# Relinquishment Report

# PL540

Block 3/6

DONG energy

NORECO

# PL540 Relinquishment Report

## List of figures

## List of tables

# 1 License history

Production license (PL) 540 covers the southern part of block 3/6. The license was awarded to Norwegian Energy Company ASA (Noreco) as Operator with 50% interest and DONG E&P Norge AS (50%) on 19.02.2010 in the frame of the Awards in Predefined Areas (APA) 2009.

On 11.12.2010 the group applied for a six month postponement of the drill or drop decision to 19.07.2011.

The license was active for 1,5 years and a total of 4 partner meetings were held during this period :

- 29.04.2010: MC meeting no. 1
- 14.12.2010: MC/EC meeting no. 2
- 19.01.2011: Status meeting for AVO and rock physics analysis
- 29.06.2011: EC meeting no. 1

The first phase of the work obligations that had to be fulfilled within one year, included reprocessing of 3D seismic.

In the APA 2009 application one prospect was identified. The Silke prospect is a Paleocene stratigraphic pinchout play within the Siri canyon.

After reprocessing the 3D seismic and an inversion study, the data quality and the understanding of the area were improved. Of special importance is the fact that the amplitude anomaly related to the prospect is now conformable with the structural closure. However, the size of the Silke prospect was now too small to justify an exploration well and the license was relinquished.

# 2 Database

The original common well database included both Norwegian and Danish wells, as listed in Table 2.1. The seismic database is listed in Table 2.2. List of the wells that have been used in this study and shown on Fig. 2.1.

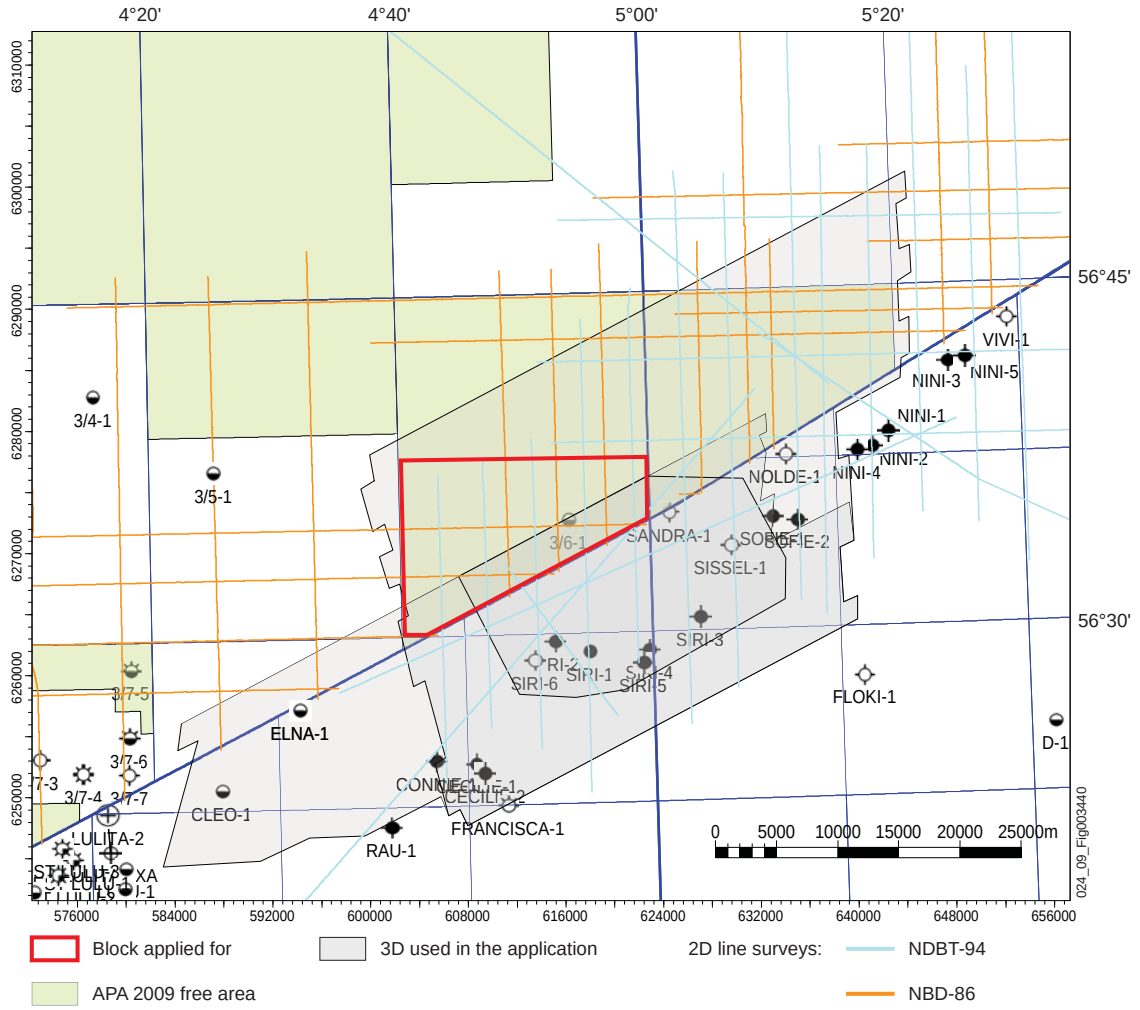


**Fig. 2.1 Seismic database**

*Table 2.1: List of the wells that have been used in this study*

| | | | |
|---|---|---|---|
| 3/5-1 | Elna-1 | Nolde-1 | Siri-4 |
| 3/6-1 | Fransisca-1 | Rau-1,-1A,-1B,-1C | Siri-5,-5A |
| 3/7-4 | Gulnare-1 | Sandra-1 | Siri-6 |
| Amalie-1,-1A | Nini-1,-1A | SCA-1 | Sissel-1 |
| Cecilie-1,-1A,-1B | Nini-2 | SCA-4 | Sofie-1 |
| Cecilie-2 | Nini-3 | Siri-1 | Sofie-2,-2A |
| Cleo-1 | Nini-4,-4A | Siri-2 | Tabita-1,-1A |
| Connie-1 | Nini-5,-5A,-5B | Siri-3,-3A | Vivi-1,-1A |

*Table 2.2: Seismic Database*

| Survey | Type | TWT (ms) | Area | Quality |
|---|---|---|---|---|
| SIRINOR-96 | | | | |
| - Near, Far | 3D | 4000 | 1316 km 2 | Good |
| NDBT-94 | 2D | 7000 | 1107 km 2 | Good |
| NDB-86 | 2D | 6000 | 938 km2 | Good |
| SIRITRYM-2003 | | | | |
| - Full, Near, Far | 3D merge | 4000 | 945 km2 | Good |
| - 5PG | 3D merge | 4000 | 945 km2 | Good |
| Simultaneous Inversion 1316 km2 | | | | |
| Absolute Acoustic Impedance | AVO | 1000-2750 | 322 km2 | Good |
| Absolute Poissons Ratio | AVO | 1000-2750 | 322 km2 | Good |
| VP/VS | AVO | 1000-2750 | 322 km2 | Good |
| Constrained Water Saturaion | Rock Physics | 1000-2750 | 322 km2 | Good |
| V clay binary | Rock Physics | | | |

# 3 Review of geological framework

The detailed description for the given geological framework for the area of the license can be found described in the APA (2009) application.

One prospect has been identified in block 3/6 i.e. the Silke Prospect. The Silke Prospect is located on the northern margin of the Siri Fairway channel SW of the 3/6-1 well. The prospect is down dip from the well and requires a stratigraphic seal to be effective. Two potentially hydrocarbon bearing sands were mapped; The Tyr Mb and the Rind Mb of the Lista Fm (Fig. 3.1). Critical for evaluating the play is the combination of high resolution seismic and inversion data that are optimally calibrated to local well control. AVO and attribute amplitudes should work well as lithology and fluid predictors. The evaluation at the time of the APA 2009 application showed that the seismic and the inversion data available were not optimal and had potential for improvement.

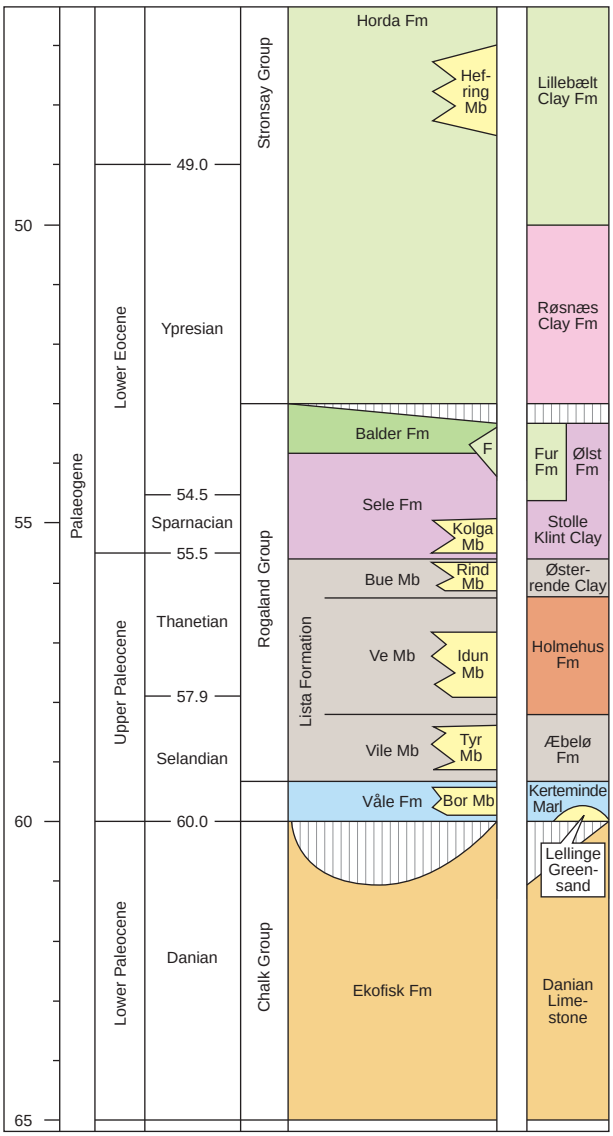


**Fig. 3.1 Lithostratigraphy of the Siri Fairway channel area.**

# 4 Prospect update

Noreco reprocessed the 3D data with WesternGeco (WG) as a Multi client processing effort. In order to avoid data defects as result of too many processing steps we asked WG to deliver CDP-gather data and velocity field to Schlumbergers Inversion department in Copenhagen.

Part of the inversion work was to make sure the seismic data match well with the log data from wells in the greater Siri area. Also final refinement of the input gather data and optimization for the elastic inversion process were done at the inversion expert lab in order to maintain data quality fit for the process.

In addition all the wells to be used from the greater Siri area were revisited from a rock physics view-point, and aligned with the seismic data in the wavelet estimation process.

Before going through this process the previous inversion run and results showed that we had potential anomalous values in a somewhat larger area than the mapped 4-way closure, this could indicate a stratigraphic component to the trap.

Noreco and our partner decided to do reprocessing because it was observed that the earlier processing had a 'whitening' (boost of higher frequencies) applied, and this is a violation for true inversion work.

The new and reprocessed dataset shows the same time structures as from earlier, however the inversion results and attributes now largely are confined to the relatively small 4-way closure.

2 maps are shown below, inversion attribute on a time map from before obligation license work (Fig. 4.1), and a similar map from the new inversion results Fig. 4.2

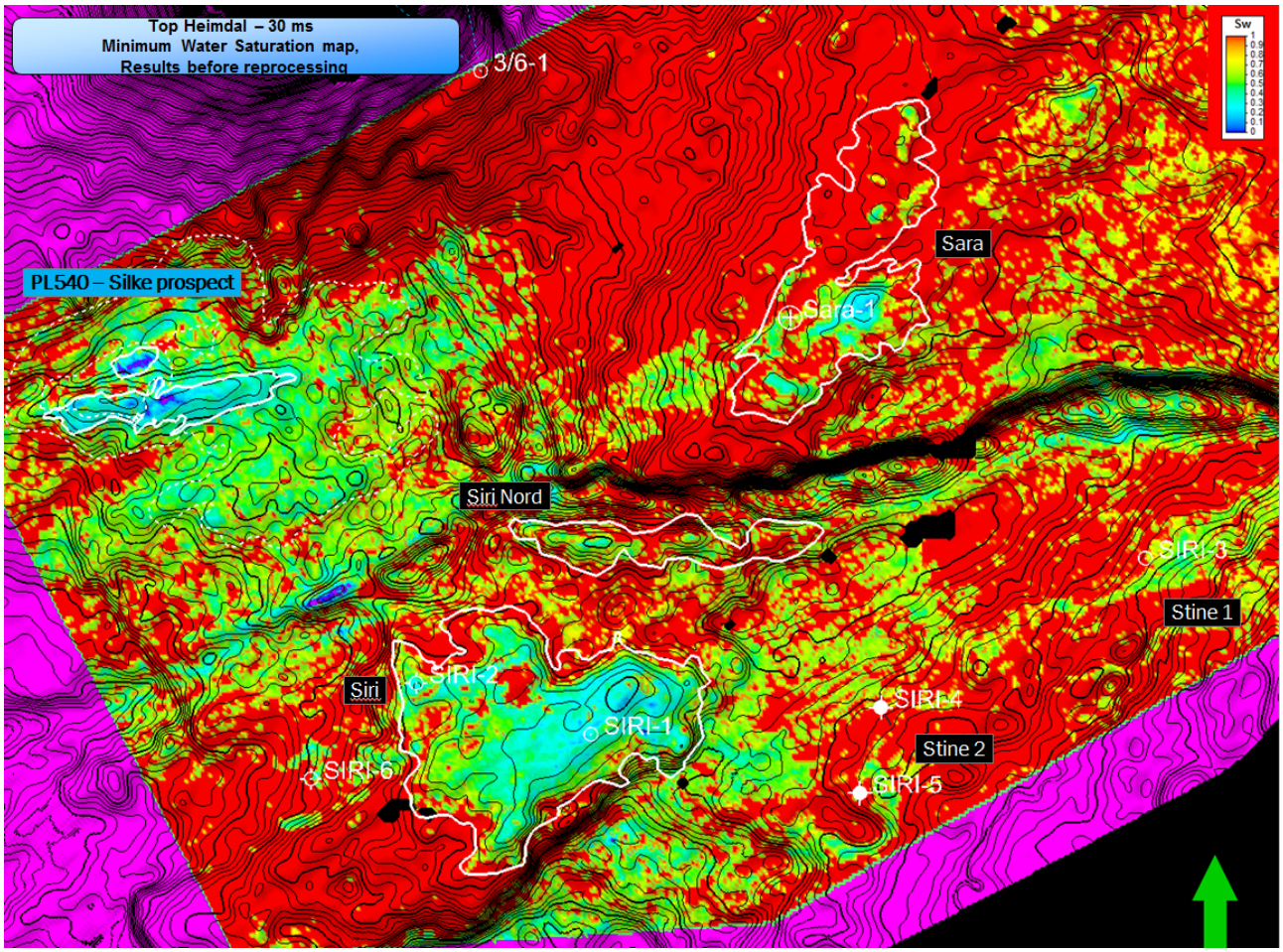


**Fig. 4.1 2009 inversion**

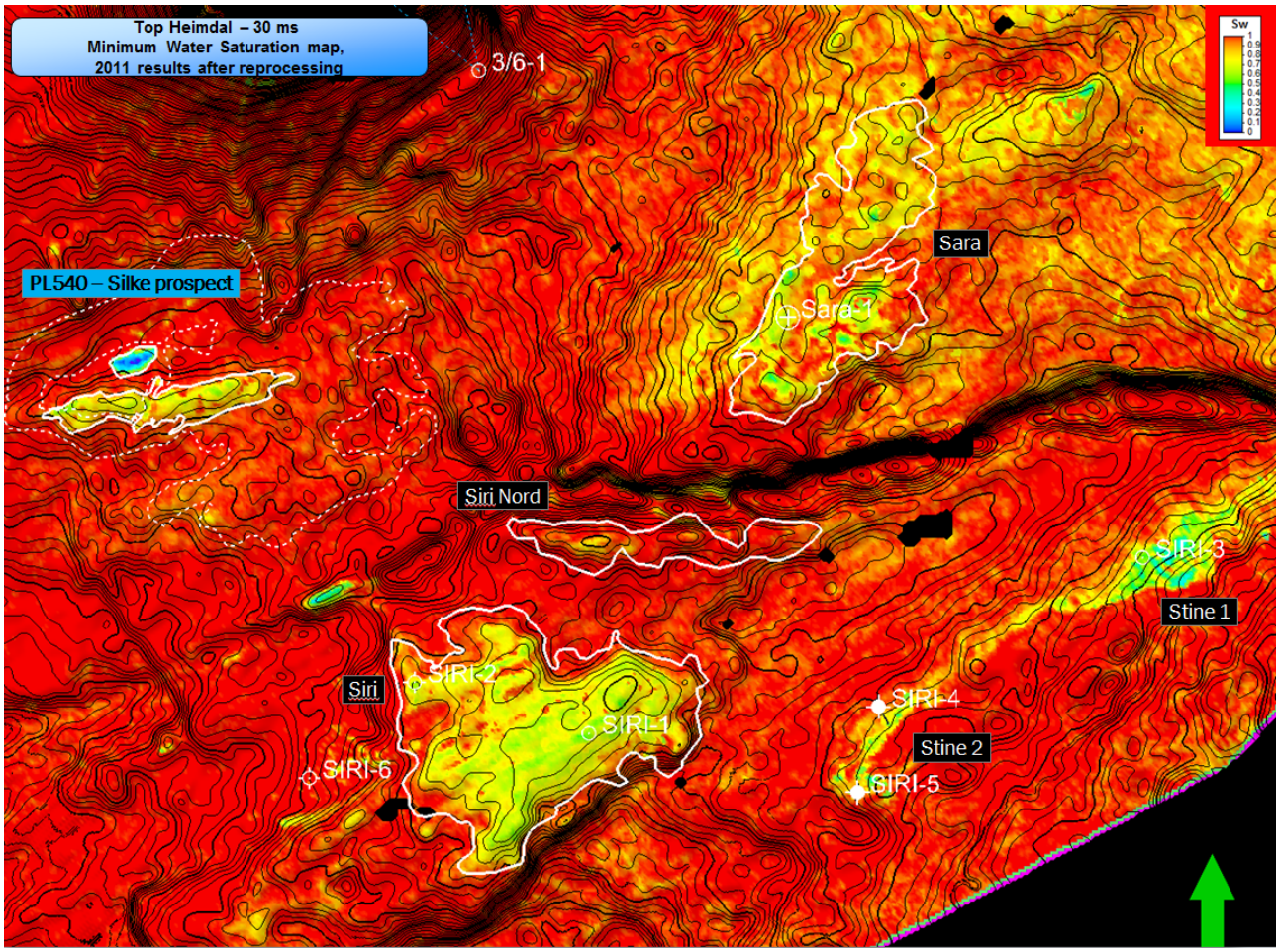


**Fig. 4.2 2011 inversion**

# 5 Technical evaluations

Technical evaluations were performed as part of the APA 2009 application. Due to the limited size of the Silke Prospect after the new evaluation, no further technical/economical studies hve been undertaken.

# 6 Conclusions

The Silke Prospect was the only opportunity identified in Block 3/6. With the data available at the time of application, the prospect shared many of the aspects of the discoveries along the Siri trend. AVO and attribute amplitudes should work well. After the reprocessing and a stringent calibration to local well control, the inversion study showed that the basic assumptions were valid. The Silke Prospect is most likely containing hydrocarbons, but only in the small four way closure. The potential volume of hydrocarbons are clearly uneconomic and the license was relinquished.

*Table 6.1 Silke prospekt data*

| Block | Prospect name | Discovery/Prosp/Lead | Prosp ID (or New!) | NPD approved? |
|---|---|---|---|---|
| 17/6 | Silke | Prospect | *NPD will insert data* | *NPD will insert data* |
| Play (name / new) | Structural element | Company/ reported by / Ref. doc. | | Year |
| *NPD will insert data* | Norwegian-Danish Basin | Noreco/Relinquishment report | | 2012 |

| Oil/Gas case | Resources IN PLACE | | | | | |
|---|---|---|---|---|---|---|
| Oil | Main phase | | | Ass. phase | | |
| | Low | Base | High | Low | Base | High |
| Oil 106 Sm3 | 1.7 | 2.2 | 2.8 | | | |
| Gas 109 Sm3 | | | | | | |
| | Resources RECOVERABLE | | | | | |
| | Main phase | | | Ass. phase | | |
| | Low | Base | High | Low | Base | High |
| Oil 106 Sm3 | 0.8 | 1 | 1.4 | | | |
| Gas 109 Sm3 | | | | 0.13 | 0.17 | 0.21 |
| | Which fractiles are used as: | | Low: | P90 | High: | P10 |

| Type of trap | Water depth (m) | Reservoir Chrono (from - to) | Reservoir Litho (from - to) |
|---|---|---|---|
| Structural/Strat. | 64 | Upper Paleocene | Rind Mb - Tyr Mb |
| Source Rock, Chrono | Source Rock, Litho | Seal, Chrono | Seal, Litho |
| Upper Jurassic | Tarsund/Bryne Fm | Paleocene | Lista Fm |

| Seismic database (2D/3D): | 2D/3D |
|---|---|

| Probability of discovery: | | | | | |
|---|---|---|---|---|---|
| Technical (oil+gas case) | Oil | | Prob for oil/gas case | | 0.53 |
| Probability (fraction): | Reservoir (P1) | Trap (P2) | Charge (P3) | Retention (P4) | |
| | 0.85 | 0.7 | 0.95 | 1 | |

| Parametres: | Low | Base | High | Comments |
|---|---|---|---|---|
| Depth to top of prospect (m) | | 2090 | | |
| Area of closure (km2) | | 4.2 | | |
| Reservoir thickness (m) | | 7 | | |
| HC column in prospect (m) | | 11 | | |
| Gross rock vol. (109 m3) | 0.3 | 0.33 | 0.37 | |
| Net / Gross (fraction) | 0.75 | 0.85 | 0.95 | |
| Porosity (fraction) | 0.25 | 0.29 | 0.32 | |
| Water Saturation (fraction) | 0.6 | 0.5 | 0.4 | |
| Bg. (<1) | | | | |
| Bo. (>1) | 1.4 | 1.3 | 1.2 | |
| GOR, free gas (Sm3 /Sm3 ) | | | | |
| GOR, oil (Sm3 /Sm3 ) | 120 | 130 | 140 | |
| Recovery factor, main phase | 0.27 | 0.33 | 0.35 | |
| Recovery factor, ass. phase | | | | |
| Temperature, top res (deg C) : | 68 | Pressure, top res (bar) : | | 127 |

For NPD use:

| Innrapp. av geolog: | | Registrert: | | Map OK: | | Nr: |
|---|---|---|---|---|---|---|
| Dato: | | Dato: | | Dato: | | |

# 7 References

APA (2009) - Application in Predefined Areas - Blocks 3/6

Schlumberger (2011): Simultaneous AVO & Rock physics inversion of the SIRINOR 2010 Reproc covering PL540 using the ISIS Software Package. Noreco ref #91360