Relinquishment Report PL791

Point Resources, Oslo, October 2017

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1 Key licence history

PL791 (Fig. 1.1) was awarded to Point Resources AS (previously Rocksource and Pure E&P) (50% and Operator) and licence partner Tullow Oil Norge AS (50%) as a part of the APA 2014. The work obligations were as follows:

- Within 3 years: Acquire 3D seismic within the awarded area and perform G&G studies as well as a drill or drop (DoD) decision.
- Within 5 years: Drill one exploration well and decide to Concretise (BOK) or drop.
- Within 7 years: Perform conceptual studies and decide on Continuation (BOV) or drop.
- Within 8 years: Prepare development plan, decide to submit PDO or Drop.

The voting rules to pass a resolution for the licence were two of two companies to vote and a minimum 50% share.

Regular licence meetings were held on the following dates:

25th March 2015 - ECMC meeting #1

20th November 2015 - ECMC meeting #2

28th November 2016 - ECMC meeting #3

7th March 2017 - EC status meeting

20th April 2017 - ECMC meeting #4

The licence work obligations are fulfilled. One seismic 3D survey was acquired (DOL15003). Based on the results from the G&G work, the Management Committee of PL791 has concluded to not drill a well and therefore relinquish the licence.

The reason for relinquishment is that seismic 3D data revealed a new understanding of the amplitudes seen on 2D, which defined the main prospect, leading to the conclusion that the prospect no longer exist. It was not possible to mature the identified leads into prospects nor to identify significant new prospects. (Fig. 1.1)

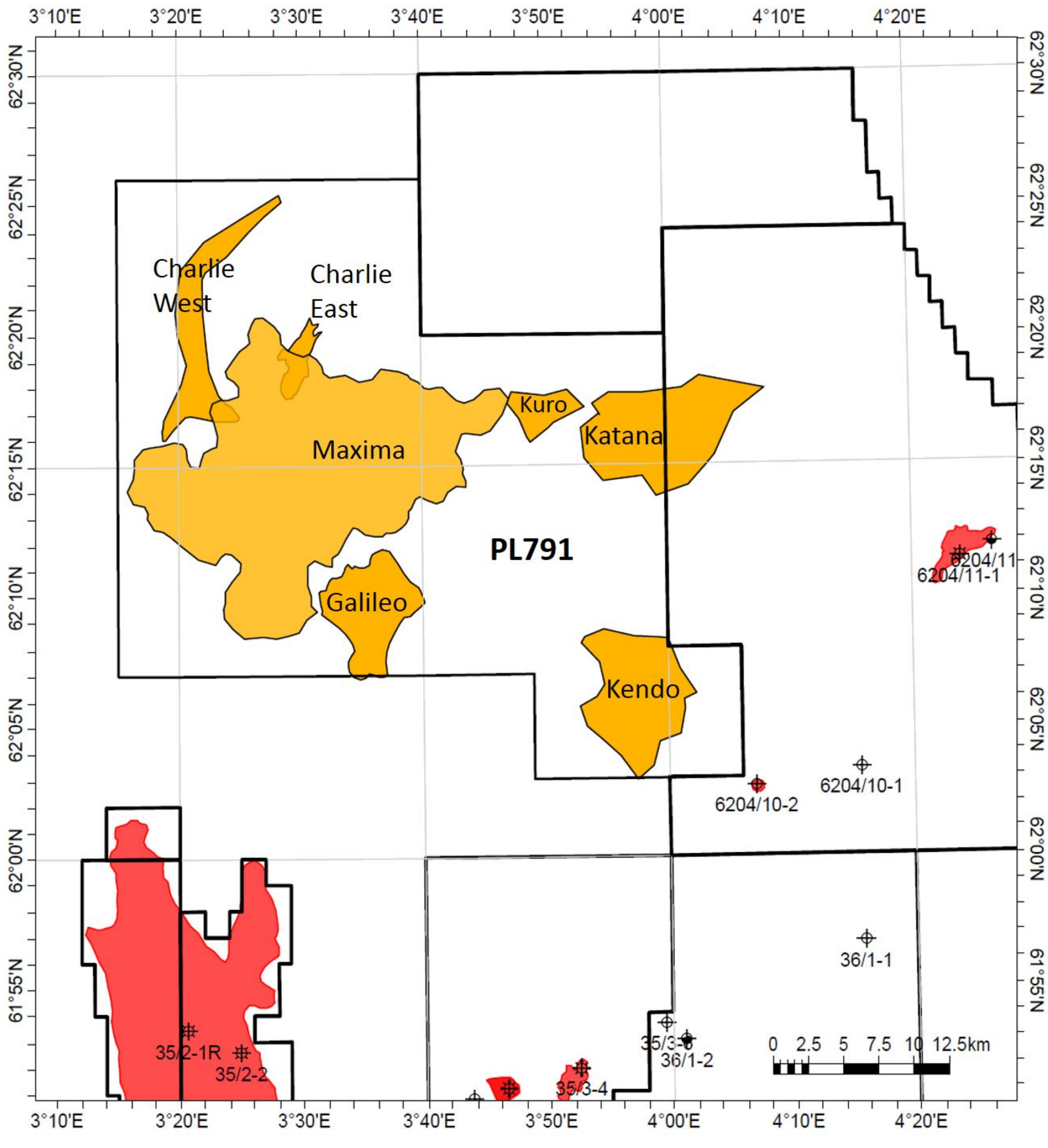

Fig. 1.1 PL791 licence map with mapped leads

2 Database

2.1 Seismic database

The seismic database used for evaluation of the PL791 is shown in Fig. 2.1. The DOL15003 3D survey covering parts of the licence and the entire original main prospect "Maxima", was aquired during the summer of 2015. The final data were delivered to the PL791 partnership in October 2016 and contained final stacks, offset stacks and prestack gathers. In addition to the DOL15003 3D survey, all public 2D and 3D (in form of the MC3D MegaSurvey) data and some long offset NSR and MNR 2D lines in the area have been utilized to evaluate the prospectivity of the licence. The DOL15003 survey is a broadband seismic survey. The data quality of the DOL15003 is good to very good, while the data quality of the public data and the long offset 2D lines varies from poor to good. The DOL15003 survey has NPDID 8201 and is a multiclient dataset.

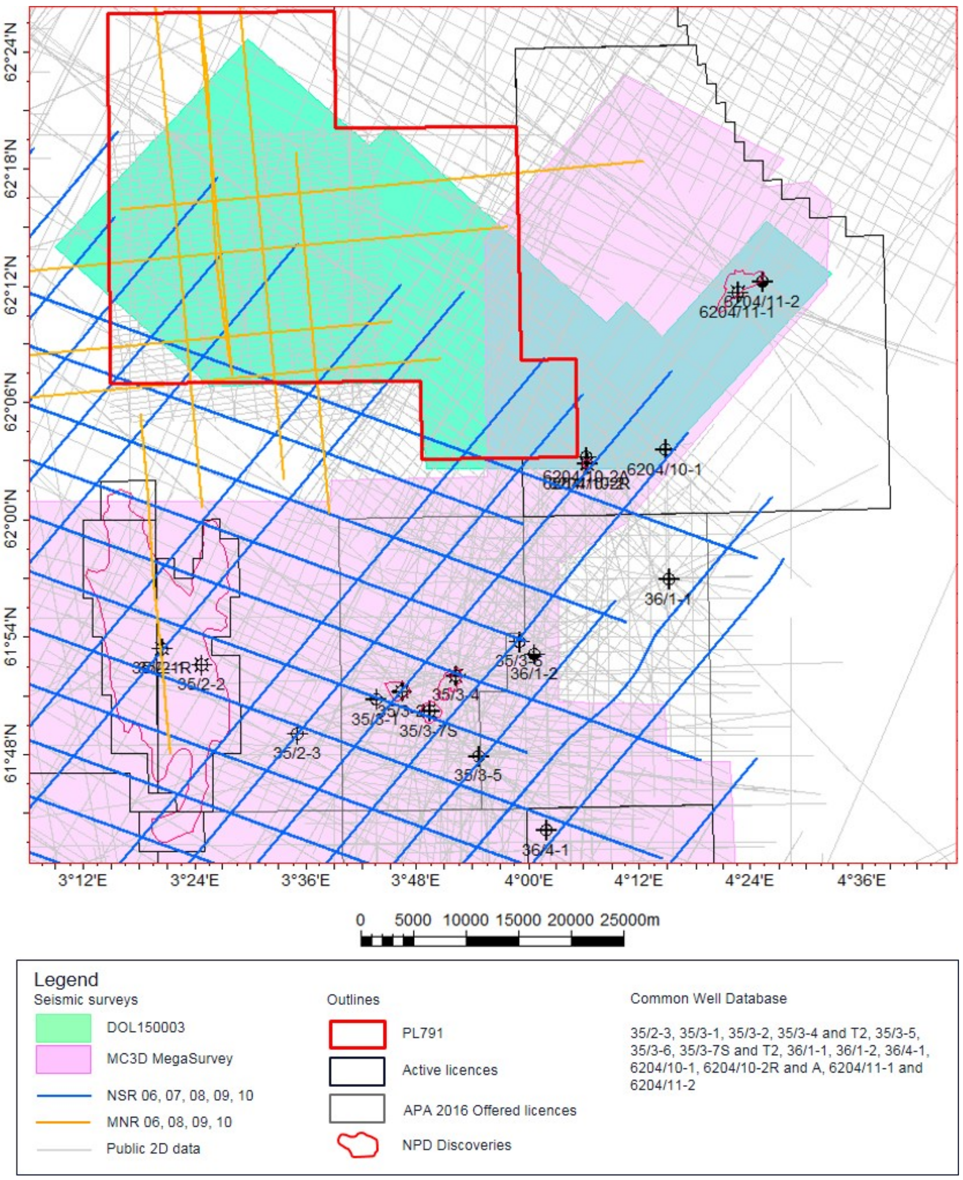

Fig. 2.1 Well and seismic database ***The MC3D MegaSurvey is a merge of the following dataset in the area: BPN9401, GDF09M1, GP3D93R02, MS97MR01, NH03M3 and ST98M6.***

2.2 Well database

The common well database established for PL791 consisted of all publically available well data in the area, however particular focus was put on the 5 wells that are covered by the DOL15003, see Table 2.1. During the licence period, no new wells were drilled in the area. The well database is shown in Fig. 2.1.

Table 2.1 Main PL791 well database

Well	NPDID
6204/10-1	2666
6204/10-2	2952
6204/10-2A	3280
6204/10-2R	3258
6204/11-1	2205
6204/11-2	3249

2.3 Special studies

The following geophysical studies has been performed and are described in 3.2 Geophysics:

- RGB blending
- Relative acoustic and elastic impedance
- AVO study
- Wedge Modelling

3 Review of Geological and Geophysical studies

The subsurface evaluation of the PL791 has primarily been focused on the Upper Cretaceous Turonian-Coniacian play, represented by the Tryggvason Formation and corresponding to the reservoir unit of the main prospect "Maxima" located in the Slørebotn sub-basin. In addition, a thorough evaluation of the prospectivity within the Paleocene and the Eocene play, corresponding to the Våle, Lista, Sele and Balder formations has been carried out. See Fig. 3.1.

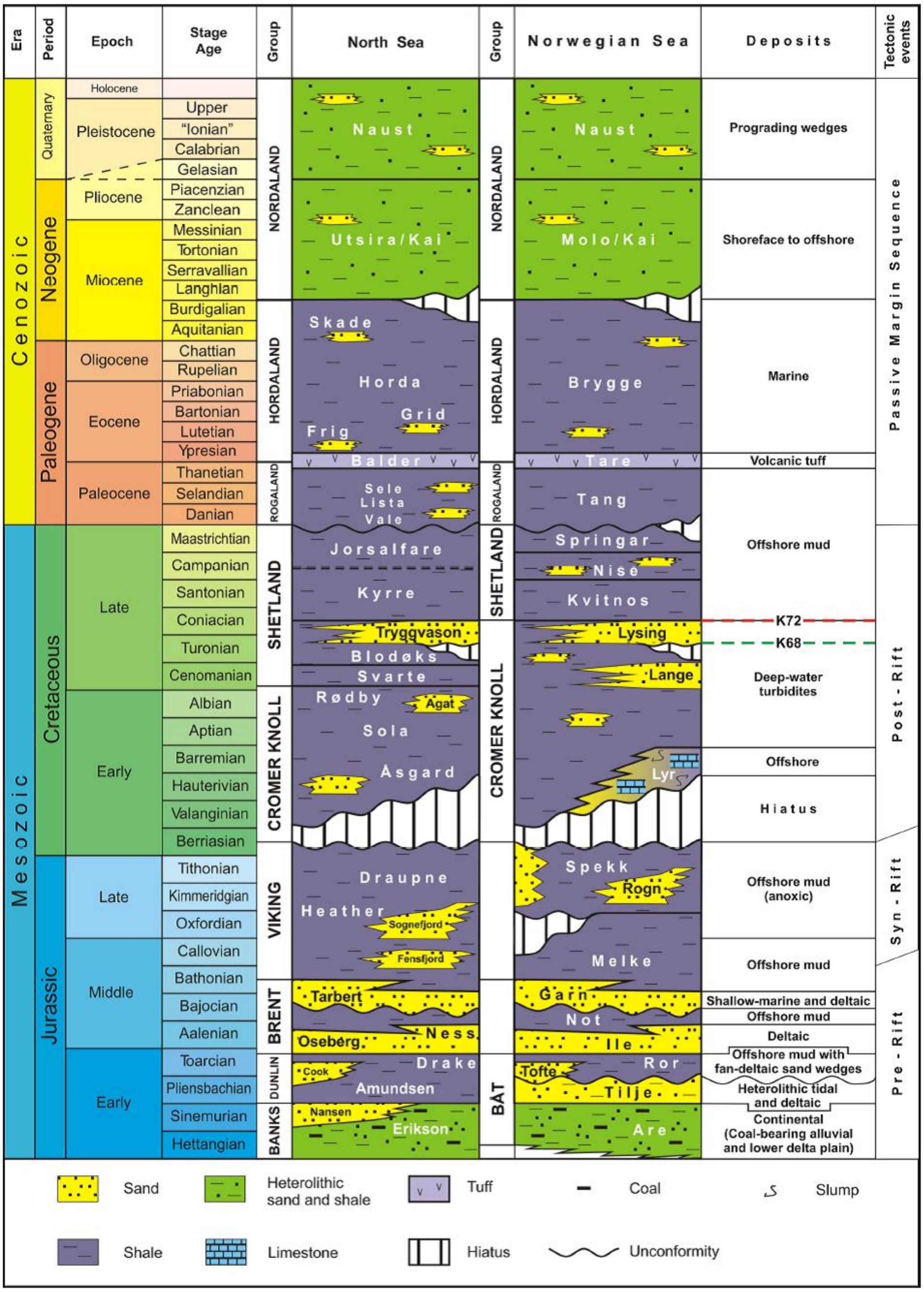

Fig. 3.1 Lithostratigraphic column ***The main reservoir target was in the Upper Cretaceous Tryggvason Fm. Leads were of Upper Cretaceous, Eocene and Miocene age.***

The application for the licence was based on seismic interpretation carried out on 2D data of different vintages. As the main prospect was relying on up-dip stratigraphic pinch-out, a large uncertainty was related to the trap definition. In addition, although the model for depositing sand in the area was plausible, a clear indication for feeder systems into the Slørebotn sub-basin was lacking. An amplitude anomaly seen on offset 2D seismic stacks provided support for the model.

In order to de-risk the different prospect elements, the DOL15003 3D seismic survey was acquired, covering 1375 km^2 including the main prospect and with tie to relevant wells.

3.1 Seismic interpretation

The main interpreted horizons on the DOL15003 survey are the seabed, base Quarternary Unconformity (BQU), top Balder, top Jorsalfare, intra Coniacian flooding surface (top Maxima prospect), intra Turonian sequence boundary (base Maxima prospect), top Blodøks, top Cromer Knoll, base Cretaceous unconformity (BCU) and top basement (Fig. 3.2). The Paleocene/ Eocene interval with the Galileo Lead has been interpreted in detail (see Fig. 4.7). Depth maps and thickness maps for all intervals have been produced. Regional maps of the top Balder, top Jorsalfare, intra Turonian sequence boundary and the top Blodøks have been produced and used for evaluation of the licence.

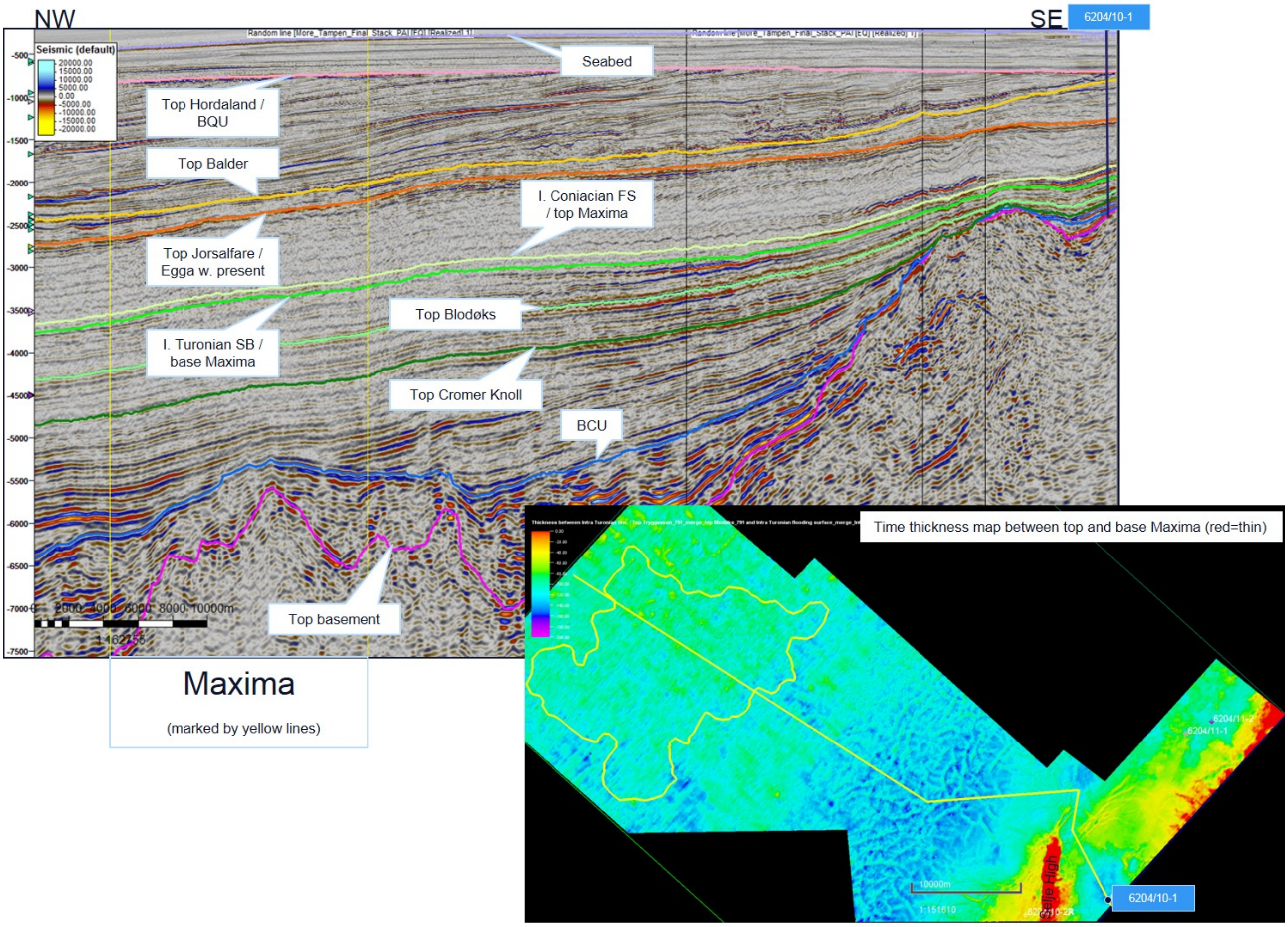

Fig. 3.2 Semi-regional interpretation on DOL150003 ***Notice the lack of structuration within the Cretaceous and younger. Polygonal faulting is clearly imaged on the thickness map and dominates the area NW of the Selje High. The location of Well 6204/10-1 is shown on the map and on the seismic line.***

Synthetic seismograms were generated for all the wells covered by the DOL15003 seismic data to identify the interpreted events. Interpreted horizons have been linked to the stratigraphic databases of TGS/FMB and Geolink.

3.2 Geophysics

For all geophysical studies the new DOL15003 seismic data were used. In addition to the stacks delivered by Dolphin, new offset stacks were generated by the operator in order to optimize the far stack amplitude response.

The following studies were carried out to help de-risk identified prospects and leads as well as identifying new possibilities.

RGB blending
RGB blending was done on the full offset stack and extracted on all interpreted horizons as well as pseudo horizons from the sea bottom to the top Basement (total of 30). The RGB cube was mostly used to identify geological features, and in particular to search for depositional patterns that could indicate depositional fairways and presence of reservoir in the area.

Relative acoustic and elastic impedance
Relative acoustic and elastic impedance cubes derived from post stack amplitude inversion can be useful for qualitative estimates of reservoir properties such as porosity, fluid, gross rock volume and others. Input data for the relative acoustic / elastic inversion were the DOL15003 near and far angle stacks respectively. The application of the impedance cubes is discussed in 4 Prospect update.

AVO
The following AVO cubes were generated to use for avo scanning:

1. AVOCUBE=ENVELOPE(FAR)-ENVELOPE(NEAR)
2. PSEUDO Intercept x Gradient=(NEAR * FAR-NEAR)

In addition to impedance and AVO cubes, pre stack gather data inspection was done for all identified prospects and leads to identify any far offset amplitude anomalies that could be caused by critical and/or converted energy.

Wedge Model
Tuning was discussed as one possibilty for the Kendo amplitude anomaly as the Cretaceous sequence is thinning towards the Selje High. Full stack data was decomposed into the following frequecies: 7 - 18 - 32Hz. Maximum amplitude was then extracted along the horizon of interest on these three cubes and plotted as a function of thickness in the wedge model. If thin bed tuning was the cause for this amplitude anomaly, the different frequency volumes would tune at different thickness in the wedge model due to the difference in wave length. The amplitude anomalies for the different frequency cubes plotted at the same location/thickness, and it was therefore concluded that the anomalies were not caused by tuning.

Table 3.1 AVO response in Prospects and Leads

Name	Period	Prospect/ Lead	AVO	Comment
Maxima	Cretaceous	Prospect	2	Weak anomaly
Charlie West	Neogene	Lead	N/A	Too small to be evaluated
Charlie East	Neogene	Lead	N/A	Amplitude anomaly, but no clear AVO (bright on all offset).
Galileo	Paleocene	Lead	2/3	Clear AVO anomaly limited to a small North-East segment.
Kendo (K2)	Cretaceous	Lead	4	Strong soft anomaly, dimming with increasing angle.
Katana (K3)	Cretaceous	Lead	4	Strong soft anomaly, dimming with increasing angle.
Kuro	Cretaceous	Lead	N/A	No anomaly within the Kuro lead on new 3D seisimic

4 Prospect update

In the APA 2014 application, one prospect and six leads were identified within the licence.

The Maxima prospect was defined by an amplitude anomaly within a stratigraphic trap (lateral and up-dip). The play was identified as deep-marine sandstones of Turonian to Coniacian age. The main risk was considered to be trap (lateral and up-dip seal).

The defined leads were: Kuro, Katana and Kendo (Tryggvason Formation), Galileo (Balder Formation), Charlie East and Charlie West (Utsira/Kai Formation).

Maxima prospect
The subsurface evaluation of the PL791 licence has mainly been focused on the Turonian to Coniacian interval within the Tryggvason Formation (Fig. 3.1). Deep marine sandstones on the Måløy slope related to the intra Turonian unconformity, created by a Turonian to Cenomanian tectonic event, are documented in wells (e.g. 6204/10-1, 6204/11-1 & 2). At the time of application, the reservoir of the Maxima prospect was believed to be related to the same tectonic event and interpreted to represent a detached deep marine fan, decoupled from the up-dip sandstones in the slope area. The Maxima play concept is summarized in Fig. 4.1

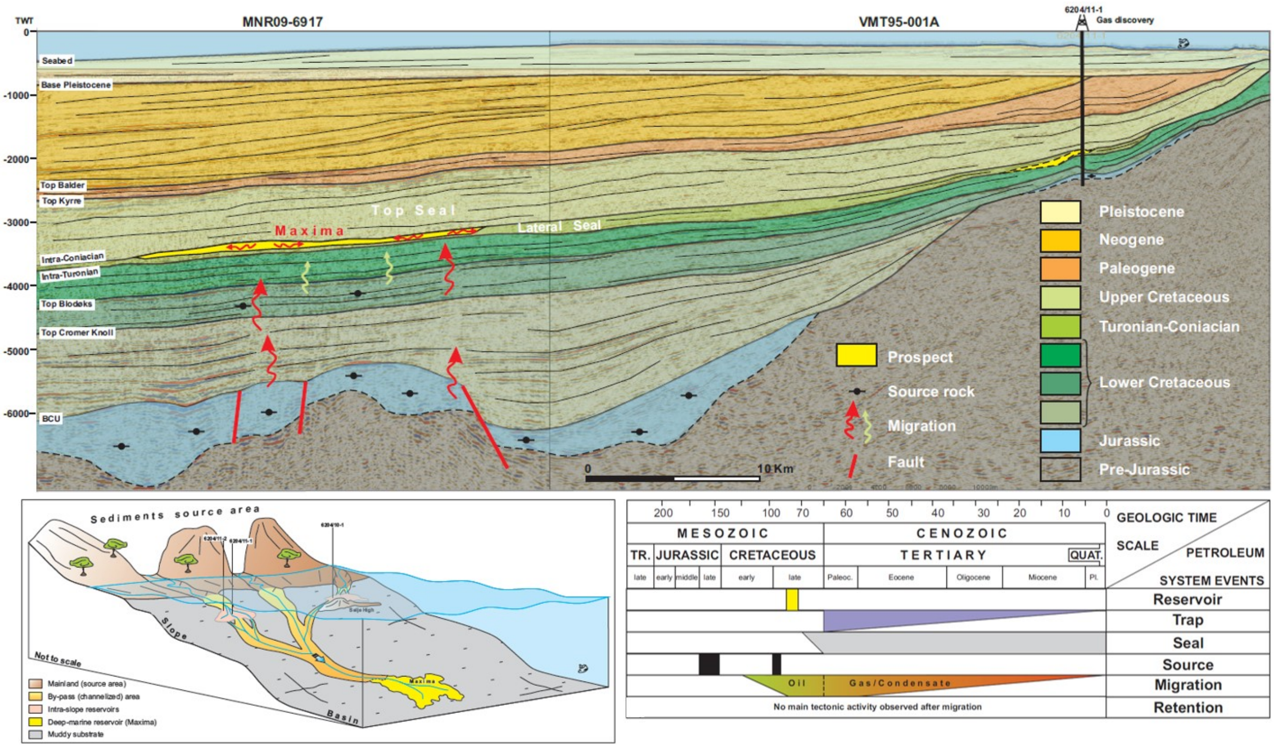

Fig. 4.1 Maxima play concept ***The geoseismic section (top) summarizes the stratigraphy of the area, the Maxima Prospect, the source rock and migration pattern. The reconstructed paleogeographical cartoon to the lower left explains the deposition of the Maxima fan and the concept of slope bypass. The timing of formation of the different elements in the petroleum system is illustrated to the lower right.***

The subsurface interpretation for the licence application was based on 2D data of several vintages. An amplitude brightening with angle was observed on 2D angle stack data, and a fan shape geometry was interpreted. The interpretation was challenging due to poor-moderate quality 2D data.

Detailed interpretation on the DOL15003 survey revealed no indications of feeder channels into the Maxima area. The Turonian to Coniacian sequence and the inferred fairway (west of the Selje High) is dominated by polygonal faulting (see Fig. 3.2 and Fig. 4.2), which is regarded as a shale indicator and related to de-watering of the deposited clays. The previously identified Maxima Prospect is situated within a sequence thin, and a fan-shape with pinch-outs cannot be identified. A slight brightening in amplitude within the interval is observed. It is possibly related to seismic disturbance caused by a combination of vertical gas migration sourced from the underlying Jurassic structure and an overlying strong amplitude/shallow gas anomaly along the BQU. Observations related to "Maxima" are summarized in Fig. 4.2.

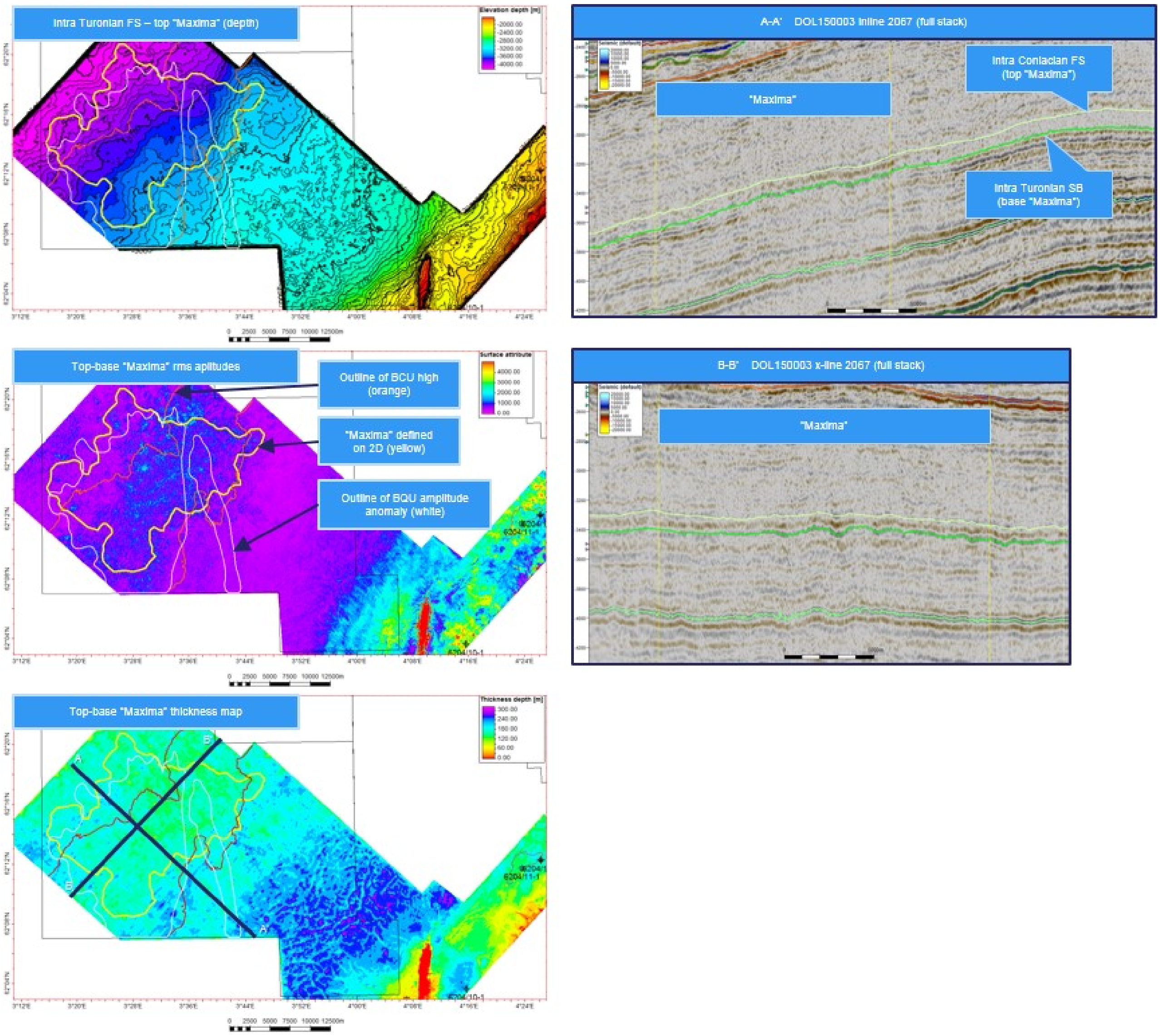

Fig. 4.2 Summary of "Maxima" observations ***The map to the upper left is a depth map of the Intra Coniacian flooding surface (top "Maxima"). Note the lack of structural closure, thus requirements for up-dip and lateral seal. The map in the middle is an rms amplitude extraction between the Intra Coniacian FS to the Intra Turonian sequence boundary (base "Maxima"). Note the slight increase in amplitudes in the area where the Maxima Prospect was defined. The map in the lower left is a thickness map between the Intra Coniacian FS and the Intra Turonian SB. Note that the area where the Maxima Prospect was defined lies within a sequence thin. Also, note the area characterized by polygonal faulting west of the Selje High. The polygons for "Maxima" (yellow), the underlying BCU high (orange) and the BQU amplitude anomaly (white) are marked on the maps. The observed amplitude anomaly across the "Maxima" area is likely to be linked to gas escape from the underlying BCU high and possibly also to the seismic disturbance caused by the overlying amplitude anomaly along the BQU. The location of the seismic lines to the right are marked on the map in the lower left. They clearly show the challenges to define a trap for "Maxima".***

The G&G work shows that it is unlikely that significant Turonian-Cenomanian deep marine sands were deposited in the "Maxima" area. There are positive observations on the seismic related to available charge. A very high risk on reservoir presence combined with the lack of trap, leads to the conclusion that the prospect no longer exist.

Kendo, Kuro and Katana leads

The Kendo, Kuro and Katana leads were originally interpreted as amplitude anomalies in the Upper Cretaceous (Tryggvason Fm) on 2D seismic. They were interpreted to represent deep-marine deposits sourced from the east, similar to the Maxima prospect.

Further evaluation of the Kendo lead based on the new DOL15003 dataset revealed a strong anomaly, see Fig. 4.3. Seismic tuning due to thin beds was investigated as a possible pitfall, but wedge modelling indicates that the anomaly is most likely not caused by tuning.

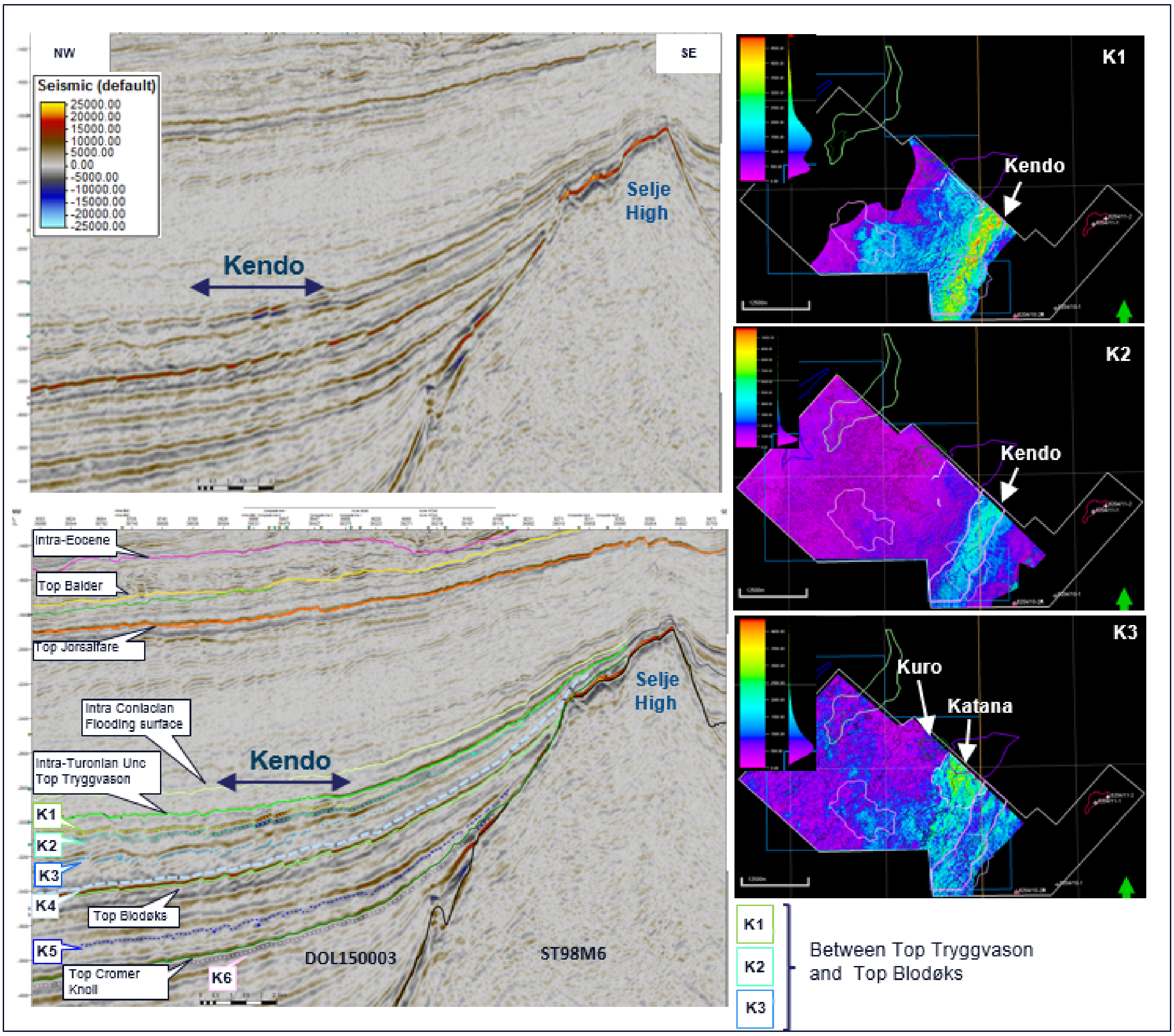

Fig. 4.3 Summary of "Kendo Lead" observations *Left: Seismic characteristics of the lead and detailed interpretation between Tryggvason Fm. and Top Cromer Knoll Gp.(K1, K2, K3, K4, K5 and K6 sequences). In K1 note the slight increase in the amplitudes. Right: RMS maps for the sequences K1, K2 and K3. K1 and K2 shows a clear anomaly response for Kendo lead and K3 for Katana lead. No amplitude response for Kuro. Also note that none of the leads are structural closures, they all rely on stratigraphic trapping.*

In the Kendo lead the ultra far vs. near relative impedance indicates a drop in Vp/Vs, this sort of response could be associated with sandy/silty lithology, see Fig. 4.4. However, the seismic expression and frequency decomposition analysis (Fig. 4.4) shows a pattern interpreted to represent dense polygonal faults characteristic of shale/mudstone-dominated lithology.

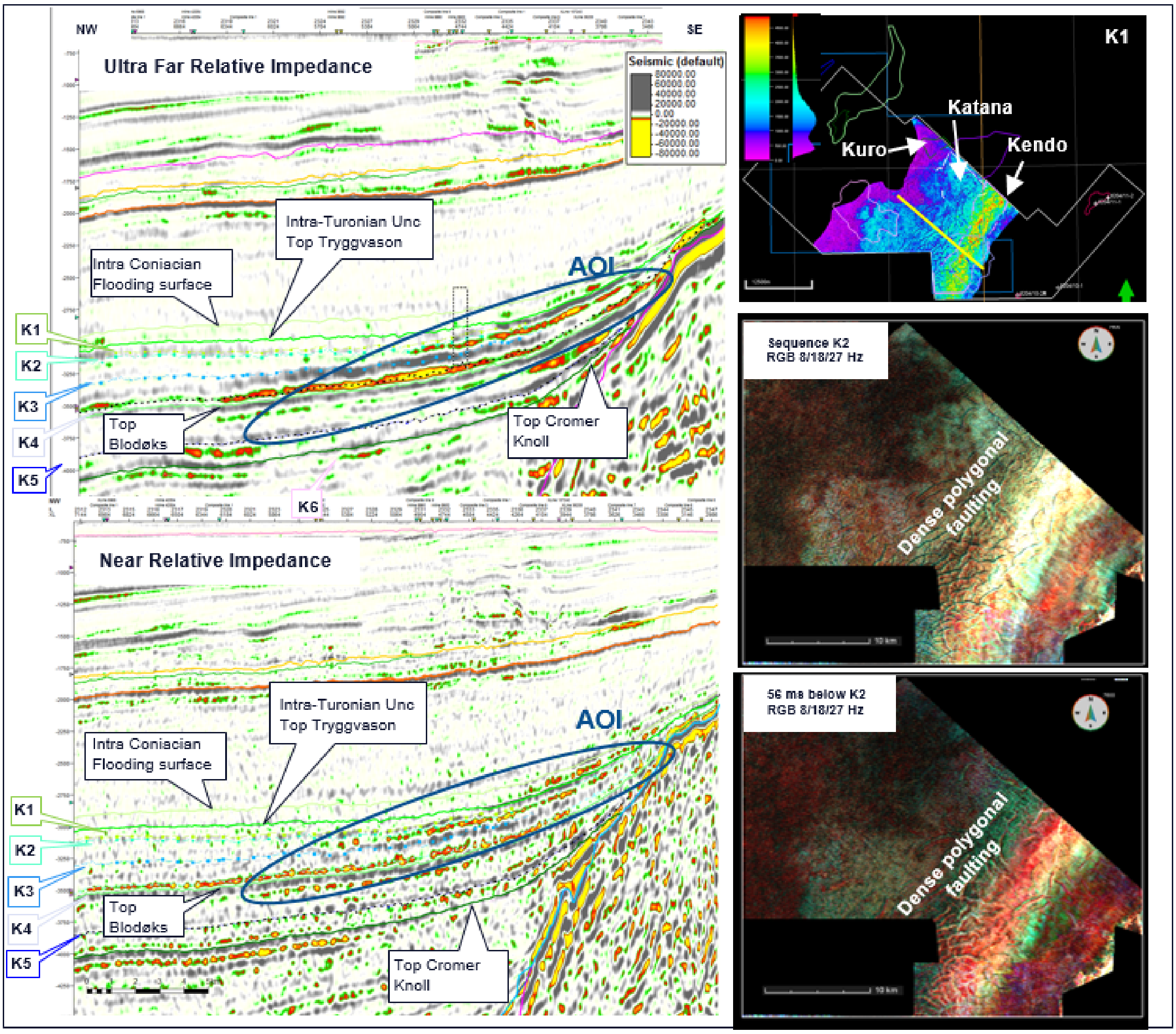

Fig. 4.4 Comparison between Ultra Far, Near relative impedance and Frequency decomposition in the Kendo lead area *Left: A drop in Vp/Vs may suggest that some sands or silts are present in the AOI. Right: The RGB suggests the presence of polygonal fault network between K1-K3 typically associated with shale/mudstone-dominated lithology.*

No distinct or large channel complexes are observed for the sequences K1, K2 and K3, neither through the frequency decomposition analysis nor in the attribute maps produced, see Fig. 4.3, it may indicate a more gradual change in flow properties. This could be attributed to smaller and less erosive gravity flows supplied from the upper slope (Selje High).

Based on the above observations, the Kendo lead has a high risk associated with the presence and quality of reservoir. In the not likely case of a fair reservoir thickness in Kendo (average 60 meter), recoverable volumes of gas are estimated to be 13.9 x 10^9 Sm^3, which is a sub-commercial volume when combined with a low POS.

The Katana lead shows an amplitude anomaly response in the K3 sequence, see Fig. 4.5, but the analysis indicates the same conclusion as for the Kendo lead. The recoverable volumes of gas are estimated to be about 14.1 x 10^9 Sm^3.

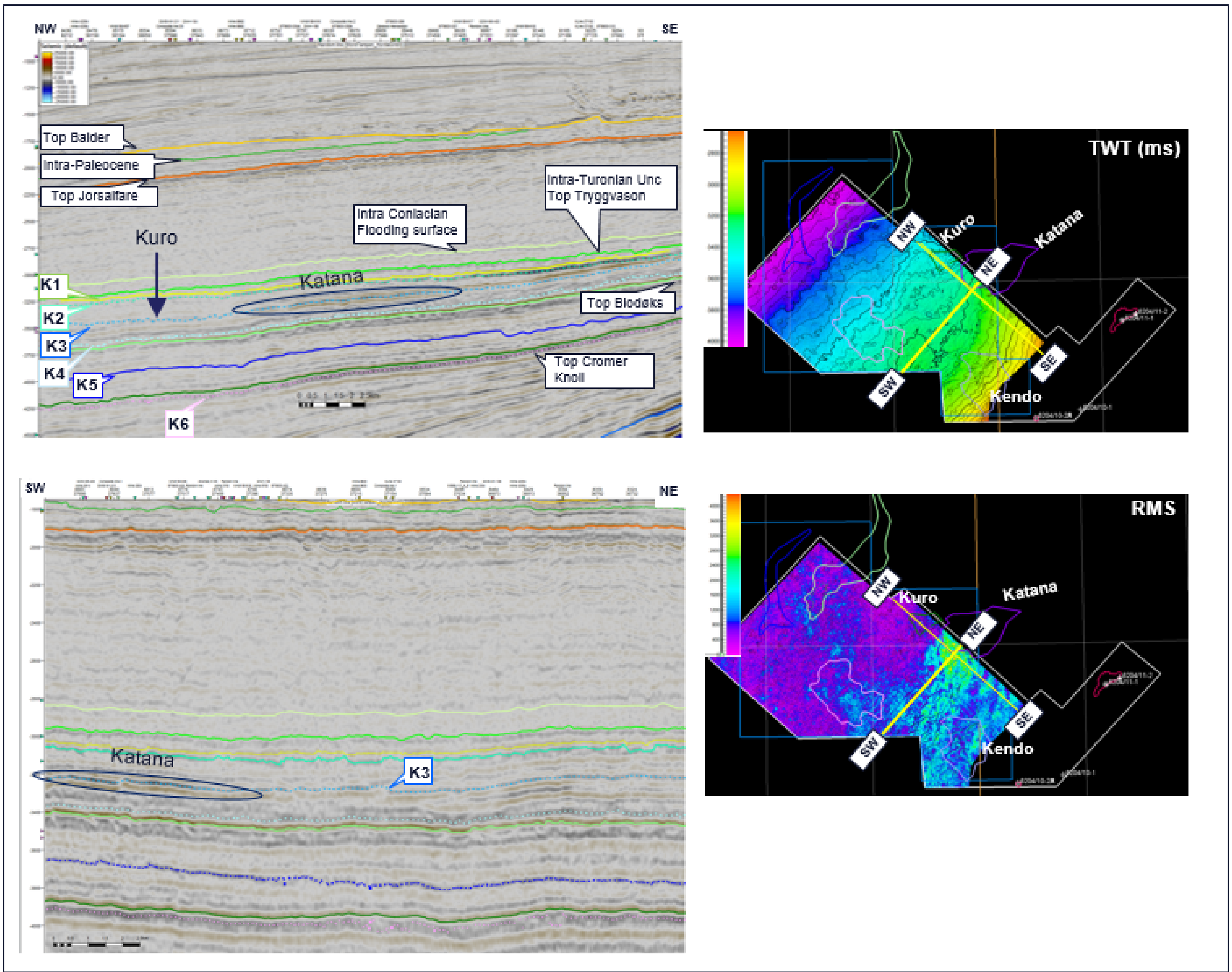

Fig. 4.5 Summary of "Katana and Kuro leads" observations ***Left: Seismic characteristics of the Katana lead and details interpretation between Tryggvason Fm. and Top of Cromer Knoll Gp. (K1, K2, K3, K4, K5 and K6 sequences). In K3 note the increase in the amplitudes. Right: TWT (ms) map for the K3 and RMS for the same sequence. K3 shows a clear anomaly response for the Katana lead, but no response for the Kuro lead defined previously with 2D seismic lines.***

The Kuro lead identified on 2D in the APA application is not well defined in the new DOL15003 seismic dataset, with no anomaly response observed, see Fig. 4.5.

The evaluation on the new seismic dataset of the Cretaceous leads, as defined in the APA application, has not given support for any upgrade of these leads to prospects. In conclusion, the Kendo, Kuro and Katana leads are not likely to have significant reservoir development, and given reservoir presence there would be an additional high risk on the trapping mechanism.

Galileo Lead

The Galileo lead was interpreted as injectite sandstones within the Balder Fm. An amplitude response defined by dimming on far stacks was observed on 2D data. The main risks were considered to be reservoir quality and presence.

Further evaluation of the Galileo lead based on the new DOL15003 dataset has revealed a channelized system, which is likely to be a northward extension of the large Paleocene / Eocene canyons feeding the slope in the 35 and 36 blocks area (Fig. 4.6). Clear thickness anomalies can be mapped out on 3D seismic, however a structural closure is not present. Due to a very high risk on top seal, base seal and lateral seal, a clear trapping mechanism cannot be identified. The expected AVO anomaly for hydrocarbon charged sandstones is only observed in a very small part in the north-eastern segment of the lead. The conclusion from the analysis is that the Galileo Lead remains high risk, and cannot be upgraded to a prospect. The Galileo Lead is summarized in Fig. 4.7.

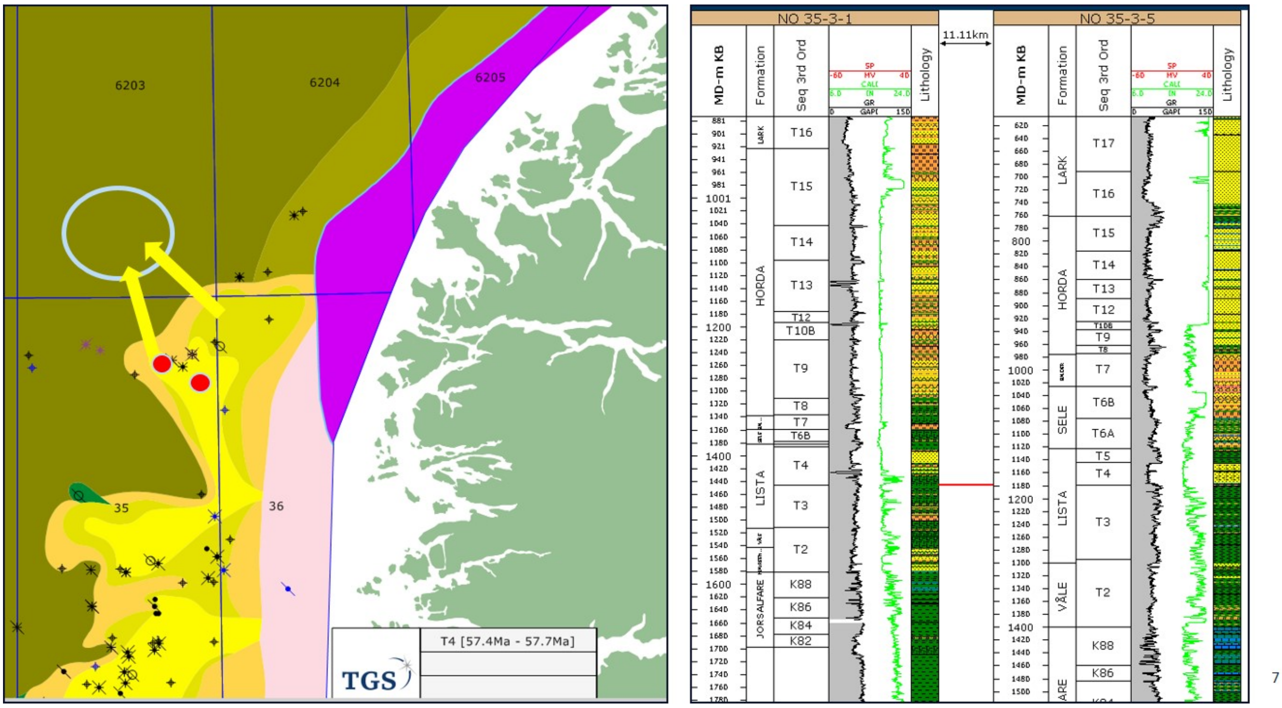

Fig. 4.6 TGS/FMB T4 Heimdal paleogeography ***The map illustrates the possibility for a northward continuation of the deep-marine turbidite system in blocks 35 and 36.***

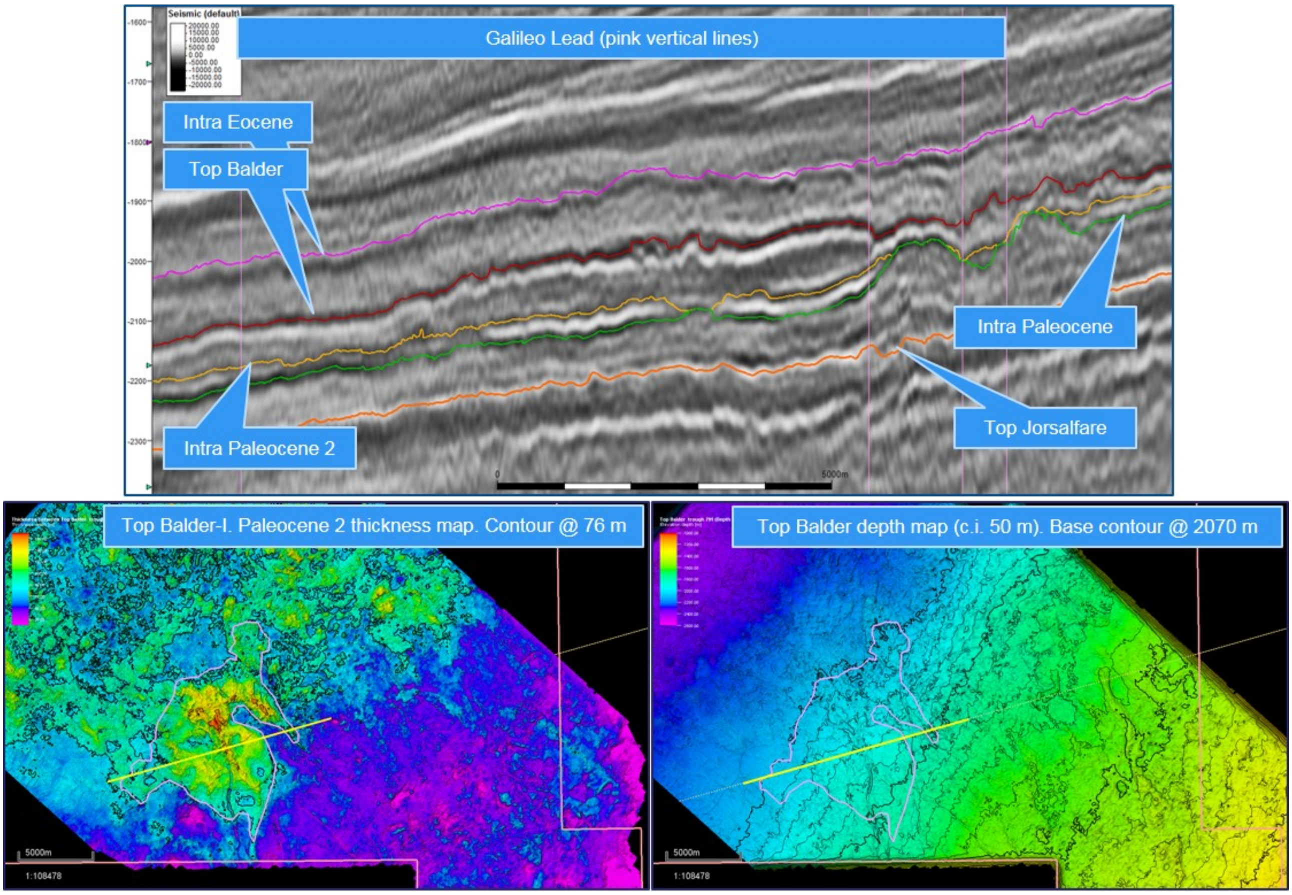

Fig. 4.7 The Galileo Lead ***The top and base of the Galileo Lead is defined by top Balder and intra Paleocene 2 as shown in the DOL150003 seismic line on top (marked by a yellow line on the maps). The lead is defined by a clear thickness anomaly (lower left - warm colours=thick). Small meandering channels can be seen cutting through the lead. However, due to the stratigraphic nature of the lead and the very high risk of top seal, base seal and lateral seal, a trap cannot be defined.***

Charlie East and Charlie West leads

The Charlie leads (west and east) are stratigraphic traps within the Utsira/Kai Formation. Charlie East is characterized by a clear amplitude brightening compared to the background rocks, both on 2D and 3D. A flat event can be observed on 3D data over the part of the Charlie East Lead with the clear amplitude anomaly (Fig. 4.8). The reservoir in these leads has been interpreted to have been deposited by submarine channels moving from the north towards the south. The main risk is considered to be trap.

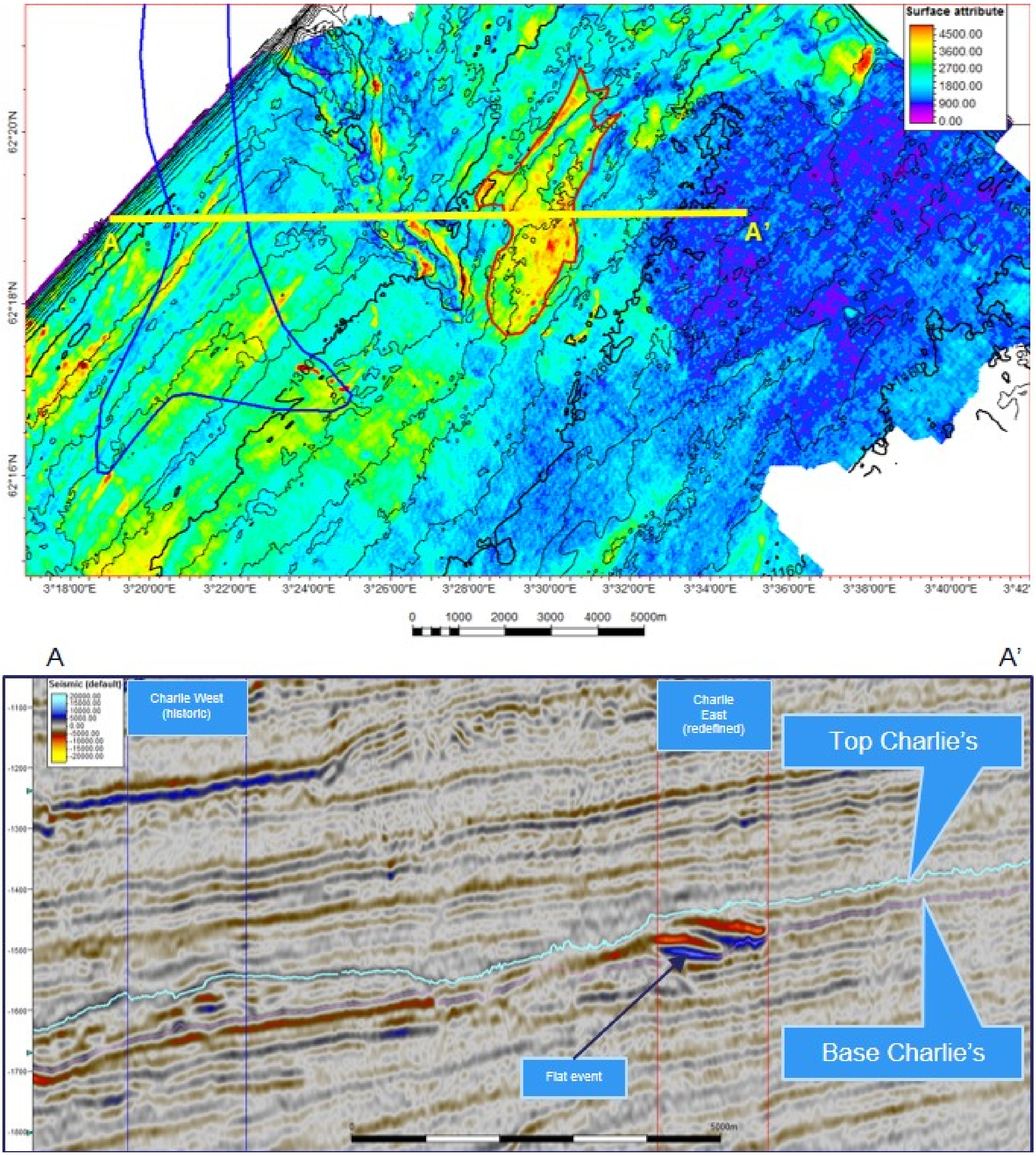

Fig. 4.8 The Charlie East and West leads ***The map on top shows an rms amplitude extraction between the top and base Charlie's horizons. The contours are depth contours, with an interval of 20m. The seismic section A-A' (full offset stack) is marked on the map. Charlie East is defined by a clear amplitude anomaly on the DOL15003, as shown on the upper and lower figure (full offset stack). However, possible gas volumes are considered subeconomic. The Charlie West Lead cannot be redefined on 3D data.***

The area of the Charlie East amplitude anomaly and the related flat event mapped on 3D seismic is 7.3 km^2, which volumetrically gives sub economical volumes (< 10 mboe). A gas case only was considered. Due to the very small size the Charlie East probability of discovery was not evaluated. It is not possible to define a trapping mechanism for the Charlie West lead, and it does not exhibit the same bright amplitude anomaly as the Charlie East. The Charlie West could not be matured into a prospect.

5 Conclusion

The evaluation of the licence area has contributed to increase the understanding of the prospectivity in the area.

Detailed investigation on the basis of the new seismic survey (DOL15003) has shown that it is very unlikely that sufficient trapping mechanisms are present within the licence. In addition, significant reservoir presence within the Upper Cretaceous interval is considered unlikely. The Lower Cretaceous and older sequences are considered too deep (>4000m) to be prospective due expected poor reservoir quality.

The list below summarizes the reasons for relinquishment:

Maxima Prospect:

- Unlikely reservoir presence
- No trapping mechanism
- Lack of geophysical support

Kuro, Katana and Kendo leads:

- Unlikely reservoir presence
- No trapping mechanism
- Lack of geophysical support

Galileo lead:

- No trapping mechanism
- Lack of geophysical support

Charlie East and West leads

- Geophysical evidence result in too small volumes
- No trapping mechanism

Based on the evaluation, the partnership has concluded that no drillable prospects are identified within the licence acreage, and it has been decided to drop the licence prior to the DoD deadline.