
Lundin
Norway

Table of Contents

List of Figures

List of Tables

1 Introduction

The purpose of this report is to sum up the PL764 licence history, the G&G work performed by the licence group and the results. An overview of identied prospectivity is also given.

1.1 Licence history

To follow up the attractive, but speculative play, identified in wells 7120/12-4 and 7120/12-2, the Storeblink lead and acreage was applied for and awarded to Lundin Norway AS, Bayerngas Norge AS and Maersk Oil Norway AS as part of the APA 2013 round (Fig. 1.1). The application area covered blocks on the SW Finnmark Platform and Hammerfest Basin, with the main prospectivity located in the Hammerfest Basin (Ringvassøy Loppa Fault Complex) (Lundin, 2013). The awarded acreage was split into three licences PL764, PL765 and PL766.

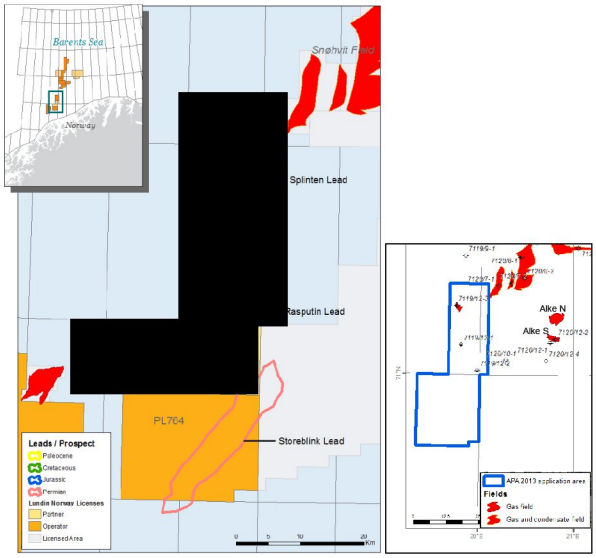


Fig. 1.1 APA 2013 prospects and leads *PL764, PL765 & PL766*

The Storeblink lead is located on the western Finnmark Platform southwest of the Alke gas/ condensate discovery (Fig. 1.2). Storeblink is a 94 km2 large hangingwall structure, down thrown to the NW. The lead was identified on 2D seismic data.

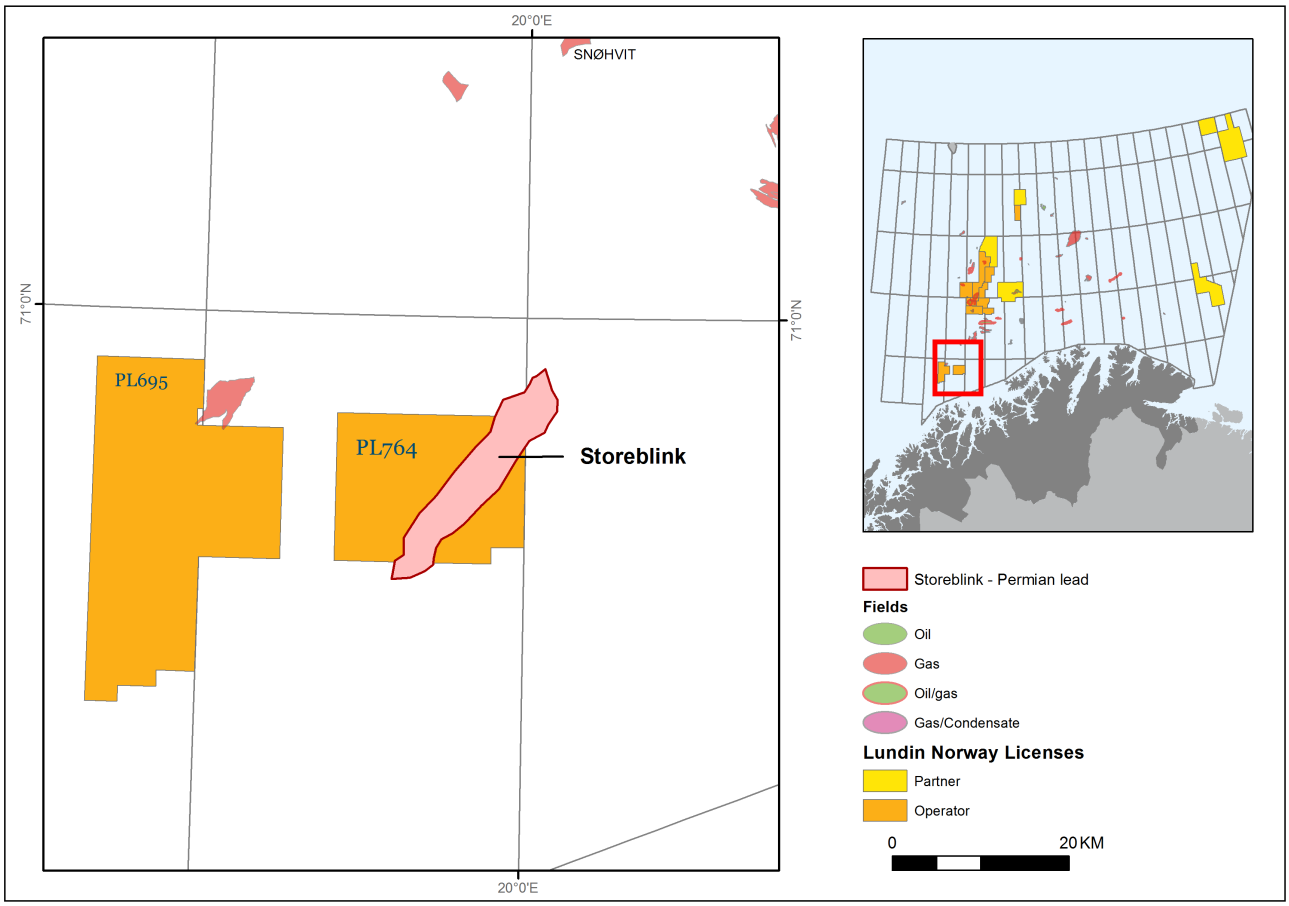


Fig. 1.2 PL764 Storeblink Lead location

Primary play is Late Permian aged siliciclastic sandstones in Ørret Fm. Sandstones with good reservoir properties were encountered in Well 7120/12-4 26 km from Storeblink. The well was dry and no shows were reported, but it tested a stratigraphic trap.

Storeblink is a gentle, to the north-west dipping hangingwall structure depending on sealing faults in three directions. Charge is expected from local source rocks in the Permian Tempelfjorden Gp and speculative Carboniferous Billefjorden Gp sources. An additional Triassic kitchen is expected downdip of Storeblink. Complex charge across the Troms Finnmark Fault Complex from Triassic or remigrated Hekkingen sources was regarded as higher risk. Main risk factors are: Source rock presence, charge and trap. High risk of trap and seal along the 22 km updip fault.

The licence commitment to acquire 3D seismic data is fulfilled. Multiclient TGS FP13 and ST09M03 3D dataset were merged and reprocessed into the LN14M02 dataset as part of a cooperation between the three licences. LN14M02 products included also PSDM and CBM datasets. Due to poorer data quality of this merge in the Finnmark Platform, a new reprocessing of the TGS FP13 was initiated and delivered as FP13LNR17 February 2018. This dataset showed improved imaging of stratigraphy and faults. Additional Lundin post stack processed volumes were also helpfull in the evaluation.

Geological and geophysical studies has been performed in order to better understand reservoir presence and quality, trap and fault seal potential, source rock presence of all potential source rock intervals, and charge and retention history.
Lundin has also conducted water column/sea floor mapping in order to identify vulnerable species on the sea floor and better understand the whole petroleum system from the timing of hydrocarbon charge to leakage.

The evaluation of improved seismic data revealed several relay ramps with low trap potential in the northeastern Storeblink. The limited offset of NW-SE trending faults were also seen as an additional risk. Secondary plays were identified in Carboniferous-Basement (Ugle Fm), and lower to upper Triassic (Havert/Klappmyss and lower Snadd fms) sandstones. Semiregional interpretation was conducted in order to predict presence of Triassic "Steinkobbe" type source rocks in front of the lower to middle Triassic clinoforms.

The license extensions:

- 2 years to 07.02.2019 due to new reprocessing of TGS FP13 3D survey (FP13LNR17). Revised volumes, of 13-50 mill. Sm3 rec. oil in Storeblink S prospect + Storeblink N lead, were presented in EC workshop October 2018. It was decided to apply for a 2nd extension.
- 1,5 year to 7th August 2020 to complete the structural evaluation, de-risk the primary prospect and mature secondary prospectivity.

As a result of a structural study, conducted by Badleys, the Storeblink prospect volumes was reduced to 6-9 Sm3 rec. oil (Storeblink S Ørret prospect). Due to the limited remaining resource potential with associated high risk, the licence group agreed to relinquish the licence.

Stakeholders:

PL764 was awarded 7.2.2014 (APA 2013) to Lundin as Operator (40%), Maersk Oil (40%) and Bayern Gas (20%).

As of 11.12.2017 Bayerngas changed the company name to Centrica Resources and per 22.12.2017 it changed to Spirit Energy.

As of 14.5.2018 Maersk Oil changed its name to Total E&P

1.2 Award and work program

The PL764 acreage was applied for and awarded 7.2.2014 to Lundin Norway AS (Operator), Bayerngas Norge AS and Maersk Oil Norway AS as part of the APA 2013 round awards (Fig. 1.1). The application area covered blocks on the SW Finnmark Platform and in the Hammerfest Basin. The main prospectivity were located in the Hammerfest Basin (Ringvassøy Loppa Fault Complex).

The work program was to aquire 3D seismic data and decide on drill or drop within 3 years (7.2.2017). The licence commitment was fullfilled by aquirering the TGS FP13 3D.

1.3 Identified prospectivity

Storeblink Ørret prospect

The Storeblink lead was identified on sparse, generally poor quality 2D seismic lines. Storeblink is a large, NE-SW trending fault-dependent structural closure situated on the Finnmark Platform. The lead is defined by Late Permian siliciclastic sandstones of the Ørret Fm. Good reservoir properties were encountered in Well 7120/12-4 26 km from Storeblink. The well was dry with no shows reported, but it tested a stratigraphic trap. Storeblink was characterised by a prominent seismic amplitude anomaly (brightening), interpreted to indicate the presence of hydrocarbons as it appeared to be conform to the structural depth map of the Ørret Fm. The area of the seismic amplitude anomaly was 120 km2 indicating a bulk rock volume of about 16 billion m3, assuming a 300 m hydrocarbon column.

Charge is expected from local source rocks in Permian Tempelfjorden Gp and in speculative Billefjorden Gp. An additional Triassic kitchen is evaluated downdip to the NW of Storeblink. Complex charge across the Troms Finnmark Fault Complex from Triassic or re-migrated Hekkingen sources is regarded as higher risk.

The evaluation of reprocessed 3D datasets LN14M02 and FP13LNR17 available in PL764 confirmed a large potential in Storeblink prospect (Fig. 1.3). The improved seismic data revealed strong seismic amplitudes in the Storeblink hangingwall. However, the amplitude anomaly continued to the south of PL764 with poorer depth conformance. The trap mechanism for a possible southern extension of the prospect cannot be defined, due to sparce to no coverage of 2D seismic data (Fig. 1.4). The amplitude anomaly extends locally into the downdip structure, which may indicate lithology rather than fluids.

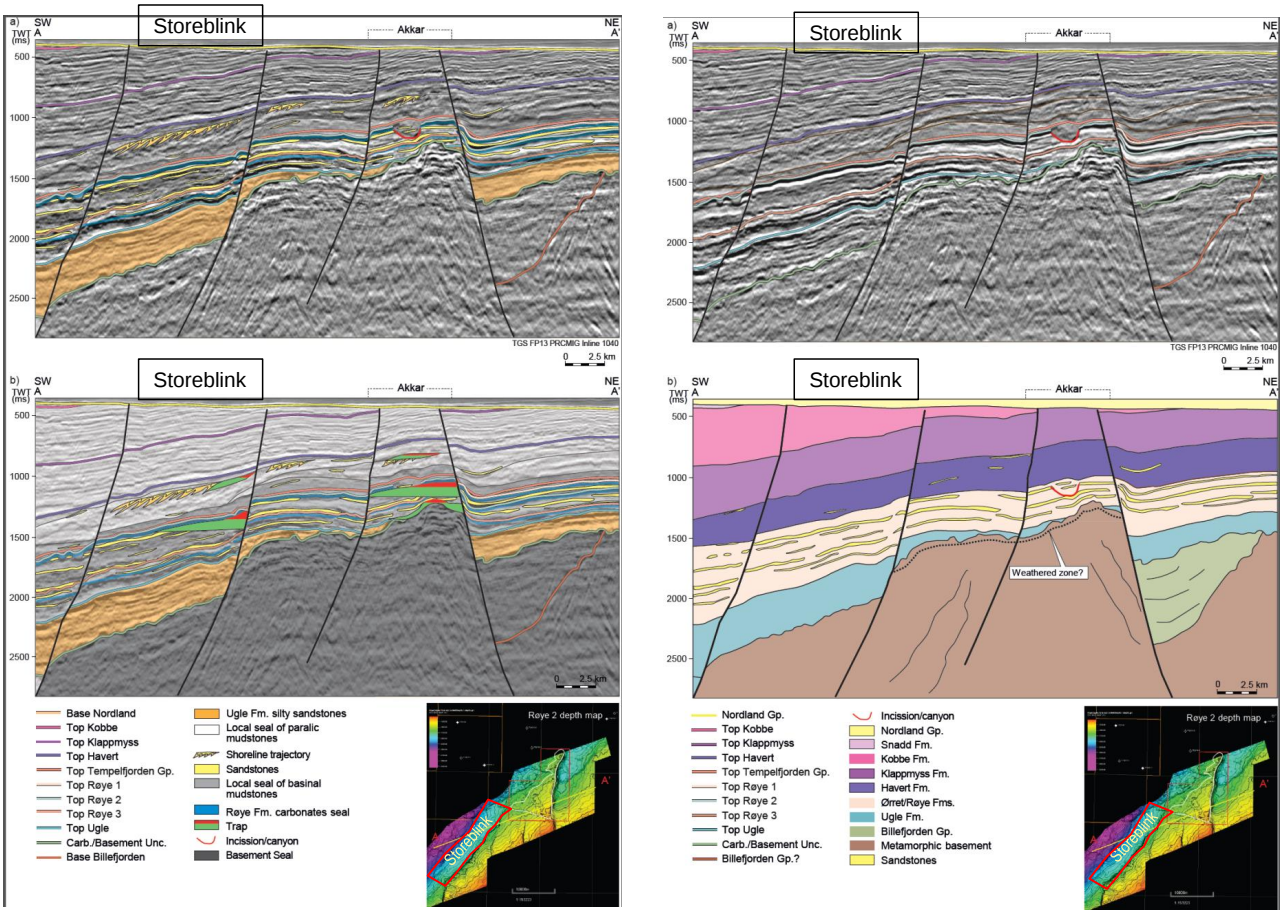


Fig. 1.3 Storeblink Ørret prospect geoseismic profiles

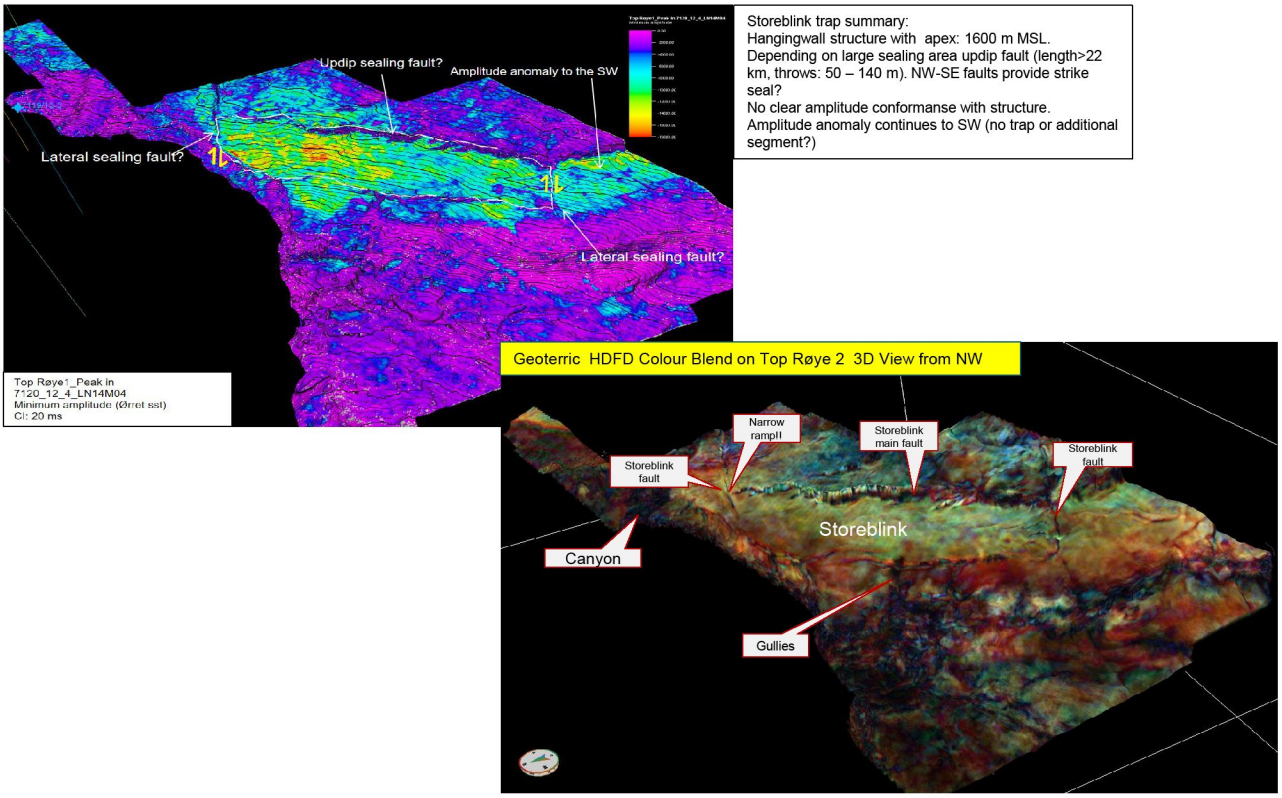


Fig. 1.4 Storeblink Ørret amplitude maps and structural interpretation *Left: Minimum amplitude of Ørret 3a sandstone Right: Geoterric structural display of Røye Fm Storeblink*

In the licence area relatively coarse siliciclastic sediment influx (Ørret Fm) from nearby Fennoscandia is interbedded with spiculitic carbonate inner ramp facies. At least five cycles of progradation are identified with HST sandstones of shoreface or distributary sandstones with coals of delta top origin, overlain and interbedded with TST spiculitic carbonates. Sandstones in the Ørret3 unit constitute the main reservoir. The well 7120/12-4 proved 48 m gross (36 m net) sandstones in Ørret3 with a porosity range of 16 - 20%. The reservoirs interfinger with Ørret Fm mudrocks and Røye Fm spiculitic carbonates, which provide the seal. The reprocessed seismic data revealed several geomorphological features and observations:

Ørret 3a and 3b are the two main reservoir intervals. Ørret 3b represents a relative sea level fall with linear features interpreted as beach ridge systems. The sea level rised from Ørret 3b to 3a where clinoform package with an associated detached? fan were recognised.

Fluid substitution of well 7120/12-4 and seismic prestack modelling of Ørret2 reservoir unit in addition to a wedge modelling of sandstones and spiculitic carbonates were conducted. The results showed that the spiculitic carbonate layers of the Røye Fm and the sandstone layers of the Ørret Fm are all within tuning thickness. The seismic response of the Tempelfjorden Gp is therefore complex, and seismic amplitude information should be used with care, when applied as a direct hydrocarbon indicator. The amplitude anomaly in Storeblink hangingwall is therefore related to lithology combined with tuning effects rather than fluids.

The latest reprocessing (FP13LNR17) resulted in better imaging of structures and faults. Several critical relay ramps were identified along the main Storeblink NE-SW fault. An additional risk factor was the limited vertical and strike offset of bounding faults trending NW-SE.

Detailed reservoir interpretation and juxtaposition evaluation were performed in order to de-risk the remaining resource potential in Storeblink Ørret (Fig. 1.5). Storeblink N (outside PL764) were reduced to a high risk lead, due to the following observations:

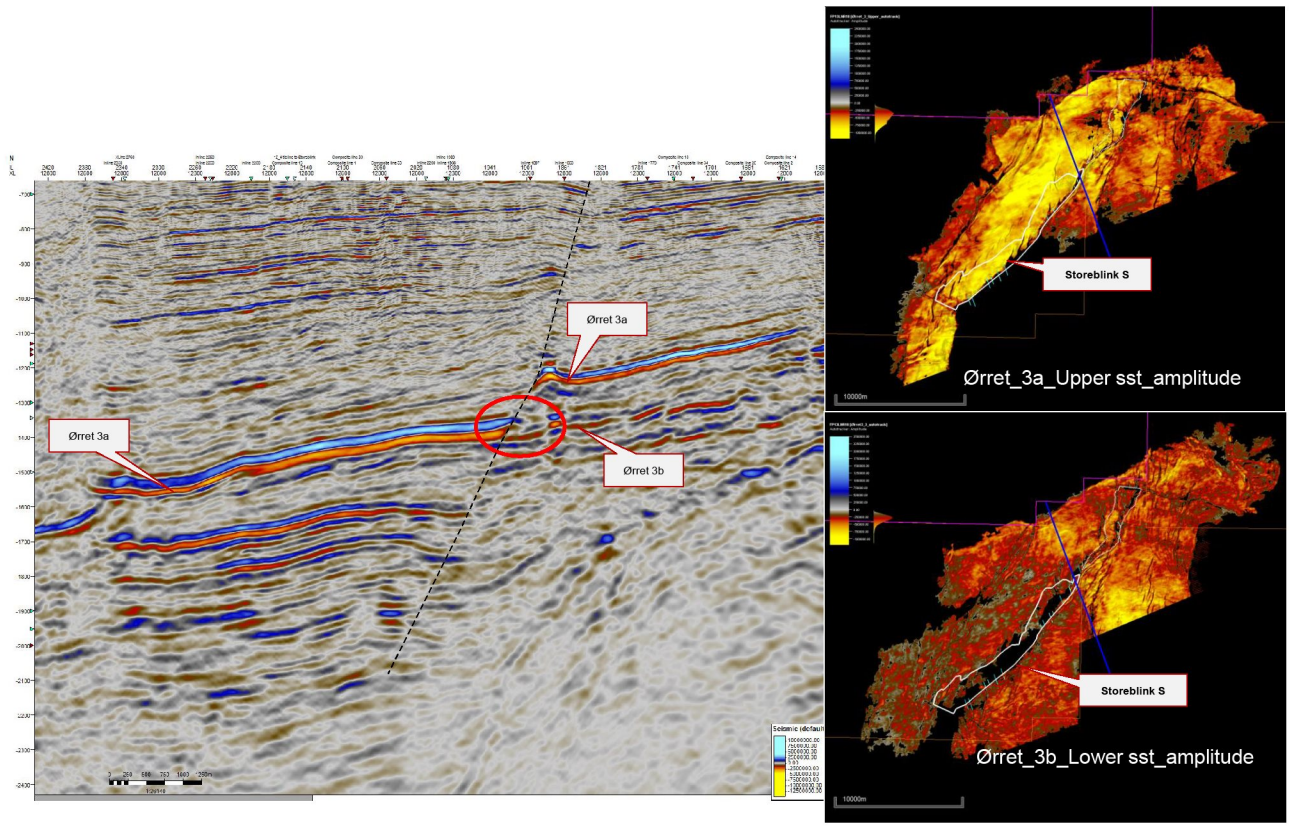


Fig. 1.5 Storeblink Ørret trap risk and interpretation of juxtaposed reservoirs

a) Reduced vertical offset of the main NE-SW fault towards the north; b) Several relay ramps; c) Juxtaposed reservoirs across the faults d) No stratigraphic pinch out of Ørret reservoirs observed in Storeblink.

Following a structural study performed by Badleys, Storeblink S were reduced to a small prospect with a higher risk (Fig. 1.6).

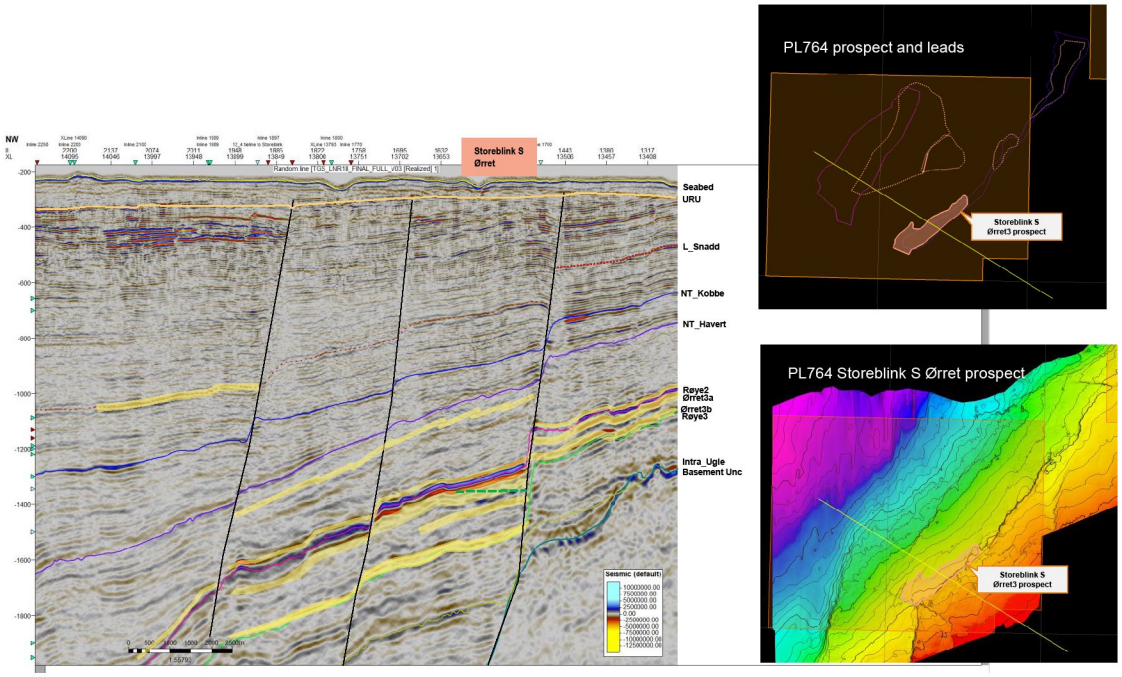


Fig. 1.6 Storeblink S Ørret geoseismic profile

Secondary prospects and leads

Additional prospects and leads were defined on the reprocessed 3D datasets (Fig. 1.7):

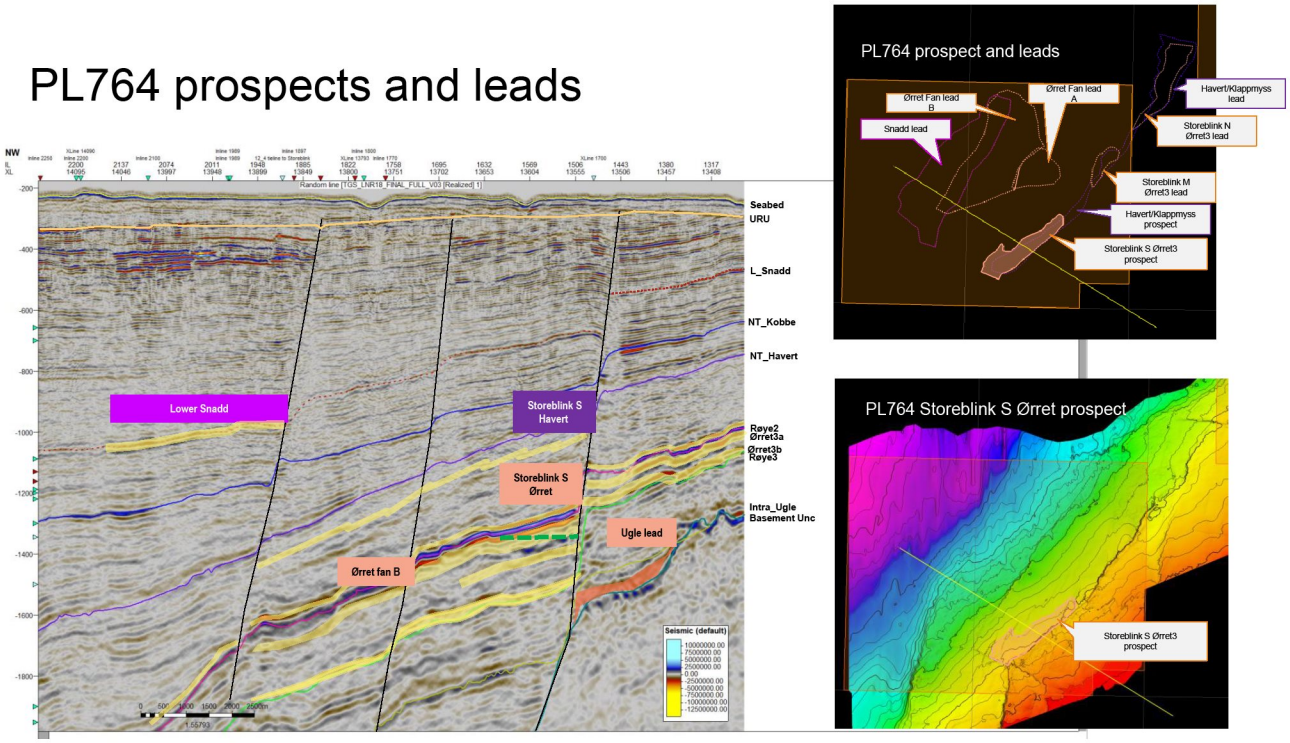


Fig. 1.7 PL764 prospects and leads

Snadd Prospect: Area: 35 km². Apex: -1150 m MSL. Max. closure -1260 m MSL
Amplitude conformanse
Main risk: Trap. Limited vertical and lateral displacement of faults to the NE and SW

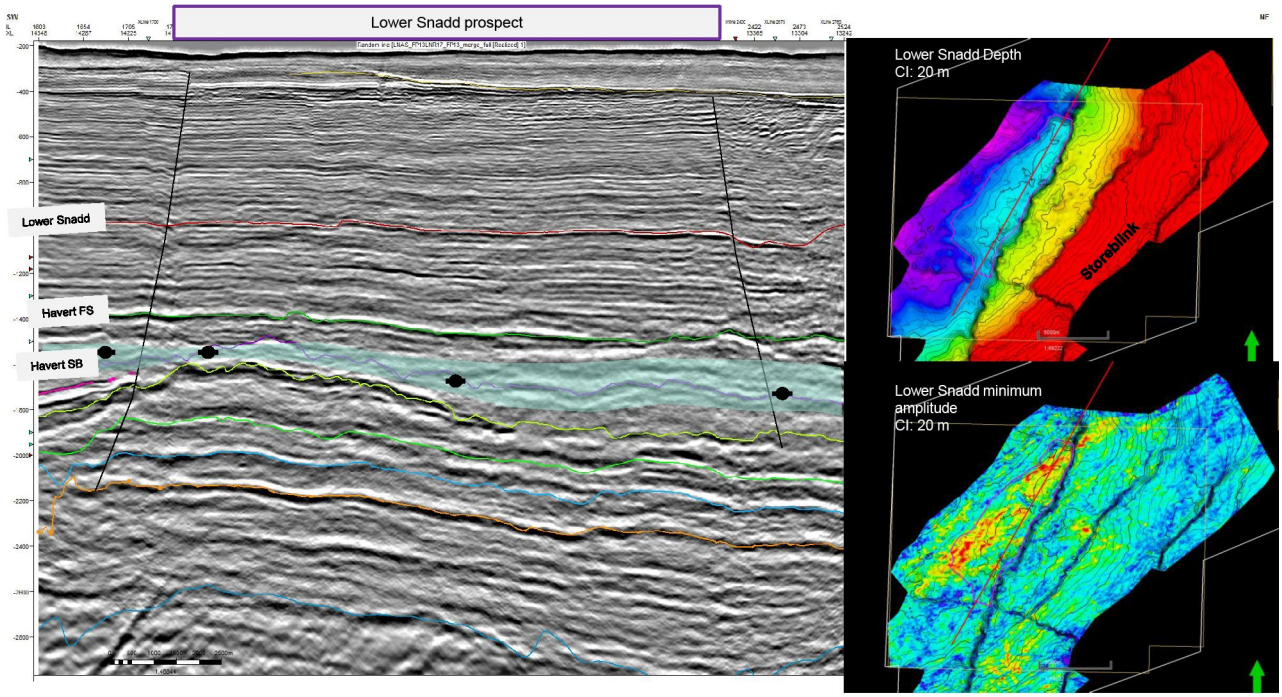


Fig. 1.8 Snadd prospect strike profile

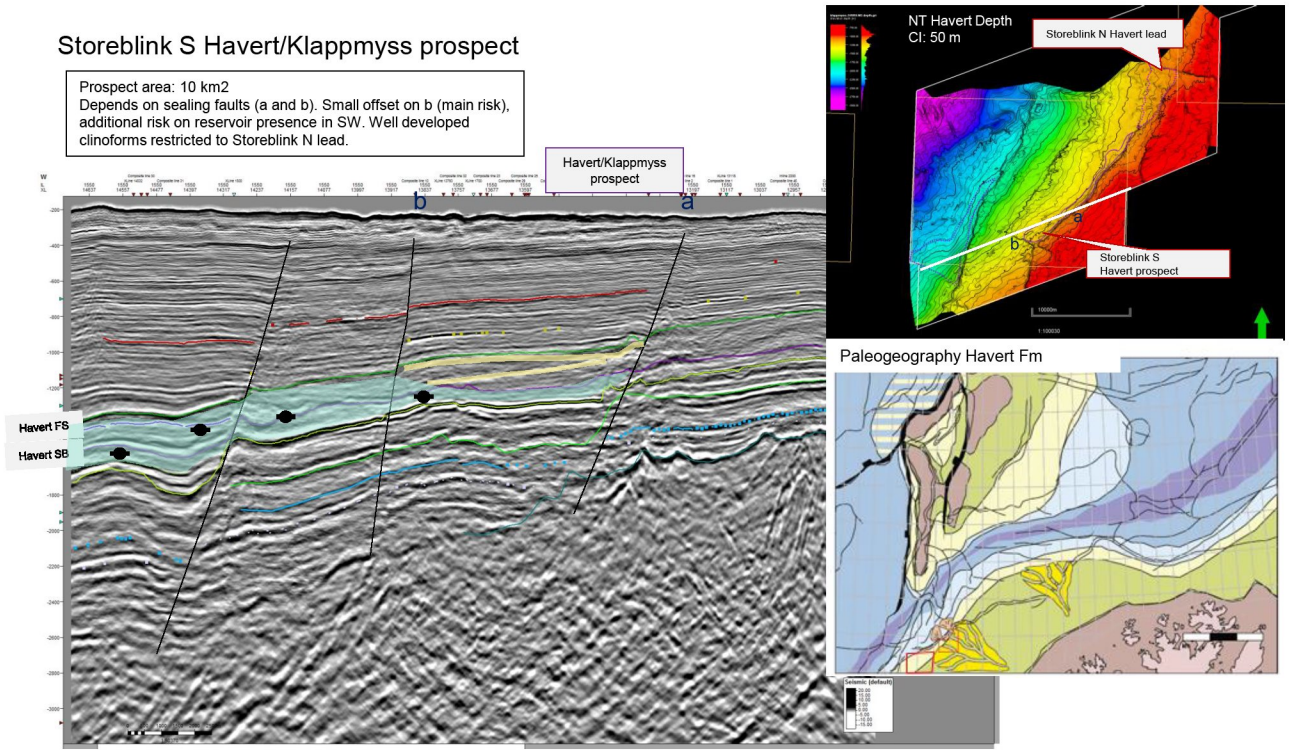


Fig. 1.9 Storeblink S Havert/Klappmyss prospect summary

Snadd prospect

The prospect is summarized in Fig. 1.8 and Fig. 1.7. The strike profile illustrates the lower Snadd prospect and the main risk of self-juxtaposed reservoir across the NE and SW faults. The deposits are interpreted as a fluvial with good reservoir quality. Seals are provided by mudrocks in Snadd and Kobbe fms. Charge is expected from lower to middle Triassic (Havert, Klappmyss and Kobbe fms) source rocks. The main risk is low trap potential with self-juxtaposed reservoir across NW-SE trending faults.

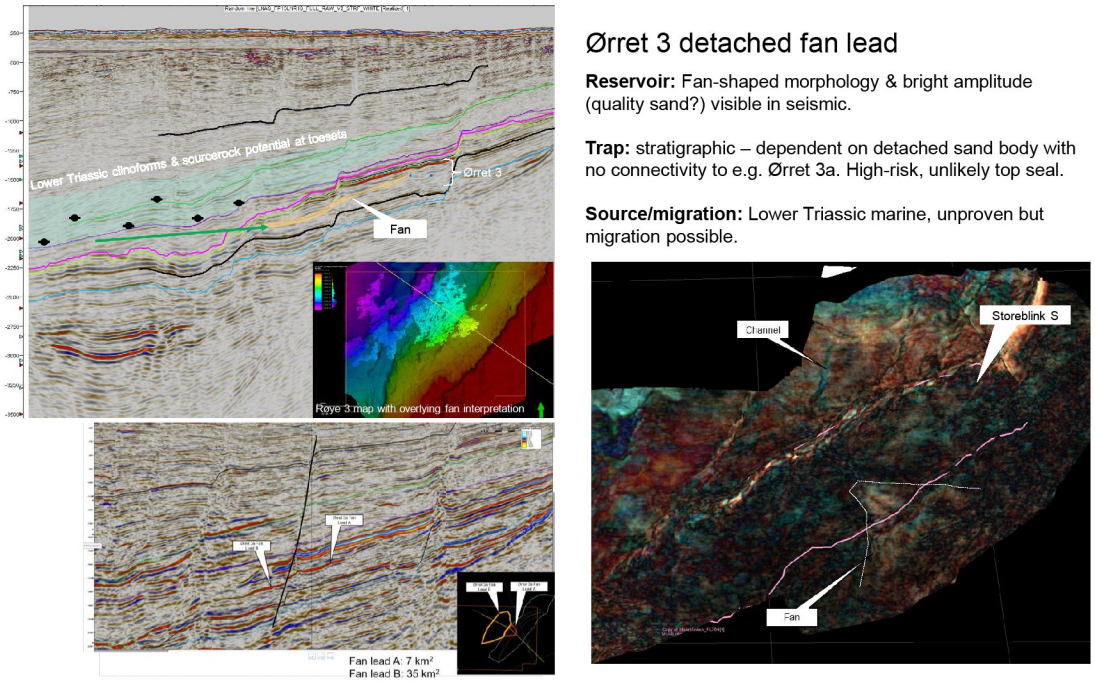


Fig. 1.10 Storeblink Ørret fan

Storeblink S Havert/Klappmyss prospect

The prospect is summarized in Fig. 1.9 and is defined as a small hangingwall closure, depending on sealing faults. Good reservoir quality is evaluated in Fennoscandian sourced sandstones. However, the small closure is located to the south of the identified reservoir sweetspot with well defined clinoforms and truncated topsets. Storeblink N Havert/Klappmyss lead is located within the reservoir sweetspot, but outside PL764. Seals are provided by Havert and Klappmyss mudrocks. Charge is evaluated from a lower to middle Triassic kitchen in front of the clinoforms. The main risk is low trap potential with self-juxtaposed reservoirs across NW-SE trending faults.

Ørret fan leads

The leads A and B are illustrated in Fig. 1.10. The reservoir is interpreted as fan deposits inferred to be detached from clinoform packages and overlying sheet sands of Ørret 3a. The trap is stratigraphic with high risk on top seal. Charge is possible from the lower to middle Triassic kitchen.

Carboniferous-Basement Ugle Lead

A secondary and speculative play is identified updip of Storeblink structure (Fig. 1.11). The Ugle Fm is proposed to contain reservoir facies in possible weathered basement rocks. The Ugle Fm was cored in Well 7120/12-4 and shows redish weathered silt- and mudstones with poor to no reservoir properties. The well did not penetrate the interpreted Carboniferous/Basement Unc. surface. A prominent relief with NWSE trending ridges and valleys are observed updip of the Storeblink structure and may contain sandy alluvial deposits. The trap is defined by stratigraphic onlap onto basement and consist of several small segments. Charge to the lead, trap and reservoir presence are all seen as high risk.

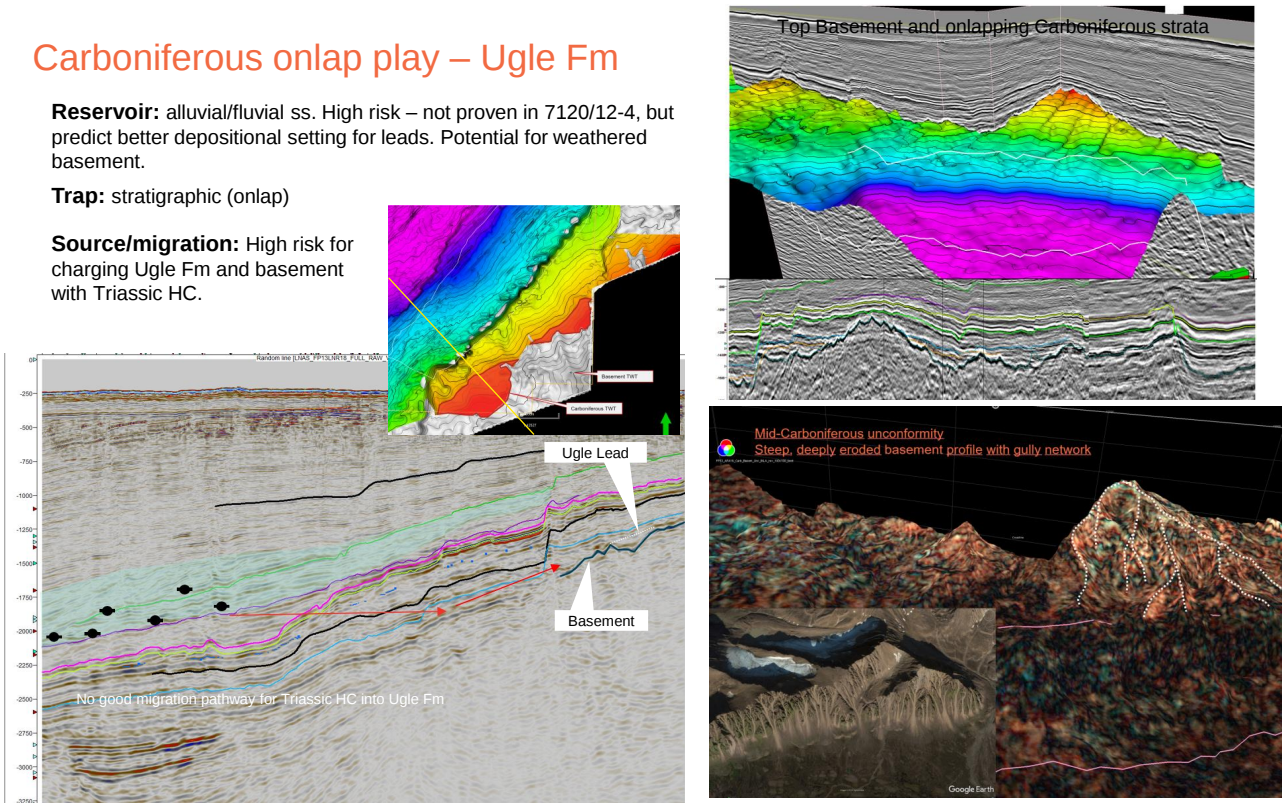


Fig. 1.11 Ugle Lead Summary

2 Database

2.1 Seismic database

The licence commitment to acquire 3D survey is fulfilled. TGS FP13 and ST09M03 3D dataset was merged and reprocessed into the LN14M02 dataset as part of a cooperation between the three licences (Fig. 2.1). LN14M02 products included PSDM and CBM datasets. Due to poorer data quality of this merge in the Finnmark Platform, a new reprocessing of TGS FP13 was initiated and delivered as FP13LNR17 February 2018. This dataset showed improved imaging of stratigraphy and faults. Additional Lundin post stack processed volumes were also helpfull in the evaluation.

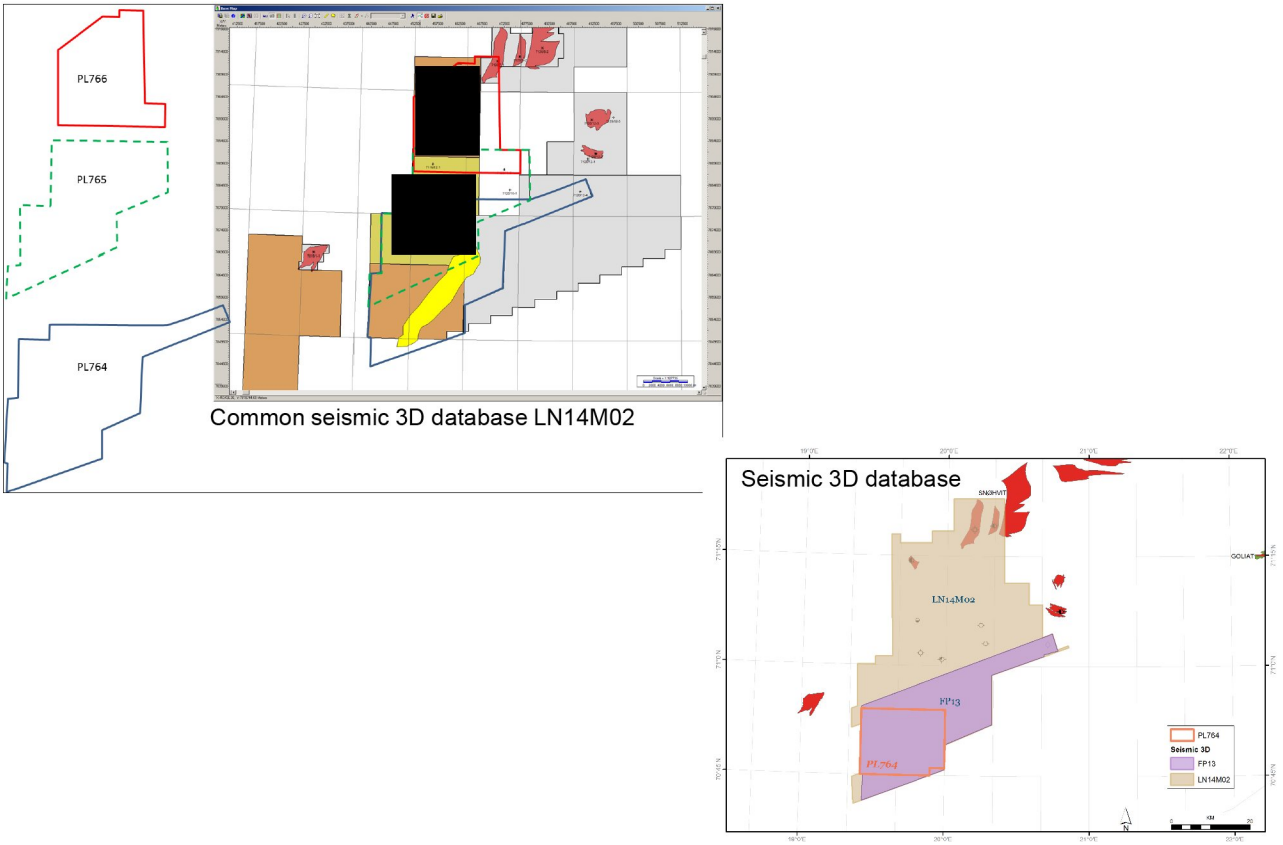
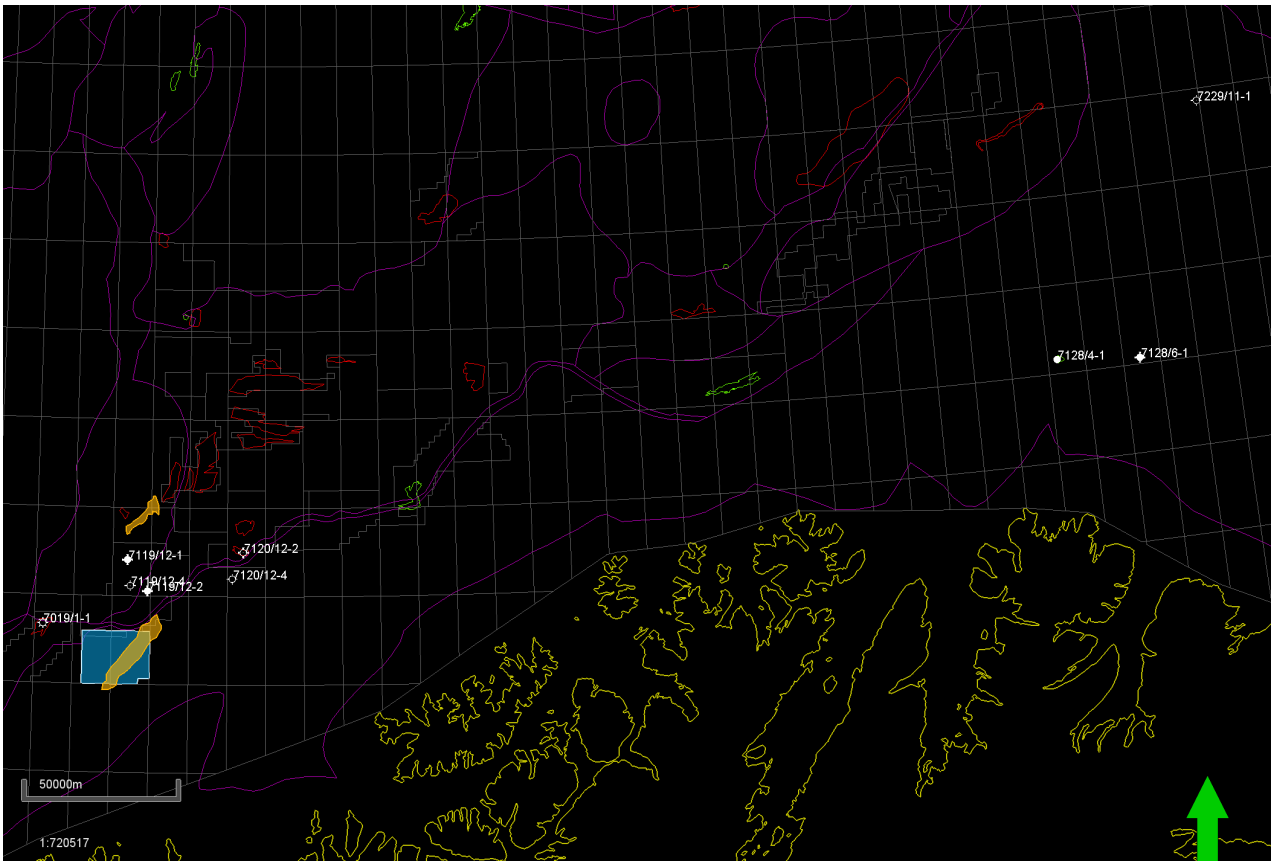


Fig. 2.1 PL764 Seismic 3D database *Left: Outline of common LN14M02 3D PL764 Right: Outline of common TGS FP13 3D PL764*

2.2 Well database

The primary play is Late Permian aged siliciclastic sandstones in Ørret Fm. Good reservoir properties were encountered in Well 7120/12-4 26 km from Storeblink. The well was dry and no shows were reported, but it tested a stratigraphic trap. The reservoir is also present in Alke 7120/12-2, but of poor quality due to post depositional deep burial. The well database is shown in Fig. 2.2



PL 764 Common well database:
7019/1-1, 7119/12-1, 7119/12-2, 7119/12-4, 7120/12-4, 7120/12-2, 7128/4-1, 7128/6-1, 7229/11-1

Fig. 2.2 PL764 Common well database

2.3 Special studies

Sedimentology and reservoir quality, well cores 7120/12-4 (Cambridge Carbonates, 2018)

7120/12-4 contains 3 cores from the Ugle, Røye and Ørret Formations.

The Ugle Formation (core 3) consists of fine sandstone and siltstone red beds that were deposited in a fluvial setting. Fine and medium grained sandstones were deposited in overbank settings as crevasse splays and channel levees. These were initially deposited in bodies of standing water in which the sediment was bioturbated. Siltstones were deposited in more distal over bank settings in ephemeral bodies of standing water. The environment subsequently dried out and was colonized by plants with the development of rhizocretions and calcrete. There is minimal reservoir quality within the Ugle Formation, the sandstones are matrix rich; detrital grains are commonly coated by hematite and the development of calcrete within the sandstones has further reduced the interparticle porosity.

The Røye Formation (core 2) consists of bioclastic limestones and sponge spiculite deposition on the mid- to deep part of a carbonate ramp below storm wave base. There is minimal reservoir quality with the Røye Formation; bioclastic limestones are compacted and have been cemented by crinoid overgrowths, the spiculite also contains minimal porosity having been cemented by silica.

The Ørret Formation (core 1) consists of a well-sorted medium to coarse grained bioclastic sandstone deposited as a high energy shallow marine siliciclastic sand body. It contains excellent reservoir quality in well-preserved interparticle porosity. Porosity has been reduced by calcite cementation, but this is restricted to minor nodules and tabular intervals.

Late Palaeozoic sedimentology of

- **Well 7128/6-1 (CCS, 2014)**
- **Well 7128/4-1 (CCS, 2014)**
- **Well 7229/11-1 (CCS, 2014)**

PL764 & PL766: Seabed studies relevant to petroleum exploration and field development (Lundin, 2016)

Summary

Sea floor data acquired in two shallow marine surveys accomplished in 2014 have yielded important observations of sea floor-surface features such as pockmarks, iceberg ploughmarks, carbonate crusts, bacterial mats and ongoing gas seepage in the Harstad Basin area, including PL764 and PL766. These observations have provided the basis for interpretation of seabed morphology and habitats for different life-forms and geohazards that might be relevant to future drilling, but also features that can be directly related to petroleum exploration and mapping of deeper hydrocarbon reservoirs.

Within the PL764 license area, much of the seabed is fine grained, some areas with an abundance of pebbles and boulders. Till ridges and ploughmarks are characteristic for the area. For most areas, sponges are not present. Much of the sea bottom is very homogeneous in character, however trawl marks are common. Generally plentiful necton of fish larvae and small shrimps are observed. Within the license, 3 crust samples were taken in the eastern depression, and one sample in the western depression. No gas samples were taken due to unpredictable and discontinuous gas seapage.

Numerous gas flares were observed from sub-bottom profiling and in water column data, and a few possible carbonate crusts identified in the Harstad Basin area. The seabed outside crust depressions was homogeneous and characterised by generally gravel sediments. Some sponge rich areas were observed closer to rocky material and tills. Several of the gas flares are located in PL764, where existing bathymetry and watercolumn data from Mareano/Statens Kartverk were analysed (Fig. 2.3). Some of these can be linked to gas anomalies in the subsurface, wheras others most likely must be linked to lateral subsurface migration.

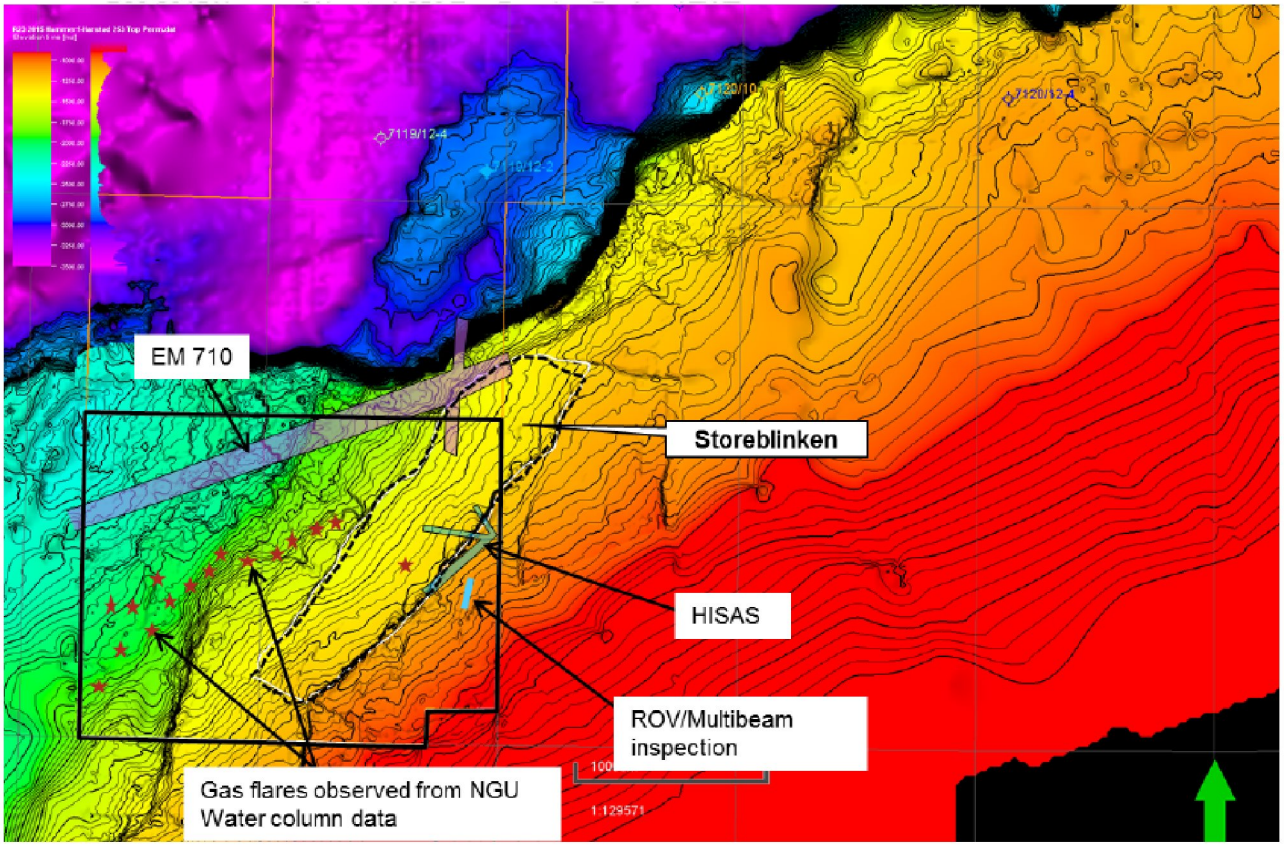


Fig. 2.3 Storeblink gas flares *Outline of Storeblink hangingwall at Top Røye with seabed survey outlines superimposed together with observations of gas flares*

On top of the Storeblink prospect an active gas flare and several larger crust field were observed from the multibeam echo sounder. Through the ROV inspection and sampling part of the cruise there were no observations of gas leakage that was suitable for gas sampling, only scattered gas bubbles in PL764. In one site in PL764 a large in situ block was drilled by BGS "rock drill" and several crust samples picked at sea floor. Dating of one of these gives 600years BP, which is the youngest age that so far has been recorded by Lundin and NGU. This can be taken as strong evidence that there has been ongoing gas migration since the ice age in the area close to the Storeblinken prospect. The isotope analysis of crust sample from this area indicate a thermogenic origin based on values of -24 to -31 ‰ VPDB. These observations give further support to the assumption of present day petroleum migration from deeper kitchens or remigration from hydrocarbon storage sites in the neighbourhood.

Fault seal analysis of Storeblink prospect, PL764 (Badleys, 2019)

An overview of Storeblink and PL764 prospectivity, faults- and surface interpretation were given as input to the structural study. Additional input was a psedo-well with a constructed Vshale log, based on the key well 7120/12-4, but adjusted to fit the predicted lithology in the Storeblink prospect (Fig. 2.4).

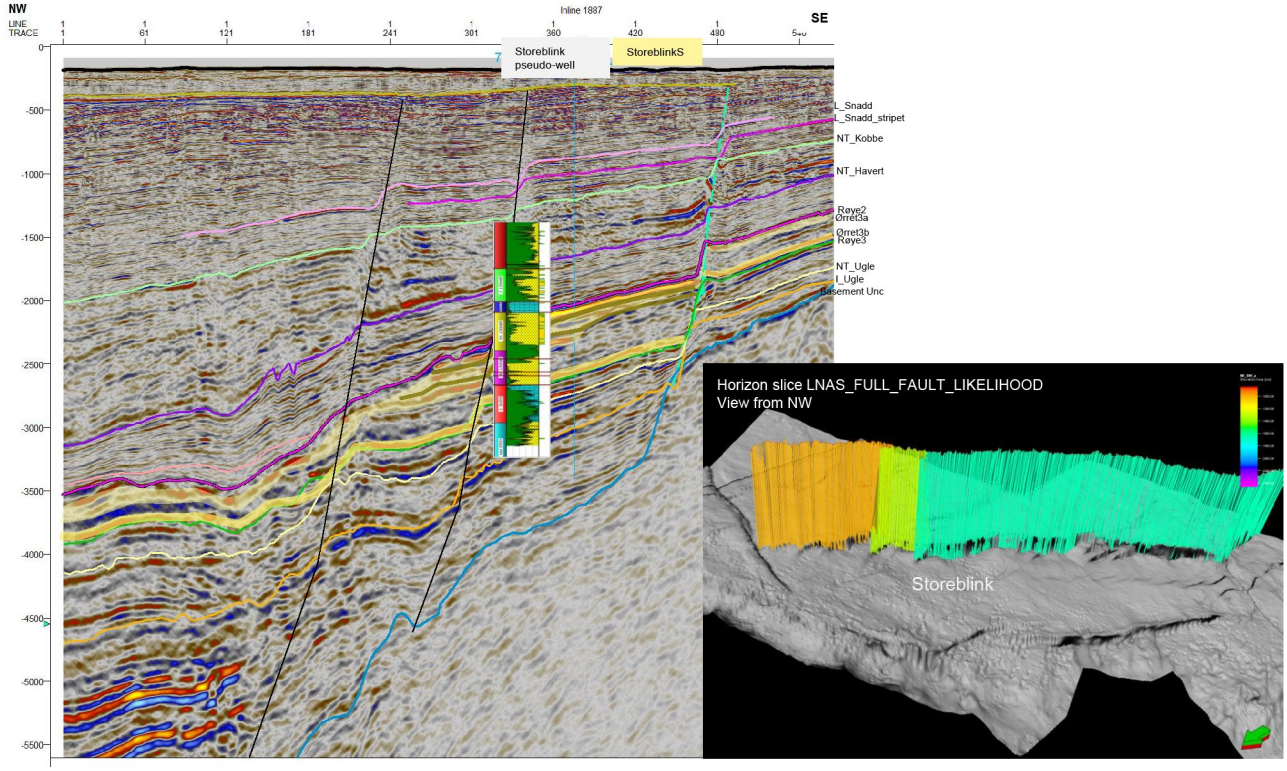


Fig. 2.4 Lundin input to fault seal analysis

Summary

The main bounding fault presented by Lundin was reinterpreted into an array principally comprising two segments (Fig. 2.5). Whilst the newly interpreted F1 and F1b cannot be proven to intersect at point A above, the seismic here is difficult to resolve and furthermore there may be a well-developed fracture zone given the degree of overlap of both faults. For the purposes of the study we will assume this seals. We must also assume the Røye2 is not a thief zone (non reservoir).

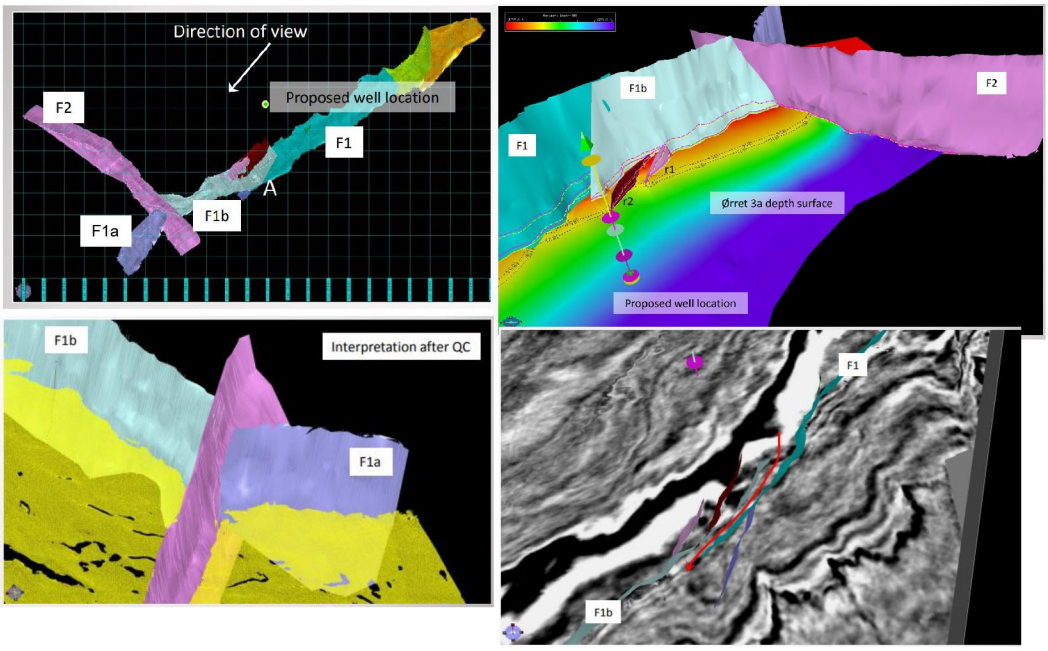


Fig. 2.5 Fault seal analysis Storeblink summary

Within the Storeblink prospect there are two main hangingwall reservoirs: 3b and 3a.

The Ørret3b is a thin unit that seals well for the majority of the contacts with the Storeblink's bounding faults. However where the Ørret 3a in the hangingwall is in contact with the Ørret 3b in the footwall, the seal is dependant on across fault membrane seal. Based on a best case across fault membrane seal we have calculated a maximum hydrocarbon contact depth of 1871 m (assuming an oil density of 850 kgm-3), which is limited by poor seals on r2 and the segment of F1b behind it. A number of small pools may be supported at the boundary as shown in the diagram above in the Ørret3a, but nothing that would be penetrated by the proposed fault. In a best case scenario it may be possible to trap oil in the Ørret3b down to the well target, but this would stretch to the maximum of what these faults might be able to support and assume not just the sealed fractured relay zone, but a seal across F2 that is difficult to envisage.

Rock physics study

Fluid substitution of Well 7120/12-4 and seismic prestack modelling of Ørret2 reservoir unit were conducted. A wedge modelling of sandstones and spiculitic carbonates was also performed.

Wedge modelling for 55 m thick Ørret2 sandstone:

• Sandstone already within tuning thickness

• Difficult to say whether variation in amplitude is due to hydrocarbons fill or variation in sandstone thickness/quality

The spiculitic carbonate layers of the Røye Fm and the sandstone layers of the Ørret Fm are all within tuning thickness. The seismic response of the Tempelfjorden Gp is therefore complex, and seismic amplitude information should be used with care, when applied as a direct hydrocarbon indicator.

Petroleums system analysis

Summary

Performed analysis:

- TOC and Rock Eval
- Thin sections and fluid inclusions

Core samples and cutttings from 7120/12-2, 7120/12-4, IKU wells 7018/5-U-1 and 5-U-6 were collected in order to identify Permian source rocks and evidence of migrated hydrocarbons on the western Finnmark Platform.

Gas and condensates dominate the discoveries in the western Hammerfest Basin, northeast of PL764. Further east, the Goliat oil field proves the presence of Triassic source rocks and long-distance migration of Jurassic oils. No rich oil prone Triassic or Permian source rocks are, however, documented in the PL764 area. New well samples have been collected and analysed without proving oil prone source rocks (TOC 1 or less). A fluid inclusion study has been initiated and is still ongoing. Preliminary results: no HC inclusions were found in 7120/12-4. Some HC inclusions were observed in Ørret Fm sandstones in 7120/12-2 and Stø Fm sandstones in IKU Well 7018/5-U-6. The basin model were updated based on seismic interpretation.

Seismic semi-regional interpretation suggest presence of marine, pro-delta facies west of the Storeblink area (analog to lower - middle Triassic source rock systems "Steinkobbe type" seen in the Goliat Field and in wells on the Loppa High).

Results of basin modelling

Late Permian - Early Triassic potential hydrocarbon kichens are identified on the Finnmark Platform/PL764 area.

Charge from Triassic - Jurassic kitchens in Hammerfest Basin is possible, but migration into PL764 prospect via TFFC may be limited by small kitchen sizes. Needs a working carrier system via the TFFC, complex migration route and increased migration loss.

Geochemistry Data Report – Analysis of Ditch Cuttings from Wells 7120/12-2 and 7120/12-4, (APT, 2018)

3 Remaining prospectivity

The evaluation of reprocessed 3D seismic data together with geological and geophysical studies such as: petroleum systems analysis, reservoir evaluation, rock physics, and structural fault seal analysis have not de-risked the Storeblink prospect. No stand alone prospectivity are observed in the licence acreage. The remaining prospectivity is limited and of high risk. The prospects and leads outlines are shown in Fig. 3.1 and the prospect volumes are listed in Table 3.1. The geoseismic depth profile illustrate some of the remaining prospects and leads (Fig. 1.7.)

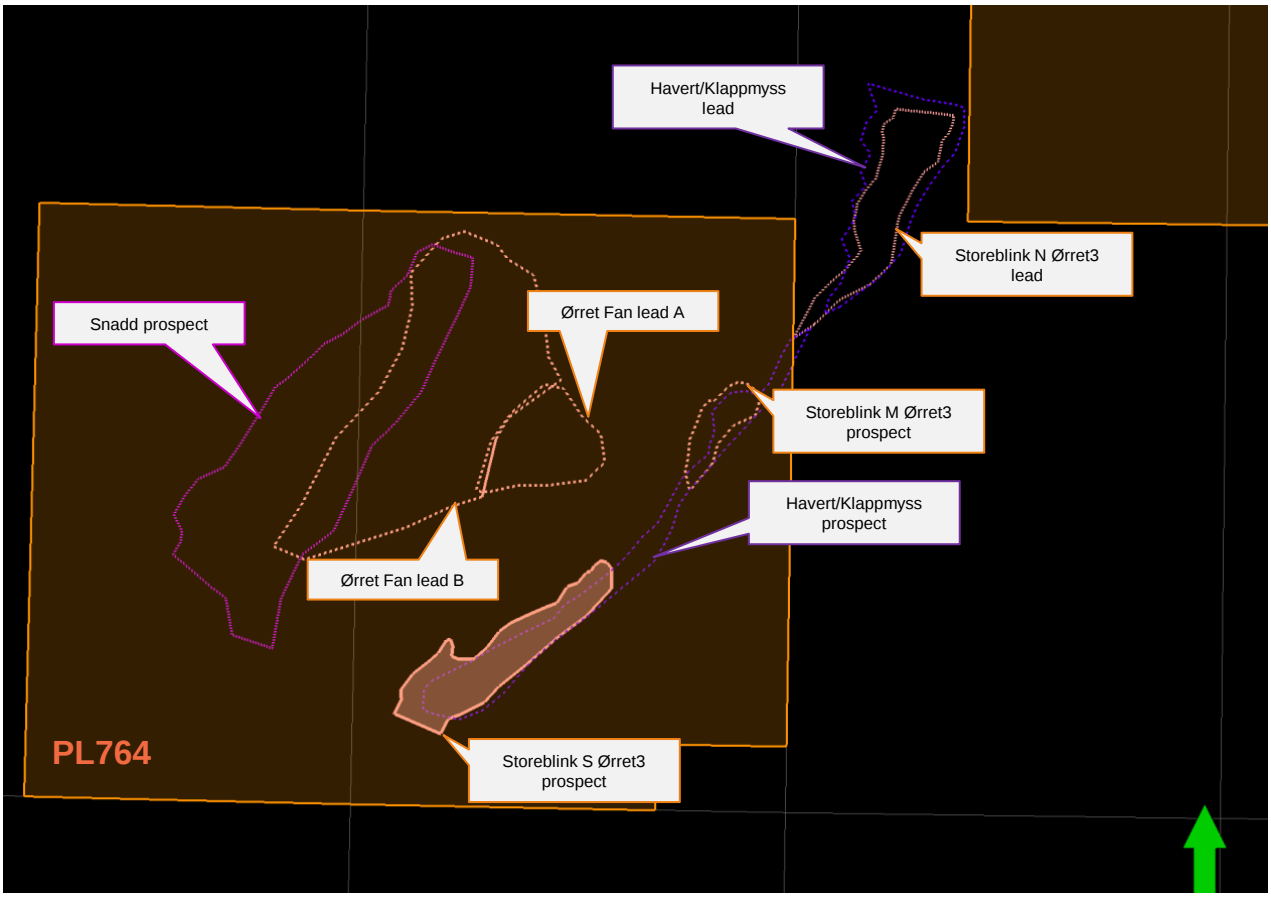


Fig. 3.1 PL764 remaining prospectivity outlines

Table 3.1 PL764 prospects and leads volumes

Storeblink	P/L	Case	Unrisked recoverable resources						Probability of discovery	Resources in acreage applied for (%)	Reservoir	
		Oil/Gas/ Oil&Gas	Oil [*10^6 sm3]			Gas [*10^9 sm3]					Litho/Chrono	Depth (m MSL)
			Low (P90)	Base (Mean)	High (P10)	Low (P90)	Base (Mean)	High (P10)				
Storeblink S	P	Gas&Oil	6	9	11				0,10	100	Ørret Fm sandstones (Permian)	1700
Storeblink N	L	Gas&Oil		13					,05	0	Ørret Fm sandstones (Permian)	
Storeblink S	P	Gas&Oil	5	8	12				,08	100	Havert/Klappmyss fms/Lower-middle Triassic	1190
Storeblink N	L	Oil		11					,05	0	Havert/Klappmyss fms/Lower-middle Triassic	
Lower Snadd	P	Gas&Oil	12	20	30				0,08	100	Snadd Fm/UpperTriassic	1150

Storeblink S Ørret prospect

The geoseismic depth profile and prospect map summarize the remaining Storeblink S prospect (Fig. 1.6, Fig. 3.2). The prospect is defined in Ørret 3a and 3b reservoirs and a gross reservoir thickness of 55 m is applied in the assessment. The top seal is provided by Røye Fm spiculitic carbonate. The Storeblink S prospect area is 8,4 km^2, apex at 1700 m, maximum hydrocarbon

column (ref. Badley) of 171 m. A gas (25%) and oil (75%) case was assessed. Only oil volumes are reported (gas GRV are subtracted). Storeblink S prospect risk is listed in Table 3.2 . As mentioned in previous sections trap and fault seal is considered the main risk factors in addition to unproven Triassic marine source rocks.

Storeblink Ørret post Badleys study

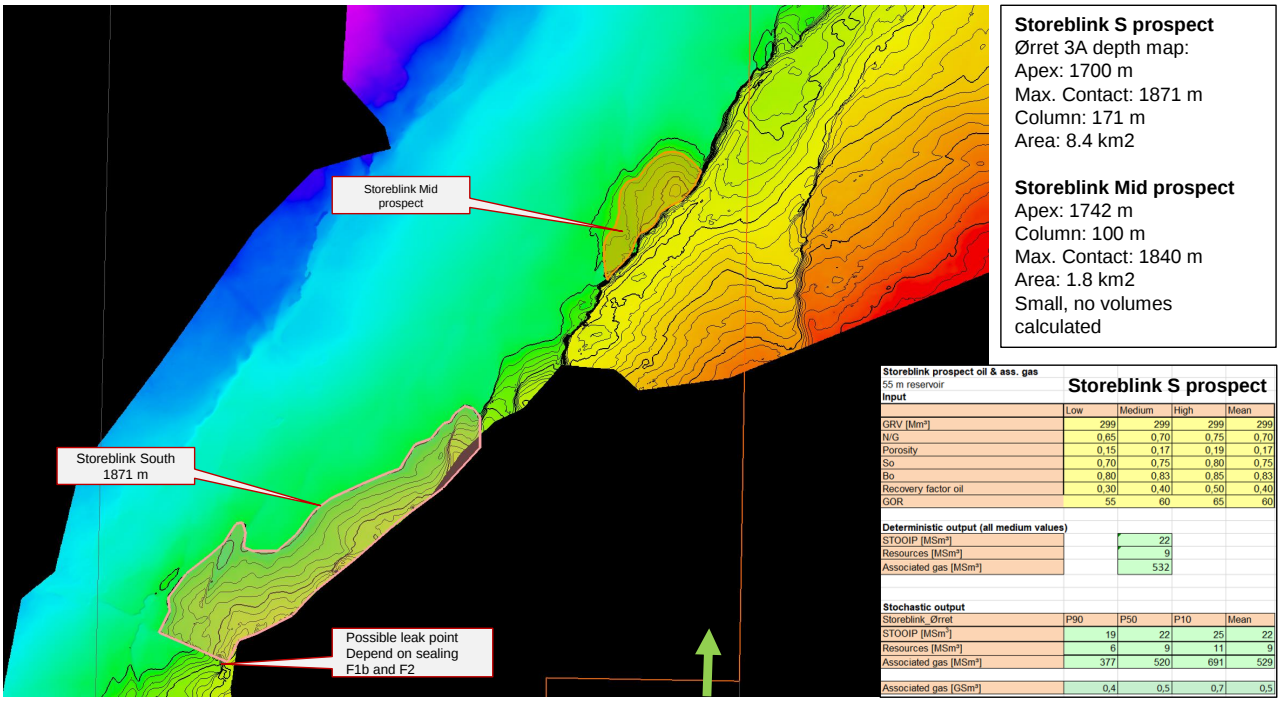


Fig. 3.2 Storeblink S Ørret prospect summary and assessment

Table 3.2 Storeblink S Ørret prospect risk

Discovery probability (fraction)	Reservoir	Trap	Charge	Retention	Probability
Storeblink South - Ørret Fm	0,9	0,25	0,55	0,8	0,10

The size of Storeblink Mid prosect is below economic interest.

Secondary prospects and leads

The prospects and leads are described in 1.3 Identified prospectivity and some are illustrated in Fig. 1.7.

<u>Storeblink S Havert/Klappmyss prospect</u>

The small hangingwall closure area is 8,4 km^2, apex at 1190 m, maximum hydrocarbon column of 90 m (Fig. 1.9). A constant reservoir thickness of 40 m is applied in the assessment. Charge is evaluated from lower to middle Triassic sources. Main risk is faults seal and self-juxtaposed reservoirs across NW-SE fault. In the prospect assessment gas (25%) and oil (75%) case was applied. Only oil volumes are reported (gas GRV are subtracted). Storeblink S prospect assessment and risk are listed in Table 3.3.

Table 3.3 Storeblink S Havert/Klappmyss prospect assessment and risk

Havert_Klappmyss reservoir				
Area: 10 km2				
Reservoir thickness: 40 m				
Storeblink S prospect oil and ass gas				
Single phase				
Input				
	Low	Medium	High	Mean
GRV [Mm³]	165	236	307	236
N/G	0,60	0,70	0,80	0,70
Porosity	0,17	0,20	0,23	0,20
So	0,70	0,75	0,80	0,75
Bo	0,80	0,83	0,85	0,83
Recovery factor oil	0,30	0,40	0,50	0,40
GOR	55	60	65	60
Deterministic output (all medium values)				
STOOIP [MSm³]		21		
Resources [MSm³]		8		
Associated gas [MSm³]		494		
Stochastic output				
	P90	P50	P10	Mean
STOOIP [MSm³]	13	20	28	20
Resources [MSm³]	5	8	12	8
Associated gas [MSm³]	293	469	718	491
Associated gas [GSm³]	0,3	0,5	0,7	0,5

Discovery probability (fraction)	Reservoir	Trap	Charge	Retention	Probability
Storeblink South – Havert/Klappmyss Fm	0,75	0,25	0,55	0,8	0,08

Lower Snadd prospect

The prospect is a 3-way hangingwall closure downflank of Storeblink (Fig. 1.7, Fig. 1.8). The prospect area is 34 km², apex at 1180 m, maximum hydrocarbon column of 110 m. The reservoir is interpreted as a fluvial, indicated by the amplitude anomaly and the nearby key well 7120/12-4. The amplitude anomaly is conform to the structure. Good reservoir quality is inferred in a 20 m gross thickness estimated from the single seismic wavelet (FP13LNR17). Seals are provided by intraformational mudrocks in the Snadd and Kobbe fms. Charge is expected from lower to middle Triassic sources. The main risk is fault seal and self-juxtaposed reservoirs across NW-SE faults. In the prospect assessment gas (25%) and oil (75%) case was applied. Only oil volumes are reported (gas GRV are subtracted). Lower Snadd prospect assessment and risk are listed in Table 3.4 .

Table 3.4 Lower Snadd prospect assessment and risk

Lower Snadd prospect
Area: 34 km²

Lower Snadd prospect oil and ass gas
Multiple phase

Input

	Low	Medium	High	Mean
GRV [Mm³]	411	587	763	587
N/G	0,60	0,70	0,80	0,70
Porosity	0,17	0,20	0,23	0,20
So	0,70	0,75	0,80	0,75
Bo	0,80	0,83	0,85	0,83
Recovery factor oil	0,30	0,40	0,50	0,40
GOR	55	60	65	60

Deterministic output (all medium values)

STOOIP [MSm³]	51
Resources [MSm³]	20
Associated gas [MSm³]	1228

Stochastic output

	P90	P50	P10	Mean
STOOIP [MSm³]	33	50	69	51
Resources [MSm³]	12	20	30	20
Associated gas [MSm³]	726	1173	1774	1219
Associated gas [GSm³]	0,7	1,2	1,8	1,2

Discovery probability (fraction)	Reservoir	Trap	Charge	Retention	Probability
Lower Snadd prospect	0,85	0,25	0,55	0,7	0,08

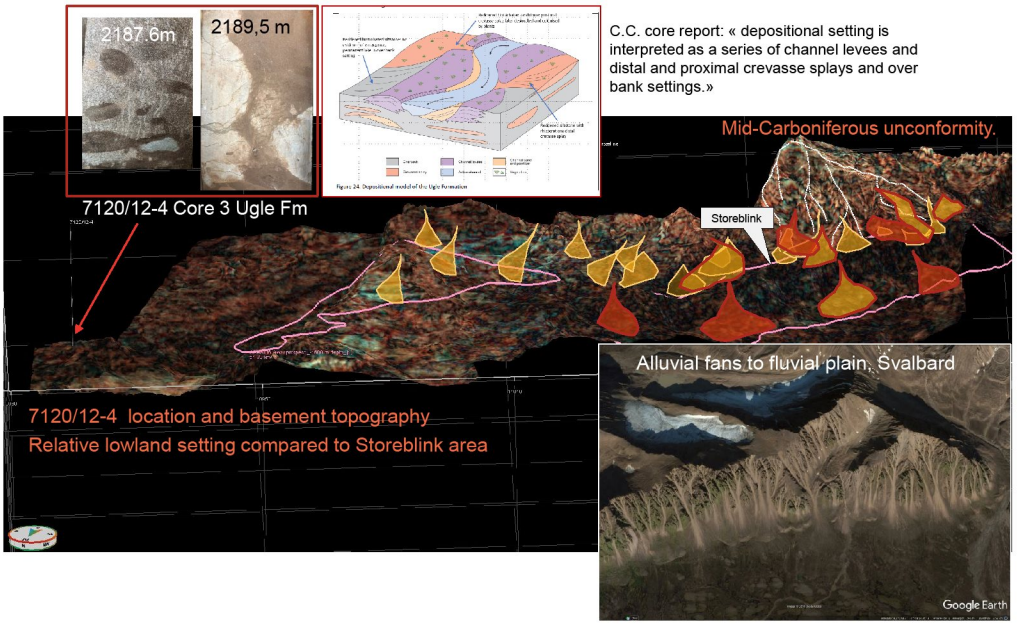


Fig. 3.3 Carboniferous-Basement Ugle lead reservoir model

Ørret Fan leads A and B

The leads A and B are illustrated in Fig. 1.10. The areas are 7 km² lead A and 35 km² lead B. The reservoir is interpreted as fan deposits inferred to be detached from clinoform packages and overlying sheet sands of Ørret 3a. The trap is stratigraphic with high risk on the top seal. Top seal may be provided by Ørret mudrocks. Charge is possible from the lower to middle Triassic kitchen. Volumes are not estimated.

Carboniferous-Basement Ugle lead

The lead consist of several small stratigraphic onlap traps updip of Storeblink and is summarized in Fig. 1.11. The Ugle Fm is proposed to contain reservoir facies in possible exposed and weathered basement rocks. A prominent relief with NW-SE trending ridges and valleys are observed and may contain sandy alluvial deposits (Fig. 3.3). Charge to the lead, trap and reservoir presence are all seen as high risk. Volumes are not estimated.

4 Conclusion

The evaluation of reprocessed 3D seismic data together with geological and geophysical studies such as: petroleum systems analysis, reservoir evaluation, rock physics, and structural fault seal analysis have not de-risked the Storeblink prospect. As a result of a structural study, the Storeblink Ørret prospect volumes were reduced to 6-9 Sm^3 rec. oil (Storeblink S). No other stand alone prospectivity are observed in the licence acreage. Based on the limited remaining resource potential with associated high risk, the licence group agreed to relinquish the licence.

5 References

FIT, A stratigraphic reconstruction of bulk volatile chemistry from fluid inclusions in: 7119/12-2, 2008

FIT, A stratigraphic reconstruction of bulk volatile chemistry from fluid inclusions in: 7120/12-4, 2009

Cambridge Carbonates, Late Palaeozoic Sedimentology of 7128/4-1, 2011.

Cambridge Carbonates, Late Palaeozoic Sedimentology of 7128/6-1, Vol. 1 & 2, 2011.

Cambridge Carbonates, Late Palaeozoic Sedimentology of 7229/11-1, Vol. 1 & 2, 2011.

Lundin Norway, APA 2013 Ringvassøy Application, September 2013

FIT, A stratigraphic reconstruction of bulk volatile chemistry from fluid inclusions in: 7119/12-4, 2015

Lundin, PL764 & PL766: Seabed studies relevant to petroleum exploration and field development, 2016

APT, Geochemistry Data Report – Analysis of Ditch Cuttings from Wells 7120/12-2 and 7120/12-4, 2018

Cambridge Carbonates, Sedimentology and reservoir quality of cores 1, 2, and 3; well 7120/12-4, SW Barents Shelf, 2018.

Badleys, Fault Seal Analysis of Storeblink Prospect, PL764 Lundin, October 2019.