REPORT

eni norge

Report ID.:	ENINO/EXP/8528760	Reference no.:	ENINO/EXP/8528760

SUBJECT:	**PL716 License Full Relinquishment Report**
ABSTRACT:	NFW 7318/12-2 (Bone') well was dry. The well confirmed the Jurassic depositional model, but not reservoir quality. The main Stø Fm (Realgrunnen) reservoir was found to be very tight, with no hydrocarbon presence.
DESCRIPTION:	

Rev.	21/03/2018	Final Version			

[redacted]

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1. KEY LICENSE HISTORY

The PL716 licence is located 320 km northwest of the Norwegian Coast, consisting of blocks 7318/11 & 7318/12 (see **Figure 1**) and covering an area of 603 km^2.

PL716 was awarded on 21st June 2013 as part of the 22nd Norwegian Concession Round, with a firm program to drill one NFW within 21st June 2016 and purchase of 3D seismic coverage. The original expiry date for PL716 was extended by one year to 21st December 2017. The purchase of the SWB12 3D seismic survey and the drilling of NFW 7318/12-2 (Bone') well fulfil the PL716 license commitment.

The license J.V. configuration consists of:

- Eni Norge AS 30% (operator)
- Bayerngas Norge* 20%
- Faroe Petroleum 20%
- Petoro AS 20%
- Point Resources AS 10%

* *Centrica Resources (Norge AS)/ Spirit Energy*

Main Prospectivity in the license, limited to the northern part of the blocks, consists of Bone'-Bigorna, a multi-target, multi-segment prospect, with targets at Jurassic and Triassic levels. Two additional prospects were identified in the same play/targets, Bigorna East and Bone' East.

The planned well NFW 7318/12-1 spudded on location on January 10th 2017. Due to difficulties in the open-hole section, this well was abandoned and a new well, NFW 7318/12-2, spudded 25m to the southeast. This report will focus on well 7318/12-2 hereafter.

The result of the NFW 7318/12-2 (Bone'), together with the negative economic evaluation prediction for the remaining exploration potential of the PL716 license, led the operator to recommend full relinquishment to the JV. The partners in the JV unanimously approved the operator's recommendation, and the decision to totally relinquish the license was conveyed to the authorities via SMIL on the 12th December 2017.

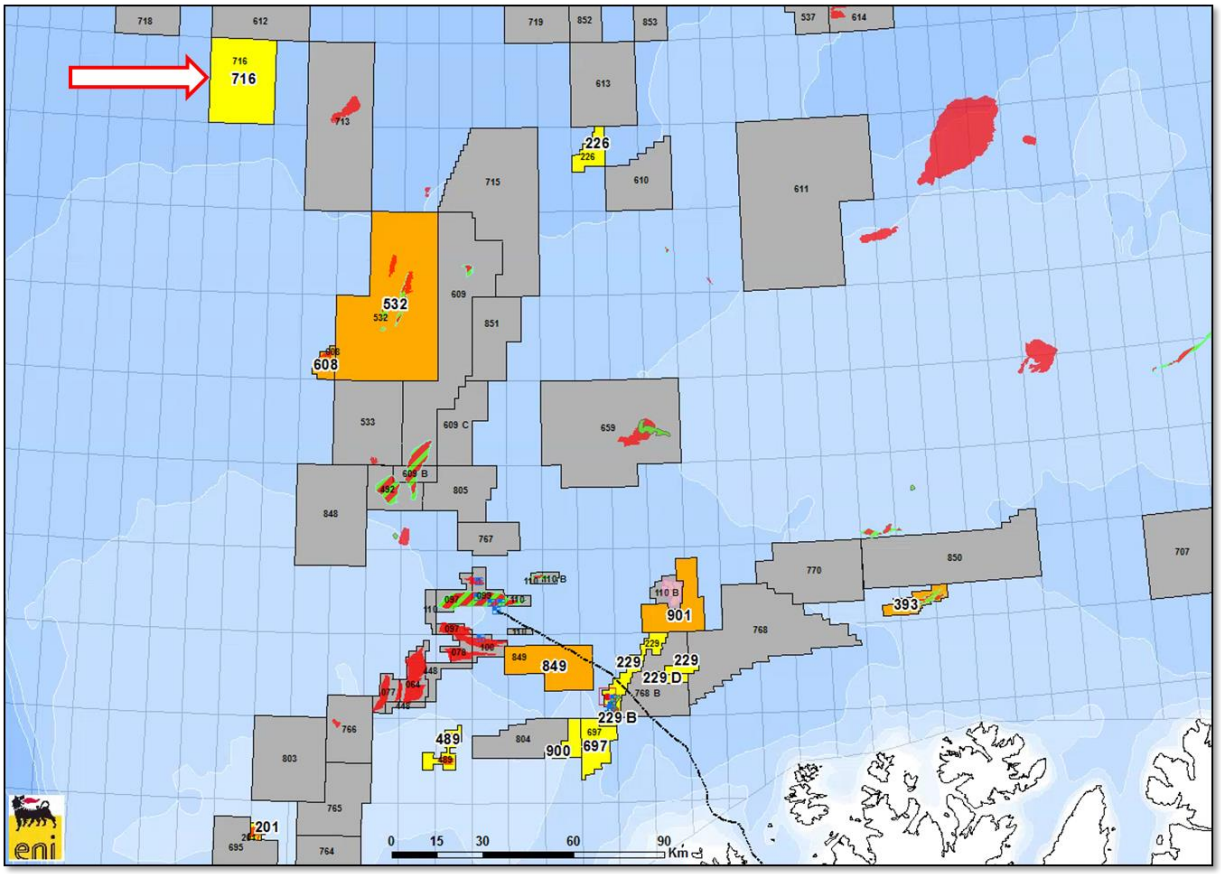
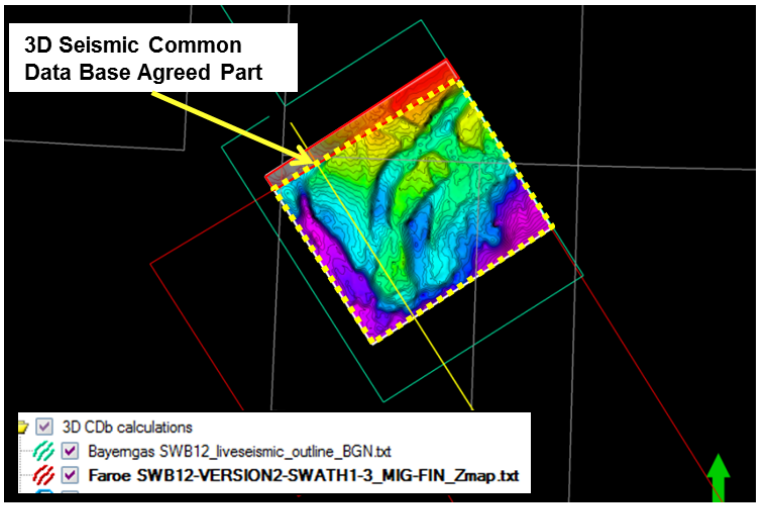


Figure 1: PL716 Location Map (*at time of license relinquishment)*

2. DATABASE

Delineation of the license prospectivity was accomplished by interpretation of a selected area of the SWB12 3D seismic, as outlined in **Figure 2**. The wells database is also illustrated in Figure 2, with well-ties accomplished via released 2D lines to the wells in the Fingerdjupet Basin (7318/9-1, 8-1 & 7-1), and to the 7219/9-1 well on the adjacent flank of the Bjørnøya Basin.



	WELLS DB
Skrugard	7220/8-1
Public	7216/11-1 S
	7219/8-1 S
	7219/9-1
	7316/5-1
	7321/7-1
	7321/8-1
	7321/9-1

SWB12 3D
In-line: 1623-2554
X-Line: 11341-14633

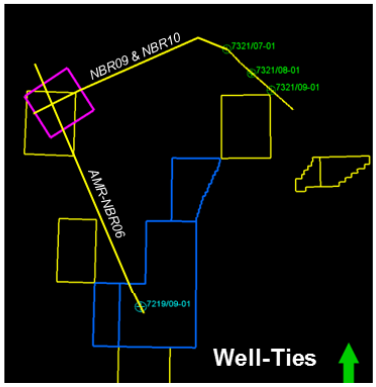


Figure 2: PL716 : Seismic & Well DB

3. REVIEW OF GEOLOGICAL FRAMEWORK

The assessment of the plays in the area is based on the updated Sedimentological Study, Petroleum System Modelling, 2-D Structural Restoration, seismic and the available wells information. These studies have been recently performed in the western Barents Sea area covering the PL716 for the de-risking of the prospects.

The dominating structural relief in the West of Loppa area was created in Cretaceous times: the fault geometry in the licence area mainly formed during the latest Jurassic/Early Cretaceous whilst the widespread subsidence mainly prevailed during successive Cretaceous period. Due to both Late Cretaceous and Tertiary uplift possible traps were rearranged (tilted, partly deformed and uplifted).

Uplift in the order of several hundred meters to more than 1.2 km has been recorded on the Loppa High and its flanks, with a similar burial and uplift scenario expected on the flanks of the Stappen High adjacent to the PL716 license area. The basinal area (Bjørnøya Basin) on the

other hand has experienced continuous subsidence and has received eroded sediments from the platform areas.

The rotated fault blocks forming the prospects in the PL716 area are the most common trap type in the area west of Loppa High, on the southern edge of the Stappen High and regionally on the Hammerfest area and on Norwegian and UK continental shelves.

The traps of the West of Loppa High prospects can be classified mainly as structural unconformity traps. However, in the PL716 area no erosion has been observed on seismic data at the upper Jurassic and BCU levels.

In the PL716 area, the plays include the Jurassic Realgrunnen (Stø+Nordmela), Late Triassic Fruholmen and Middle to Late Triassic Snadd. These plays have been proven in the West of Loppa High area (in wells drilled in PL532 and PL533). The Upper Jurassic/Lower Cretaceous shales are thought to act as top seal for the Jurassic Realgrunnen reservoir. For the Fruholmen reservoir, the top seal is provided by the top and intra-formational Fruholmen shales, while for Snadd sandstone seal is provided by the lower Fruholmen shales. The organic rich Upper Jurassic mudstone unit is well-defined both in the wells and also by the seismic reflectivity and is acting as a main source rock for the hydrocarbon charge in the West of Loppa High discoveries (PL532). For the PL716 area these organic rich units of the Bjørnøya Basin are considered as a main source rock, with possible additional input from Early Cretaceous Kolje and Knurr shales.

The Bjørnøya Basin is considered as a main source kitchen area for the hydrocarbon charge of PL716 prospects by direct migration from the kitchen to the prospects or by fill-spill from previously filled structures.

Realgrunnen- Stø & Nordmela Formations

The Stø Formation is dominated by moderately to well-sorted and mineralogical mature sandstones.

The sandstones were deposited in prograding coastal settings and several marginal marine facies occur. Marked, sub-regional shale/siltstone intervals represent regional transgressive pulses in the late Toarcian and late Aalenian.

The Nordmela Formation is characterised by an overall coarsening/shallowing upward trend consisting of sandstone, interbeded siltstones, shales and claystones with minor coals. Sand-prone intervals prevail in the upper portion. The Nordmela Formation was deposited in deltaic, shoreface environments strongly influenced by the tidal reworking where individual sandstone packages represent prograding mouth bars/shorefaces associated to small tidal creeks and distributary channels.

Fruholmen Formation

The Fruholmen Formation generally consists of basal grey to dark grey shales that passes gradually upwards into an interbeded sandstones, shales and coals. Sand dominates in the middle of the Formation in several wells, while the upper part are more shale-rich and act as a seal rock for Fruholmen reservoirs.

The depositional environment is open marine, as shales pass up into a fluvial sandstone-dominated sequence. These represent northward fluviodeltaic progradation with a depocentre to the south. As the main deltaic input shifted laterally, most of the central and southern parts

of the basin became the site of flood-plain deposition, with more marine environments to the north.

Snadd Formation

The Snadd Formation consists at the base of grey shales coarsening up into the shales with sandstones.

The prevailing Ladinian depositional environment is a relatively distal marine one, following a major transgressive pulse which submerged all structural highs and platform areas in the region. Input of storm-derived silts and sands from southern sources is indicated.

The Carnian section is marked by the progradation of a composite large-scale deltaic system over the entire region. It is characterised by stacked fluvial channel complex with limited lateral areal extent interbedded with flood plain fines and coals.

The topmost Carnian-Norian portion of the Snadd Formation, lying under a major flooding surface (Norian MFS), it is represented by marginal marine deposits (upper/lower shoreface and mouthbars) with considerable lateral extent.

4. PROSPECT UPDATE

The PL716 prospectivity consists of Bone'-Bigorna, Bigorna East and Bone' East, all of which have reservoir at multiple levels. Main reservoir is the Realgrunnen, composed of Stø and Nordmela. Secondary reservoir levels are provided by the Fruholmen and Snadd formations. **Figure 3** shows the Top Realgrunnen Depth map with the different prospects and segments highlighted.

The Bone' Segment of the Bone'-Bigorna Prospect is a 3-way dip structural closure bounded by a main NW-SE trending fault on the eastern side, and a NW-SE trending fault on the western side. The former fault displays a large throw, while the latter has a more variable throw. The structure closes short of reaching the western fault. One major east west oriented fault has also been interpreted in the south of the Bone' prospect. There is no risk of the compartmentalization of the Bone' Prospect. The presence and the orientation of the structure are quite robust and has been mapped with a high level of confidence on 3D PSDM volume.

The Bigorna Segment of Bone'-Bigorna Prospect is a 2-way horst-like structure bounded by two NE-SW trending faults on the eastern and western side of the prospect. Both faults display a large amount of throw.

The risk of lateral seal failure is low for both the segments, since the Jurassic and Triassic reservoir sands are most likely juxtaposed against the Upper Jurassic and Cretaceous shales, due to the large throw of the prospect-bounding faults.

In addition to the Bone'-Bigorna Prospect two additional prospects, Bigorna East and Bone' East, have been identified in the eastern part of the licence.

Table 1 shows a summary of the calculated volumes, with associated risk, for the entire pre-drill licence prospectivity. The prospect reservoir sequences are present in all wells in the region, and so, reservoir presence at play and local level is not considered to be a risk.

However, due to the lack of an identified DHI, the effective reservoir presence is risked at local level. Source rock presence and charge is proven by the discoveries in the PL532 and PL533 license areas, but charge timing and migration pathway is risked at local level.

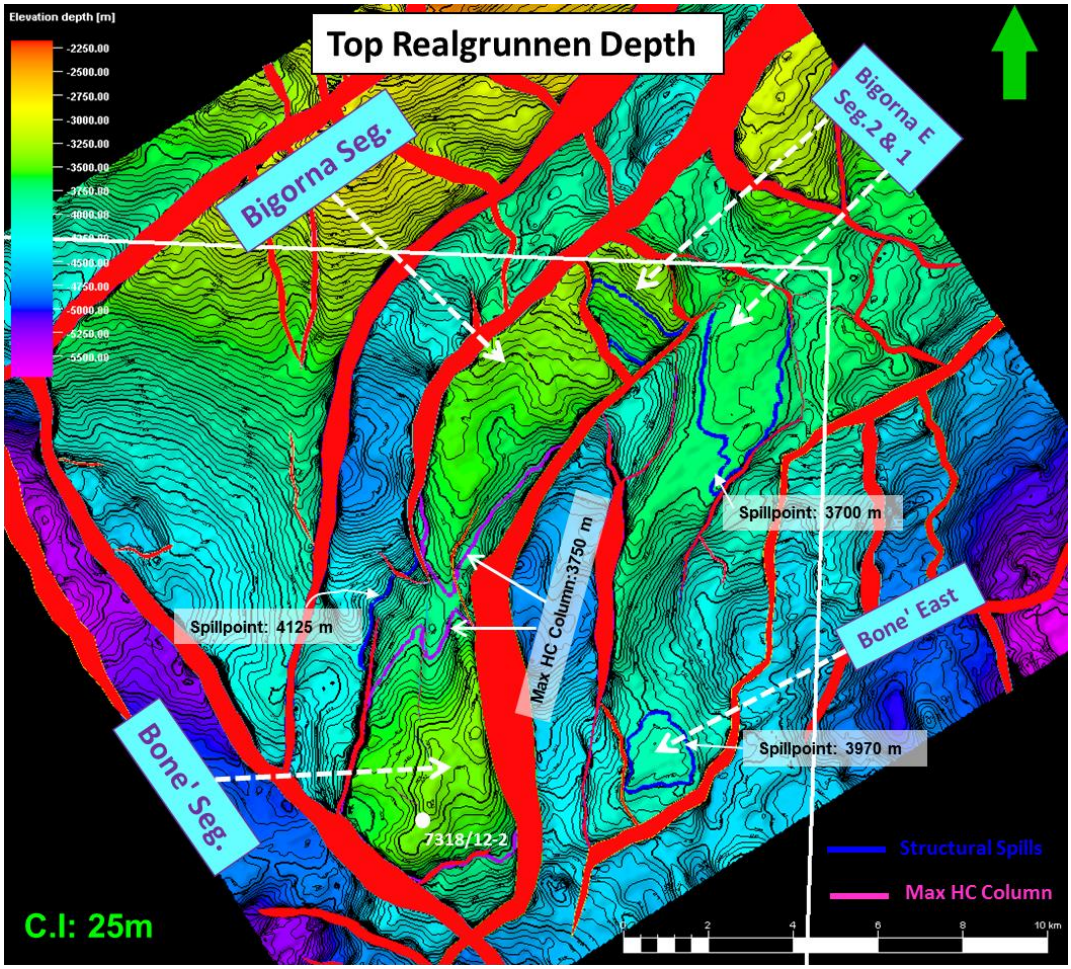


Figure 3: PL716 Realgrunnen Prospectivity

PL716			OIIP Mbbl				Sol GIIP GSm3				Gas Cap IP GSm3				Condensate IP Mbbl				Total MBOE	POSg PAPA++
			P90	P50	P10	PMean	P90	P50	P10	PMean	P90	P50	P10	PMean	P90	P50	P10	PMean		
Bone- Bigorna	Bone Seg.	Realgrunnen	176,65	340,41	576,32	361,86	4,02	7,77	13,12	8,24	0,98	4,72	13,96	6,33	0,41	1,98	5,85	2,65	458,23	40 %
		Fruhlomen	45,23	139,59	347,28	172,60	1,10	3,38	8,46	4,21	0,34	1,31	4,05	1,85	0,14	0,55	1,70	0,78	212,35	33 %
		Snadd	29,85	74,59	165,95	87,87	0,80	2,00	4,50	2,37	0,27	0,89	2,49	1,19	0,11	0,37	1,04	0,50	111,26	24 %
	BONE MULTI		365,85	594,18	922,32	622,33	8,67	14,12	22,06	14,82	3,12	7,86	17,68	9,37	1,31	3,30	7,41	3,93	781,80	
	Bigorna Seg.	Realgrunnen	7,80	155,44	647,84	251,20	0,17	3,46	14,39	5,60	0,00	0,04	0,19	0,07	0,00	0,02	0,08	0,03	287,74	13 %
		Fruhlomen	1,04	45,78	287,61	101,83	0,02	1,08	6,68	2,42	0,00	0,00	0,03	0,01	0,00	0,00	0,01	0,00	117,45	11 %
		Snadd	1,21	35,86	173,38	64,71	0,03	0,92	4,67	1,73	0,00	0,01	0,03	0,01	0,00	0,00	0,01	0,01	75,90	7 %
	BIGORNA MULTI		80,85	347,52	858,30	417,75	1,89	8,17	19,92	9,75	0,01	0,06	0,22	0,09	0,01	0,03	0,09	0,04	481,09	
Bigorna East	BE Segment.1	Realgrunnen	4,79	21,84	71,79	31,06	0,10	0,48	1,58	0,68	0,01	0,07	0,29	0,11	0,00	0,03	0,12	0,05	36,19	29 %
		Fruhlomen	0,41	6,61	46,32	16,20	0,01	0,16	1,10	0,38	0,00	0,00	0,01	0,01	0,00	0,00	0,01	0,00	18,71	24 %
		Snadd	0,17	0,90	3,13	1,33	0,00	0,02	0,08	0,04	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	1,59	19 %
	BE Segment.2	Realgrunnen	13,53	42,38	108,55	53,07	0,29	0,93	2,38	1,16	0,06	0,29	1,10	0,46	0,02	0,12	0,46	0,19	63,68	29 %
		Fruhlomen	1,51	10,52	44,55	17,81	0,04	0,25	1,05	0,42	0,01	0,09	0,49	0,19	0,00	0,04	0,20	0,08	21,81	24 %
		Snadd	1,79	6,11	18,64	8,53	0,05	0,16	0,49	0,22	0,02	0,09	0,29	0,13	0,01	0,04	0,12	0,05	10,83	19 %
	BIGORNA EAST MULTI		53,50	117,07	219,03	128,00	1,23	2,65	4,96	2,91	0,29	0,73	1,76	0,91	0,12	0,31	0,74	0,38	152,89	
Bone East	Realgrunnen		1,96	6,14	13,91	7,17	0,05	0,16	0,37	0,19	0,01	0,05	0,16	0,07	0,00	0,02	0,07	0,03	8,88	43 %
	Fruholmen		1,45	4,40	10,49	5,32	0,04	0,12	0,29	0,15	0,02	0,08	0,21	0,10	0,01	0,03	0,09	0,04	6,95	35 %
	Snadd		0,80	3,59	9,50	4,47	0,02	0,11	0,29	0,14	0,01	0,04	0,14	0,06	0,00	0,02	0,06	0,03	5,76	25 %
	BONE EAST MULTI		5,09	14,64	32,31	16,95	0,14	0,41	0,91	0,47	0,05	0,18	0,48	0,23	0,02	0,08	0,20	0,10	21,58	
											TOTAL MBOE BONE-BIGORNA PROSPECT								1262,89	MBOE
											TOTAL MOBE BONE- BIGORNA PROSPECT + BONE EAST & BIGORNA EAST								1437,36	MBOE

Table 1: PL716 Pre-drill Prospect Summary: Volumes and Risk

4.1 Pre Drill status

The well location for the NFW 7318/12-2 well is shown on the map in **Figure 4** and on intersection seismic lines in **Figure 5**.

The well objectives and criteria for selecting the 7318/12-2 drilling location were as follows:

- Prove commercial volumes of hydrocarbons in the primary target: Realgrunnen
- Acquire data to verify the reservoir facies, age, reservoir quality and fluid properties.
- Test the secondary targets*: Fruholmen & Snadd formations.

* *Contingent on primary target success*.

The objective in the drilling of the well NFW 7318/12-2, on the Bone'-Bigorna Prospect, was to investigate the presence of hydrocarbons and to acquire data on potential reservoirs. The main priority of the well was to prove hydrocarbons in the Jurassic Realgrunnen Sub Gp. Secondary targets at Fruholmen and Snadd formation levels (both Triassic) would be targeted contingent on a success in the Realgrunnen. **Table 2** summarises the volumes associated to the NFW 7318/12-2 well targets.

NOTE: The two wells of Kramsnø and Iskrystall are considered most analogous to the PL716 area for their close position to the kitchen and the present day reservoir burial. With this in mind, a HC phase chance of 60% Gas and 40% Oil was assigned.

PL716		OIIP	Sol GIIP	Gas Cap IIP	Cond.IIP		POSg PAPA++
		Mbbl	GSm3	Gsm3	Mbbl	MBOE	
		PMean	PMean	PMean	PMean		
Bone Seg.	Realgrunnen	361,86	8,24	6,33	2,65	458,23	40 %
	Fruholmen	172,60	4,21	1,85	0,78	212,35	33 %
	Snadd	87,87	2,37	1,19	0,50	111,26	24 %
BONE MULTI		622,33	14,82	9,37	3,93	781,80	

PL716		Gas IIP				MBOE	POSg PAPA++
		GSm3					
		P90	P50	P10	Mean		
Bone. Seg.	Realgrunnen	12,03	26,54	49,58	29,01	186,53	40 %
	Fruhlomen	3,19	10,39	26,31	12,81	82,37	33 %
	Snadd	2,26	5,78	13,58	6,96	44,75	24 %
BONE MULTI		27,14	46,59	73,28	48,79	313,72	

Table 2: PL716 Pre-drill Bone' well (NFW 7318/12-2): Volumes and Risk – Oil & Gas and Gas only scenarios

The Bone'–Bigorna prospect is an N-S trending 3way-dip fault assisted closure. The segmented prospect is characterized by two culminations separated by a saddle, as shown in the Top Realgrunnen Depth Map (**Figure 3**).

The two segments share the same targets of Jurassic (Realgrunnen) and Triassic plays (Fruholmen and Snadd). None of the targets are DHI supported as their depth is below the DHI threshold. The two plays are proven in the Bjørnoya Basin to host HC: Oil and Gas cap in PL532 Skrugard, Havis, Drivis and Skavl, and Gas only in PL532 Kramsnø, in PL714 Isfjell and in PL608 Iskrystall. Gas is also found in PL532 Nunatak in Cretaceous and in PL713 Paleocene (all these discoveries were DHI supported with well-defined HC contacts, dual flat events in the cases of Oil and Gas cap discoveries).

The well was located on the Bone' segment on the southern flank of the trap, in order to avoid areas of shallow gas and iceberg scars; and with the purpose of finding the most likely fluid contacts of the three targets.

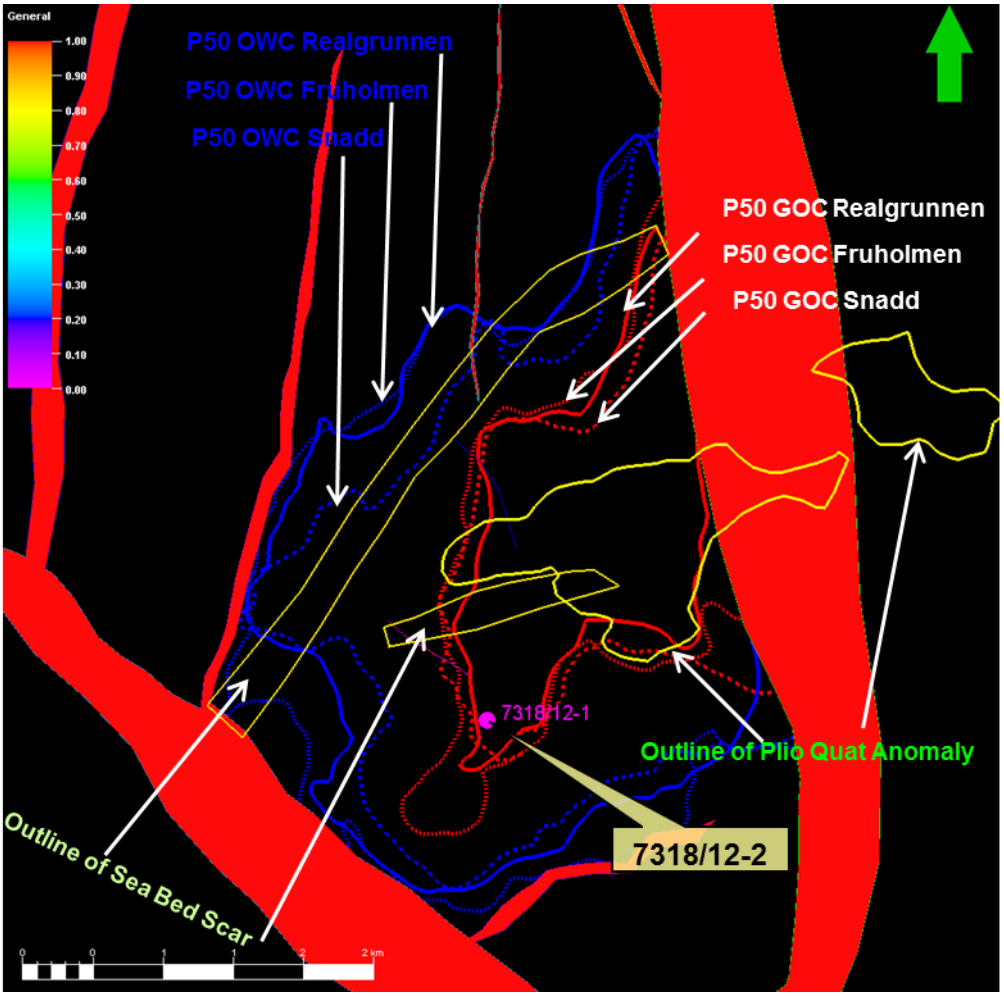


Figure 4: NFW 7318/12-2 Location & Target Outlines

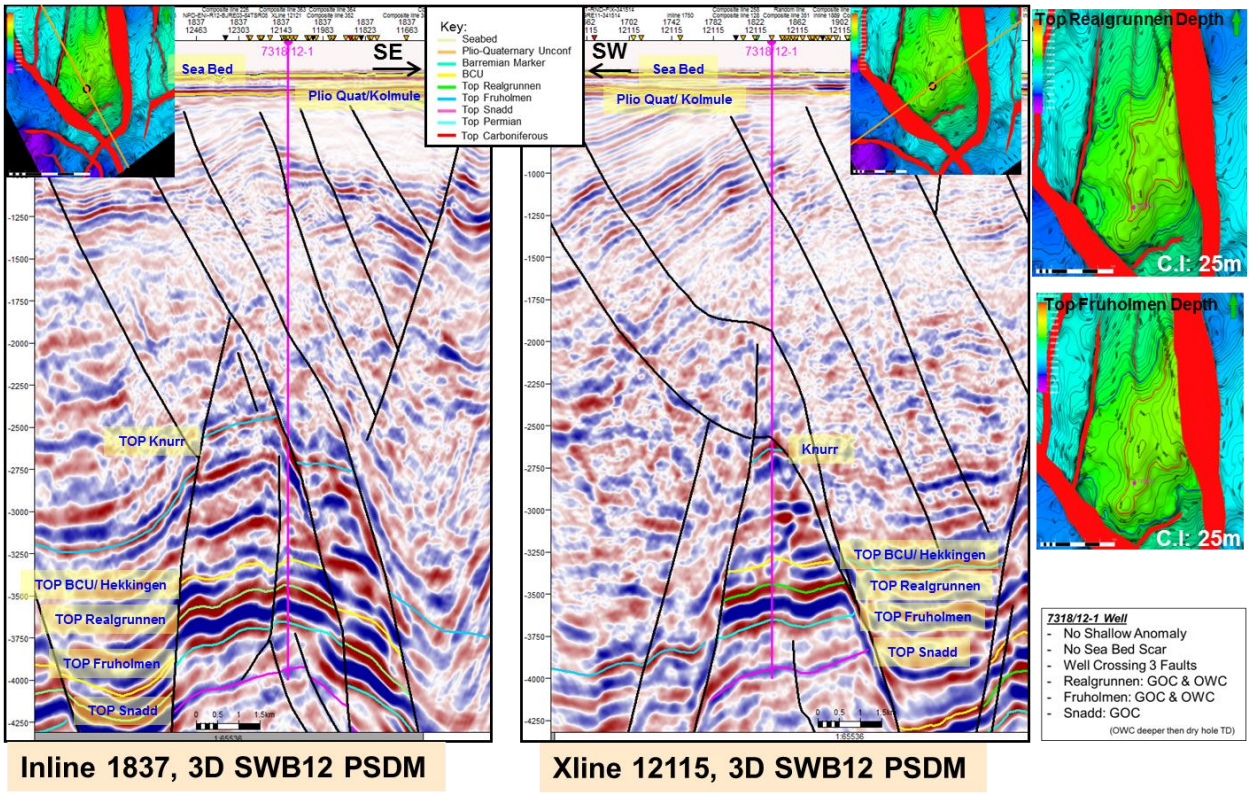


Figure 5: Pre Drill seismic interpretation status

The geological targets of the Bone' well are illustrated in **Figure 6**.

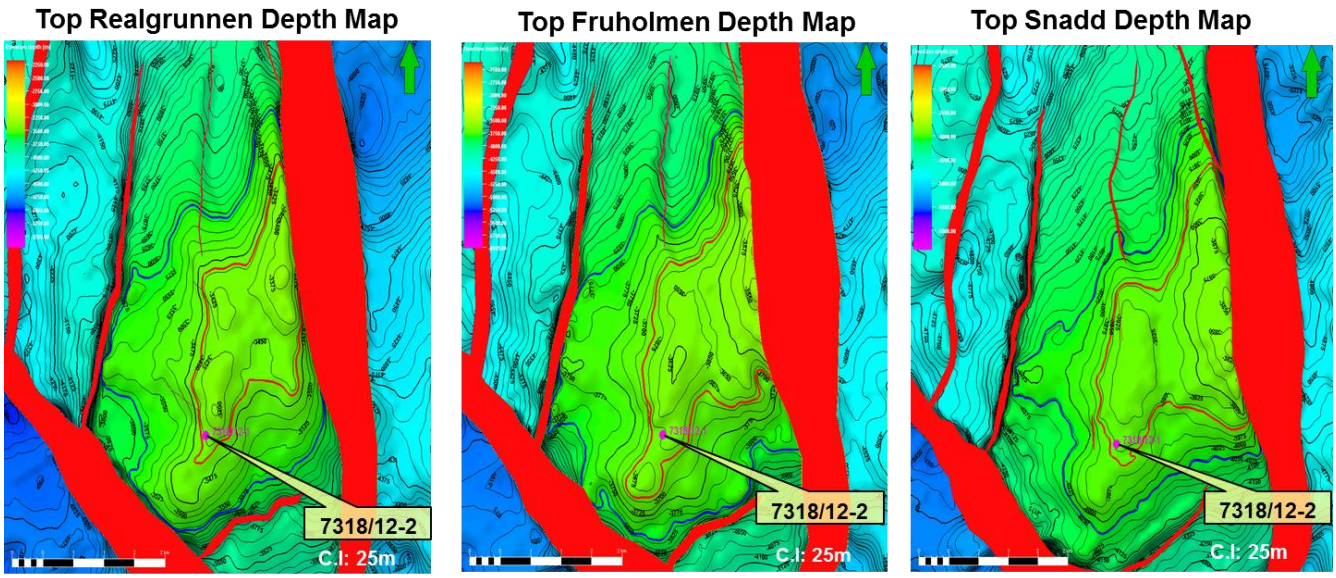


Figure 6: NFW 7318/12-2 - Target Depth Maps, with GOC & OWC

4.2 Post Drill status

The well was drilled to a depth of 3535m (3501m TVDMSL), terminating 115m into the Realgrunnen Sub Gp in the Nordmela Fm.

The target level at Realgrunnen was penetrated, with the deeper targets at Fruholmen and Snadd levels not penetrated. The Stø Fm, of the Realgrunnen Sub Gp, was penetrated at a depth of 3417m, and was found to be very tight sandstone, with very low porosity and permeability. In all, 115m of Realgrunnen Sub Gp reservoir was drilled, with the well TD at 3535m in the Nordmela Fm. Average porosity in the Realgrunnen reservoir is estimated at 7%, with permeability very low. Water saturation average is 95% with no evidence of gas shows.

Table 3 shows the prognosed depths of target penetrations against the actual target penetrations recorded in the well, while **Figure 7** shows the geological well summary of the well in graphical format.

Top	Prog. Top mMD	Prog Top mTVDSS	Actual Top mMD	Actual Top mTVDSS	m High/Low
Seabed	452	418	452	418	-
Kolmule Fm	555	521	562	528	7m low
Fault 1	1179	1145	1180	1146	1m low
Fault 2	1974	1940	1911	1877	63m high
Kolje Fm	-	-	2155	2121	-
Fault 3	2604	2570	2674	2640	70m low
Knurr Fm	2719	2685	2550	2516	169m high
Hekkingen Fm	3319	3285	2864	2830	455m high
Fuglen Fm	-	-	3380	3346	-
Stø Fm	3481	3447	3420	3386	61m high
Nordmela Fm	-	-	3448	3414	-
TD	3550	3516	3535	3501	115m high

Table 3: Prognosis vs Actual Stratigraphy

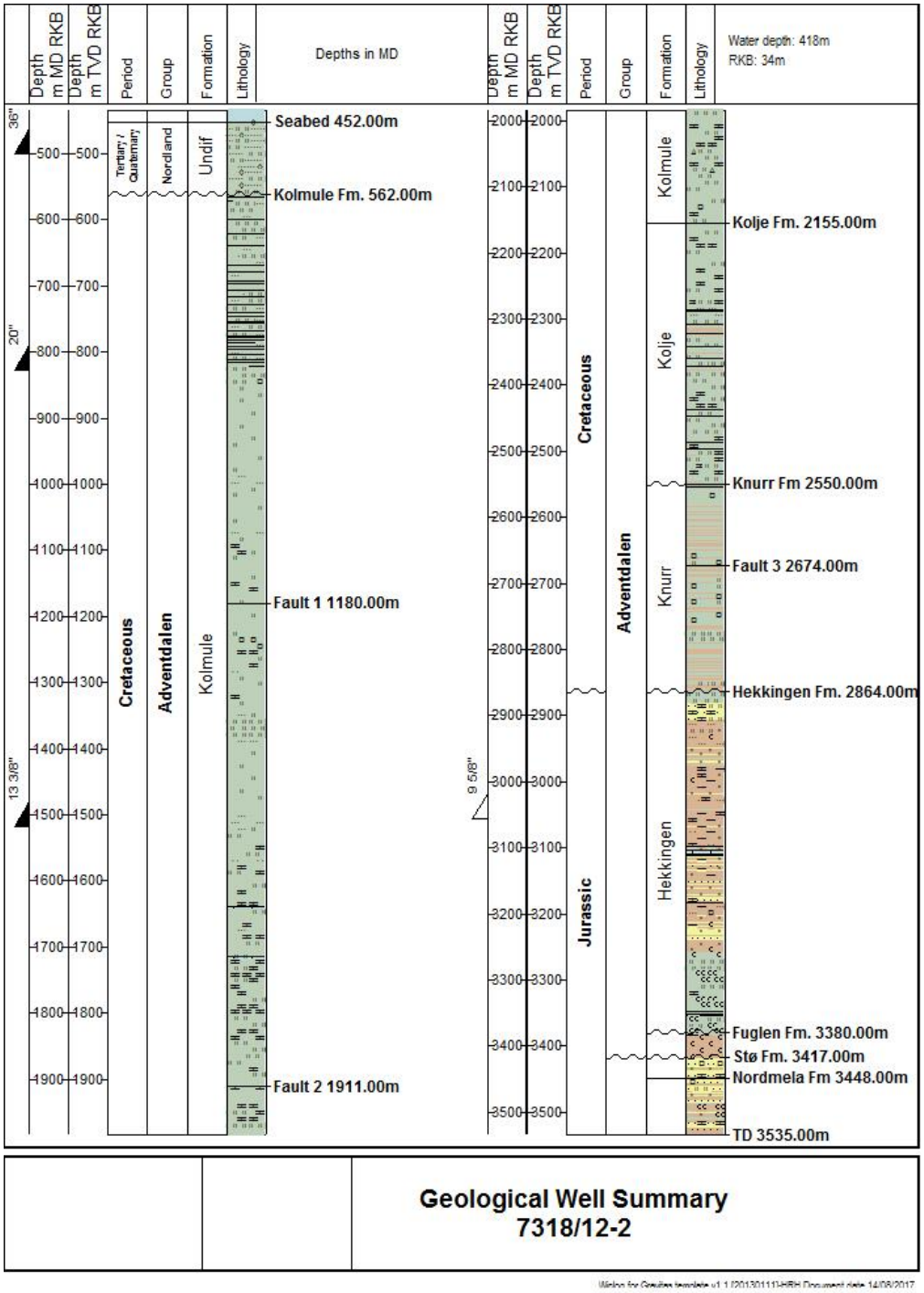


Figure 7: Geological Summary: NFW 7318/12-2

The Upper Jurassic Sequence containing the Hekkingen and Fuglen Fm, known source rocks of the HC discovered in the South Eastern Loppa area, was found unexpectedly at 2864m MD (455m shallower than prognosis) and with a total measured thickness of 750m. The sequence, although containing high radioactive Fuglen shales, unusually did not show any trace of HC. It is assumed that the original organic content is completely depleted due to exposure to very deep burial and early oil migration before the trapping mechanism was established. The

geochemical analysis of cuttings have not yet been finalised to support or contradict this hypothesis.

The Realgrunnen reservoir was penetrated at the depth of 3420m MD (-3386mssl), 61m shallower than prognosis, still inside the pre-drill structural closure. It was found water bearing in very low porosity and low permeability reservoir, with no detection of HC shows.

Pressure measurements confirm the Realgrunnen reservoir extremely low mobility.

The CPI shows poor petrophysical properties in the Hekkingen and in the Realgrunnen reservoirs (7% phie).

The well reached the final TD at 3535m MD (-3501m ssl), with the 8.5'' hole section, in the tight Realgrunnen sand. Top Realgrunnen was penetrated 65m shallower than prognosed using the PSDM seismic volume, well within tolerance.

5. TECHNICAL EVALUATIONS

The NFW 7318/12-2 (Bone') well post-drill analysis of the reasons for failure indicates the causes to be the reservoir effectiveness, source effectiveness (depleted organic content) and charge timing.

Given the well results, it is clear that the license area has been subjected to extreme burial conditions, and that HC migration from a known source appears to have occurred after the diagenetic process and prior to trap generation. No residual HC potential is expected in the Bigorna segment and in the other remaining prospects in the PL716.

NFW 7318/12-2 is the first meaningful well in the license area, and as such has great bearing on the future prospectivity. The effects that the deep burial has had on the Upper Jurassic source rock, and the Realgrunnen reservoir potential must be expected in all reservoir sequences in this area.

6. CONCLUSIONS

Eni Norge has revised the technical evaluation of PL716. The residual prospectivity of the license is deemed nil.

The work commitment of the license has been fulfilled.

The decision to relinquish the license was proposed, and unanimously supported by the JV partners. This decision was relayed to the authorities via SMIL on 12th December 2017.