PL622 Relinquishment Report

REV	ISSUE DATE	STATUS	AMENDMENT DETAILS	ORIGINATED BY	APPROVAL
1	2014-11-30	Draft v1		[redacted]	
2	2014-12-17	Draft v2	General edits		
3	2015-02-24	Final			

TABLE OF CONTENTS

1.0 LICENSE HISTORY

PL622 was awarded to Premier Oil Norge AS (Operator, 60%) and Maersk Oil Norge AS (40%) in February 2012 with a work program consisting of 3D seismic acquisition, licencing of long offset 2D seismic and relevant geological/geophysical studies with a drill-or-drop decision after three years.

During the licence period six EC/MC meetings were held.

Following an evaluation of the prospectivity in the licence acreage the partnership concluded that, although the prospect volumes on the licence were substantial, the charge/migration risk was too great to warrant drilling. A unanimous drop decision was therefore taken by the partnership December 15th 2014.

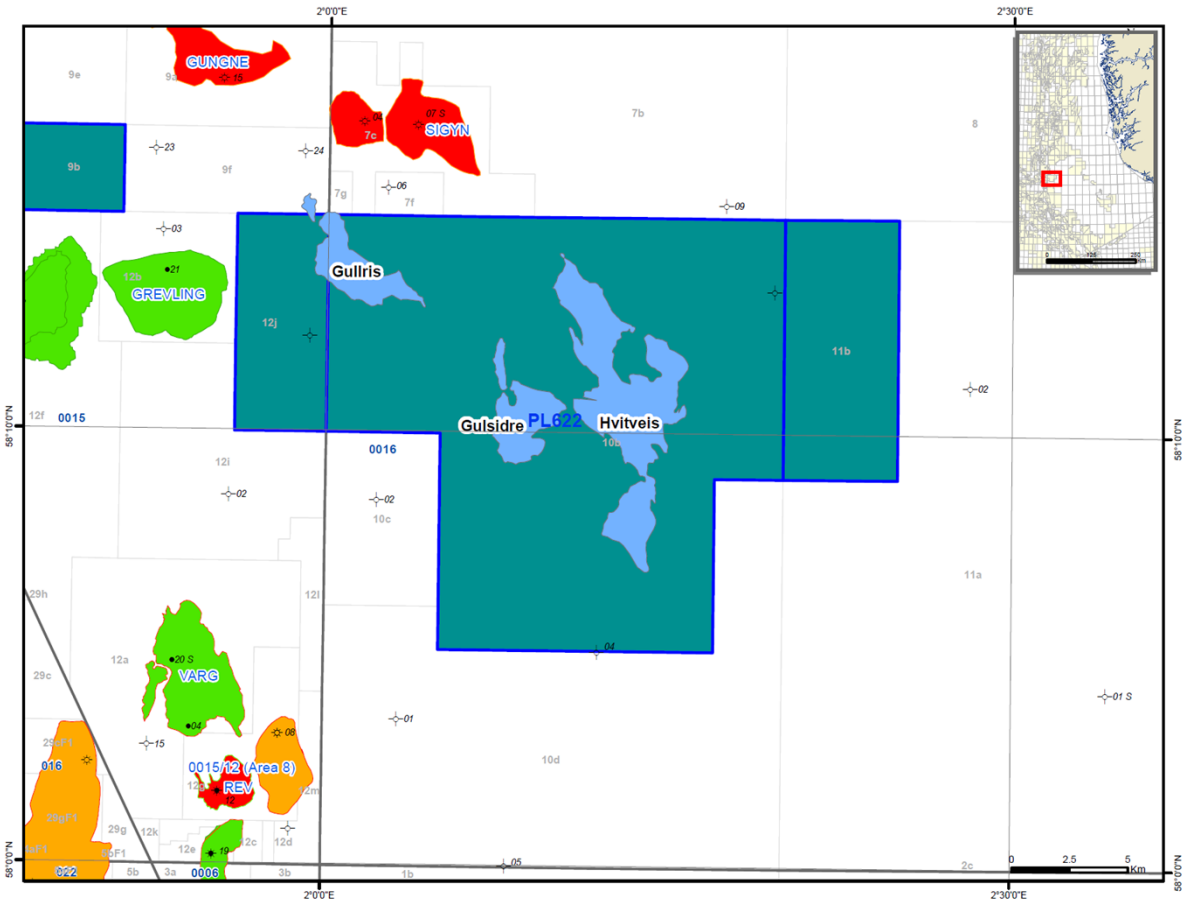

Figure 1. Map showing location of PL622 with the nearest fileds, wells and identified prospectivity.

2.0 DATABASE

The seismic database for the licence at time of application consisted of 2D and 3D seismic surveys including the Fugro Terracube merged 3D product. Seismic coverage of the area applied for was good. The 2D seismic database consisted of a selection of multi-client and released public surveys of varying vintages.

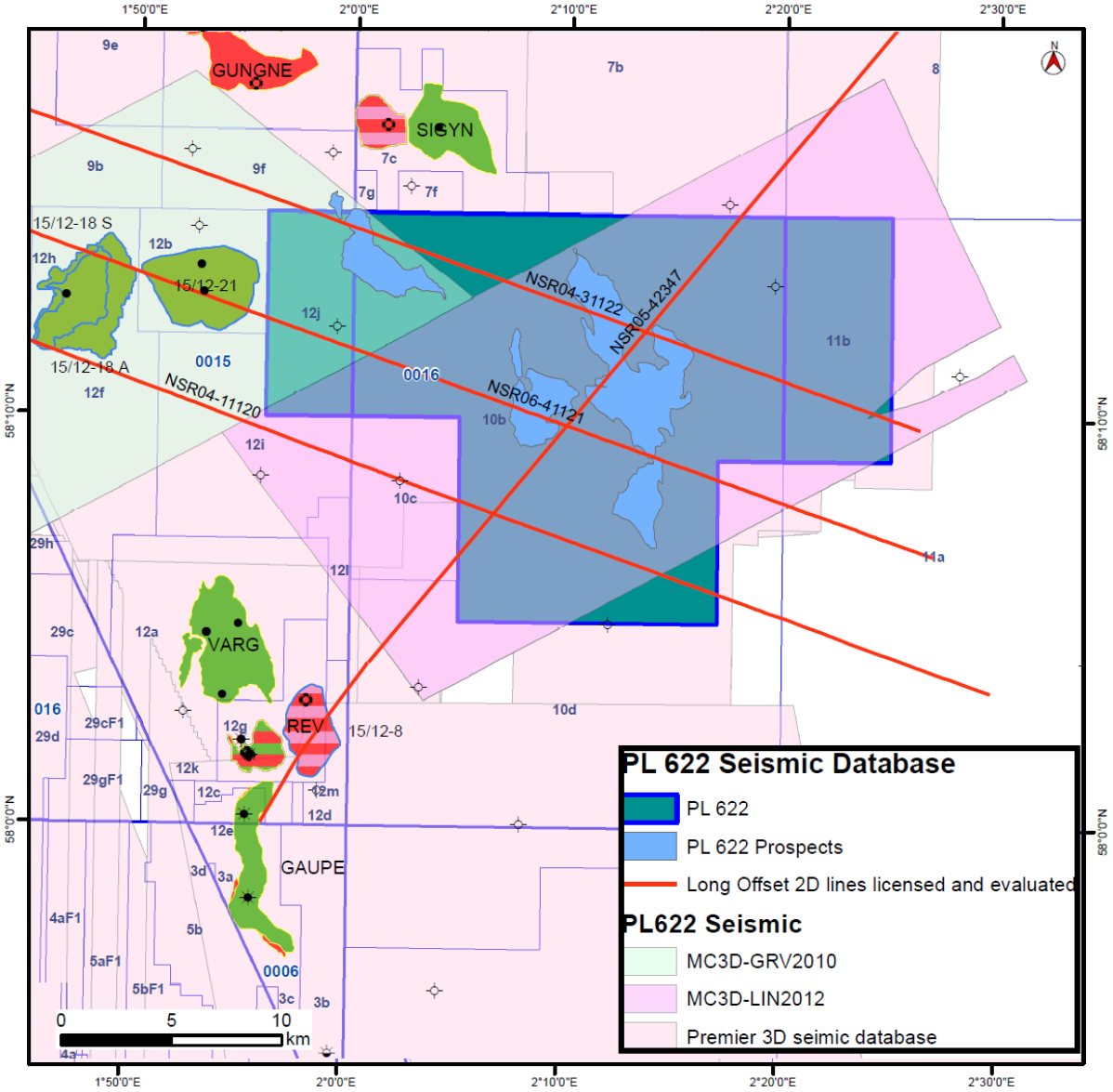

Figure 2. The seismic coverage of surveys used for evaluation – MC3D LIN2012 (pink transparent colour), MC3D GRV2010 (green transparent colour) and 2D NSR lines (marked in red). Shown in the background is the existing Premier 3D seismic database with location of wells, fields and extent of PL622.

Premier Oil acquired a new 500km2 3D Geostreamer seismic survey in cooperation with PGS as part of the work programme on PL622. The acquisition took place in the summer of 2012 and the data was merged and processed together with the pre-existing survey MC3D-GRV2010 from PGS. The processed products were delivered in April 2013. The quality of

the seismic data is considered to be good and it covers most of PL622 with only a small gap in the north of the licence area (Figures 2 and 3).

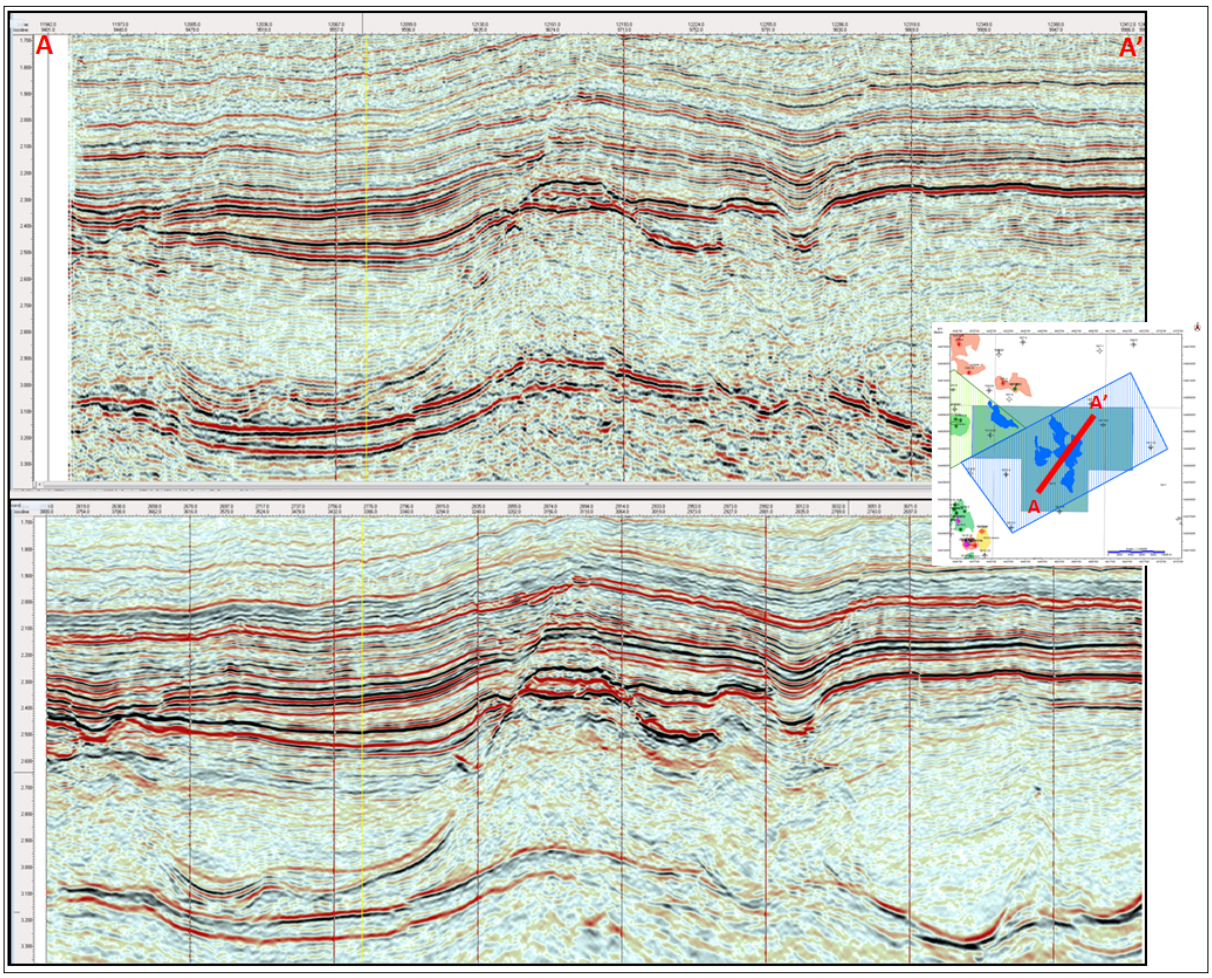

Figure 3. Comparison of data quality between Terracube (above) and the PGS Geostreamer data MC3D LIN 2012 (below).

3.0 REVIEW OF GEOLOGICAL FRAMEWORK

The PL622 partnership has undertaken five major studies as part of the prospectivity evaluation: biostratigraphy of the Jurassic, paleogeographical mapping based on core interpretations, reservoir quality of the Rotliegendes, gravity-magnetic interpretation for depth to basement and basin modelling.

A biostratigraphic evaluation of fourteen selected wells in the late Jurassic fairway in the Q15 area was carried out by Ichron Ltd. Only nine of these wells were found to contain biostratigraphic data of sufficient quality to integrate them into a comprehensive dating scheme. The studied interval ranged from the Triassic Skagerrak Formation to the Volgian Draupne Formation. The main interval of interest corresponds to sand prone intervals of variable age within the Jurassic, historically assigned to the Middle Jurassic Hugin or Sleipner Formations. The primary objective of the project was to provide a full quantitative palynological evaluation of the studied intervals and to partition the succession in terms of

the Partington sequence stratigraphic scheme of the North Sea (Partington et al., 1993). The intention was to recognise where biozones could be confidently recognised, standardise the picks and adopt the stratigraphic nomenclature of the South Viking Graben. This enabled stratigraphic time lines to be honoured in the evaluation (i.e. as opposed to time-transgressive lithostratigraphy such as Sandnes, Egersund and Tau Formations).

In this study, it should also be noted that the boundary between the Draupne Formation (Kimmeridgian-Ryazanian) and the Heather Formation is sometimes difficult to place accurately based on palynological information. This is due to the dilution effect on in situ palynomorphs by the huge quantity of Amorphous Organic Matter (AOM) caved from the overlying Draupne Fm in ditch cutting samples. Despite these limitations the study improved the understanding of the stratigraphic evolution of the license area.

An integrated Paleogeographical study based on core descriptions and petrography incorporating the aforementioned biostratigraphic work was also commissioned from Ichron Ltd. The scope of the study was to understand the distribution through time of Middle and Upper Jurassic reservoir sandstones in the area of interest and also to assess their reservoir quality. A total of 20 wells were included in the study, 10 of which contained cores available at the NPD.

Three main play-types were identified in the area:
- Shallow marine shorefaces; Hugin Formation and intra-Heather Formation sandstones
- Continental sandstone deposits; Sleipner and Skagerrak Formations
- Deep marine gravity flows within the Draupne Formation

As part of the deliverables of the study a set of paleogeographic maps were produced.

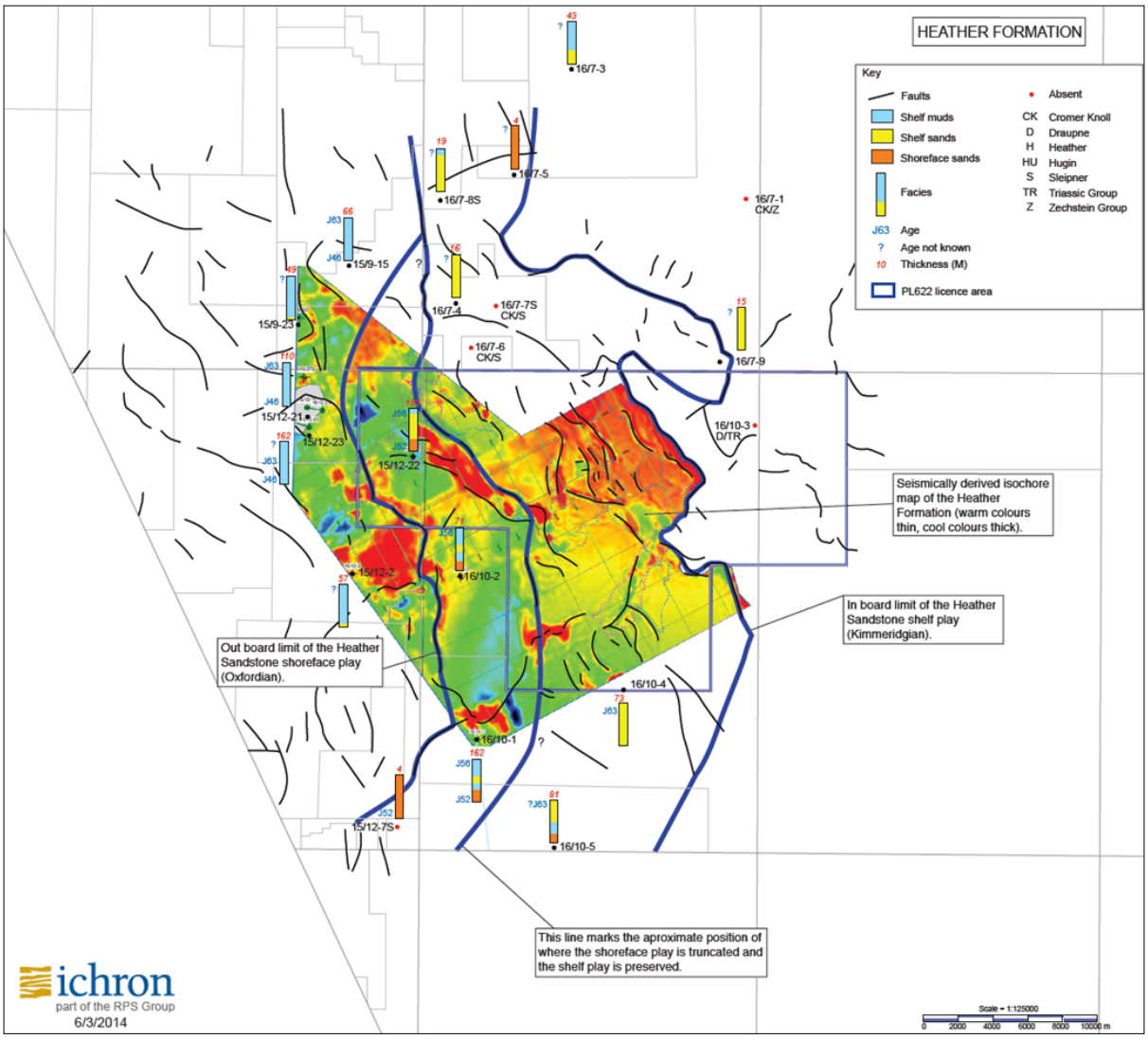

Figure 4. The depositional extent of Kimmeridgian and Oxfordian deposits is shown by blue lines. The background image is the Heather Formation isochore map with interpretation of core analysis posted (facies, age, and thickness).

In addition to the Jurassic studies, Permian prospectivity identified at time of application was investigated through studies commissioned with CGG and RPS Ichron. A Gravity-Magnetic study was carried out by CGG utilising data obtained from NGU, NSR, BGS and DECC (licensed through ARKeX). The purpose of the study was to improve understanding of the regional geology in Q16 by looking at aspects of basement architecture, tectonic features and basin/sub-basin characteristics. The location and extent of Carboniferous basins would be identified using marine gravity data and aeromagnetic data. This would be calibrated to the underlying geology using long offset 2D seismic lines. The results of the study showed that Carboniferous basins are present and estimates of their thickness of fill were provided. 2D modelling indicates the presence of several braided sinistral strike-slip fault zones of ~SW-NE strike and indicated deep seated master faults of a probable similar orientation. This is observed in large wavelength bandpass filter maps. The SW-NE orientation is supposedly activated during mid Jurassic extension, resulting in N-S oriented normal faults, such as those creating the Sleipner terrace. NW-SE oriented deep structures are parallel to the Northern and Southern Tornquist Zones of supposedly Carboniferous-Permian age. The Ling Depression probably continues further west of PL622 instead of the Southern Viking

Graben extending south due to the continuation of a major Bouger gravity anomaly low along the northern boundary fault of the Ling Depression.

In order to determine the potential for reservoir presence and quality in the Rotliegend a petrographic study was commissioned with RPS-Ichron. A core review of 11 study wells was performed, with 50 samples obtained from 9 of those. Wireline signatures (mainly GR and neutron/density) of GDE's identified in the cored sections of the study wells were used to identify probable analogues in uncored intervals. Alluvial depositional environments are located close to paleogeographic highs. The area around PL622 is dominated by alluvial and fluvial sediments, passing into lacustrine facies to the north-east (wells 16/7-2 and 16/7-3). Aeolian facies are largely restricted to the southern and northern ends of the study area but also occur in wells 6/3-2 and 7/3-1, 20-50km south and south-east of PL622. The low abundance of late diagenetic cements and preservation of moderate reservoir quality in wells 1/3-5 and 2/1-7 is believed to be related to overpressure in the Ula-Gyda area, which may not affect the area around PL622. On the other hand, pore-filling dawsonite cement, which reduces the reservoir quality of aeolian dune slip-face deposits in well 7/3-1 close to PL622, is known to be related to throughput of CO2 and is therefore likely to be localised close to deep-seated faults.

Analysis of reservoir quality was carried out concluding that reservoir quality is poor in samples from alluvial and fluvial settings due to a combination of poor to moderate sorting, authigenic clays and /or authigenic cements. Aeolian samples show a better spread of poro-perm values, although these deposits are not expected in PL622, being apparently restricted to the North and South of the study area.

A semi-regional basin modelling study was carried out in cooperation with Torena AS. The interpretations and learnings from the mentioned studies was incorporated into a Trinity (software provided by ZetaWare) model together with seismic interpretations, geochemical and temperature data.

The study included burial history, temperature gradients, source rock evaluation, maturity modelling and qualitative and quantitative hydrocarbon expulsion, migration and trapping.

The results show that PL622 is located in an area with several source rocks, source rock facies and oil families. The basin modelling concluded that any hydrocarbon charge into identified PL622 prospects is most likely restricted to hydrocarbons from Upper Jurassic source rocks derived from local source kitchens. These source rocks are only marginally mature in these local basins and very limited quantities of oil and almost no gas have been expelled. Estimated in place volumes in the prospects are in the order of 1-3 MSm3 of oil or less. Eventual hydrocarbons are likely to be black oil with a gas-oil ratio of about 30-40 Sm3/Sm3.

4.0 PROSPECT UPDATE

At the time of application multiple structures were identified at Permian, Triassic and Jurassic levels. Based on paleogeographic interpretations, seismic mapping and biostratigraphic work Hugin and Sleipner Formations were disregarded as potential reservoirs in PL622. The new interpretation indicates Intra-Heather sandstones and Skagerrak Formation sandstones are the most likely reservoirs to be present in the identified prospectivity in PL622. Re-interpretation and depth conversion indicates some of the Jurassic prospects could be compartmentalised (Hvitveis).

Hvitveis

Hvitveis is a salt-induced 4-way dip closure at Upper Jurassic level. It is compartmentalized into three separate culminations (North, Central and South) with a combined maximum area of closure of 27 sq. km. The structure is sealed by Upper Jurassic and Lower Cretaceous shales exceeding 100m in thickness, and the structural relief is mapped to be 170m from a crest at 2490m (Figure 5). The reservoir is anticipated to be Upper Jurassic (Heather Formation.) sandstones, alternatively Skagerrak Formation (Triassic). Reservoir thickness and quality of the intra-Heather sandstones is uncertain and an absence of reservoir over the central segment of Hvitveis is possible (Figure 5).

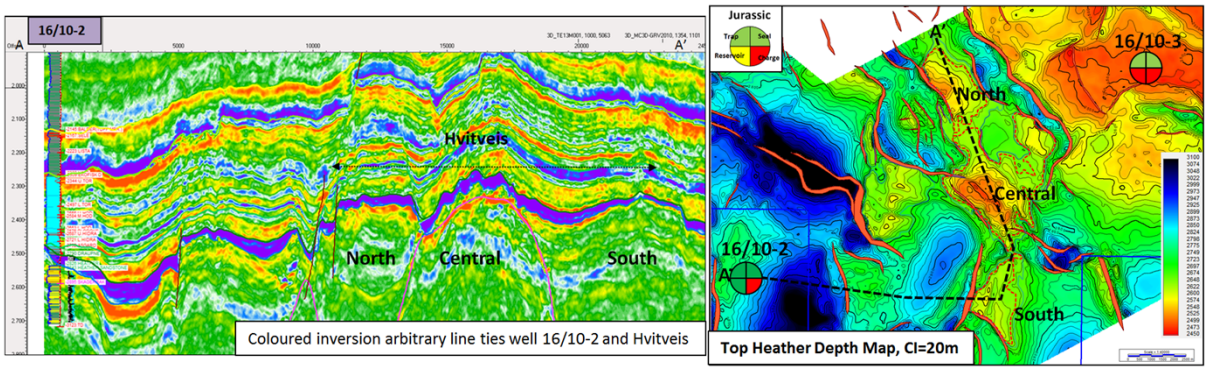

Figure 5. Arbitrary line through a coloured inversion cube indicates similarity in seismic response around Hvitveis and well 16/10-2. Location map (Top Heather depth) with Hvitveis outlined is shown on the right.

Gullris

Gullris is a small, robust 4-way dip closure with dip-closure in two directions and two-way fault-closure as upside. The crest of the structure is predicted at 2635m and spill point at 2790m. Expected reservoir is Upper Jurassic Heather Fm. sandstones with good reservoir properties. However, variable thickness and a waste zone at the top of the unit is possible. The basin modelling study results indicates limited local charge potential from the adjacent basin to the west between Gullris and the Grevling discovery (Figure 6). Long-distance migration from other potential kitchen areas is unlikely. Expelled volumes are modelled to be limited and an under-filled structure can be expected. In the volumetric model a mean column height of 47.5 m is used versus 150 m of mapped structural relief.

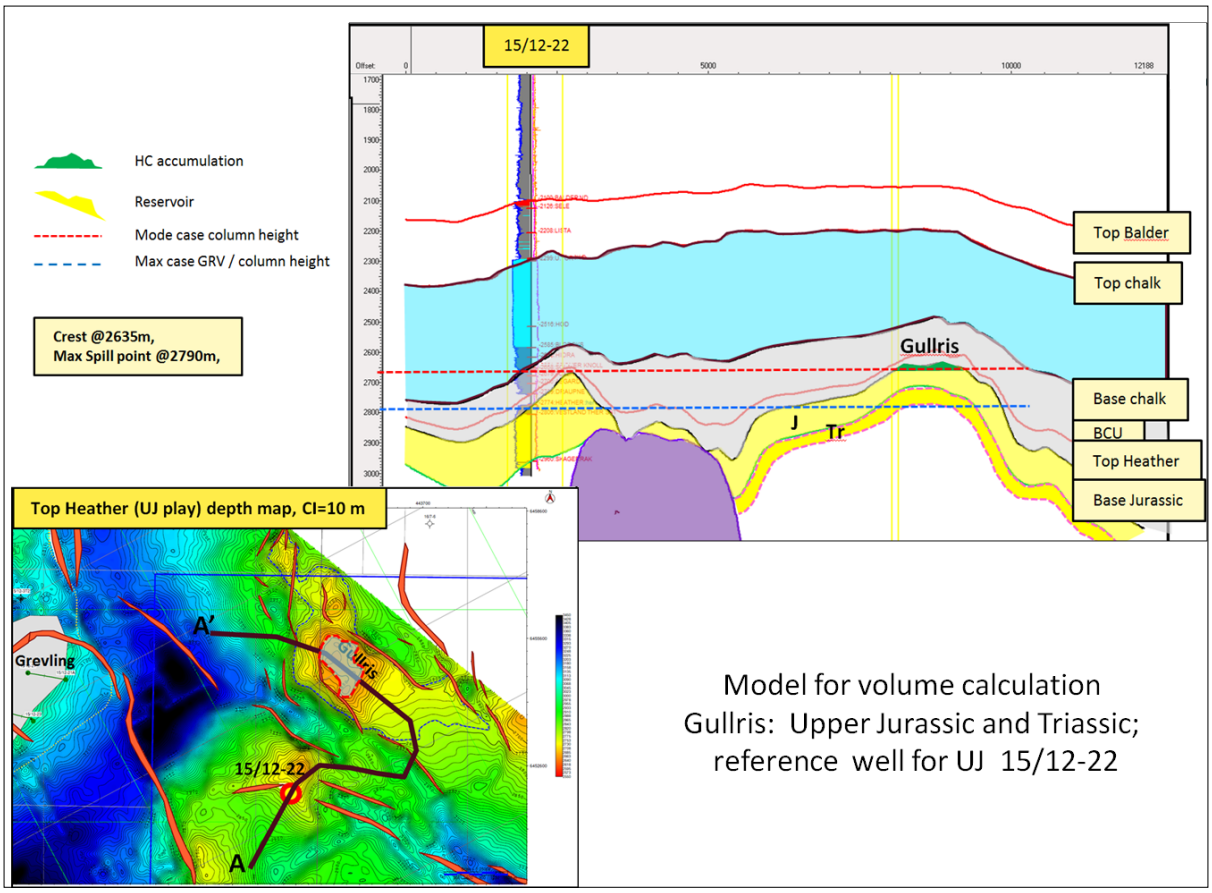

Figure 6. Illustration of scenario with mean column height of 47.5 m, (limited as a consequence of results from the basin modelling study).

Gulsildre

Gulsildre is a fault dependent structure with a maximum structural relief of 95m. The crest is mapped at 2595m and maximum structural closure at 2690m. Expected reservoir is Upper Jurassic Heather Fm. sandstones and potentially Triassic Skagerrak Formation sandstones as well. Long-distance migration from the kitchen to the south-west which is mature for oil generation is considered unlikely as no migration pathways were identified in the basin modelling study. This significantly downgrades the probability of success.

Three volumetric models have been constructed in for Hvitveis (one for each culmination), and then consolidated (segments in a prospect, common play). The source risk is common for all segments within the model.

The Gulsildre lead has a significant area of closure. However, the probability for geological success is very low due to very high risk on hydrocarbon charge.

The final volumetric model of Gullris incorporates basin modelling results to define the column height distribution as the potential expulsion from the source kitchen is limited. The prospective volumes and risks of the leads are given in the table below.

Hvitveis North	Element	Sub-Element	Risk
	Source (Play)	Presence	100
		Quality	100
	Charge	Maturation (Play)	80
		Migration (Local)	20
		Timing (Local)	100
	Reservoir (Play / local)	Presence	100
		Effectiveness	70
	Seal (Play / local)	Top, lateral & base	100
	Trap Configuration (Local)	Geometry & reliability	100
	Pg		14%

Hvitveis Central	Element	Sub-Element	Risk
	Source (Play)	Presence	100
		Quality	100
	Charge	Maturation (Play)	80
		Migration (Local)	14
		Timing (Local)	100
	Reservoir (Play / local)	Presence	80
		Effectiveness	70
	Seal (Play / local)	Top, lateral & base	100
	Trap Configuration (Local)	Geometry & reliability	100
	Pg		10%

Hvitveis South	Element	Sub-Element	Risk
	Source (Play)	Presence	100
		Quality	100
	Charge	Maturation (Play)	80
		Migration (Local)	12
		Timing (Local)	100
	Reservoir (Play / local)	Presence	100
		Effectiveness	70
	Seal (Play / local)	Top, lateral & base	100
	Trap Configuration (Local)	Geometry & reliability	100
	Pg		8%

Table 1. Risk assessment for Hvitveis segments (North, Central, South) in play/local aspect.

Gulsildre	Element	Sub-Element	Risk
	Source (Play)	Presence	100
		Quality	100
	Charge	Maturation (Play)	80
		Migration (Local)	18
		Timing (Local)	100
	Reservoir (Play / local)	Presence	100
		Effectiveness	70
	Seal (Play / local)	Top, lateral & base	100
	Trap Configuration (Local)	Geometry & reliability	100
	Pg		13%

Gullris	Element	Sub-Element	Risk
	Source (Play)	Presence	100
	Charge	Quality	100
		Maturation (Play)	100
		Migration (Local)	70
		Timing (Local)	100
	Reservoir (Play / local)	Presence	100
		Effectiveness	75
	Seal (Play / local)	Top, lateral & base	90
	Trap Configuration (Local)	Geometry & reliability	100
	Pg		47%

Table 2. Risk assessment for Gulsildre and Gullris in play/local aspect.

PL622 Gross Recoverable Resources (mmboe)					
	P90	P50	P10	Mean	Ph
Hvitveis North	2	12	34	15	0.14
Hvitveis Central	4	25	70	32	0.1
Hvitveis South	1	4	12	5	0.08
Hvitveis Consolidated	3	20	76	31	0.18
Gulsildre Jurassic	7	25	53	27	0.13
Gullris Jurassic and Triassic	1	9	38	15	0.47

Table 3. Summary of PL622 Gross Recoverable Resources.

5.0 TECHNICAL EVALUATIONS

Hvitveis has a probability of success (Ph) of 18% for the consolidated mean net resource of 17 mmboe. The probability for all three culminations being charged is only 3%.

The economic evaluation has been run with full-cycle economics as exploration cost is relatively high due to licencing of multi-client 3D seismic. The value assessment of the consolidated Hvitveis lead gives a mean net NPV @ $65/bbl. of $29 million and $65 million net @ $85/bbl. The probability of commercial success in a low price scenario is 11%. The EMV of the prospect is $-2.6 million @ $65/bbl. and $3.9 million @ $85/bbl.

The Ph of the Gullris lead is 47% for a mean net resource of 9 mmboe. The full-cycle economic assessment gives a mean net NPV @ $65/bbl. of $9 million and $26 million net @ $85/bbl. The probability of commercial success in a low price scenario is 18%. The EMV of the prospect is $-0.7 million @ $65/bbl. and $7.1 million @ $85/bbl.

6.0 CONCLUSIONS

Detailed seismic interpretation and basin modelling study has highlighted the significant challenges to charging identified structures on the licence, although the paleogeographical work that has been carried out has considerably improved knowledge of Mesozoic reservoir development in the area. While the seismic interpretation on new seismic data to a large extent has confirmed the initial interpretation carried out on Fugro Terracube, the basin modelling has indicated that these structures are significantly under-filled. In general, the geological studies programme entered into on this licence has greatly improved understanding of the risk spectrum associated with the identified prospectivity.

The technical and economical evaluation of PL622 has illustrated that the identified prospectivity fails to demonstrate commercial viability and a decision not to drill a well on the license was unanimously taken by the partnership.

7.0 REFERENCES

Partington, M.A.P., Copestake, P., Mitchener, B.C. & Underhill, J.R., 1993. Biostratigraphic correlation of genetic stratigraphic sequences in the Jurassic – lowermost Cretaceous (Hettangian – Ryazanian) of the North Sea and adjacent areas. *In:* Parker, J.R., (ed.): Petroleum Geology of Northwest Europe: Proceedings of the 4th Conference: 371-386.