CONFIDENTIAL

bayerngas norge

PL 735 S
Relinquishment Report

DM#90056 / 2017-05-30

Table of Contents

List of Figures

List of Tables

1 Key license history

Summary of award and participants

PL735 S was awarded to Bayerngas Norge AS (Operator - 40%), Statoil Petroleum AS (20%), Suncor Energy Norge AS (20%) and Fortis Petroleum Norway AS (20%) on February 7th 2014, as part of the APA2013. The license outline, nearby fields and the mapped prospects and leads in APA2013 are shown in Fig. 1.1. The license, covering acreage in block 25/4 and 25/7, is stratigraphically divided and applies to all levels below Top Albian.

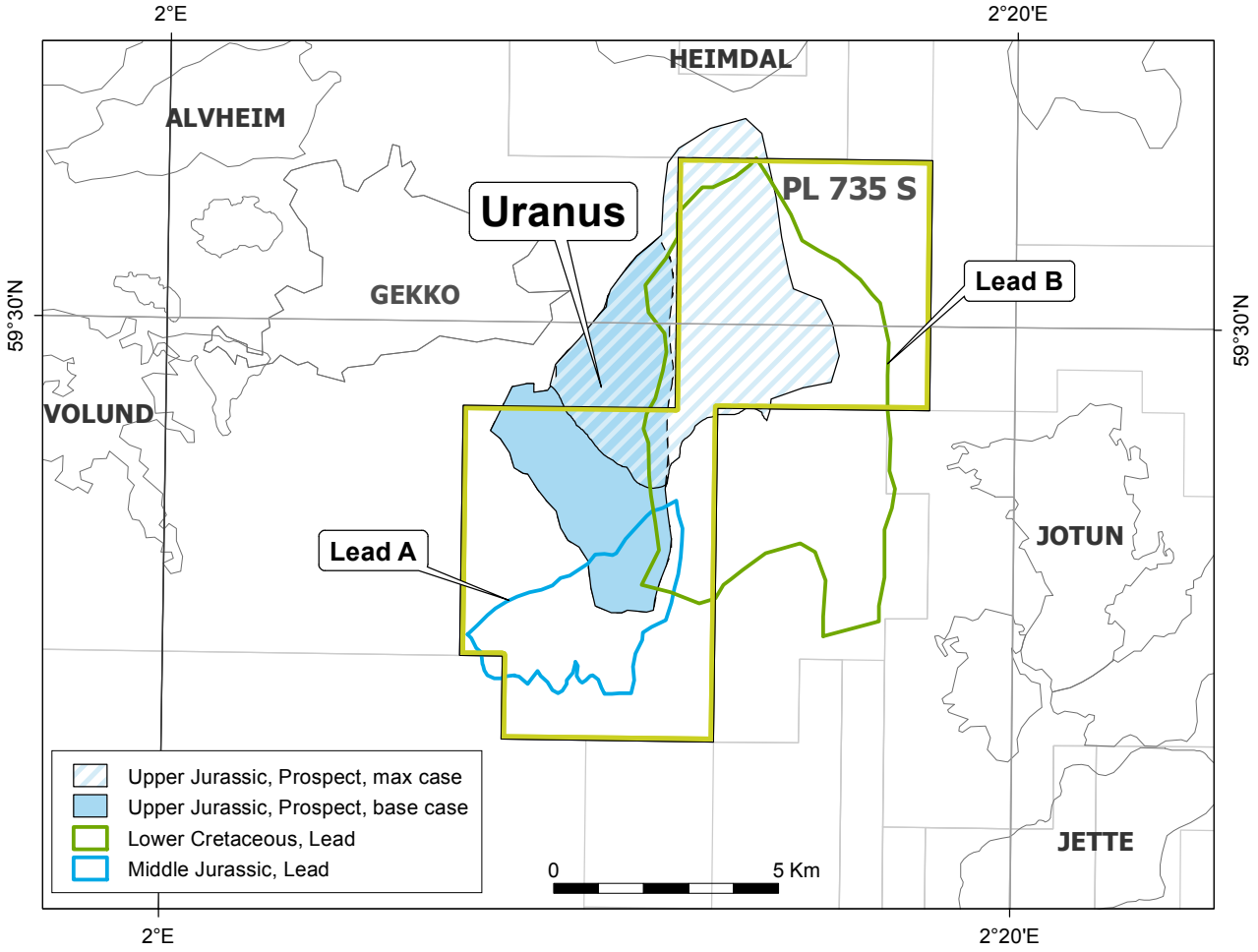

Fig. 1.1 PL735S APA2013

At the time of application, the Upper Jurassic was the main stratigraphic interval of interest, with additional prospectivity identified in Lower Cretaceous and Middle Jurassic reservoirs.

Initial work obligations

The work commitment was to purchase and reprocess seismic data, G&G studies and to make a drill-or-drop (DoD) decision by February 7th 2016. The work program for the initial period is shown in Table 1.1. The initial DoD deadline was later extended to February 7th 2017 due to a 6 month delay in the seismic reprocessing project from the contractor, delay in loading the data into Petrobank and delay in a regional well study.

Table 1.1 PL735 S workprogramme

Period	Phase	Duration	Work Program	Decision at milestone
Initial Period	1	2	Purchase 3D seismic Reprocess 3D-seismic	Drill or drop
	2	2	Drill exploration well	Concretize (BoK) or Drop
	3	2	Concept studies	Continuation (BoV) or Drop
	4	1	Prepare development plan	Submit PDO or Drop
	Sum	7	Initial period	7 years
			Extension period	20 years

License Meetings:
During the license period, the following meetings have been held:

2014

2 ECMC meetings: 20.02 and 20.11.

2015

1 ECMC meeting: 04.11.

1 technical work meeting (core workshop): 12.05.

2016

1 ECMC meeting: 16.11

Reason for relinquishment
The work obligation has been fulfilled. No commercially attractive prospect has been identified in the license area and the license is therefore relinquished,

2 Database

2.1 Seismic data:

The seismic database used in the APA 2013 comprised all available public 2D and 3D seismic surveys covering the license acreage and the NSR proprietary 2D data sets as listed in Table 2.1 and shown in Fig. 2.1.

Table 2.1 APA2013 Seismic database

3D seismic	Quality
PGS MegaSurvey	Fair - Good

2D seismic	Quality
NSR03	Good
NSR06	Very Good
NSR07	Very Good
NSR08	Very Good

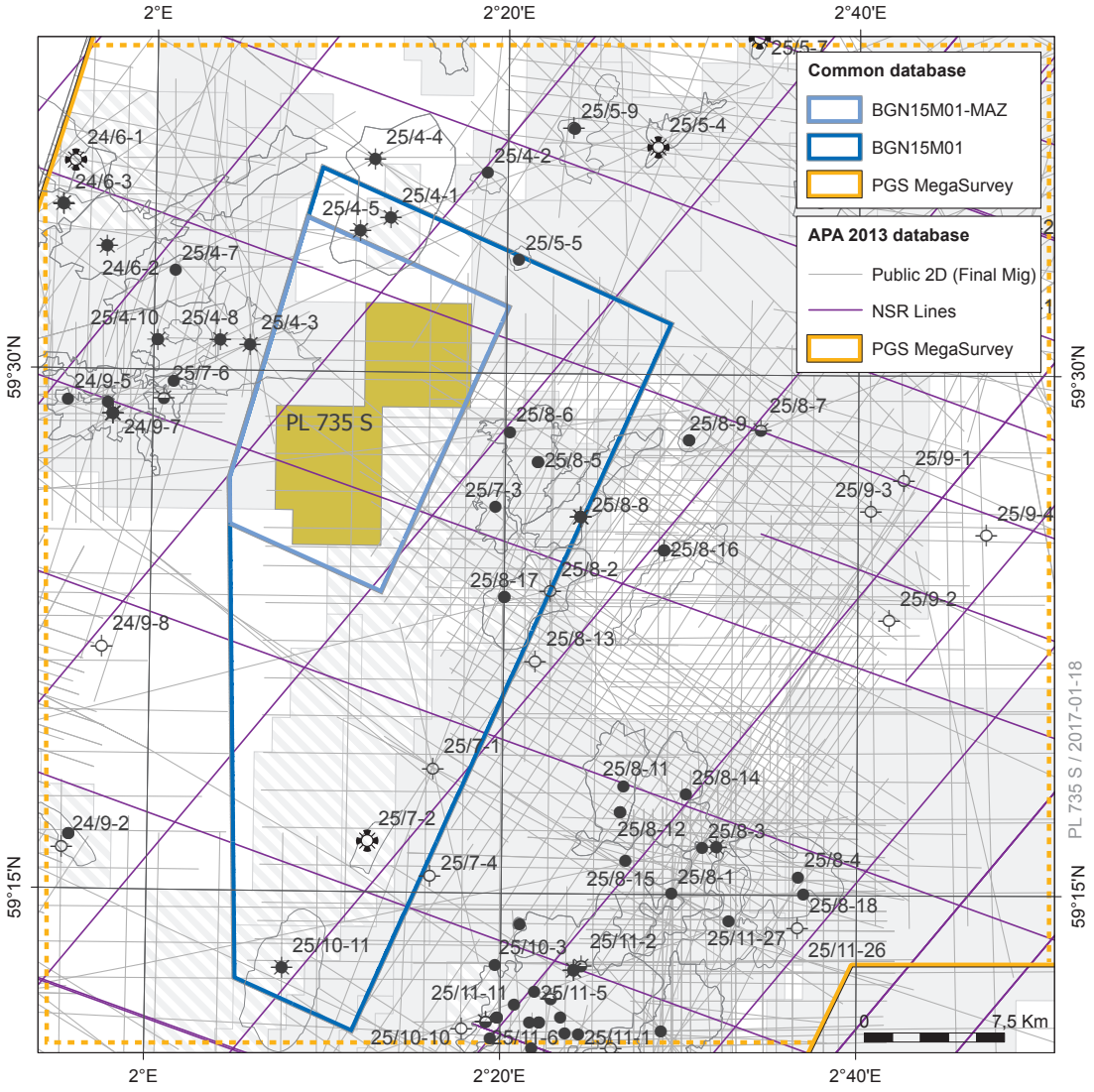

Fig. 2.1 Seismic database

As part of the commitment work program, the seismic survey MC3D-NVG11M, a merge between the two multiclient Geostreamer surveys MC3D-SVG11 and MC3D-NVG10, was purchased from Petroleum Geo-

Services (PGS) in 2014 and subsequently reprocessed by PGS during 2015. The vintage surveys NH9603 and ES9403 was used to fill holes in the newer data set. The resulting processed data was named BGN15M01 and comprised the common seismic database for the license as shown in Fig. 2.1.

MC3D-NVGSVGM2013 deliverables from PGS were:

Final Kirchhoff PreSTM (full stack + 4 angle stacks)

BGN15M01 processing deliverables from PGS were:

- Raw Kirchhoff PreSTM stacks (5 angles + Full stack) in depth and time
- Final Kirchhoff PreSTM stacks (5 angles + Full stack) in depth and time
- CBM PreSDM full stack depth converted
- Velocity models (Vvert, Delta and Epsilon) + Manually picked radon velocities
- Premig Shot Gathers
- Postmig NMO-corrected CDP gathers
- Processing report

Due to a shallow velocity artifact in the Uranus prospect area in the reprocessed dataset, an additional Dual Azimuth processing was carried out as a part of the license work. This processing included field data from MC3D-NVG10/SVG11 and NH9603. The processed dual azimuth data was merged with the BGN15M01 single azimuth data and conditioned in-house. The outline of BGN15M01 and the Dual Azimuth data are shown in Fig. 2.2.

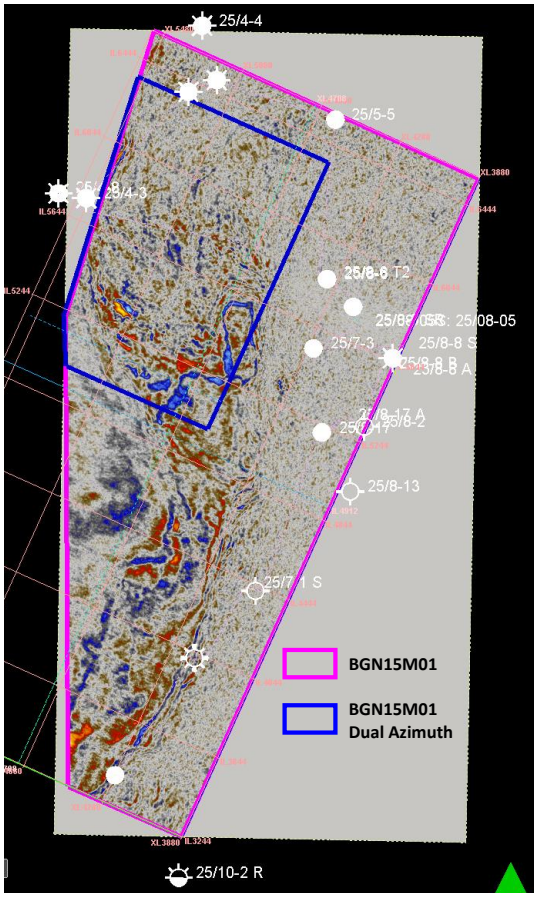

Fig. 2.2 Outline of reprocessed seismic volumes (BGN15M01)

BGN15M01 Dual Azimuth processing deliverables from PGS were:

- Raw Kirchhoff PreSTM stacks (4 angles + Full stack) in depth and time
- Final Kirchhoff PreSTM stacks (4 angles + Full stack) in depth and time
- Velocity models (Vvert, Delta and Epsilon) + Manually picked radon velocities
- Postmig NMO-corrected CDP gathers
- Mazstack raw & final (time & depth)
- Mazstack CDP gathers (time converted)
- Processing report

The resulting seismic quality is good to very good. PGS MegaSurvey seismic data was utilised east and west of the license for basin modeling and regional mapping purposes.

2.2 Well data:

The PL735 S common well database used is listed in Table 2.2.

Table 2.2 Common Well database

>20 year, full access	Only access to raw data
16/1-2	16/1-5
24/9-1	16/2-5
24/12-1 R	25/8-7
24/12-2	25/8-8 S
25/4-1	25/8-9
25/4-3	25/8-11
25/4-5	25/8-12 A
25/4-6 S	25/8-13
25/5-1	25/8-15 S
25/5-2	25/8-16 S
25/5-3	25/8-17
25/5-4	25/9-1
25/6-1	25/9-2 S
25/6-2	25/9-3
25/7-1 S	25/10-6 S
25/7-2	25/11-19 S
25/8-1	25/11-23
25/8-2	25/10-8
25/8-5S	25/10-8 A
25/10-2 R	
25/10-4 R	
25/10-11T2	
25/11-1	
25/11-5	
25/11-15	
25/11-17	
25/12-1	
26/4-1	

2.3 Special studies:

The following studies have been performed in-house or by external contractors:

- Reprocessing of the survey MC3D-NVG10/SVG11 (PGS data processing 2015)
- Well Study (Ichron Limited 2015)
- Dual Azimuth processing (PGS data processing 2015/16)
- Sandstone Reservoir Quality Modelling using Touchstone (Geocosm 2016)
- Geophysical studies including seismic conditioning, AVO and seismic inversion
- Seismic mapping and prospect evaluation
- Basin modelling

3 Review of geological framework

Several special studies have been carried out both in-house and by external contractors. These studies include:

Seismic reprocessing (PGS Data processing 2015)

As PL735 S is a stratigraphic license the seismic processing focussed on the deeper targets. However, an understanding of the overburden is important in order to image the deeper targets.

The processing sequence is given in Fig. 3.1. In order to improve the result in the depth conversion a full waveform inversion (FWI) was carried out, as this process gave a high resolution velocity model for the shallow interval. An example of the velocity improvement is shown in Fig. 3.2. A Q-Kirchhoff migration was performed in order to improve the resolution. The overall quality of the reprocessing is good. For further information on the reprocessing we refer to the processing report "3555bay_Processing_Report_030815_final_signed".

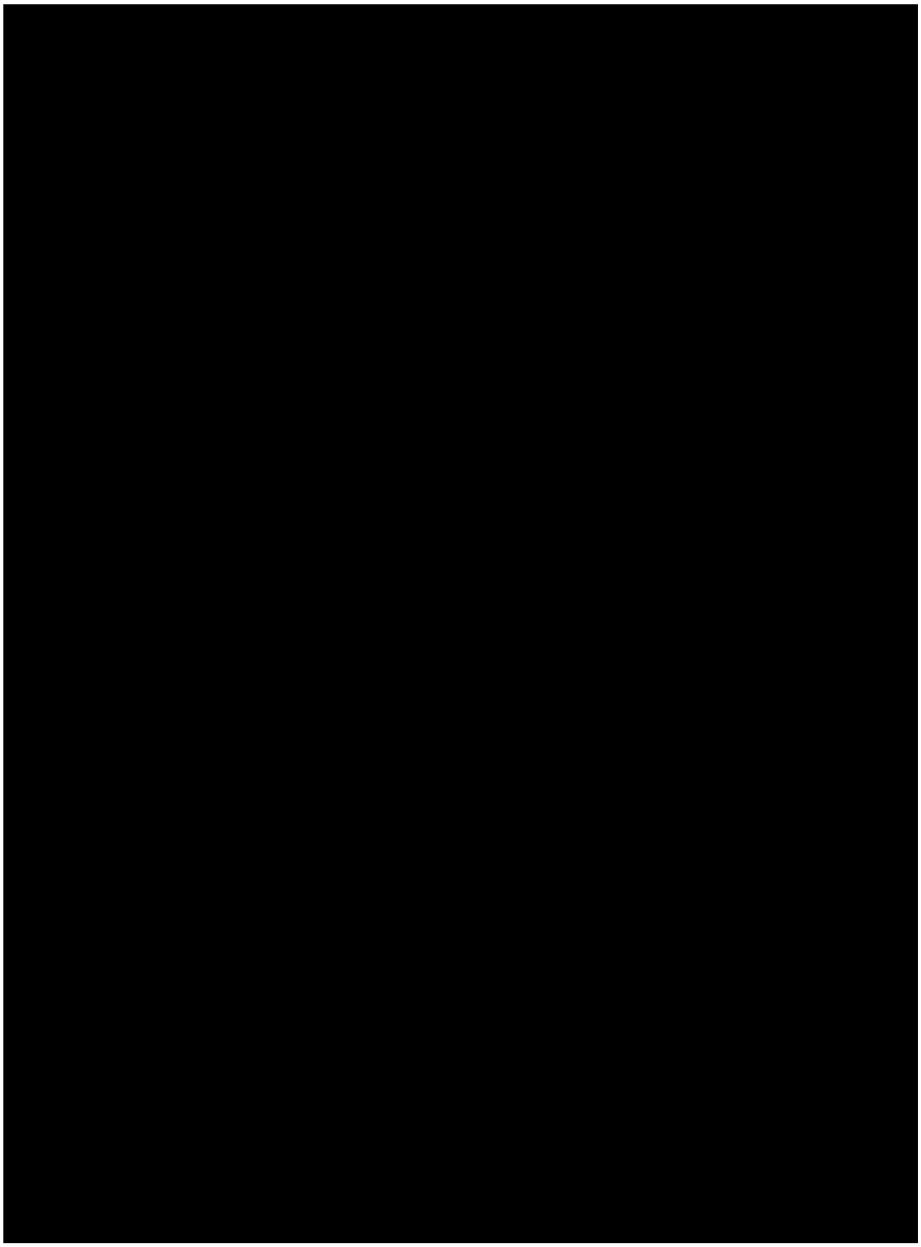

Fig. 3.1 Main reprocessing sequence

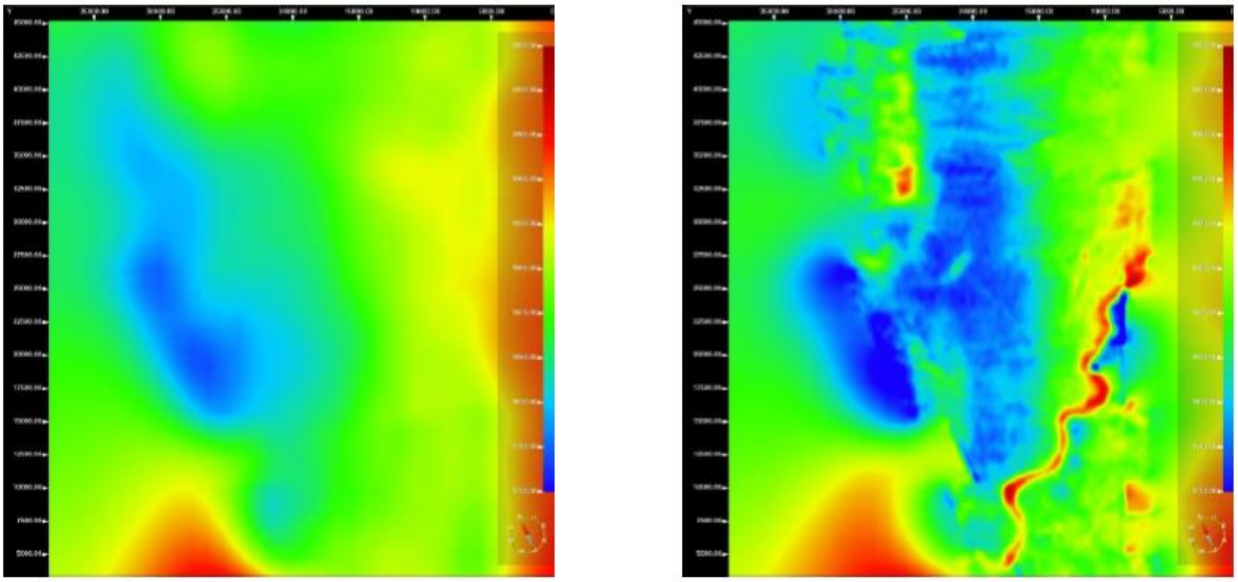

Fig. 3.2 Improvement in velocity model due to FWI
Initial model (right) and FWI velocity model (left) at depth slice 435m

Dual Azimuth reprocessing (PGS Data processing 2015/16)

The quality of the reprocessing was not optimal in an area over the Uranus prospect. This was solved by performing a Dual Azimuth/Multi Azimuth (MAZ) reprocessing by combining data from MC3D-NVG10 and NH9603. These two data sets are shot almost perpendicular. This processing was able to image the Uranus target with little influence from the velocity anomaly in the overburden. As a part of the MAZ processing an updated and improved velocity model was generated. In Fig. 3.3 the improvement in the MAZ reprocessing is shown. For further information on the MAZ processing we refer to "3555bay_Processing_Report_Dual_Azimuth_290524_final_signed".

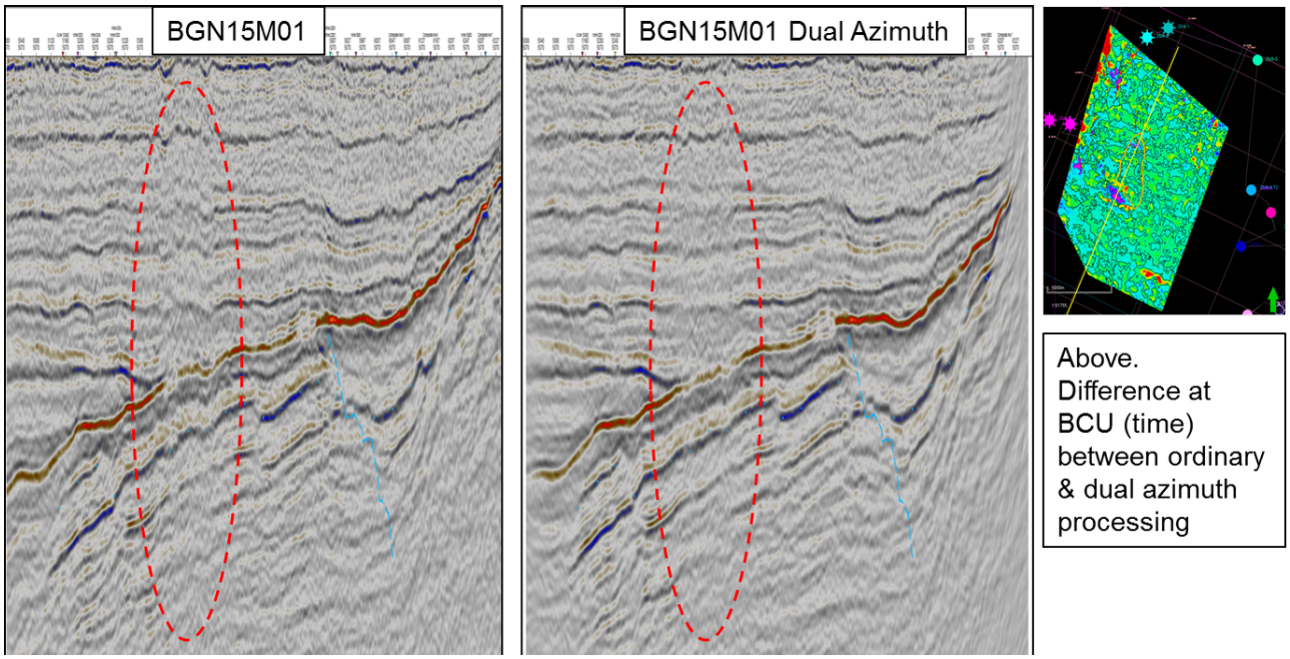

Fig. 3.3 Dual azimuth processing

Special geophysical studies (In-house)

The seismic pre-stack inversion study was performed as a part of the prospect de-risking and consisted of two parts.

The first part was a rock physics analysis of well data for three target intervals (Draupne Fm., Heather Fm. and Vestland Gp.) to determine the best elastic attributes to distinguish sand from other lithologies and brine from HC bearing reservoir. Two main attributes: acoustic impedance and psi projection at -70° (rotation of acoustic & shear impedance) were identified as the best lithology indicators. No reliable fluid indicator was found.

The second part consisted of the pre-stack elastic inversion itself using the single azimuth seismic dataset. The lithology indicators had a reasonably good match with the wells in the area. The inversion results didn't show any sand at the Uranus prospect (Draupne Fm.), but it indicated sand presence in both Heather and Vestland intervals. Amplitude variations in acoustic impedance indicated possible variations in reservoir quality.

Well Study (Ichron Limited 2015)

The objective of the combined biostratigraphic and chemostratigraphic well study, with special focus on the Upper Jurassic, was to capture the transition between the Cretaceous, Jurassic and Triassic in Quadrants 24 and 25.

The study included a biostratigraphic review of the available data, palynological analysis to supplement existing data and geochemical analysis (X-ray fluorescence) of samples from the sand-prone intervals of the Vestland Group (Sleipner and Hugin formations) and Viking Group (intra-Heather and intra-Draupne sands).

Sandstone Reservoir Quality Modelling using Touchstone (Geocosm 2016)

Reservoir quality is a principal concern for both the Upper and Middle Jurassic prospectivity due to the potential for destructive diagenetic processes during deeper burial. In order to constrain the potential risk a study was undertaken using the TouchstoneTM forward modelling technology, which simulates the physical and chemical changes (diagenetic history) in sandstones from the time of deposition to the present day. The project used petrographic data and core analysis data collected from Upper Jurassic and Middle Jurassic analogue sandstones together with in-house 1D basin modelling.

Reservoir quality predictions were made for two different burial depths (apex and down dip) for both Upper Jurassic and Vestland Gp and for different scenarios (incorporating the possible effects of grain coating and of illite precipitation).

Reservoir Quality in the Upper Jurassic is heavily dependent upon the presence of grain coatings which are considered unlikely to be present in the prospect area and modelling results indicate that the reservoir quality of Upper Jurassic sandstones at the prospect is likely to be affected by both quartz cementation and illitisation. Preservation of reservoir quality could occur in the presence of sufficient grain coating. Reservoir Quality in the Vestland Gp is very dependent upon original mineralogy and the likelihood of illite precipitation.

Geological model update for the LateJurassic (In-house)

The geological model for the Late Jurassic in the PL735 S area was developed in APA 2012 and APA 2013. Based on the evaluation of the new seismic data, the well study, and special studies, an updated geological model for the Upper Jurassic is presented Fig. 3.4.

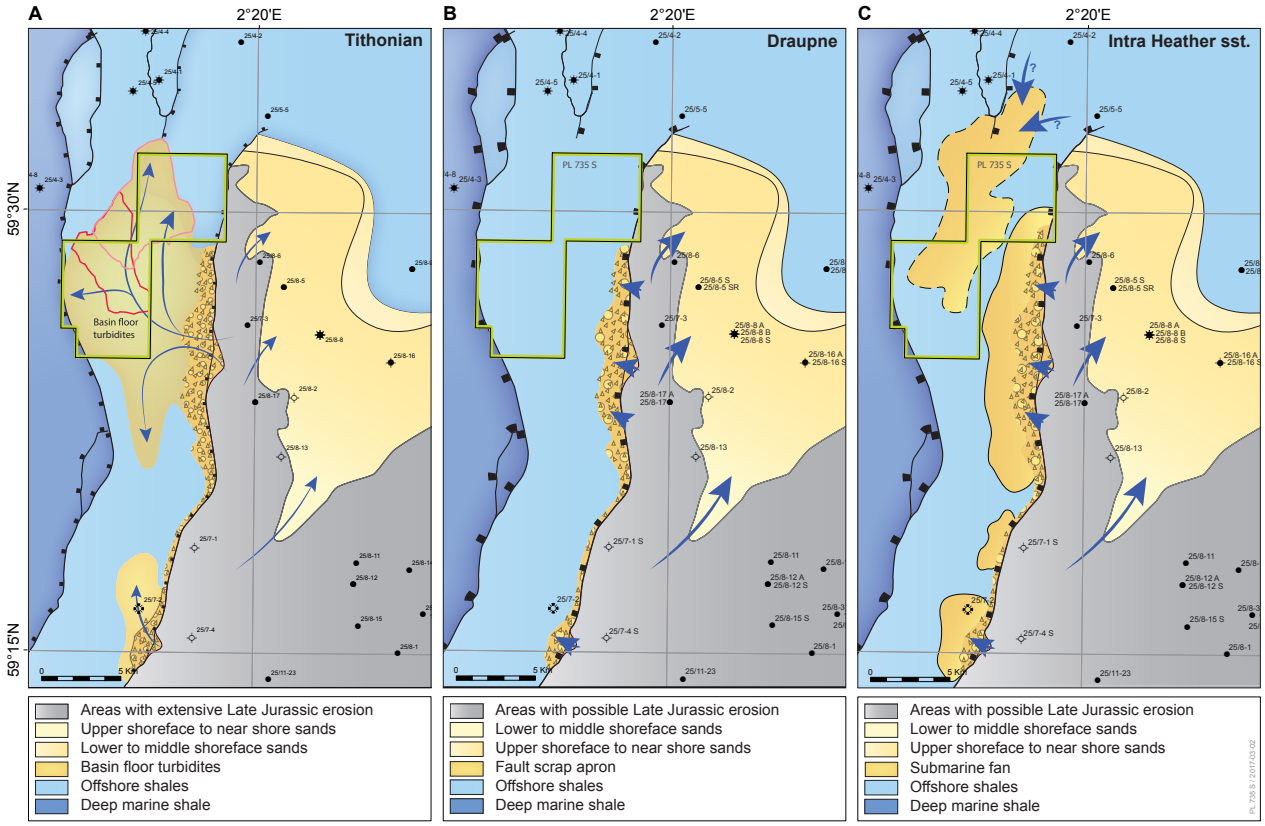

Fig. 3.4 Upper Jurassic paleogeography
A) APA 2013 Tithonian paleogeography . B) and C) Updated paleogeography for the Draupne and Heather fms.

The main prospect, Uranus, of late Jurassic age, was expected to be part of a sedimentary wedge just down-flank of the Utsira High, with a reservoir consisting of Tithonian age gravity flow sediments. Based on the evaluation no Tithonian age sandstones could be mapped within the Uranus prospect area, and only minor indications of a possible fault scarp apron could be interpreted east of the license area along the western bounding fault of the Utsira high.

An inferred intra Heather sandstone (Oxfordian), that could be correlated to the lower intra Heather sandstone in the 25/7-2 well, was mapped, based mainly on seismic inversion data. A possible sediment source to the north on the Heimdal Terrace is suggested, but the sands cannot be confidently mapped north of BGN15M01..

4 Prospect update

Uranus

The Uranus prospect was defined in the APA 2013 application as a combined stratigraphic/structural trap in Block 25/4 with a prognosed reservoir comprising Tithonian age intra Draupne sandstones deposited as deep marine gravity flows sourced from the western Utsira High, where deep erosion into Jurassic and Triassic strata can be recognized. The depositional model was based on intra Draupne sandstones interpreted in well 24/7-2, deep erosion into the western margin of the Utsira High and seismic mapping in the PL735 S area. A similar prospect, the Halfsnøy prospect, was mapped by Fortis Petroleum AS, but with a higher upside to the east and north.

Interpretation of the BGN15M01 reprocessed seismic data, including the Dual Azimuth dataset, could not confirm the Uranus trap as mapped in APA2013 nor could any new trapping mechanism for the Draupne interval be confidently defined based on the reprocessed seismic data Fig. 4.1. Geophysical studies could not confirm the presence of sand in the Draupne interval in the Uranus area, and only minor indications of sand interpreted as fault scarp aprons deposited along the western bounding fault of the Utsira High could be interpreted from the inversion data. This is also supported by the redating of the intra Draupne sands in 25/7-2 to intra Heather sand (Oxfordian), and therefore the APA2013 proposed geological model of Tithonian intra Draupne sands is no longer considered valid Fig. 3.4. The Uranus prospect has therefore been downgraded to lead status.

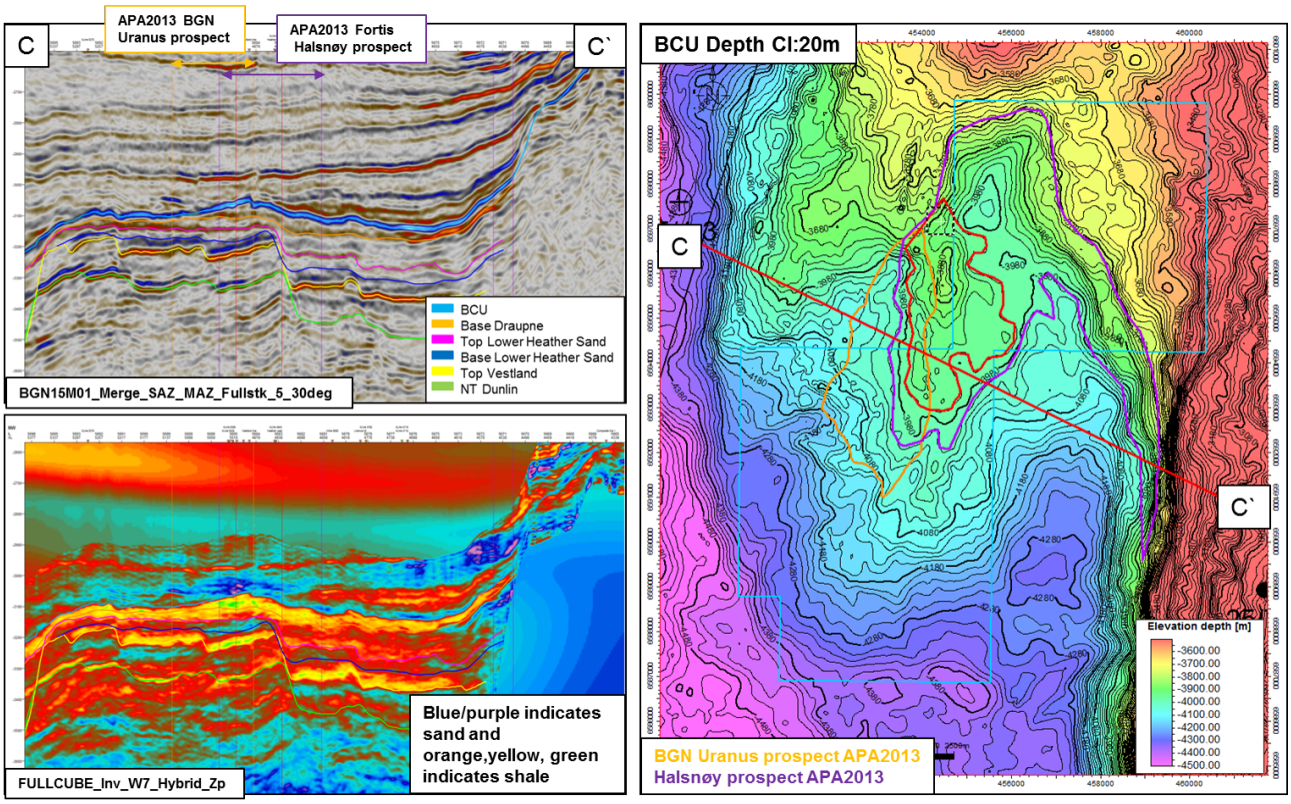

Fig. 4.1 Uranus summary

Vestland

The Vestland prospect was originally defined as lead in the APA 2013 application. The reprocessed seismic data did not change the overall structural outline of the Vestland prospect, but the base of the Vestland Group and faults could be interpreted with greater confidence. This was specially important as fault seal was necessary for the trap to work Fig. 4.2 . Fault seal capacity was calculated for the Vestland interval as the the Vestland

Group is not fully offset at the apex of the structure (-4260mTVDSS) with a throw of ~100m. Throw diminishes southwards along the eastern fault and zero offset occurs at -4600m TVDSS. SGR values indicate that a displacement in the order of 100m is needed for the fault to seal, which is only possible for the P90 case. Furthermore, the mapped intra Heather sandstones are most likely juxtaposed against the Vestland sandstones at the apex of the structure and could act as thief sands and carrier beds updip towards the Heimdal High.

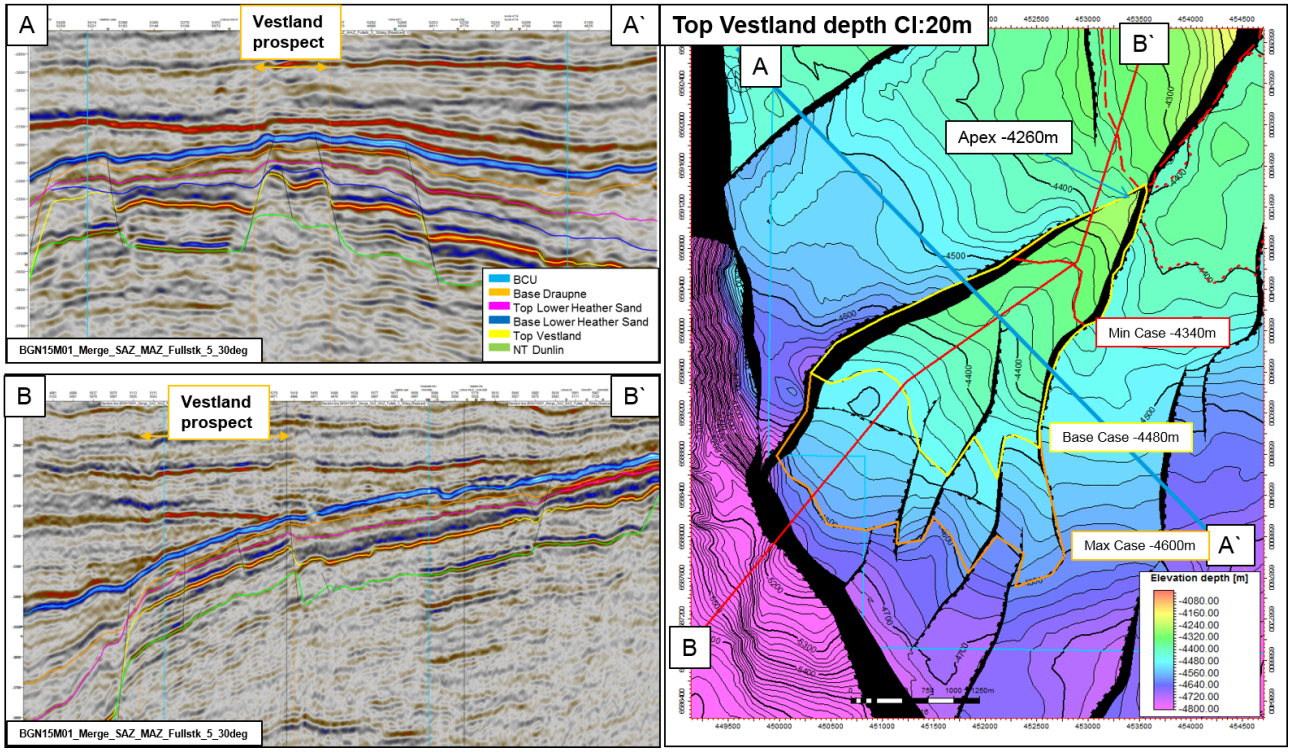

Fig. 4.2 Vestland summary

Individual Risk elements for the Vestland prospect has been set to:

Trap 0.3

Reservoir 0.7

Charge 0.8

Retention 0.9

The Operators risk evaluation gives a PoS= 15% with a killer risk on trap

Recoverable volumes of gas for the Vestland prospect have been calculated to $2.58*10^9$ Sm3 (P50)

Table 4.1 Vestland prospect
Inplace and recoverable resources

Inplace resources	P90	P50	P10
HC liquid (1e 6 Sm3)	0.829	2.4	5.12
Gas (1e9 Sm3)	1.63	4.13	8.28
Total resources (1e9 Sm3 GE)	2.52	6.54	13.3
Recoverable resources	**P90**	**P50**	**P10**
HC liquid (1e 6 Sm3)	0.252	0.778	1.92
Gas (1e9 Sm3)	0.744	2.0	4.14
Total resources (1e9 Sm3 GE)	1.07	2.83	5.84

Due to the high risk, low volume potential and conditions close to HTHP, it was decided not to pursue the Vestland prospect further.

Additional Leads

As a consequence of the redating of the Intra Heather sands in 25/7-2 and the geophysical mapping and studies performed on BGN15M01, two Intra Heather sandstone leads, shown in Fig. 4.3, have been defined in the license. Both leads carry a high risk on trap, reservoir presence and quality, and it has not been possible to mature the leads to prospect status. No Lower Cretaceous prospectivity has been identified.

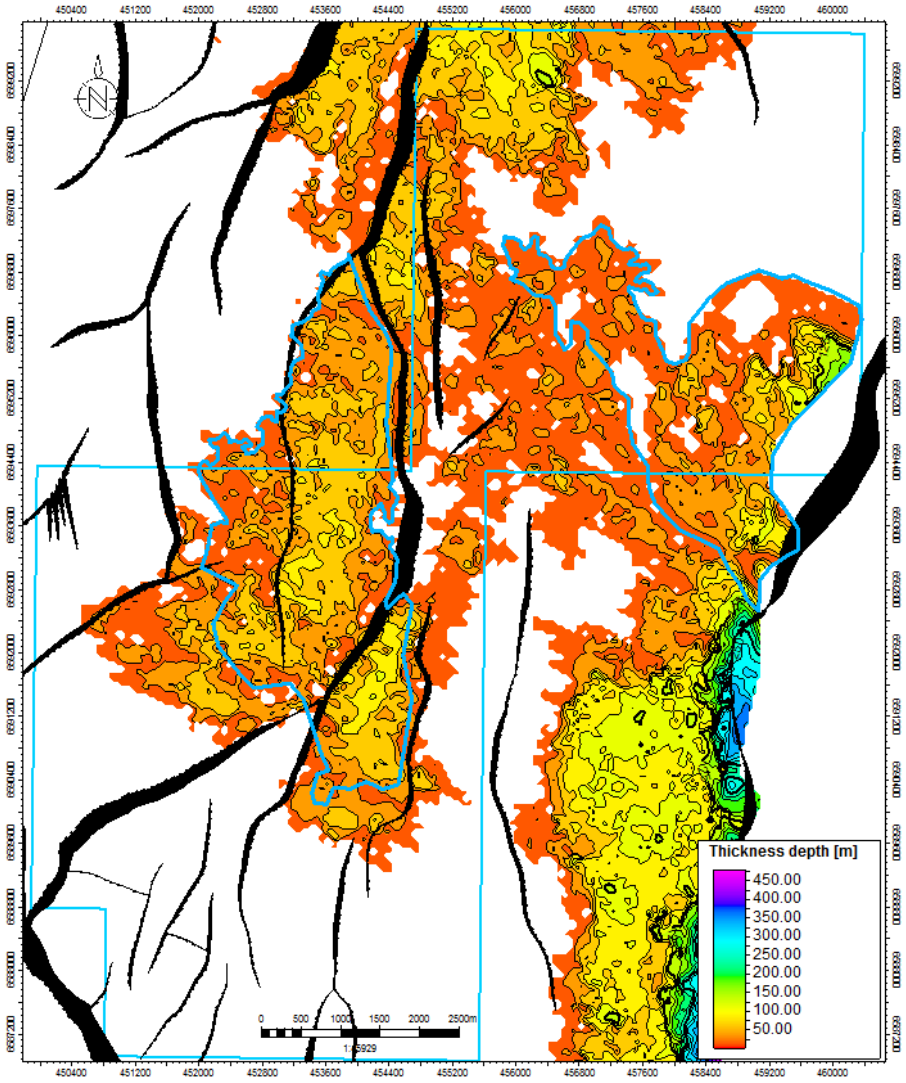

Fig. 4.3 Intra Heather sandstones
Blue polygons showing the identified intra Heather sst leads

5 Technical evaluations

No technical-economical evaluations have been performed in the license, since the Uranus prospect was downgraded to lead status and the Vestland prospects carried a killer risk on the trap and preliminary volume estimates showed only marginal P50 Volumes. No other prospects with commercial volumes were identified in the license.

6 Conclusions

The partnership in PL735 S has completed Phase 1 of the work programme comprising purchase of seismic data, reprocessing, G&G studies and evaluations. The work performed has greatly improved the understanding of the area, but the prospectivity evaluations have not resulted in a drillable prospect with commercial volumes within the license. The license partners have unanimously concluded to relinquish the license acreage.