much lower than expected), and Zone 2, the lower Tarbert, which was tight. CPI logs suggest a GWC at 5055mMSL. The contact gives a potential column height of 375m (top structure 4680m).Top reservoir depth map is shown Fig. 1.3, indicating that Kolsås S may be charged from almost any direction with spill towards the north.

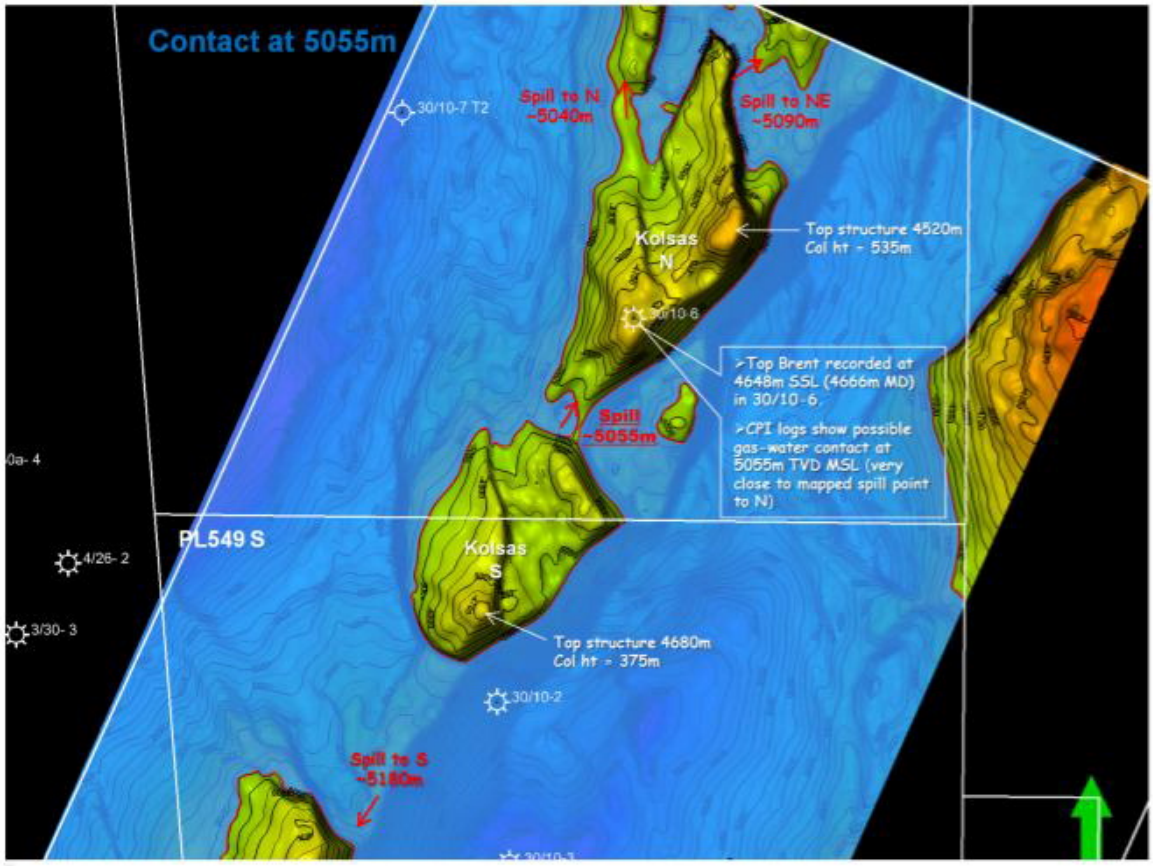

Fig. 1.3 Top Brent depth map. *Top reservoir depth map with 375m column height and spill towards north.*

The Kikut prospect is located north and downflank of the Frigg High and separated from this high by a NW-SE fault. The Frigg High have been tested by 2 wells, 30/10-5 and 25/1-10. Both wells were dry. Brent has an overpressure of 480 bar in 25/1-10, and this brings pressure to fracture gradient at the apex. Slightly higher overpressure is assumed for the Kikut prospect. The Kikut prospect has a high risk on trap/seal failure. Sand to sand juxtaposition is expected across the bounding fault to the south, where the throw is 140m-200m (may be as little as 60m locally). The Brent Group sands are 279m thick (i.e. in nearby 30/10-5). The assumed high pressure, probably higher than in 25/1-10, may fracture the fault zone or cap rock. Leakage to the Frigg High is therefore likely. Top reservoir depth map is illustrating the Kikut prospect Fig. 1.4.

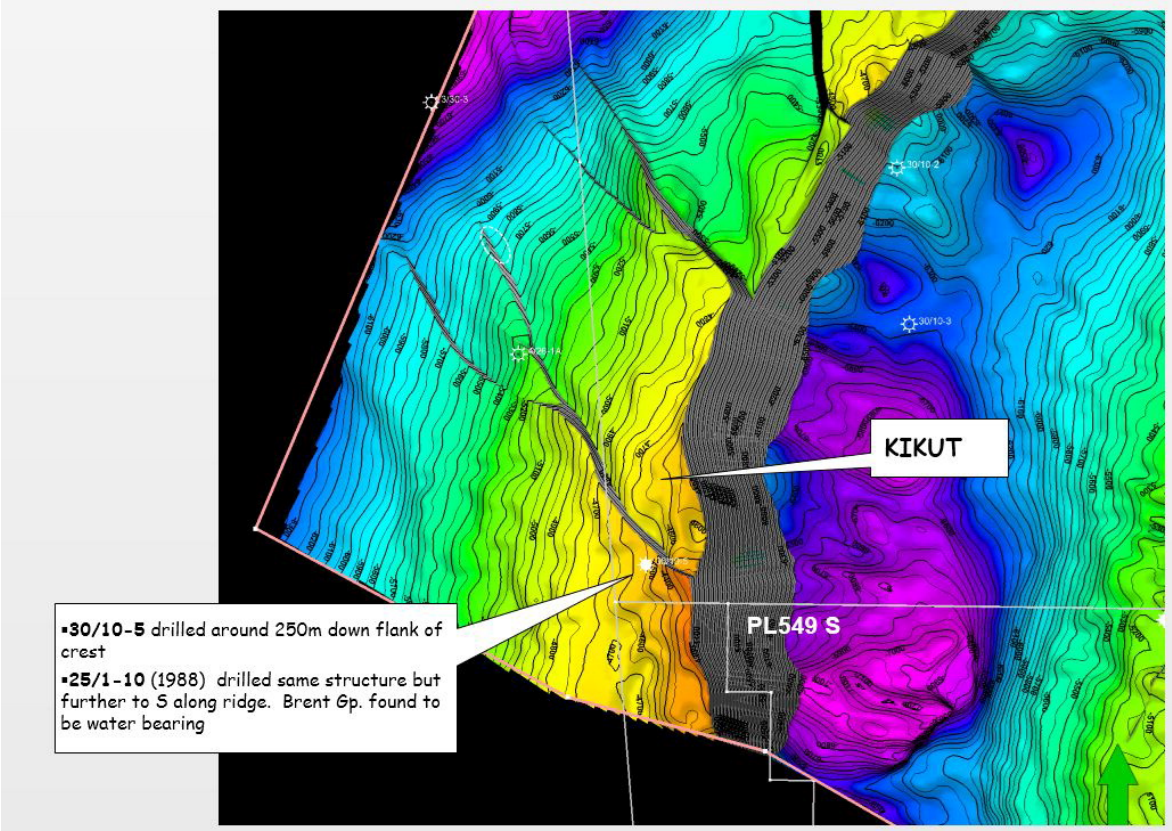

Fig. 1.4 Top Brent depth map. *Top reservoir depth map showing the Kikut prospect.*

The Gyrihaugen lead consists of two westward rotated fault block segments (S1-S2) that are downfaulted relative to each other, and located west of the Fulla discovery.Gyrihaugen is considered to have a high risk on trap: Small faults and no welldefined trap. Top reservoir depth map is illustrating the Gyrihaugen lead Fig. 1.5.

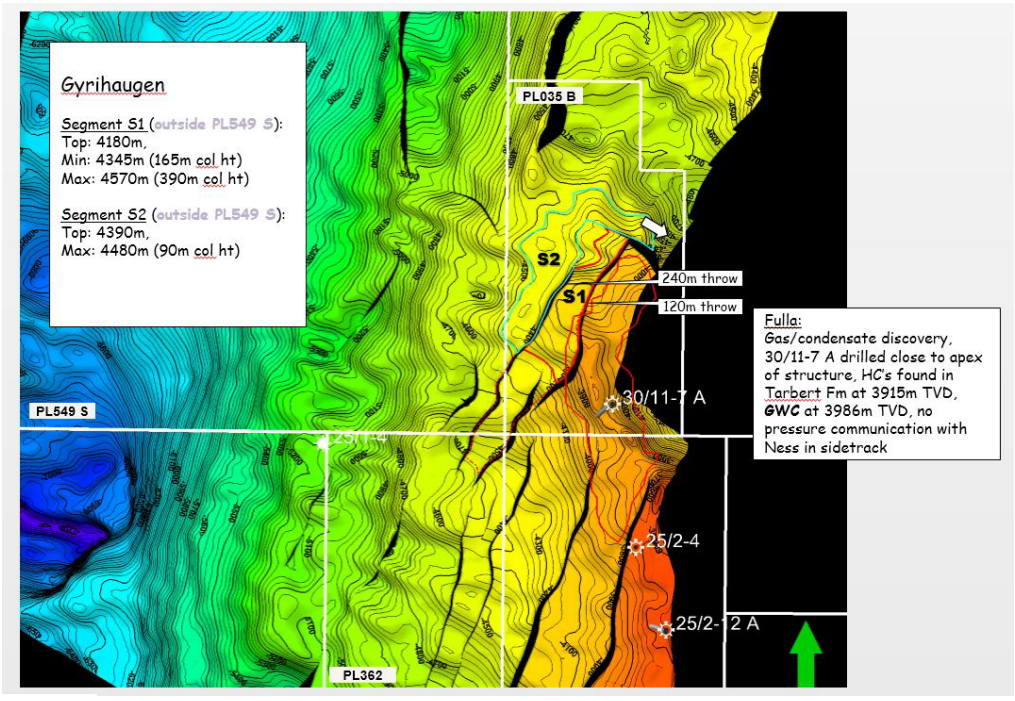

Fig. 1.5 Top Brent depth map. *Top reservoir depth map showing the Gyrihaugen lead.*

The Oppkuven lead comprises an Upper Jurassic sandstone wedge which pinches out in three directions and is fault bounded to the southwest. On earlier seismic data the lead was identified by a possible flatspot, but this is not observed on the new seismic data. The Oppkuven lead has a high risk on reservoir. Although recorded in UK well 4/26-1A, the presence of Upper Jurassic sands further to the east is uncertain and would require either long distance sediment supply from the west, or more proximal supply from the east. In addition the reservoir quality is uncertain at this depth (4730mMSL). The lead also has a high risk on trap, as it is a poorly defined stratigraphic trap, with uncertain pinchouts to the east, north and west. Seismic reservoir characterization has been performed, and cross plotting of the elastic parameter AI versus Vp/Vs shows no signs of hydrocarbon- filled sand in the Oppkuven lead. Top reservoir time map is illustrating the Oppkuven lead Fig. 1.6.

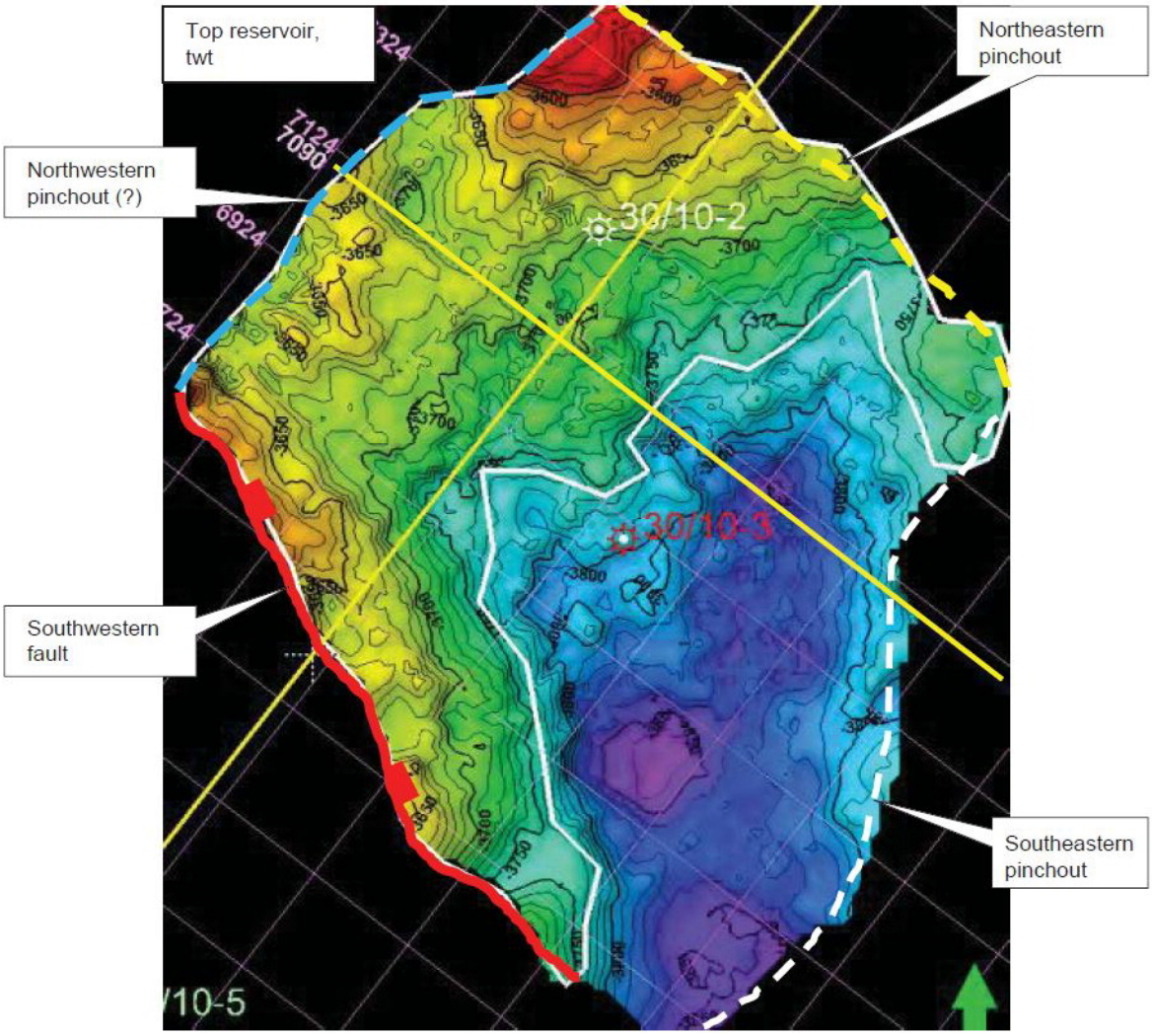

Fig. 1.6 Top Upper Jurassic time map. *Oppkuven delineatin map.*

The expected recoverable resources for the two prospects and the two leads are shown below Table 1.1.

Table 1.1 PL 549S Recoverable resources. Expected recoverable resources for the prospects and leads.

PL 549S					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										
Kolsås S	Middle Jurassic, Brent Gp.	gas	0,65	38		4,6		14,5		24,5
Kikut	Middle Jurassic, Brent Gp.	gas	0,65	21		1,9		5,8		10,7
LEADS										
Gyrihaugen	Middle Jurassic, Viking Gp.	oil/gas	0,65	21	0,2	1,2	0,9	4,1	1,7	7,5
Oppkuven	Upper Jurassic, Viking Gp.	oil/gas	0,7	10,0	7,2	26,5	12,1	35,3	17,5	45,4

2 DATABASE

2.1 Seismic database

The seismic database is shown in Fig. 2.1.

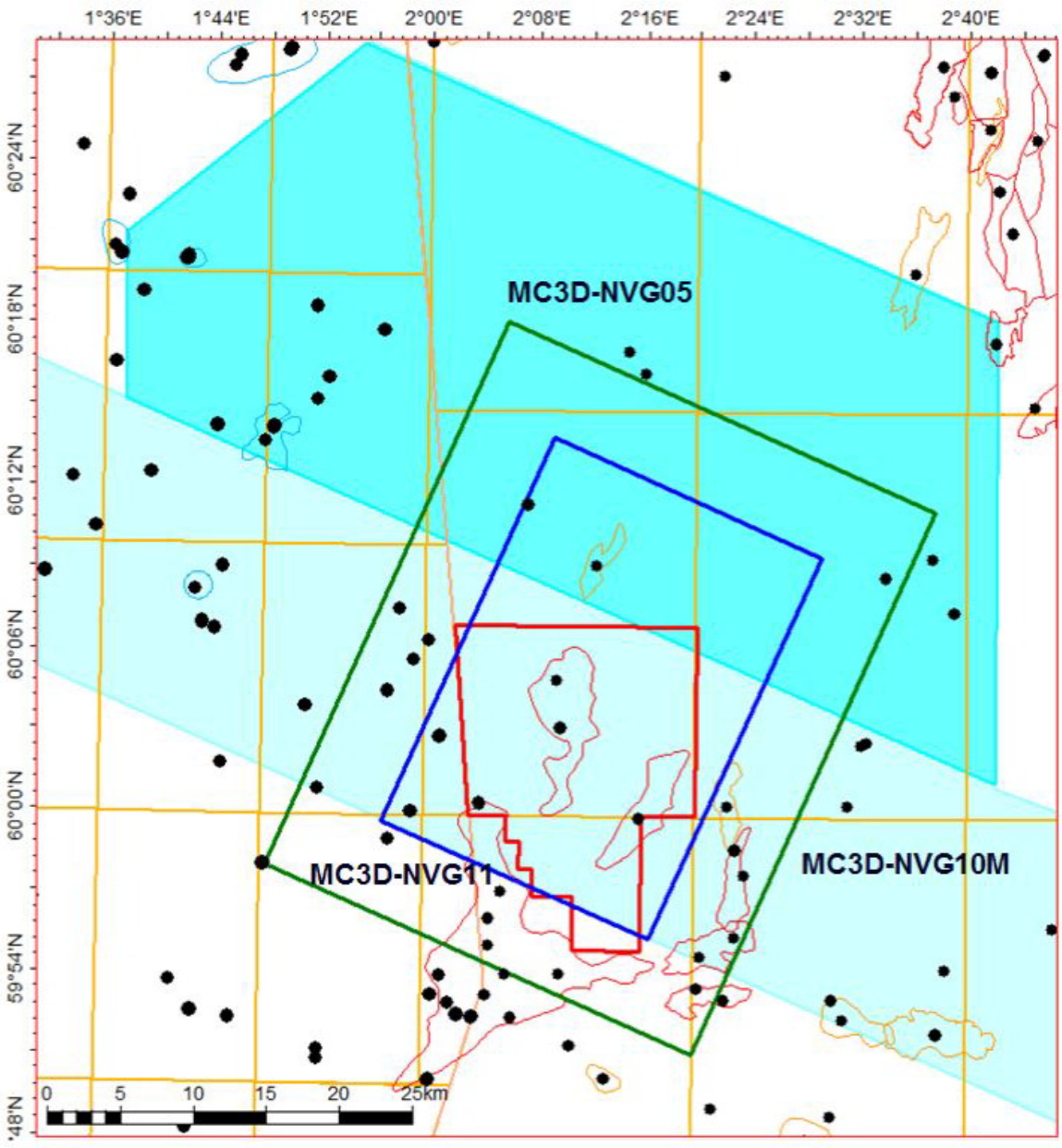

Fig. 2.1 Seismic database. *3D surveys used in the prospect and lead mapping.*

With reference to the committed work program for PL549S, the surveys NVG05,10M and 11 in PL549S was reprocessed by CGGVeritas in 2012. The area covered 1314 sq.km. of reprocessing area, where output from the migration is approximately 580 sq.km. The geophysical aspect and objective was to perform a good multiple attenuation in the area. The main problem was internal multiples below the BCU.

The final deliveries for the NVG11MDNR12 were: Table 2.1

Table 2.1 NVG11MDNR12 deliverables

Delivery of products according to contract	Completion date	Place of delivery
1. Pre-PSDM Gathers (Time) Input to migration	15/03/2013	Iron Mountain Norge
2. PSDM Gathers (Time) Final RMO, no Radon	22/01/2013	Trondheim office
3. PSDM Raw Stacks (Time) full, near, mid, far, ultra-far	20/02/2013	Petrobank
4. PSDM Final Stacks (Time & Depth) full, near, mid, far, ultra-far	06/03/2013	Trondheim office
5. RMO Velocity (Vrms, Time)	31/01/2013	ftp site
6. RMO Anellipticity (Time)	31/01/2013	ftp site
7. PSDM model, Velocity (Vrms, Time)	31/01/2013	ftp site
8. PSDM model, Velocity (Vint, Depth)	31/01/2013	ftp site
9. PSDM model, Delta, Epsilon (Depth)	26/02/2013	ftp site
10. PSDM model, Phi, Theta (Depth)	26/02/2013	ftp site

2.2 Well data

The wells in the common database for PL549S are shown in Fig. 2.2. The wells are also shown in Table 2.2, which includes well name, CPI, Pressure, Biostrat, and Checkshots.

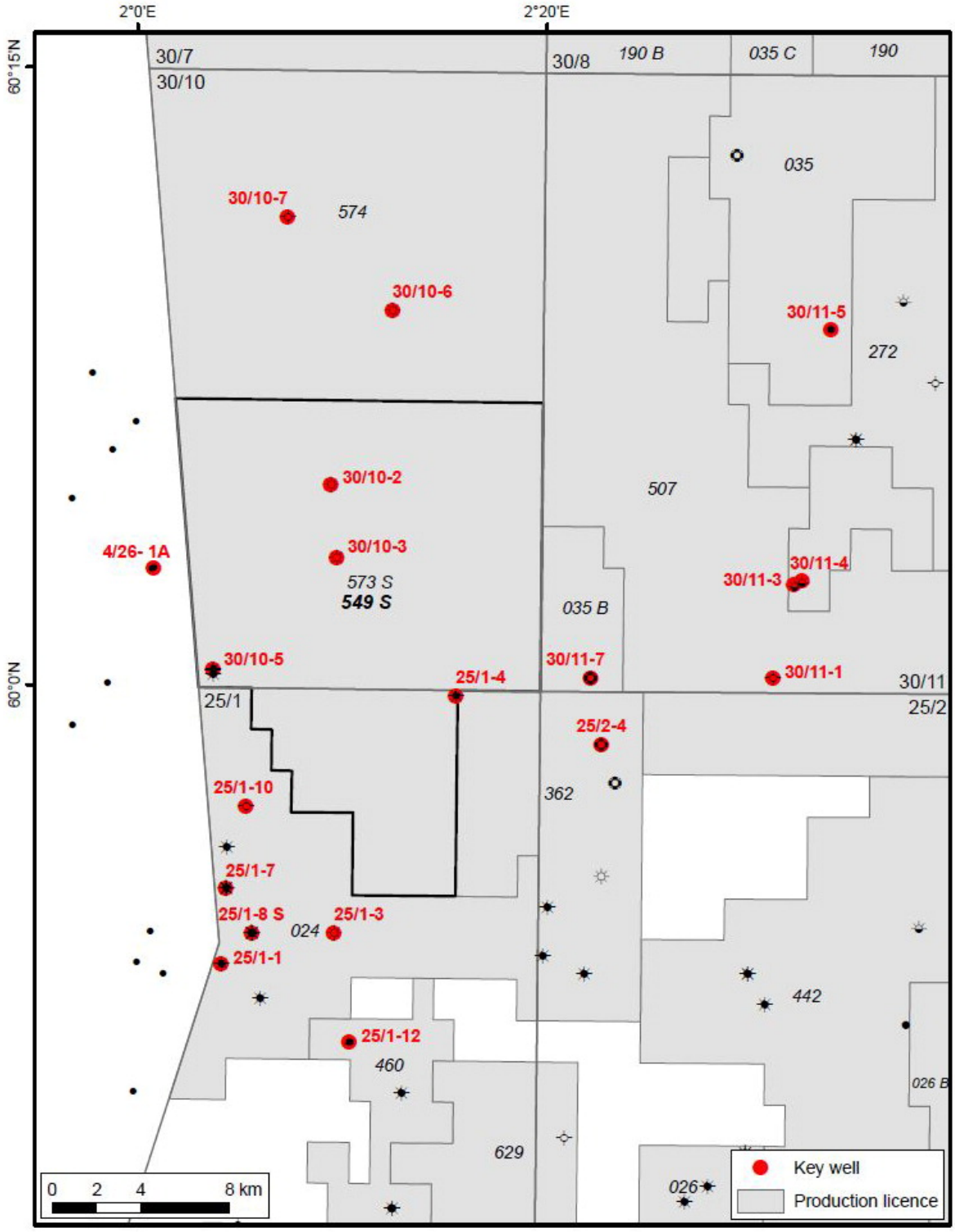

Fig. 2.2 Map of common well database

Table 2.2 Common well database

Well Name	CPI	Pressure Data	Biostrat Data	Checkshot survey
25/1-1				x
25/1-10	x	x		x
25/1-3				x
25/1-4	x			x
25/1-7				x
25/1-8 S				x
25/2-1		x		x
25/2-12	x		x	x
25/2-4	x		x	x
25/2-5			x	x
30/10-1				
30/10-2				x
30/10-3				x
30/10-5	x		x	x
30/10-6	x	x	x	x
30/10-7				x
30/11-1				x
30/11-3	x			x
30/11-4		x		x
30/11-5	x			x
30/11-7	x			
30/11-7 A	x			
30/7-7			x	x
UK 4/26-1A	x		x	

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 PL549S prospectivity. These studies include:

Core description
Core description done by AGR on the wells 25/2-4,5,13 and 30/10-5,6 and 30/11-7A to better understand the range in different depositional environments, and the reservoir quality in middle Jurassic sandstones at depths ranging from 3400m-4700m.

Diagenesis and reservoir quality study
An in-house evaluation of the diagenesis and reservoir quality in the middle Jurassic using the wells 25/2-4,5,13, 30/10-6 and 30/11-7A. The diagenesis study was carried out to understand the controlling factors for the reservoir quality, and to predict/ model the porosity/permeability in different facies in the middle Jurassic succession.

Numerical interpretation of DST # 4 well 30/10-6
An in-house evaluation of this test which produced at a rate of 90000Sm3/day gas. Due to mud invation this upper reservoir zone was most likely damaged, and a new well with more modern mud and DST design should produce at much higher rates.