Relinquishment Report PL 744S

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1 Key license history

Production license 744S comprises 148 km² and covers parts of block 30/3. The license was awarded on 7th February 2013 for a six year initial period with a drill-or-drop decision on 7th. of February 2016. Partners in the license were Tullow Oil Norge (Operator, 40%), Bayerngas Norge (20%), Noreco Norway (20%) and Wintershall Norge (20%). The commitments for the initial period were to acquire/purchase and re-process 3D seismic and to carry out G&G studies, which have been fulfilled. One prospect and 2 leads were identified in the APA2012 application, see Fig. 1.1, all positioned northwest and down flank of the Veslefrikk Field.

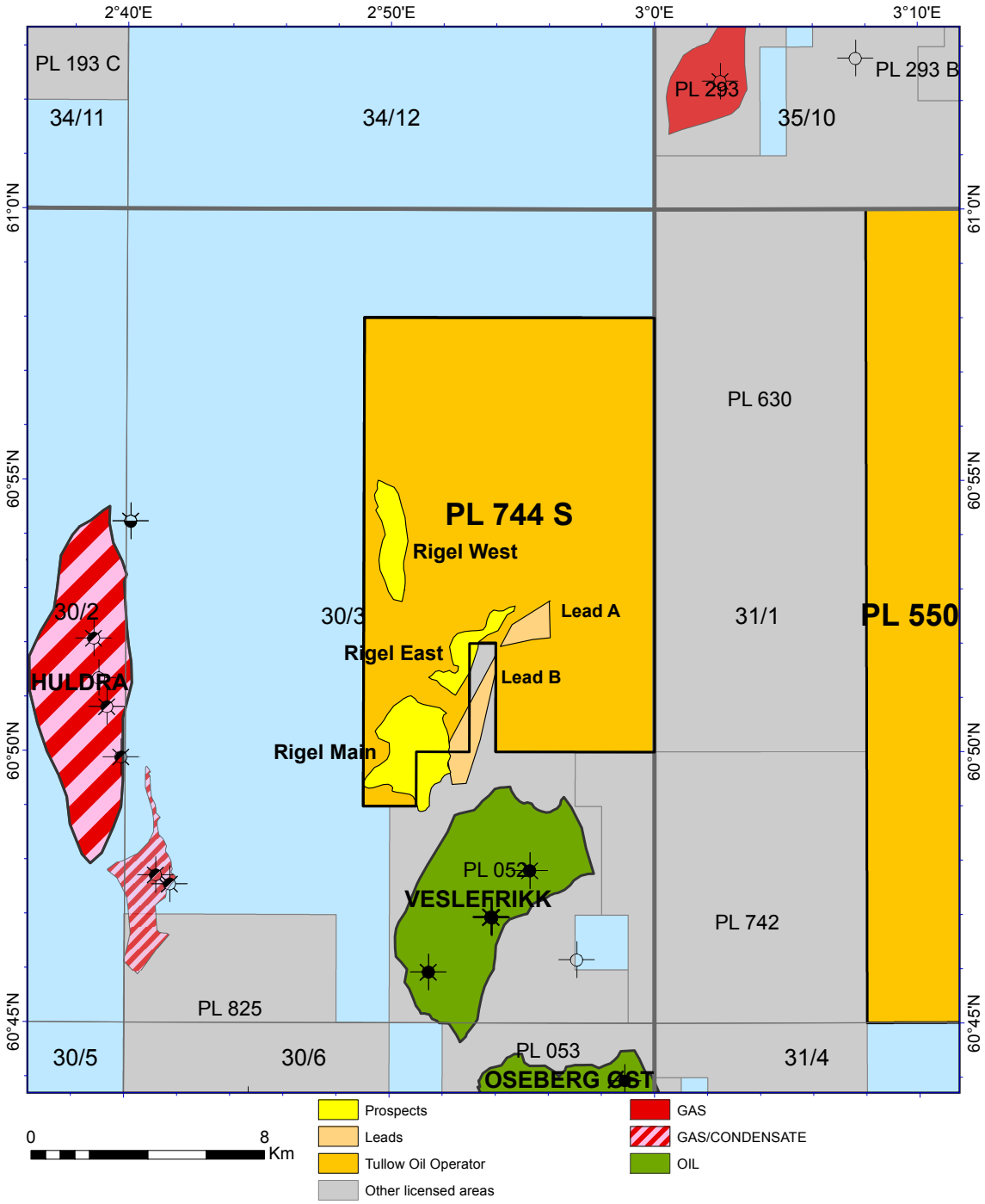

Fig. 1.1 PL744S, license area. *The lisence PL744S i positioned east of the Huldra Field and north of the Veslefrikk Field.*

Three formal ECMC meetings have been held in the license, in addition to one EC work meeting. Presentations from the meetings are available on L2S.

Based on the re-processed data, the license group performed extensive geological and geophysical analysis to evaluate prospectivity and commercial potential of the license acreage. The prospects are located within a sweetspot regarding source and migration, but size, reservoir properties and seal capacity reduces volumes to below minimum economical field size.

A decision to relinquish the licence was taken by a majority of the Management Committee in January 2016. Bayerngas did not cast their vote but accepted the decision and the Ministry of Petroleum and Energy was notified by letter dated 02.02.2016.

2 Database

Seismic database

The work commitment for PL744S was to acquire/purchase 3D seismic and re-process the seismic data to cover the licence. Approximately 890 km² of the NX0208/NX10M02 survey was purchased and re-processed (PSDM, Pre Stack Depth Migration). The survey was re-named NNS-MEGASURVEYPLUS-PHASE1 and constitute the seismic database used for the G&G evaluation. The outline of the survey is shown in Fig. 2.1.

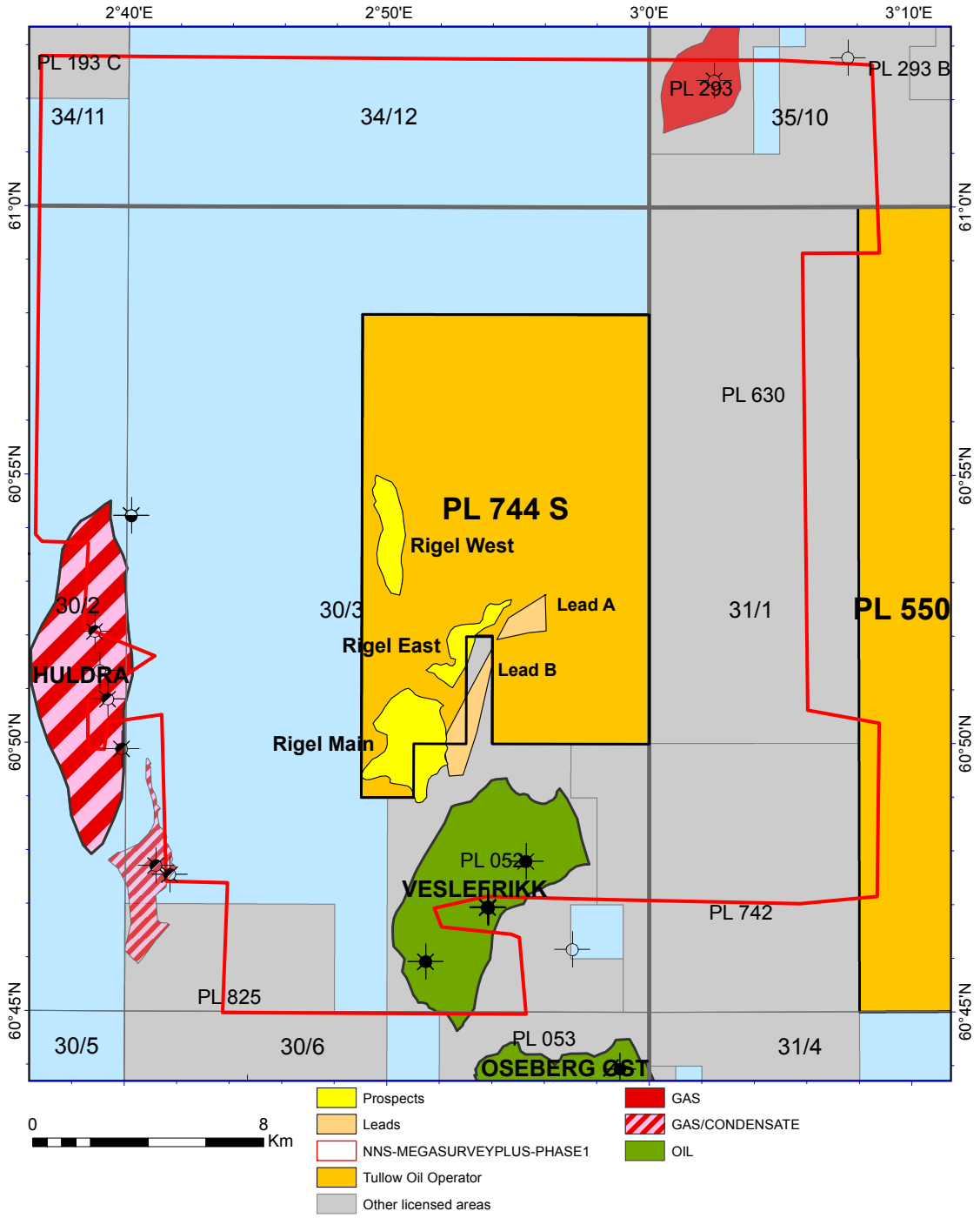

Fig. 2.1 Seismic database PL744S. *The red polygon shows the live 3D seismic. The purpose was to cover the Huldra wells, Veslefrikk wells and small Brent Gp dicovery of well 35/10-2.*

Well database

The wells used to evaluate the prospectivity of the PL744S license are shown in Fig. 2.2 and in Table 2.1.

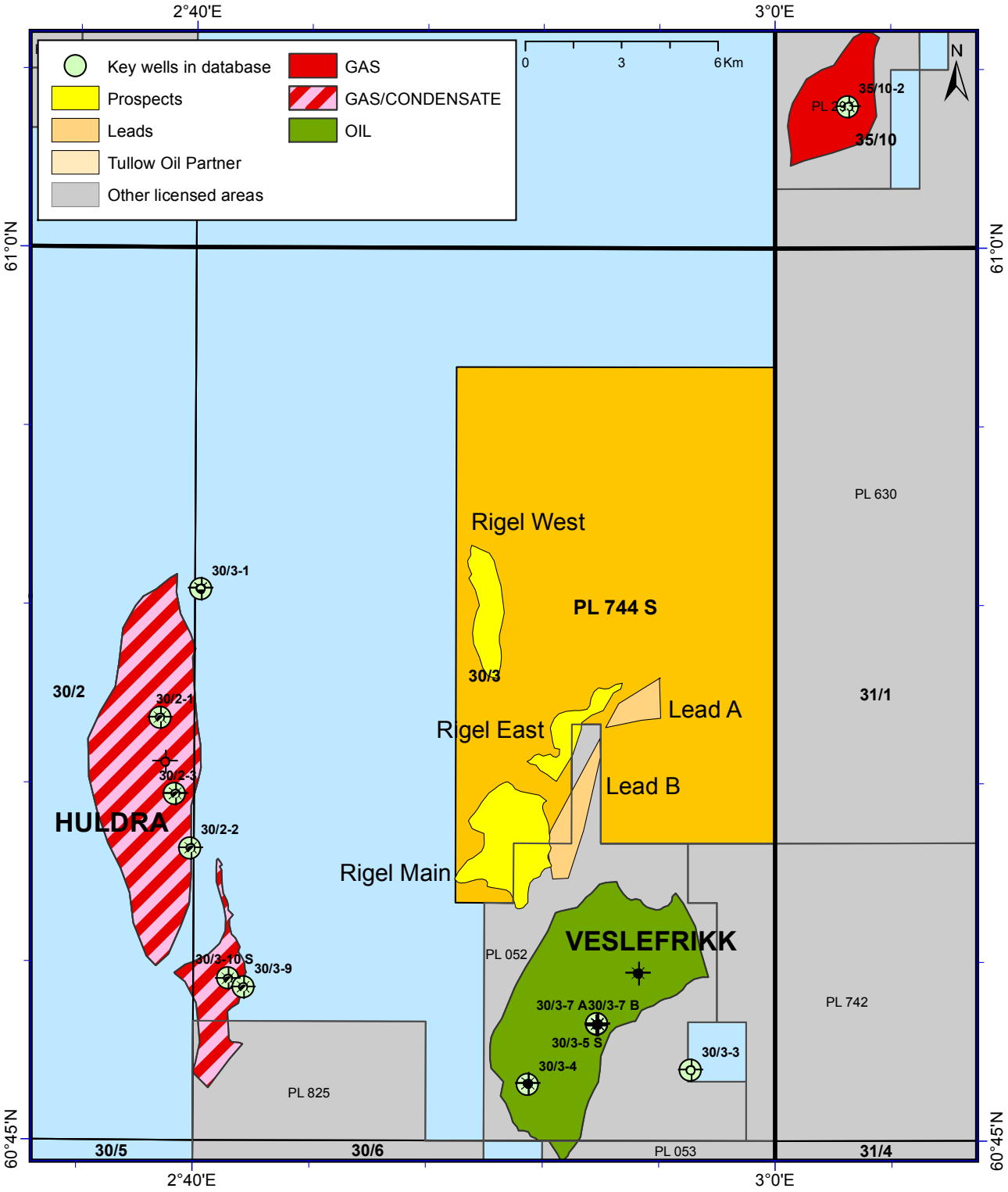

Fig. 2.2 Well database PL744S. *The wells listed in Table 2.1 is shown in map view.*

Table 2.1 Well Database

Well	Year	Operator	Content	TD (mRKB)	Age TD	Status
30/2-1	1982	Statoil	Gas/Con	4243	Early Jurassic	Public
30/2-2	1984	Statoil	Gas/Con	4170	Early Jurassic	Public
30/2-3	1992	Statoil	Gas/Con	4325	Early Jurassic	Public
30/3-1	1979	Statoil	Shows	3718	Early Cretaceous	Public
30/3-3	1983	Statoil	Dry	3419	Early Jurassic	Public
30/3-4	1985	Statoil	Oil/Gas	3287	Early Jurassic	Public
30/3-5 S	1992	Statoil	Oil	4724	Early Jurassic	Public
30/3-7 A	1997	Statoil	Gas/Con	6678	Early Jurassic	Public
30/3-7 B	1998	Statoil	Oil/Gas	5970	Early Jurassic	Public
30/3-9	2000	Statoil	Gas/Con	4015	Early Jurassic	Public
30/3-10 S	2009	Statoil	Gas/Con	4168	Early Jurassic	Public
35/10-2	1996	Statoil	Gas	4677	Early Jurassic	Public

3 Review of geological framework

PL744S is located to the North of the Brage Horst covering parts of Lomre Terrace, Flatfisk Slope and the Magne Sub-Basin. The primary prospectivity of the license is in the Lower Jurassic Cook Fm, see Fig. 3.1, deposited as N-S elongated tidal bars in an estuarine setting with some influence of prograding shoreface coming from the Horda Platform. Secondary target is the Brent Gp. Well 30/3-7 B was drilled on the B-Prospect wich is a good analogue to the Rigel prospect with oil saturation in the Brent Gp and gas in the Cook Fm. Gas below oil is due to the different sources described further below. The evaluation of the PL744S license has been performed on the acquired (NX0802/NX10M02) and re-processed 3D survey named NNS-MEGASURVEYPLUS-PHASE1 in both time (PSTM) and depth domain (PSDM).

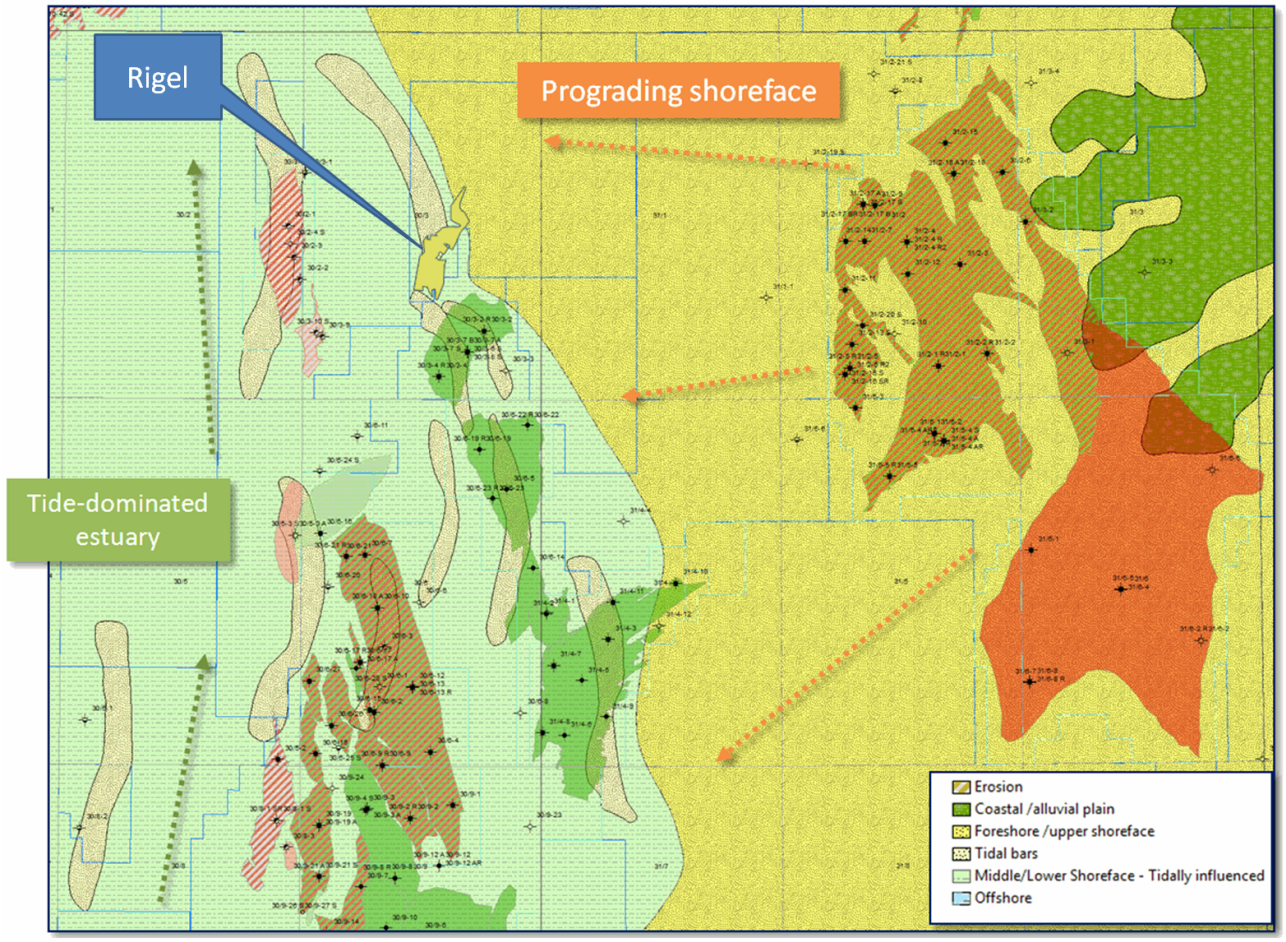

Fig. 3.1 The Lower Jurassic Cook facies map. *The Rigel prospect is located on the transition between off shore and tide dominated delta front.*

Performed geological work includes sedimentology and special reservoir studies, petrophysical analysis, pressure analysis, FIS studies and basin modelling. Geophysical special studies includes rock physics and inversion.

- The seismic data NNS-MEGASURVEYPLUS-PHASE1 have been important to be able to identify, interpret, evaluate and de-risk the main risk elements. This was not possible on the old data used in the application. The improvement in the data quality has enabled us to interpret the structure below the prominent gas chimney above Rigel and initiate other geophysical studies. The project was finalized February 2015.

- A petrographic, diagenetic and reservoir quality assessment of core samples from the Cook Fm and Brent Gp on the Velefrikk and Oseberg fields was conducted by Syed Moiz Hasnain at UIO as part of his Master Thesis, final report received June 2015. The report stated that Cook properties are ranging from moderate to good, but also that Cook is a heterogeneous sandstone body in terms og reservoir quality.
- In paralell Ichron Limited performed a petrographic study on core and cuttings of selected wells from Kvitebjørn, Valemon, Veslefrikk and Huldra. The final report were received November 2015.The background for the above mentioned geological studies was initated to examine the porosity enhancing processes of chlorite coating and area of distribution. The work improved our understanding of the factors that control the chlorite coating (porosity/permeability), such as; grain size, mud content (proximal-distal) and burial depth (diagenesis). This has enabled us to decrease the risk of reservoir presence, but has also lowered the quality of the reservoir parameter used in the volume estimations.

- Analysis of several wells on both Huldra, Veslefrikk and 35/10-2 led to the conclusion that Rigel is not located within high pressure but high temperature (150 ^{o}C) regime.

- FIS studies conducted by ICHRON. Draft recived do not show significant oil anomalies in the B-structure. Gas/Condensate is the most likely hydrocarbon phase in Cook Fm.

- In house basin modelling of the Dunlin (Gas/Condensate), Heather (Gas/Condensate), and Draupne (Oil) Fm shows a active hydrocarbon kitchen in direct contact with both the Cook Fm. (Gas/Condensate) and Brent Gp. (Oil) sufficient to fill the Rigel prospect.

- To mature the prospect further, the license conducted a simultaneous elastic inversion study with CGG. The aim was to increase resolution for improved mappability, thickness estimation and lithology prediction of the Cook Fm. and Brent Gp. The final report was received September 2015. Based on the inversion data, an internal rock physics study was initiated.
- The stiff rock frame at this burial depth implies relatively low fluid sensitivity. At the Veslefrikk B-Structure, the deepest well penetration of the Brent Gp, we see no indications of hydrocarbon-filled sandstones from the seismic inversion data.
- The combined ambiguity in acoustic impedance (sandstones versus shales), together with unreliable Vp/Vs data, makes it difficult to conclude about reservoir properties at Rigel from seismic inversion data.

4 Prospect update

Table 4.1 shows the updated summary for prospects and leads after the final evaluation process had concluded negative to a drill decision prior the deadline on the 7 th. of February 2016.

Table 4.1 Prospect and leads. An overview of the mapped prospect and leads in the license with volumes and risk on each element.

Discovery/prospect/lead name	D/P/L	Unrisked recoverable resorces						Probability of discovery	Resources in acreage applied for %	Reservoir		Distance to infra-structure (km)
		Oil 10 6 Sm 3			Gas 10 9 Sm 3					Litho-/Chrono-stratigraphic level	Reservoir depth (m MSL)	
		Low	Base	High	Low	Base	High					
Rigel Main	P				0,84	3,42	5,69	43	90	Cook	4084	30
Rigel Main	P	0	0,78	1,8				44	90	Brent	3829	30
Rigel E	P				0,13	0,37	0,89	24	98	Cook	4244	26
Rigel E	P	0,43	1,13	2,49				28	98	Brent	4050	26
Rigel W	P				0,01	0,14	0,27	24	100	Cook	4080	20
Rigel W	P	0,57	3,17	7,93				28	100	Brent	4438	20
Lead A	L							0	100	Cook	3225	30
Lead B	L							0	20	Cook	3203	28

The Rigel Prospect

The Rigel prospect is trapped on the terrace between the rotated Huldra field faultblock to the west and the Brage Horst with the Veslefrikk field to the east. Two major southwest-northeast trending faults constrains the prospect, making it a fault dependent four way closure on the migraton path to the 30/3-7B B-structure and further into Oseberg. On the positive side it is clear that the prospect is located in a sweet spot with an active hydrocarbon system and proven reservoir units in both the Brent Gp and Cook Fm. On the negative side the Rigel reservoir depth is at 3829 m for the Brent Fm and 4084 m for the Cook Fm. Only 3 km south of Rigel the 30/3-7B well was drilled on the B-structure. See Fig. 4.1. This structure is used as an analogue both for reservoir properties, fluid phase, saturation and the sealing capacity of the fault against the Veslefrikk field.

New interpretation on both time volume and depth domain change the lateral extension of the Rigel prospect from one large structure into 3 independent structures. This is a result of the new velocity model derived from the PSDM work. See Fig. 4.2. To adress this both Aker Geo veolcity-cube and a Tullow velocity model were used. From the results it was concluded that the two separate structures in the northern part is below defined hydrocarbon contact in the APA2013. A prominent gas cloud above the prospect is linked to a graben on the crest of the structure. The graben is dying out in the Dunlin Gp shales, leaving the Cook Fm. reservoir intact. This reduces the gross rock volume of the Brent Gp. In addition it is assumed that only 30 % hydrocarbon is trapped above the mapped faults of the graben.Fig. 4.3

Grain coating chlorite is reported from 30/3-2 and 30/3-A1 on Veslefrikk as a secondary control on reservoir quality in the Cook Fm. Since the lateral distribution is poorly understood we tried to solve it statistically by evaluating 9 exploration and 6 production wells from Veslefrikk to see if there was some trends. There is good correlation between high log porosity between the three Intra Dunlin sand, IDS1, 2 and 3, on Veslefrikk. It seems to appear mainly in upper IDS3 but only in zones ranging from 1-10 meters. Reservoir properties was thought to be of great importance but as the work went on it was more and more apparent that gross rock volume (GRV) became the determining factor on recoverable volumes. Grain coating chlorite only appeare in minor zones.

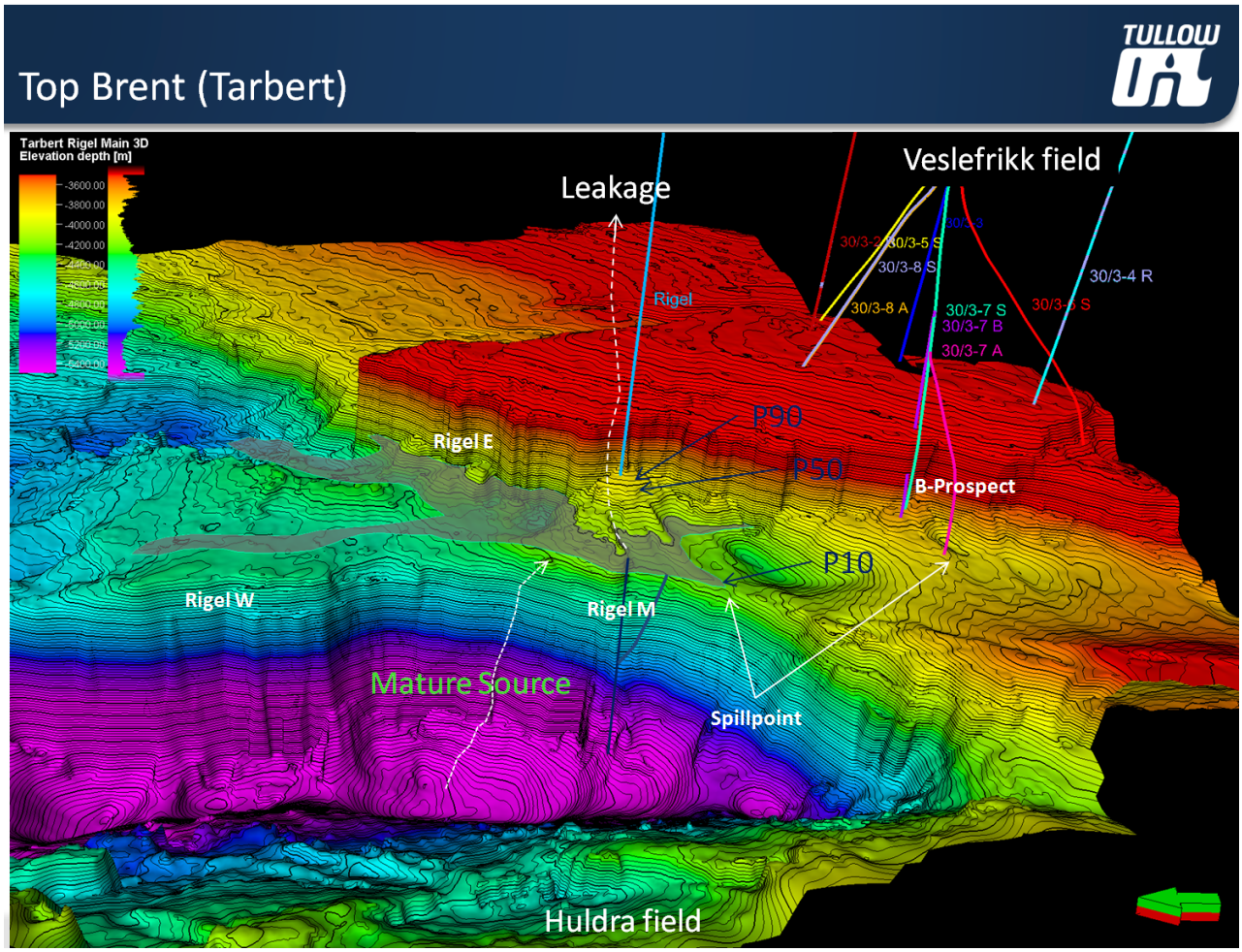

Fig. 4.1 Structural setting. *Top Brent map [depth] showing the Rigel prospect with P10 spill against the B-prospect. Rigel W are below P10 spill. Rigel E are above spill but a separate structure unless Rigel M is filled below spill.*

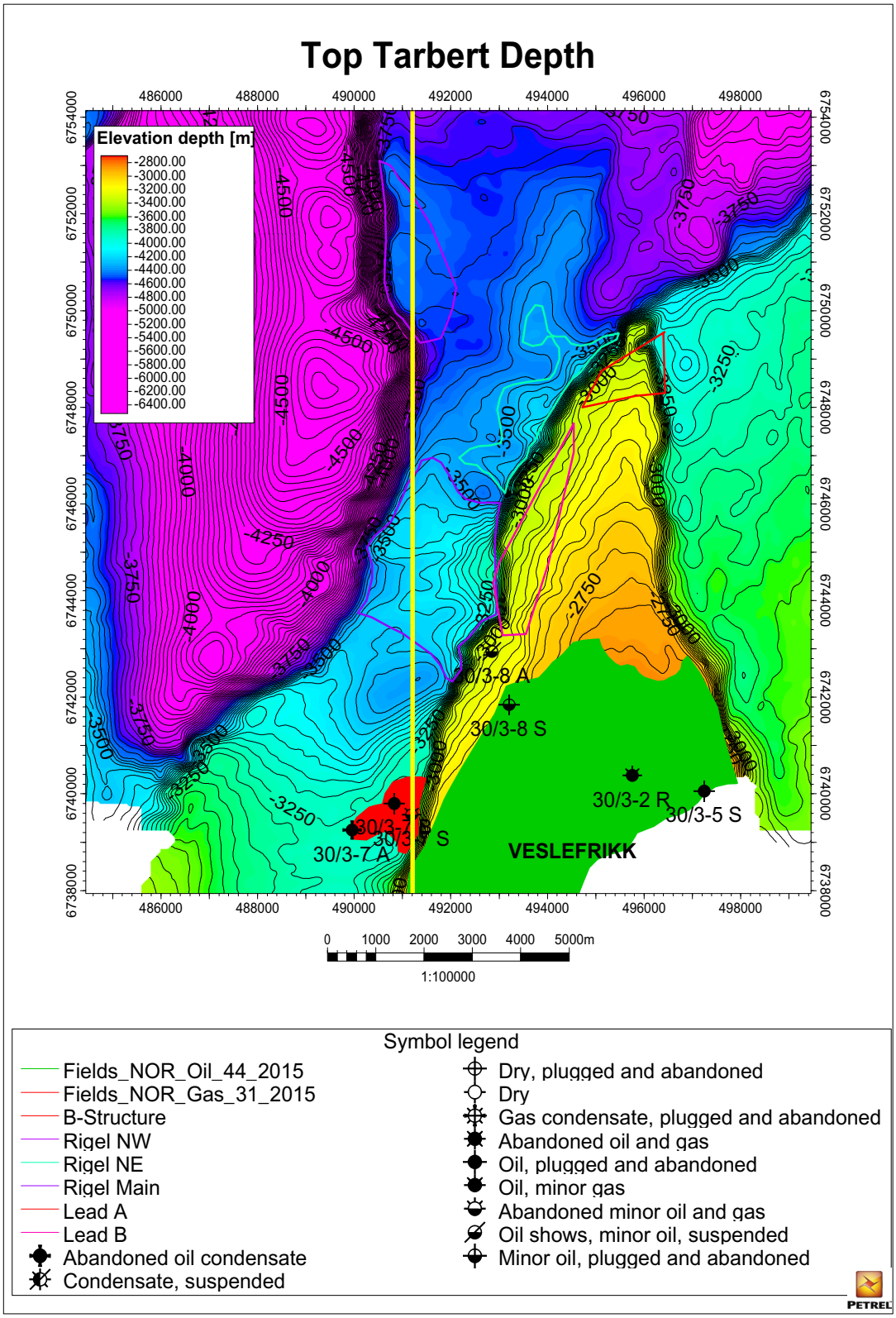

Fig. 4.2 Map of Top Tarbert with Veslefrikk and Rigel. *The maps outline the Rigel prospect, Veslefrikk, and the B-Structure. The yellow line indicates where seismic section of figure 4.3 is located.*

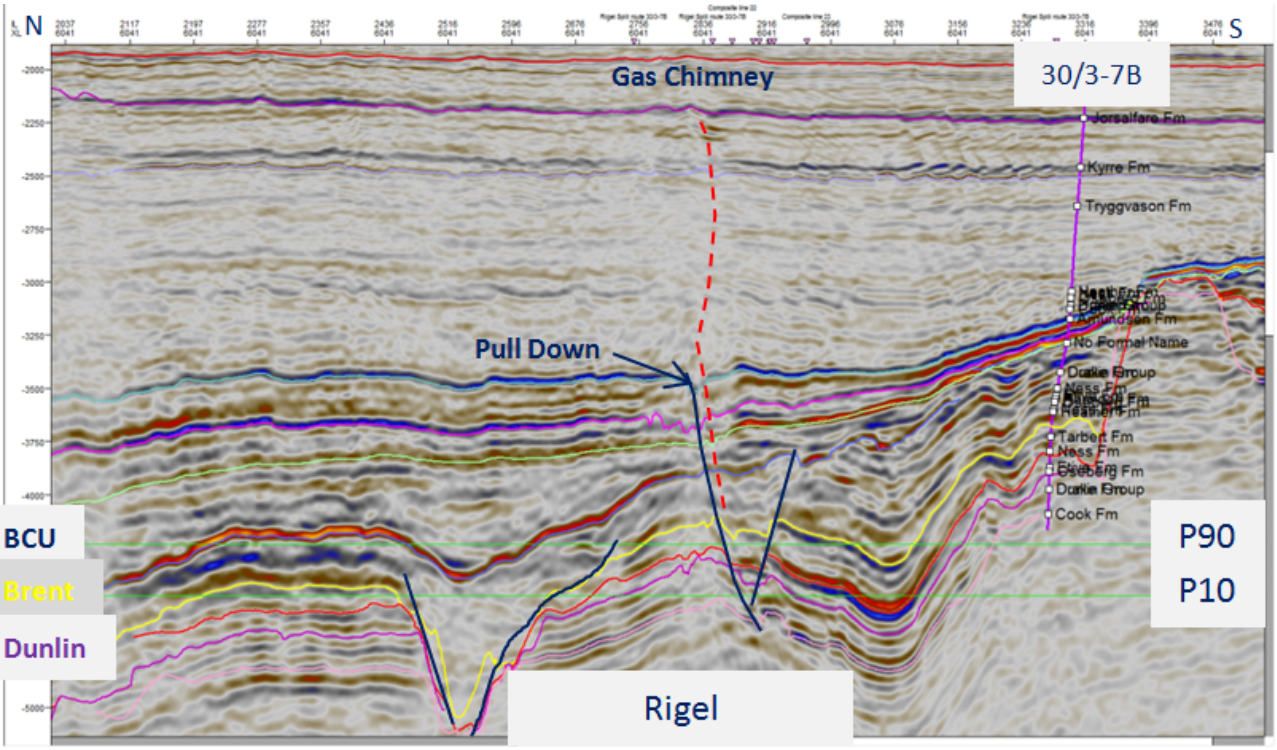

Fig. 4.3 Seismic section trough Rigel. *This N-S seismic section trough Rigel M into the B-prospect is showing the fault controlling the filling of Brent. The massive gas chimney above and brightening in Late Cretaceous means the trap is leaking. For location see Figure 4.2.*

Rigel West

The structure is a 3-way fault dependant closure located juxtaposed to mature source rock to the west on the tilted Flatfisk slope. In the APA2013 application it was part of the Rigel main prospect, but with the new velocity model it is separated by a saddle to the Rigel main structure below spill in both Brent and Cook unless there is a trapping mechanism like a fault updip so the main structure could hold a larger coloumn. The interpretation does not support this. The P10 closure is 3.4 Km^2

Rigel East

The structure has a similar trap and reservoir as the Rigel Main prospect and its analogue with the Veslefrikk B-Prospect, located down dip to the north. In the APA2013 it was part of the main prospect but with the new velocity model it is below spill in both Brent and Cook. The P10 closure is 2.98 Km^2 and is calculated receoverable volumes are not economical by it self. (Table 4.1)

Lead A

Defined on the original survey NX0802 as a small hanging block north on the Brage Horst. The fault defining this lead is not present on the re-processed seismic and there is no HC filled sst response in the inversion results. (Fig. 4.4) Due to the uncertain presence of trap and small previously mapped size 1.4 Km^2, the potential structure is regarded as high risk and below commercial treshold.

Lead B

On the western crest of the Brage Horst lies a potential undrained segment of Veslefrikk field. The Brent Gp is not present due to Late Jurassic/ Early Cretaceous erosion. Hence the lower Jurassic Cook reservoir represents the main target. The lateral and top seal is the main risk and only 20% of the lead (2.8 Km^2) is located within the license, the rest is within PL052. As no hydrocarbon filled sandstone response is observed in the inversion results, the lead is regarded as high risk.

Top Cook with Litho Classification

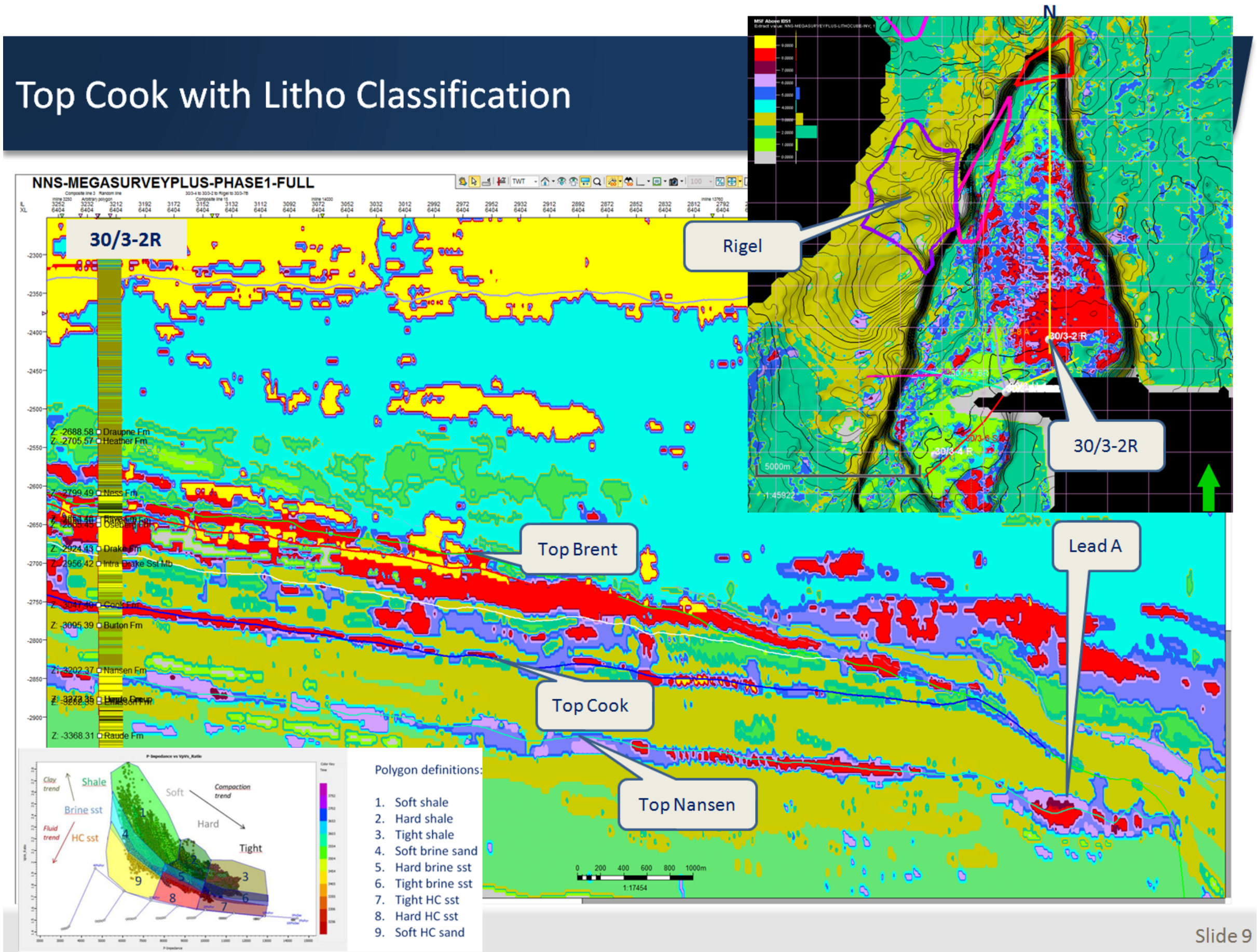

Fig. 4.4 Inversion results on the Brage Horst, Veslefrikk. *The lithology classification on the inversion results show the expected Veslefrikk reservoar zones. Lead A on the tip of the Brage Horst does not give indications of hydrocarbon filled sanstone of Cook Fm, but the inversion results suggests that Nansen Fm is hydrocarbon filled. Lead B is within the faultzone which might explain the lack of hyrdocarbon response in Cook Fm.*

5 Technical Economical evaluations

No new detailed scale technical-economical evaluation regarding possible development has been performed since the APA2013 application. However, there has been conducted a light evaluation regarding the Rigel prospect:

Rigel is assumed developed as a subsea tie back to Kvitebjørn (32 km). Drainage strategy is pressure depletion through 2 deviated production wells. Development cost is estimated to be:

Wells	1900	MNOK
Subsea and flowlines	4300	MNOK
Host modification	800	MNOK
Total	7000	MNOK

This gives a minimum commercial field size of 5.1 BCM gas assuming 70 USD/bbl for condensate and 7 USD/mcf for gas. As shown in table 4.1, this is in the higher end of the resource potential for Rigel. The prospect is therefore not viewed to be sufficiently robust to justify an exploration well.

6 Conclusions

The estimated recoverable volumes of oil (Brent) and condensate (Cook) in the prospect within PL 744S have through the license work program been reduced. The main reason for this is that the reprocessing of high quality 3D seismic data have resulted in improved seismic interpretation, updated assessment of the risk elements and new high resolution velocity control and depth surfaces. Volumes are further reduces as the study on reservoar properties reduced N/G and porosity. This in combination with the Rigel prospect not passing the technical-economical process, resulted in a decision to relinquish PL 744S.