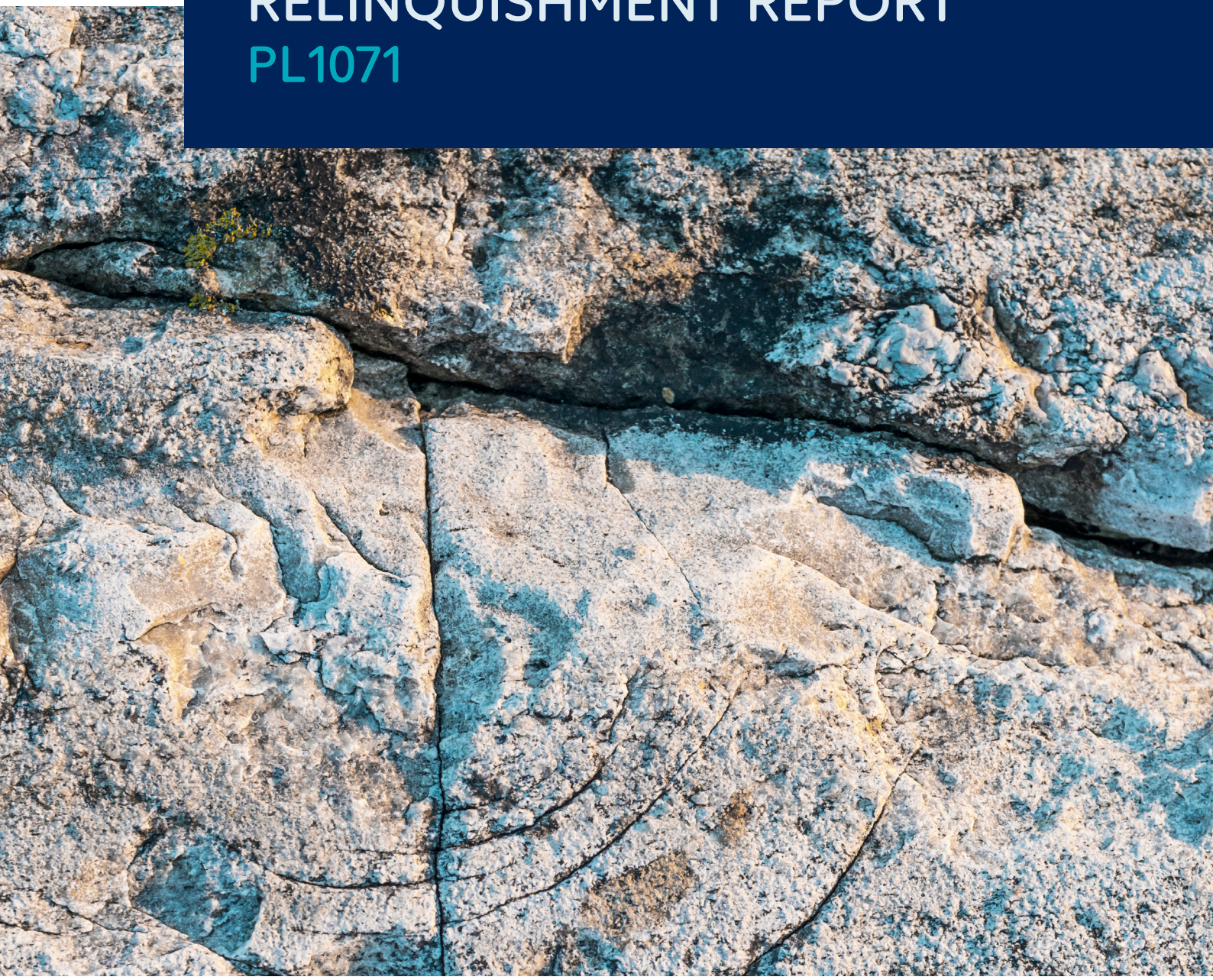
wintershall dea

RELINQUISHMENT REPORT
PL1071



equinor

petoro

one dyas

PL1071 relinquishment report summary

PL1071 (Wintershall Dea Norge AS Op / 30%, Equinor Energy AS / 20%, Petoro AS 20% / AS Norske Shell 20% / One Dyas AS 10%) was awarded in February 2020 with an initial work program of G&G studies and seismic reprocessing to reach a drill-or-drop decision on 14th February 2022. All prospects within the awarded area as presented in the APA 2019 document have been re-evaluated based on the completed seismic reprocessing PGS16004WINR19 and PGS16004WDR20. Four prospects were identified in the Cretaceous Nise Formation and three in the Cretaceous Springar Formation.

The main prospectivity in PL1071 is identified in the Nise Formation. Four fault bounded closures can be defined from north to south, Løvetann, Grynsildre, Rødsildre and Gullrublum. All these prospects have a closure at the shallower Springar Formation as well, but with significantly lower volume potential. The main risk of all identified prospects in the license risks are trap efficiency and reservoir quality. The proximity of the Aasta Hansteen SPAR was the main driver to evaluate any remaining prospectivity in PL1071. The decision to relinquish is based on the latest technical evaluations using the reprocessed seismic data, which indicate significant risk on trap integrity for Nise prospects and only prove small upside in the Springar Formation. None of the indentified prospects and leads in PL1071 prove economic potential at the time of writing of this report.

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Summary

PL1071 (Wintershall Dea Norge AS Op / 30%, Equinor Energy AS / 20%, Petoro AS 20% / AS Norske Shell 20% / One Dyas AS 10%) was awarded in February 2020 with an initial work program of G&G studies and seismic reprocessing to reach a drill-or-drop decision on 14th February 2022. All prospects within the awarded area as presented in the APA 2019 document have been re-evaluated based on the completed seismic reprocessing PGS16004WINR19 and PGS16004WDR20. Four prospects were identified in the Cretaceous Nise Formation and three in the Cretaceous Springar Formation as shown in Fig. 1.

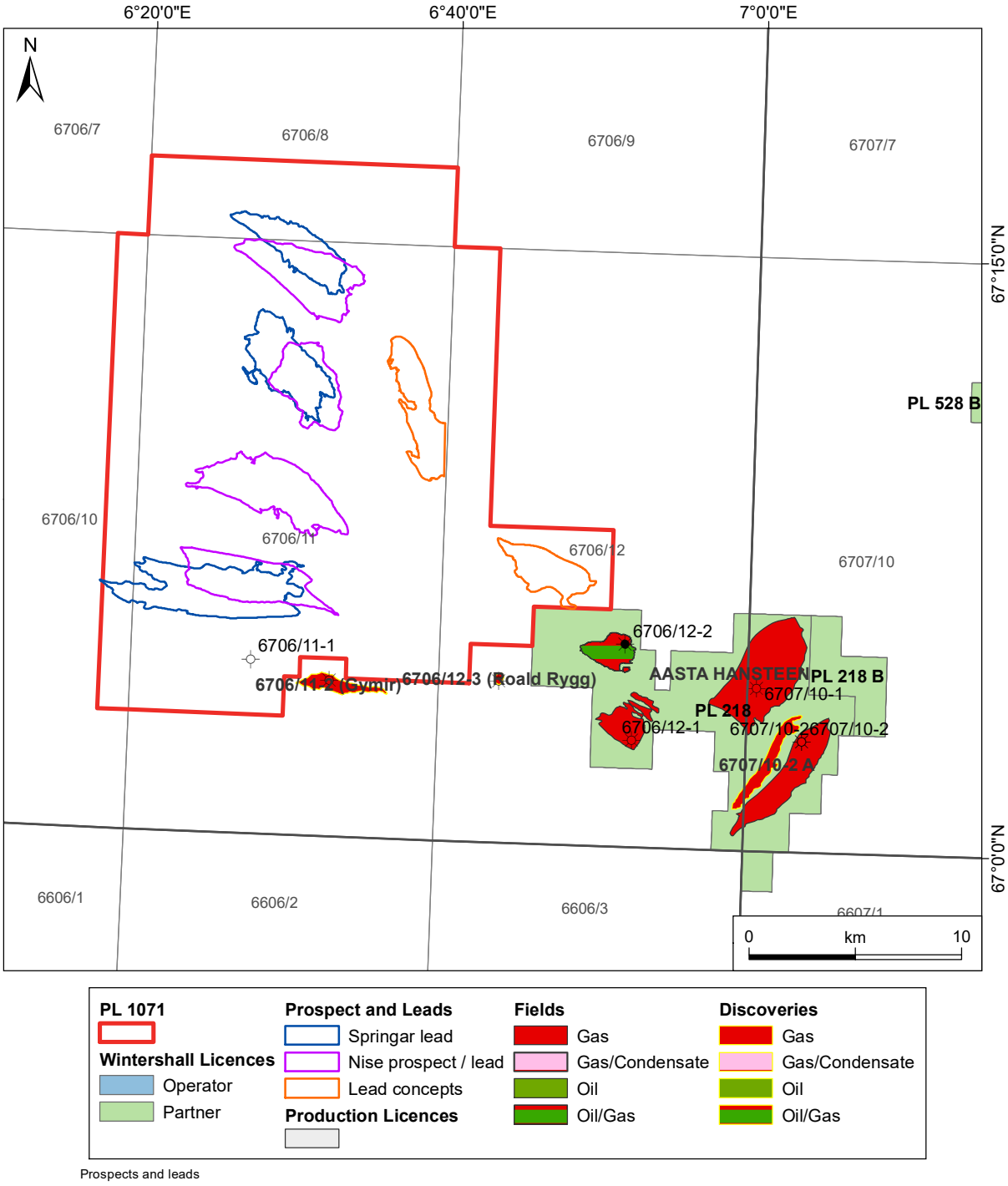

Fig. 1 Prospect and lead map

Identified prospects and lead in the PL1071 area

The PL1071 license is located just north of the Aasta Hansteen field in the PL218/PL218B license. The main prospectivity in PL1071 is identified in the Nise Formation. Four fault bounded closures can be defined from north to south, Løvetann, Grynsildre, Rødsildre and Gullrublum. All these prospects have a closure at the shallower Springar Formation as well, but with significantly lower volume potential. The main risk of all identified prospects in the license risks are trap efficiency and reservoir quality. The proximity of the Aasta Hansteen SPAR was the main driver to evaluate any remaining prospectivity in PL1071. The decision to relinquish is based on a significant risk for the Nise prospects to have breached traps. The latest technical evaluations using the reprocessed seismic data indicate significant risk on trap integrity for Nise prospects and only small upside in the Springar Formation. This conclusion is drawn from the lack of amplitude support in the Nise Formation. Additionally, small crestal direct hydrocarbon indicators in the Springar Formation suggest that the hydrocarbon system is effective, but that no gas is retained in the Nise Formation and that Springar Formation structures are severely underfilled.

1 History of the production license

Table 1.1 PL 1071 Milestone overview

License	PL1071
Awarded	14.02.2020
License blocks	6706/8, 6706/10, 6706/11 and 6706/12
License period	Expire 14.02.2027 (DOD 14.02.2022)
License group:	Wintershall Dea Norge AS 30% (Operator) Equinor Energy AS 20% Petoro AS 20% A/S Norske Shell 20% One Dyas AS 10%
License area	461 km2 (Fig. 1)
Work program	3D seismic reprocessing and G&G studies to reach DoD, deadline 14 February 2022
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: Reprocessing of 3D seismic survey PGS16004. Seismic interpretation, mapping, sedimentological studies. 2021: Seismic inversion and fluid substitution modelling feasibility study. Evaluation and maturation of prospectivity in Cretaceous Nise and Springar formations. Decision made to drop the license.
Reason for drop	The Nise 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. The Springar prospects have some DHI support, but our evaluation shows only limited non-commercial volume potential.

2 Database overviews

2.1 Seismic database

All 3D seismic data from SUN12NO01-PC10NO01 and PGS16004NWS (full fold and angle stacks) were included in the common database (Fig. 2.1, Table 2.1) and used for prospect evaluation. Additional 2D data are listed in Fig. 2.2 and Table 2.1. Part of the seismic data (300 km^2) of PGS1600NWS have been reprocessed as per work program, and a further 579 km^2 have been re-imaged (see Chapter 3).

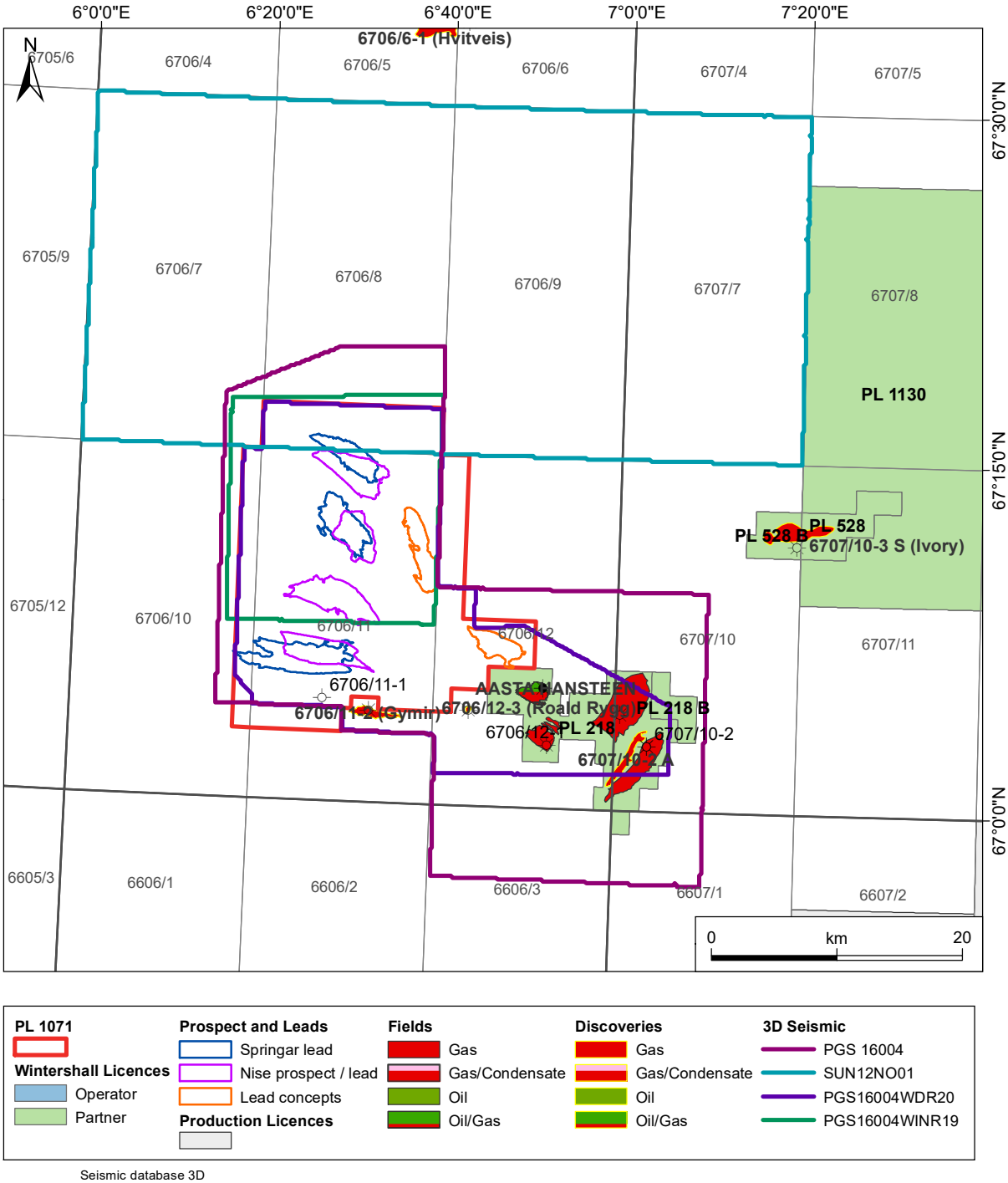

Fig. 2.1 Seismic database map

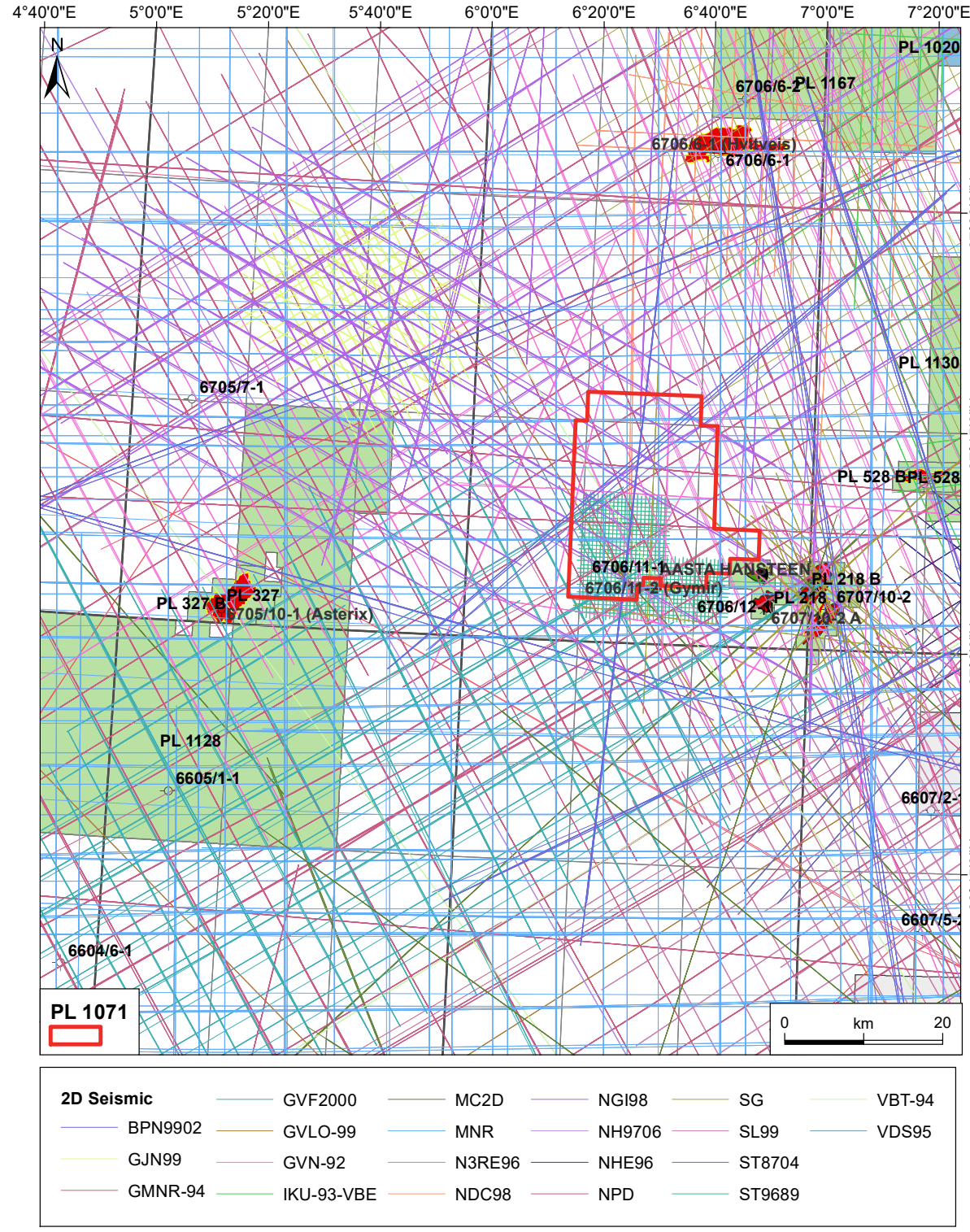

Fig. 2.2 2D seismic data in PL1071 common database

Table 2.1 Seismic 2D and 3D survey database list

2D	BPN9902
	GJN99
	GMNR-94
	GVF2000
	GVLO-99
	GVN-92
	IKU-93-VBE
	MC2D-HDV2006
	MC2D-OV2003
	MNR04
	MNR05
	MNR06-FUGRO
	MNR07
	MNR08
	MNR09
	N3RE96
	NDC98
	NGI98
	NH9706
	NHE96
	NPD-ML01-72
	NPD-TB-85
	NPD-VØ-81
	NPD-VØRB-85
	NPD-VØRB-86
	NPD-VØRB-87
	NPD-VØRB-88
	NPD-VØRB-89
	NPD-VØRB-90
	SG9404
	SG9405
	SG9514
	SL99
	ST8704
	ST9689
	VBT-94
	VDS95
	VGUH0301-2D
3D	SUN12NO01-PC10NO01 all angle stacks
	PGS16004NWS all angle stacks

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
6604/2-1	Gullris	2011
6604/5-1	Balderbrå	2018
6604/10-1	Gro 2	2010
6704/12-1	Gjallar	1999
6605/1-1	Obelix	2008
6705/7-1	Stordal	2017
6705/10-1	Asterix	2009
6706/6-1	Hvitveis	2003
6706/11-1	Vema	1998
6706/11-2	Gymir	2015
6706/12-1	Snefrid S.	2008
6706/12-2	Snefrid N.	2015
6706/12-3	Roald Rygg	2015
6707/10-1	Luva	1997
6707/10-2A	Haklang	2008
6707/10-2S	Haklang	2008
6707/10-3S	Ivory	2014

3 Results of geological and geophysical studies

The main goal of the geophysical work program was to improve the quality of reflectivity below the Base Cretaceous Unconformity north of Aasta Hansteen. Whereas the 3D seismic covering the Aasta Hansteen discoveries in PL218 is of high quality, the original PGS16004NWS 3D seismic data covering PL1071 had generally poor image quality. The observed poor data quality is likely due to overburden effects such as remobilized ooze and abundance of volcanic intrusions. The main objective to improve seismic data quality was accomplished by reimaging 300 km^2 of the PGS16004NWS multiclient survey. The resulting dataset is called PGS16004WINR19. A standard pre-processing workflow was applied to the dataset (noise attenuation, deghosting, demultiple, binning and regularization) after which full waveform inversion (2-24Hz) and reflection tomography using WEM gathers was applied to the data. Finally, a fairly standard post-processing sequence was applied including 3D Dipscan noise attenuation. A reasonable uplift in seismic data quality was achieved, but the prospects in the north of the license are still affected by poor image quality, making it difficult to accurately pick the Top Cretaceous and intra-Cretaceous reflectors (Fig. 3.1 and Fig. 3.2). In addition, to improve the seismic data quality of the entire PL1071 area covered by PGS16004NWS, a seismic conditioning of 579 km^2 was carried out. The resulting dataset is called PGS16004WDR20. The seismic conditioning improved the overall quality of the data, particularly in the Cretaceous section, but it did not reveal any amplitude anomalies (class 3 AVO) that are not detectable on the original data (Fig. 3.3 and Fig. 3.4).

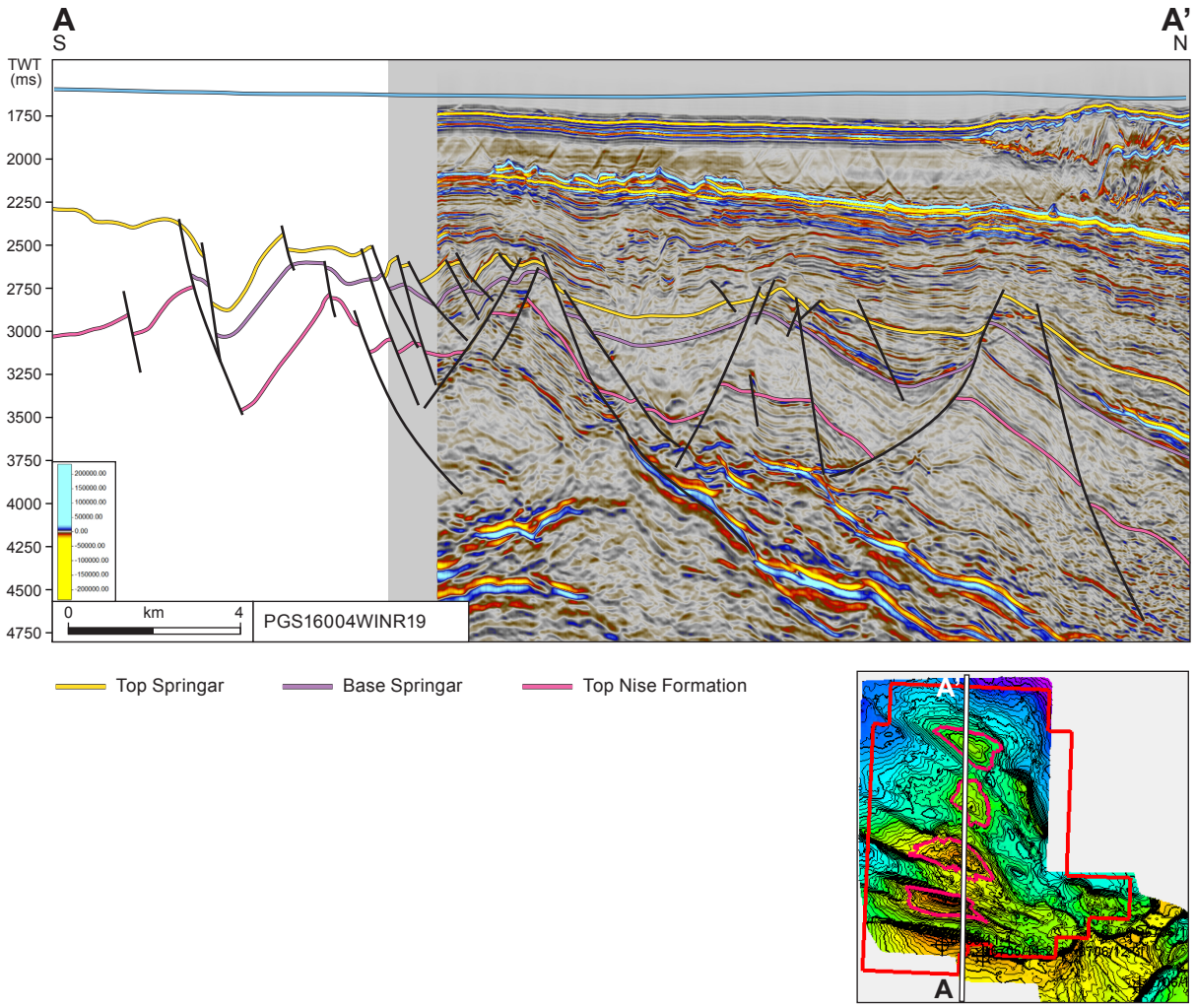

Fig. 3.1 PGS16004WINR19 section line

Example line showing the data quality of PGS16004WINR19 (proprietary reprocessing of PGS16004NWS 3D seismic). Note decreasing picking uncertainty in the Cretaceous section from south to north.

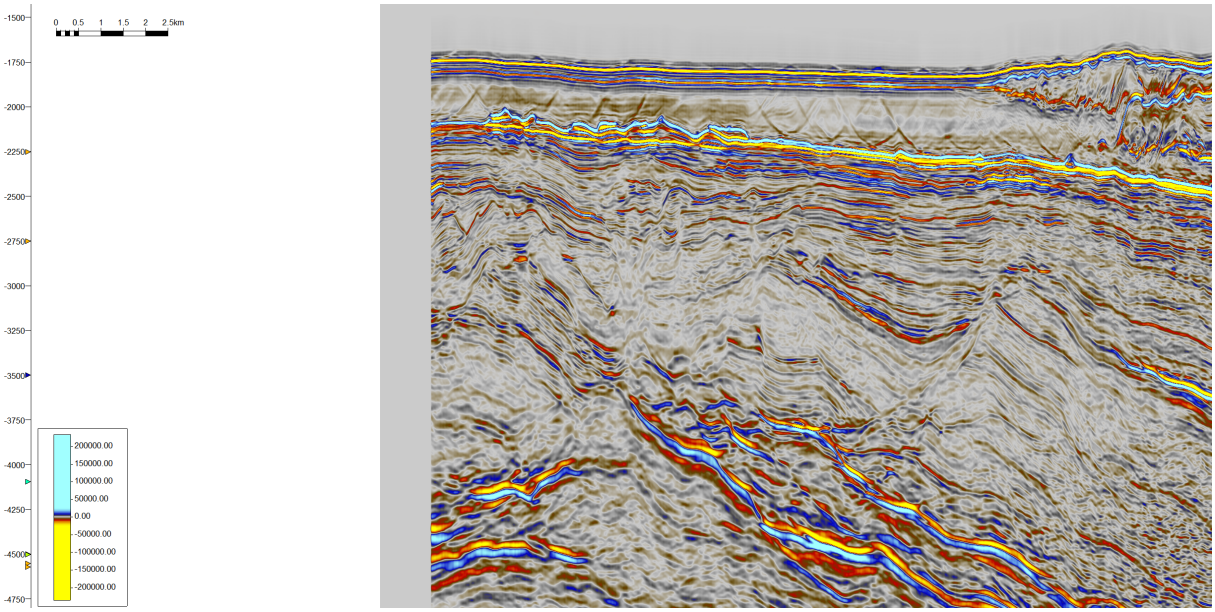

Fig. 3.2 PGS16004WINR19 section line

Example without interpretation

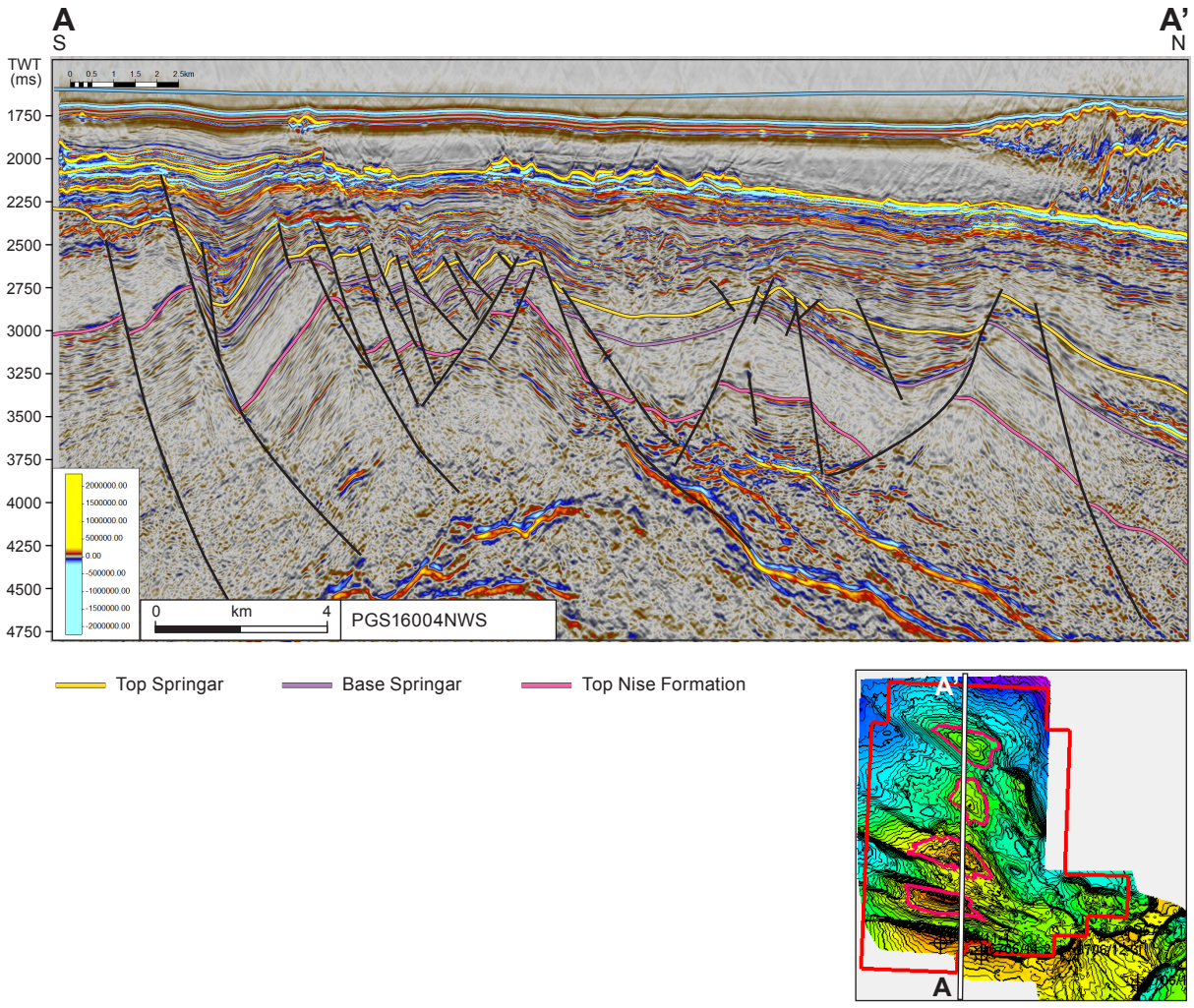

Fig. 3.3 PGS16004WDR20 section line

Example line showing the data quality of the PGS16004WDR20 3D seismic (proprietary conditioning of PGS16004NWS 3D seismic). Overall improvement in data quality, but interpretability decreases towards the north

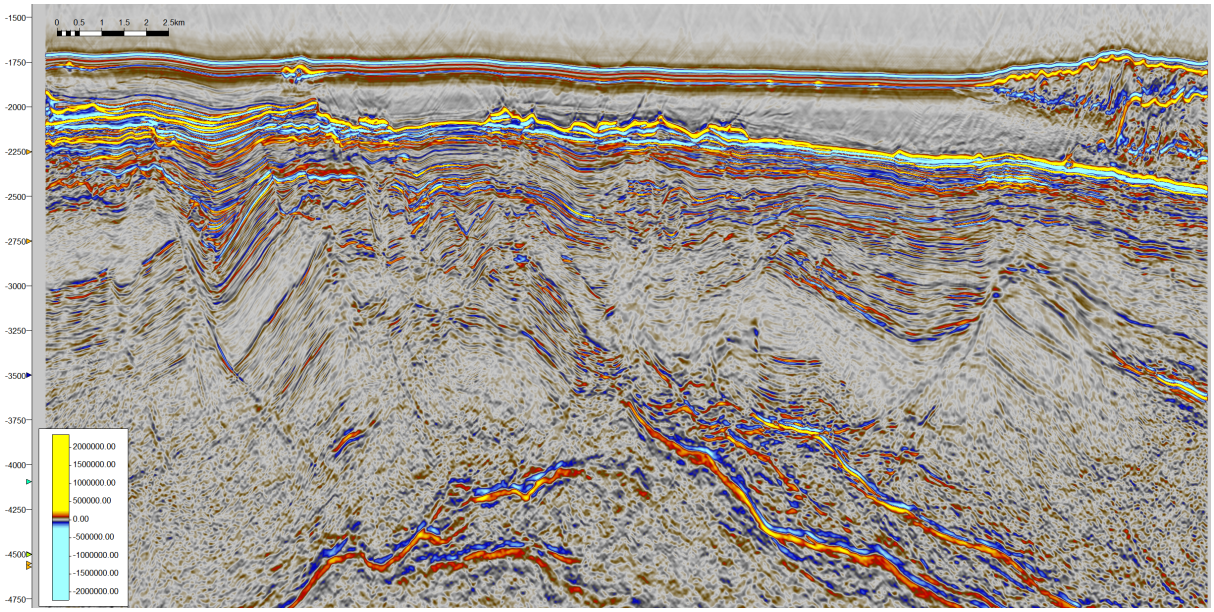

Fig. 3.4 PGS16004WDR20 section line

Example without interpretation

A seismic inversion and fluid substitution feasibility study was carried out. Amplitude and inversion derisking generally work very well in the Luva/Snefrid area. However, given the decreasing quality of seismic data towards the north across the PL1071 license, the objective of the study was to investigate whether the seismic quality improvement could be extended to the prospect area. The main focus was to determine if conclusive fluid indicators could be identified in either amplitude or other derived products. The results unfortunately show no evidence of Nise leads in PL1071, although some interesting amplitude evidence is present in the Springar. The Springar leads remain difficult to de-risk after conditioning, given issues with the current seismic data quality.

A sedimentological study of the Springer and Nise Formation was completed for the area of interest. The overall reservoir quality is expected to be similar to the Aasta Hansteen area. The Nise Formation (Fig. 3.5) shows evidence for reaching the fairway margin in the Vema well, which has slightly worse reservoir properties as the wells to the east. With the sediment supply coming from the northeast, the reservoir properties of the PL1071 prospects are not expected to be worse than those in Vema. The Springar formation has a higher uncertainty with respect to reservoir properties, as only the eastern Aasta Hansteen wells have found a sandstone succession in the Springar. The top of the Springar Formation is eroded in the area of interest, thinning from northwest to southeast, and it is completely eroded in the southeast of the license. Nevertheless, a significant Springar sandstone sequence is expected to be present across most of the prospective area. Based on the 6707/10-1 (Luva) well which has upper fine to medium sand, good reservoir properties can be expected, similar to Irpa (Asterix) for example and better reservoir quality compared to the Balderbrå discovery.

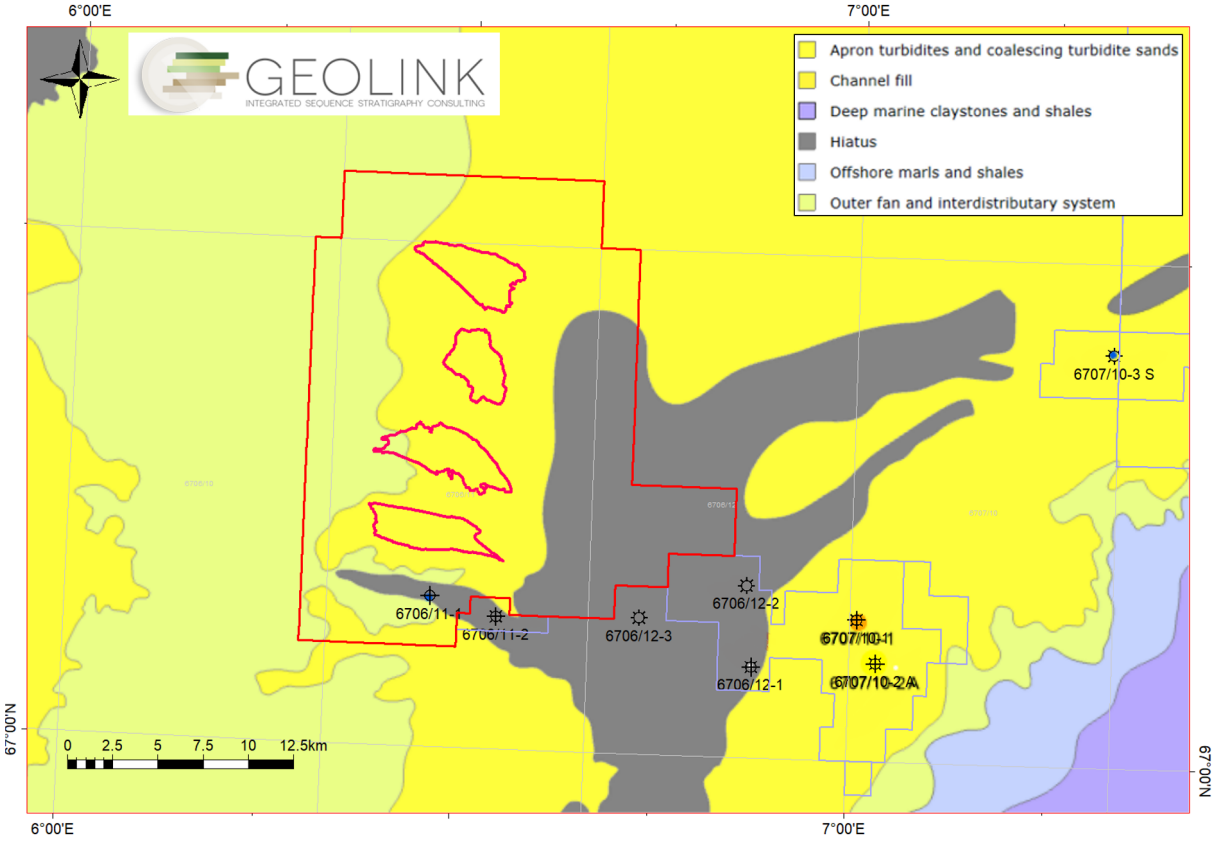

Fig. 3.5 Gross depositional environment Nise Fm

4 Prospect update report

From north to south, the Nise prospects are called Løvetann (Mean 11.8 million m3 oe. rec., POSg 31%), Grynsildre (Mean 7.59 million m3 oe. rec., POSg 32%), Rødsildre (Mean 13.2 million m3 oe. rec., POSg 20%) and Gullrublum (Mean 18.9 million m3 oe. rec., POSg 12%). They are all quite similar fault bounded three-way closures (Fig. 4.1), with an increasing risk on trap effectiveness from Løvetann in the north to Gullrublum in the south due to the increase in fault intensity and fault continuity into the overburden. The overburden is thinning significantly from north to south. A secondary risk is identified in reservoir effectiveness, as well control decreases away from the Aasta Hansteen structures and lower amplitudes could be indicative of poorer reservoir quality. Furthermore, a GPOS downgrade was applied to all prospects and leads due to lack of amplitude support in an area where all drilled accumulations are associated with seismic DHIs. The presence/effectiveness of top seal and the presence of an effective hydrocarbon system are thought to be quite likely. Upside is identified in the Springar Formation, for Løvetann, Grynsildre and Gullrublum (Fig. 4.2), although the upside volume potential is small. Rødsildre Springar shows clear evidence of trap breach, due to the presence of small gas hats in pockets near the crest and is therfore not considered.

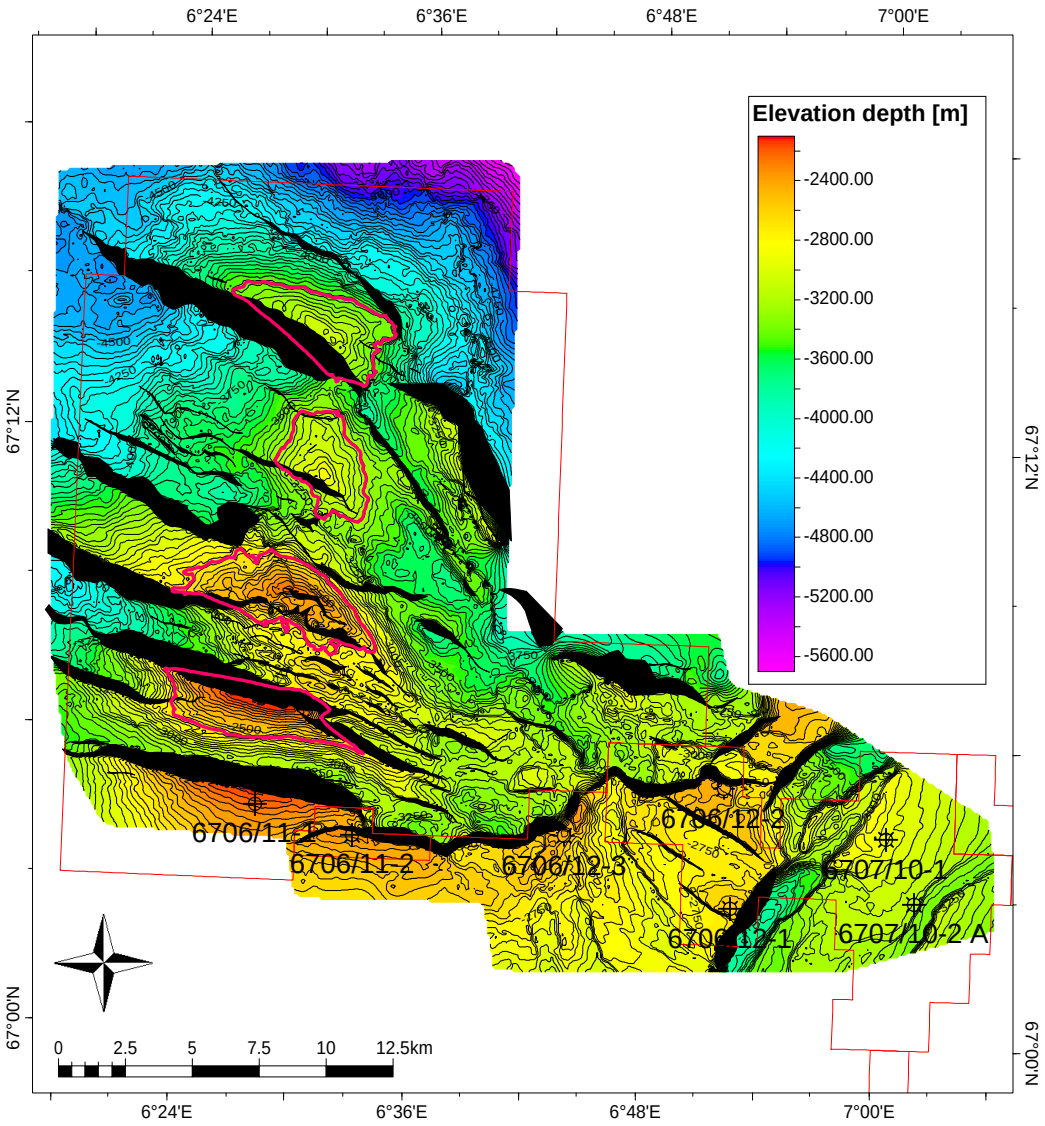

Fig. 4.1 Top Nise depth map

Geological map of Top Nise showing the outlines of the four identified leads in this formation. Contour interval 25 meters

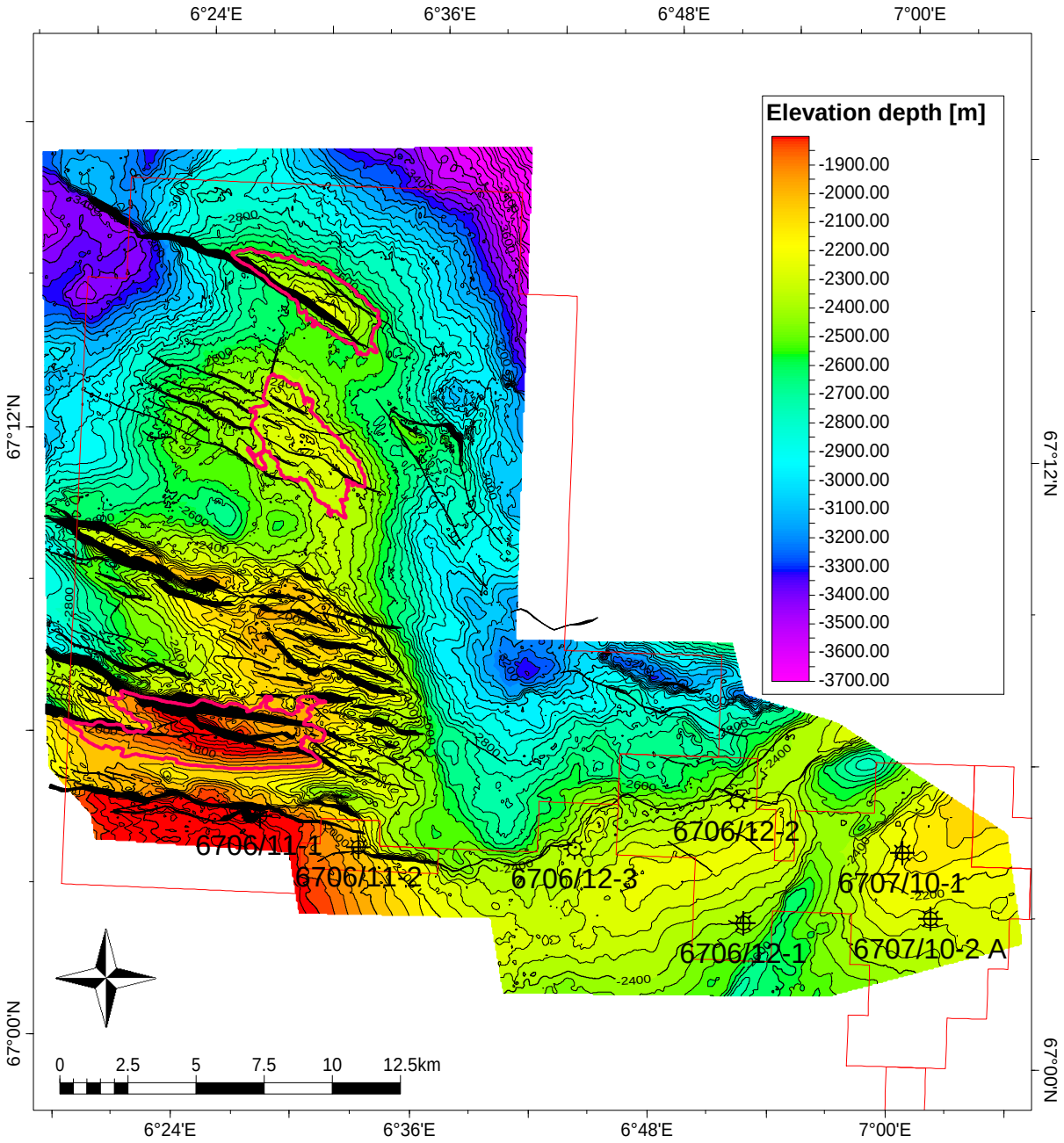

Fig. 4.2 Top Springar depth map

Geological map of Top Springar showing the outlines of the four identified leads in this formation. Contour interval 50 meters

The prospects have been matured based on the two new seismic data sets. The Løvetann and Grynsildre prospects would potentially benefit from additional geophysical work, as better image quality might reveal some amplitude support. However, the chances that a full reprocessing or new seismic acquisition would reveal any DHI is considered unlikely. The Rødsildre and Gullrublum prospects can be confidently mapped on the reprocessed seismic and no further uplift is expected from additional reprocessing or new seismic acquisition. There are no amplitude anomalies observed in the Nise Formation. The presence of gas hats in the Springar Formation emphasizes an increased trap integrity risk and therefor Rødsildre and Gullrublum have been downgraded to leads.

5 Technical assessment

The prospect outlines and volumetric assessment has been updated with respect to the APA 2019 based on the additional G&G maturation as mentioned above and interpretation of the reprocessed seismic data. The volumetrics of the remaining prospects and leads in PL1071 are shown in Table 5.1 , 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 Remaining volume potential PL1071 in million cubic meters oil equivalent

PL1071 In place volumes	**Million m3 oe**	**Million m3 oe**	**Million m3 oe**	**Million m3 oe**
Prospect	**Mean**	**P90**	**P50**	**P10**
Løvetann Nise	17.5	2.07	12.2	40.2
Grynsildre Nise	11.2	1.22	7.26	26.8
Rødsildre Nise	19.5	2.65	11.5	45.5
Gullrublum Nise	27.9	3.26	19.6	64.4
Løvetann Springar	4.01	0.67	2.97	8.64
Grynsildre Springar	3.66	0.446	2.54	8.26
Gullrublum Springar	6.56	0.93	4.37	14.6
PL1071 Recoverable volumes	**Million m3 oe**	**Million m3 oe**	**Million m3 oe**	**Million m3 oe**
Prospect	**Mean**	**P90**	**P50**	**P10**
Løvetann Nise	11.8	1.4	8.3	27.5
Grynsildre Nise	7.59	0.829	4.88	18.3
Rødsildre Nise	13.2	1.8	7.75	31.0
Gullrublum Nise	18.9	2.15	13.1	43.4
Løvetann Springar	2.01	0.315	1.44	4.39
Grynsildre Springar	1.84	0.207	1.22	4.23
Gullrublum Springar	3.28	0.435	2.12	7.36

6 Conclusion

In the view of the partnership, the opportunities identified in license PL1071 do not present drillable targets, based on our current technical understanding and the significant risks of finding an economic accumulation of hydrocarbons.