wintershall dea

RELINQUISHMENT REPORT
PL944

equinor

PL944 relinquishment report summary

PL944 (Wintershall Dea Norge AS (Op) 40%, Equinor Energy AS 60%) was awarded in March 2018 with an initial work program of G&G studies and seismic reprocessing to reach a drill-or-drop decision at 2nd March 2021. All prospects presented in the APA 2017 document have been re-evaluated based on the completed seismic reprocessing WIN19M02. The main prospect Maiblom is a stratigraphic pinch out trap of the Springar Formation with some amplitude support. The other prospects in the license are smaller 4-way closures of the same Springar Formation. The main risk of all identified prospects in the license risks are trap efficiency and reservoir quality. The main driver for the license was to identify drillable targets based on the outcome of the Balderbrå appraisal and a potential Gullstjerne discovery and develop as additional resources to these discoveries. Unfortunately, the Balderbrå appraisal found only residual gas and Gullstjerne was plugged and abandoned as a dry well. The decision to relinquish is based on a significant risk of Maiblom and the other prospects to have residual gas in poor quality reservoir. The latest technical evaluations based on the reprocessed data indicate volumes and risks for which commercial development is challenging.

Table of Contents

List of Figures

List of Tables

Summary

PL944 (Wintershall Dea Norge AS (Op) 40%, Equinor Energy AS 60%) was awarded in March 2018 with an initial work program of G&G studies and seismic reprocessing to reach a drill-or-drop decision at 2nd March 2021. All prospects presented in the APA 2017 document have been re-evaluated based on the completed seismic reprocessing WIN19M02 (Fig. 1). The main prospect Maiblom is a stratigraphic pinch out trap of the Springar Formation with some amplitude support. The other prospects in the license are smaller 4-way closures of the same Springar Formation. The main risk of all identified prospects in the license risks are trap efficiency and reservoir quality. The main driver for the license was to identify drillable targets based on the outcome of the Balderbrå appraisal and a potential Gullstjerne discovery and develop as additional resources to these discoveries. Unfortunately, the Balderbrå appraisal found only residual gas and Gullstjerne was plugged and abandoned as a dry well. The decision to relinquish is based on a significant risk of Maiblom and the other prospects to have residual gas in poor quality reservoir. The latest technical evaluations based on the reprocessed data indicate volumes and risks for which commercial development is challenging.

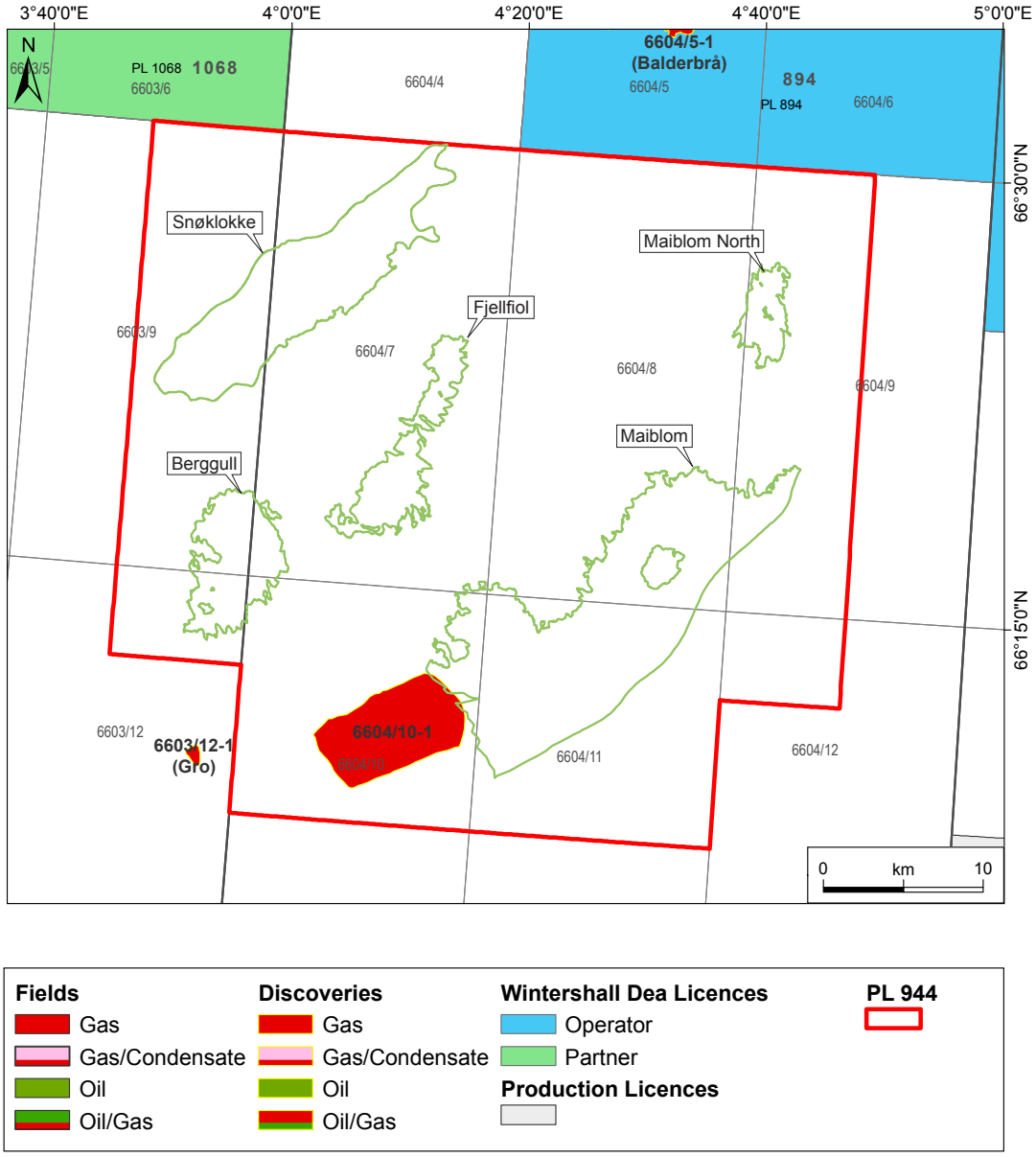

Fig. 1 Prospect and lead map

Identified prospects and lead in the PL944 area.

1 History of the production license

Table 1.1 PL944 Milestone overview

License	PL944
Awarded	02.03.2018
License blocks	6603/9, 6603/12, 6604/7, 6604/8, 6604/9, 6604/10, 6604/11 & 6604/12
License period	Expire 02.03.2026 (DOD 02.03.2021)
License group:	Wintershall Dea Norge AS 40% (Operator) Equinor Energy AS 60%
License area	1802.786 km2 (Figure 1.1)
Work program	Drill or Drop, deadline 2 March 2021
Meetings held	24-04-2018 EC/MC startup meeting 29-10-2018 EC/MC meeting 26-11-2019 EC/MC meeting 01-12-2020 EC/MC meeting
Work performed	2020: License start-up Technical evaluation and valuation. G&G work: Screening for prospectivity in Cretaceous Lysing and Springar Fm's, in addition to potential defined in the APA application. 2021: License decision made to drop the license.
Reason for drop	The prospects identified do not present viable drillable targets, based on our current technical understanding and the significant risks due to lack of consistent amplitude support.

2 Database overviews

2.1 Seismic database

All released 3D seismic data from OMV15M02 and SH1001M11 and angle stacks were included in the common database (Fig. 2.1, Tab. 2.1) and used for prospect evaluation. Additional 2D seismic data are listed in Table 2.1. A selection of the seismic data (1530 km^2) have been reprocessed as per work program (see Chapter 3).

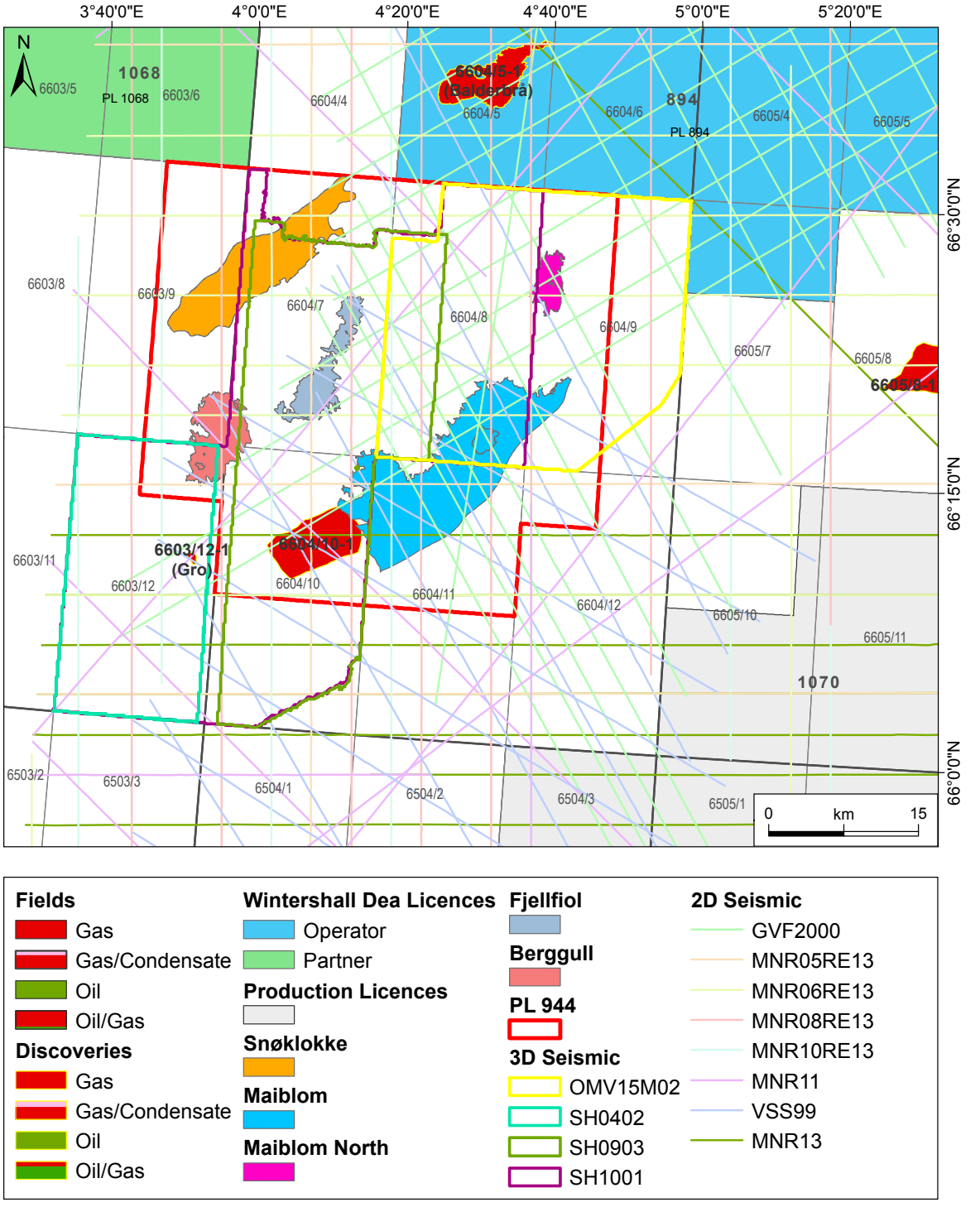

Fig. 2.1 Seismic 2D and 3D database

Pink colored outline is the license boundary of PL944. See labels for name of 3D surveys.

Table 2.1 Seismic 2D and 3D survey database list

2D	GVF2000
	VSS99
	MNR05RE13 & angle-stack
	MNR06RE13 & angle-stack
	MNR08RE13 & angle-stack
	MNR10RE13 & angle-stack
	MNR11 & angle-stack
	MNR13RE13 & angle-stack
3D	Released OMV15M02 & angle-stack
	Released SH1001M11 full stack

2.2 Well database

The wells in the common database are listed in Table 2.2.

Table 2.2 Well overview table

Wells	Name	Year drilled
6603/12-1	Gro 1	2009
6604/10-1	Gro 2	2010
6604/5-1	Balderbrå	2018
6604/2-1	Gullris	2011
6605/1-1	Obelix	2009
6603/5-1	Dalsnuten	2010
6605/8-1	Stetind 1	2005
6605/8-2	Stetind 2	2008
6704/12-1	Gjallar	1999
6705/10-1	Asterix	2009

3 Results of geological and geophysical studies

The PL944 license is located just south of the PL 894 with the recently drilled Balderbrå appraisal well (6604/5-2) and the Gullstjerne exploration well (6604/6-1). The PL944 prospects would have been a natural follow up in case of a successful result in PL 894, but unfortunately both wells were dry and proved very poor reservoir quality.

The Gro gas discovery well (6603/12-1) operated by Shell, targeting Upper Cretaceous sands was drilled in 2009 and one appraisal well (6604/10-1) was drilled in 2010, both based on amplitude anomalies but proving poor reservoir quality. The Gro discovery is expected to have low recoverable volumes, reservoir quality is poor, and estimated permeability is very low. No reserves or resources were booked on this discovery in PL 944. The main focus of the PL 944 lead evaluation was to mature and de-risk additional prospects for a drill or drop decision.

One of the major goals in the initial program was to improve the seismic image quality at Springar reservoir level by means of a 3D seismic reprocessing. The resulting 3D survey WIN19M02 is a reprocessing and merge of surveys SH0402, SH0903 and SH1001 (Merged as SH1101M11). The outcome of the reprocessing is a seamless merge with the WIN19M01 survey of PL894. The reprocessing shows good levels of de-ghosting on all surveys, an average 8 times increase in peak to trough ratio as well as an increase in usable bandwidth down to 5 Hz. The reverse-time migrated product shows a superior structure around and below the volcanic intrusions. Finally, there is an overall improvement of the definition of the velocity model. The updated mapping based on the reprocessing is that the Maiblom trap is now subdivided into two separate structures.

The above results led to a re-evaluation of the amplitude (class 3 AVO) anomalies in the license (Fig. 3.1). The Balderbrå appraisal (6604/5-2), the Gullstjerne exploration well (6604/6-1) and Gro-2 (6604/10-1) all showed residual gas, except for the Balderbrå discovery well (6604/5-1) which showed commercial gas. With these wells in the input model, a seismic inversion was done to highlight any potential commercial gas columns in the Springar Fm in PL944. The model captures the reservoir extent very well and the variability in the data is of a similar magnitude as the difference between good and residual saturation. The stratigraphic lateral variation and lack of structural context, however, makes that interpretation is still ambiguous (Fig. 3.2, Fig. 3.3). A sedimentological study of the Springer Formation was done for the area of interest. The overall reservoir quality for Maiblom is expected to be similar to the Balderbrå and Gullstjerne area, although in a slightly more distal facies (Fig. 3.3). There is low potential for finding better reservoir quality than that found in the Gro wells, meaning effective permeabilities of around 1 mD (Fig. 3.4).

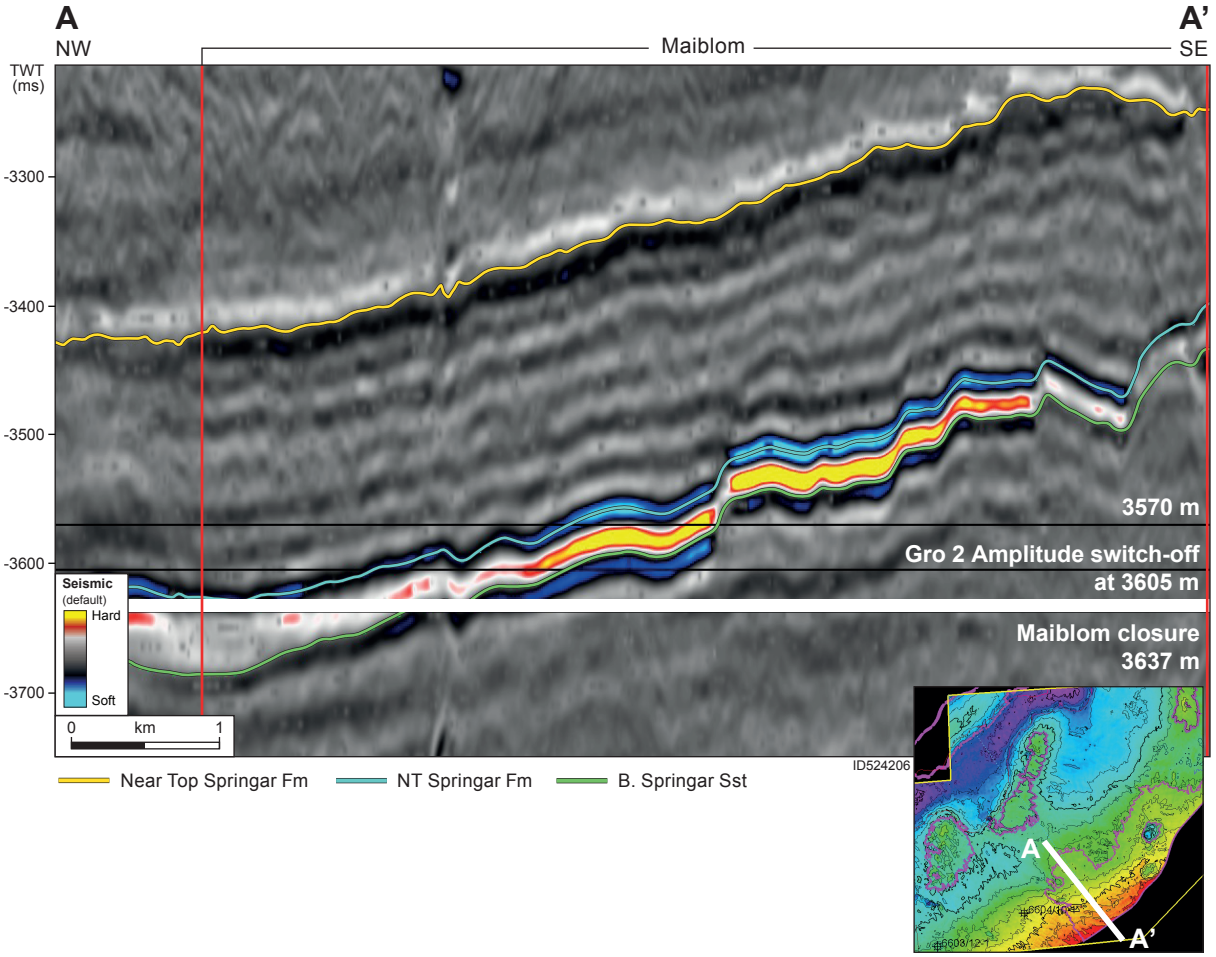

Fig. 3.1 Maiblom prospect dip oriented line and amplitude observations

In the south the Maiblom amplitude switch off is consistent with Gro-2 (3605m).

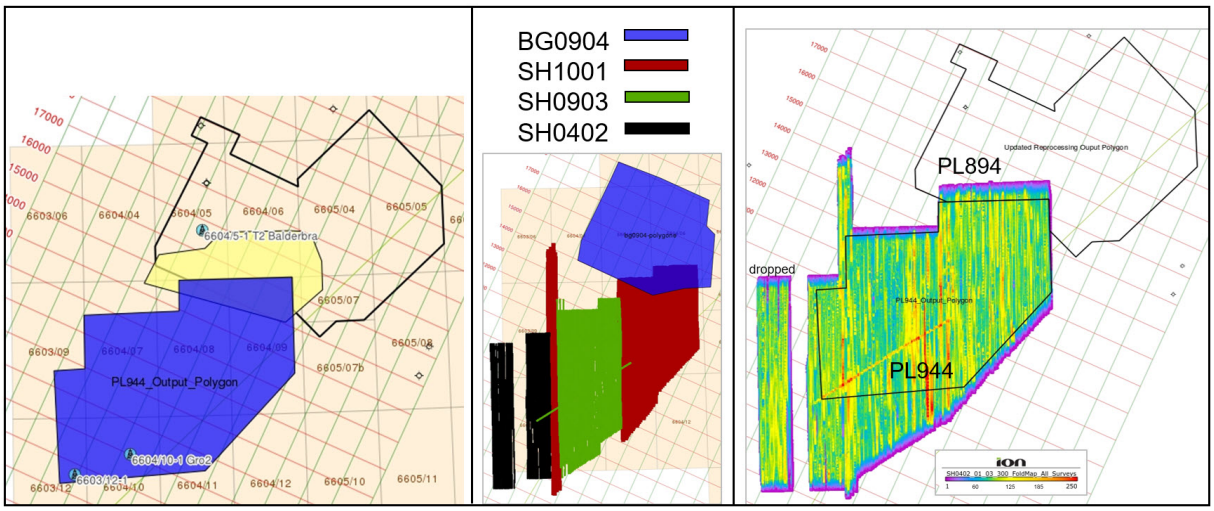

Fig. 3.2 Seismic 3D reprocessing and surveys

The left map shows the geographical extent of the seismic surveys. The centre illustration shows the individual input surveys for the reprocessing. The right positioned map shows the level of seismic fold for the reprocessed area.

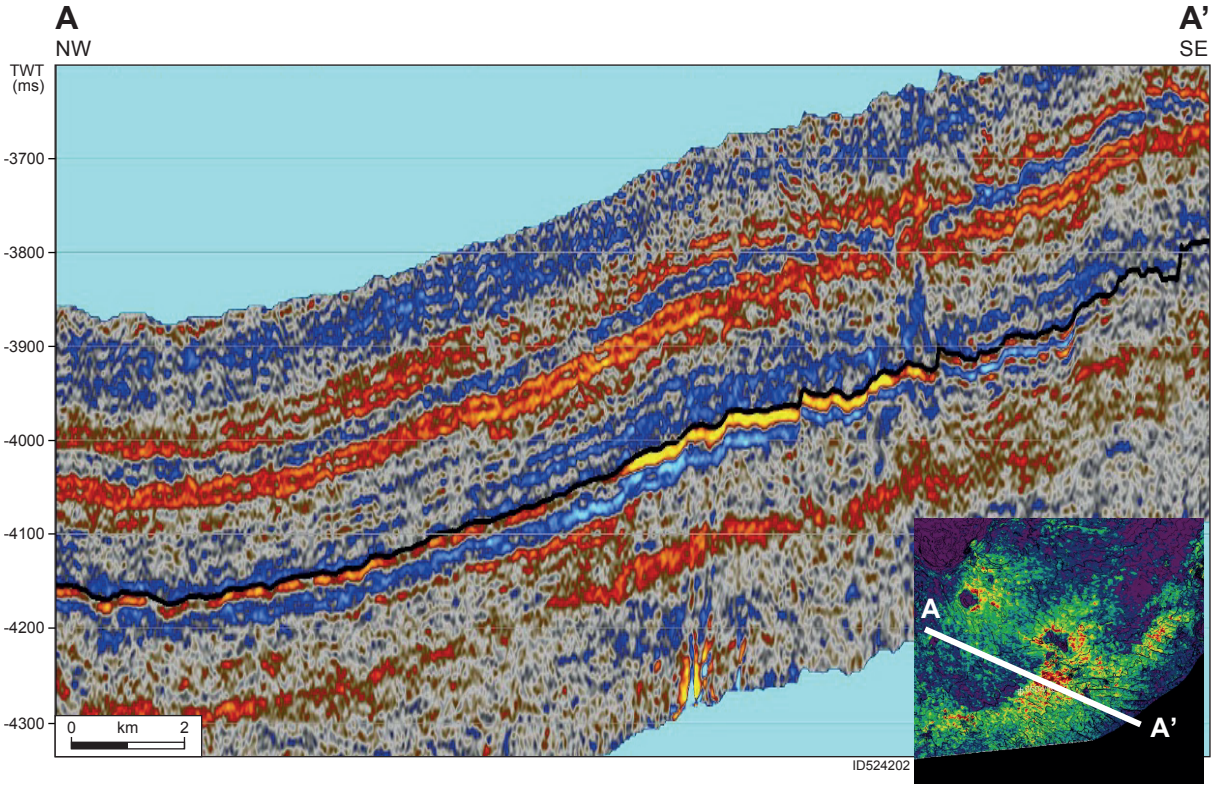

Fig. 3.3 Relative P-Impedance example

Relatively strong impedance response below top reservoir interpretation (black line). Moderate structural fit with observed impedance observations. The top reservoir amplitude anomaly disappear in the northern part of Maiblom.

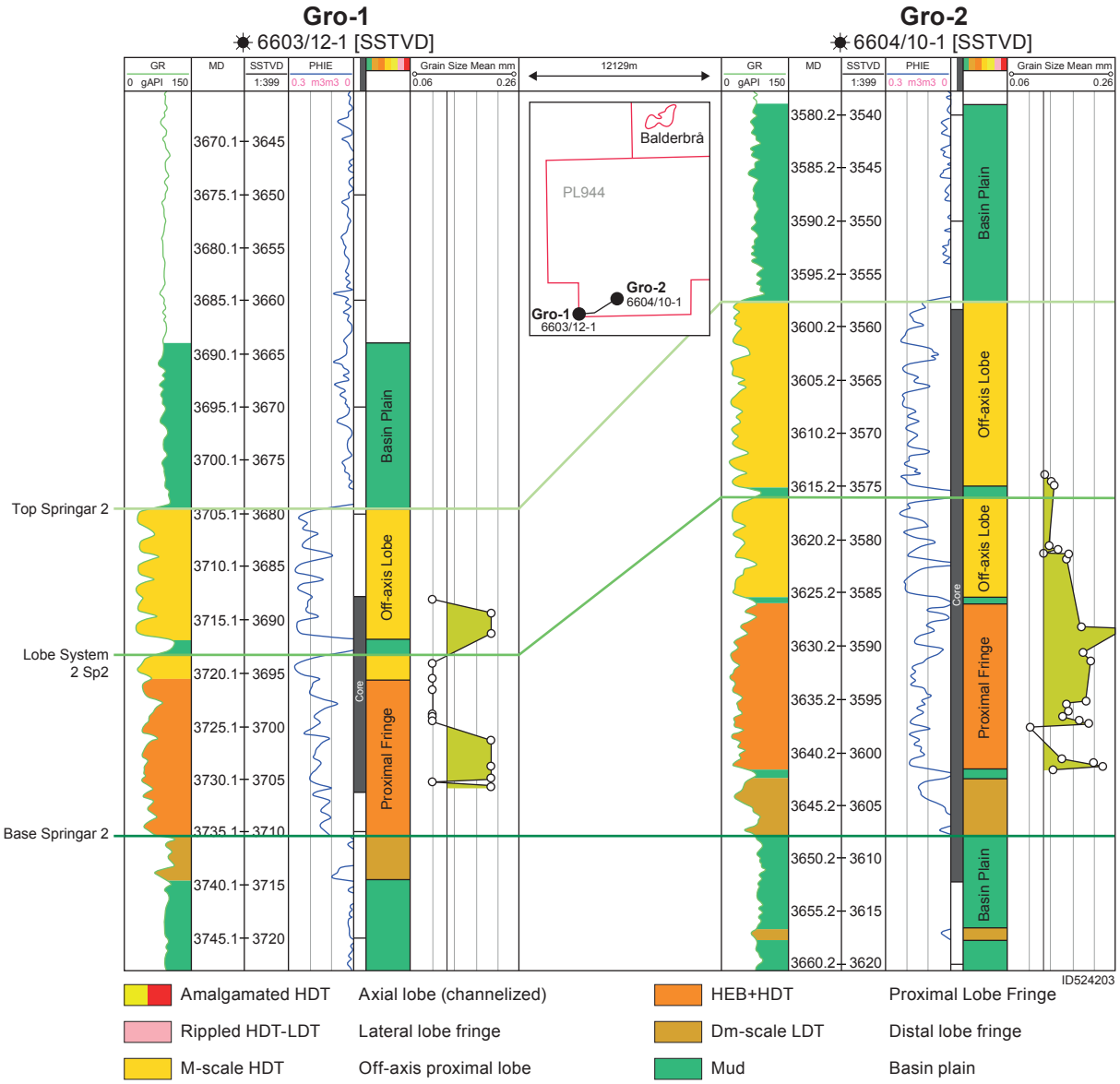

Fig. 3.4 Well correlation panel

Depositional facies and correlation between Gro and Balderbrå exploration and appraisal well

4 Prospect update report

Maiblom is the largest identified prospect, a combined structural-stratigraphic pinch out trap of the Late Cretaceous (Maastrichtian) Springar Formation. Maiblom has an area of 162 km^2 with a mean 143 mmboe recoverable and a POSg of 32%. Interpretation was done on the WIN19M02 3D survey. The prospect is located down dip from a proven hydrocarbon accumulation (Gro). Maiblom shows a geophysical anomaly (class 3 AVO) and low acoustic impedance indicative of a gas bearing reservoir. The current volume outline of Maiblom is based on the lowest closing depth contour. Maiblom has a patchy amplitude anomaly which is bright in the southern part of the prospect indicating some gas saturation, but in large parts of the prospect bright amplitude anomalies are missing, which is suggesting only residual gas presence. Compartmentalization of the reservoir is likely, based on the observed faulting. The mean recovery factor is estimated at 50% although there are some indications from reservoir modeling that 50% may be optimistic and producibility of reservoir could be problematic. The dominant risks are trap efficiency and poor reservoir quality.

Leads Maiblom North (13 km 2, Mean 21 mmboe rec., POSg 16%), Fjellfiol (30 km 2, Mean 42 mmboe rec., POSg 14%), Berggull (37 km^2, Mean 45 mmboe rec., POSg 14%), and Snøklokke (92 km^2, Mean 65 mmboe rec., POSg 23%) are all 4-way dip closures of the Springar Formation (Fig. 4.1). The leads lack observed amplitude anomalies or show anomalies not conformable with the mapped four-way closures. Based on the QI geophysical observations and expected poor reservoir quality, all prospects have a low possibility of success. Similar to Maiblom low recovery efficiency and low permeability is expected. As with the Maiblom prospect, the recovery factor of these leads is expected to be low, and commerciality is challenging.

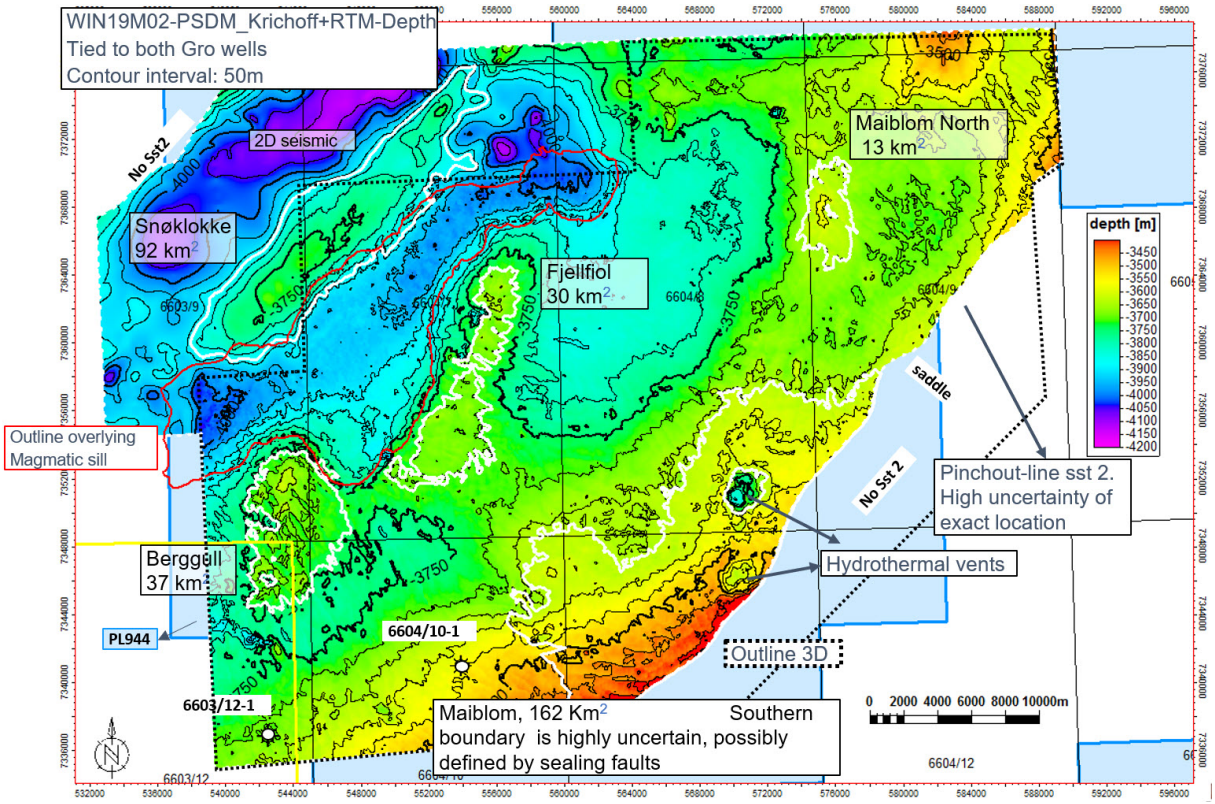

Fig. 4.1 Propect and lead overview near top Springar Fm depth map

Additional leads in the licensed acreage and occurance of hydrothermal vents and magmatic sills. Map contour interval 50m.

5 Technical assessment

The prospect outlines and volumetric assessment has been updated with respect to the APA 2017 based on the additional G&G work and interpretation of the reprocessed seismic data. A development scenario including Balderbrå is no longer realistic due to the disappointing results of Balderbrå appraisal and Gullstjerne wells. Table 5.1 shows the volumetrics of the remaining prospects in PL944, based on the operator's evaluation. The present volumes and significant risk result in negative economic potential. Therefore, the partnership has unanimously decided to drop the license.

Table 5.1 Volumetric summary table

PL944 remaining volume potential, in place				
	P90 (MMboe)	**Pmean (MMboe)**	**P10 (MMboe)**	**GPOS (%)**
Maiblom	5.4	49	108	32
Berggull	1.7	15	37	14
Fjellfioll	1.9	14	32	14
Snøklokke	1.6	22	55	22.5
Maiblom North	1.2	7	16	16

PL944 remaining volume potential, Recoverable reserves				
	P90 (MMboe)	**Pmean (MMboe)**	**P10 (MMboe)**	**GPOS (%)**
Maiblom	2.4	23	52	32
Berggull	0.8	7	17	14
Fjellfioll	0.8	7	15	14
Snøklokke	0.7	10	26	22.5
Maiblom North	0.5	3	8	16

6 Conclusion

In the view of the partnership, the opportunities identified in license PL944 do not present drillable targets, based on our current technical understanding and the significant risks of finding an economic accumulation of hydrocarbons.