



PL 866 License Relinquishment Report

Reference is made to the application for extension of deadlines dated 08.02.2019 and the response from OED dated 12.04.2019 regarding the approval of conditional extension of the license deadlines. The conditions for the one year license extension have not been met and the license therefore expired on 01.06.2019.

This report outlines the key license history, the database, prospects and the technical evaluation of the production license 866 (PL866) and fulfills the requirement by the NPD for a license status report within 3 months of relinquishment.

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1 Key license history

PL866 is located within block 15/5 and 15/8 in the North Sea, in the South Viking Graben to the west of the Sleipner Vest field (Fig. 1). PL866 was awarded through the APA 2016, with the Upper Jurassic Space Cadet prospect as the main prospect in the license. During the license period, the prospects have been firmed up through seismic data acquisition and G&G work during 2017-2018. While Equinor proposed a drop decision in February 2019, the only partner LOTOS Exploration and Production Norge AS proposed to take over operatorship and operator's share, and to find a new partner. A one year extension of the license terms was therefore requested on 08.02.2019 in order to allow LOTOS to find a new partner and undertake seismic reprocessing before making a drill or drop decision. A one year extension until 10.02.2020 was granted by OED on 12.04.2019, but the extension was contingent on LOTOS securing a new partner by 01.06.2019. A new partner was not found by the deadline, so the license therefore expired.

The distribution of PL866 shares is:

- Equinor Energy AS, Operator 70 %
- LOTOS Exploration and Production AS 30 %

The license area has been evaluated on all relevant seismic surveys, and the Space Cadet and Space Oddity prospects are the main prospects in the license. The Space Cadet prospect (Fig. 2, 3) consists of a Middle Jurassic three-way closure with the Hugin Fm. as the reservoir, and an Upper Jurassic stratigraphic segment with intra-Draupne Fm. Sandstones as the reservoir. The Space Oddity prospect (Fig. 4, 5) consists of two Upper Jurassic intra-Draupne Fm. segments. All prospects are considered to be gas-condensate prospects, with moderate volume potential and a low chance of oil discovery. Screening of the shallower post-Jurassic stratigraphy showed no potential within PL866. For these reasons a license drop was proposed by Equinor.

Work obligations and Decisions	Expiry date	Status
Acquire 3D seismic data		Approved
Decision to drill or relinquish	10.02.2020	Drop decision

Table 1: Work program – Phase 1

The following Management and Exploration committee meetings have been held in the license:

- MC meeting - 23.03.2017
- MC meeting - 07.11.2017
- MC/EC meeting - 28.11.2018

2 Database

Interpretation for PL866 at the time of application was based on the ST04M01 and MC3D_NSEA_MEGA seismic datasets. As a part of the license obligations the PGS16M03-PGS16902VIK PSDM dataset was acquired. This dataset covered approximately the southern half of the license, while the MC3D_Q16 dataset covered the northern half of the license. Seismic interpretation was done on an internal merged volume of the two cubes to ensure consistency (Fig. 6).

Key wells: **15/3-1S, 15/3-3, 15/3-7, 15/5-1, 15/5-7, 15/5-7A, 15/6-9A, 15/8-1, 15/8-2, 15/9-3, 15/9-6, 15/9-7, 15/9-18, 15/9-22, 15/9-B-8, 15/9-B-8A, 15/9-B-8B, 15/9-B-8C, 15/9-B-8D, UK16/13-1, UK16/13a-2, UK16/17-14, UK16/17-19, UK16/18-1, UK16/18-2, UK16/18b-5, UK16/23-1, UK16/24a-1.**

A number of wells both inside, and outside the common database were selected for a special cuttings analysis study by RockWash Prep and Store Limited. This study analysed cuttings data to investigate the potential for missed Upper Jurassic sandstone intervals in key wells around the license.

3 Review of geological framework

The application securing the PL866 in 2016 focused on the Middle Jurassic Hugin Fm. and the Upper Jurassic Draupne Fm. in an area of open acreage located to the west of the Sleipner Vest Field. The Middle Jurassic segment consists of a downthrown three-way dip closure (Fig. 2), and the main risk for the Middle Jurassic is fault seal due to small fault throw and potential for high N/G reservoir intervals (e.g. 15/8-2). Furthermore, interpretation of the Top Hugin Formation is in places challenging and in difficult areas the interpretation is based on the interpretation on the more reliable top Sleipner coal reflector.

The main risks for the Upper Jurassic play are trap seal (due to a high to complete dependency on stratigraphic trapping components) and reservoir presence. While proven in the UK wells to the west (the Brae Fm.) and in the Gudrun area to the north, the intra-Draupne sandstones have not yet been proven as a working reservoir in the area of PL866. Due to seismic imaging challenges it has not proven possible to differentiate between sandstones and shales on seismic data, and no convincing seismic geomorphology has been identified in the area to support the presence of Upper Jurassic deepwater turbidite sandstones. A cuttings study of selected UK and Norwegian wells did also not help to reduce the risk on reservoir presence.

In detail, the studies/work completed for PL866 were the following

- Purchase of seismic data with the aim of reducing risk on the Middle and Upper Jurassic plays
- New mapping of key horizons, including intra-Draupne horizons
- Seismic-well ties
- Fault seal analysis
- Middle-Upper Jurassic fault interpretation
- Optimized velocity model for depth conversion
- Seismic modelling of reservoir/hydrocarbon imaging potential
- Well data analysis for reservoir presence and quality
- Cuttings study (Cleaning, high-resolution photography and quantitative XRF analysis) to evaluate missed Upper Jurassic sands (completed by RockWash Prep and Store Limited).
- Tectonic restoration/reconstruction to help predict Upper Jurassic reservoir presence
- Updated petroleum systems analysis for expected phase, analysis of expelled volumes and fetch areas
- Prospect volumetrics and risk analysis
- Seismic interpretation and prospect screening of post-Jurassic to seafloor stratigraphy

4 Prospect update

The Space Cadet prospect (Fig. 2, 3) consists of a downthrown three-way Middle Jurassic Hugin Fm. segment and an Upper Jurassic segment. Reservoir potential of the Hugin Fm. is proven in the Sleipner area where it consists of marginal marine to marine sediments. The main risk for the Hugin segment was trap seal integrity and although the geological risk for this segment is only moderate, the shape of the structure means that limited in place volumes are estimated. The Upper Jurassic (Intra-Draupne Fm.) segment of the Space Cadet prospect and the two segments of the Space Oddity prospect (Fig. 2, 3, 4, 5) carry a high risk on both reservoir presence and stratigraphic trap seal. Extensive Upper Jurassic sandstones are proven in the South Viking Graben, where they are sourced from the East Shetland Platform but the basin configuration during the time of deposition of the Draupne Fm. means that these are considered unlikely to have been deposited all across the graben and into the area of PL866. If the intra-Draupne Fm. sandstones were transported into PL866 from the west, then it is expected that the reservoir would most likely consist of thin and fine-grained distal turbidite sandstones. Upper Jurassic reservoirs have not been proven in the Sleipner or Gina Krog areas. Mature source rock

presence is proven in the South Viking Graben and migration routes and expelled volumes were considered to be low risk for these prospects which have been evaluated as most likely to be gas-condensate phase prospects.

Prospect	Pg	Total In Place Volumes MSm ³ OE			In Place Gas GSm ³			In place Condensate MSm ³		
		P90	Mean	P10	P90	Mean	P10	P90	Mean	P10
Space Cadet (Mid Jurassic)	0.26	0.9	2.5	4.8	0.6	1.7	3.3	0.27	0.8	1.5
Space Cadet (2 U Jurassic segments)	0.15	1.0	6.0	4.4	0.7	4.2	9.8	0.3	1.9	4.4
Space Oddity (2 U Jurassic segments)	0.14	1.3	9.4	22.8	0.9	6.5	15.7	0.4	2.9	7.1
Prospect		Total Recoverable Volume MSm ³ OE			Recoverable Gas GSm ³			Recoverable Condensate Msm ³		
		P90	Mean	P10						
Space Cadet (Mid Jurassic)	0.26	0.5	1.4	2.7	0.37	1.0	2.0	0.12	0.4	0.7
Space Cadet (2 U Jurassic segments)	0.15	0.6	3.4	7.9	0.4	2.5	5.9	0.14	0.9	2.0
Space Oddity (2 U Jurassic Segments)	0.14	0.7	5.3	12.9	0.55	4.0	9.7	0.18	1.3	3.3

Table 2: Volumes and risk for the prospects – gas case considered. Note that both prospects contain aggregated segments. Single segment Pg is less than 0.1 for the Upper Jurassic segments.

5 Technical evaluations

A simple case based on subsea tieback to Sleipner Vest and minimum threshold volumes has been evaluated. The business case is currently negative due to moderate volumes, expected phase and high geological risk. Due to the negative outcome from this simple business case screening and low volume potential of the prospects, no detailed technical-economic analysis has been undertaken.

5 Conclusions

The work programme for PL866 has been fulfilled. The Space Cadet and Space Oddity prospects have been evaluated within the specified time frame and numerous geological and geophysical studies have been completed. Based on a lack of attractive prospects (based on moderate hydrocarbon volumes and high geological risk) Equinor recommended to drop the licence but LOTOS wanted to remain in the license. An extension was granted to allow time for LOTOS to find a new partner and take over operatorship, but due to the lack of a new partner the license expired on 01.06.2019.

Kind regards



Equinor Energy AS

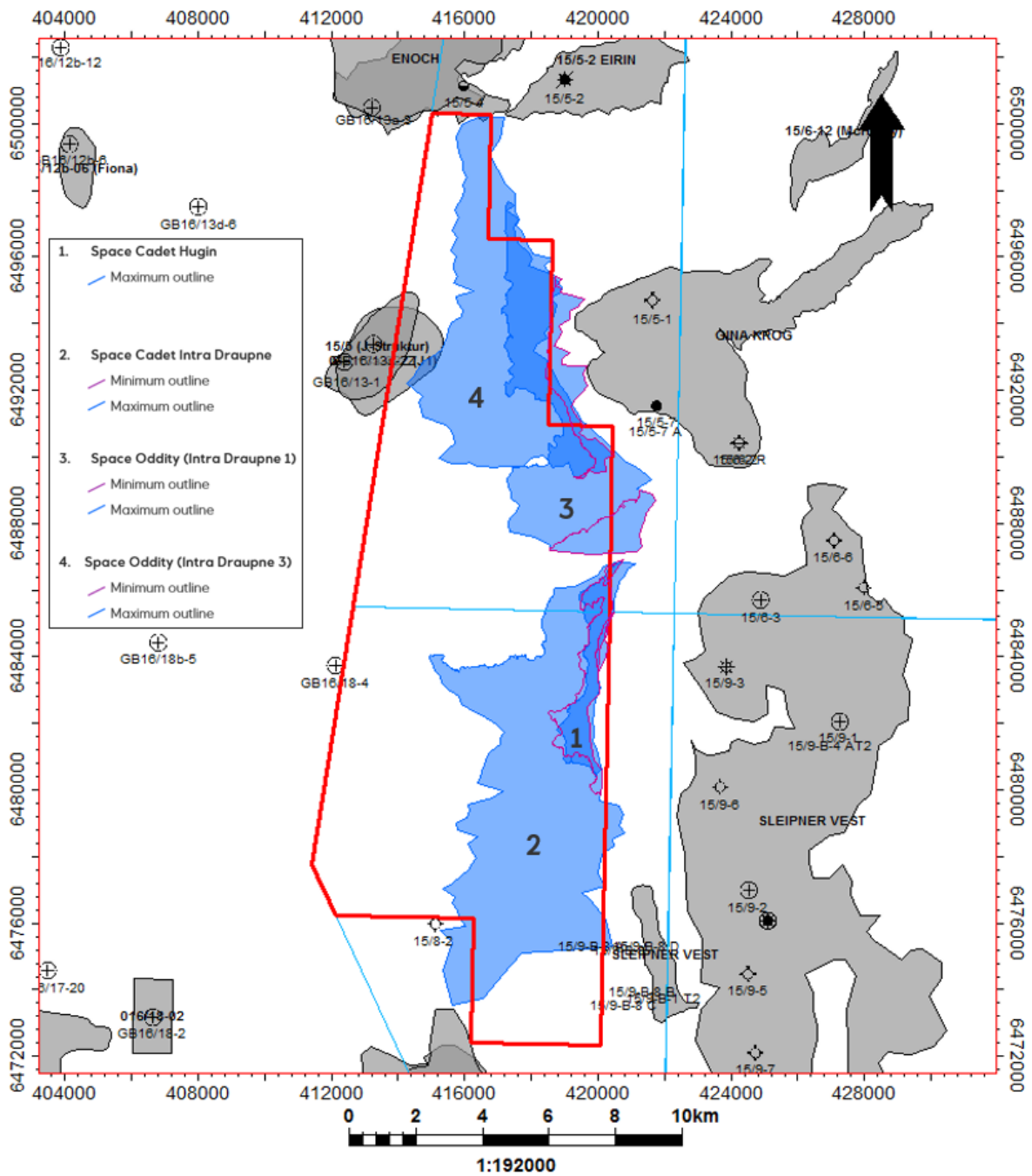


Figure 1: License overview map with discoveries, wells, license boundary (red polygon), and prospect polygons in blue.

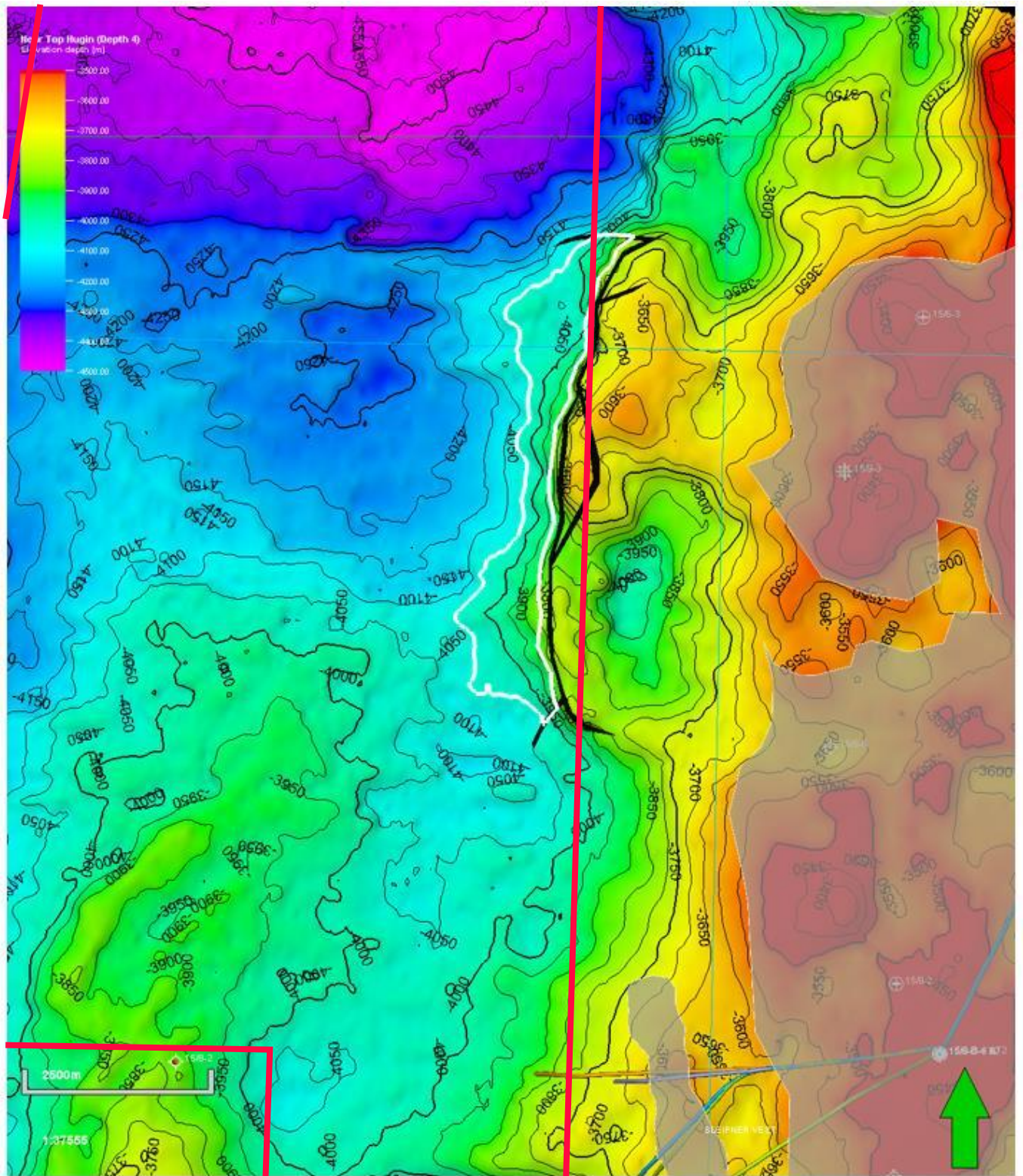


Figure 2: Top Hugin structural depth map with Space Cadet Hugin polygon (white), and main prospect-bounding fault in black. PL866 outline shown in red.

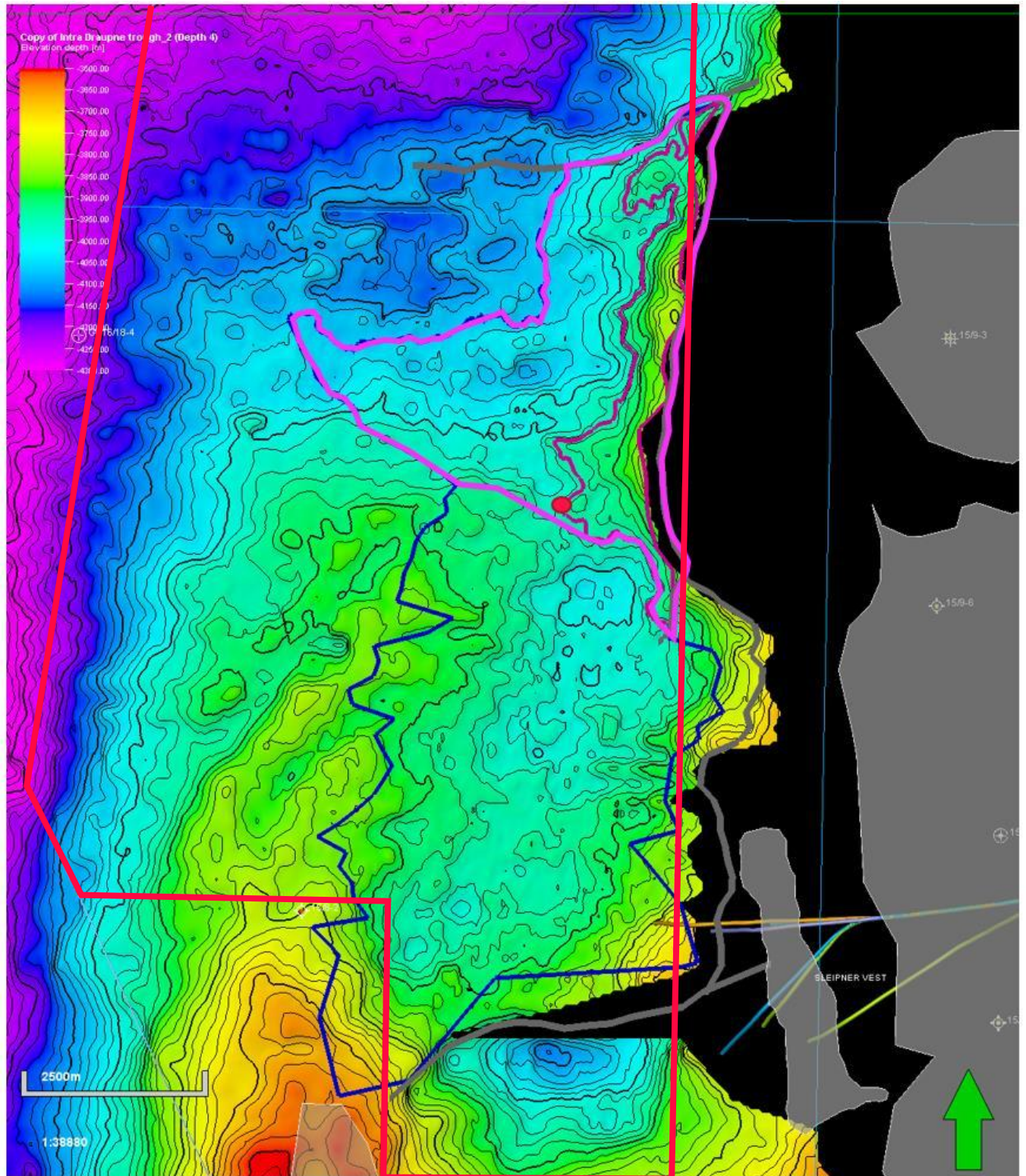


Figure 3: Top “Intra-Draupne Trough 2” depth map with discoveries and Space Cadet Draupne polygons: minimum 3-way closure (purple), saddle spill point (red dot), base case stratigraphic segment (pink) and fully stratigraphic upside segment (blue). Key faults shown in grey and PL866 outline in red.

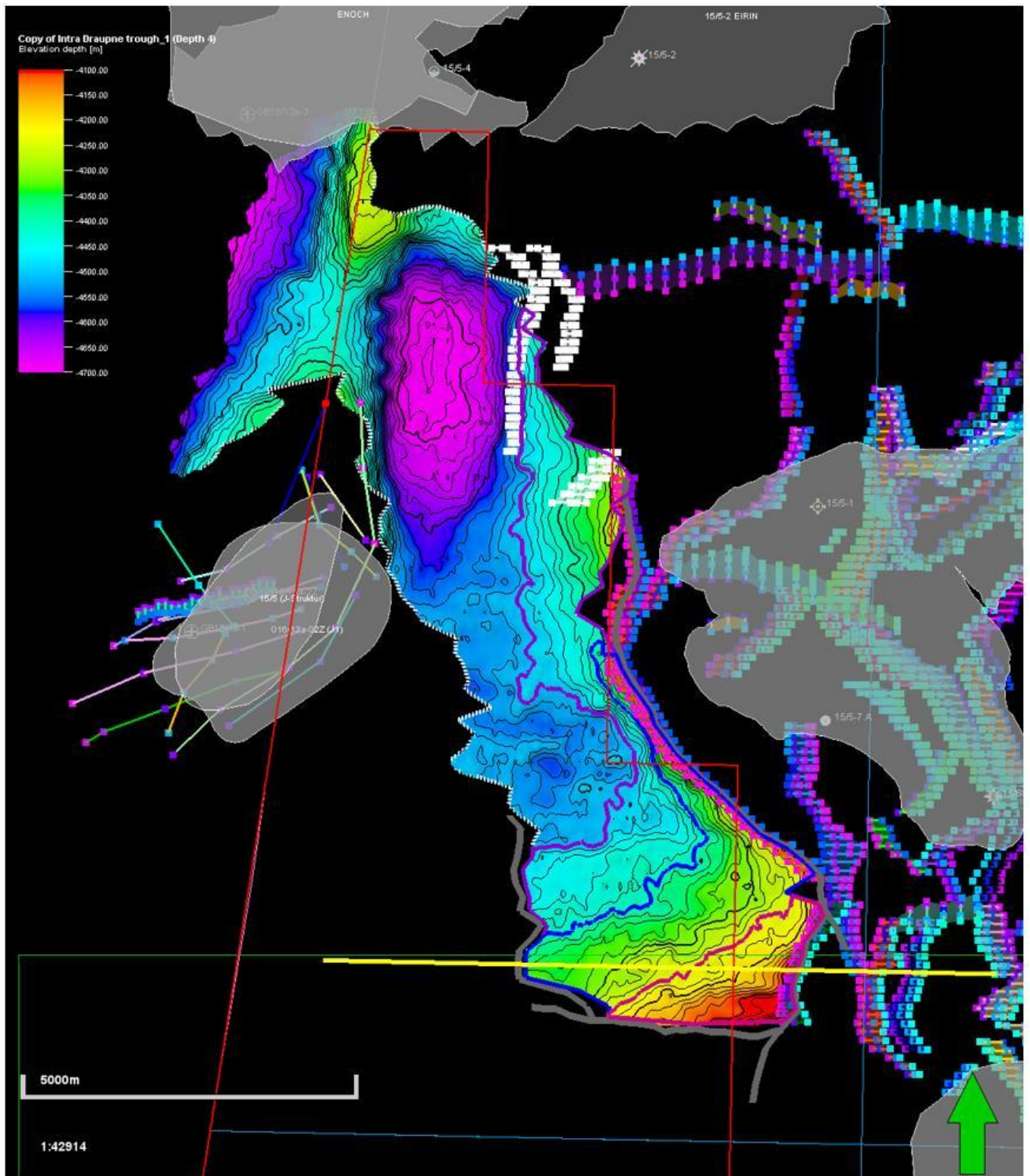


Figure 4: Top “Intra-Draupne Trough 3” structural depth map with discoveries, Space Oddity Draupne 3 segment polygons: pink (minimum), purple (maximum) and key interpreted faults. PL866 outline shown in red.

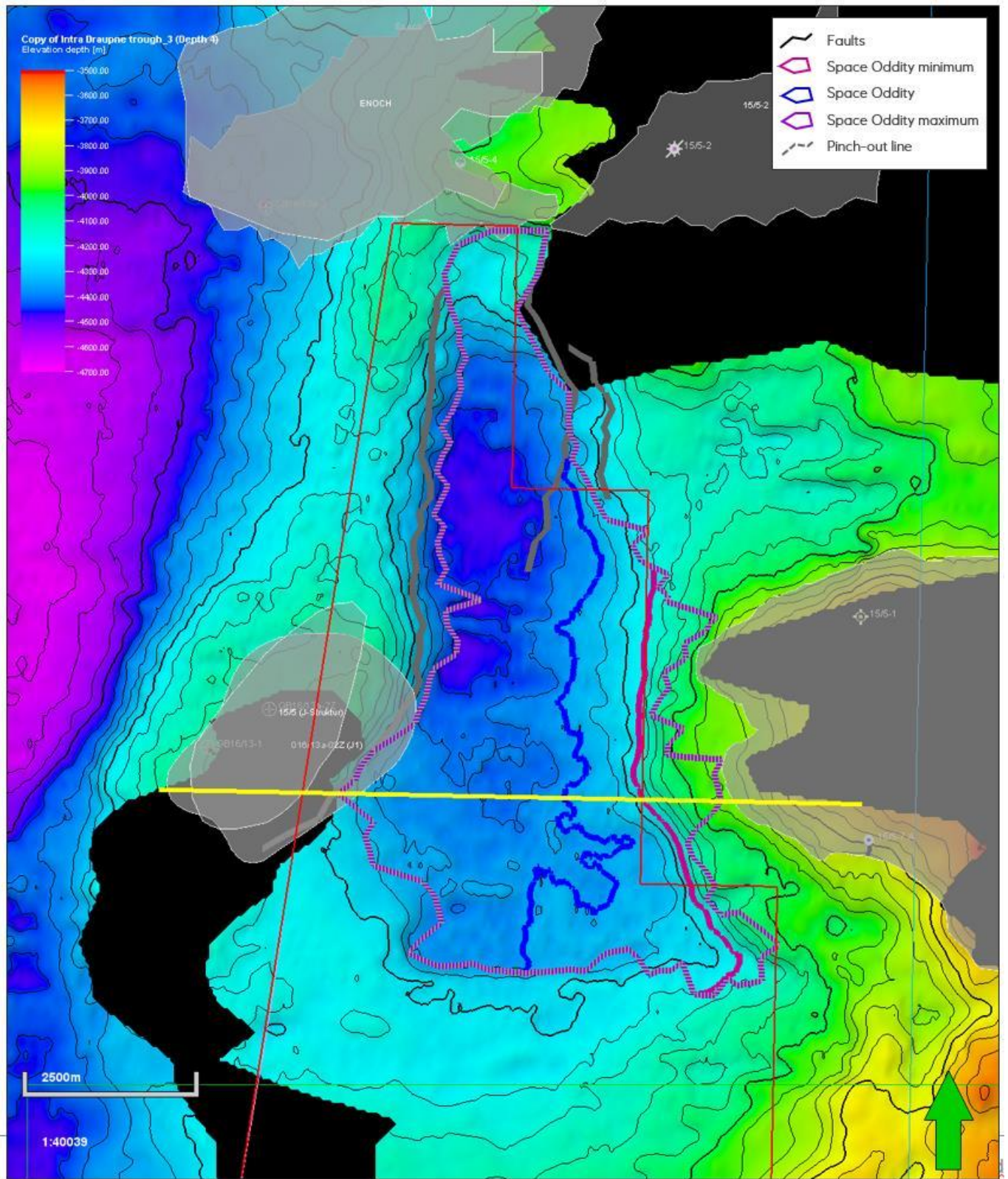
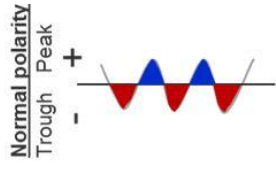


Figure 5: Top “Intra-Draupne Trough 1” structural depth map with discoveries and Space Oddity Draupne 1 segment polygons: pink (minimum), purple (maximum stratigraphic) and key interpreted faults. PL866 outline shown in red.

Horizon	Color	Polarity	Quality
Top Cromer Knoll		- Trough	Good
BCU		- Trough	Good
Intra Draupne trough 3		- First trough below BCU	Moderate
Intra Draupne trough 2		- Trough	Moderate
Intra Draupne trough 1		- Lowest trough in Draupne (only in basin SW of Gina Krog)	Moderate
Near Top Heather		+ Peak	Uncertain
Near Top Hugin		- Trough	Uncertain
Top Sleipner/Pentland		- Trough	Moderate



BCU time surface

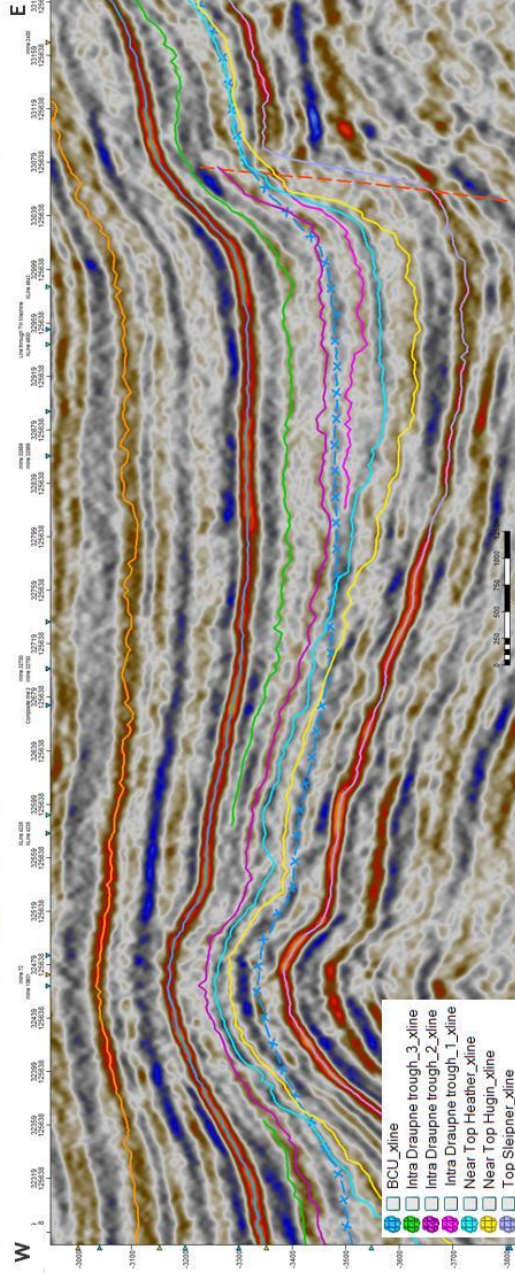
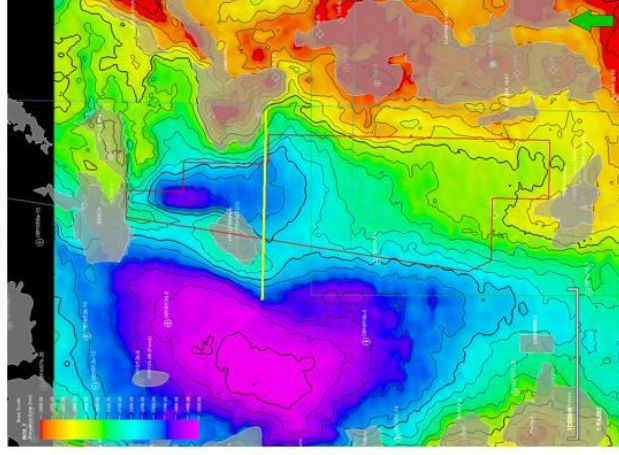


Figure 6: Seismic horizons and their interpretation strategy, plus W-E oriented seismic line through the Space Oddity prospect showing key horizons and interpretation methodology

