PL229F Relinquishment

Status Report

vår energi

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1 Key license History

PL229F is located to the west of the PL229 license and consists of blocks 7121-9, 7122-5, 7 and 8 and was awarded on the 1st of March 2019 and has a Drill or Drop Decision within 1st of March 2021 (Fig. 1.1). Geologically, the license is situated in the south-western part of the Barents Sea on the southern edge of the Hammerfest Basin. The present partnership consists of Vår Energi as operator with 65% interest and Equinor with the remaining 35%. The Goliat field is located 20 km to the S-SE and production started on March 2016 from Realgrunnen and Kobbe reservoirs and in 2017 from Snadd reservoir. Goliat West exploration well was drilled in 2018, and proved oil and gas in Tubåen Fm and oil in Fruholmen Fm.

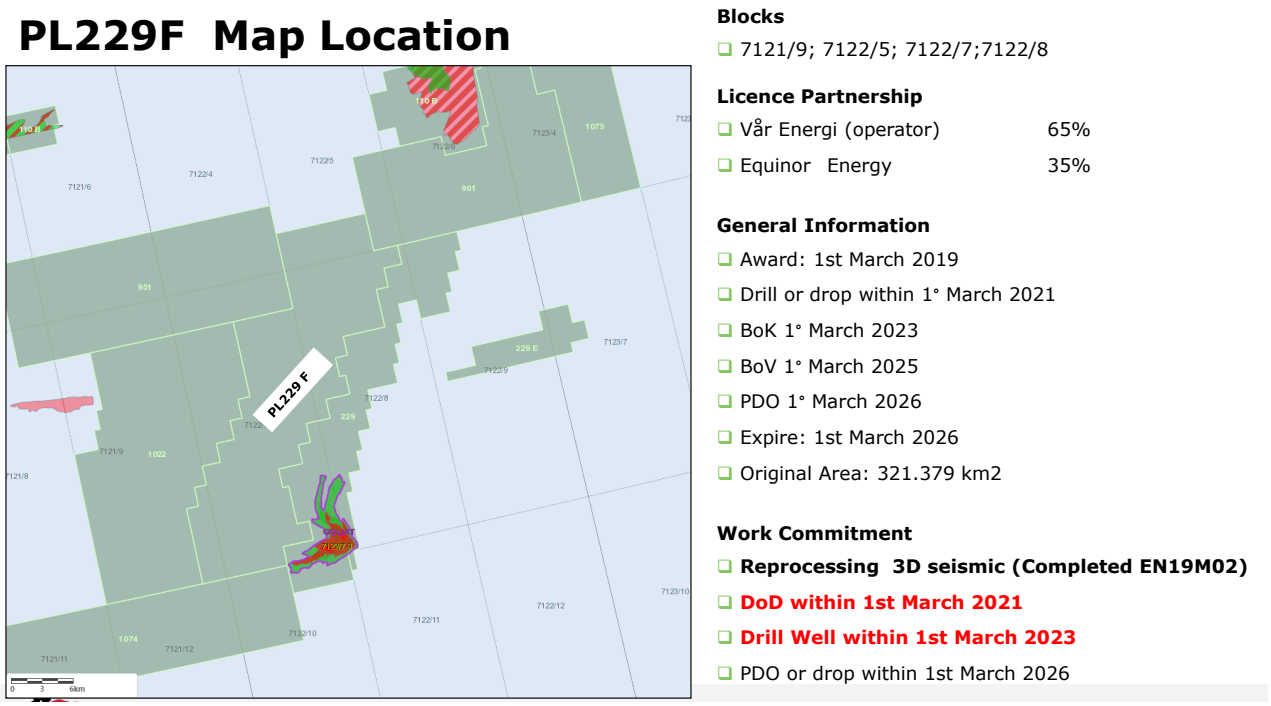

Fig. 1.1 Location Map
PL229F licence location map, with licence terms

In the central part of the Hammerfest Basin, all four formations of the Realgrunnen Subgroup are preserved: Fruholmen, Tubåen, Nordmela and Stø formations. The Nordmela Fm, and most importantly the uppermost Stø Formation, form prolific reservoirs as proven in the greater Snøhvit field (Albatross and Snøhvit fields), and Askeladden and Blåmann discoveries. By contrast, in the Goliat field uplift along the main bounding fault of the Troms-Finnmark Fault Complex eroded parts of the Realgrunnen Subgroup sequence. As a consequence, the Nordmela and Stø Fms have been eroded and the Fruholmen and Tubåen Fms are the oil- and gas-bearing reservoirs in Goliat. Along the west-downflank of the Goliat roll-over structure composite stratigraphic pinch-outs of the Stø-Nordmela-Tubåen formations have been mapped as stratigraphic traps.

In the APA2018 application 2 large prospects, Cuneo & Pizzi, stratigraphic in nature, were mapped in the area applied for. Subsequent interpretation on the EN19M02 3D seismic (reprocessed vlume available after the APA, as part of the licence work programme) resulted in a quite different interpretation and a different suite of prospects and leads. (Fig. 1.2)

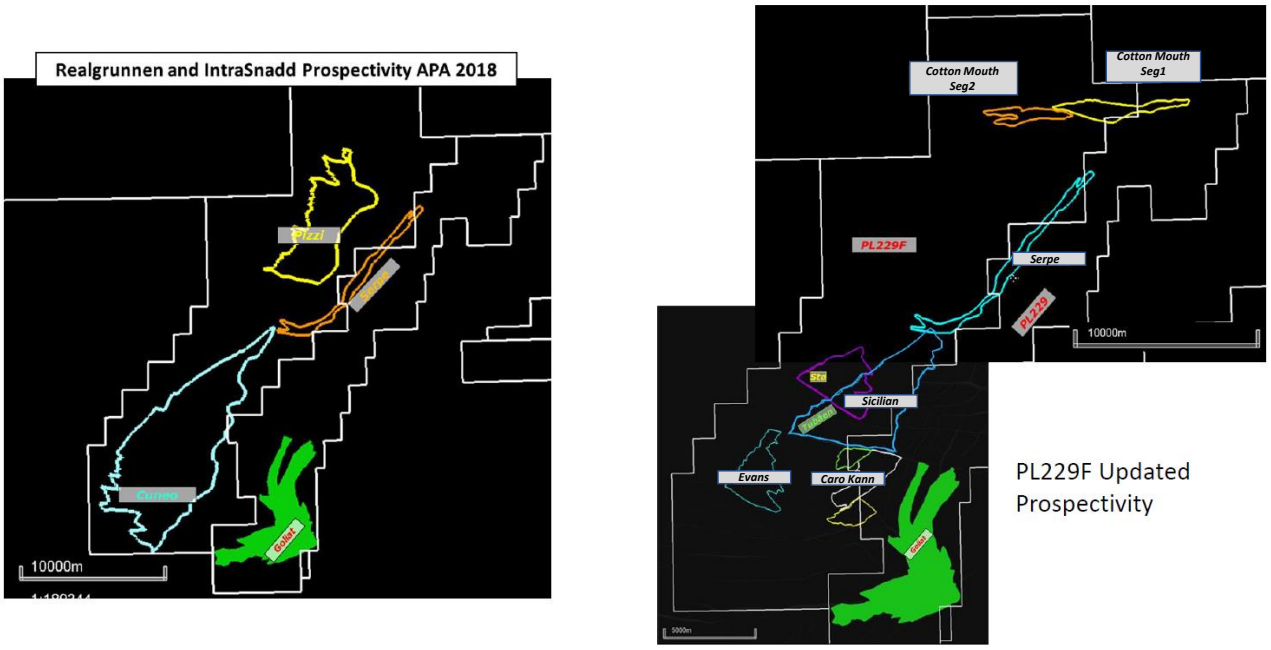

Fig. 1.2 Prospectivity Maps
Outline maps showing the APA prospectivity and the updated prospects outlines after licence re-interpretation

Three prospects and two leads were identified: Sicilian, Evans, Caro Kann, Serpe and Cotton Mouth. Evans is a stratigraphic prospect formed by the pinch-out of the Stø Fm, whereas Sicilian is a pinch-out of both Tubåen and Stø Formations. Serpe and Cotton Mouth are stratigraphic prospects at the InstraSnadd level in the Snadd Fm formed by pinch-out of Carnian fluvial sandstone, an analogue to the reservoir in the Tornerose discovery. In contrast, Caro Kann is a multi-target structural prospect at the Tubåen, Fruholmen and Kobbe formations.

2 Database

Vår Energi carried out the Greater Goliat re-processing on existing survey around PL229 license with the objective to provide a reliable merged volume and enhanced imaging over EN0901, EN0702 and FP13. The quality of the data (EN19M02) is generally good with improvement in some areas (i.e. platform and Northern Goliat), with less over the Goliat field. This current assessment has fully utilized this seismic to evaluate the PL229F prospectivity.

The wells database consisted of wells from the Hammerfest area, including Goliat, Tornerose, Albetross, and Blåmann.

Fig. 2.1 illustrates the 3D coverage over the licence area, and the wells used in the licence.

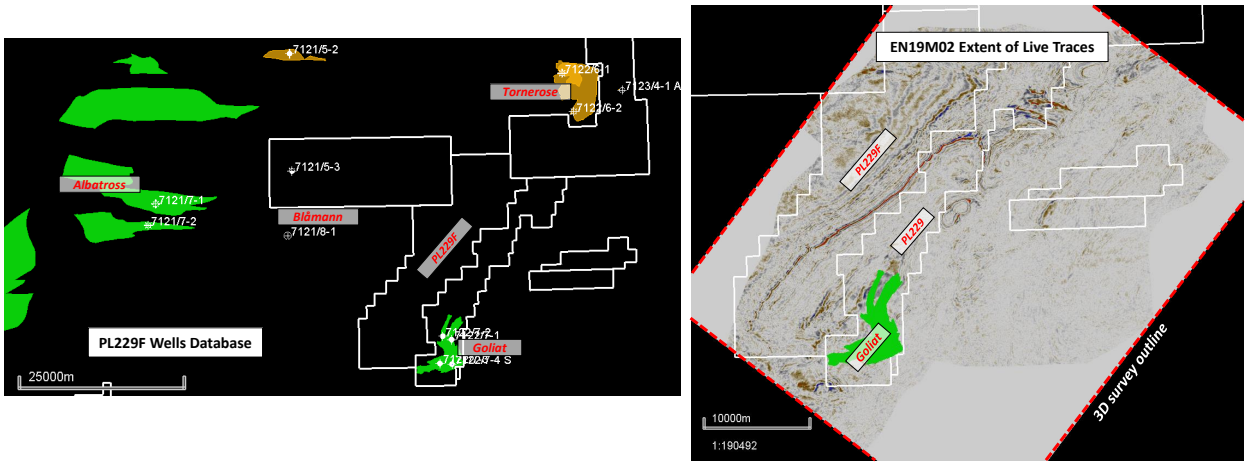

Fig. 2.1 Seismic & Wells Database
Seismic: EN19M02 PSDM and PSTM with angle stacks (AESI Reprocessing of EN0702, FP13 and EN0901)
Wells: Goliat, Tornerose, Albatross, Blåmann and other wells across the Hammerfest Basin

3 Geological and Geophysical Studies

The license area at time of award was 321,379km2, which was the acreage of the licence at the time of relinquishment.

The original prospectivity at time of award (APA2018) was based on work carried out on the 3D volumes EN0702, and ST05M09. The 'Greater Goliat reprocessing' project began in 2018 to produce an homogeneous 3D survey covering PL229 and the surrounding licences. The input surveys were EN0702, EN0901, FP13, NA9801 and NA0102. The work program for PL229F was aligned with this reprocessing work, and with the generation of the EN19M02 3D survey, the work commitment of PL229F is thus fulfilled.

There followed an intensive re-interpretation of the prospectivity in the licence, utilizing this reprocessed seismic volume. The result was the prospectivity illustrated in Section 4 of this report.

In order to de-risk reservoir in the PL229 area, separate FMI studies were carried out by Eiriksfjord, looking at the Realgrunnen and Kobbe reservoirs. These were primarily to feed directly into the Goliat reservoir model, but also provided valuable insight to the potential reservoir levels in PL229F. In addition, a regional core study was carried out by Skolithos, for the Realgrunnen reservoir.

Vår Energi also instigated several in house studies to further evaluate the Kobbe Formation potential. A semi-regional sedimentological study was performed, together with AVO screening and analysis.

4 Prospect Update

The updated interpretation resulted in 3 prospects and 2 leads, see Fig. 4.1 for the locations of the 3 prospects.

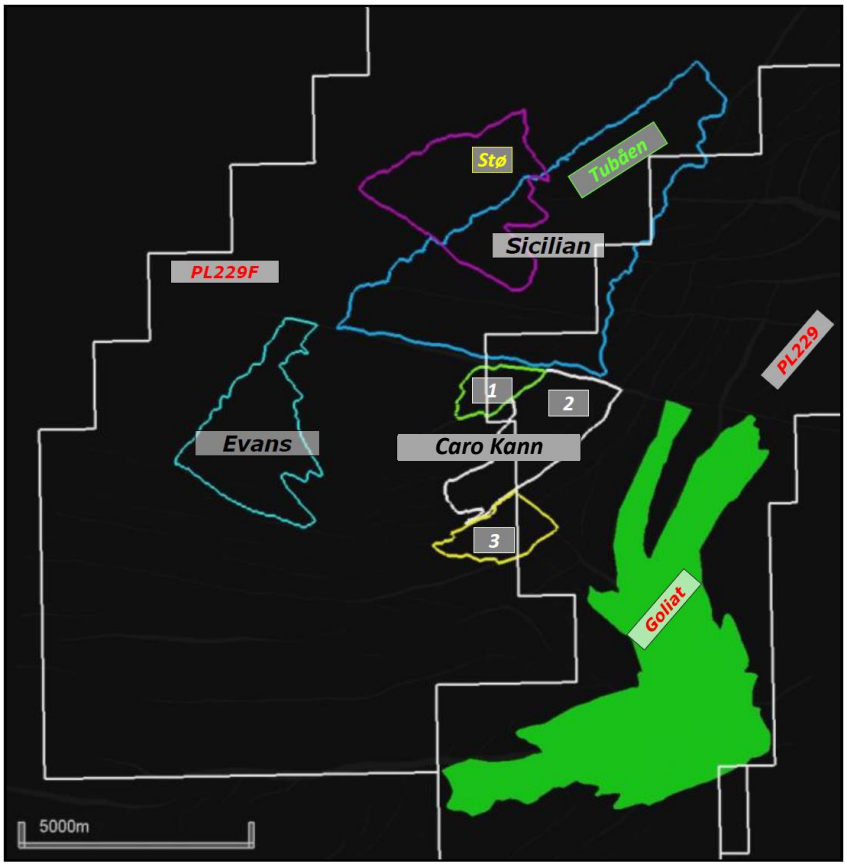

Fig. 4.1 Prospects Location map
Sicilian, Evans and Caro Kann prospect outlines

Sicilian and Evans

Sicilian and Evans are two pinch-outs wedge prospects in the Stø and Tubåen Formation (see Fig. 4.2 & Fig. 4.3), which are located approximately 7-10 km west of the Goliat field. No major issues were foreseen for the reservoir presence and efficiency for the two targets at the prospects. Good quality sandstones were encountered in Stø Formation in the nearby wells of the Tornerose discovery, in the great Snøhvit field area and in the Blåmann (7121/8-1) discovery. The Stø Formation was deposited in nearshore/deltaic settings and is typically characterized by wave winnowing resulting in better-sorted, homogeneous sandstones. The Tubåen Formation is present over most of the discoveries in the Hammerfest Basin such as the wells of the Tornerose discovery, in the great Snøhvit field area, in the Blåmann (7121/8-1) discovery, and in the Goliat field (wells 7122/7-2 and 7122/7-7S). The most recent well in the Goliat field 7122/7-7S Goliat West found 10m of clean sandstones with excellent reservoir properties and 100% net-to-gross. The typical depositional environment for the Tubåen Formation is fluvial to deltaic with lithologies characterized by coarse-grained, poor- to well-sorted sandstones with high net-to-gross. The main petroleum system for the PL229F prospects is considered deriving from the Upper Jurassic Hekkingen Formation with the main expulsion phase occurring during Oligocene-Miocene time and continuing hydrocarbon generation and expulsion in the basin to the present-day. A long-distance migration is foreseen, and all prospects are favourably located along the hydrocarbon pathways that are

believed to have charged the Goliat field at its Realgrunnen Sub Group hydrocarbon level. Charging took place from the west by Realgrunnen Sub Group carrier beds through a fill-to-spill mechanism from the greater Snøhvit field or the Blåmann discovery

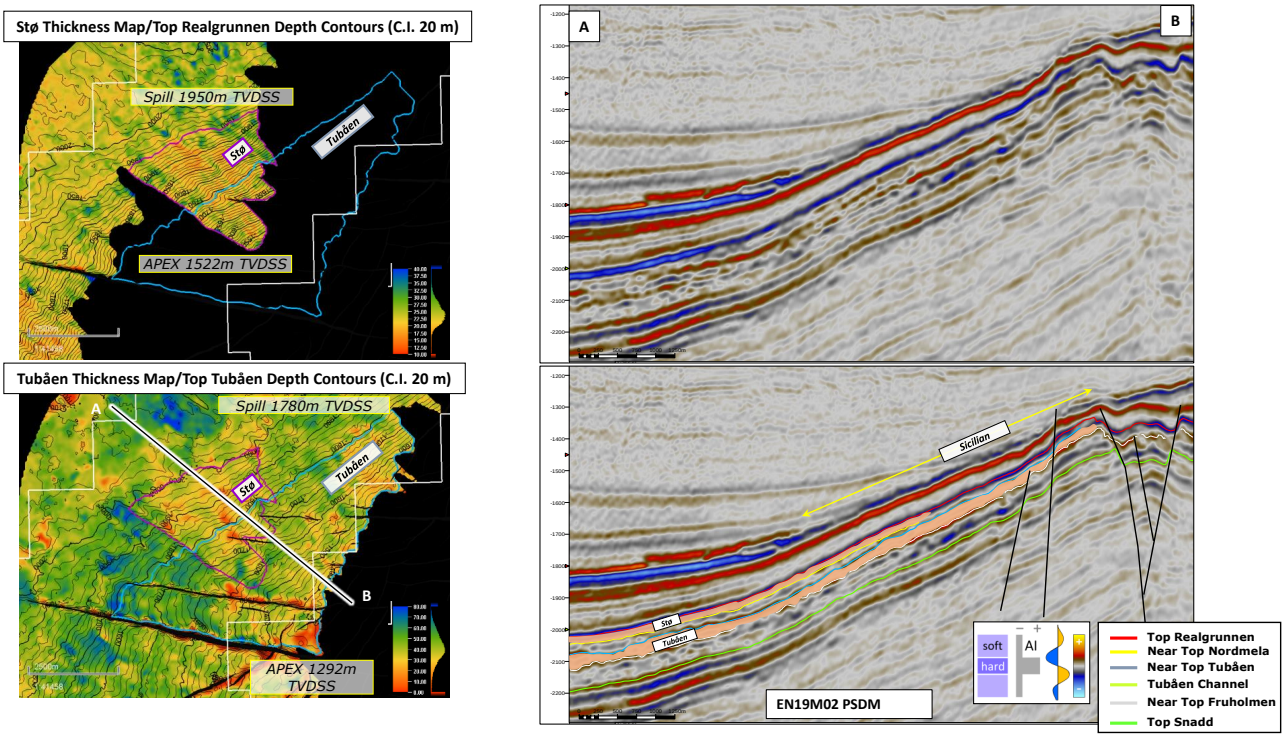

Fig. 4.2 Sicilian Prospect
Stø & Tubåen top reservoir depth maps and seismic section

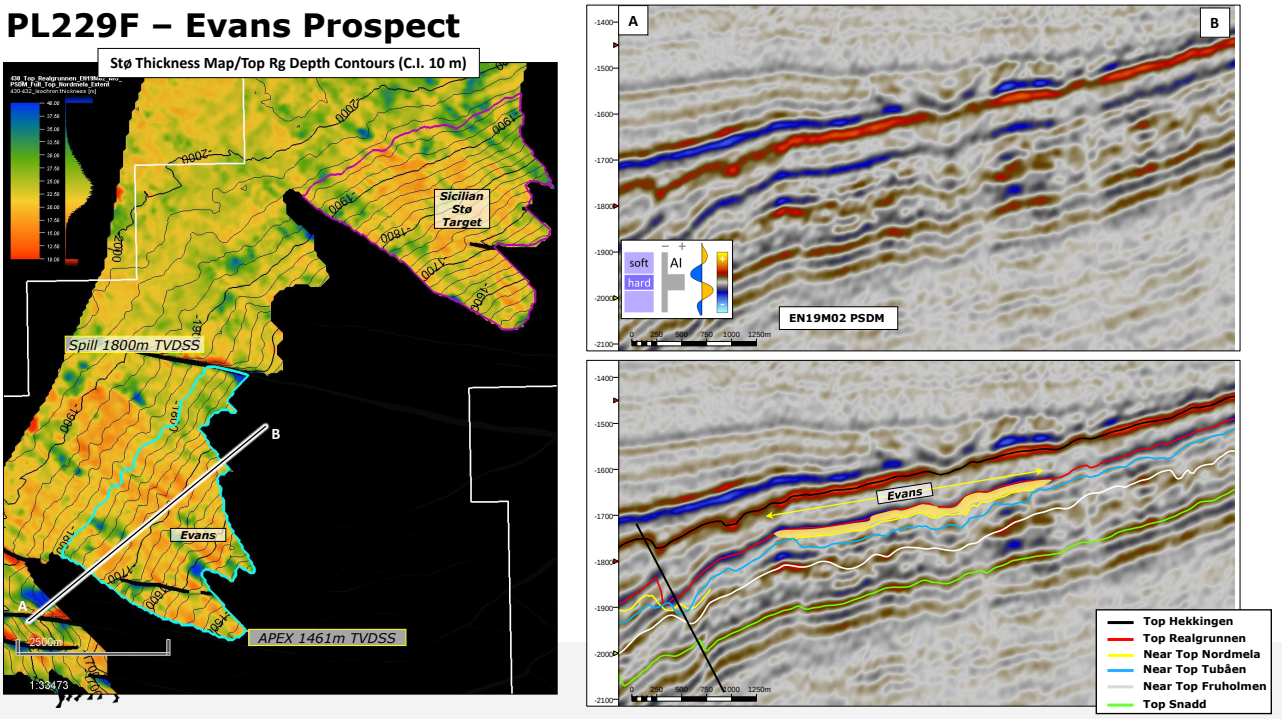

Fig. 4.3 Evans Prospect
Stø top reservoir depth map and seismic section

Caro Kann

Caro Kann is a faulted 3-way closure located adjacent to the Goliat West compartment of the Goliat field. A major E-W trending fault separates Caro Kann to the Sicilian prospect to the North, whereas to the East two faults separate the Caro Kann down-thrown fault blocks from Goliat West. The prospect is divided by two SW-NE directed faults into three segments with different culminations and spill points for all three targets: Tubåen, Fruholmen and Kobbe (Fig. 4.4 & Fig. 4.5). Fruholmen Formation is present across all the discoveries in the Hammerfest Basin and consists of channel to over-bank and inter-fluvial deposits. Segment two of the structure has as additional target the Kobbe Fm. The Kobbe reservoir consists of the upper Kobbe interval and represents a coastline with a prograding delta front environment. Sandstone bodies are interpreted as stacked deltaic mouth bars and distributary channels, vertical separated by prodelta claystones. Seal of the Realgrunnen Group in Caro Kann is a thick package of shales of the Middle Jurassic Fuglen Fm., Upper Jurassic Hekkingen Fm., and the Cretaceous Knurr and Kolmule Formations. The top seal for Kobbe target is defined by the shales of the lower part of Snadd Formation proved to be effective seal in the Goliat field.

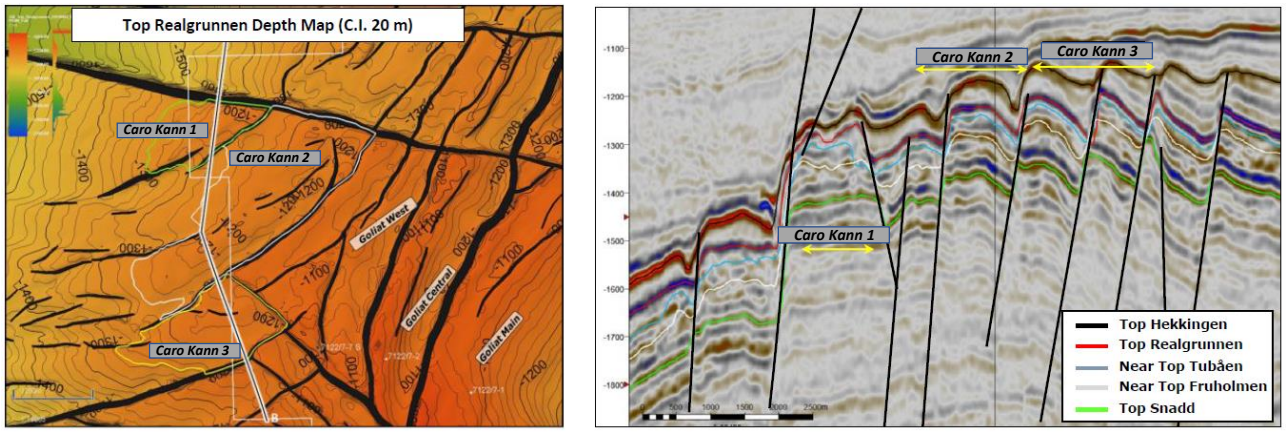

Fig. 4.4 Caro Kann Prospect - Realgrunnen
Top Stø reservoir depth map, with prospect segments outlines and seismic section.

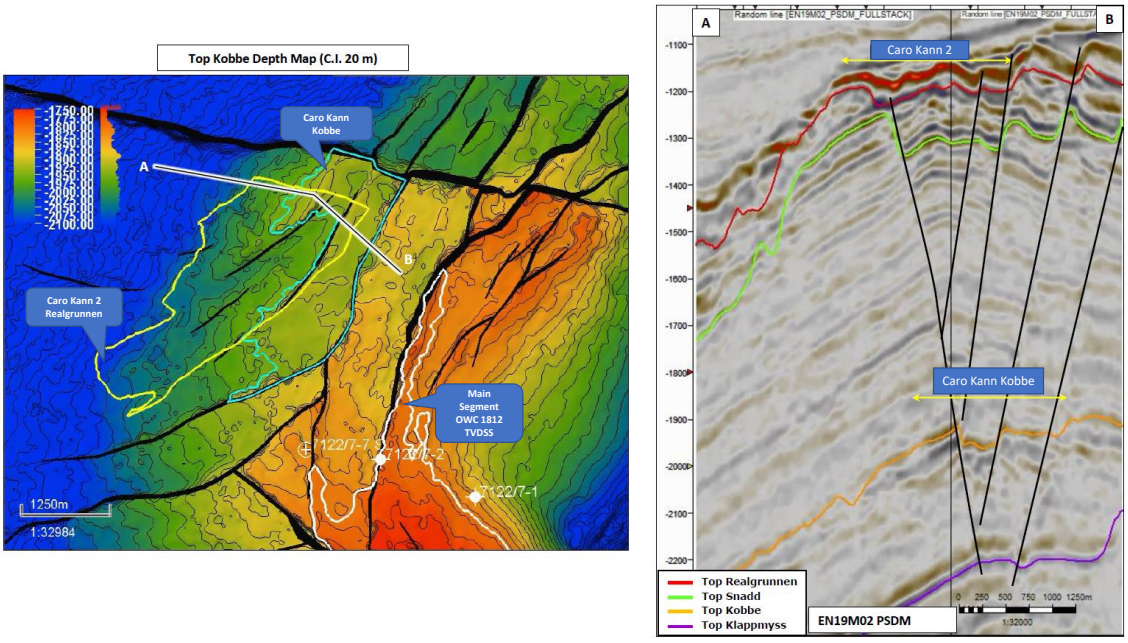

Fig. 4.5 Caro Kann Prospect - Kobbe
Kobbe reservoir map and prospect outline, with seismic section.

Serpe

Serpe is a stratigraphic trap that consists of a channel feature at the Intra Snadd reservoir level, see Fig. 4.6. The channel feature is located on the western flank of a large roll-over anticline, which develops from the Goliat field to the Tornerose discovery to the west of the Troms-Finnmark Fault Complex. Closure at the prospect level is ensured by the direction of the channel itself, which runs first up-dip and then down-dip on the western flank of the above mentioned roll-over anticline. Carnian IntraSnadd sandstone is the reservoir target of the Serpe and Cotton Mouth prospects. This sequence is expected to consist of fluvial sandstones representing mainly laterally amalgamated (i.e. multi-lateral) fluvial meandering channel belts. The Carnian IntraSnadd sandstone is the main reservoir in Tornerose discovery (7122/6-1, 7123/4-1S Fig. 1.11). In the Snadd Formation, the Goliat field and Tornerose discovery wells show both vertically separated compartments with different water-pressure regimes. Therefore, top seal for the IntraSnadd Serpe and Cotton Mouth prospects is not regarded as a major risk.

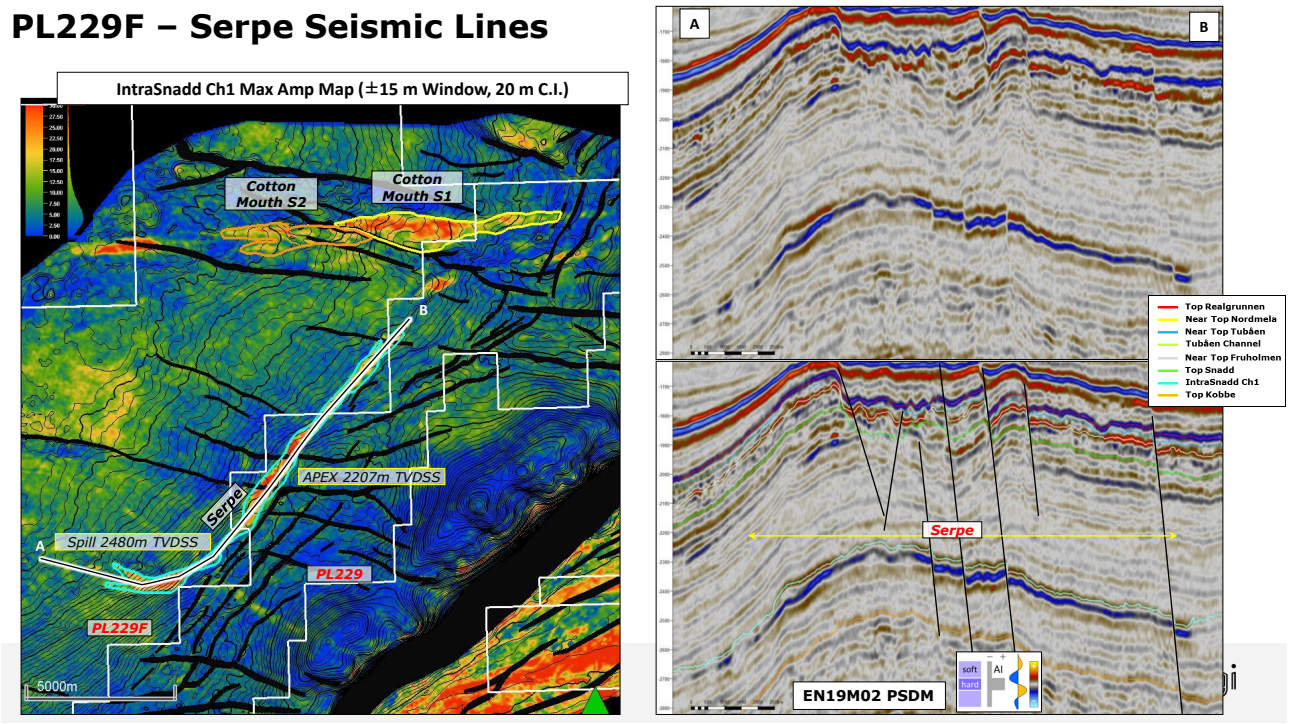

Fig. 4.6 Serpe Lead
Intra-Snadd amplitude map with Serpe outline, and seismic section

Cotton-Mouth (seg 1-2)

Cotton-Mouth consists of two segments of a same sedimentary pathway separated by a fault, which throw enough to offset the entire thickness of a channel belt clearly visible on seismic, see Fig. 4.7 .

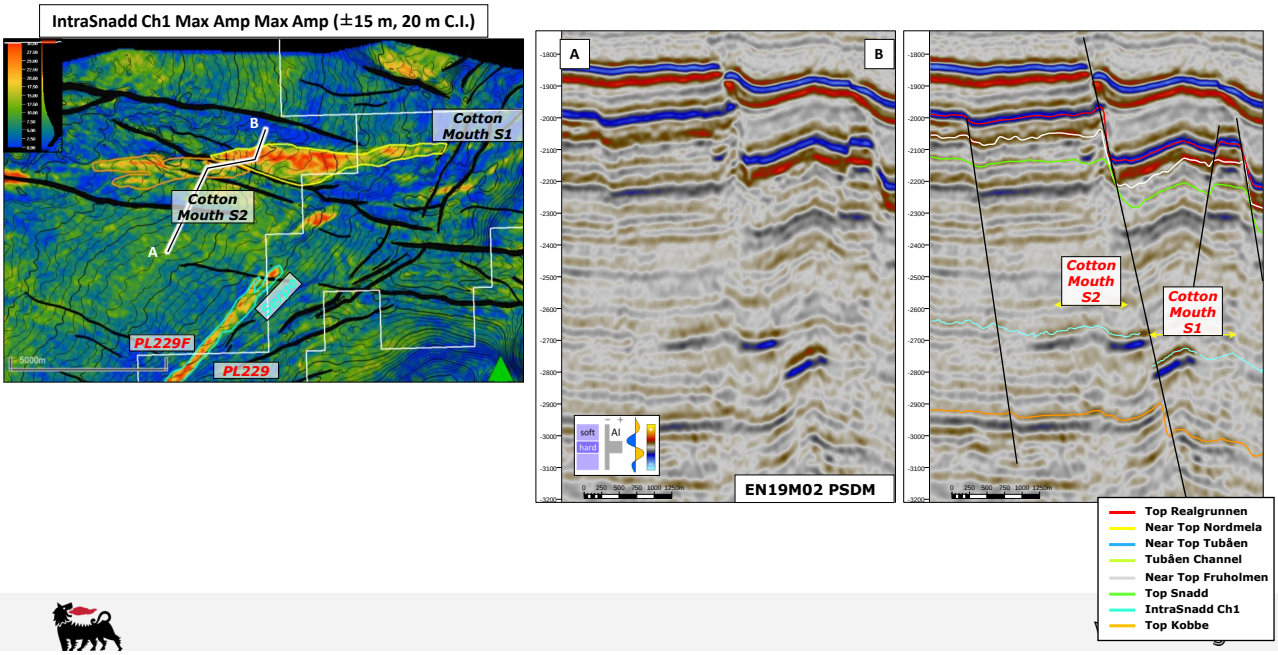

Fig. 4.7 Cotton Mouth Lead
Intra-Snadd amplitude map with Cotton Mouth segment outlines, and seismic section

5 Technical Evaluations

Volumetrics & Risking

A summary of the calculated in-place volumes and associated risk for each of the prospects and leads is found in Table 5.1.

Table 5.1 In-Place Volumes and Risking

Prospect	HIIP MBOE				POS avg
	P90	P50	P10	Pmean	%
Sicilian	17	50	127	62	7
Evans	1	5	22	9	10
Caro Kann	35	60	98	64	44
Serpe	7	14	25	15	35
Cotton Mouth	7	15	30	17	35

The main points with regard to the calculation of the volumes and the assignment of risk with regards to the 3 prospects are as follows:

Sicilian and Evans prospects are both on migration path of hydrocarbons toward Goliath on a monocline where the Realgrunnen sequence is thinning and shaling out, and this in principle could support the existence of stratigraphic traps and the filling. The proposed model is a fill to spill mechanism from west existing traps.

However, Nordmela and Fruholmen formations, which act as seals in the presented stratigraphic traps, are proven reservoir in the area, according multiple field and discoveries. Both prospects are few km up-dip of Blåmann discovery, where Sto, Nordmela and and Tubaen, from MDT data, are single tank good quality reservoirs, and the same is in the Tornerose discovery. Fruholmen seems to be more a sandy formation then a robust seal. Therefore, the trap mechanism is very risky in terms of sealing.

Although the formation of small stratigraphic traps cannot becompletely excluded, the sandy sequence of the Realgrunnen does not shows any amplitude anomaly supporting the existence of the traps or supporting a significant HC column. Lack of clear evidences of a seal and of direct evidences of HCs, at least with the current information, significantly increases the risk associated with Evans and Sicilian. Without amplitude support, no analog and a questionable trapping mechanism (see Fig. 5.1), a high risk has been associated to expected HC column height and trap.

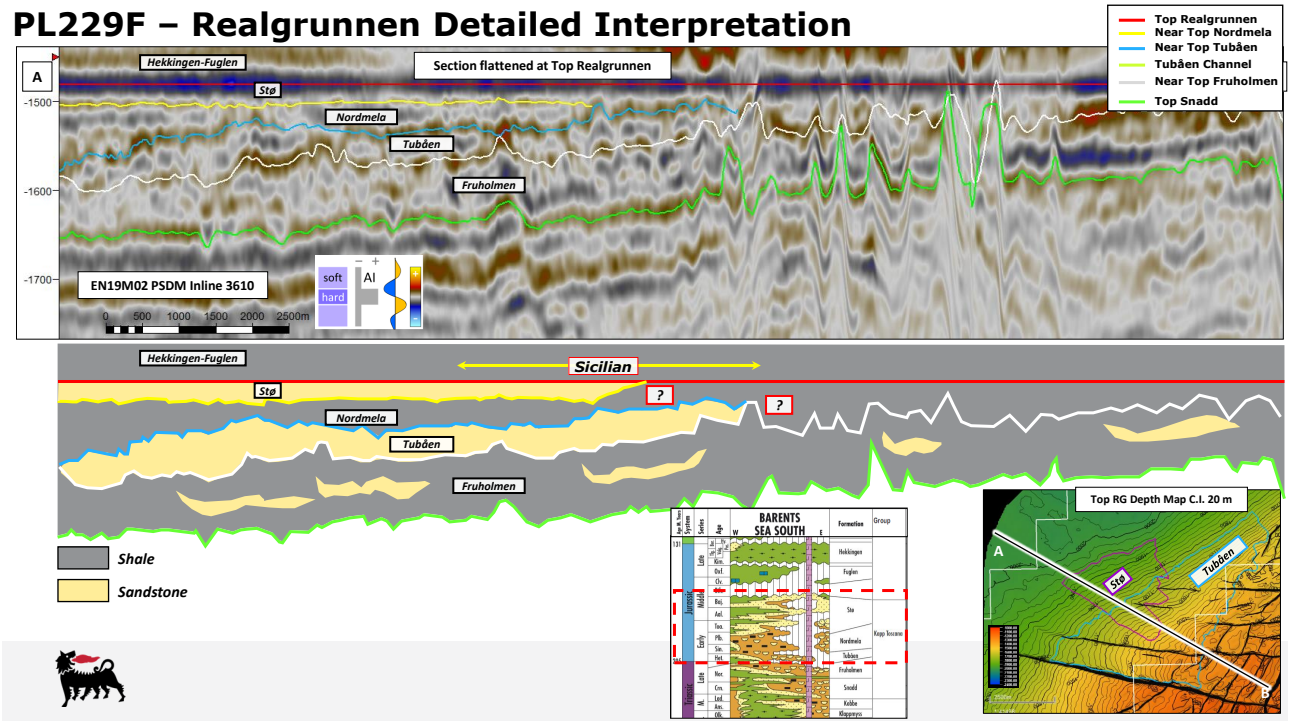

Fig. 5.1 Sicilian Geosection
Flattened seismic section illustrating the detailed realgrunnen interpretation and the trap risks.

Caro Kann prospect sits on the margin of the already underfilled Goliat discoveries. In the Goliat drilled segments a structural conformance of the amplitude anomaly is observable, clear in Goliat Central, more ambiguous in the other segments. In Caro Kann some positive amplitude indications, when present, are only in the very upper part of the segments, or where hints of minimum four deep way closures are present (Fig. 5.2). A weighted distribution to the contact ranges was used, heavily weighted towards the minimum.

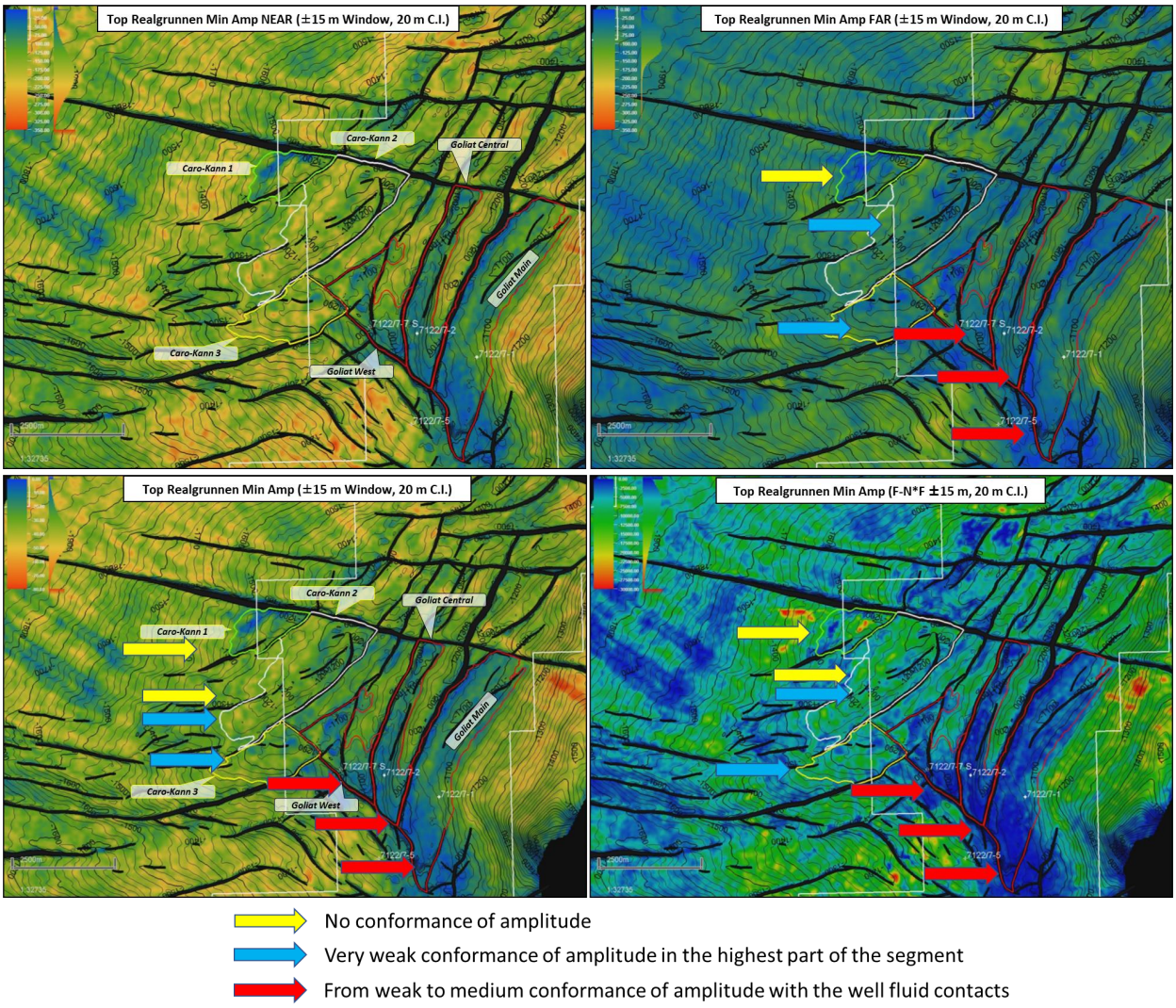

Fig. 5.2 Caro Kann Amplitude Maps

The risk associated to Sicilian and Evans makes them impossible to de-risk to a drill decision, and the volumes associated to Cotton Mouth likewise.

Caro Kann and Serpe remain of interest, but with the bulk of both prospects lying with the PL229 licence, it was decided to assign these prospects to PL229.

6 Conclusions

The updated interpretation, on the reprocessed EN19M02 3D seismic has not produced any viable drilling candidates.

It is the unanimous view of the JV that the stratigraphic prospects identified cannot be de-risked sufficiently, and that the licence be relinquished.