Relinquishment Report PL 591

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1 Key license history

Production License PL591 was awarded Feb 4th 2011 in the APA 2010 to Spring Energy Norway AS (Operator, 60 %) and Noreco (40%). Further license extensions were awarded in APA 2012 (PL591 B) and APA 2013 (PL591 C). The drill decision taken Feb 2014 lead to Noreco withdrawal and entrance of new partners North Energy (15%) and Lime Petroleum (25%). Pure Exploration entered the license June 2015 (20%). In January 2013, Tullow Oil plc. announced the completion of its acquisition of Spring Energy Norway AS, hence the operator from this date is Tullow Oil Norge AS. The present license group consists of Tullow Oil Norge AS (Operator, 40%), Lime Petroleum (25%), Pure Exploration (20%) and North Energy (15%). The license area is located in blocks 6507/8,9 and 11 in the Norwegian Sea, Fig. 1.1

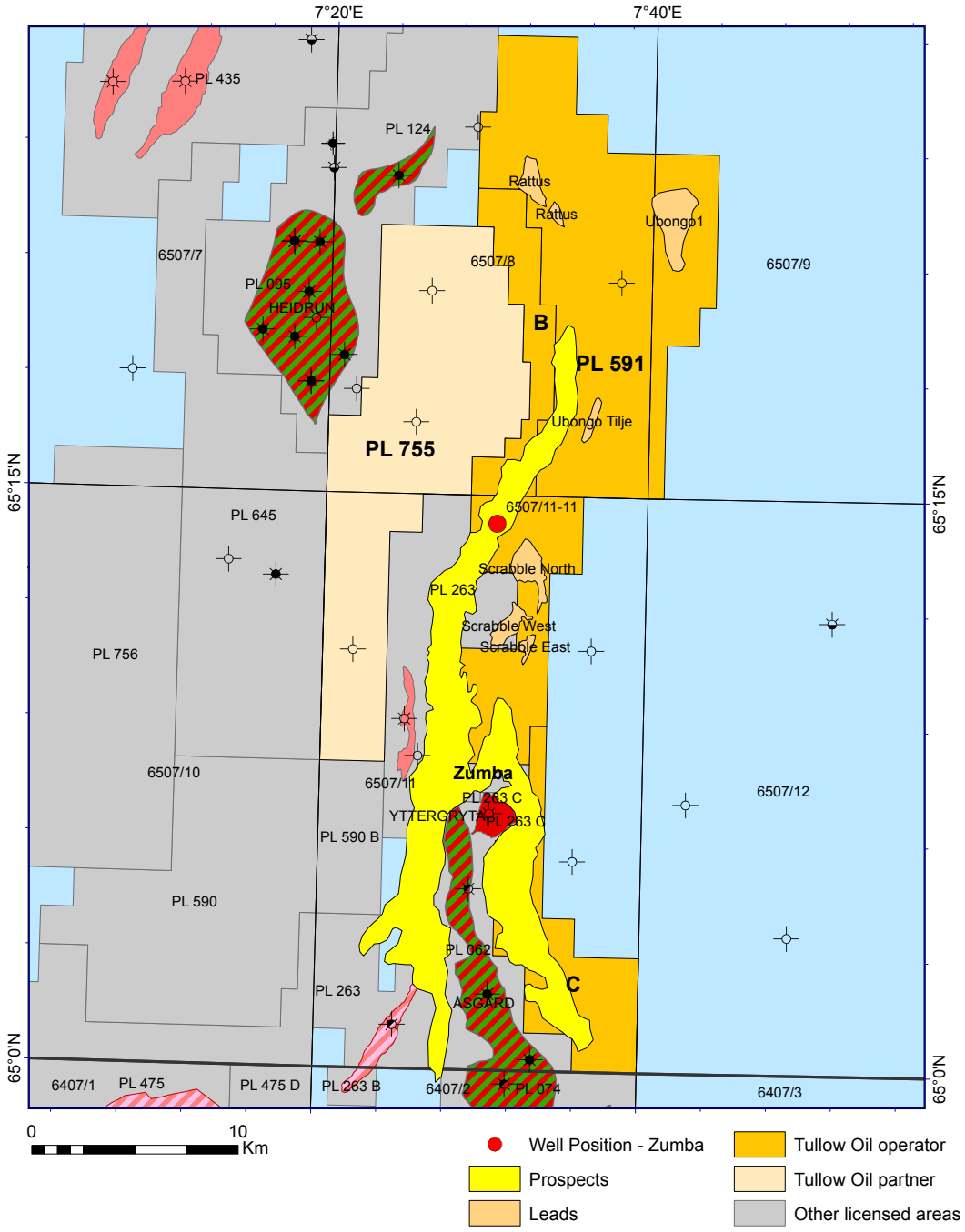

Fig. 1.1 PL591, PL591 B and PL591 C license area

The license group work commitment included acquisition of new 3D seismic and performance of relevant geological and geophysical studies in order to make a DoD decision before February 3rd 2014.

Seven formal ECMC meetings have been held in the license. In addition, three work meetings (EC members) have been held. Presentations from the meetings are available on L2S.

During the summer of 2011 the license acquired 501 km^2 of new 3D seismic data, MC3D-HVG2011. Based on the new data, the license group performed extensive geological and geophysical analysis in order to evaluate the prospectivity and commercial potential of the license acreage. A drill decision was taken February 2014.

The 6507/11-11 Zumba well was drilled June 2015 with a negative well result.

A unanimous decision to relinquish the licence was taken by the Management Committee December 2015 and the Ministry of Petroleum and Energy was notified by letter dated 29.01.2015

2 Database

Seismic database

The work commitment for PL591 was to acquire and re-process 3D seismic of the licence area. Approximately 501 km² of new 3D seismic was acquired during the summer of 2011, (MC3D-HGV2011). Approximately 800 km² 3D seismic was later re-processed (PSDM, Pre Stack Depth Migration). This seismic data are part of 3D surveys MCW98, HT07, AN9701 and ST0815. In addition, available 2D lines were utilised for the prospect mapping. The seismic database is shown in Fig. 2.1.

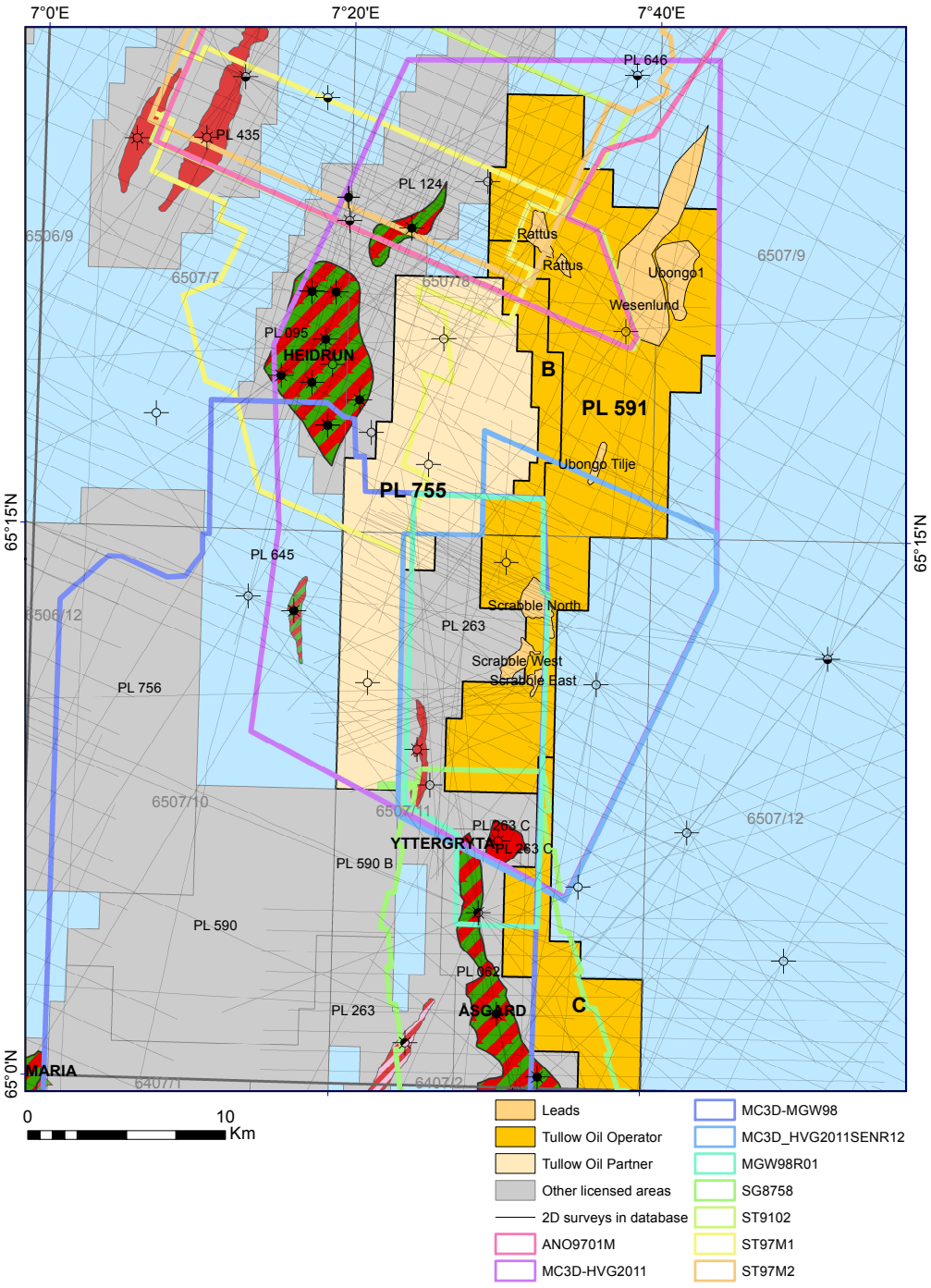

Fig. 2.1 Seismic database PL591, B & C

Well database

The wells used to evaluate the prospectivity of the PL591, B & C license are shown in Fig. 2.2.

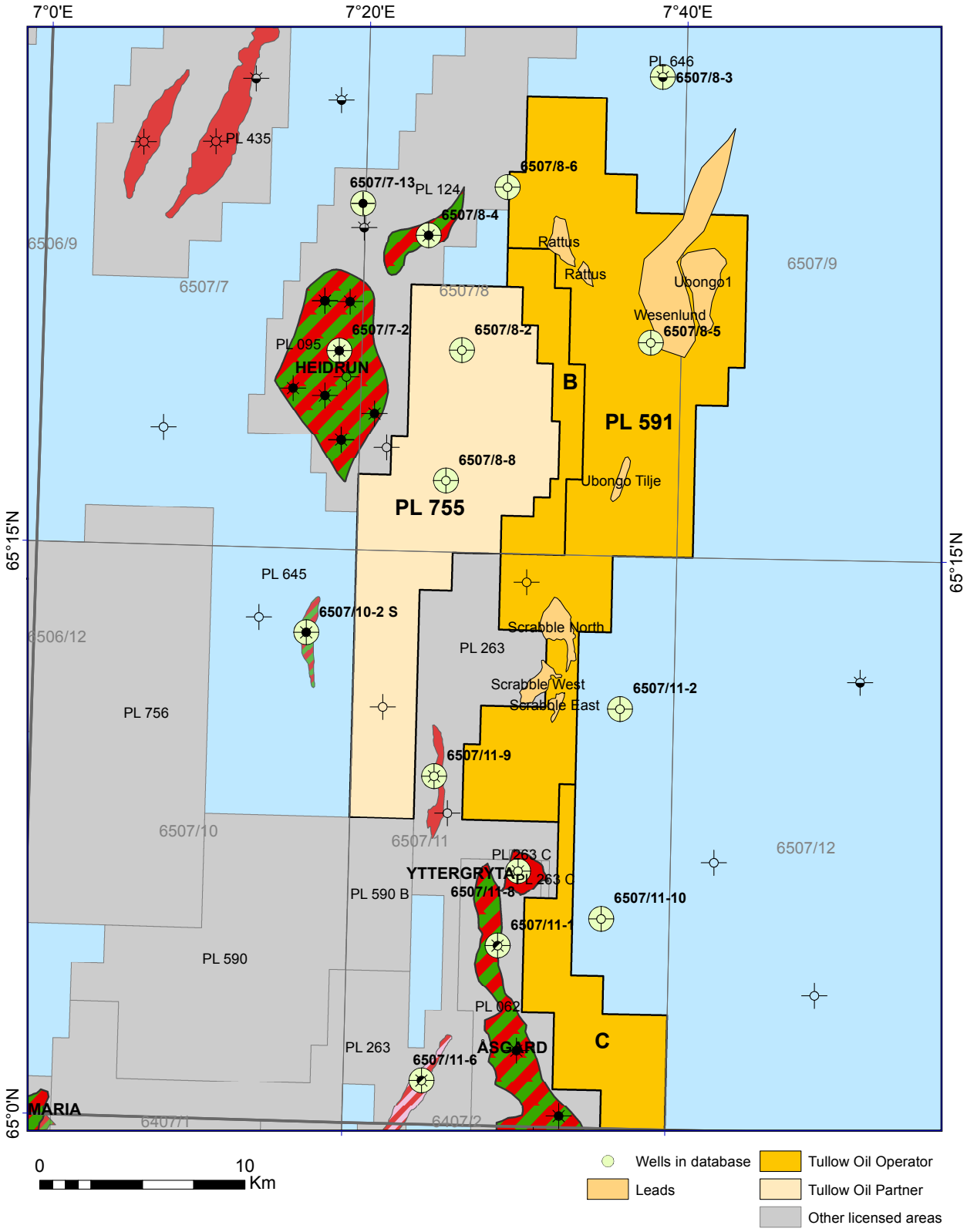

Fig. 2.2 Well database PL591, B & C

3 Review of geological framework

PL591, B & C is located on the northeastern part of the Halten Terrace, at the transition zone between the Halten Terrace and the Nordland Ridge. The prospectivity of the license were in the Upper Jurassic Rogn Fm Eq. sandstones deposited as turbidites eroded from surrounding highs. The Høgbraken Horst defined the trapping geometries for the Zumba prospect. The evaluation of the PL591 license has been performed on newly acquired 3D seismic data in addition to re-processed 3D seismic data (see section 2 Database).

In the APA 2010 application, the original prospectivity was in the Middle Jurassic Scrabble and Rattus prospects, see Fig. 3.1. As part of the work program, new seismic were shot in 2011 (MC3D-HVG2011, PGS) and a PSDM was performed by Western Geco. The geological work performed includes sedimentology and reservoir special studies, mass balance study, petrophysical analysis, fault seal analysis, FIS studies and basin modelling. Geophysical special studies include rock physics, velocity modelling and inversion. Post-well studies include biostratigraphy and follow-up on the geophysical special studies.

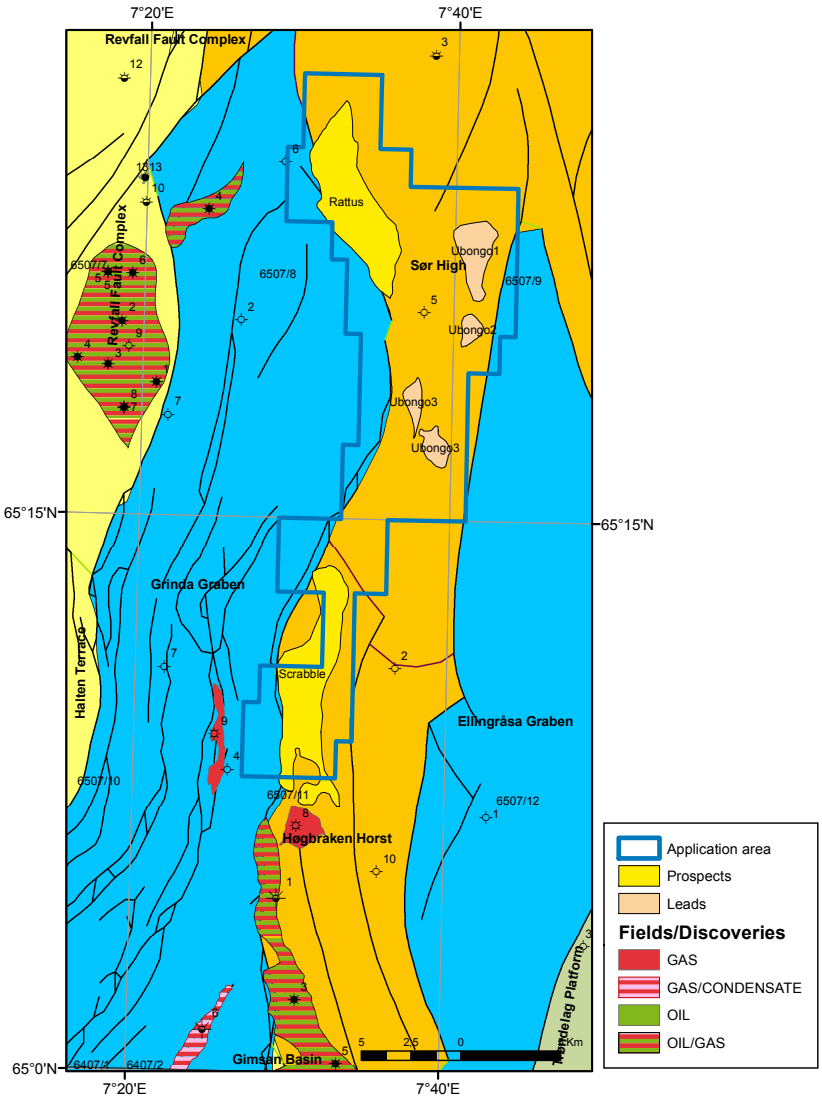

Fig. 3.1 The APA 2010 prospectivity in PL591. *The Middle Jurassic Scrabble and Rattus prospects and the Ubongo leads.*

The Zumba prospect was highly supported by geophysical observations and quantitative seismic interpretation. AVO attributes indicated a class II to III AVO anomaly just beneath the BCU in the Zumba graben. A simultaneous AVO inversion was carried out by Q-eye Labs and showed low Vp/Vs anomalies corresponding with the AVO anomalies. Rock physics attributes (Fluid and Rock Impedances) together with hydrocarbon probability cubes derived from acoustic impedance and Vp/Vs inversion data supported the presence of hydrocarbons (gas or light oil) within a sandy interval, see Fig. 3.2. The Zumba anomaly showed a depth-consistent amplitude shut-off in the south, near the spill-contour of the Sigrid gas discovery.

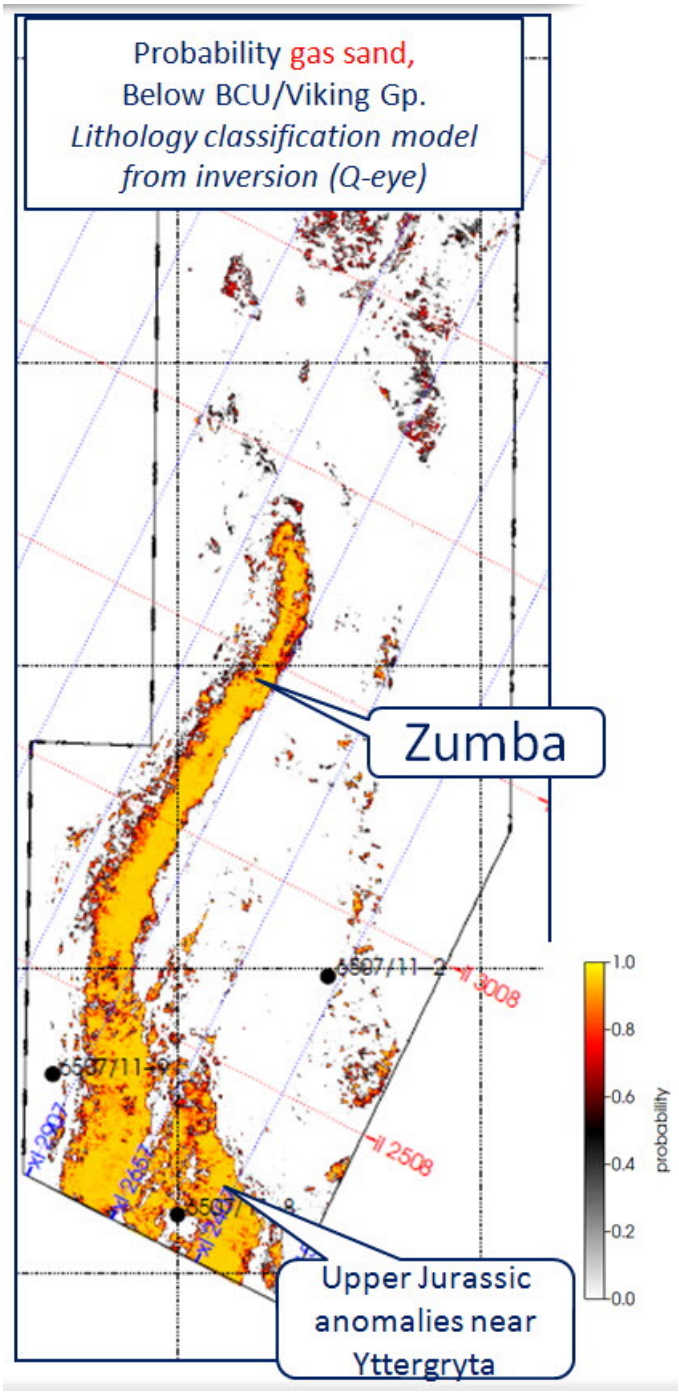

Fig. 3.2 Lithology/fluid classification map within the HVG 2011 survey (inversion cube). *Hydrocarbon probability map which illustrates the geometry of the previously predicted hydrocarbon filled reservoir sands in the Zumba prospect.*

4 Prospect update

Zumba Prospect

The 6507/11-11 Zumba well was targeting an unconventional play type yet to be proved on the Norwegian shelf. The Zumba reservoir was predicted to be deposited in a long and elongated graben, approx. 2 x 30 km. The prospect showed an anomaly response on the 3D elastic inversion result (Fig. 4.1), suggesting an Upper Jurassic unit with a possible higher sand content than the Upper Jurassic siltstones and shales encountered in adjacent wells on the highs. Fig. 4.2 shows a geosection through the 6507/11-11 Zumba well.

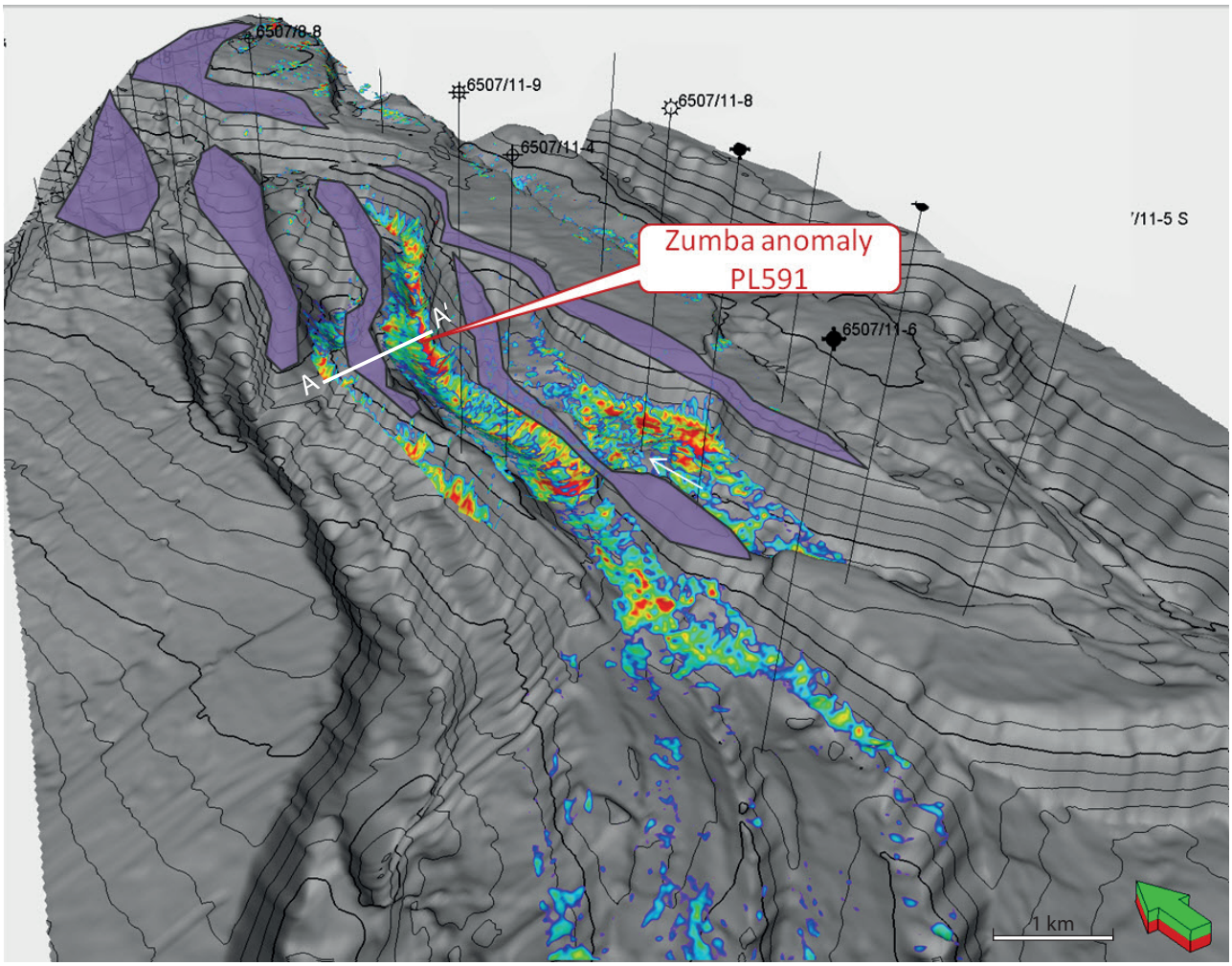

Fig. 4.1 BCU Depth map. *Oblique BCU depth surface showing the anomaly in the Zumba graben.*

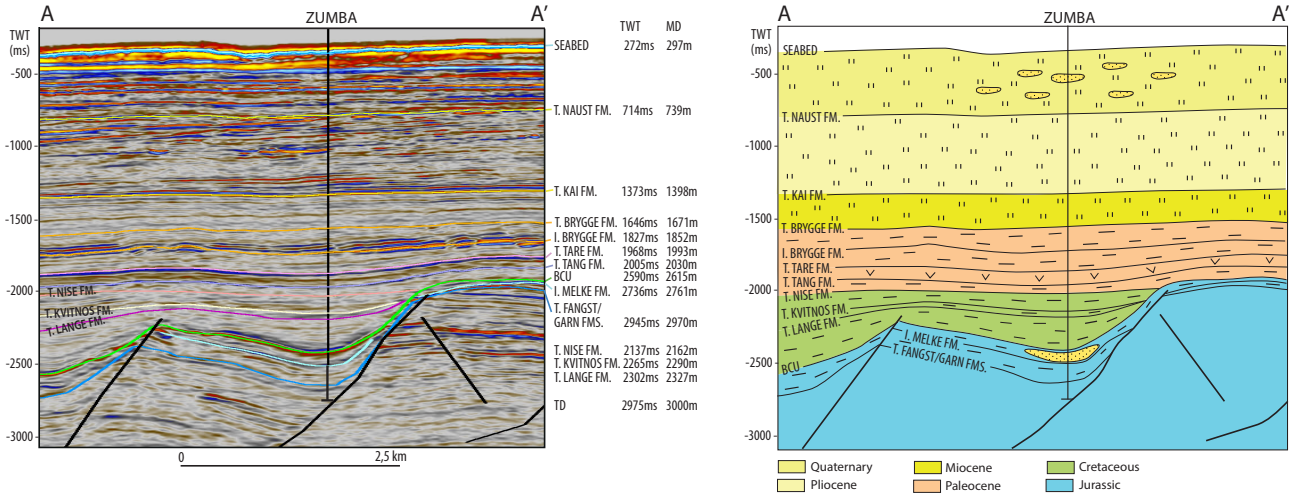

Fig. 4.2 Zumba Geosection. *The Zumba well 6507/11-11 was targeting Upper Jurassic Rogn Fm sandstones. Location of the cross-section is shown in fig. 4.1.*

The targeted reservoir was Upper Jurassic Rogn Fm Eq., gravity flow deposited sandstones. The Rogn Fm Eq. sandstones have proved excellent reservoir properties in wells on the Mid-Norwegian shelf (i.e. Draugen Field). The trap was a combined structural/stratigraphic trap with pinchout to the north and lateral seal on the bounding graben faults. The Upper Jurassic Spekk Fm shales and the Lower Cretaceous Lange Fm form the top, base and lateral seals. The expected hydrocarbon phase was gas/condensate, migrated from the mature Spekk and Melke Fms source rocks in the deeper Gimsan Basin south of the Zumba graben.

The main risks were considered to be the lateral seal, given the long graben (~ 30km) and the stratigraphic apex in the north of the prospect.

The Zumba well was drilled in June 2015 to a total vertical depth of 2900 m below sea level with TD in the Garn Fm. The well encountered 4-5 m of reservoir sands with no shows (Fig. 4.3) and is classified as dry.

The Zumba well is the first well in the area drilled in a graben position. All wells used to calibrate the stratigraphy are located on structural highs, hence a high uncertainty on graben stratigraphy. Post-drill analysis show that geophysical failure ("false anomaly") was caused by the increased thickness of the overlying hard Lyr Fm. Refraction energy caused by large velocity contrast at the Top Lyr interface occuring at a critical angle of around 40-45°, and this energy has interferred with the Top Spekk seismic event just below. The Top Spekk event normally shows a dimming with far angles (class IV AVO), but the refraction energy from Top Lyr Fm made this event appear as a class III AVO anomaly with brightening on the far angle response.

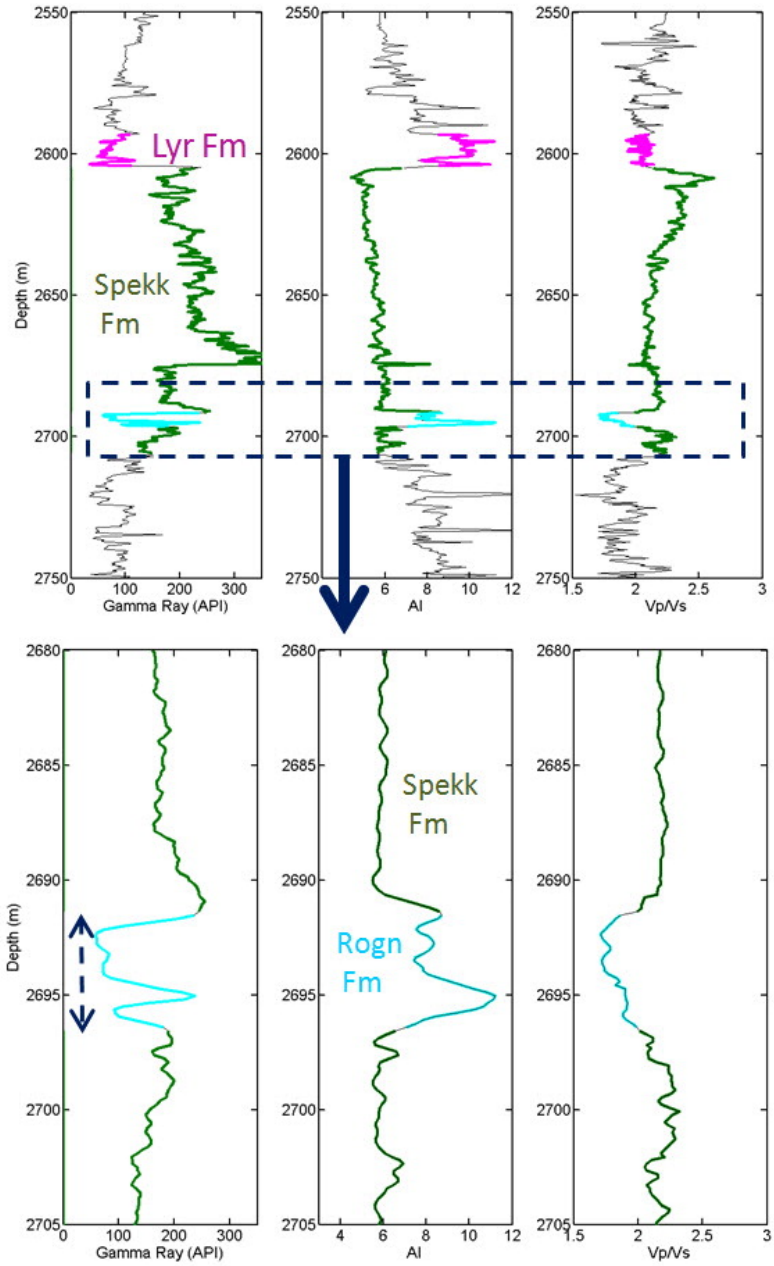

Fig. 4.3 6507/11-11 well log. *Thin Rogn sand encountered in Zumba well 6507/11-11.*

Remaining Prospectivity

Scrabble Prospect

The Scrabble prospect is located west of the Høgbraken Horst and northwest of the Yttergryta discovery (Fig. 3.1). The prospect was mapped within a Jurassic ramp structure assumed to be formed by the combination of a breached relay ramp, erosion and reactivation of older faults. The prospectivity is in the Jurassic Fangst and Båt Groups. The proposed migration and charge model is gas migration from the Yttergryta discovery, northwards into the structure. The Scrabble structure is dependent on fault seal in three directions, 1) east upwards on to the Høgbraken Horst, which is tested by the dry wells 6507/11-2 and 6507/11-10, 2) towards west on a small horst sitting along a large NE-SW trending normal fault and 3) northwards where a cross-cutting normal fault defines the

northern part and the crest of the Scrabble prospect (Fig. 4.4).

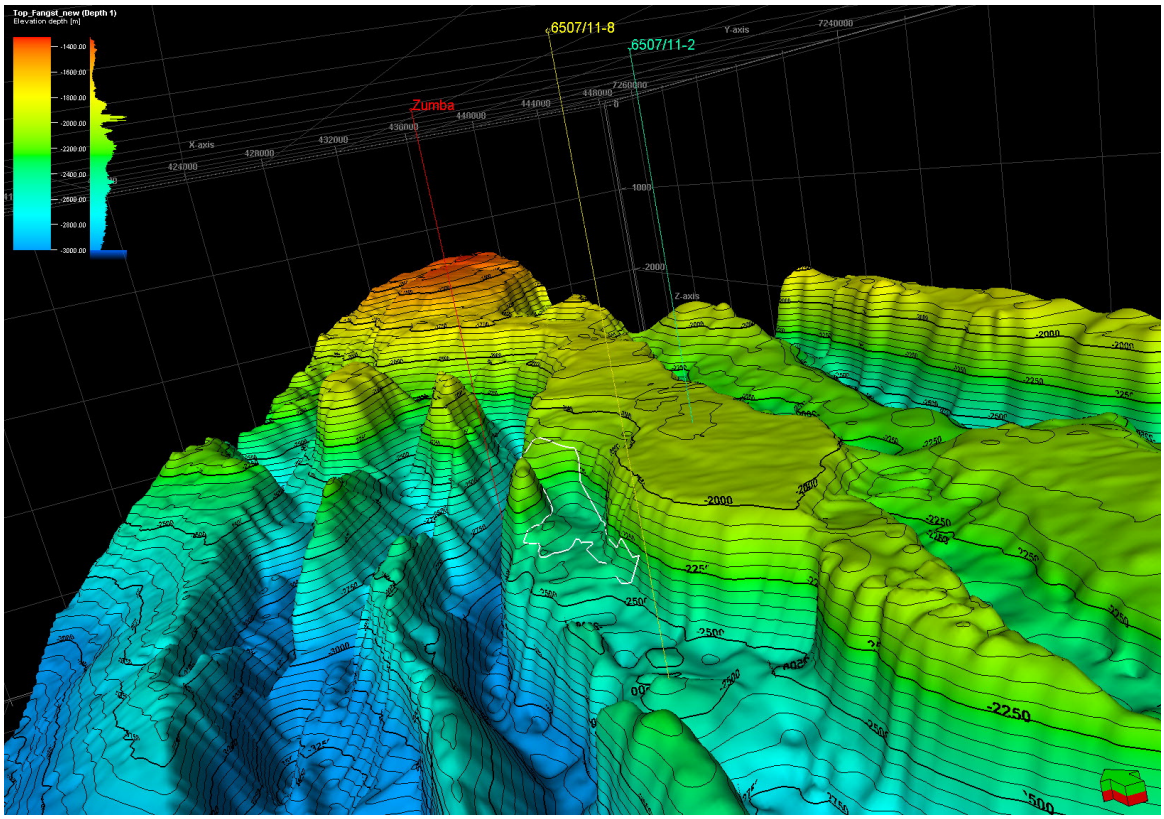

Fig. 4.4 Top Fangst map (Depth). *Scrabble Prospect is mapped within a Jurassic ramp structure.*

The new 3D seismic data indicated more cross-cutting faults up along the relay ramp suggesting segmentation, hence smaller non-commercial hydrocarbon accumulations (2,4 Sm^3 gas).

Rattus prospect

The Rattus prospect lies on a downthrown Jurassic block south of well 6507/8-3 (Fig. 3.1). The prospect is a combined structural and stratigraphic trap, defined by faults except on the northwestern side of the structure where it is defined by a truncational boundary. Well 6507/8-3 encountered excellent quality sandstones with high N/G in both Fangst and Båt Groups, hence increasing the risk of cross-fault leakage due to sandstone juxtaposition across bounding faults. Main reservoir is the Jurassic Tilje Fm., while top seal is provided by Cenozoic shales.

Re-mapping of the prospect with new 3D seismic data, revealed limited sealing capacity along the critical northwestern fault.

Ubongo leads

The Ubongo leads are a collection of subtle Jurassic anticlines located on the northern part of the Høgbraken Horst (Fig. 3.1). Small Middle Jurassic horst structures are interpreted to contain reservoir in the Fangst Gr. The leads are located along the modelled migration route between the Scrabble and Rattus prospects, and believed to be charged if the trap fails at the Scrabble prospect.

The inversion showed no geophysical anomaly in the Ubongo leads.

5 Technical evaluations

No new evaluations regarding possible developments has been performed since the APA 2010 application.

6 Conclusions

The exploration well 6507/11-11 Zumba was drilled in June 2015 to a vertical depth of 2900 m below sea level within the Garn Formation. The well did not encounter any hydrocarbons, and is classified as dry. The Zumba prospect was strongly geophysically driven testing the Upper Jurassic anomaly which proved to be false. The geological model was partly proven, i.e. sand presence in the graben.

The remaining prospectivity contain minor structures with small volumes. In addition, there is a lack of confidence in the geophysical support. The remaining prospectivity in the license area is concluded to be non-commercial.

The decision to relinquish the license was unanimously taken by the PL591 Management Committee in December 2015.