wintershall

SURRENDER REPORT

PL 734

Lundin Norway

centrica energi

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1 Key License History

Production License 734 was awarded to Wintershall Norge AS (operator 40%), Lundin Norway AS (30%) and Centrica Resources (Norge) AS (30%) with the APA 2013, and became effective on the 7th of February, 2014. DoD was 07.02.2016. The License is valid until 07.02.2021. Decision to concretize (BoK) is 07.02.2018.

The license acreage is located in part of block 10/4 in the Egersund Basin of the Southern North Sea (Fig. 1.1), and covers an area of 284.674 km². The initial work commitment included the acquisition and/or re-processing of 3D seismic data that covered the licensed acreage (Fig. 1.2).

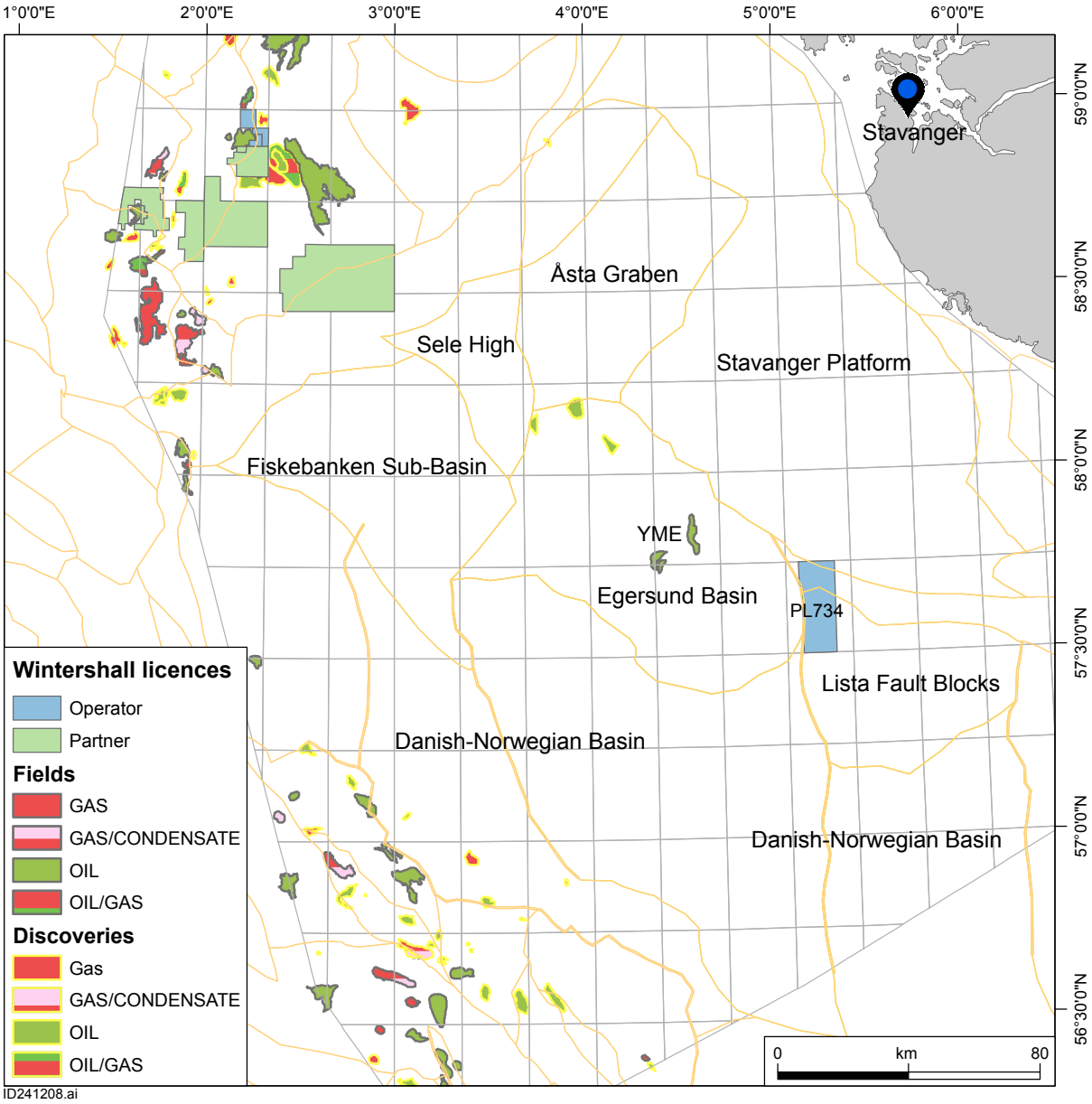

Fig. 1.1 Location Map PL 734, Egersund Basin, Southern North Sea

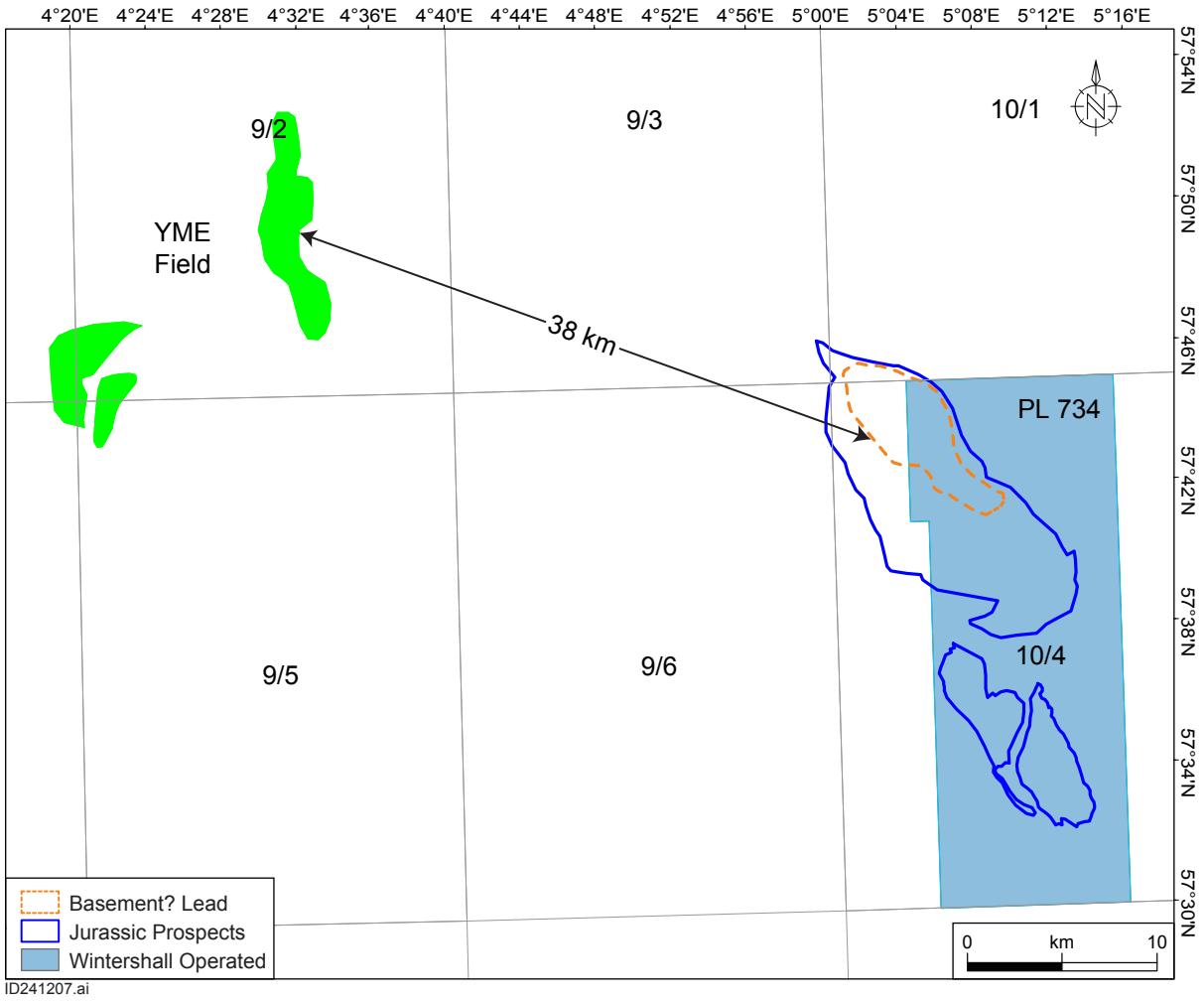

Fig. 1.2 Location Map for PL 734
with outlines of major identified and assessed prospects

This initial work commitment was fulfilled with the purchase, in 2014, of the 3D survey PSDM EGB RE 2013 by PGS (Fig. 2.1).

Held Meetings Table:

Table 1.1 Overview of held meetings in PL 734

Kick-off Meeting	**31.03.2014**
EC/MC Meeting	06.11.2014
MC Zeppelin Well 10/4-1 Drilling Program	02.06.2015
MC Zeppelin 10/4-1 Well Results and PL 734 Way Forward	19.11.2015
EC Meeting Presentation and Discussion of Post Well 10/4-1 Studies	13.09.2016
MC/EC Meeting	06.12.2016

As previously noted, the initial license period started on the 7th of February, 2014 and it is now recommended to end at the end of January, 2018. During this period one site survey (WIN14302/8070, by Fugro) was acquired in 2015 and one exploration well, 10/4-1, was drilled and completed in the same year. Further on in 2016, results of the 10/4-1 well, as well as additional geological and geophysical studies were used for the evaluation of the remaining hydrocarbon potential in the acreage.

Well 10/4-1 targeted the Middle Jurassic Sandstones Play Model of the Bryne and Sandnes formations within the "Zeppelin" Prospect, an elongated NW - SE horst block dipping SW. This Play Model is proven in the nearby Yme Field about 38 Km to the northwest. The Zeppelin Prospect had, at time of application, an attractive hydrocarbon potential of 247 MM STB (Recoverable, Most Likely), as well as an upside of 570 MM STB (Recoverable, P10). Probability of geological success (GPOS) was 28%, with major geological risk interpreted to be the lack of adequate charge to fill the structure. The well (Borgland Dolphin Drilling Rig) spudded on the 20th of June, 2015 in 100 m of water and reached a T.D. of 2415 m (RKB) in sedimentary rocks of Permian age (Zechstein Group). The well was completed on the 12nd of July, 2015. Drilling days were 23. Good sandy reservoirs were encountered in the Sandnes and Bryne formations, as predicted, but no hydrocarbons were detected (Fig. 1.3).

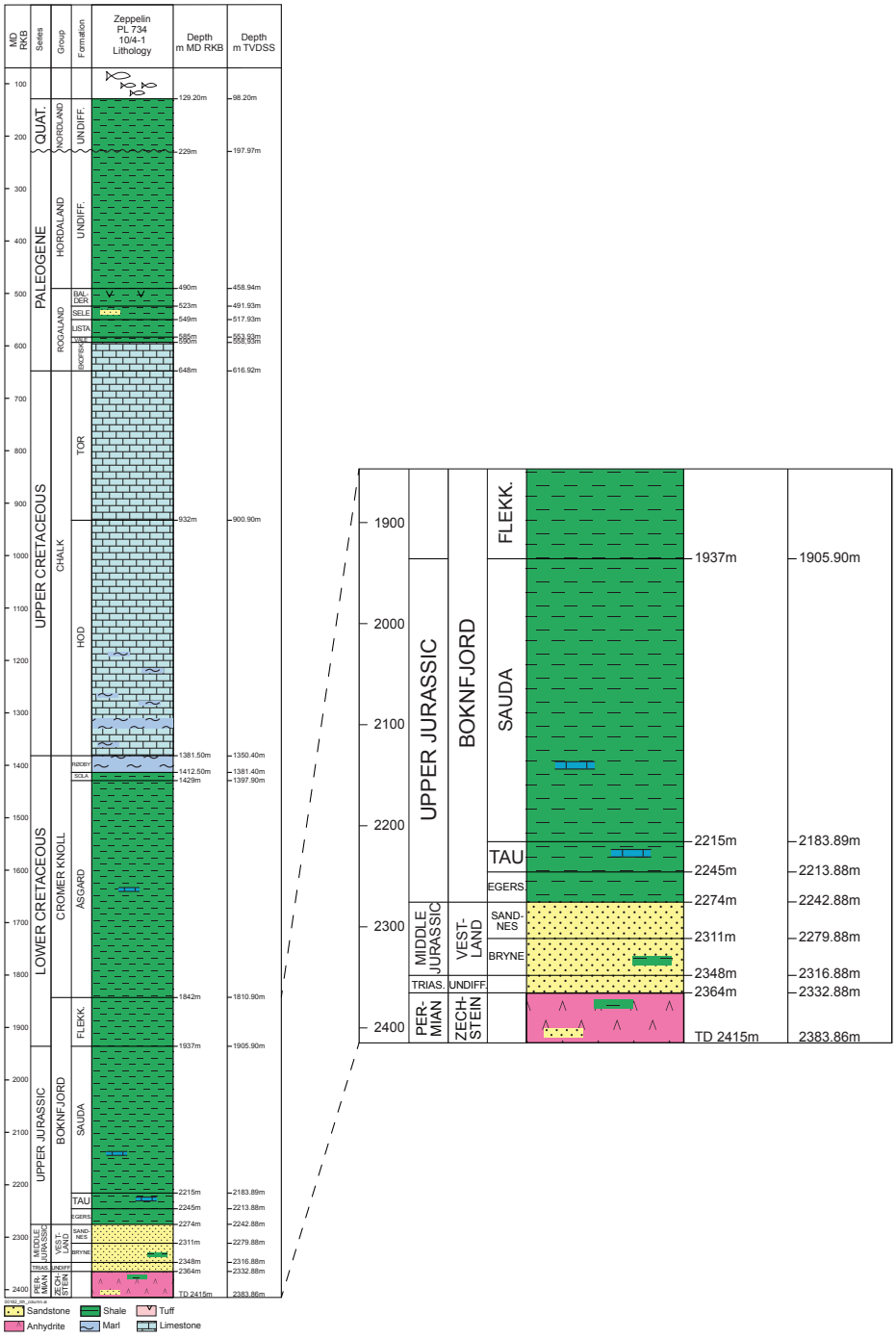

Fig. 1.3 Lithostratigraphy, Well 10/4-1

In addition to other prospects evaluated during the APA Round 2013 (3 Review of Geological and Geophysical studies), an additional opportunity was identified and evaluated during 2015-2016. This is the Gamma Ray Prospect at Upper Permian level (Zechstein Group) within the "Zeppelin" horst block. As none of these opportunities is considered to be economically attractive at this time of writing (January 2017), Wintershall Norge AS has proposed to fully surrender this Production License early 2018. This proposal has been endorsed by all other partners in the license.

2 Database

2.1 Seismic data

The initial work commitment in PL 734 consisted of the acquisition/purchase of re-processed 3D seismic to cover the acreage. In 2014 the PL 734 Partnership agreed to purchase part of the PSDM EGB 2013 (PGS) that covers the acreage (Fig. 2.1). This purchase fulfilled the work obligation.

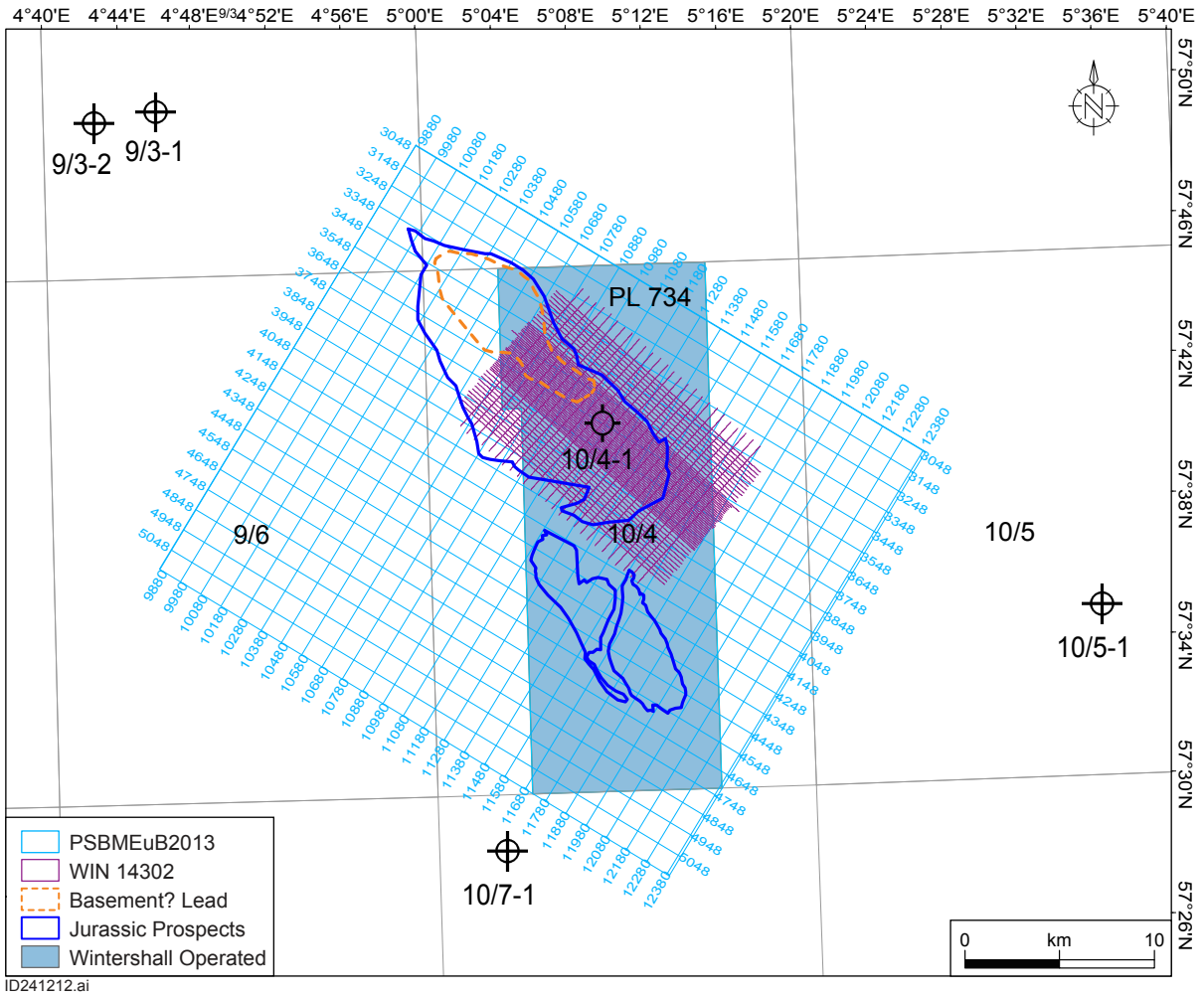

Fig. 2.1 PL 734 seismic Database

In preparation for well 10/4-1, a seismic site survey (WIN14302/8070) was acquired by Fugro on behalf of PL 734 in 2014.

Table 2.1 PL 734 Seismic Database

Seismic Survey Name	NPDID	Category
PSDM EGB2013	4294	SPEC
WIN14302	8070	Site Survey/Owned

2.2 Well data

The well database consists of the following wells:

Table 2.2 PL 734 Well Database

Well Name	NPDID
9/2-1	1038
9/2-11	6341
9/3-1	921
9/3-2	5173
10/5-1	306
10/7-1	1972
16/3-8	7302

2.3 Special studies

In addition to seismic interpretation, biostratigraphy, and petrographic thin sections, 3D seismic inversion, AVO analysis, and geochemical studies were carried out in order to evaluate the hydrocarbon potential of the acreage

Table 2.3 Special Studies in PL 734

Study	Author	Date
Spectra Log Evaluation 10/4-1	Spectra-Map	December 2015
SpectraMap Special Study 10/4-1 Mud and 9/2-1 Oil Comparison	Spectra-Map	March 2016
Amendment Including Yme Oils and wells 10/5-1 and 10/7-1	Spectra-Map	April 2016
Post Drill Well Evaluation of HC contents in cuttings 10/4-1 Zeppelin	UiO - D.A. Karlsen	March 2016
Amendment - Some Petroleum Geochemical Data from the North Sea on Dry Wells 10/5-1, 10/7-1 and oils from 9/2-1 and 9/2-3	UiO - D.A. Karlsen	March 2016
Fluid Inclusions in wells 10/4-1, 10/5-1 and 10/7-1- New evaluation Core Extract from 10/4-1	UiO - D.A. Karlsen	December 2016
Biostratigraphic Evaluation of well 10/4-1 "Zeppelin", NOCS	Ichron	February 2016
Well 10/4-1 Petrography and Infrared Analysis of Zechstein Cutting Samples	Wintershall	June 2016
AVO and Inversion Study	Wintershall	November 2016

3 Review of Geological and Geophysical studies

Geological Background

Block 10/4 is located in the south-eastern part of the Egersund Basin in the Southern North Sea (Fig. 1.1). The Egersund Basin trends NW - SW and it is bounded by the Sele High and Åsta Graben to the north west, the Stavanger Platform to the east, the Fiskebanken Sub-basin (Danish - Norwegian Basin) to the west and the Lista Fault Block Complex to the south. Its northern flanks represent the continuation of the Fjerritslev Fault Zone, which is in turn linked to the Sorgenfrei - Tornquist Fault Zone more to the south east (Denmark and Kattegat areas), these latter faults being interpreted as transtensional and transpressional fault zones developed during Permian and likely older times. The Egersund Basin is therefore here interpreted as a pull-apart basin, filled during the Late Palaeozoic and Mesozoic and successively inverted during the Late Paleogene - Early Neogene. Subsequent uplift and tilt occurred during the Late Neogene because of glacioeustatic rebound. Presence of mobile Permian evaporites affected and accentuated faulted structures as well as created salt diapirs, the latest being the main targets during the initial phases of exploration of the area (Ex.: Yme Field).

The sedimentary fill, unconformably resting above a metamorphic Caledonian Basement (Ex.: nearby well 10/5-1), consists of the Upper Permian Rotliegend and Zechstein Groups (continental and marine deposits of the Rotliegend, Kupferschiefer-source-rock? and Zechstein, this latter a potential reservoir); Triassic Hegre Group (mostly continental deposits); Lower Jurassic Dunlin Group (transitional to shallow marine deposits); Middle Jurassic Vestland Group (transitional to shallow marine sediments of the Bryne and Vestland formations, main reservoirs); Upper Jurassic Viking Group (marine shales, Egersund and Tau formations, main source rocks); Cretaceous Boknfjord, Cromer Knoll and Shetland groups (marine shales and calcareous oozes); Paleogene Rogaland Group (marine shales and volcanics); Oligo - Miocene Hordaland Group (prevailing marine shaly deposits); and Miocene - Pleistocene glacio-marine deposits of the Nordland Group (Fig. 3.1).

LITHOSTRATIGRAPHIC CHART NORWEGIAN NORTH SEA

NPD 2014

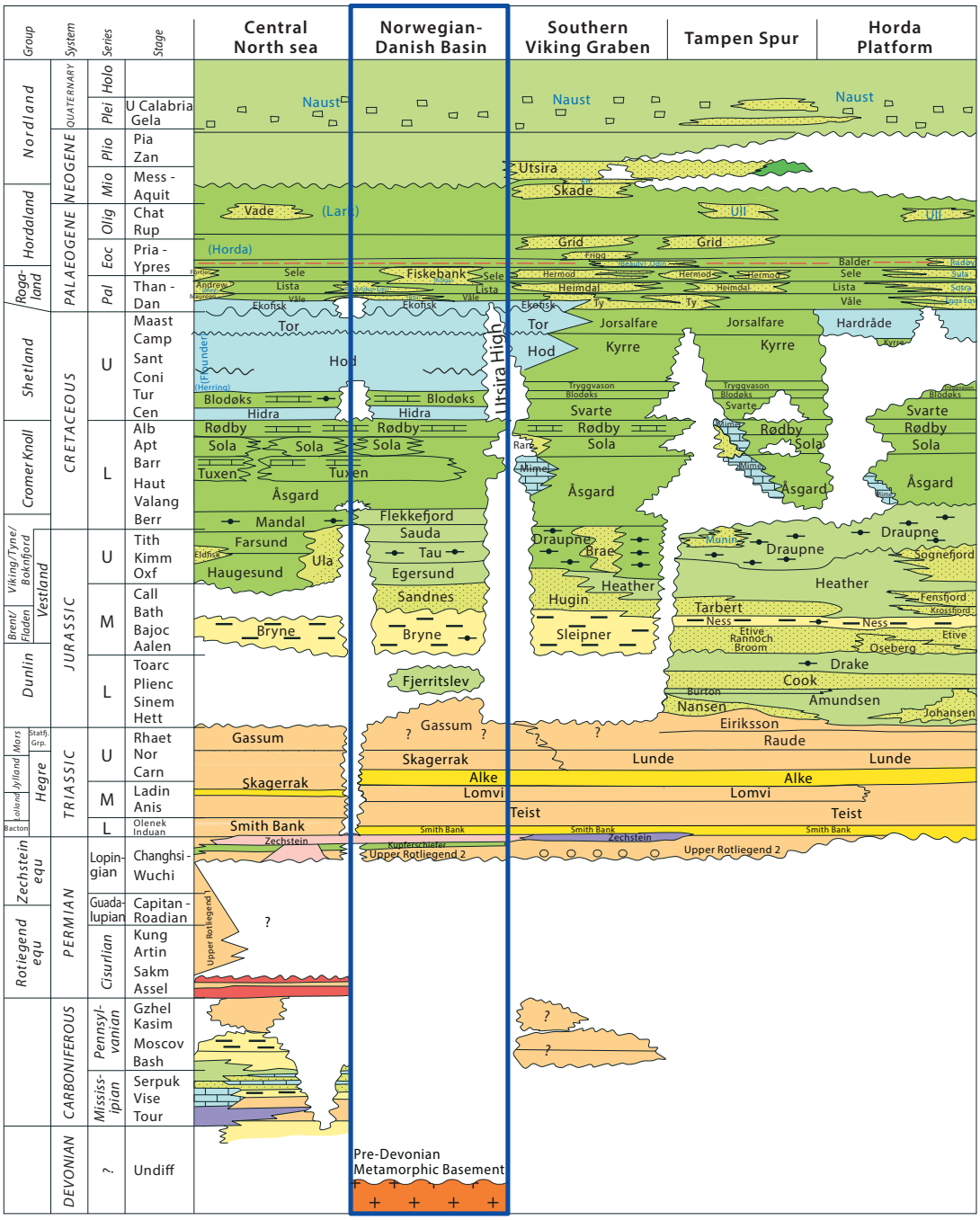

Fig. 3.1 Stratigraphic Chart for the North Sea from NPD (2014), slightly modified.

Hydrocarbon Prospectivity

The main Play Model in this basin is represented by Middle Jurassic marine sandstones of the Vestland Group, as proven by the nearby Yme Field. Traps are salt-induced- and faulted blocks. Hydrocarbon charge is provided by Upper Jurassic organic-rich shales of the Tau Formation. Top seals are the Egersund and Tau shales. Although commercial oil accumulations have been proven in this basin, the total amount of hydrocarbons expelled to fill other potential structures

has always been considered a challenge, as the fully mature hydrocarbon kitchen is areally limited. The Late Neogene uplift and tilt to the north east, as a consequence of the glacioeustatic rebound of the Scandinavian mainland, has been considered as a new mechanism that could have facilitate hydrocarbon migration from the basin deeps towards the north eastern basin flanks. This was the main new concept for charging of the Zeppelin structure.

Three main prospects within this play model were identified at time of Application, namely Zeppelin, Chton and Zyklon (Fig. 3.2). Zeppelin was tested by well 10/4-1 and proved to be dry. Consequently, geochemical analysis of rock- and fluid samples from the 10/4-1 well and nearby wells were subsequently carried out to address any occurrence of charge. Results of these studies were intended to address the charge risk for the other recognised opportunities in the acreage.

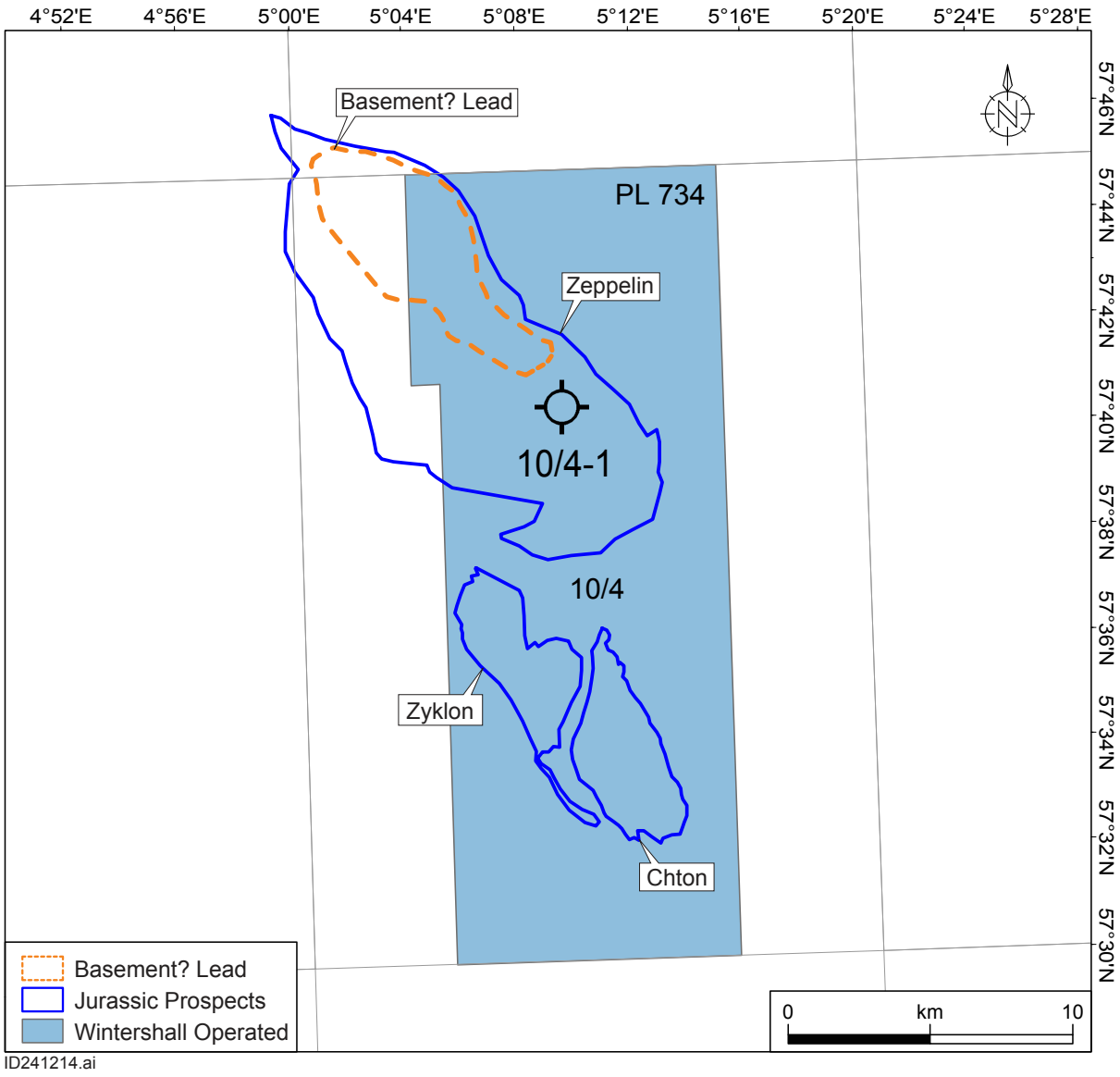

Fig. 3.2 Main Identified Prospects and Leads in PL 734 at time of APA 2013 Application

The secondary play model is represented by the sub-aerially exposed carbonates of the Zechstein Group. Traps are faulted blocks. The 3D seismic PSDM EGB 2013 indicated hummocky seismic facies, at Zechstein level, that could be interpreted as exposed carbonate build-ups within a three-way dip-closure, i.e., the Gamma Ray Prospect (Fig. 3.2;Fig. 4.6; Fig. 4.7). Hydrocarbon charge would have been provided either by the Upper Jurassic Tau shales

or by the Upper Permian Kupferschiefer shales (yet unproven as an effective source rock in this basin). This play model is proven in the Johan Sverdrup Field onto the Utsira High, on the UK side of the Southern North Sea (Ex.: Argyll and Auk oil fields), as well as further south (in Denmark, The Netherlands, Germany and Poland onshore). It is tested but not proven as yet in the Egersund Basin.

Early reconnaissance AVO work in 2015 on the PSDM EGB 2013 seismic data set indicated the presence of an AVO seismic anomaly within the build-up seismic facies at Zechstein level. Therefore, a geophysical AVO and Inversion study was carried out to further address the presence of potential porous layers and their hydrocarbon fill.

Geological and Geophysical Studies

Geochemistry

IR spectrometry (Spectra Map, UK, three studies and reports) and Fluid Inclusion (Prof. D.A. Karlsen, UiO, three reports) were carried out to detect and evaluate any presence of hydrocarbons in the penetrated section of well 10/4-1. In addition, oil samples from the Yme Field (DST`s from wells 9/2-1 and 9/2-3) were analysed for correlation (both SpectraLog and GC/Fluid Inclusions). Cutting samples from wells 10/5-1 and 10/7-1 were also analysed. Extracts from these cuttings indicated the presence of asphaltenes from a migrated oil within Zechstein dolomitised grainstones as well as within the Upper Cretaceous Shetland/Chalk section (Fig. 3.3). Results from the IR spectrometry from well 10/4-1 were deemed ambiguous (the well was drilled with an oil-based mud). Results from the Fluid Inclusion study indicated the presence of migrated thermogenic hydrocarbons (light oils and gases) within the Cretaceous, Jurassic and Permian sections in well 10/4-1, and likely generated from the Draupne Formation shales. Although confirming the presence of migrated thermogenic hydrocarbons, these studies could not adress their amount. Therefore, the main charge risk remains unchanged.

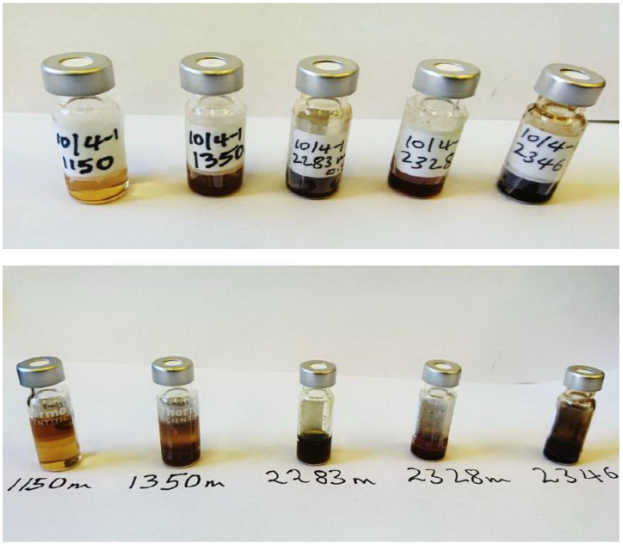

Figure 1b: *DCM:MeOH (93:7%) cutting extracts from well 10/4-1, analyzed in the previous repor – shown here for comparison. If the same mud system was used throughout the investigated sample-intervals, then core or cutting samples will normally have the same slight yellowish or greenish colours. In this case are the bitumen extracts dark coloured – a factor clearly indicating that some oil exists in the section as a residual system. Note that it is the asphaltenes which are responsible for the colouration.*

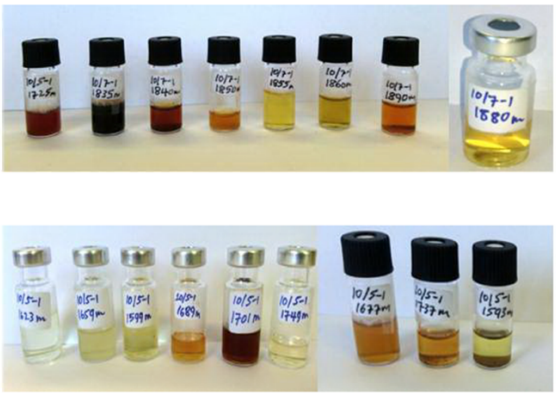

Figure 1a: *DCM:MeOH (93:7%) cutting extracts from well 10/5-1 and 10/7-1. See Table 2 for description of lithology. GC-FID data and chromatograms of selected samples follow below.*

Note that in case the same mud system was used throughout the investigated sample-intervals, it is normally the case that the mud system would produce similar type of colouration of the cutting extracts. This is not the case here. This could indicate that real migrated HC-compounds invaded the strata concerning some of the samples.

Alkanes are producing no colour or slight yellowish extracts (e.g. as for diesel), aromatic HCs produce yellow to greenish extracts, while asphaltenes from black-oil produce brownish to black extracts.

It is concluded that the darker colour of the extracts could represent migrated oil, and in particular asphaltenes from a migrated oil.

Fig. 3.3 Cutting Extracts from wells 10/4-1, 10/5-1 and 10/7-1 showing presence of migrated oil

Inversion and AVO Study

A seismic inversion and AVO study was carried out by Wintershall in Kassel, Germany in 2016. The goal was to identify porous zones with hydrocarbon fill within the Gamma Ray Prospect at Zechstein level. Well 16/3-8 from the Johan Sverdrup field (with oil in porous Zechstein

dolomites) was used for calibration for porous zones with hydrocarbons within Zechstein seismic facies (Fig. 3.4). Results of this study indicate that: 1) It is very likely that the seismic build-up facies within the Gamma Ray Prospect correspond to layers of porous dolomites within organogenic build ups, different from the Permian section encountered by well 10/4-1 at Zechstein level; 2) the AVO anomaly at this level is structurally conformable; and 3) it is impossible to determine any fluid content. Consequently, these results only confirmed the presence of potential reservoir layers but not of their potential hydrocarbon content.

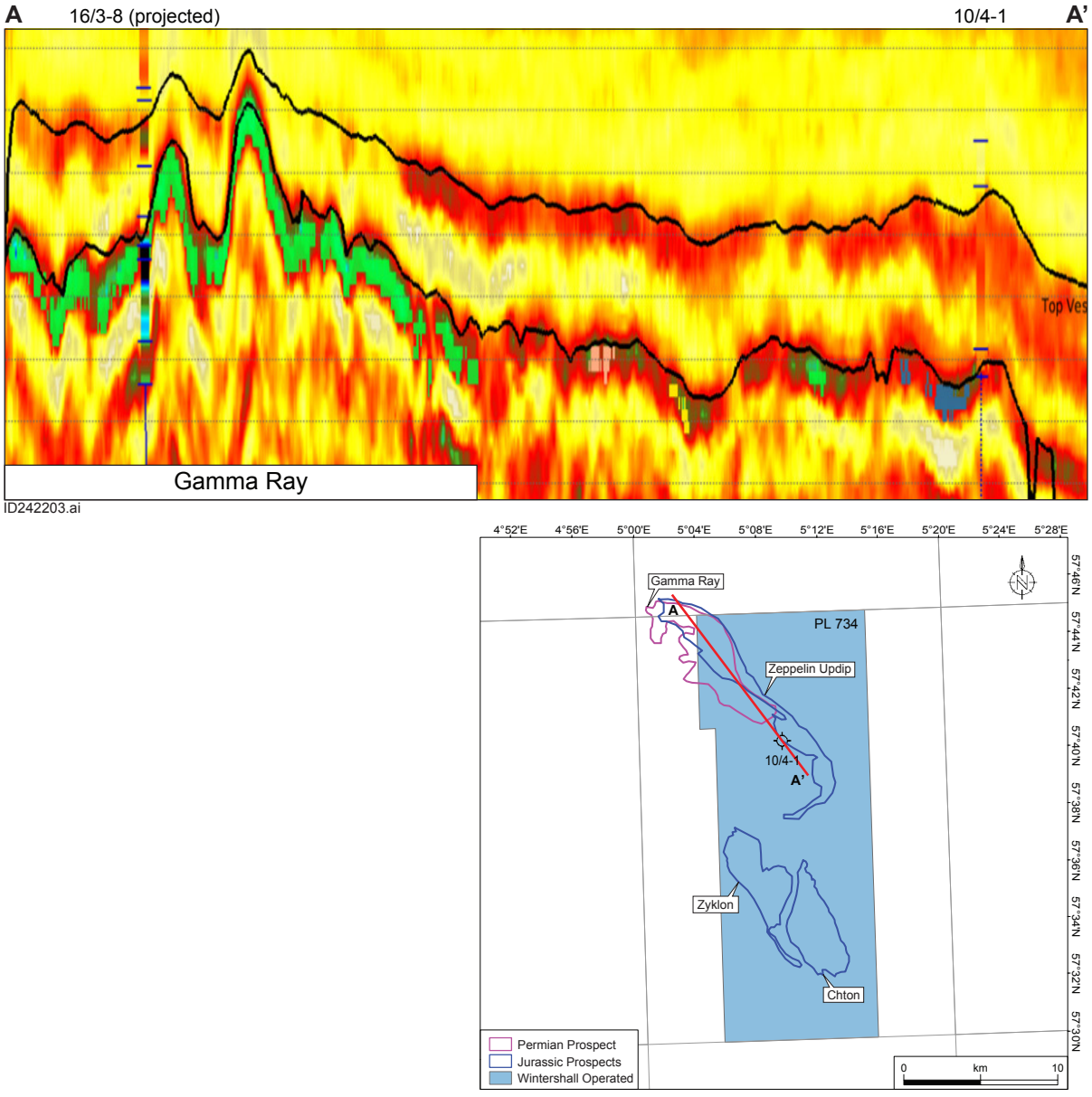

Fig. 3.4 Inversion Volume

4 Prospect Update report

In the 2013 APA Application, three main prospects were identified and assessed, namely Zeppelin, Chton and Zyklon. All three represented salt induced, faulted blocks. Main targets were the Middle Jurassic shallow marine sandstones of the Vestland Group (Sandnes and Bryne formations). At this time of writing in January 2017, the Zeppelin Updip (i.e., the updip volumes left untested by well 10/4-1) and the Zyklon and Chton are the remaining untested prospects (Middle Jurassic Play Model) within the PL 734 acreage (Fig. 4.1; Fig. 4.2; Fig. 4.3; Fig. 4.4; Fig. 4.5).

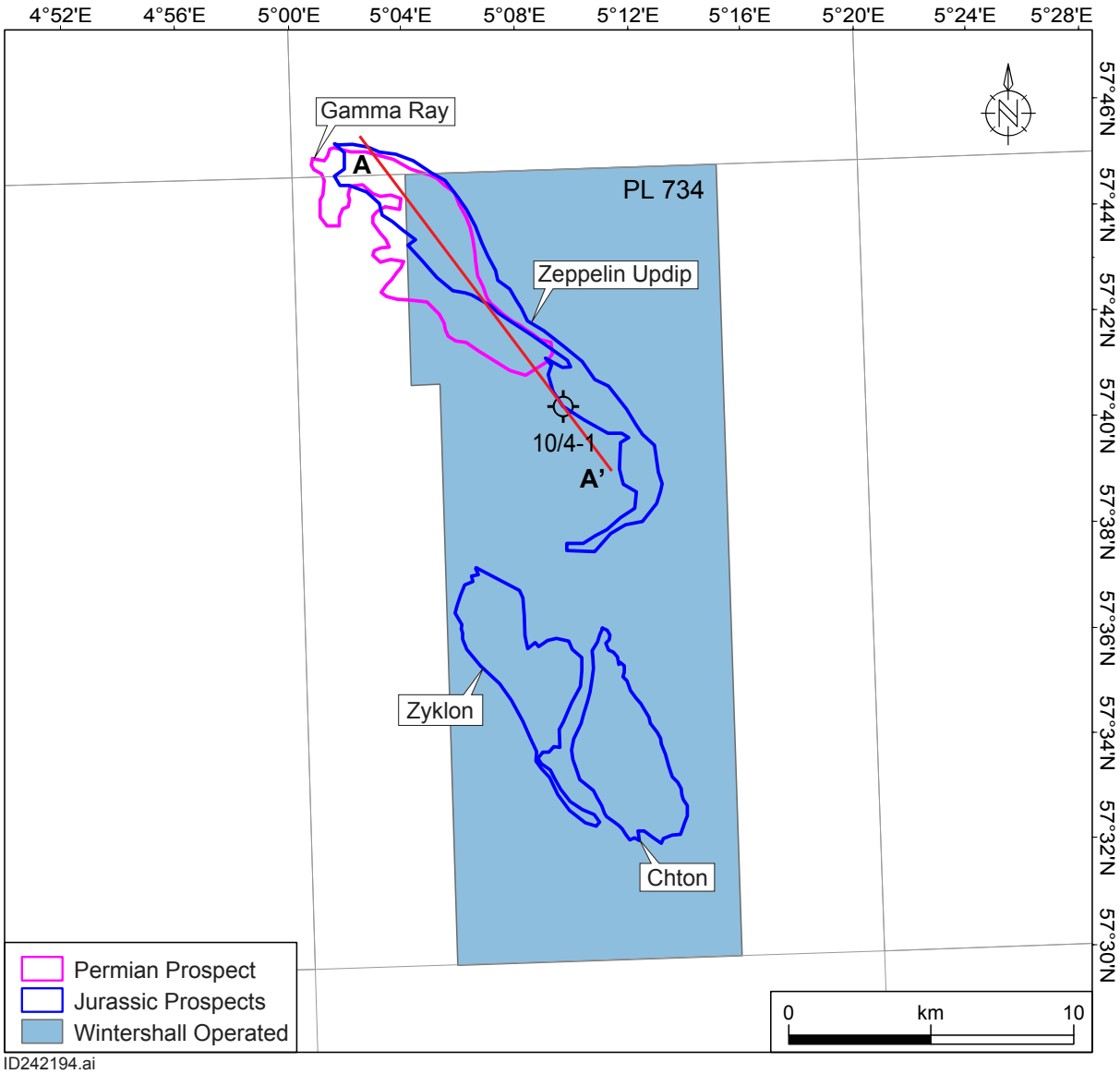

Fig. 4.1 Remaining Prospects in PL 734 Acreage Jan 2017

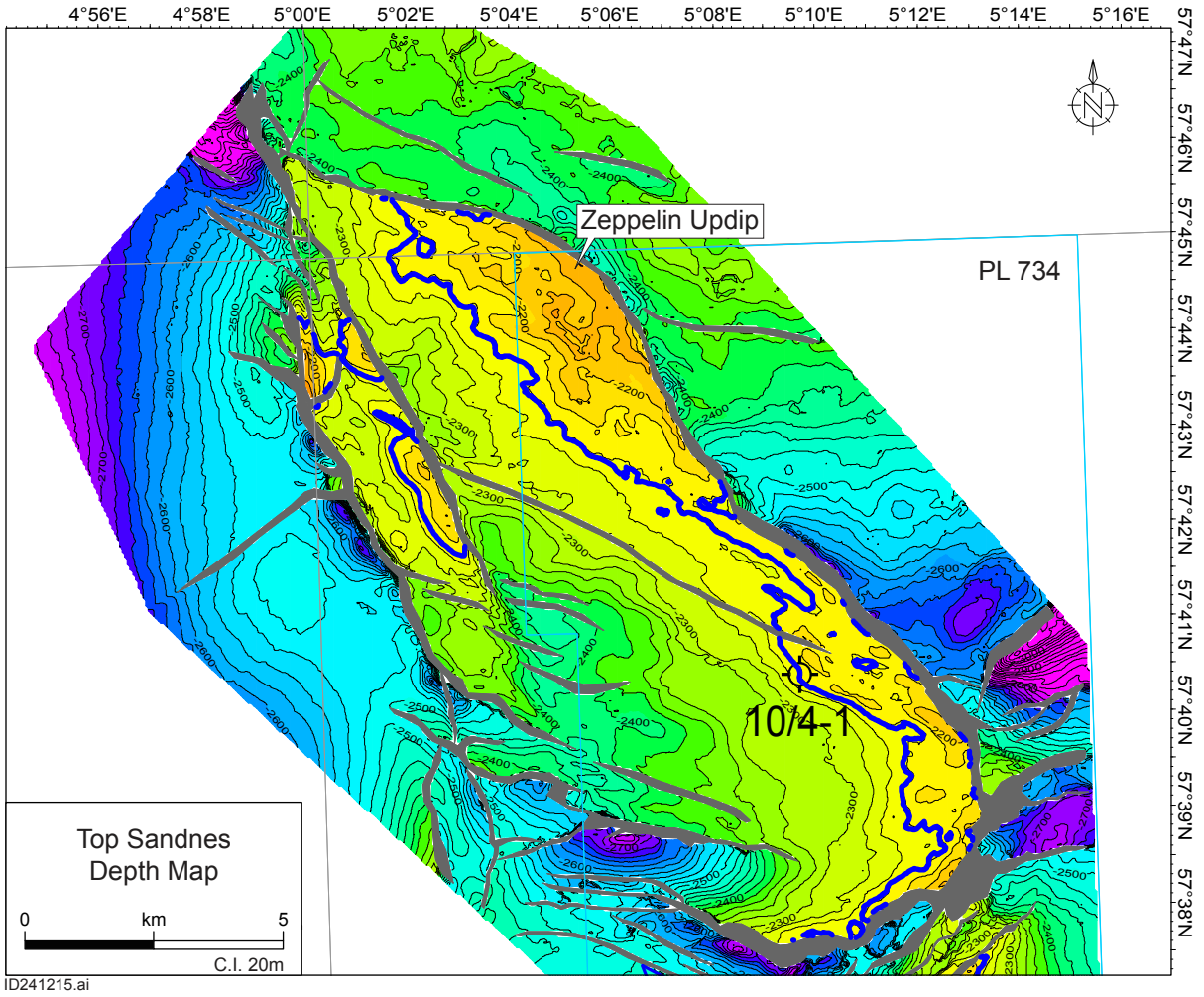

Fig. 4.2 Zeppelin Updip Prospect
Untested by Well 10/4-1. The blue contour represents the WUT

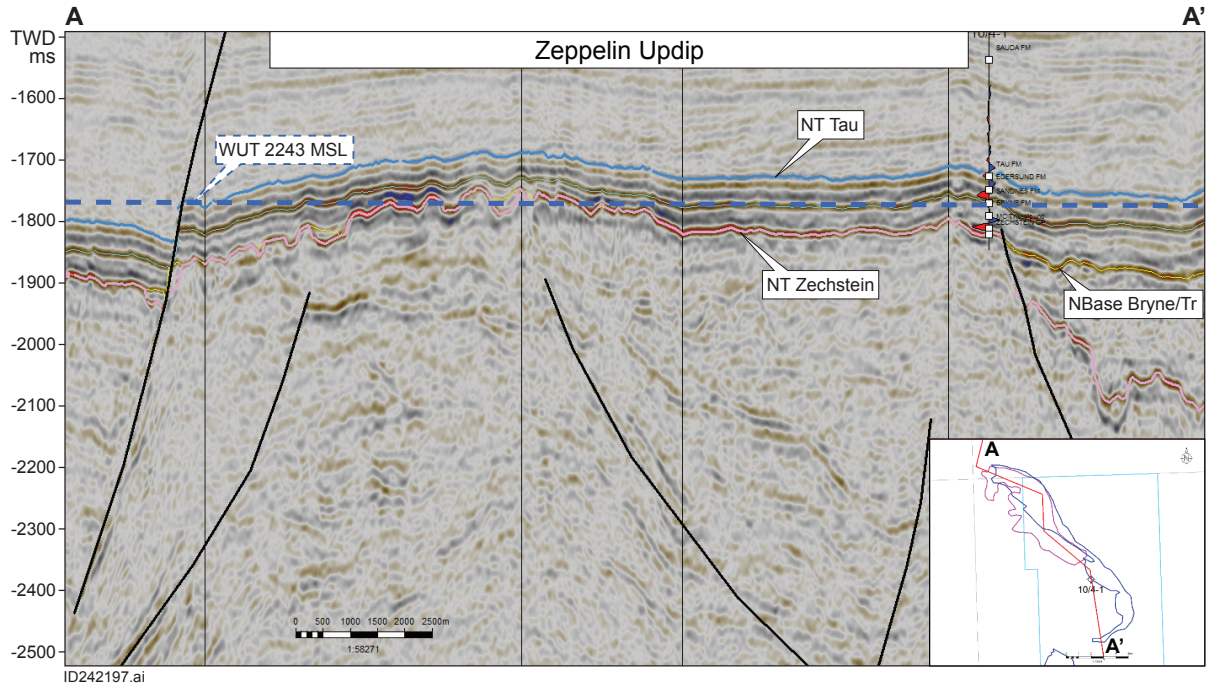

Fig. 4.3 Zeppelin Updip Prospect

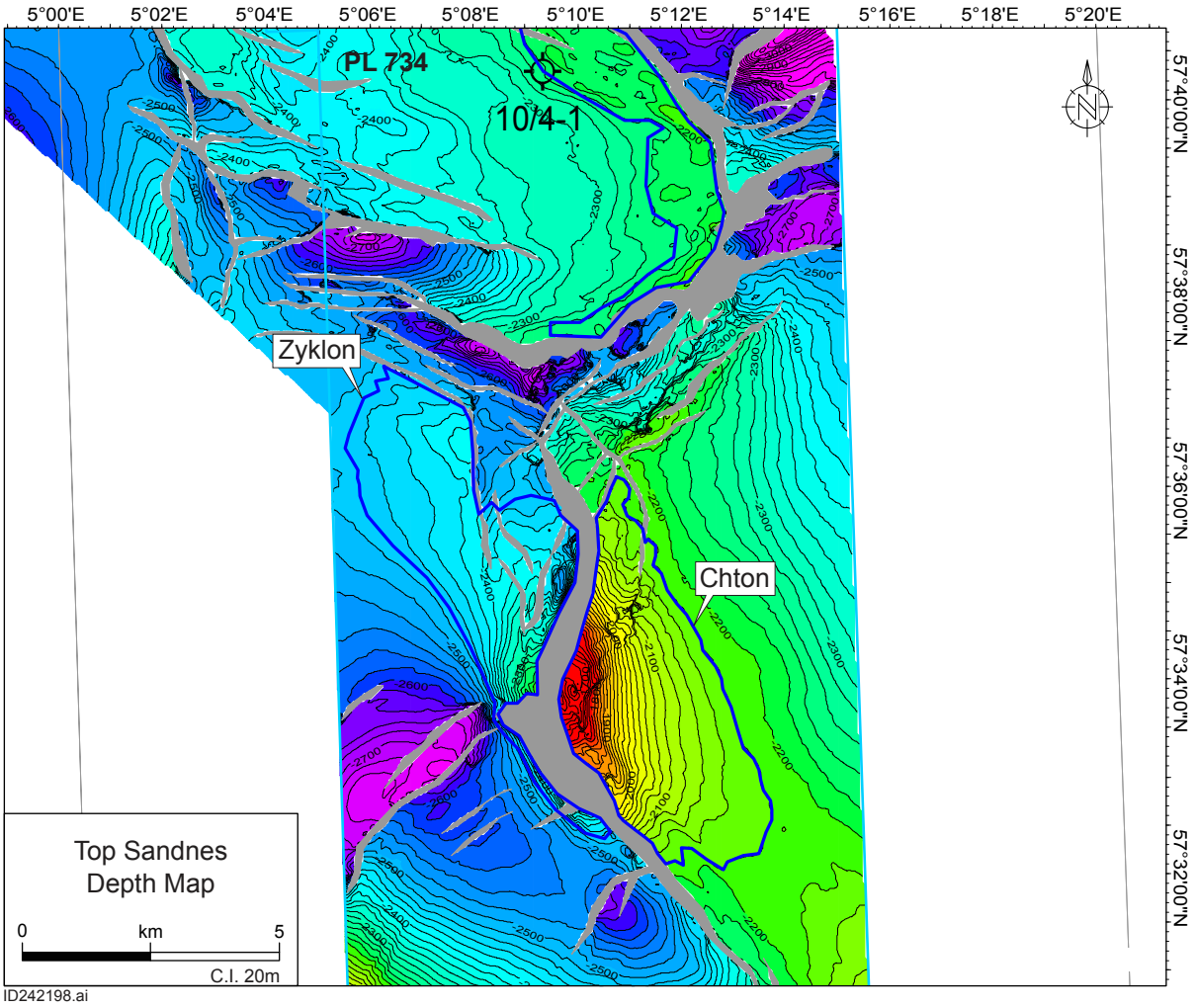

Fig. 4.4 Top Sandnes Depth Map, Zyklon and Chton Prospects

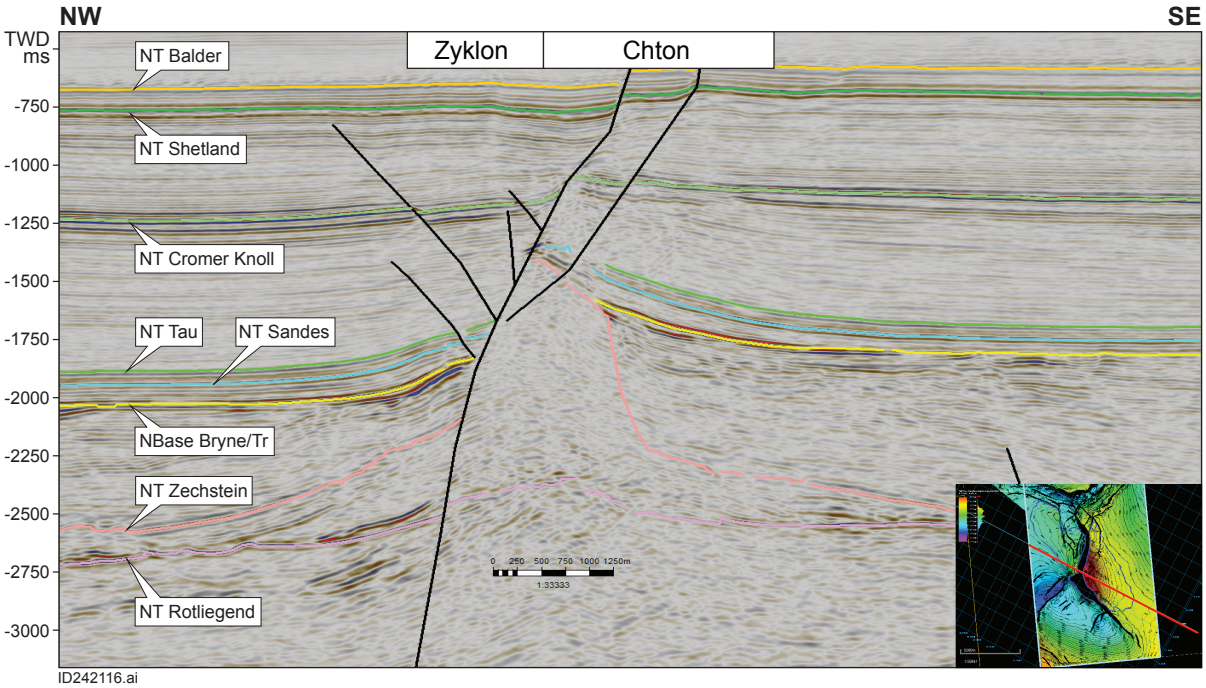

Fig. 4.5 Chton and Zyklon prospects

In addition, the Gamma Ray Prospect, with main targets represented by porous limestones and dolomites of the Upper Permian Zechstein Group, was identified and evaluated during 2015 and 2016 (Fig. 4.6; Fig. 4.7).

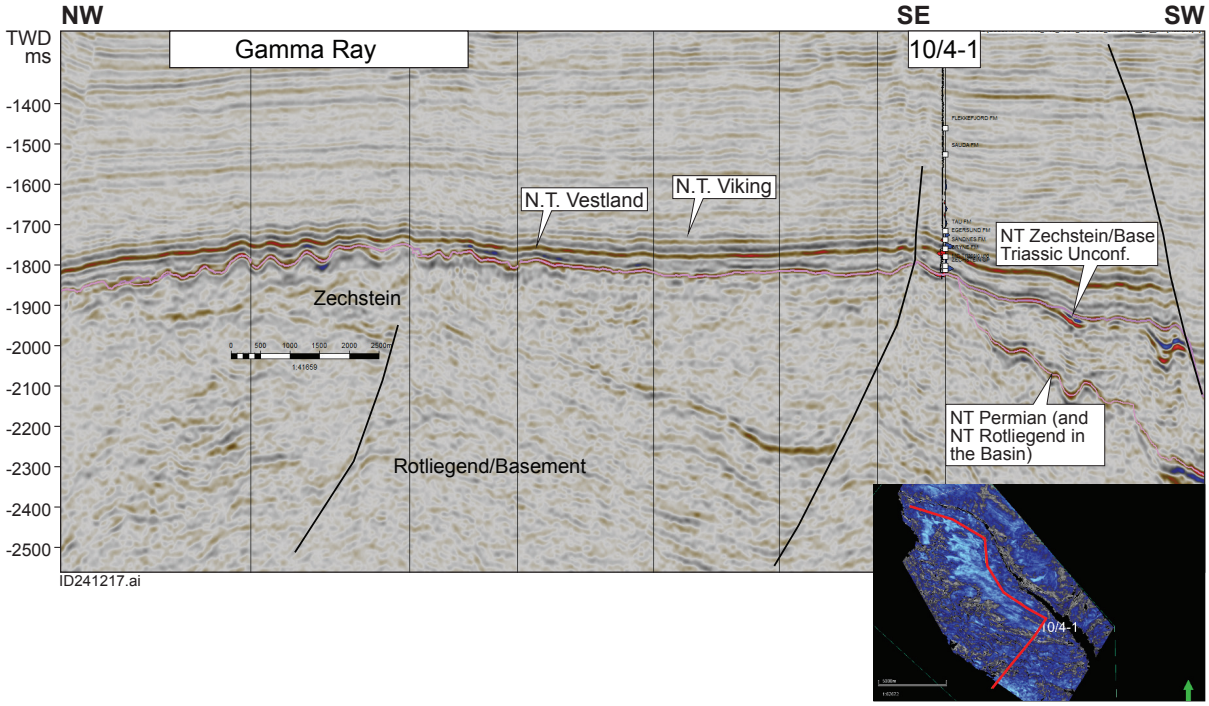

Fig. 4.6 Gamma Ray Prospect

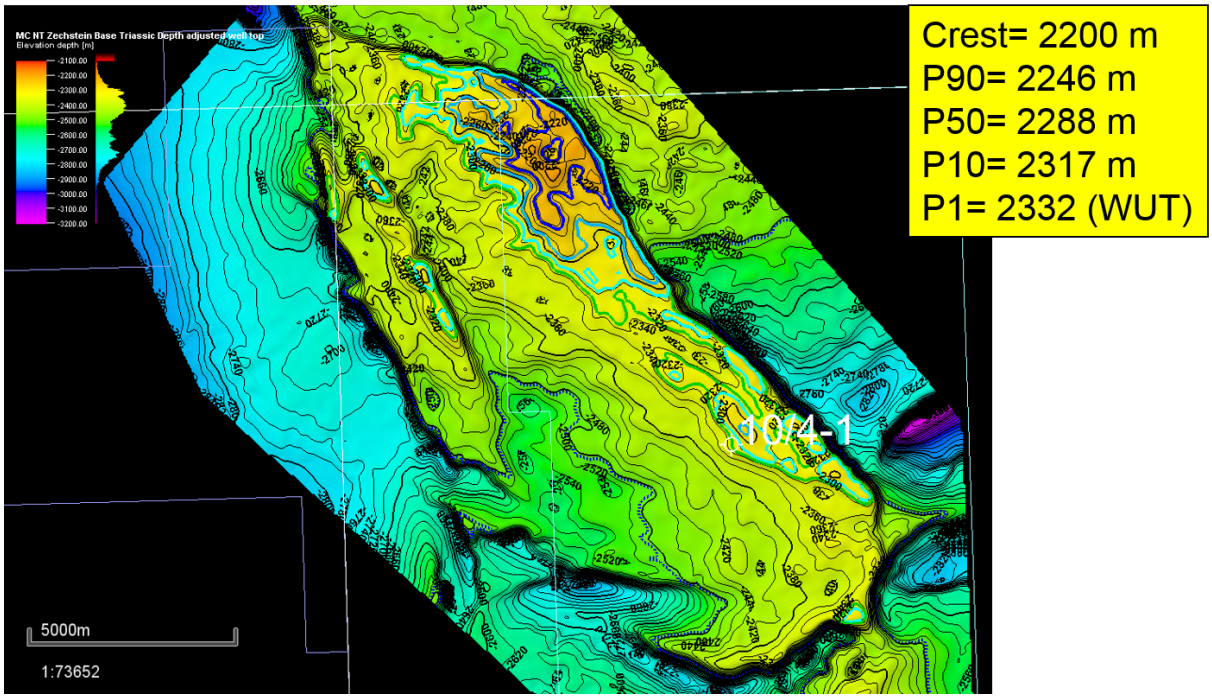

Fig. 4.7 Gamma Ray Prospect NT Zechstein Depth Map

After the drilling of well 10/4-1 targeting the Zeppelin Prospect, depth surfaces were updated and rock/hydrocarbon volumes recalculated. The main geological risk common to all the mapped prospects is assessed to be the amount of available hydrocarbons to fill the structures. Top Seal is another main risk for the Gamma Ray Prospect.

Updated expected Recoverable Hydrocarbon Volumes (MM STB) and Geological Probability of Success (GPOS, %) are given in the table below:

Table 4.1 PL 734 Prospect recoverable volumes (mm stb) and Geological Probability of Success (GPOS)

	Reservoir	P90	P50	Mean	P10	GPOS (%)
Zeppelin Updip	Vestland Group	5.69	16.65	23.1	48	14
Zyklon	Vestland Group	1.4	6.7	10.5	23.1	8.4
Chton	Vestland Group	1	7.3	23.1	31.2	8.4
Gamma Ray	Zechstein Group	3.44	15.3	20.56	44.1	1

5 Technical evaluations

N.A.

6 Conclusions

Wintershall Norge AS regards all the assessed prospects as economically unattractive at this time of writing. Consequently, Wintershall Norge AS has recommended to fully surrender the PL 734 acreage in 2018. This recommendation has been unanimously accepted by all license partners.