Relinquishment Report PL 750 & 750B

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1 Key license history

Production License 750 was awarded to Tullow Oil Norge AS (60% and operator), and Repsol Exploration Norge AS (40%) after the APA 2013, and became effective on the 7th of February, 2014. The license covers part of blocks 6405/4, 7 & 10 (Fig. 1.1).

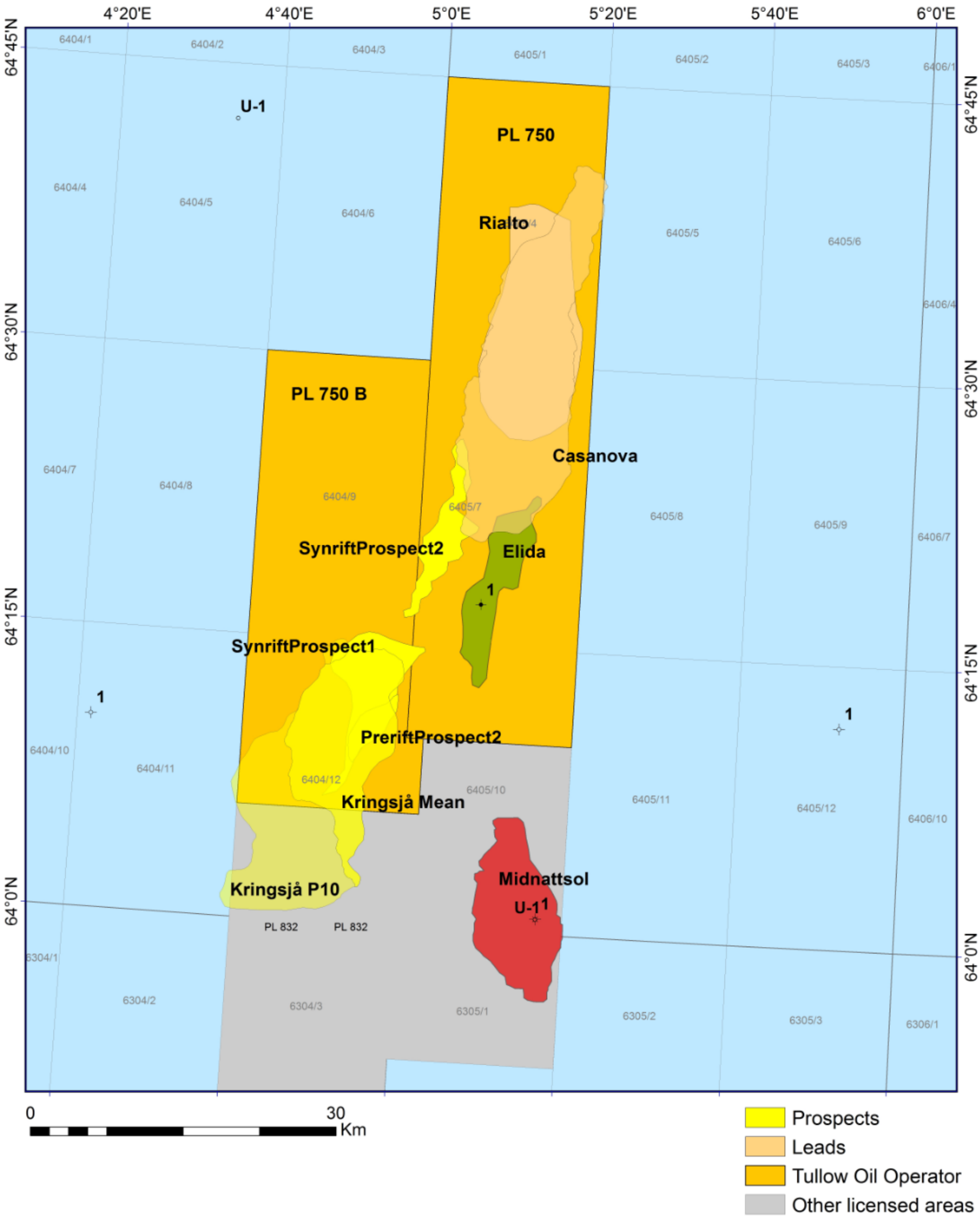

Fig. 1.1 License prospect and leads. *The Cretaceous Kringsjå prospect, Casanova Lead and Rialto Lead. The pre-Cretaceous Synrift prospect 1 & 2 and Prerift 1 Prospect.*

The work commitment of the PL750 license included acquiring 3D Seismic data, processing, to perform relevant geological and geophysical studies and to reach a Drill or Drop (DoD) decision before 7th of February, 2016.
In summer of 2014 the license acquired 2000 km^2 of 3D seismic data (TUN14001) to fully cover the license area and the identified prospectivity.
Due to a delay in the PSDM processing of the TUN14001 survey (received May 2016), a one year extension of the DoD decision was applied for in August 2015. The extension applied for was granted on 15th of October 2015, and the DoD date was extended to 7th of February 2017.

Within the license two Cretaceous and one Jurassic prospect has been defined, and mapping based on the fast track data of TUN14001 received in Q3 2014 confirmed the extension of the Jurassic prospect into the neighbouring blocks 6404/9 & 12.
In APA 2015, the lisence group delivered an application for extension for the two blocks 6404/9 & 12, and the PL750 B was awarded in February 2016 Fig. 1.1. The participating interests, license duration and work program for 750 B was linked to PL750.

Four formal ECMC meetings, and two work-meetings (EC members) have been held in the license. Minutes and presentations from the meetings are published on L2S (Table 1.1).

Table 1.1 Meetings held

Meeting	Date	Overview of meetings
ECMC #1	01.06.2014	Establishment of license, workprogram and budget, review of prospectivity. Planning of seismic aquisition
ECMC #2	10.11.2014	Brief status on prospectivity. Status seismic program - aquisition and processing. 2014 Budget status, 2015 workprogram and budget
ECMC #3	19.11.2015	Status on seismic interpretation. Status on TUN14001 processing. Seismic inversion results. 2015 Budget status, 2016 workprogram and budget.
EC WM #1	24.06.2016	Status on seismic interpretation and regional geological studies. Presentation of semi-regional Cretaceous reservoir properties study. Proposal and work plans for Geochemistry, source rock characterization and petroleum system modelling studies.
EC WM #2	18.10.2016	Presentation of the new understanding of the prospectivity and play models. Proposal for seismic inversion study performed on final PSDM gathers. Presentation of semi-regional geochemsitry study, including oil source correlations.
ECMC #4	21.11.2016	Final prospect definition with resource calculation and risk evaluation. Presentation of Petroleum System Analysis study. Tech/Ec evaluation summary. PL750 way forward recommendation. 2016 Budget status, 2017 workprogram and budget

Based on the new mapping a risk and commercial evaluation of the license was performed, and the licence has concluded that the probability of proving commercial quantities of producible hydrocarbons is too low to justify a decision to drill an exploration well.
A unanimous decision to relinquish the licence was taken by the Management Committee, and the Ministry of Petroleum and Energy was notified by letter dated 07.02.2017

2 Database

2.1 Seismic data

The work commitment for PL750 was to acquire 3D seismic coverage of the licence, and in summer of 2014 the license acquired 2000 km2 of 3D seismic data (TUN14001).

The TUN14001 survey has formed the base for all the G&G activities The license database also includes angle stacks and inversion cubes derived from the TUN14001 survey. In addition the 3D survey HTS99 and 2D survey KFW98 have been used in the technical evaluation of PL750, as it provides regional seismic tie intto the stratigraphy in the PL750 area. All seismic surveys used are shown in Fig. 2.1, and listed in Table 2.1.

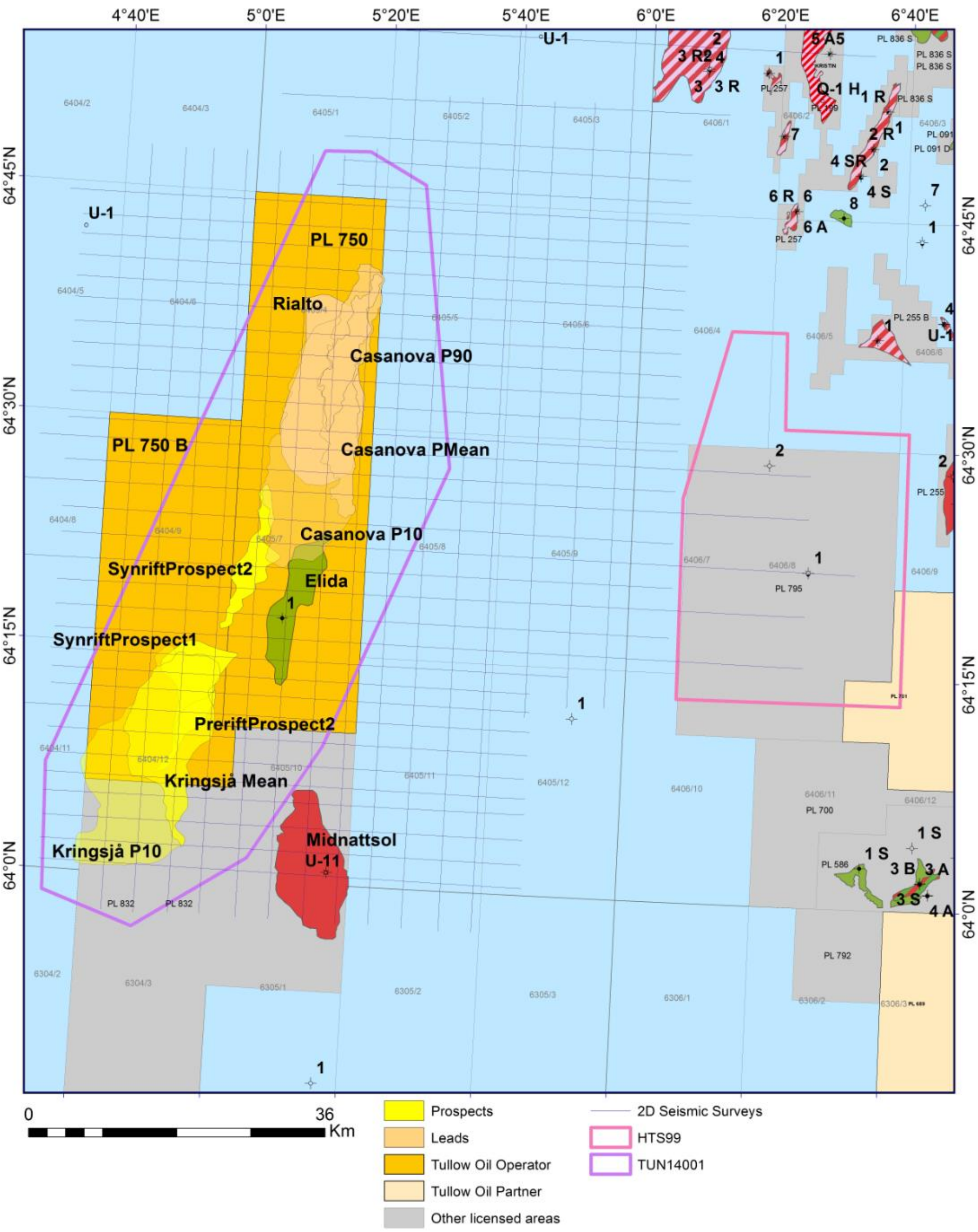

Fig. 2.1 Seismic database PL750

Table 2.1 Seismic database PL750

SURVEY	NPD ID	PROCESSING YEAR	TYPE	PUBLIC	OWNER
HTS99	3984	1999	3D	YES	W.GECO
KFW98	3912	1998	2D	YES	TGS
TUN14001	8095	2016	3D	NO	PL750

2.2 Well data

The wells used to evaluate the prospectivity of the PL750 license is shown Fig. 2.2, and listed in Table 2.2. In addition data from published regional studies has been incorporated as appropriate (e.g. Vergara et al., 2001; Lien, 2005; Fjellanger et al., 2005; Fugelli et al., 2007).

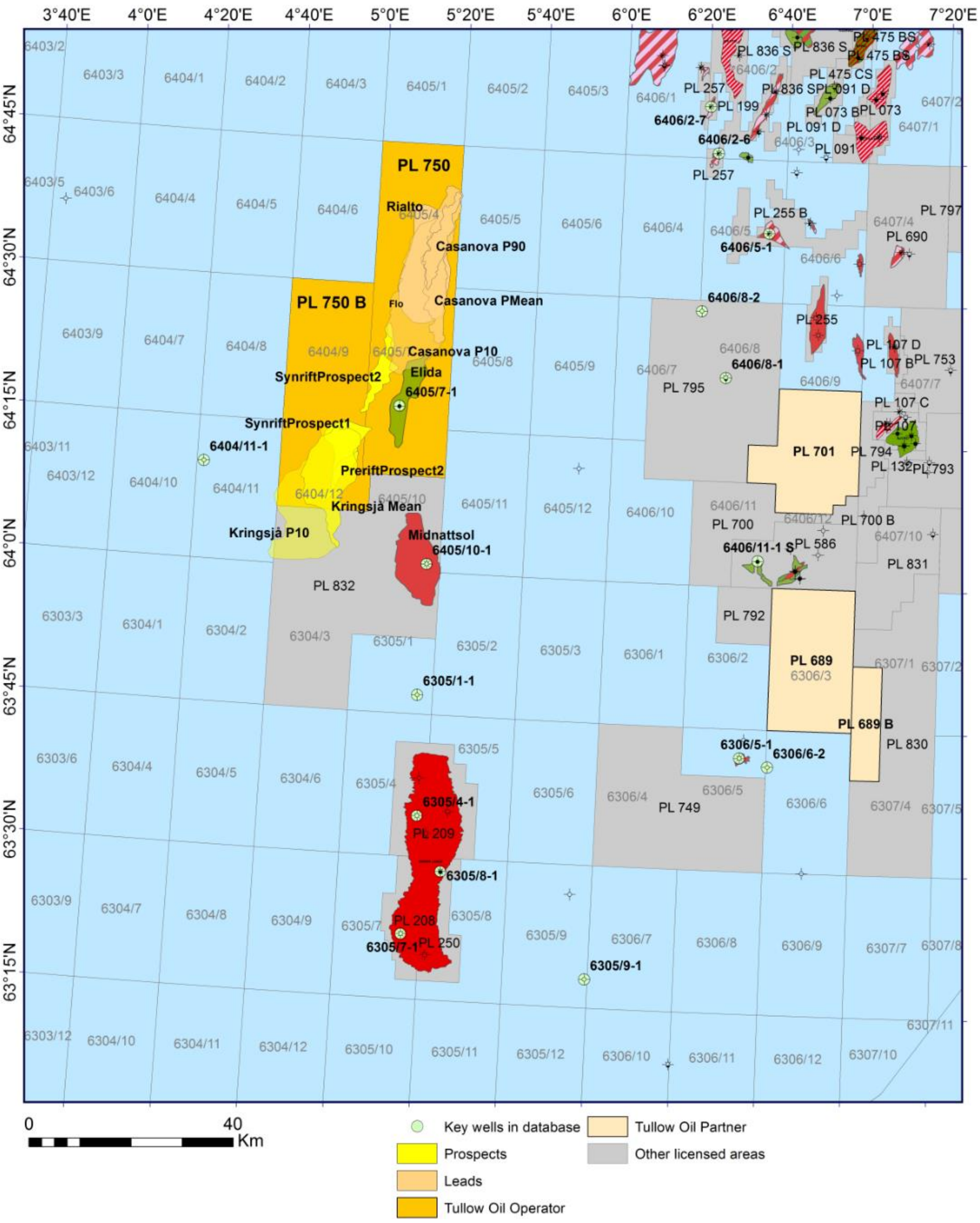

Fig. 2.2 Well database PL750

Table 2.2 Well database PL750

WELL NAME	NPD ID	COMPLETION DATE	TD	LITHOSTRAT
6406/8-1	1136	1988	4910	Åre Fm.
6305/1-1	3555	1998	4560	Lysing Fm.
6405/7-1	4749	2003	4300	Springar Fm.
6405/10-1	5565	2007	3182	Nise Fm.
6406/8-2	5435	2007	4700	Tilje Fm.
6406/11-1 S	1539	1991	4185	Red Beds
6306/5-1	3060	1997	2050	Kvitnos Fm.
6305/7-1	3535	1998	3377	Springar Fm.
6406/2-6	3407	1998	5263	Åre Fm.
6505/10-1	3259	1998	5028	Lange Fm.
6406/2-7	3878	1999	4981	Tilje Fm.
6305/8-1	4109	2000	3175	Nise Fm.
6305/9-1	4297	2001	2655	Springar Fm.
6406/5-1	4451	2002	4692	Tilje Fm.
6404/11-1	4465	2002	3650	Nise Fm.
6305/4-1	4441	2002	2975	Springar Fm.
6306/6-2	6143	2009	2080	Basement
6405/12-1	7551	2015	3330	Nise Fm.

2.3 Special studies

As part of the license work and license prospect definition, the following geological and geophysical studies has been performed
Table 2.3.

Table 2.3 Studies performed for the PL750 prospectivity evaluation

Year	Study	Author
2015	AVO and Litho/Fluid classification (on TUN14001 fast track gathers)	Tullow
2015	Seismic interpretation and prospect maturation (TUN14001 fast track data)	Tullow
2015	Regional Mapping of Cretaceous depositional system	Tullow
2016	Reservoir development in Cretaceous & Jurassic	Tullow
2016	Geochemistry of Ormen Lange, Ellida and Midnattsol	APT
2016	Biomarkers and oil-source rock correlation	Tullow
2016	Petroleum System Analysis (Temprature & Migration)	Tullow

3 Review of Geological and geophysical studies

Review of Geological and Geophysical studies (maximum two pages)
Performed studies, results of block evaluation, any major changes in understanding and expectations based on new data and evaluations, compared to original licence application.
SKAL FJERNES NÅR KAP ER FERDIG

Performed studies

As summarised in Table 2.3, the license has performed several studies to establish an understanding of the prospectivity and geological framework of the license blocks, and perform a proper evaluation for a Drill or Drop decision.
The prospects described in the application for the license is defined within the Cretaceous Nise Fm and potential reservoirs of Jurassic age. The main risks for both the Cretaceous and Jurassic prospects, are the presence of a reservoir with adequate reservoir properties. Also for the Cretaceous, the evidence for a oil producing source rock is an important de-risking factor.
The studies that has been performed has been focussed on these issues.

Cretaceous depositional and Reservoir quality study

A regional mapping project to generate regional thickness maps of the Cretaceous sections and get a better understanding of depocenter, potential sediment fairways and provenance areas. By integration of mapping, published studies, well information and facies map databases (e.g. TGS ACECA Facies Map Browser), integrated playmaps for the main Cretaceous reservoirs placed PL750 in a distal position within the regional Cretaceous depositional framework for the Nise Fm. Based on published regional data, the most likely provenance area for the Cretaceous sands are East Greenland (Vergara et al., 2001; Fjellanger et al., 2005; Morton et al., 2005). However, a model with source from the Norwegian mainland can not be ruled out. The license group did not have access to any heavy mineral analysis from the Cretaceous of the Ellida well (6405/7-1).

A reservoir quality study with main objective to assess the potential for effective Cretaceous reservoirs, based on analysis of well data, core plug measurements and petrographical studies from thin section analysis (ICHRON reservoir quality database), concluded a high risk for presence of reservoir in the Nise Fm. This is mainly due clay and grain size, likely due to the distal position to these submarine fan systems.

The Cretaceous submarine fan systems of the Flo area can be seen on Frequency color blends (Fig. 4.1). However, due to the regional extent of these systems, their provenance is not currently mappable due to limited seismic coverage.

Jurassic depositional and Reservoir quality study

For the Jurassic syn-rift and pre-rift prospects and leads, reservoir presence is likely, and assumed to follow extrapolated trend trends from the Trøndelag platform where this stratigraphy has been penetrated by more than 100 wells. The chance of Jurassic sand presence is expected to be high, however due to deep burial (>3800m below seabed), elevated temperatures and extensive quartz diagenesis has decreased the chance of effective permeable reservoirs. The chance of having effective clay coatings, that could impede authigenic quartz growth as evidenced from the Kristin field (Ehrenberg, 1993; Storvoll et al., 2002) and yield reservoir quality sandstones at elevated depth was evaluated for these prospects and leads. However, analysis of Tullow in-house core plug database containing 23,819 core plugs from reservoir buried deeper than 4000m TVD only about 12% has anomal porosity, i.e. deviating from a 'normal' porosity depth trend line. Furthermore, since the most likely hydrocarbon phase in the syn- and pre-rift reservoirs are gas, and assuming clean quartz sands the diagenesis could be impeded since the water films covering each quartz grain could be very low and halt effective ion transport driving the quartz diagenesis. This fact help modify the reservoir quality risk, but it is still significant and for the pre- and syn-rift plays they have been estimated to 30%, making reservoir a key risk factor for these reservoirs.

Geochemistry and basin modelling

A detailed geochemistry study was performed by Tullow on APT data, prior to running the Petroleum system migration model. The main conclusion from the geochemistry study was that based on the age specific biomarkers the age of the oil samples in the Nise Fm of the Ellida well, is of Cretaceous age (Fig. 3.1), potentially and intermediate/mixed origin with Upper Jurassic. The source for Ellida oil is marine, the maturity of the Ellida oil is estimated to 0.65 %Ro (main oil window), based on MPI-1. Another important point regarding the analysed Ellida oil, is that it seems to water washed, indicating a long migration distance. The Jurassic Spekk Fm is too deeply buried to account for the observed oil maturity and a deeper Cretaceous source above/close to the Grip High will most likely not be able to account for the long migration distance needed to achieve the water washing. Based on these observations it is reasonable to assume that the oil have originated from a Cretaceous source to the West of the Grip High, with a possible gas/condensate contribution from the underlying Spekk Fm to account for the potential mixed age specific biomarkers in the Ellida oil (Fig. 3.1).
The Upper Jurassic Spekk Fm has been mapped from seismic with fair confidence on the eastern side of the Grip High, most of the high became submerged in Lower Cretaceous (Fig. 4.5).

The petroleum system model indicate that given the maturity of the Ellida oil and the documented waterwashed oil, a filling of Ellida oil discovery from the west is most likely. Furthermore, it is worth noting that the Upper Jurassic Spekk Fm has reached advanced maturities across most of the Grip High present day (Fig. 3.2).

AVO analyses and seismic inversion study

In order to de-risk the cretaceous prospectivity in the license, pre-stack data analyses have been performed in-house on both, the initial fast-track PSTM data and the final processed PSDM data. The image gathers received from the contractor have been further conditioned for AVO and seismic inversion work by utilizing additional de-noise, de-multiple and event alignment techniques. From this data, new, improved angle and AVO attribute (e.g. Intercept x Gradient) volumes have been calculated.
The cretaceous prospect screening in the license was based on these optimized volumes and resulted in the detailed mapping of the amplitude anomalies and prospect/lead definitions at the Nise level (see Fig. 4.2).

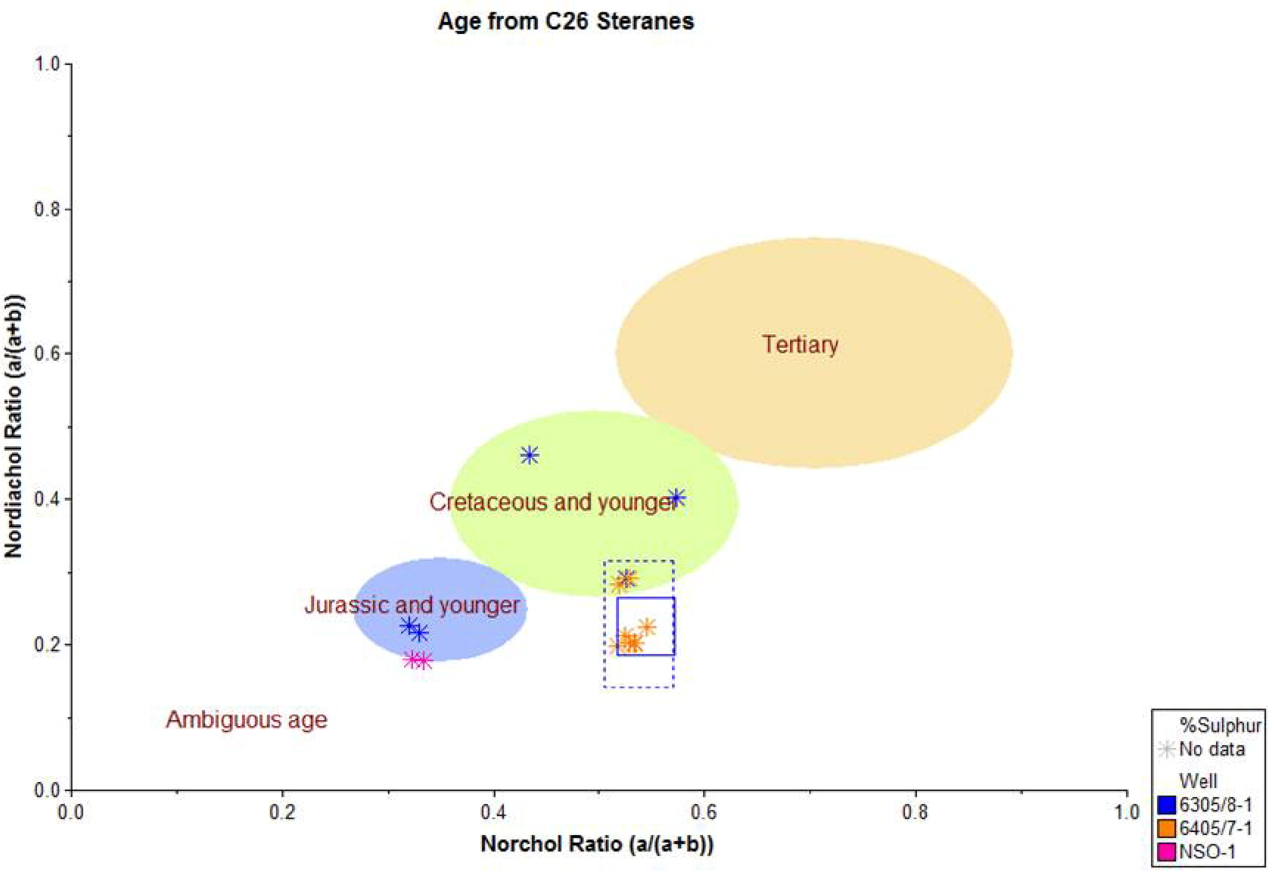

Fig. 3.1 Age specific biomarkers from Ellida (6405/7-1) & Ormen Lange (6305/8-1). *Note that the sampled Ellida (6405/7-1) oil is plotting partly inside and partly outside the expected ratios for a cretaceous source (ratios vs age are as defined by Holba (1998)). There is a chance that these oils could be Jurassic since they have migrated thru Cretaceous, however is is not very likely these picked-up molecules completely masking a Jurassic source. Furthermore, any fractionation effects of possible long range migration is poorly understood. Giving rise to some uncertainty in the size of the proposed age specific 'age ellipses'.*

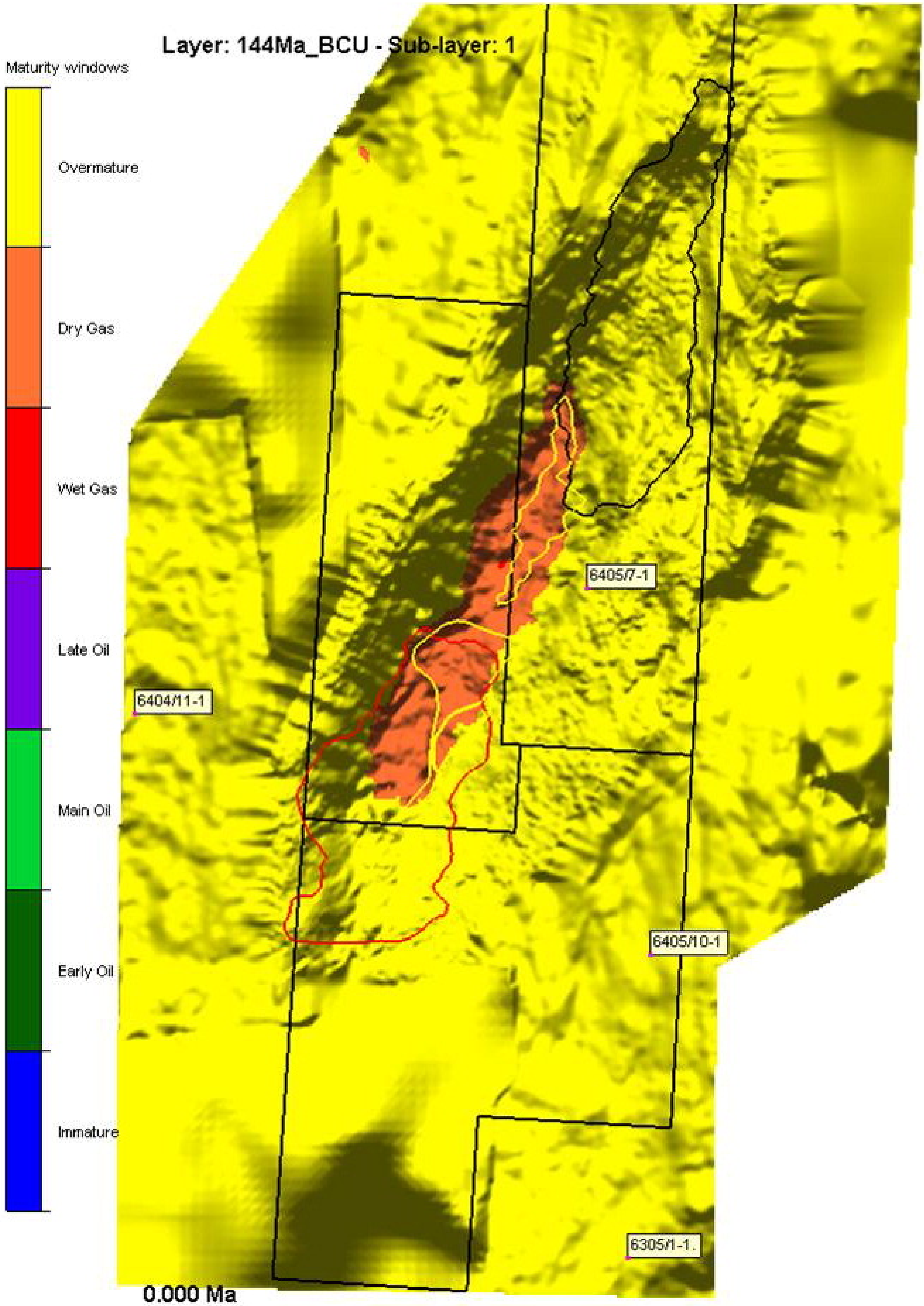

Fig. 3.2 Maturity of the Spekk Fm, Grip High. *Present petroleum system model indicate that most of the Spekk Fm source rock on Grip High is overmature present day. This makes it likely that any potential syn- and pre-rift reservoir has been extensively gas flushed and present day filled with gas.*

Very early in the process, in February 2015, Tullow initiated a 3D elastic seismic inversion study with CGG GeoConsulting using fast-track PSTM data as input. The derived acoustic impedance volume is of decent quality and helped to delineate the Nise Fm and Lysing Fm sands. However, the

Vp/Vs ratio volume proved unreliable for several reasons. Even after extensive noise attenuation the near-angle ranges still suffered from strong noise and could not be used.
Amplitudes and frequencies of the seismic data are vertically very un-stationary within the inversion window. The strong attenuation and absorption below Top Springar Fm prohibited the extraction of viable wavelets representative for the entire zone of interest. Ooze layers and channels in the overburden also cause lateral variations in amplitude and frequency content. The inverted Vp/Vs sections showed a too strong resemblance with low-frequency input model and were therefore deemed as inconclusive. Due the questionable Vp/Vs results, an initially planned lithology and fluid prediction was not attempted.
A re-run of the seismic inversion with the new and final PSDM data was considered. In spite of the much improved data quality in terms of imaging and noise content, this idea was dropped though, because the main problem, the lack of dynamic in the seismic data and the strong absorption of high frequencies at and around the Nise Fm level, could not be resolved in the final processing. Also seismic inversion will not help to lower the main risk for the Cretaceous prospects, which is reservoir performance by permeability.

4 Prospect update

In the applications for PL750 and PL750B, the main prospect Flo was defined as a very large Jurassic 4-way closure on top of the Grip High. A secondary prospect Casanova was defined within a 4-way closure at Top Nise fm. Volumes and risk based on the prospect definition presented in the APA 2013 application, is summarized in Table 4.1.

Table 4.1 Volumes and risk for the prospects presented in APA 2013

Year	Prospect/Lead	Reservoir	Depth (Msl)	POS (main risk)	Fluid	P90 - Pmean - P10 (mmboe rec.)
APA 2013	Flo	Middle-LowerJurassic	5200	16 % (Reservoir quality & retention)	Gas	150 - 1435 - 3786
APA 2013	Casanova	Cretaceous Nise fm.	2690	15 % (Reservoir quality)	Oil	22 - 138 - 340

The prospectivity presented in the 2013 application, was based on interpretation of vintage 2D and 3D seismic data. The data quality did not allow for detailed geophysical analysis of the extent of seismic anomalies in the Cretaceous or a detailed understanding of the structuring and distribution of potential reservoir units in the pre-Cretaceous section.
Based on the license acquired TUN14001 survey, and especially the final PSDM data, a complete re-interpretation of the area was performed. Performed geological and geophysical analysis of the new data has led to new prospect definitions, and a more detailed understanding of the geological development and configuration of both the Jurassic and Cretaceous prospectivity has been established.
In the Cretaceous, Kringsjå is now the main prospect, while Casanova has been downgraded to a lead. In the pre-Cretaceous, the Flo prospect has been replaced by two syn-rift and one pre-rift prospect, believed to represent Upper Jurassic and Middle - Lower Jurassic plays respectively.

Cretaceous prospectivity

The Cretaceous prospectivity within PL750 and PL750B is defined by the Kringsjå prospect and Casanova Lead, classified as stratigraphic traps within deep marine gravity flow deposits in the Upper Cretaceous Nise Fm (Fig. 4.1). The prospect and lead outlines are defined by a combination of the depositional model (Fig. 4.1), AVO anomalies (Fig. 4.2) and DHI's (Fig. 4.3). The depositional model is based on observations of possible fan outlines in various frequency color blend results (Fig. 4.1), wells in the region and regional knowledge of the Upper Cretaceous depositional environment on the mid-Norwegian shelf.

The Kringsjå trap relies on an up-dip pinch out to the northeast, possibly assisted by small faults. The Casanova trap has been tied to the largest Top Nise Fm structural closure up-flank of the AVO anomaly, but with a stratigraphic component to the north and south (Fig. 4.2). The reason for tying the northeastern part of the lead to the structural closure is because of poor data quality caused by overlying ooze, making it challenging to see the true extension of the Casanova AVO anomaly towards the North and East. The difficulty in defining the polygon around the Casanova anomaly is the main reason for classifying the oppurtunity as a lead.

The main risk element for the prospectivety in the Nise Fm within the PL750 & PL750B license is reservoir quality (reservoir performance). Several wells have tested the Nise Fm in the area around the Grip High (e.g. 6505/10-1, 6404/11-1, 6403/10-1, 6406/3-1), all showing poor reservoir quality. The Ellida well (6405/7-1) within the PL750 license show the same results, confirming fine grained Nise FM sand with good porosity (micro-porosity), but poor permeability (0.1-10mD), due to the significant detrital and authigenic clay content.

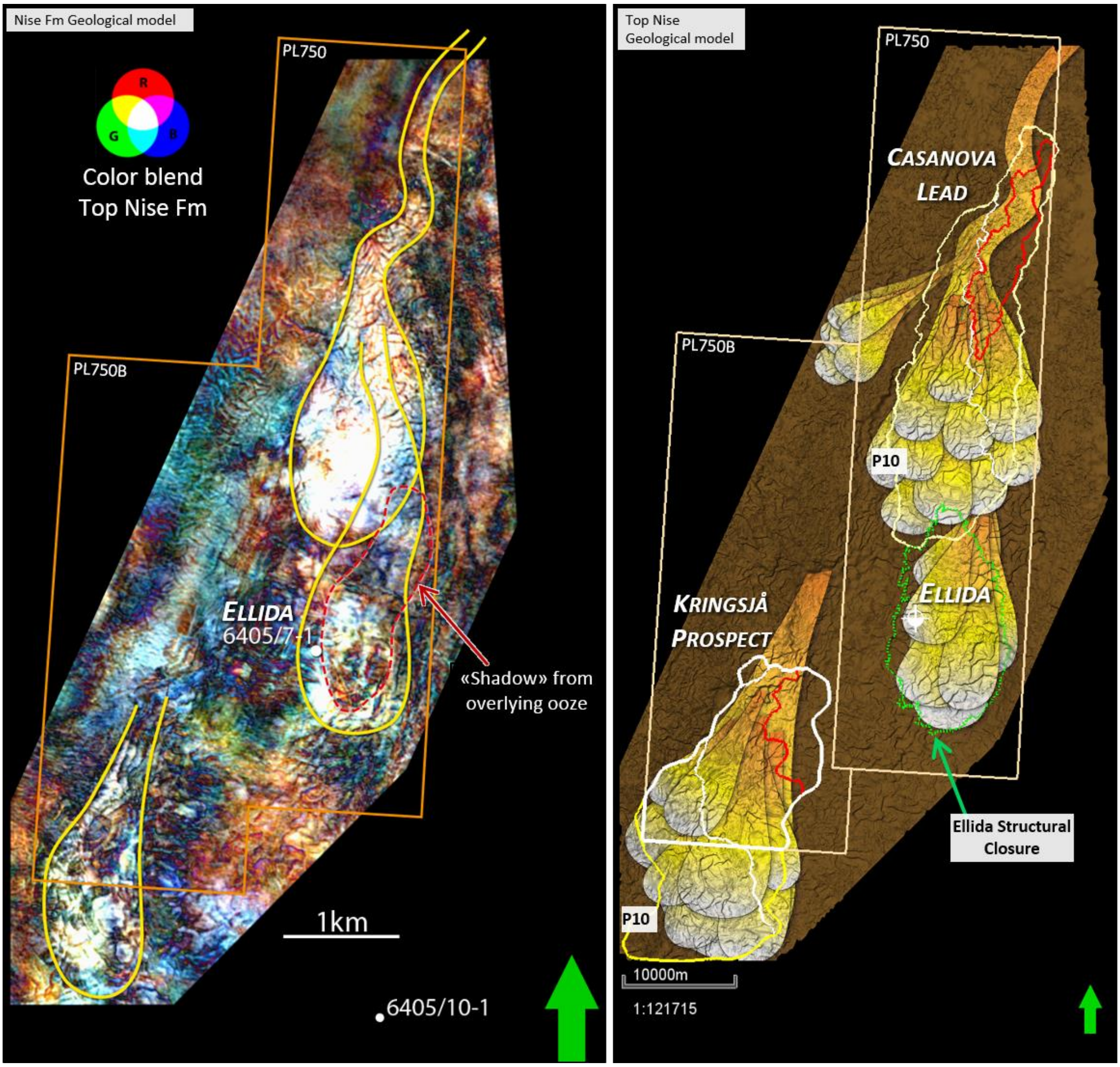

Fig. 4.1 Cretaceous Nise Fm Color blend and depositional model

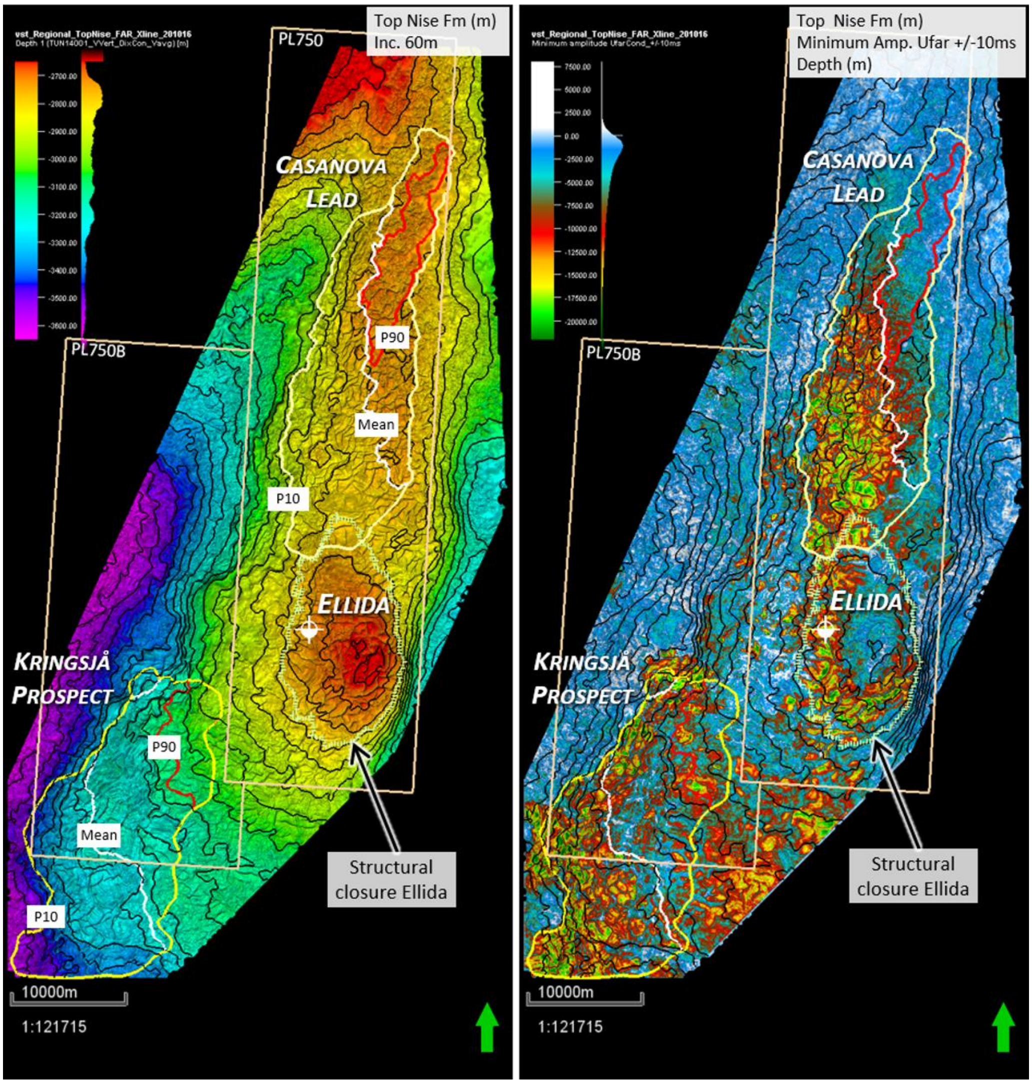

Fig. 4.2 Nise Fm AVO anomaly. *Left: Top Nise Fm depth map with Kringså prospect and Casanova lead polygons. Right: AVO anomaly from the Top Nise (top reservoir) surface. Note the dimming within the Ellida structural closure, and to the Northern and Eastern part of the map, due to overlying sediments/ooze causing shadow zones.*

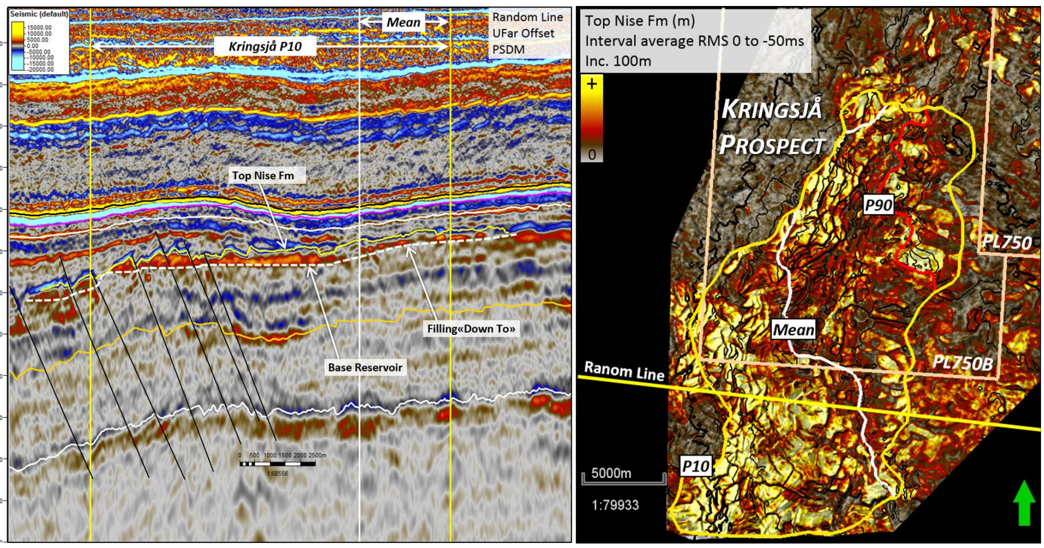

Fig. 4.3 Kringsjå prospect outline

The Nise Fm geological reservoir model developed for the license assumes that the reservoir interval of the Kringsjå prospect and Casanova lead consist of separate stacked fan lobe systems compared to what is tested by the Ellida Well (Fig. 4.1). In addition it can be argued that the Ellida well is located in an unfavorable distal position relative to the Ellida stacked gravity flow lobes. A third assumption/argument is that the gravity flow fans can have originated from the northwest (Greenland), although this has not been confirmed by any of the wells West of the Grip High. The prospectivity in the Upper Cretaceous is heavily dependent on these assumptions and explains why the reservoir quality is the main risk element.

The close proximity to the oil filled Nise Fm in the Ellida well (6405/7-1) have resulted in a high probability of encountering oil in the Kringsjå prospect and the Casanova lead.

The mean recoverable volumes calculated for the Kringsjå prospect and Casanova lead are 419 and 495 Mmboe respectively Table 4.2. The main explanation to the large volumes are the 100-150 km^2 mean areas each of these two possibilities cover, despite only a ~50m average reservoir thickness. The high risk for reservoir quality have resulted in a POS of ~6-10% for the two targets (see Table 4.2).

Table 4.2 Volume and risk for the Cretaceous prospectivity

Prospect/Lead	Reservoir	Depth (Msl)	POS (main risk)	Fluid	P90 - Pmean - P10 (mmboe rec.)
Kringsjå	Cretaceous Nise fm.	3234 m	10 % (Reservoir performance)	Oil	81 - 419 - 988
Casanova	Cretaceous Nise fm.	2791 m	6,4 % (reservoir performance)	Oil	118 - 495 - 1108

Pre-Cretaceous prospectivity

In the applications for PL750 and 750B, the pre-Cretaceous prospectivity has been defined as a very large Jurassic closure, represented by the apex of the Grip High. The definition represented more a play concept than a detailed prospect definition, limited by the poor seismic resolution of the pre-Cretaceous strata on the vintage seismic data and fast track versions of the TUN14001 survey.
The new seismic mapping based on the final PSDM volume, has resulted in a total redefinition of the pre-cretaceous structural configuration and tectono-stratigraphic units.
A WNW - ESE trending cross section across the Grip High illustrates the present definition of 3 main tectono-stratigraphic units consisting of a basement complex, a pre-rift and a syn-rift sedimentary sequence Fig. 4.4. The Grip High is defined as a basement structure, deeply eroded and peneplaned on the top, as seen in Fig. 4.4. The pre-rift sequence are positioned in down faulted blocks along the Eastern flank of the High, resting on a seismic facies defined as basement rocks. The syn-rift sequence is represented by the wedge shaped infill of the pre-rift topography, onlapping on the eastern side of the apex of the high and thickening down flanks towards the east. Due to the lack of well control, the specific age of the individual units can not be confirmed, but for the prospect evaluation the pre-rift sequence is considered to represent a early to mid Jurassic unit, while the syn-rift is considered Upper Jurassic in age.

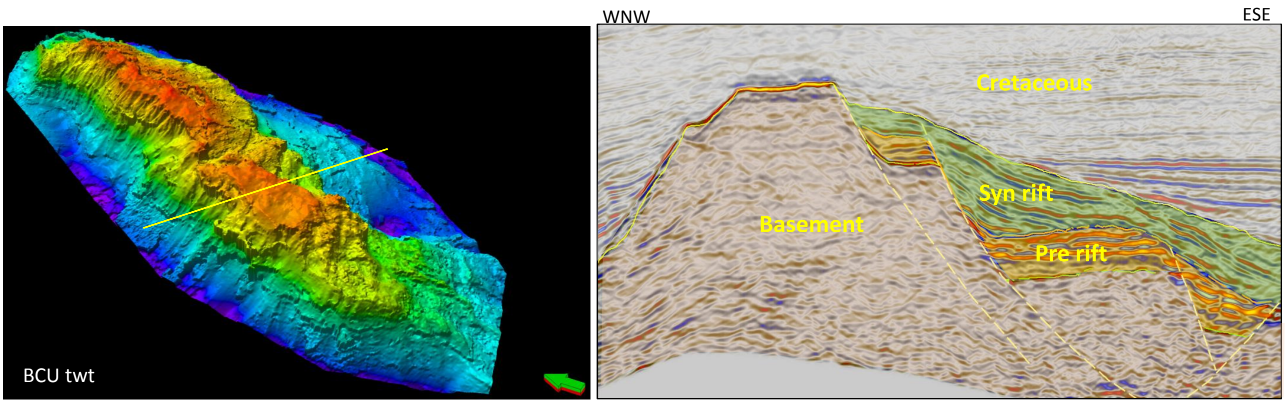

Fig. 4.4 Seismic cross section across the Grip High. *The cross section illustrartes the separation of the pre Createceou strata sinto a separate tectonostratigrafic units*

The hydrocarbon phase in the pre-cretaceous prospects are believed to be gas, due to the deep burial and advanced maturity of the expected Upper Jurassic source rock.

Syn-rift prospects.

Two prospects has been identified within potential the syn-rift sequence (syn-rift prospect 1 and 2), these are located in high positions on the Grip High. Syn-rift prospect 1 sits in a graben on top of basement cored Grip High, bounded laterally by basement rocks, while syn-rift prospect 2 is defined within an incised or faulted controlled basement inlayer Fig. 4.5. Both prospects are capped by Lower Cretaceous shales. The reservoir is considered to be the Upper Jurassic Rogn Fm., and reservoir properties are estimated based on properties found in Rogn Fm penetrations in Norwegian Sea wells.

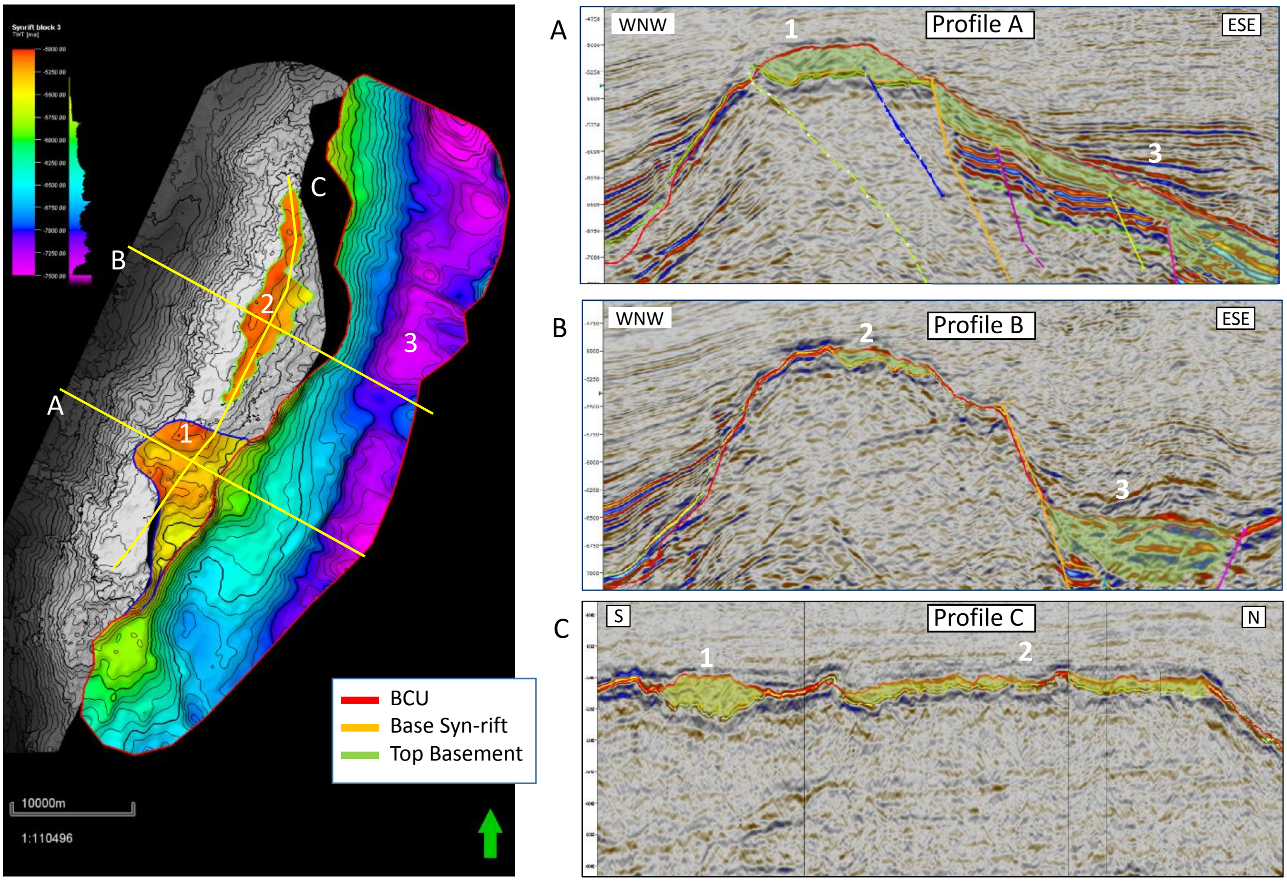

Fig. 4.5 Seismic profiles trough syn-rift prospects 1and 2. *The map illustrates the position of syn-rift prospects 1 and 2 and. The basement rocks of the Grip High is represented in grey scale. The syn-rift package is defined between the Base Cretaceous and the Base syn-rift interpretation. Profiles A, B and C illustrates the setting and position of the prospects, with respect to the underlying basement and the Lower Cretaceous cap rock. The syn-rift unit 1 and 2 represents the prospects, while unit 3 represents the down flank syn-rift infill, and is not considered prospective.*

The main risk element for both syn-rift prospects are the presence and quality of the expected reservoir. The deep present day burial of the prospects of around 5300m Msl (~4000m below seafloor), may have altered potential reservoir sand by diagenetic processes significantly.
The mean recoverable volumes calculated for the syn-rift prospects are 274 and 118 Mmboe respectively, and the high risk for reservoir quality and presence have resulted in a POS of ~6 % for the two prospects (see Table 4.3).

Table 4.3 Volume and risk for the syn-rift prospects

Prospect/Lead	Reservoir	Depth (Msl)	POS (main risk)	Fluid	P90 - Pmean - P10 (mmboe rec.)
Kringsjå	Cretaceous Nise fm.	3234 m	10 % (Reservoir performance)	Oil	81 - 419 - 988
Casanova	Cretaceous Nise fm.	2791 m	6,4 % (reservoir performance)	Oil	118 - 495 - 1108

Pre-rift prospects.

In the pre-rift section, one prospect has been defined within a fault block, down faulted towards the ESE of the high. The pre-rift sequence is characterized by a sequence of high amplitude reflectors, defined between the Top Basement and Base syn-rift horizon interpretations (Fig. 4.6).
The pre-rift unit is believed to represent a sequence of Mesozoic sediments, resting on the basement rocks. Several other blocks of pre-rift strata has been identified on the Eastern flank of the Grip High, but they are all buried deeper than 6-7 Km Msl (1200 - 1300m water depth). The pre-rift prospect has a depth to apex of around 6300m Msl, but with water depth of approx. 1300m, the effective depth of burial is about 5000m. This depth has proven prospective on the Halten Terrace

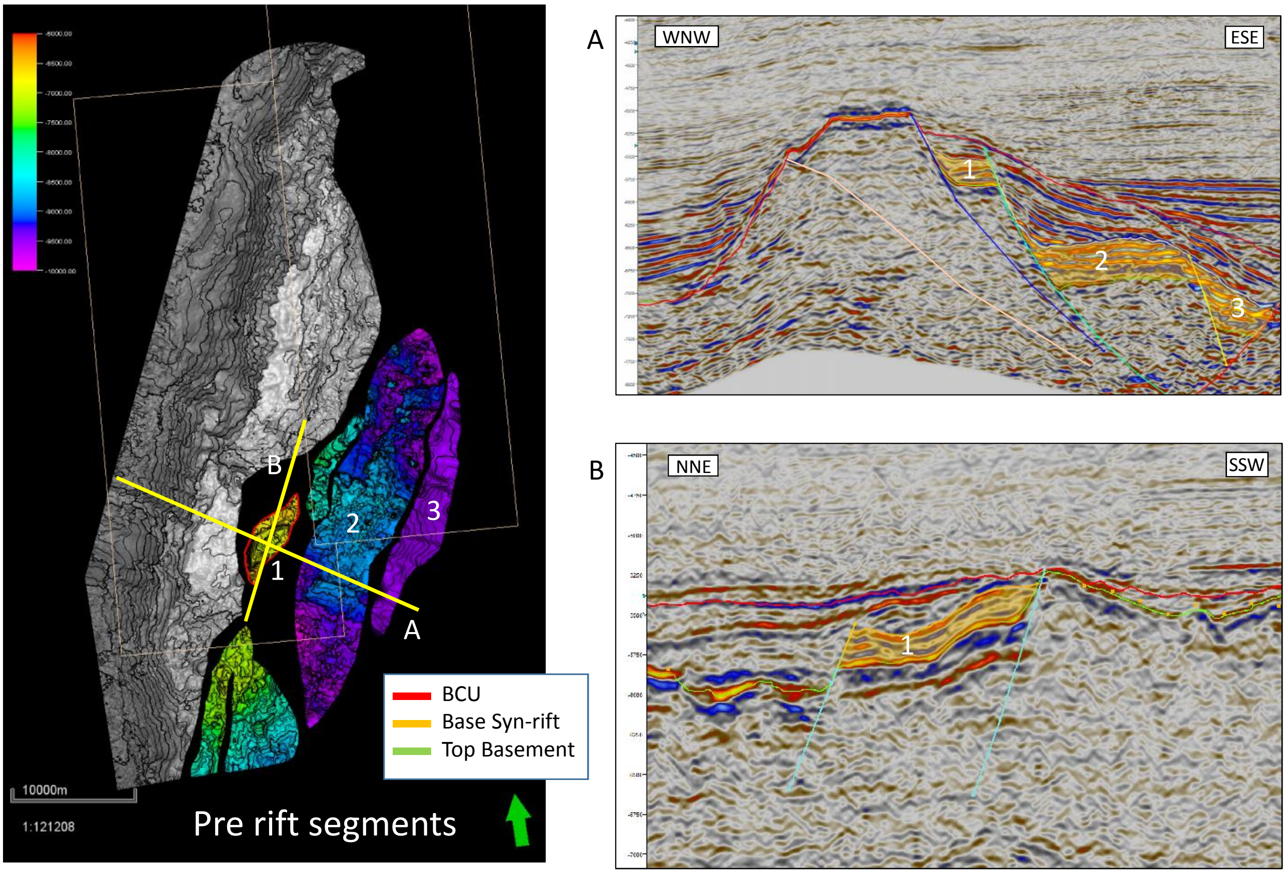

Fig. 4.6 Map and seismic sections throug the pre-rift prospect. *The map illustrates the position of the pre-rift prospect, marked with red outline. The basement rocks of the Grip High is represented in grey scale. The pre-rift package is defined between the Base syn-rift and the Top Basement interpretations. Profiles A and B illustrates the setting and position of the prospect, with respect to the underlying basement and the cap rock. The pre-rift unit 1 represents the prospect, while unit 2 and 3 are to deeply buried, and not considered prospective.*

(e.g the Kristin Field), but depends on porosity preserving processes such as chlorite coating or othe clay coatings (Storvoll et al., 2002), to be able to produce hydrocarbons.
The reservoir properties has been estimated based on analogue Jurassic reservoirs from wells on the Halten Terrace, and the presence and quality of the reservoir is the main risk element for the prospect.
The mean recoverable volume calculated for the pre-rift prospect is 87 Mmboe, and the high risk for reservoir quality and presence have resulted in a POS of ~8 % (see Table 4.4).

Table 4.4 Volumes and riks for Pre Cretacous prospectivity

Prospect/Lead	Reservoir	Depth (Msl)	POS (main risk)	Fluid	P90 - Pmean - P10 (mmboe rec.)
Pre rift 1	Late to Middle Jurassic	6300 m	7.7 % (Reservoir quality)	Gas	20 - 87 - 180

5 Technical evaluations

Development of a potential discovery in the Cretaceous Kringsjå and the pre-Cretaceous Synrift 1 prospect, has been evaluated to establish the economic potential for oil and gas development scenarios, respectively.

Kringsjå Prospect

The Kringsjå oil prospect is assumed developed as deep water FPSO. Gas can either be exported to Åsgard Transportation System (70 km) or Polarled (110 km). The economic evaluation assumes that sufficient capacity in ÅTS can be provided as the gas production is moderate.
The drainage strategy is based on voidage replacement by water injection and artificial lift by gas lift. The resulting production profile is shown in Fig. 5.1

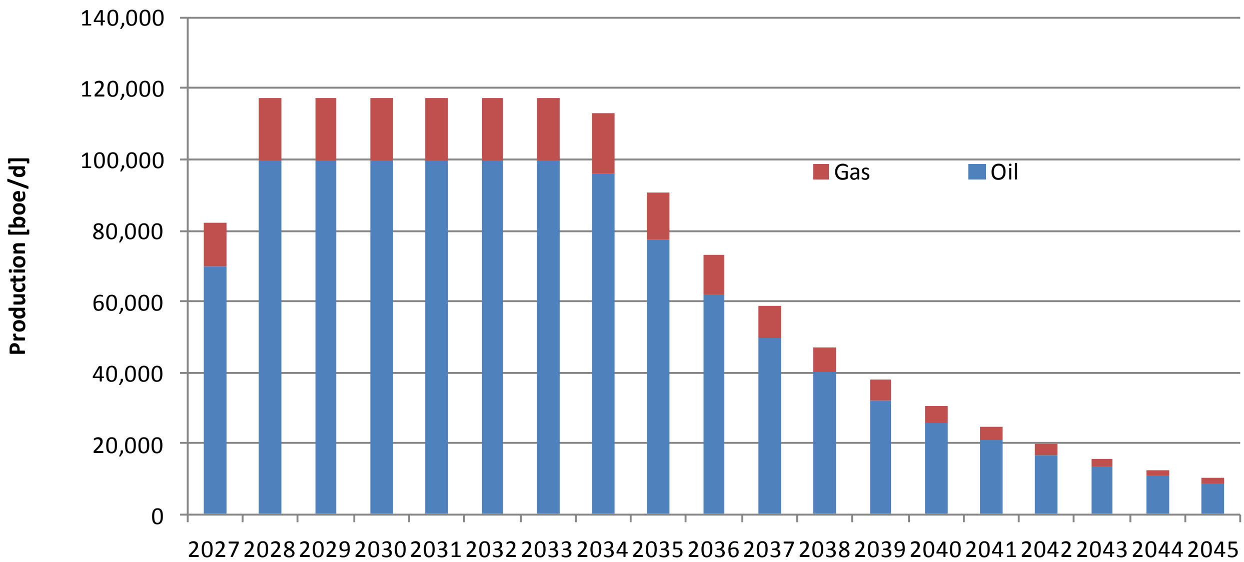

Fig. 5.1 Kringsjå production profile

A total of 56 horizontal or highly deviated producers and 19 vertical water injectors are assumed to be required. The high well count is caused by relatively poor reservoir properties expected in combination with a significant prospect area. This has a significant negative impact on the development economics both through the well cost directly, and through knock on effects on the subsea infrastructure cost. This is further amplified by challenging drilling environment caused by the deep water (~1300 m). Experience recorded in the Rushmore experience database indicate that very low average penetration rate (down to 35 m/day) must be expected. Some element of efficiency improvement should be expected over time, but this is not likely to be sufficient as well cost needs to be reduced by about 50% to result in break even NPV10 at 70 USD/bbl.

Development cost and economic performance at an oil price of 70 USD/bbl is summed up in Fig. 5.2 and Fig. 5.3 respectively.

CAPEX Estimate	% of CAPEX	MUSD	MNOK
Field Development Cost	0.5%	71	600
Development DRILLEX		8159	69149
SURF		3041	25769
Subsea Processing			
Production Facility		1730	14663
Gas & Oil Export Pipelines		326	2761
Loading			
Owners Cost	10%	510	4319
Total		**13765**	**116661**
Abandonment		1348	11428
E&A Cost		390	3305

Fig. 5.2 Kringsjå development cost

NPVs and IRRs nominal discount MUSD	NET	GROSS
Pre tax CF NPV @ 10%	400	400
Pre tax IRR	11.7%	11.7%
After tax CF NPV @ 10%	(441)	(441)
Tax value of LCF	-	-
After tax IRR	7.2%	7.2%

Fig. 5.3 Kringsjå economic performance at 70 USD/bbl oil price

Syn rift prospect 1

The Synrift 1 gas prospect is assumed developed as a deep water FPSO. Alternative solutions would be using a semisubmersible processing unit or a tension leg platform but both would require an oil export pipeline or a separate storage vessel. Also a deep water SPAR with condensate storage similar to Aasta Hansteen may be considered if the condensate content proves to be very low. Gas is assumed exported to Polarled (110 km).
The drainage strategy assumes pressure depletion. Twenty highly deviated producers are assumed to be required due to expected poor reservoir properties. The resulting production profile is shown in Fig. 5.4.
As for Kringsjå, poor drilling performance must be expected and the well cost is further amplified by very deep wells, and the expected high reservoir temperature and unknown pressure regime results in HPHT drilling procedures being required.

Development cost and economic performance at an oil price of 70 USD/bbl is summed up in Fig. 5.5 and Fig. 5.6, respectively.

Although there may be scope for further optimization of the concepts, it does not appear likely that the economic performance can be lifted to better than marginally positive at best. Taking into account the high geological risk and high exploration cost involved, it is not seen that this can be sufficient to justify an exploration well.

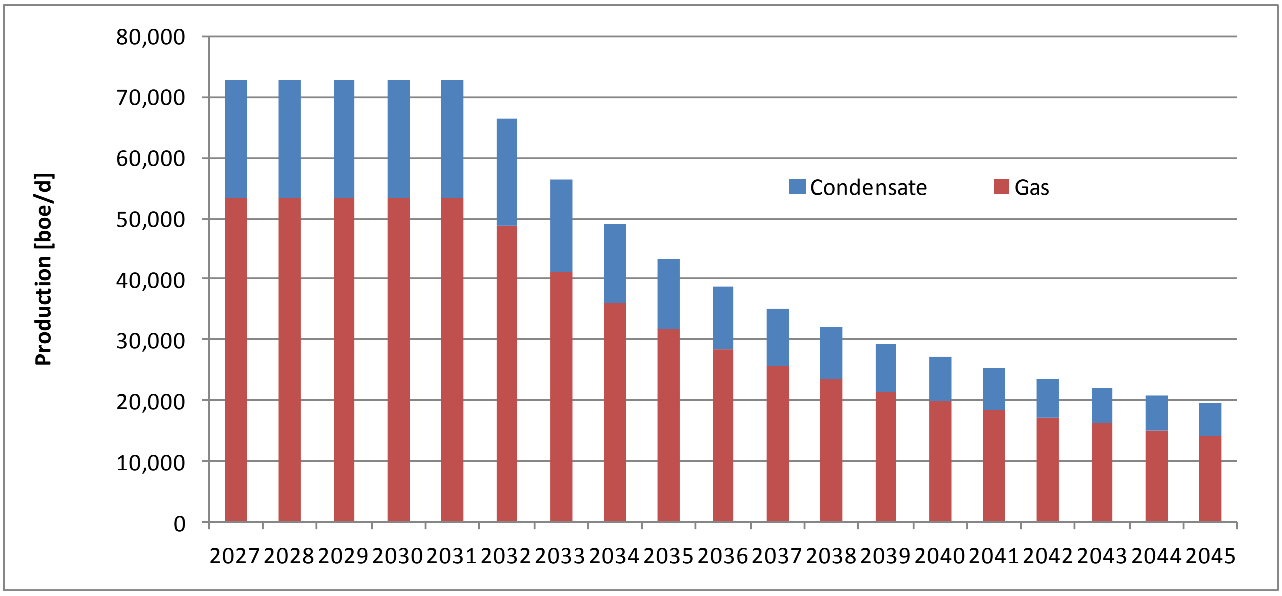

Fig. 5.4 Synrift 1 production profile

CAPEX Estimate	% of CAPEX	MUSD	MNOK
Field Development Cost	1.0%	71	600
Development DRILLEX		3785	32079
SURF		1640	13902
Subsea Processing			
Production Facility		1098	9309
Gas & Oil Export Pipelines		326	2761
Loading			
Owners Cost	10%	306	2597
Total		**7156**	**60649**
Abandonment		510	4320
E&A Cost		668	5658

Fig. 5.5 Synrift 1 development cost

NPVs and IRRs nominal discount MUSD	NET	GROSS
Pre tax CF NPV @ 10%	(673)	(673)
Pre tax IRR	6.3%	6.3%
After tax CF NPV @ 10%	(625)	(625)
Tax value of LCF	-	-
After tax IRR	4.8%	4.8%

Fig. 5.6 Synrift 1 economic performance at 70 USD/bbl oil price

6 Conclusions

The Upper Cretaceous Nise Fm Kringsjå prospect and Casanova lead have a very high risk associated with reservoir quality. This main risk element has been documented by several exploration wells near the Grip high, in addition to the Ellida well (6405/7-1) within the PL750 license. The high risk in addition to the commercial potential does not support a positive decision for drilling an exploration well to test the Kringsjå prospect.

The pre-Cretaceous syn-rift and post-rift prospects also have a large risk associated with the prospect definition. Even though the structural definition of the prospects are good, the lack of well control in the Lower Cretaceous strata and the pre Cretaceous section introduces a large uncertainty related to the age, depth of burial (velocity information), pressure and temperature and the presence and quality of the expected reservoirs.

These risk elements combined with the low economic potential for both the pre Cretaceous syn rift and Cretaceous Kringsjå prospects, leads to the conclusion that non of the prospects, individually or combined, have the economic potential to support an exploration well.

The partnership of the PL750/PL750B license has taken a decision in the management committee to drop the license on the DoD date 07.02.2017.

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