PL566S Relinquishment Report

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2	2014-04-04	Final	General edit		

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1.0 LICENSE HISTORY

PL566S was awarded to Nexen Exploration Norge AS (Operator 50%), RWE Dea Norge AS (30%), and Petoro AS (20%) in February 2011 with a seismic reprocessing work program and a drill-or-drop decision after two years. Premier Oil Norge AS ('Premier') acquired Nexen's interest and operatorship January 31, 2012. A twelve months license extension was granted in February 2013 which extended the drill or drop decision date until February 2, 2014. During the licence period five combined EC/MC meetings and one MC meeting were held.

Following an evaluation of the prospectivity in the license acreage the partnership concluded that no prospect of sufficient volumetric potential to warrant drilling was present and it was decided to drop the license at the license anniversary.

2.0 DATABASE

The seismic dataset used in the evaluation leading up to the licence application was the PGS Megamerge and GA3D-93. As part of the work program, the GA3D-93 survey was merged and reprocessed with the NH8702MR12 survey to give nearly full coverage of the license. The PON12M02 (Figure 1) merged survey was used by the operator for interpretation and was checked for consistency with the PGS multi-client geostreamer datasets (CGR2010 & CGR2011) where possible. The reprocessed seismic data quality was deemed to be of good quality and is greatly improved when compared to the original GA3D-93 data (Figure 2).

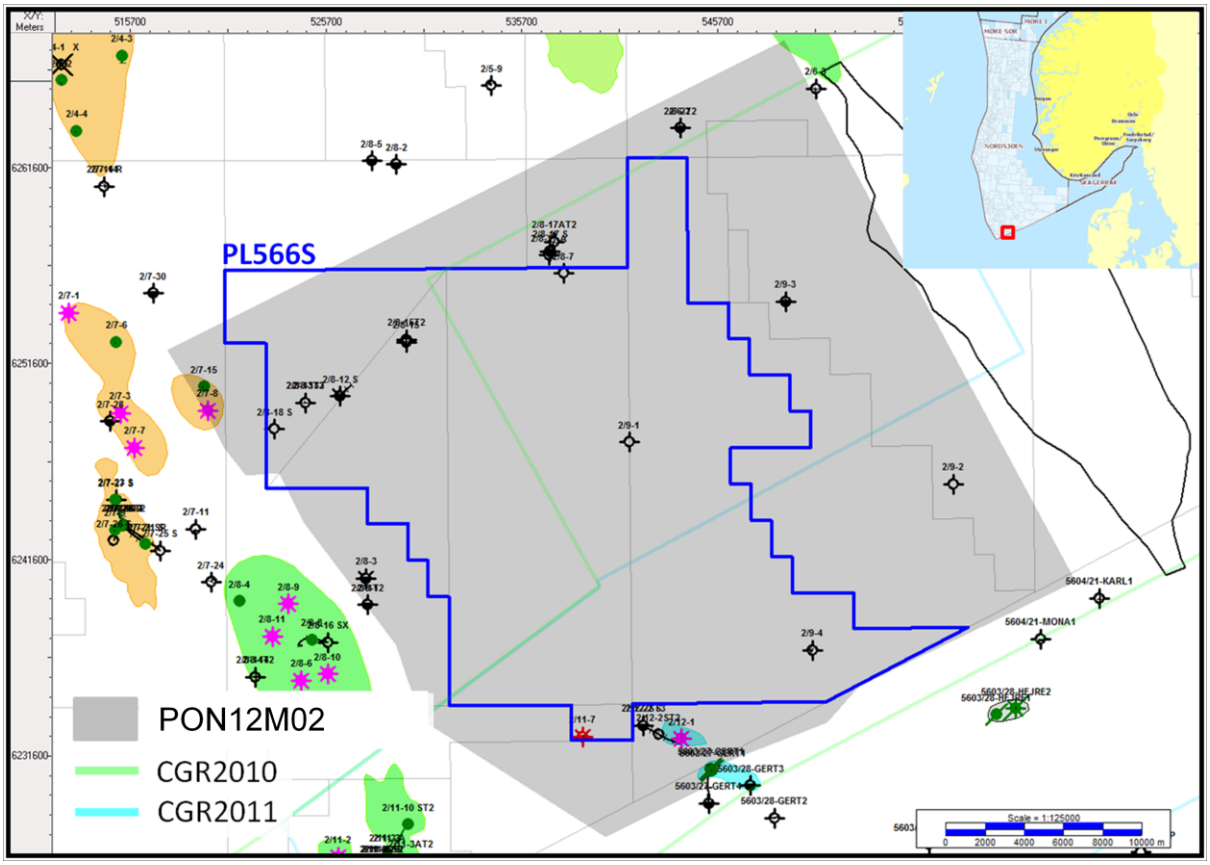

Figure 1. PL566S location is shown by the blue polygon. The extent of the merged and reprocessed seismic dataset PON12M02 is shown in grey.

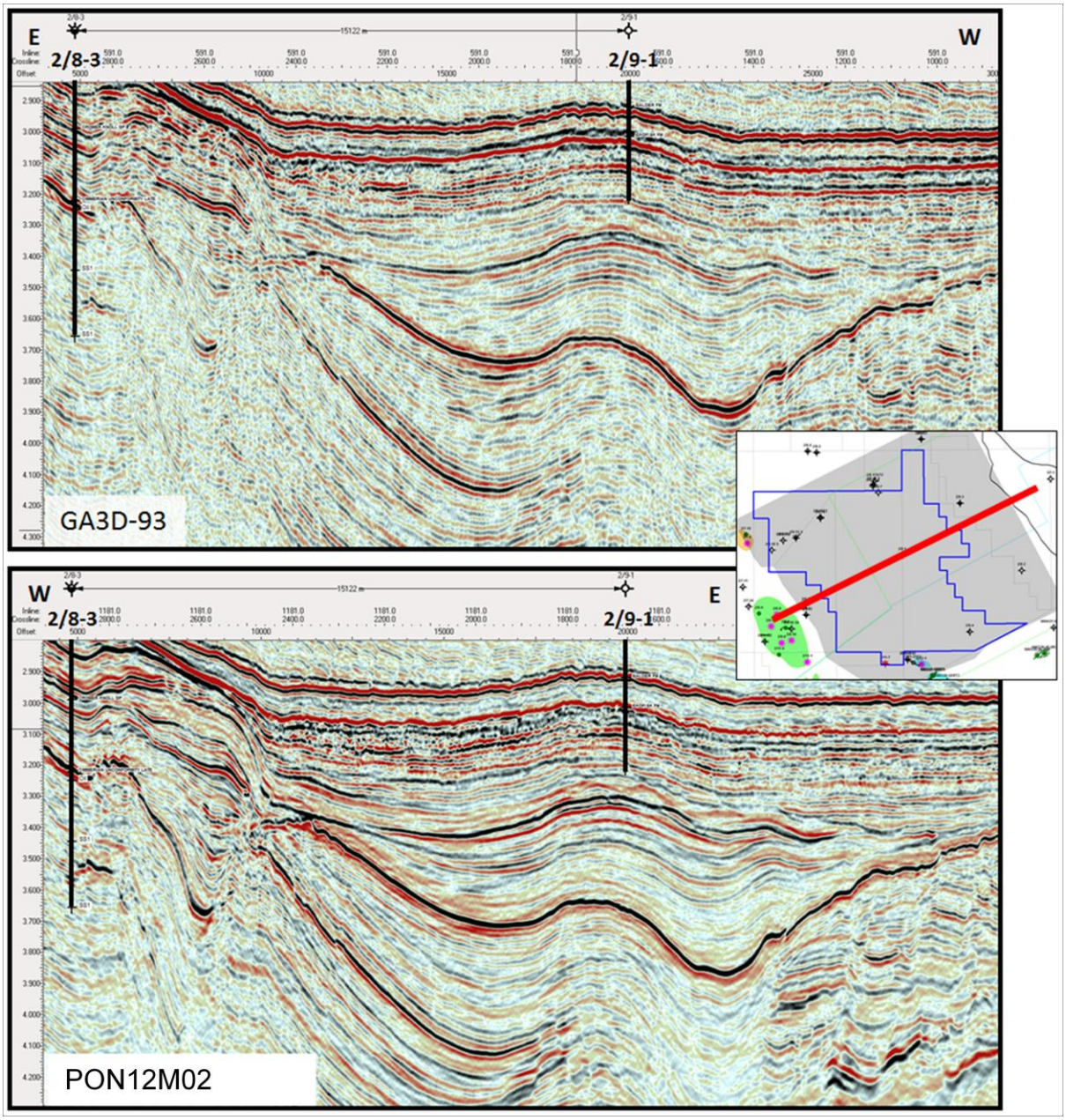

Figure 2. Comparison between the GA3D-93 dataset (top) used for the application and the PON12M02 dataset (bottom) used for the operator's interpretation. In many areas, the uplift provided by reprocessing is significant.

3.0 REVIEW OF GEOLOGICAL FRAMEWORK

The PL566S partnership has performed a number of studies as part of the prospectivity evaluation.

A regional biostratigraphic and GDE (Gross Depositional Environment) mapping exercise was performed by Ichron in 2013. The main scope of this work was to:

1. Perform a biostratigraphic evaluation of the Jurassic interval from regional wells and quantify the succession in terms of the Partington sequence stratigraphic scheme of the North Sea (Partington et al., 1993).

2. Provide a stratigraphic framework to accurately define and interpret the studied interval and define stratigraphic breaks
3. Provide a correlation of wells to aid in understanding regional gross depositional environments (see example in Figure 3)

The interval studied ranged from J55 through J77 which included the main sand-prone intervals of the late Jurassic. Within the PL566S license, this corresponds to the diachronous Ula shoreface sands and Eldfisk-like turbidites of the Farsund Formation.

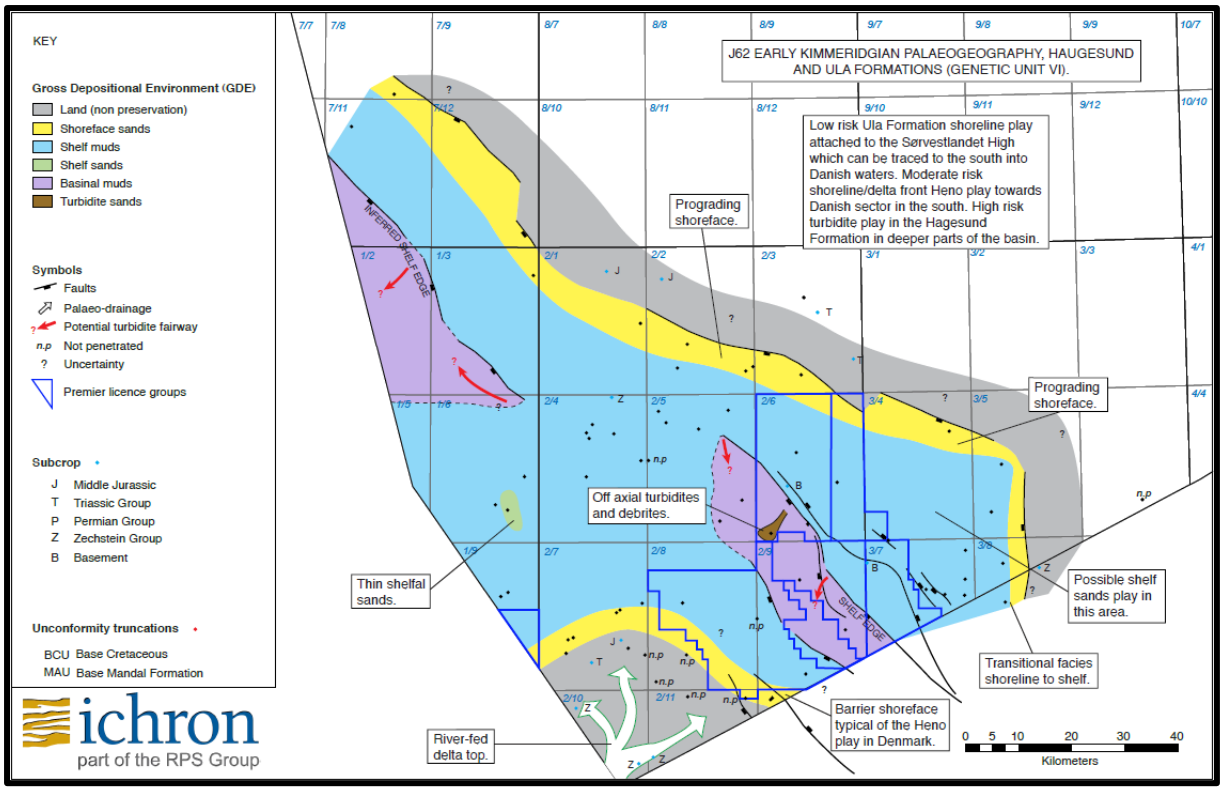

Figure 3. An example GDE map produced for the J62 level showing the regional coverage of the Ichron study.

Two main play-types were identified in the area:

1. Shallow marine shoreface, (including the main Ula trend, plus an older shoreline system to the south that is broadly equivalent to the Heno Fm. barrier shoreline system in the Danish sector)
2. A deep marine gravity flow fairway/fairways within the Upper Jurassic Haugesund and Farsund formations.

Petrophysical work on relevant regional wells indicates the widespread presence of Ula/Heno sands. The reservoir quality of these sands in the immediate area tends to be quite good as a result of the high overpressures which tend to support high porosities (>20%) at depths greater than 4500m (2/12-1).

As part of a regional study, Ikon Geopressure was commissioned to investigate pore pressures. The scope of the study was to define the most-likely pressure regime and seal capacities within the PL566S license area. The main conclusions from this study are that the Jurassic leads and prospects in the PL566S license lie in a 6000-6500psi overpressure cell and that the risk of seal breaching is high.

Other studies completed on the license include: structural reconstruction work focused on salt and faults, updated basin modelling study, and inversion and quantitative seismic analyses.

4.0 PROSPECT UPDATE

The prospectivity initially described by Nexen was comprised of 12 leads, 3 of which had been matured into prospects with unrisked recoverable base case resources ranging from 4.2Sm3 oil equivalent (Blåmeis) to 11.8Sm3 oil equivalent (Vandretrost). The leads and prospects ranged in age from Kimmeridgian/Oxfordian to Barremian and in depth from 3275m to 4600m. All of the prospectivity (with the possible exception of the late Cretaceous Islom lead) is expected to be high pressure (HP) but not (likely), high temperature (HT).

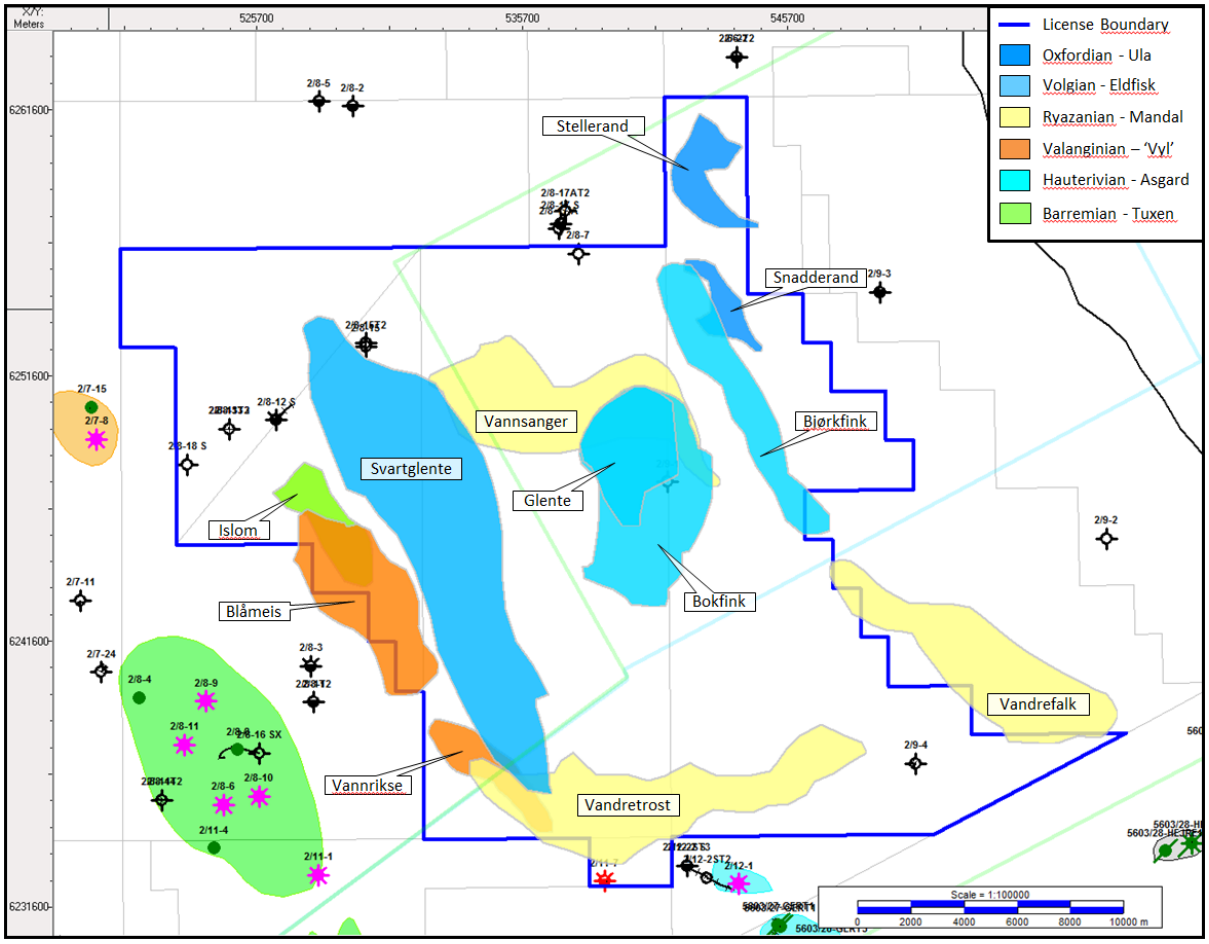

Figure 4. An overview map of the prospects and leads identified as part of the Nexen application.

PL566S covers parts of the Gertrude Graben and its western margin in the southernmost Norwegian North Sea adjacent to the Norway-Denmark median line. The prospective interval is considered to be the Upper Jurassic which is characterised as HP in this area. Given the depths of the leads proposed in the original Nexen application, the pressures are expected to range from about 11,000psi to 13,000psi at temperatures between about 100°C and 150°C.

Work by the partnership initially focused on the Vandretrost prospect described by Nexen in the original application document. Situated just below the BCU, the channel-like feature is

identified by its amplitude response (Figure 5) and spectral characteristics. Although interesting as a distinct geologic feature, the prospective size of the structure is small when one considers its HP nature and the effect that this may have on maximum column height. Because of this, the partnership decided to pursue other, potentially larger, leads in the license.

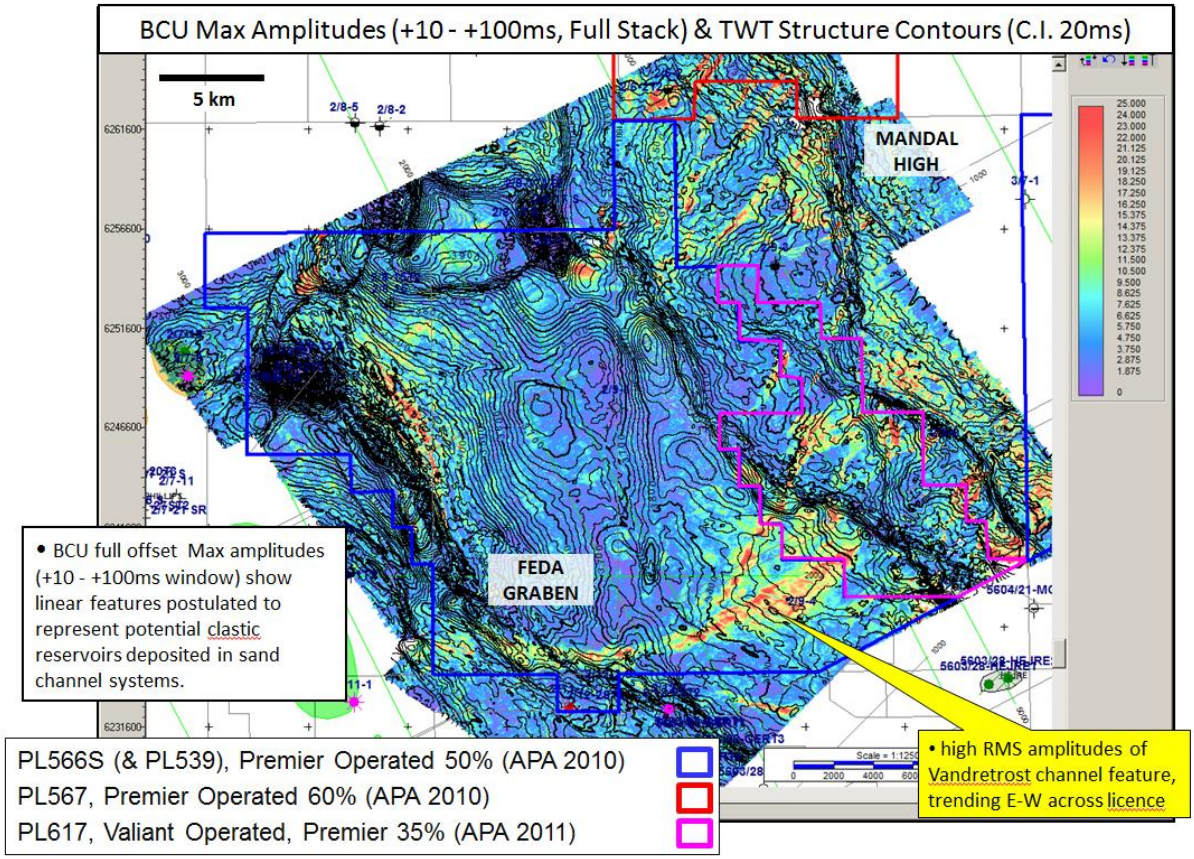

Figure 5. An amplitude extraction near BCU highlights the Vandretrost channel-like feature. The brightest parts of the channel are not only confined to a small area but, for the most part, lie down-dip, in the deepest part of the feature

The mapping carried out indicates that the Svartglente prospect is, structurally, quite complex. At J64 levels, it consists of a large 3-way dip element sealed against small offset faults in the south, a large offset fault in the mid-section, sub-crop at BCU in the north, and an additional large offset fault element in the northern-most portion. At Base Upper Jurassic ('BUJ'), the structure relies on stratigraphic pinch-out to the north and fault seal along its western edge.

Glente is interpreted as a 4-way dip-closed structure with fault elements controlling the structure for the high case models at all levels within the Jurassic section.

Further technical evaluations of the two main leads (Svartglente and Glente) suggested that Svartglente was potentially the larger lead and carried the least risk. At BUJ levels offset wells indicate that Ula/Heno sands can be expected. Although these sands have good reservoir properties, it is very difficult to imagine an effective seal around the 2/8-12S salt structure. As a consequence, the area of closure and subsequent volumes are small at the BUJ level. The J63/J64 trapping mechanism for Svartglente is complex as it relies on a two-

way fault closure to the west and south, dip-closure to the east and a stratigraphic closure to the north where the Upper Jurassic sub-crops at the BCU. This complexity adds to the risk of retaining hydrocarbons within the structure.

Although the maximum vertical closure at Svartglente is large (ca. 450m), regional experience suggests that a column height of this order of magnitude is unlikely. The high pressure nature of the area further complicates the story as our pressure modelling suggests that Svartglente has a high risk of seal breaching.

Upper Jurassic sandstones are recognised in wells in the region and are generally interpreted as being turbidite deposits. However, they are thin (maximum a few meters), intermittent and dispersed over many hundreds of meters of shales. Well 2/8-12S which was drilled within the closure area of the Svartglente upside case (>P50) penetrated one thin (1 m) water-wet Upper Jurassic sand thus illustrating the scarce UJ sand deposition in the area. The prospect is very conceptual in that it relies on far better reservoir development than the offset wells have found, i.e. existing wells have not sampled all depositional facies types and local sandy depocentres could be present.

Three potentially stacked, relatively thick (50m), reservoir intervals are considered in the volumetric assessment. Depth to top reservoir for the shallowest target is 3600m whereas the deepest target is at about 4200m. As suggested from offset wells, the Upper J63 and J64 reservoirs are assumed to have better reservoir properties that the Lower J63 turbidites. The Lower J63 reservoir therefore has a higher reservoir effectiveness risk than the shallower reservoirs.

The Gjertrude Graben is proven to contain significant thicknesses of Kimmeridgian source rocks that are locally mature for oil generation. Source presence and maturity is thus not considered as a risk but some uncertainty is attributed to carrier bed presence and migration routes into the prospect.

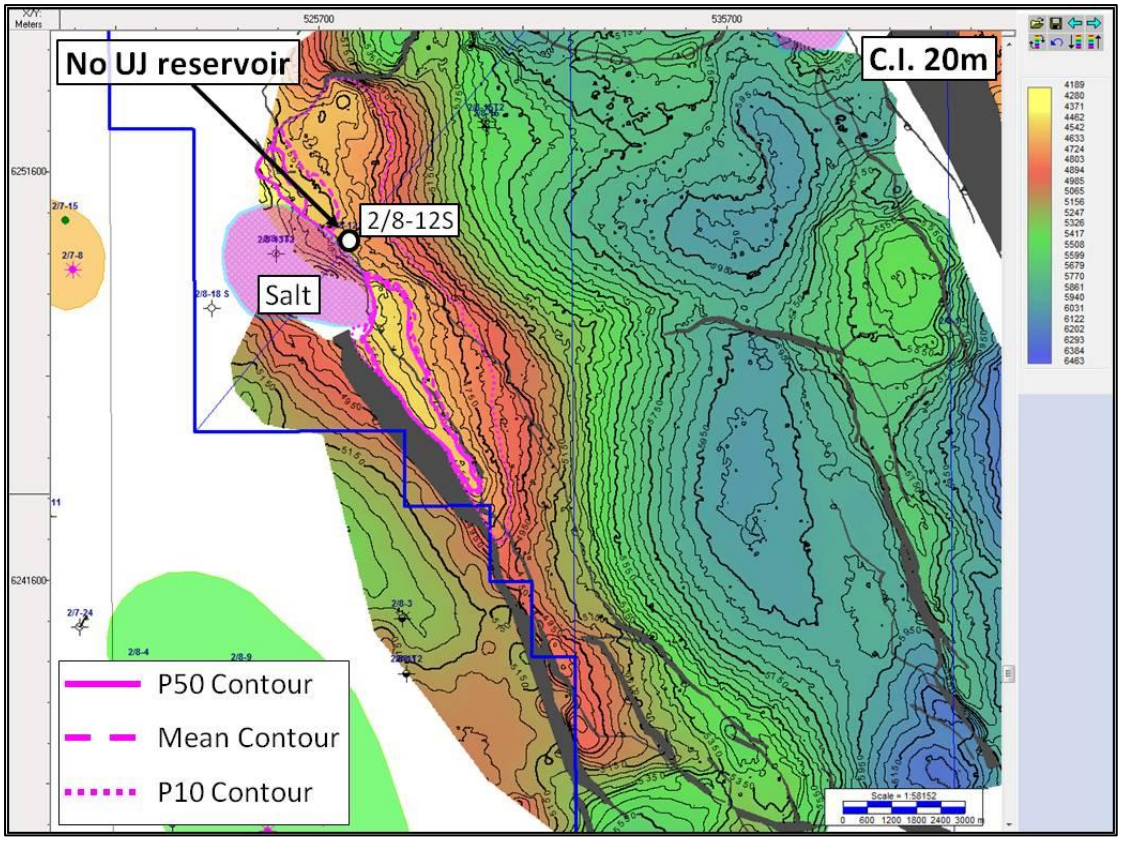

Figure 6. Depth structure showing the Svartglente prospect at the interpreted lower J63 level. No Upper Jurassic sands were present in the 2/8-12S well.

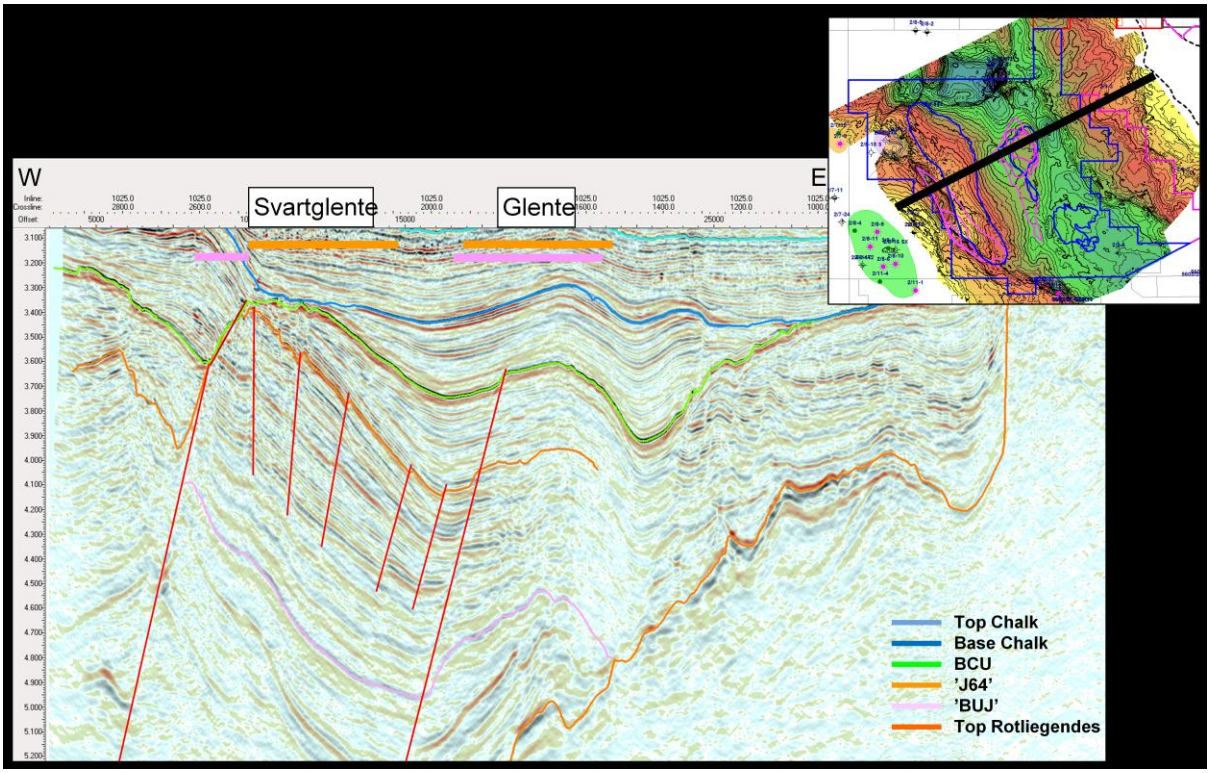

Figure 7. A seismic inline across the Svartglente and Glente prospects showing the main horizons. Orange extent is Upper Jurassic, pink extent is BUJ.

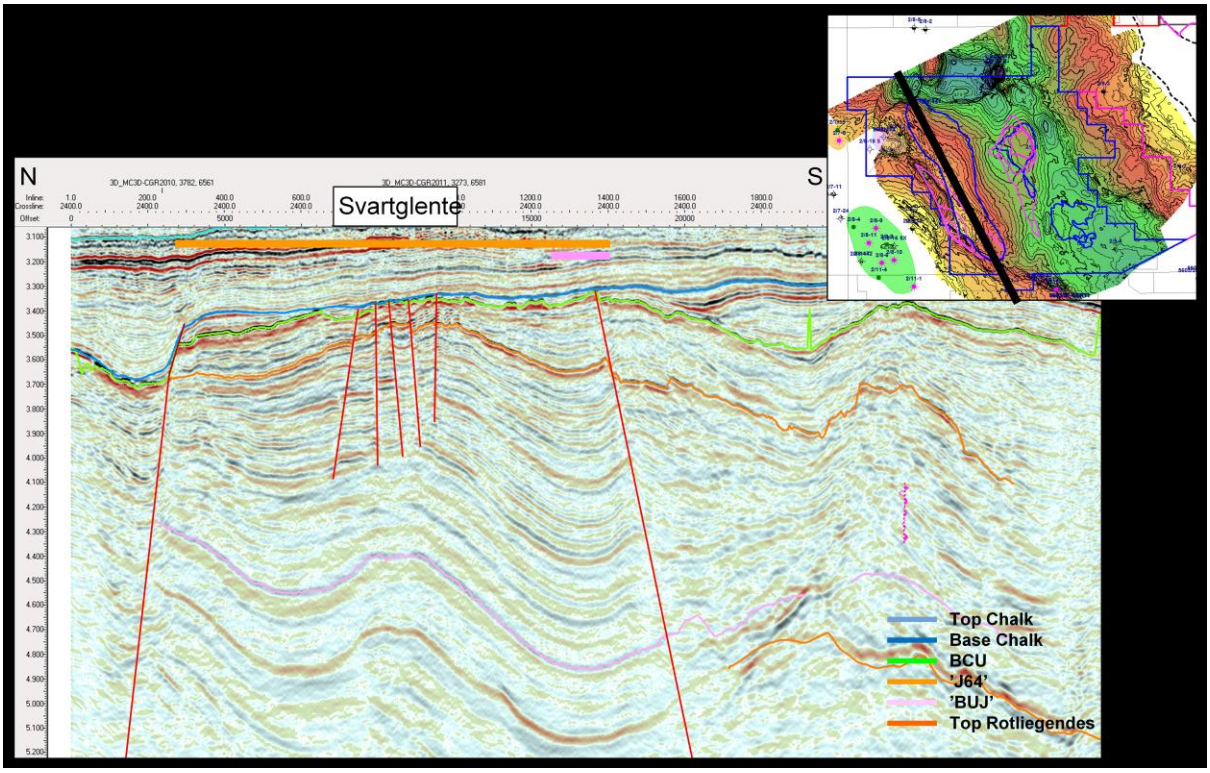

Figure 8. A seismic inline across the Svartglente and Glente prospects showing the main horizons. Orange extent is Upper Jurassic, pink extent is BUJ.

The key points with regard to the identified prospectivity are:

- Structural 3-way dip closures with two segments in the P50 case
- Fault seal and pinch-out onto salt required
- Source rock is locally mature
- Reservoir presence is high risk
- Reservoir quality uncertain and becomes worse at greater depth
- Estimated Ph 0.12 (J63L) and 0.17 (J63U/J64) with the key risk being reservoir presence
- High pressure environment, 14000 psi pressure expected at top reservoir

Table 1. Risk summary for the potential reservoir intervals of the Svartglente prospect

Svartglente J64 & J63U	Risk Element			%
	Trap	Presence	100	90
		Effectiveness	90	
	Reservoir	Presence	40	24
		Effectiveness	60	
	Charge	Presence	100	80
		Effectiveness	80	
		Ph		17

Svartglente J63L	Risk Element			%
	Trap	Presence	100	90
		Effectiveness	90	
	Reservoir	Presence	40	16
		Effectiveness	40	
	Charge	Presence	100	80
		Effectiveness	80	
		Ph		12

The prospective volumes for the Svartglente prospect are given below (Table 2). The consolidated mean recoverable volume is estimated to be 50 mmboe (8 Sm^3).

Table 2. Gross recoverable resources for the Svartglente prospect at Upper Jurassic levels.

Svartglente Gross Recoverable Resources (mmboe)					
	P90	P50	P10	Mean	Ph
J64	1	11	173	64	17
J63 Upper	0.5	8	118	43	17
J63 Lower	0.1	4	67	25	12
Consolidated	0.4	10	134	50	33

5.0 TECHNICAL EVALUATION

In the economic assessment low (P90) base (P50) – high (P10) case scenarios have been modelled with 1-2-3 reservoir intervals respectively.

The following inputs (ref. Table 1) have been used as the basis for the reservoir engineering and economic evaluation:

P90: J64 P50

P50: J64 P50 + J63U P50

P10: J64 mean + J63U mean + J63L mean

Due to the geometry of the Svartglente structure the target area for the three prospective intervals are not overlying each other, but the two shallowest could be tested by one vertical well. For the evaluation this results in the following assumptions being made:

-given discovery at the two shallower targets a sidetrack would be required to test the deepest interval (J63 Lower).

-given no hydrocarbons in any of the shallowest intervals the well would be TD'd.

Svartglente is a complex trap with different trapping mechanisms for different parts of the distribution of outcomes. However, for simplicity the risk described in this memorandum is related to the P90 fault-bounded 3-way dip closure. Thus, the risk for any larger scenarios would be higher.

The mean volumes are moderate and the results of the economic evaluation indicate that the opportunity is uneconomic in all but the most optimistic cases as shown in Table 3.

Table 3. Recoverable reserves and estimated value potential of the Svartglente prospect at various oil price scenarios.

	EUR		Economic Resource		NPV10			No of wells			
Case	MMboe	MMbbl	MMboe	MMbbl	$65	$85	$105	Prod	Water Inj	Gas Inj	Exp/App
Low	11	8.5	9.98	8.2	-268	-219	-163	2	1	0	2+ST
Base	19	15	18.4	14.6	-291	-189	-113	2	2	0	2+2ST
High	135	103	120	97.5	-182	84	342	6	3	0	3+2ST

6.0 CONCLUSIONS

Detailed seismic mapping over the PL566S license area along with other studies has furthered our understanding of the region. Geologically, there is a high reservoir presence risk within the Upper Jurassic section. The interpreted turbidites are typically thin, intermittent, and encased in hundreds of meters (even kilometres) of shale. The 2/8-12S well was drilled within Svartglente closure on the flank of a salt dome. The lack of well developed sands at this location increases the reservoir presence risk.

Because of the high-pressure nature of the Jurassic section and the target depths, the main prospects and leads in this license would be difficult and expensive to drill which has a negative impact on the economic assessment.

The largest identified prospect, Svartglente, is modelled to be uneconomic for all scenarios except high case outcomes (P10) in a high oil price environment. As a result, it was agreed by the partnership to make a drop decision on PL566S.

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.