Relinquishment report PL573S

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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 PL573S license was awarded 04.02.2011 as an APA 2010 license, valid to 04.02.2019. The license outline and nearby fields and discoveries are seen in Fig. 1.1. The license is stratigraphical devided to all levels above Top Cretaceous.

The work program for this award included:

- Acuire 3D seismic, G&G studies
- DoD within 04.08.2014
- BOV within 04.02.2018
- PDO within 04.02.2019

Three prospects and four leads have mapped within PL573S. Odin South is a stratigraphic, four-way dip closure with Frigg Formation reservoir. This prospect has a COS of 80% due to a flat spot and the closed down Odin Field. Odin S has always been considered the main prospect in the license, and the prospect is shown by the geoseismic section in Fig. 1.2.

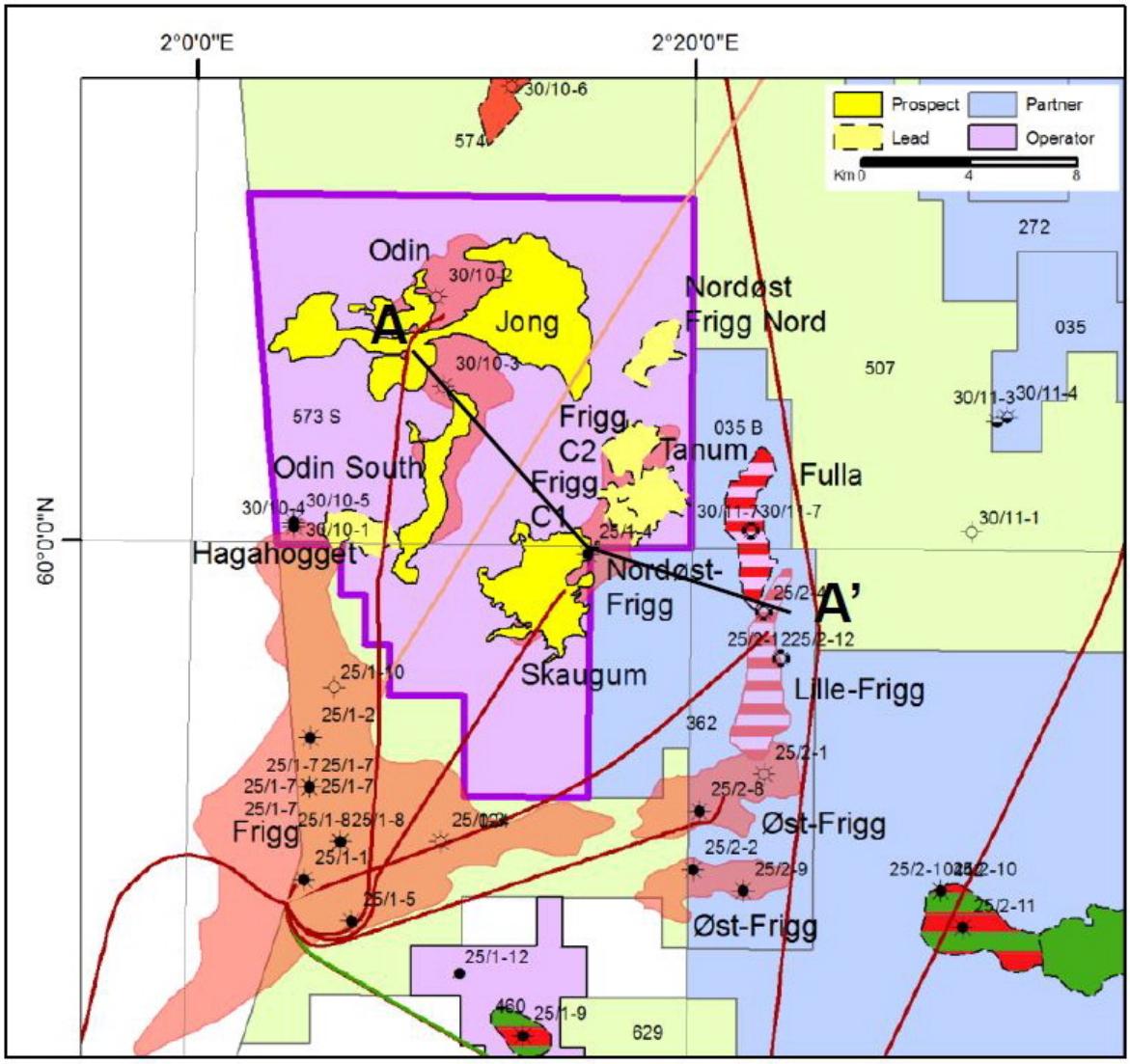

Fig. 1.1 License outline with prospects and leads. *The license outline with nearby Fields and discoveries.*

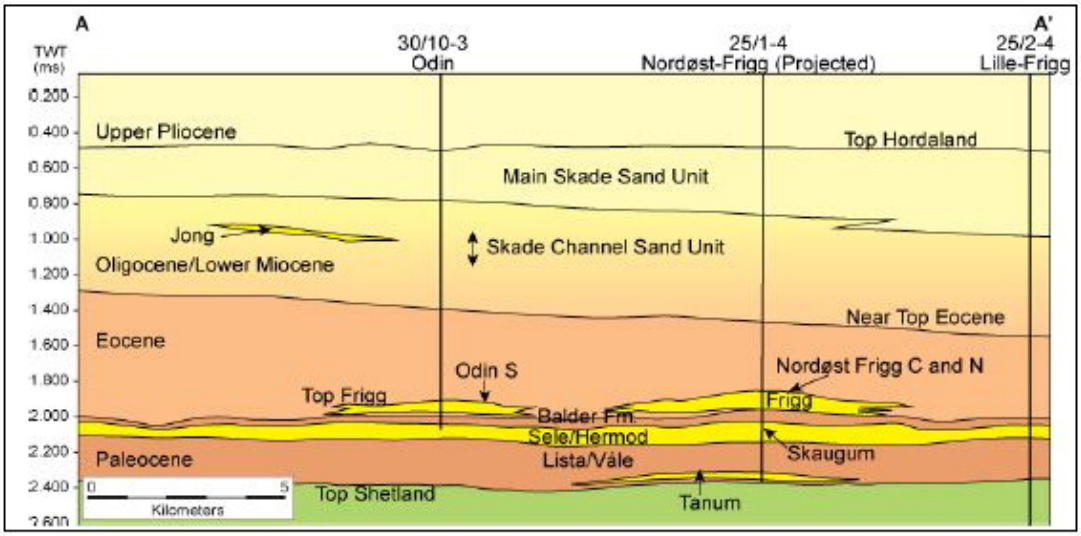

Fig. 1.2 Geoseismic section of Odin South along line A-A'.

1.3 PL573S prospectivity

The volume potential for the main prospect, Odin S, has been reduced since the APA application. The gas volume factor Vf (1/Bg) is very much dependant on the reservoir pressure at the end of the Odin production. Det norske has not succeeded in getting access to these data from the Odin operator Exxon, but published pressure data from the first 3 years of production shows the depletion trend, and it is obvious that the pressure by the end of production in Odin was lower than anticipated during the APA evaluation. This influences a reduced Vf from 182 Sm3/m3 (175-192 Sm3/m3) in the APA application to 77 Sm3/m3 in the operator's latest evaluation. The GRV is sensitive to the presence of none permeable lithologies at top of the reservoir in the saddle area and the velocity in the gas zone. This has been implemented with a span in GRV (30-110Mm3), which in general is less than the volumes in the APA evaluation (36-149-228Mm3). The recoverable gas volumes according to this evaluation are then:

Pmean = 0.8GSm3, P90 = 0.4GSm3, P10 = 1.2GSm3.
The Odin Field remaning in place volumes after production is estimated to be 11.7GSm3. This represent the volumes in the residual gas zone. The volumes in Odin S are expected to be trapped in the residual gas zone. Odin S top reservoir depth map is shown in Fig. 1.3.

The Skaugum prospect is a four-way closure with Hermod Formation as reservoir. Hermod sands are proven in the area, and the presence and quality of the sand are not a risk. The trap definition is low risk. The charge and migration into the prospect is regarded as a risk, while retention is regarded to be the major risk for the prospect due to faulting of the caprock. The COS is 9% for the Skaugum prospect. Due to low volumes and high risk the Skaugum prospect is not regarded to be a drillable prospect. Skaugum reservoir depth map is shown in Fig. 1.4.

The Jong prospect is a stratigraphic pinch-out trap, representing a east-west trending erosive channel. The reservoir is Skade Formation. The prospect needs a stratigraphic pinch-out upflanks to hold the hydrocarbon column. The major risk is regarded to be the seal, and the COS is only 3%. Jong reservoir depth map is shown in Fig. 1.5.

The four leads have reservoir sections in Frigg, Ty and Skade formations. They have either very low COS, or small volumes and none of them are regarded as drillable prospects.
The expected recoverable resources for all the prospects and leads asre shown below Table 1.1.

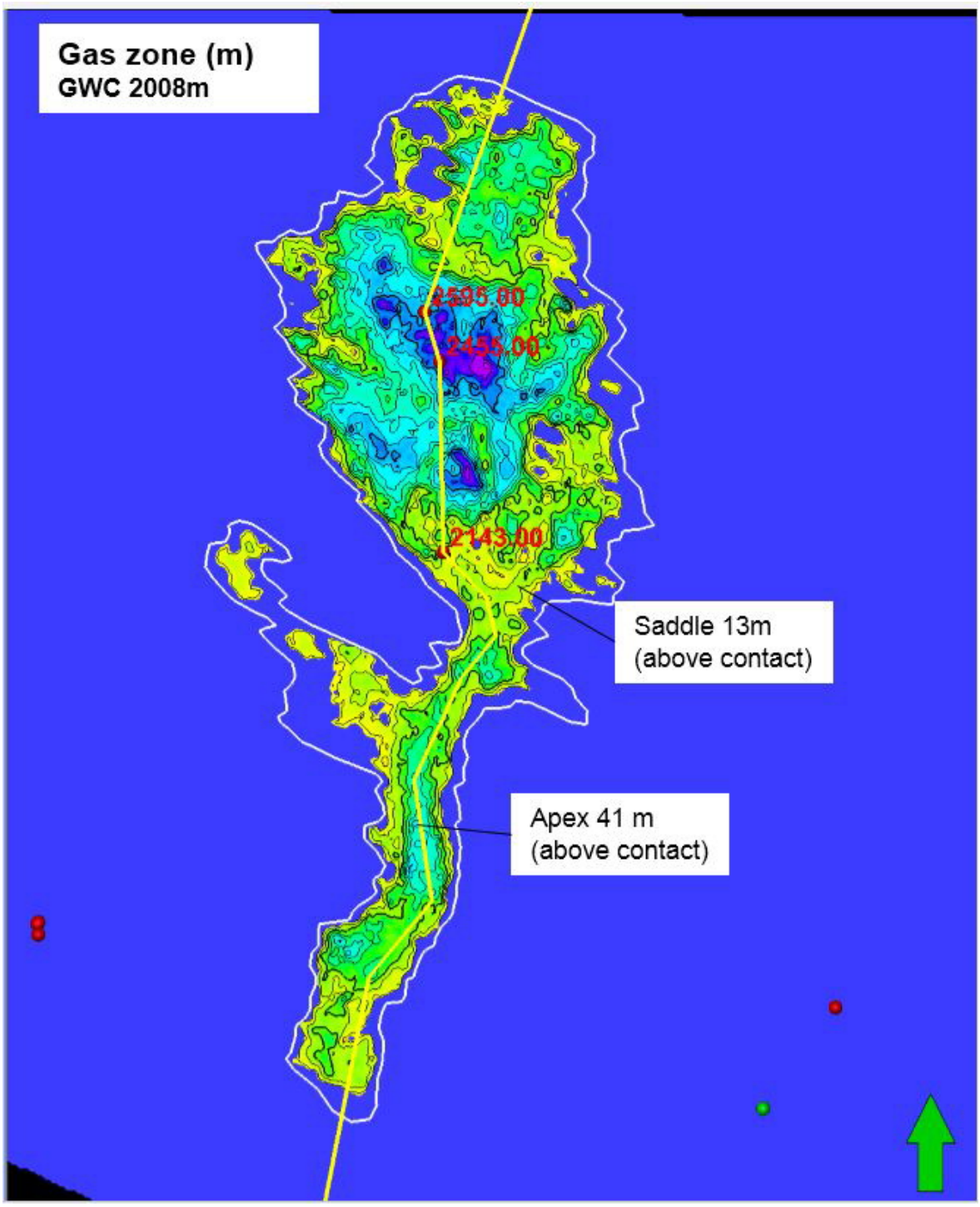

Fig. 1.3 Odin S top reservoir depth map. *Top Frigg depth map*.

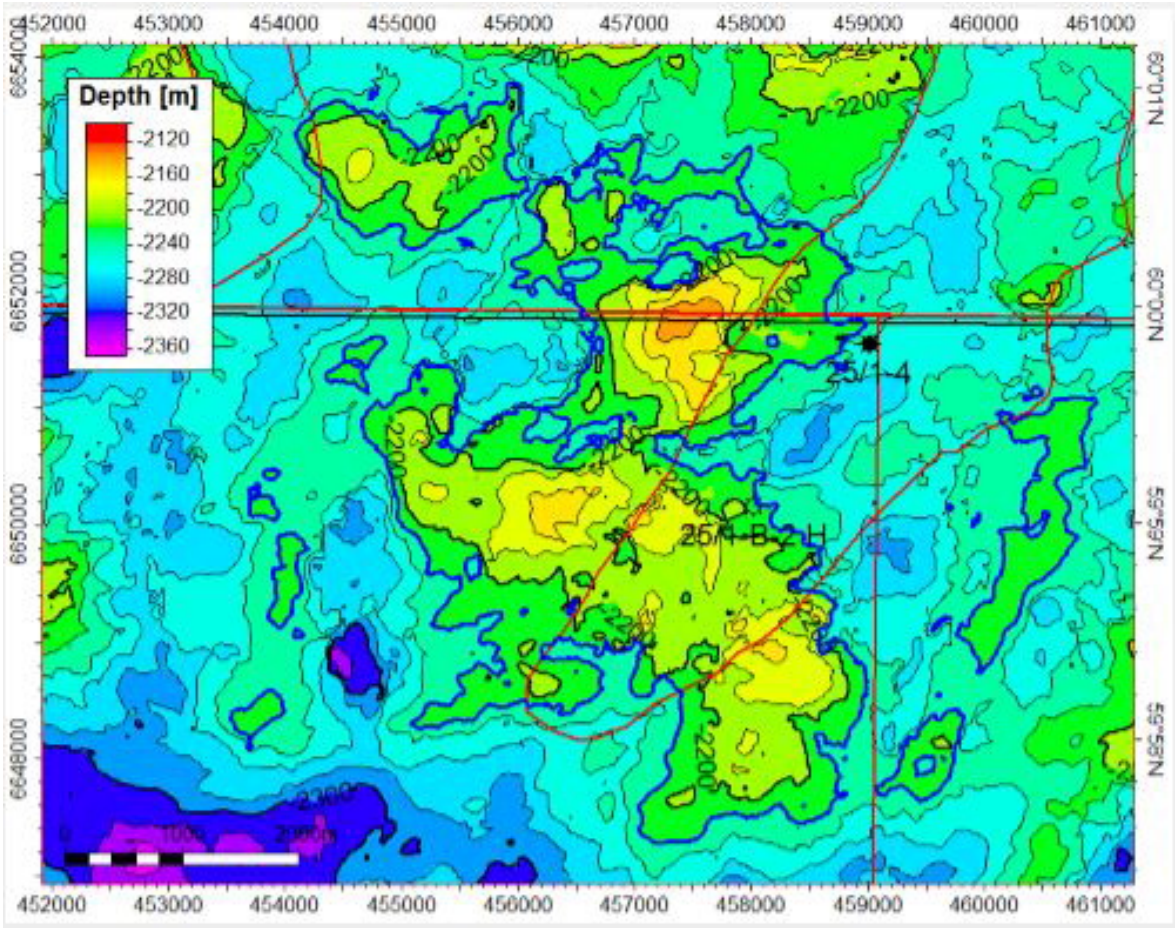

Fig. 1.4 Skaugum prospect depth map. *Top Hermod depth map.*

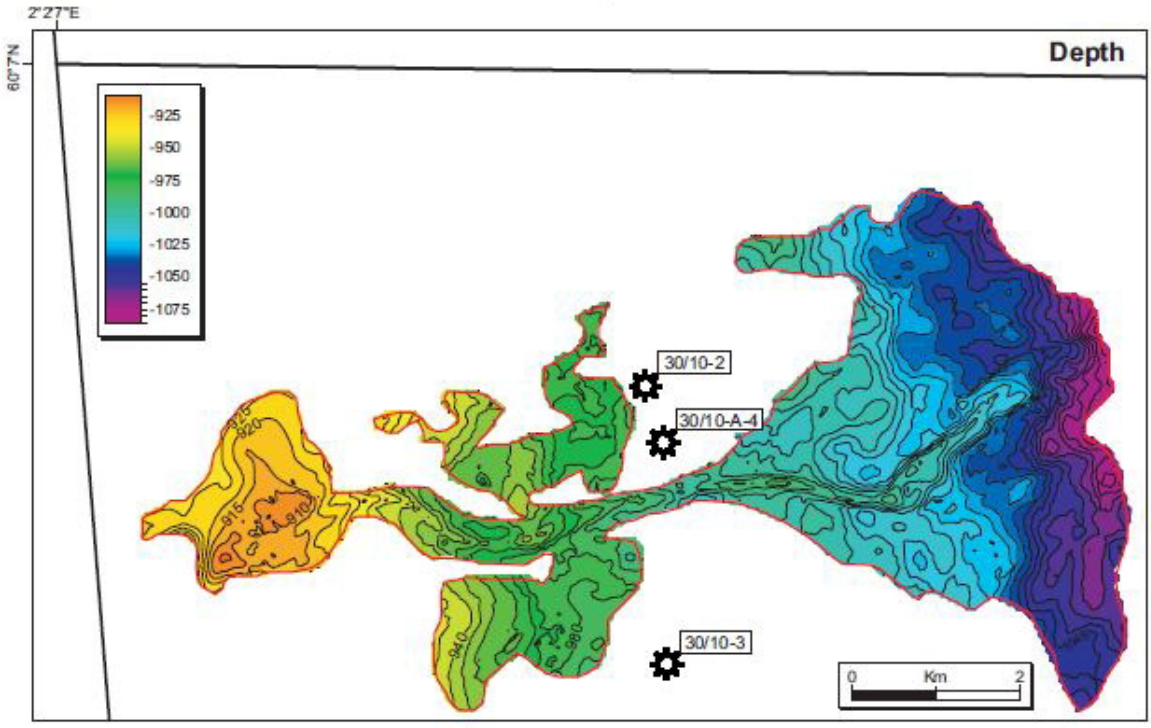

Fig. 1.5 Jong prospect depth map. *Top Skade depth map.*

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

PL 573S					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										
Odin South	Frigg	gas	0,70	80		0,4		0,8		1,2
Skaugum	Hermod	gas	0,70	9		2		3,6		7,9
Jong	Skade	oil	0,16	3	1,3		4,4		8,6	
LEADS										
Nordøst Frigg C	Frigg	gas		80		0,8		1,7		2,5
Nordøst Frigg N	Frigg	gas		15				2,0		
Tanum	Ty	oil		8	1,7		2,7		3,0	
Hagahogget	Skade	oil		8			2,5			

2 DATABASE

2.1 Seismic database

The seismic database is shown in Fig. 2.1.

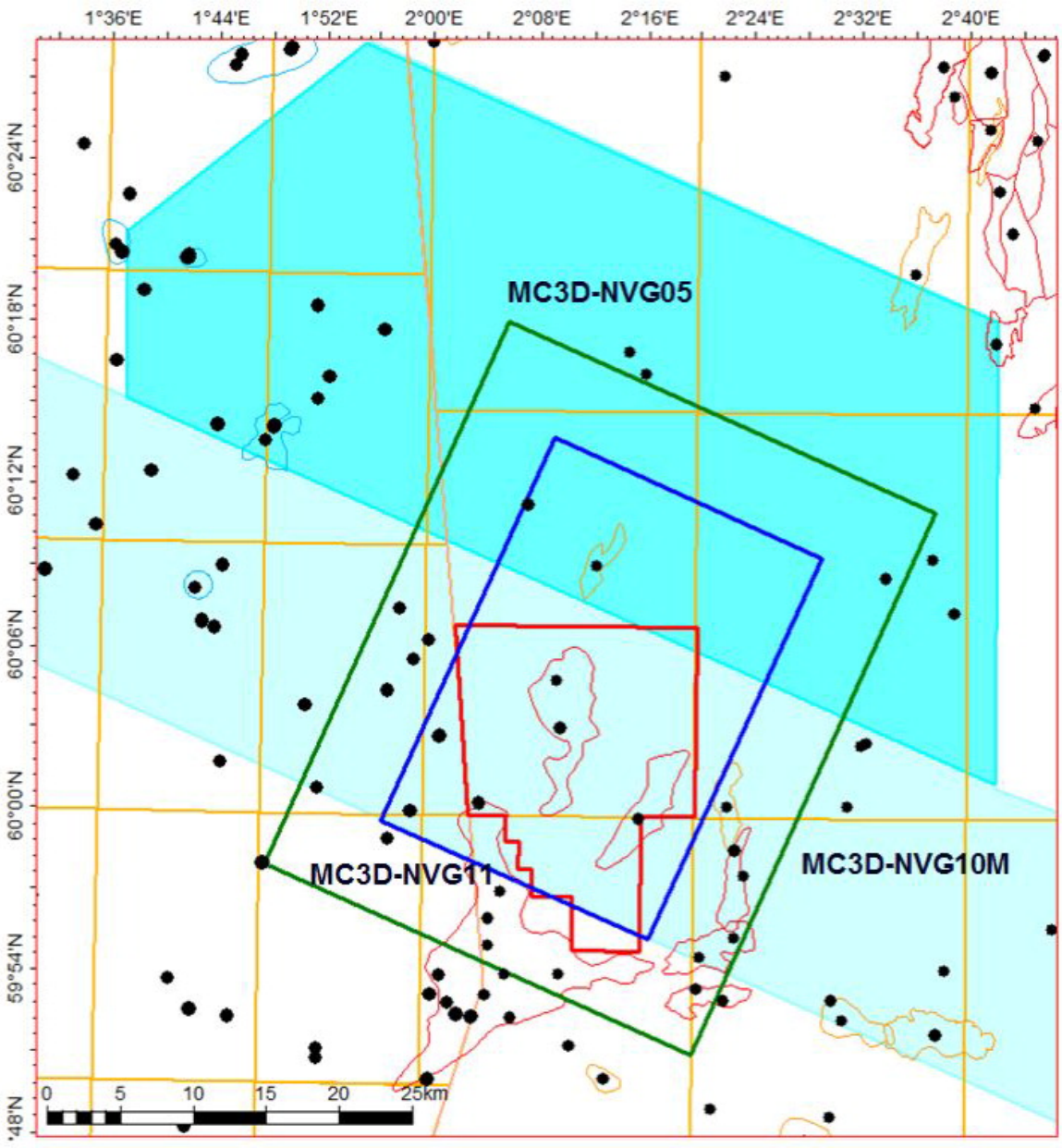

Fig. 2.1 Seismic database. *3D surveys used in the prospect and lead mapping.*

With reference to the committed work program for PL573S, the surveys NVG05, 10M and 11 were 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 final deliveries for the NVG11MDMR12 were: Table 2.1.

Table 2.1 Final deliverables NVG11MDNR12

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 PL573S are shown in Fig. 2.2. Key wells are marked in red. The wells are also shown in Table 2.2, which includes well name, CPI, Pressure, Biostrat and Checkshots.

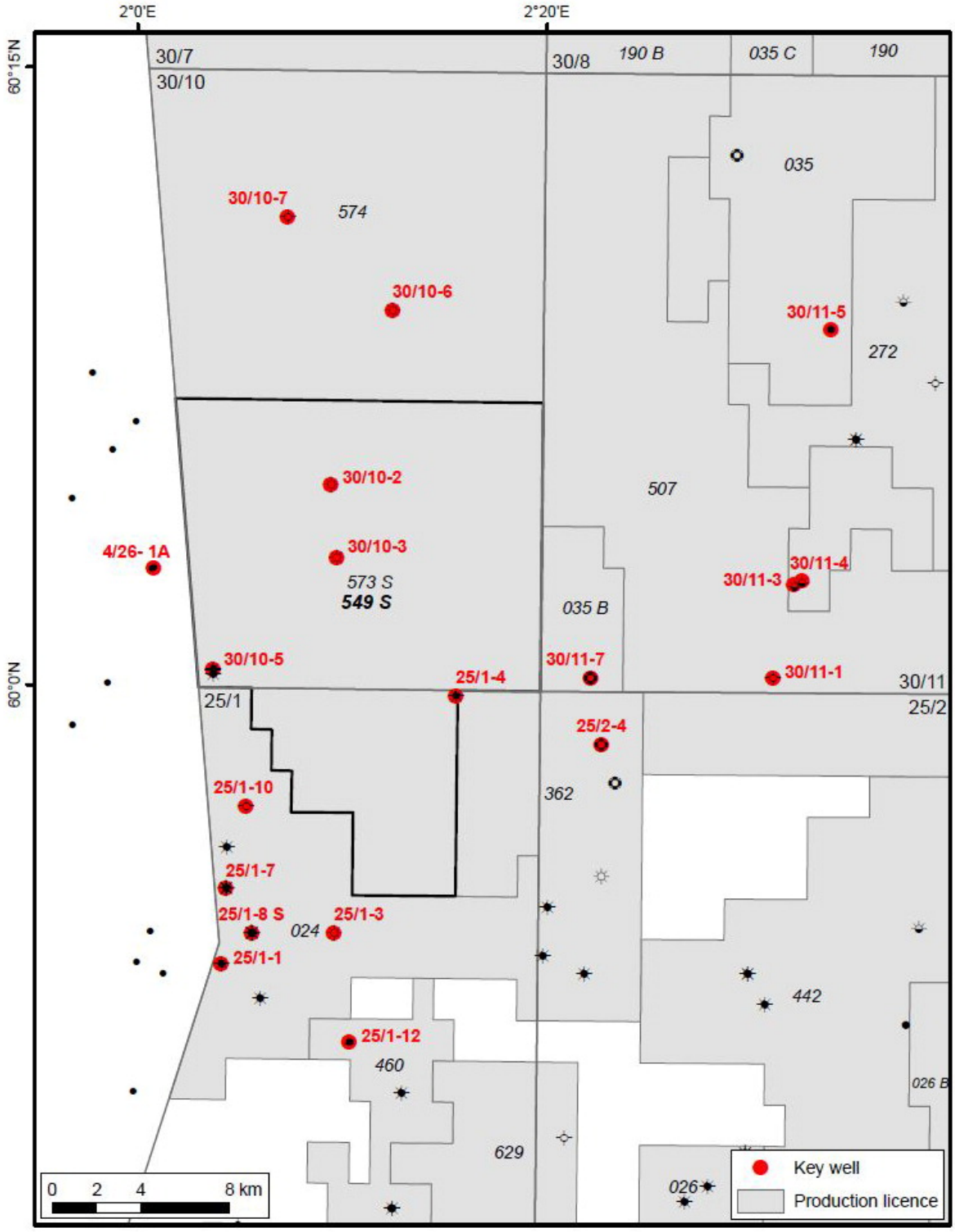

Fig. 2.2 Map of common well database

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 PL573S prospectivity. These studies include:

Seismic inversion studies

Inhouse(Hampson-Russell), Deterministic

Sharp Reflections, Stochastic

Geotrace, Stochastic

All these studies generated litholody-fluid cubes, with the purpose to discrimate between different lithologies, discriminate between HC and brine in the reservoir section and detection of any HCWC.

Acoustic velocity measurements, P- and S-wave measurements, in Frigg sandstone.
NGI study of the variabilities of P-and S-wave velocities in Frigg sandstone during depletion and pore fluid substituition of brine saturated sample with different degree of gas saturated sample.