Relinquishment Report of License PL 478 in Blocks 6507/7 and 6507/10

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1 Key License History

Summary

PL 478 was awarded on 29th February 2008 through APA 2007 to the License Group:

- Centrica Resources (Norge) AS: 40% (Operator)
- Faroe Petroleum Norge AS: 30%
- Petro-Canada Norge AS: 30%

The work commitments for the license and work periods were:

Within 3 years from award (by 28th February 2011)

- Acquisition of 3D seismic covering prospective area
- G&G studies
- Decision to Drill or relinquish the license

The Group applied for a 6 month extension of the initial period in order to complete the evaluation of the license. The extension period was required as the results of several studies, additional to the work commitment, were not available for analysis before the original drill or drop date. This included the PSTM seismic reprocessing which was important for enhancing the seismic quality of the Jurassic and Cretaceous sections. The extension was granted by the Ministry of Petroleum and Energy (MPE) allowing 6 months to complete the evaluation of the license and make the decision on continuation before 29th August 2011.

Overview of Meetings

All meetings held in the license are summed up in Table 1.1

Table 1.1 Summary of License Meetings.

Date	Meeting	Comments
9th May 2008	Kick-off/ECMC Meeting	The official establishment of license and EC/MC groups, proposed work programme and budget for 2008.
30th June 2008	Work Meeting	Seismic aquisition program meeting.
27th November 2009	EC/MC Meeting	Update on interpretation status and seismic merge project. Proposed work programme and budget for 2010.
14th January 2010	Work Meeting	Seismic merge project meeting, outcome of tender evaluation.
5th May 2010	Work Meeting	Updates on G&G work from Centrica and Faroe Petroleum, presentation of results from 2D structural restoration special study.
2nd December 2010	EC/MC Meeting	Updates on G&G work, interpretation,and special studies. Update from Faroe Petroleum on intial seismic reprocessing results and from Geolink. Proposed work programme and budget for 2011.
6th April 2011	Work Meeting	Presentation of results of porosity study .
17th June 2011	EC Meeting	Review of PL 478. Presentation of updated interpretation and prospect evaluation. Decision to drill or drop the license made.

Reason for Relinquishment

The Group decided to relinquish PL 478 on 29th August 2011. The work commitments were met, and supplementary studies carried out, yet the seismic imaging of the structure was not of sufficient quality to derisk the prospect to a level at which a drill decision could be made by the Group.

2 Database

Seismic Database

The PL 478 License is covered with 3D seismic of differing vintages, the database utilized is shown in Fig. 2.1 and summarized in Table 2.1. The CE0801M2 survey was aquired as part of the work commitment for the PL 478 License. The Group also reprocessed the CN-6507-94 and the CE0801 surveys to better image the Jurassic and Cretaceous sections of the Manilow Prospect. The result of this reprocessing was an improvement in seismic quality. However the imaging quality needs to be improved further for understanding the structural complexity and reservoir dip imaging and positioning.

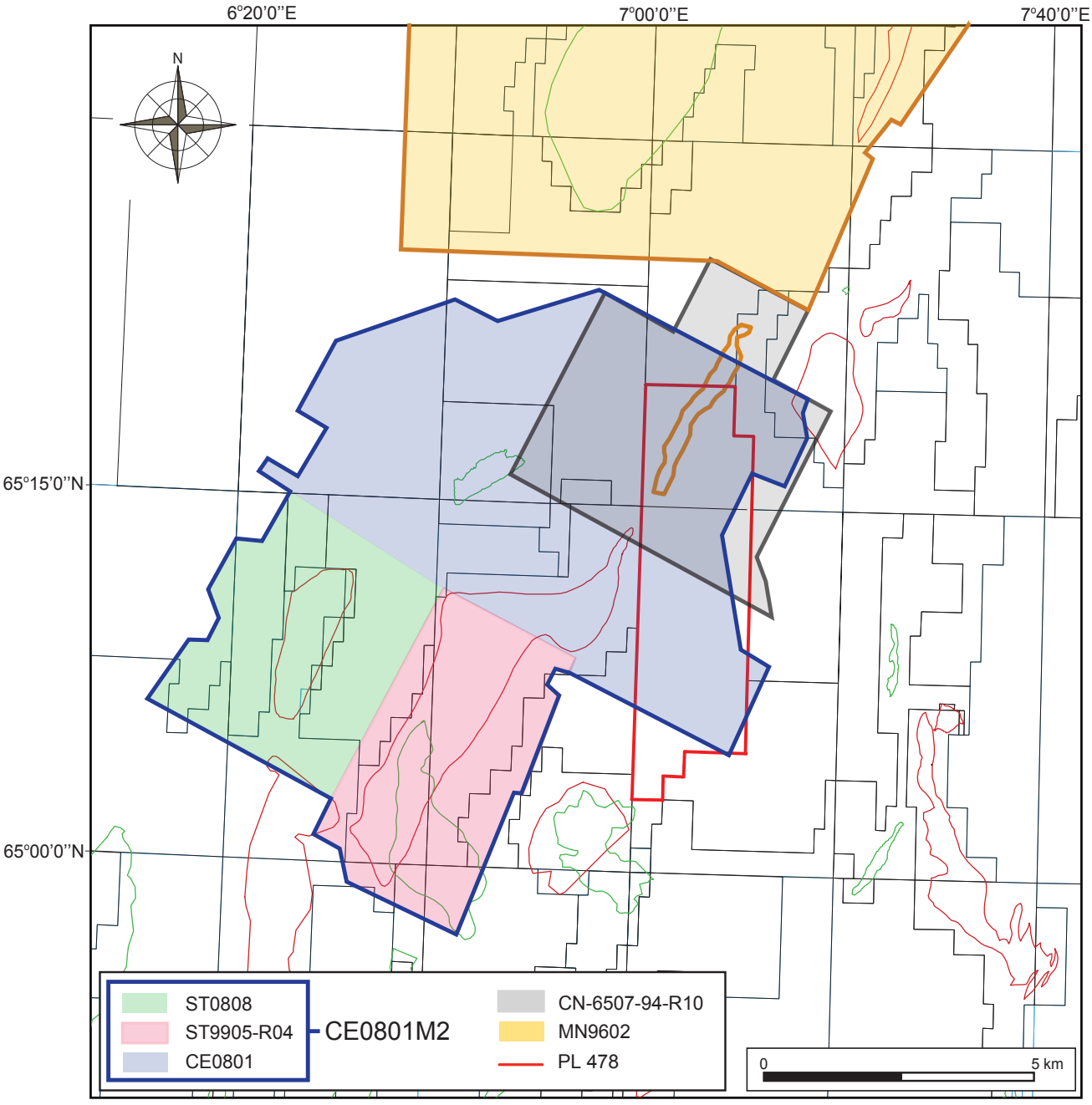

Fig. 2.1 Seismic Database.

Table 2.1 Seismic Database.

Survey	Type	Released	Km^2	Version	Year	Quality
CN0801M2	3D	No	1322	Full, Near, Mid Ultrafar angle	2008	Moderate
CN-6507-94-R10	3D	No	410	Full, Near and Far stacks, repro 2010	2010	Moderate
MN9602	3D	Yes	1800	Full	1996	Poor

Interpretation was carried out on surveys CE0801M2 and CN-6507-94-R10. In addition, MN9602 has been used to tie in from the north through the Zidane wells (6507/7-1 and 7-14 S) into the Manilow Prospect. This more reliable interpretation has improved the correlation confidence in the area.

Well Database

All released wells in the area were used to assess the prospectivity of the License, with focus on the exploration and appraisal wells of the Smørbukk and Heidrun Fields, in particular wells 6506/12-7, 6506/12-1, 6506/12-4 and 6507/7-4. Well 6507/7-11 S was also important to the evaluation, as the dry well result needed to be explained. The remaining released wells were used for regional understanding. In addition, the group traded for the full data-set of wells 6506/12-12 S and 6507/7-14 S and own the data for well 6506/9-2 S (Fogelberg Discovery well 2010).

Most of the wells in the database were used in a petrophysical study (Geolink, 2011), which was conducted to gain a better understanding of the net-to-gross and porosity versus depth distributions in the area.

3 Review of Geological Framework

PL 478 is located on the Halten Terrace, to the west of the southern extension of the Nordland Ridge, north east of the Smørbukk Field. Two prospects (Manilow and Whitesnake Rogn) and one lead (Whitesnake Intra-Melke) were identified in the application for the acreage (see Fig. 3.1). The Manilow Prospect was initially interpreted as a footwall fold on the downthrown side of a steeply dipping, large offset normal fault. Reservoir presence and retention were calculated to be the main risks, the overall probability of success was calculated at 22%.

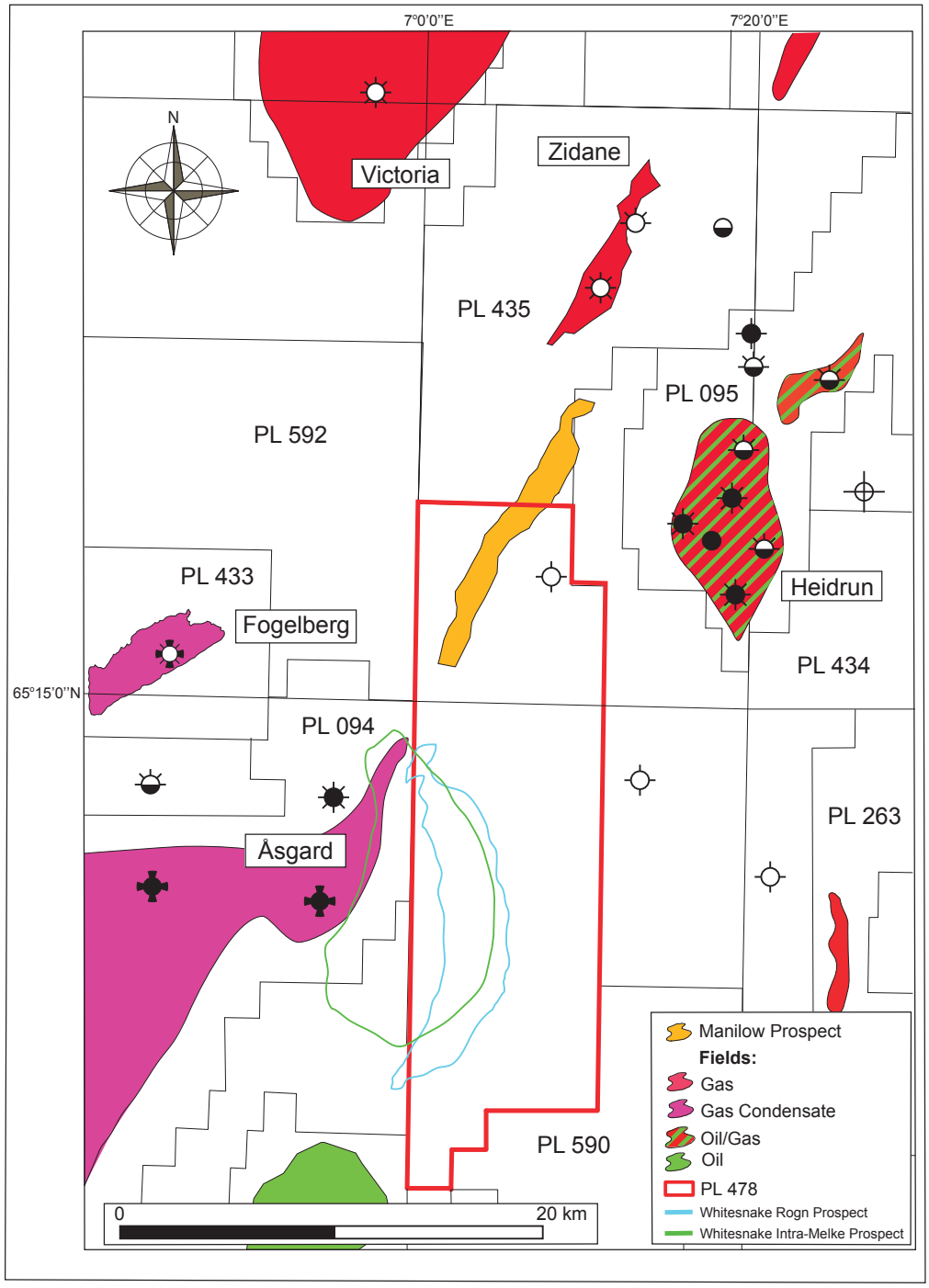

Fig. 3.1 Map of License and Identified Prospects and Leads.

After being awarded the acreage, the Group conducted a series of studies and aquired new data in order to evaluate the prospectivity in PL 478. A summary is given below:

2D Structural Restoration

A 2D structural restoration of 3 seismic inlines was conducted by Steve Knott (Atlantic, 2010) to gain better understanding of the structural development in the area, and to improve the confidence in the structural interpretation. A vertical shear modelling approach was taken, which did not include flexure, dcompaction or eustacy. This approach is basic, but is considered to be fit for purpose in testing geometries and revealling the structural history of the area. The results positively influenced the structural interpretation of the Manilow Prospect.

The result provided a structural interpretation which fits the complex structural history of the area. The structure is now interpreted as an overturned horst block with a steep bounding fault. Rollover was created by the large salt-detached listric fault situated above the basement fault block. It is this rollover that creates the opaque zone of very steep dips in the present day seismic profile. The location of the salt swell is controlled by a major permo triassic fault, and the horst location is controlled by the underlying salt swell. Passive rotation of the Manilow structure was produced by extension along the Fles Fault Complex to the north west.

Petrophysical Study

A petrophysical study of 31 wells in the western Halten Terrace area was carried out by Geolink (Geolink, 2011). A stratigraphic framework has been developed based on available biostratigraphy, detailed well correlations and extensive seismic sub-regional mapping. For each stratigraphic interval gross thickness, net sand thickness, net to gross, porosity versus depth relationships, areal porosity distributions and average water saturation across the net reservoir zones have been compiled and analyzed. These results were used in the evaluation of the Manilow Prospect.

PSTM (Auto-Imager) Seismic Reprocessing

The 3D seismic survey CE0801 was acquired as part of the original work programme for PL 478, but did not cover the northern extension of the Manilow prospect. This part of the prospect is covered by the vintage 3D seismic CN-6507-94 , unfortunately the full cube is suffering from remnant multiples and general noise. As a result, a seismic reprocessing including CE0801 and CN-6507-94 was initiated in an attempt to produce one single continuous data-set covering the entire Manilow Prospect. The data was processed from field tapes and merged in the premigration stage, in order to obtain a seamless transition in the merge zone between the two input 3D seismic cubes. The reprocessed dataset (CN-6507-94-R10) was gridded into the same geometry as CE0801 for simple comparison in the interpretation stage. The final cube met the objective of creating a continuous 3D seismic dataset covering the entire Manilow Prospect, but the anticipated seismic uplift is still not sufficient in terms of confident mapping within this fault complex.

Some of the remaining issues with the CN-6507-94-R10 are summarized below:

- Apparently lower bandwidth than CE0801M2 in areas of direct overlap giving rise to less confidence in the seismic event. This is possibly caused by the limited bandwidth in CN-6507-94 due to it being an older seismic data-set
- Remnant multiple energy remains within the data-set coinciding with the level expected for Triassic salt under the Manilow Prospect. This is a key marker for fully understanding the structural model in the prospect area and needs additional work or new data in order for an adequate assessment
- A general limited quality in terms of seismic continuity around the 6507/7-11 S well, which is crucial for a seismic tie of the Fangst group updip of the Manilow prospect

All listed elements have scope for improvement either through additional reprocessing or acquisition of new 3D seismic data and will have a direct impact on the risk asessement of the Manilow Prospect.

Conclusions from Interpretations and Special Studies

- The mapping of 3D seismic data after the award of PL 478 was focussed on the Middle and Lower Jurassic targets of the Fangst and Båt Groups. The overburden and Triassic sections were also interpreted as these areas are important for understanding the structural development and were input data into the 2D structural restoration
- The results of the new mapping and interpretation were combined with the new data and special studies for prospect evaluation. In the APA 2007 application, reservoir presence and retention were calculated to be the main risks, however the results of the latest evaluation placed retention and trap (seal) as the highest risk

Retention (Seal)

The regional pressure cell data was analysed and collated into a pressure cell map. A pressure cell boundary exists somewhere between the 6507/7-11 S/Heidrun cell in the east and the Fogelberg high pressure cell to the west. The Revfallet Fault is thought to be the main pressure barrier in the area between near normally pressured and overpressured reservoirs. It is most likely that the pressure boundary is located at the upper fault and not the lower fault of the Manilow Prospect, however this still represents the biggest risk of the prospect.

Trap

The imaging of the upper fault is more or less defined by the transparent zone seen in the 6507/7-11 S hanging wall. The geometry of the reservoir is well defined and the sands terminate at the upper fault where the imaging is of low quality. This lack of good imaging represents an uncertainty which could be reduced with further work.

4 Prospect Update

Two prospects and one lead were defined in the APA 2007 application, with the majority of the evaluation focussed on the Jurassic Manilow Prospect. The poor quality imaging in shallower formations has hindered a thorough evaluation of the Whitesnake Prospect and Lead. The Whitesnake Intra-Melke Lead was considered to be of high risk in the APA 2007 application and the traded 6506/12-12 S well found no sands within in the Melke Fm. Although there is a chance of sands being present to the east, it is unlikley they would be of reservoir quality.

The Whitesnake Rogn Prospect is located in the Upper Jurassic Spekk Fm above the Manilow Prospect. A wedge represents a well defined stratigraphic pinchout with sands possibly eroded off the 6507/7-11 S hanging wall and redeposited in the lows. However, the reservoir interval is untested in this area and the potential of the prospect has not been quantified. Further work would need to be undertaken for full understanding.

The Cretaceous sands of the Lysing and Lange Fms were not assessed for PL 478 in the application, but they are seen to onlap and thin going from the west towards the east over the Manilow Prospect. However these sands are difficult to map in detail even with the reprocessed PSTM data quality, and no AVO (DHI) anomalies can currently be seen.

Manilow Prospect

The 2D structural restoration and updated interpretation has had a significant impact on the evaluation of the Manilow Prospect. The structure is now interpreted as an overturned horst block with a steep bounding fault (Fig. 4.1). Rollover was created by the large salt-detached listric fault situated above the basement fault block. It is this rollover, located directly above the Manilow Prospect, that creates the opaque zone of very steep dips. The poor seismic imaging of this area, which is integral to the understanding of the prospect, has created high risk for the seal and trap of the Manilow Prospect. Futher work to improve seismic quality would have to be undertaken to mitigate this risk, and to take the prospect forward for a drill decision.

The evaluation of the Manilow Prospect has, however, made a positive effect in several areas. The crest of the structure was initially mapped as 4170mTVDss and the spill point at 4610mTVDss. These are now 4000mTVDss and 4700mTVDss respectively (see maps in Fig. 4.2), improving the prospect size and, with a shallower crest, improving potential reservoir quality. The pressure and breach model analysis of the APA 2007 application has been validated and expanded with data from the Fogelberg and Zidane discoveries. Pressure and fluid data from these discoveries combined with the pressure cell analysis have changed the predicted hydrocarbon type from oil to gas. Additionally, with new information from these wells, the probablility of reservoir presence has been increased. Although the expected porosities remain similar, with an upside taken from values found in the 6507/7-14 S well.

Prospect Evaluation Volumetrics and Risking

Further evaluation of the Manilow Prospect has resulted in a significant reduction in resource estimates from the inital APA 2007 evaluation. The largest factor in this change is due to the remapping of the structure, this has altered the fault geometries, and the reservoir is now located in steeply dipping beds (approx 22 degrees). The differences in the resource estimates and input parameters are summarised in Table 4.1.

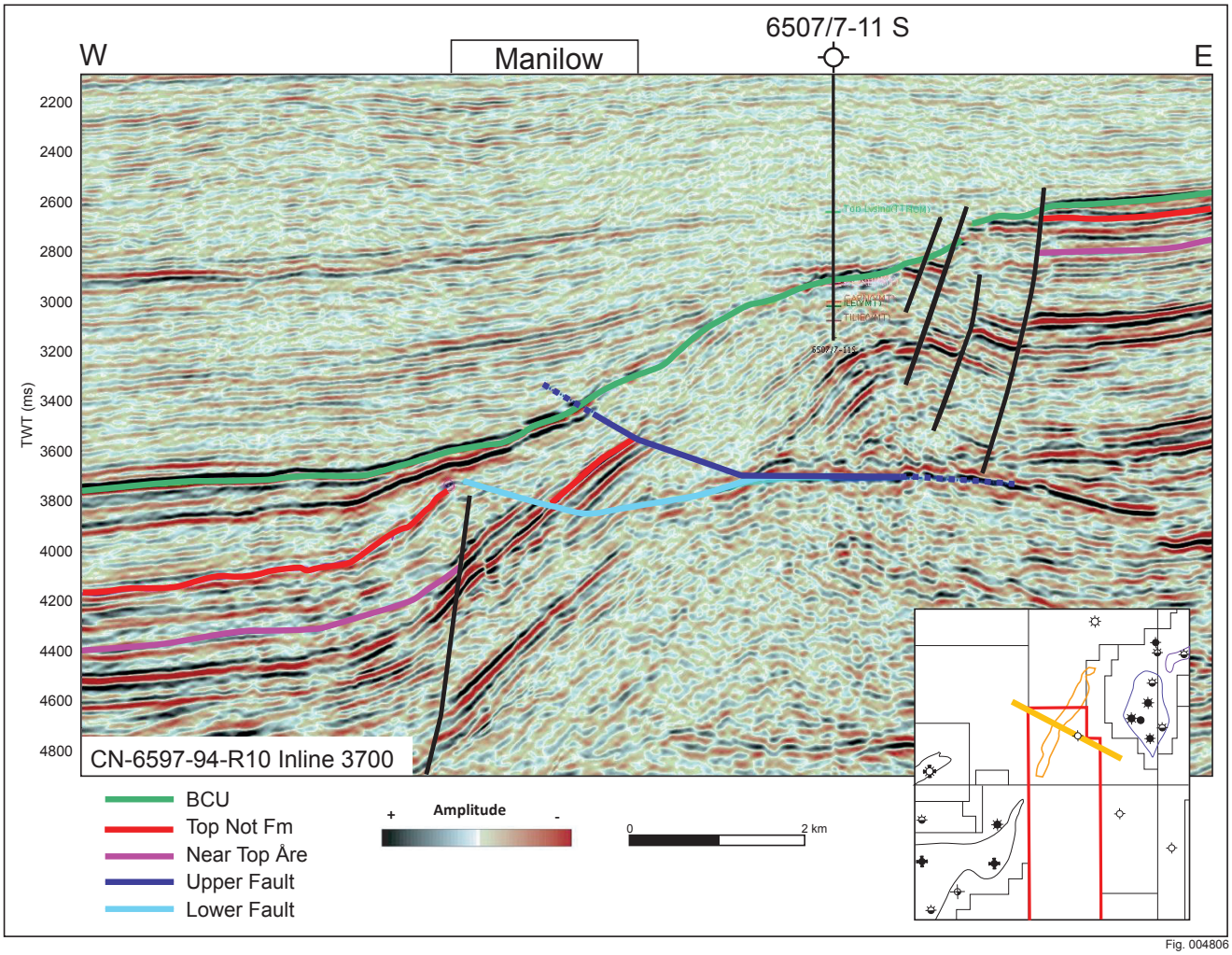

Fig. 4.1 Seismic line over the Manilow Prospect.

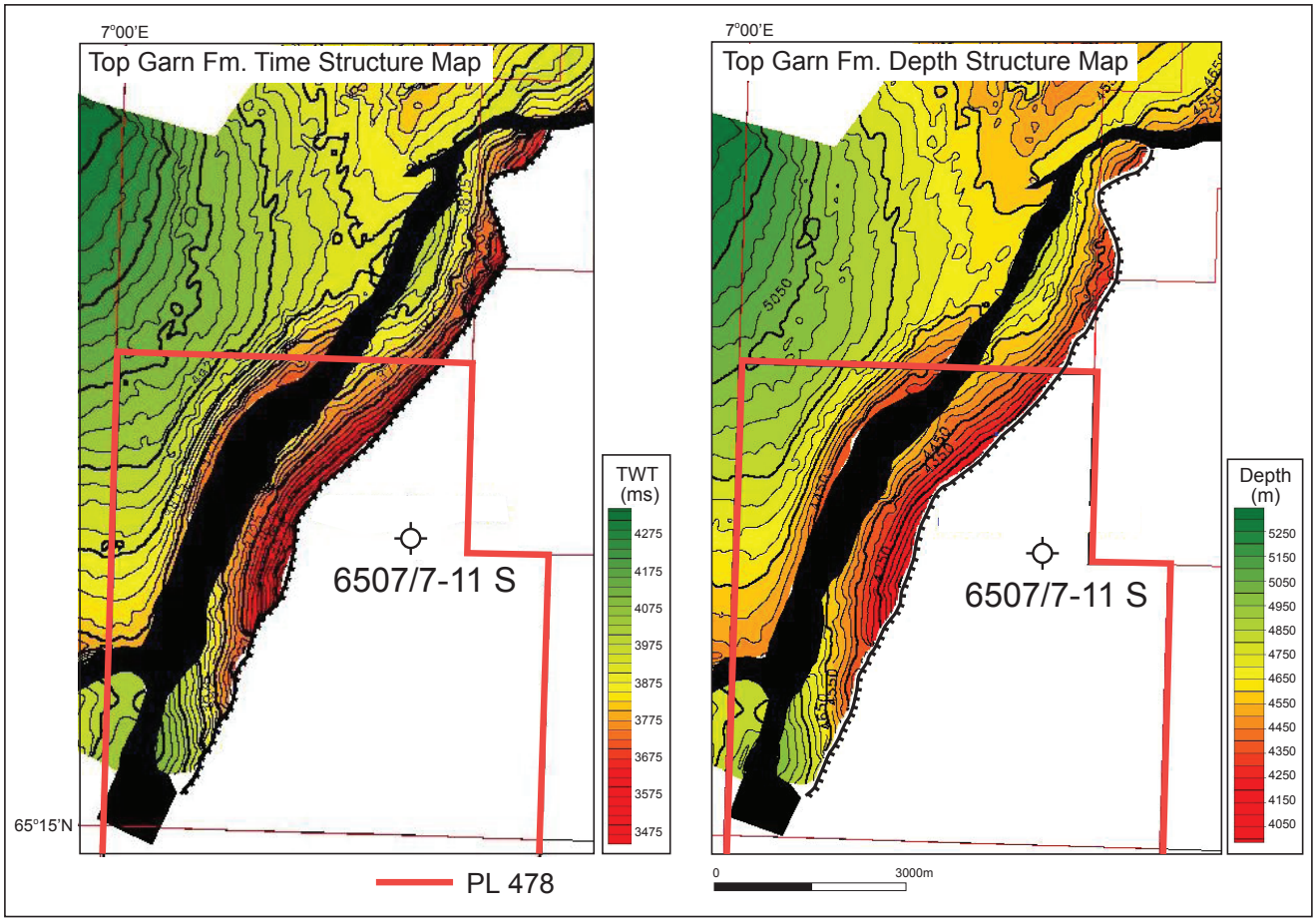

Fig. 4.2 Top Garn Time and Depth Structure Maps. *Only footwall interpretation due to lack of good seismic imaging in 6507/7-11 S hangingwall.*

Table 4.1 NPD Table 1 - Prospect Data. Comparison of resource estimates and input parameters to the volumetrics from the APA 2007 evaluation (in black) versus the prospect evaluation in 2011 (in red).

Block	Prospect name	Discovery/Prosp/Lead	Prosp ID (or New!)	NPD approved?
6507/7	Manilow	Prospect	*NPD will insert data*	*NPD will insert data*
Play (name / new)	Structural element	Company/ reported by / Ref. doc.		Year
NPD will insert data	Halten Terrace	Centrica Energi Norge, Faroe Petroleum Norge		2007/ 2011

Oil/Gas case	**Resources IN PLACE**					
Oil/ Gas	Main phase			Ass. phase		
	Low	Base	High	Low	Base	High
Oil 10^6 Sm^3	21,6	36,4	53,4			
Gas 10^9 Sm^3	3,4	11,0	40,8			
	Resources RECOVERABLE					
	Main phase			Ass. phase		
	Low	Base	High	Low	Base	High
Oil 10^6 Sm^3	6,1	10,9	16,6	0,3	0,9	3,2
Gas 10^9 Sm^3	2,3	7,2	26,5	3,1	5,8	9,1
	Which fractiles are used as:		Low:	90	High:	10

Type of trap	Water depth (m)	Reservoir Chrono (from - to)	Reservoir Litho (from - to)
Downfaulted Block	260	Middle Jurassic	Garn Fms (Ile, Tofte and Tilje Fms)
Source Rock, Chrono	Source Rock, Litho	Seal, Chrono	Seal, Litho
Oxfordian to Tithonian	Spekk Formation	Callovian to Oxfordian	Melke Fm

Seismic database (2D/3D):	3D

Probability of discovery:					
Technical (oil+gas case)	0,22/ 0,25		Prob for oil/gas case		80/20 0/100
Probability (fraction):	Reservoir (P1)	Trap (P2)	Charge (P3)	Retention (P4)	
	0,6/ 0,9	0,7/ 0,7	0,9/ 1	0,6/ 0,4	

Parameters:	Low	Base	High	Comments
Depth to top of prospect (m)	4000	4100/ 4000	4000	Main contributing reservoir assumed in the calculations is the Garn Formation. However, the group has included Ile, Tofte and Tilje in the upside potential (High/P10). This has been done in order to bridge two types of assessment methodologies. The thickness (base case model) and Net-to-gross represents therfore the entire section. Note also that CO^2 has been subtracted from the rec. volumes. P50 value used is 4.2% as seen in Fogelberg.
Area of closure (km^2)	3	8.0/ 9.0	14	
Reservoir thickness (m)	30/ 50	40/ 62.5	50/220 75/175	
HC column in prospect (m)	300	350/ 500	700	
Gross rock vol. (10^9 m^3)	822/ 0.154	1406/ 0.502	2086/ 1.855	
Net / Gross (fraction)	0.75/ 0.65	0.85/ 0.75	0.95/0.65 0.85/0.65	
Porosity (fraction)	0.11/ 0.09	0.13	0.15/ 0.17	
Water Saturation (fraction)	0.25/ 0.2	0.3	0.35/ 0.4	
Bg. (<1)	0.00286	0.002989	0.003125	
Bo. (>1)	0.5	0.455	0.417	
GOR, free gas (Sm^3 /Sm^3)	7200	8260	9400	
GOR, oil (Sm^3 /Sm^3)	358	529	700	
Recovery factor, main phase	0.2/ 0.55	0.3/ 0.65	0.4/ 0.75	
Recovery factor, ass. phase	55	65	75	
Temperature, top res (deg C) :	150	Pressure, top res (bar) :		725/ 650

5 Technical Evaluations

An evaluation was carried out on the possible development of the Manilow Prospect. With the current P50 case, and being located only 12 km west of the Heidrun platforms, a sub-sea tie-back would be expected. A 3 well development (2 producers and 1 water injector) is assumed, all located at the same sub-sea template and then tied back to the Heidrun platform. Capacity at Heidrun would be subject to commercial negotiations but it is seen as technically feasible; an upside would be to develop the field fast track. However, access to gas processing/transport capacity (ÅTS) is an identified issue in this area.

6 Conclusions

The prospectivity within the PL 478 License remains promising, and the work conducted so far has made vast improvements to the understanding of the area. The Manilow Prospect has most potential of PL 478, and was evaluated to a high level, but the uncertainties in trap definition and geometries are unresolved, therefore further work needs to be carried out to mitigate these risk elements.

The Whitesnake Intra-Melke Lead has been discounted as it is unlikely that sands are present in this area. However the Whitesnake Rogn Prospect shows potential, and the Cretaceous sands of the Lange and Lysing Fms. Further evaluation of the potential in all stratigraphic levels should be conducted, and should include a seismic study to improve the seismic imaging of the Manilow Prospect, and to quantify the potential in the Cretaceous sands and Spekk Fm.

The Group has fulfilled the work commitments of the license, but the complex nature of the Manilow Prospect and the poor seismic imaging has meant that the Group is unwilling to drill a prospect which does not have clear trap definition. As a result the License Group has decided to relinquish the license entirely.