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Report ID. :		Reference no.:	
SUBJECT:	PL900 License Report		
ABSTRACT	<p>Given the structural complexity of the area, the updated seismic interpretation on purchased seismic together with the G&G studies conducted within the PL900 license-duration have shown that the presence of the main license prospect, Goliat Eye West, is questionable. In addition, well 7122/10-1S (Goliat Eye) in 2017 resulted dry and, thus, downgraded extensively the possible migration pathway and charging through the Goliat Eye West prospect.</p> <p>The evaluation concluded that PL900 is a low materiality asset with main risk associated to hydrocarbon migration and trap retention capability.</p>		
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1 License history

The PL900 license, within block 7121/12, has a total area of 79.24 km² and it is located 20 km south-west of the Goliat field (PL229) and around 10 km NW of the Goliat Eye structure (PL697). The JV was composed of Vår Energi AS 90% (Operator) and Concedo ASA 10% (Fig. 1.1).

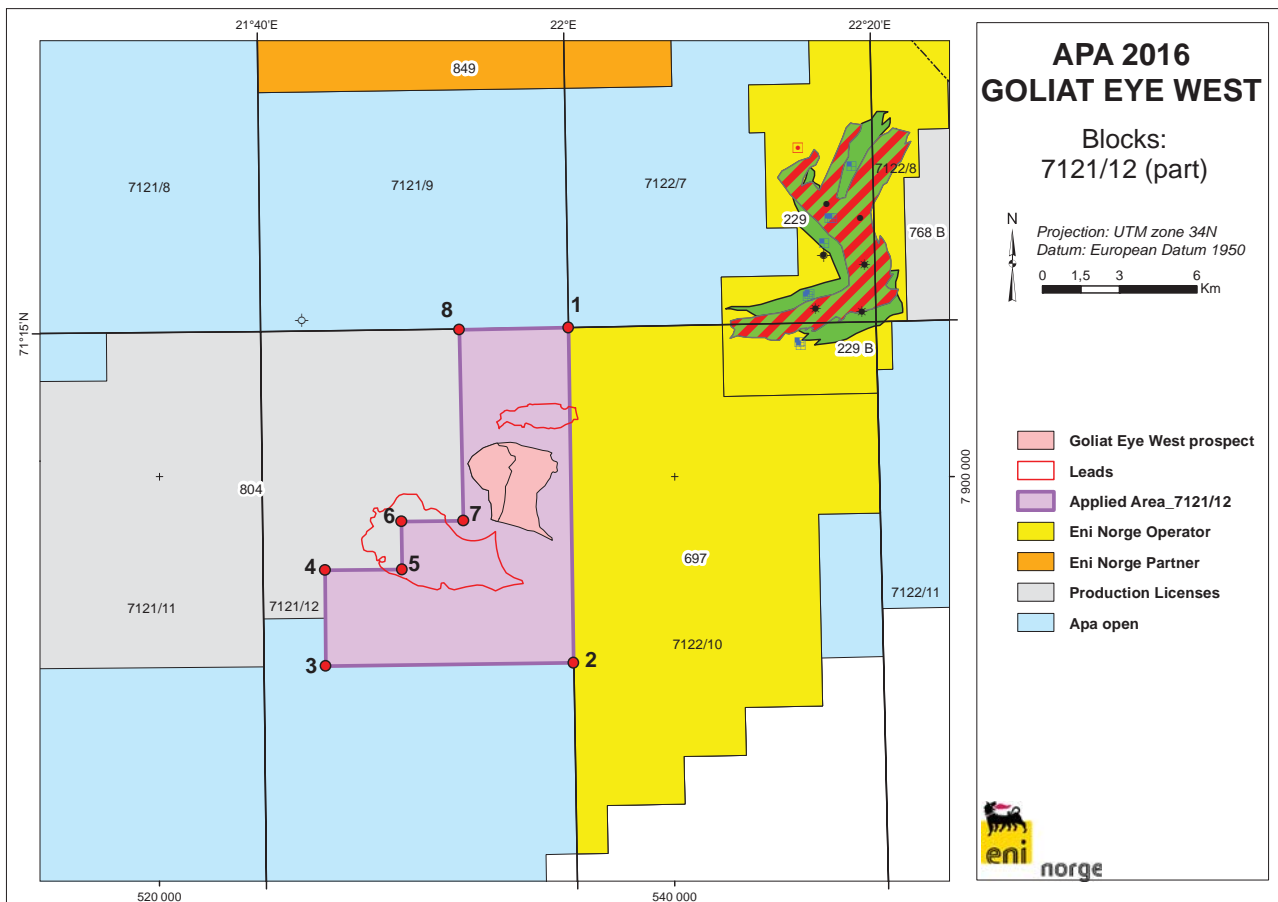


Fig. 1.1 Acreage applied for with prospect outlines

PL900 was awarded in February 2017 in the frame of the APA/TFO 2016, with the obligation of acquiring 3D seismic data and a Drill or Drop Decision to be taken within 10.02.2019. The application was based on the resources associated to the Goliat Eye West prospect, with the aim of identifying possible synergies in case of success in the drilling of the NFW 7122/10-1S Goliat Eye. The disappointing results of the Goliat Eye drilling have significantly downgraded the potential of the area.

The work commitment related to this license consisted in the acquisition/purchasing of 3D seismic data, has been fulfilled by purchasing the FP13 and the portion not publicly released of the WINR16 3D seismic datasets. A new interpretation of the 3D seismic data led to a revision of prospects and leads inventory of PL900. Three prospects have



been mapped in the license: Pianosa, Goliat Eye West, and Giglio. The play concept for these prospects is the Middle Triassic shallow-marine to fluvial-deltaic sandstone of the Kobbe/Klappmyss formations.

During the licence life-period the following meetings have been held with partners:

27.03.2017 ECMC start up meeting

28.11.2017 ECMC meeting

26.11.2018 ECMC meeting

The revised exploration potential of the license led to a negative economical evaluation and, therefore, the operator recommended to the partnership to surrender PL900 at the drill drop deadline of February 9th, 2019. This recommendation was supported unanimously by the partner in the JV.



2 Database

2.1 Seismic

The 3D and 2D seismic databases agreed by the JV and used for interpretation and prospectivity evaluation of the PL900 is a combination of proprietary and public data. Table 2.1 lists the utilised 3D and 2D seismic data.

Table 2.1 Seismic survey database

Survey	Type	Quality	Public	Year
DG0901	3D	Good	Yes	2009
WINR16	3D	Good	Partially	2016
FP13 (PL900)	3D	Fair/Good	NO	2013
BSS01-108,109,110,203,204	2D	Fair	Yes	2001
NPD-TR-77-NH-R01	2D	Fair	Yes	1977
NPD-TR-73-NH-R01	2D	Fair	Yes	1973

2.2 Well data

The table below illustrates the PL900 common well database.

Table 2.2 Well database with relevant information

Well Name	Operator	Status	TD (mRKB)
7120/12-4	Hydro	Traded	2199
7122/7-3	Eni	Operator	2726
7122/7-4	Eni	Operator	2550
7122/7-5	Eni	Operator	2228
7122/7-5A	Eni	Operator	2186
7122/7-1	Eni	Operator	1524
7122/7-2	Eni	Operator	1418

2.3 Special Studies

The following studies were conducted during the duration of the license:



- Hammerfest Basin regional petroleum systems modelling (PSM)
- Kobbe formation rock physics modelling (RPM)



3 Geological framework

In this section, a brief review of the tectono-stratigraphic history and geological factors relevant for the prospectivity of PL900 is provided. The stratigraphy of the area of interest, with specific focus on reservoir intervals both at prospect and lead scales, is illustrated in Fig. 3.1.

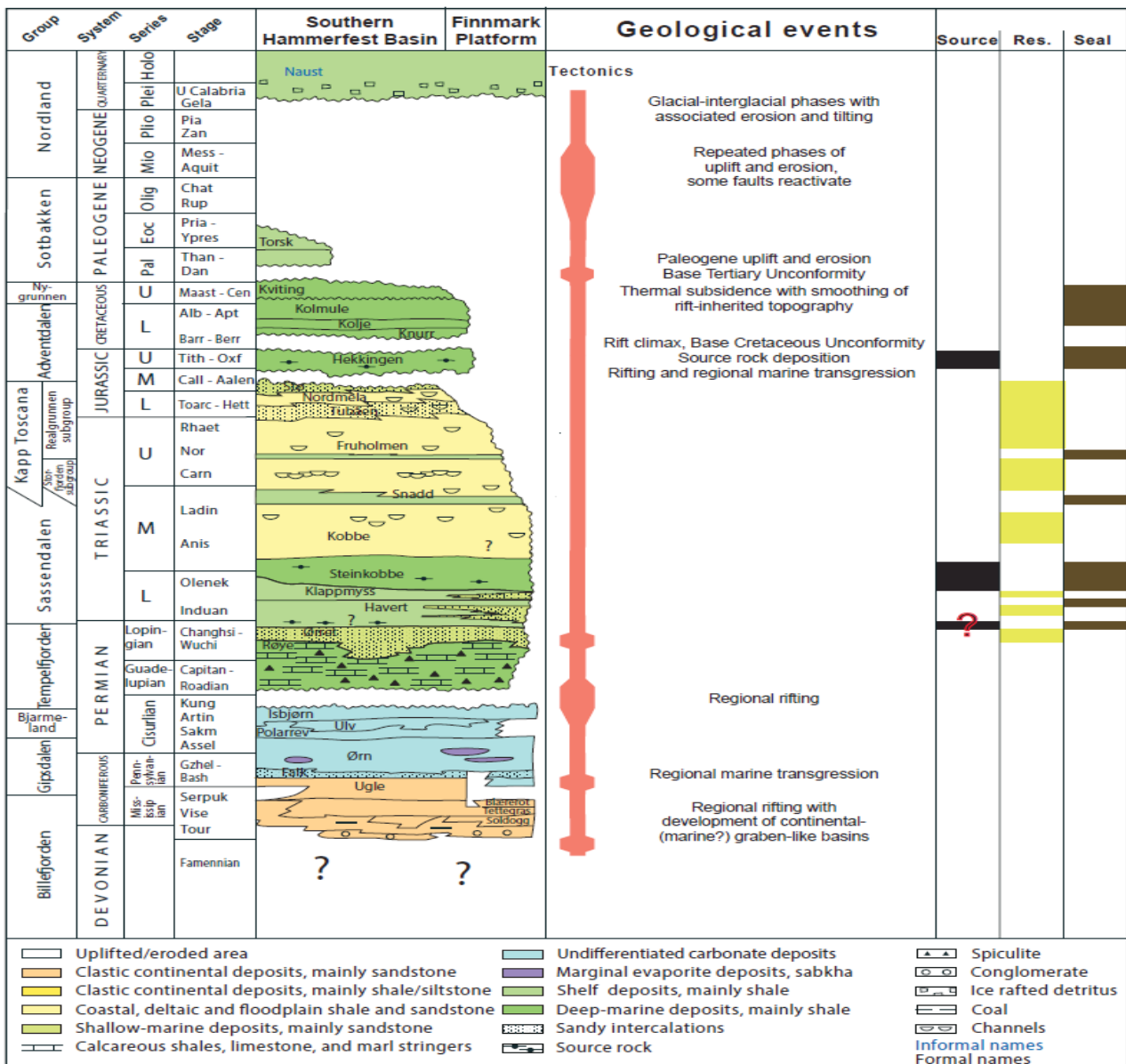


Fig. 3.1 Hammerfest Basin and Finnmark Platform geological framework

Main structural elements

The PL900 is located between the southern margin of the Hammerfest Basin and the Finnmark Platform (Fig. 3.2). The Hammerfest Basin and the Finnmark Platform are



separated by the Troms-Finnmark Fault Complex representing a major, long-lasting tectonic element that repeatedly accommodated deformation through geological time, and played a major role in hydrocarbon prospectivity (Fig. 3.2).

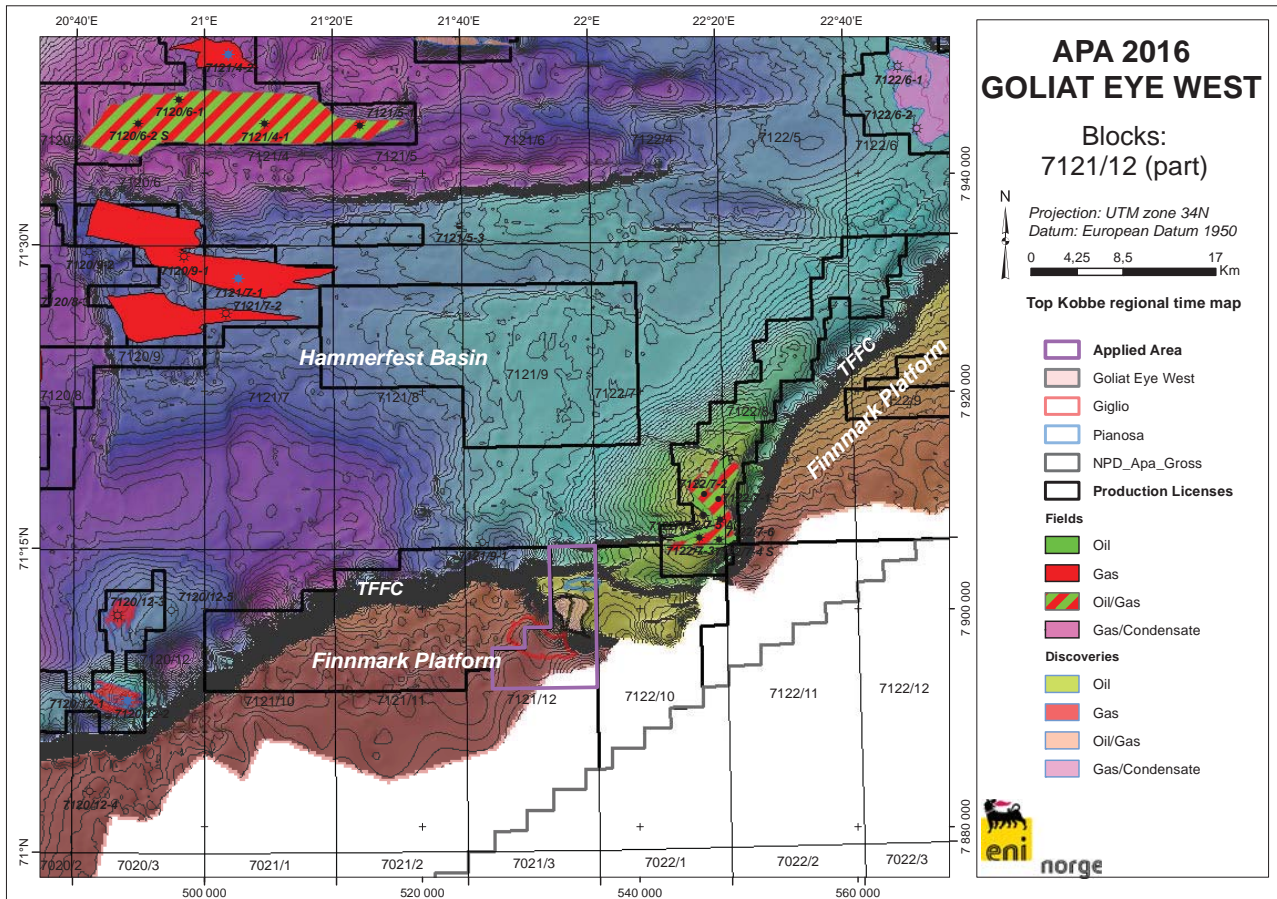


Fig. 3.2 Structural map along the Troms-Finnmark Fault Complex

Permo-Triassic tectono-stratigraphic history

The Late Paleozoic structural evolution of the Western Barents Sea was characterized by a NW-SE oriented rifting phase which resulted in the development of basins with intervening highs (e.g. Gudlaugsson et al., 1998). Rifting reactivated deep-rooted, Caledonian and Early Paleozoic tectonic lineaments (e.g. Gernigon et al., 2014), and, though, principally concentrated in the Nordkapp, Tromsø and Harstad Basins, it also affected the Hammerfest Basin.

During Late Permian, the paleo-Hammerfest Basin represented a broad sag basin developed between Loppa High and Finnmark Platform, both shedding clastics to the basin (e.g. Gudlaugsson et al., 1998). Upper Permian, inner shelf sandstones were penetrated by well 7122/7-3 (Eni Norge-APT, 2006), and typically occur at the top of coarsening-upward sequences including carbonates and a shale-rich basal interval.

The Triassic period was characterised by sedimentation in a highly-subsiding and tectonically quiet setting with the Finnmark Platform as the main source of clastics.



Individual sequences marked discrete phases of shoreline/shelf edge progradation interrupted by short-lived, transgressive events. Major transgressions promoted deposition of open-shelf, shale-rich units and locally of organic-rich shales forming proven and unproven (e.g. lower Havert Formation) source rocks.

A major transgression at the top of the Havert Formation re-established bathyal conditions in the area of interest with extensive sedimentation of dark-grey shale of the lower Klappmyss Formation. This is overlain by alternating shales, siltstones and sandstones of open-to-marginal marine settings. Klappmyss Formation sandstones are the main reservoir target of the Giglio lead, and possibly an upside potential of the Goliat Eye West prospect and Pianosa lead. They were proven to be oil-bearing in the nearby Goliat 7122/7-3 and 7122/7-4S wells, with 7122/7-4S well core showing forced-regressive mouth-bar sandstones resting sharply on top of bioturbated offshore fines.

Renewed transgressive conditions promoted relatively deep-marine sedimentation of fines over the Hammerfest Basin, with development of the Steinkobbe Formation. Following the basal transgression, general regressive conditions characterised the Kobbe Formation in the southern margin of the Hammerfest Basin, with extensive development of fluvio-deltaic and shoreface sandstones at the top of high-frequency transgressive-regressive sequences. These sandstones form the main reservoir of the Goliat Eye West Prospect and Pianosa lead, are sealed by the transgressive shales at the base of the overlying Snadd Formation.

4 Prospect update

All the prospects in PL900 are located in a morpho-structural terrace representing the hangingwall of a breached relay ramp which developed along the linkage zone of two main segments of the Troms-Finmark Fault Complex (Fig. 3.2). PL900 prospectivity is shown in Fig. 4.1.

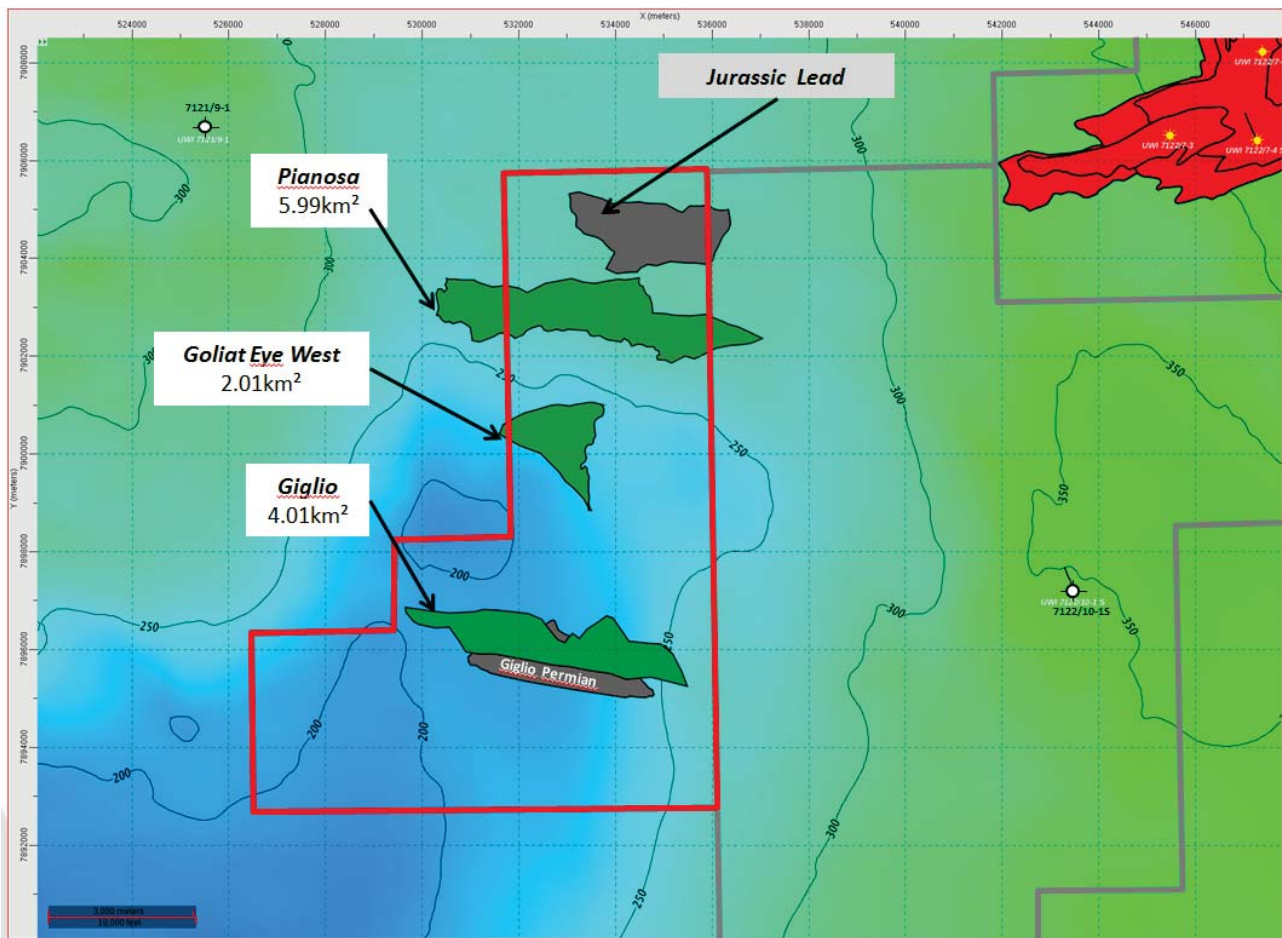


Fig. 4.1 Prospect outlines and sizes, together with seabed morphology

Pianosa is a 3-way fault assisted closure at Kobbe Formation, which is internally further segmented by minor E-W oriented faults. It is located 10 km northeast of Goliat Eye West, at water depth of 270 m. The top Kobbe Formation culmination is at 1485 m tvdss and the maximum vertical closure is 85 m (Fig. 4.2). Trap is fault-assisted; therefore sand to shale juxtaposition is required for granting trap integrity due to fault seal capabilities. At Pianosa, lateral seal is provided by the Upper Cretaceous formation shales. The structure of Pianosa has been confirmed by PSDM and PSTM seismic interpretation, highlighting in both surveys a NW-SE elongated structure with prominent seismic anomaly in the northern segment of the structure (Fig. 4.3).

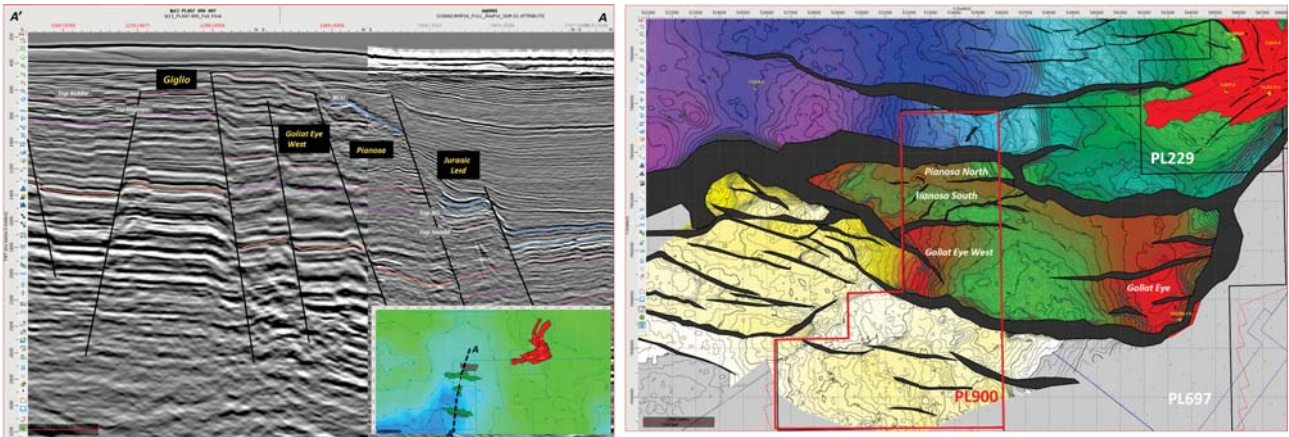


Fig. 4.2 Composite seismic line through the prospects and lead, and Top Kobbe structural map

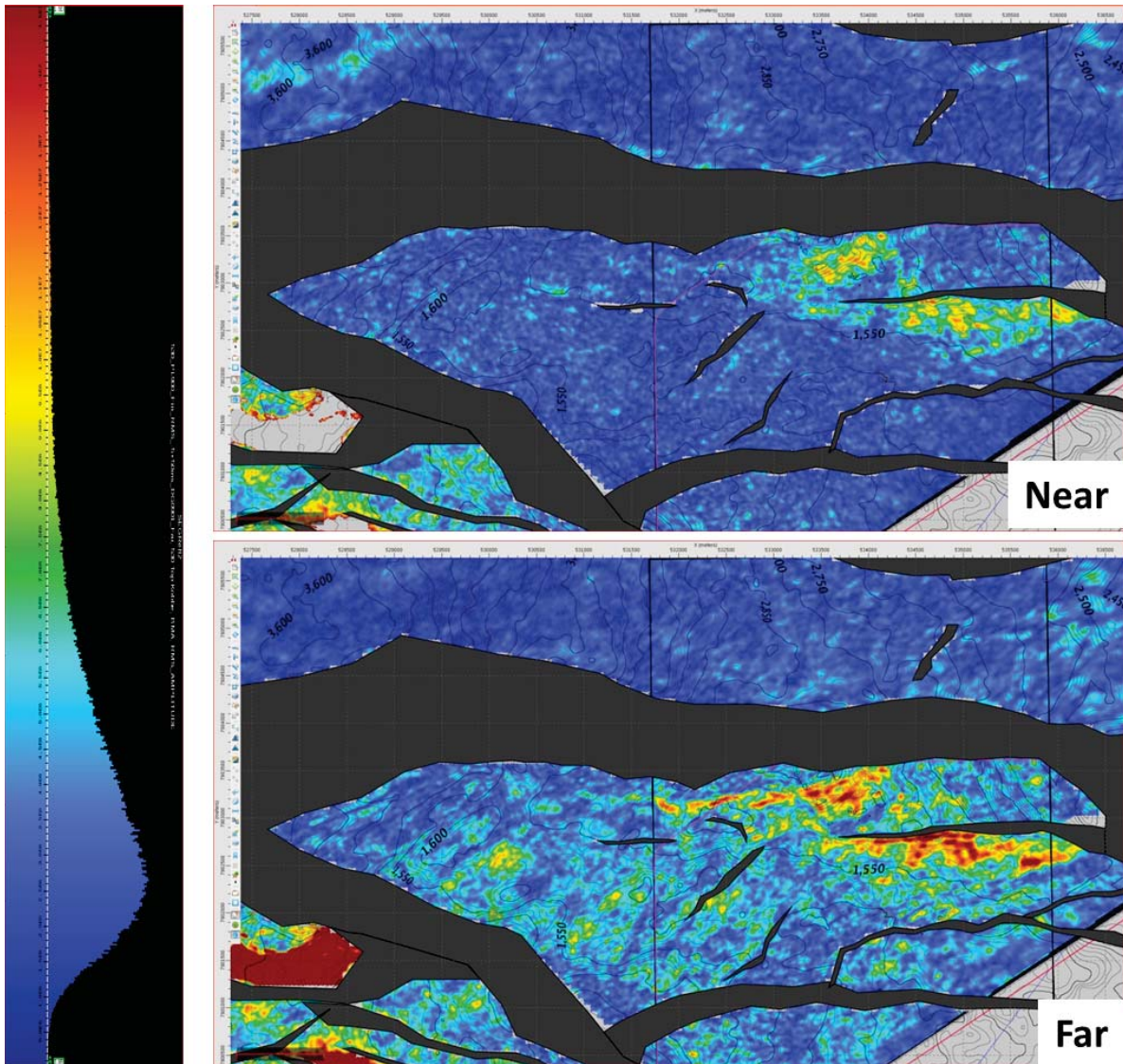


Fig. 4.3 Top Kobbe RMS amplitude extraction
Extraction is on near and far stacks at a -10 ms to 50 ms window



The Goliat Eye West prospect is a triangular shaped fault bounded closure at Kobbe Formation (no DHI). It is limited to the north by a north dipping E-W oriented fault and to the west and south by the SW-NE Troms-Finnmark Fault Complex (Fig. 4.2). The prospect lies on the downthrown side of the Troms-Finnmark Fault Complex system, specifically on a relay ramp developed along the linkage zone of two main segments of such Fault Complex (Fig. 4.4).

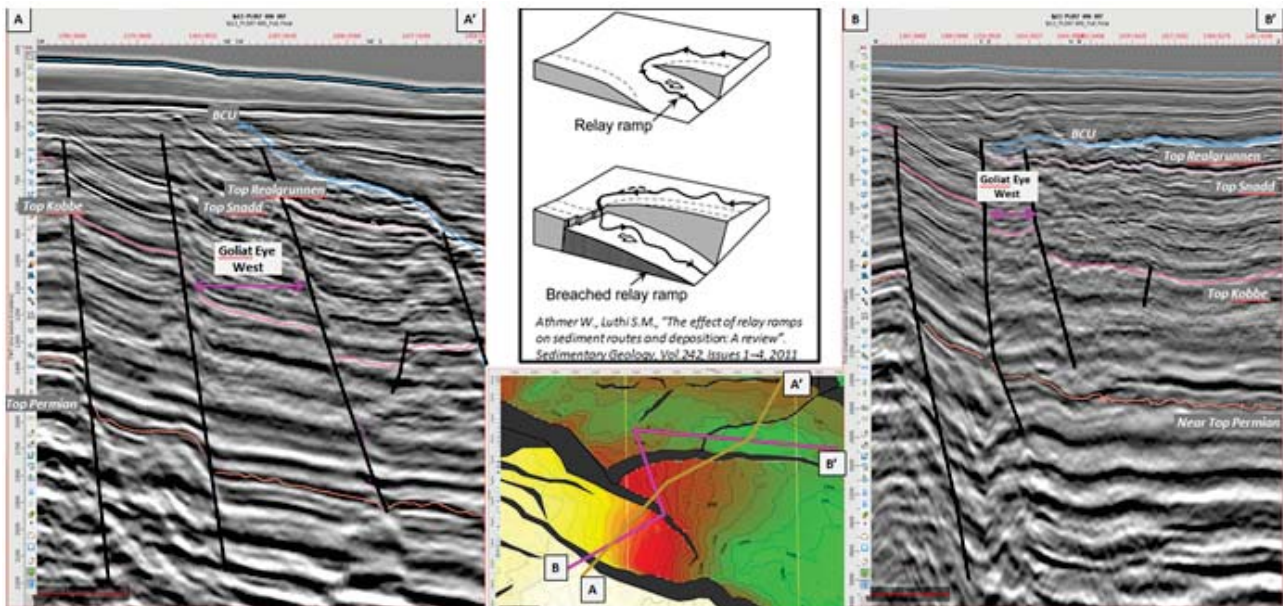


Fig. 4.4 Prospect seismic line with Troms-Finnmark Fault Complex

Giglio is a 3-way fault bounded prospect at Klappmyss Formation located on the Finnmark Platform at a water depth of 200 m. The top Klappmyss Formation culmination is at 797 m tvdss and the maximum vertical closure is 38m (Fig. 4.5).

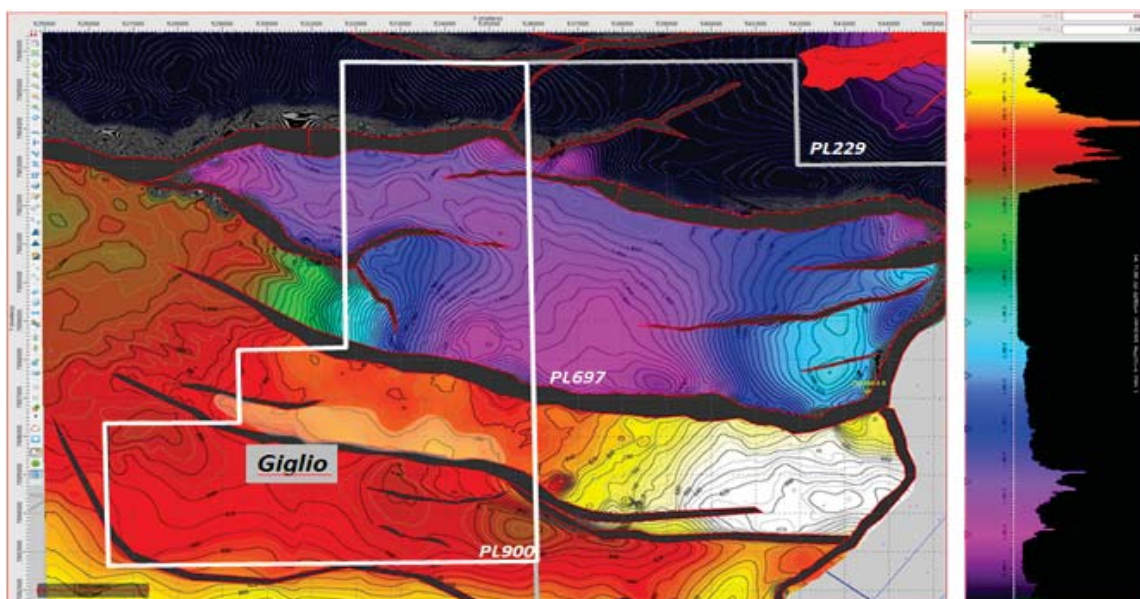


Fig. 4.5 Top Klappmyss depth map



5 Technical evaluations

Seismic interpretation was carried out on 3D PSTM/PSDM dataset, and was supported by both a regional petroleum systems modelling study (PSM) and a rock physics modelling (RPM) study for Kobbe Formation. Subsequently, updated volumetric and risk assessment have been performed.

The volumes of hydrocarbon in-place of the prospects in PL900 licence have been estimated using PRES (Vår Energi's in-house software for volume calculation based on Monte Carlo simulation) following the most recent interpretation and studies. The volumetric estimations are relevant to the Kobbe and Klappmyss formations. Input parameters have been derived from the nearest reference wells and summarized in Table 5.1, Table 5.2 and Table 5.3.

Table 5.1 Reservoir/fluid parameters at Kobbe Formation

PIANOSA Kobbe formation	Gross Thickness	Total HC Column	Gas Column	N/G	Por	Sw (oil/gas)	FvF	GOR	Spill Point	Vertical closure
	(m)	(m)	(frac.)	(frac.)	(%)	(%)	Bo/Bg	scf/bbls	(m)	(m)
Gas Cap and Oil Ring	140-260	1510-1530-1570	0.3-0.6	0.3-0.6	0.19-0.26	0.10/0.15	1.3/210	650	1570	85
						0.25/0.3	1.4/217	800		
						0.40/0.45	1.48/225	850		

Table 5.2 Reservoir/fluid parameters at Klappmyss Formation

GIGLIO Klappmyss formation	Gross Thickness	Total HC Column	Gas Column	N/G	Por	Sw(oil)	Sw(gas)	FvF	GOR	Spill Point	Vertical closure
	(m)	(m)	(frac.)	(frac.)	(%)	(%)	(%)	Bo/Bg	scf/bbls	(m)	(m)
Gas Cap and Oil Ring	50-80	825-835	0.4-0.6	0.3-0.5	0.15-0.25	0.2-0.4	0.2	1.23/154	600	835	38
							0.3	1.27/171	800		
							0.4	1.31/190	850		

Table 5.3 Offset well reservoir parameters

KOBBE	APEX	Owc penet.	OWC - grad.	OIL column	GOC grad.	GAS column	TOT HC (m)
7122/7-3 S3	1655	1840	1840	72,5	1767,5	112,5	185
7122/7-4 S4	1670	1853		85,5	1767,5	97,5	183
7122/7-5 C5A	1725	1817	1817	57	1760	35	92
7122/7-6 M0	1675	1812	1812	56	1756	81	137

The calculated HIIP volumes and the conducted risk assessment are illustrated in Table 5.4.



Table 5.4 Volume of HIIP

Hydrocarbons Initially in Place											
Prospect	Target	Segment	GAS (bcf)				OIL (mmbbls)				Sol.Gas(bcf)
			P90	P50	P10	Pmean	P90	P50	P10	Mean	
Pianosa	Kobbe	2-North	0,41	2,26	8,45	3,58	5,67	15,32	37,00	18,87	14,10
Pianosa	Kobbe	1-South	0,18	0,52	1,58	0,73	2,40	7,03	16,63	8,41	6,29
Pianosa	Kobbe	Total Struct	0,95	3,06	9,28	4,31	11,71	24,35	46,89	27,28	20,44
GE West	Kobbe	1	0,18	0,61	1,70	0,79	5,30	13,88	32,77	16,78	12,60
Giglio	Klappmyss	1	0,41	0,75	1,48	0,87	4,28	7,26	11,91	7,74	6,38
Pianosa Volumes inside PL900											
Pianosa	Kobbe	2-North	0,36	1,80	6,80	2,89	4,59	12,82	31,06	15,77	11,83
Pianosa	Kobbe	1-South	0,01	0,08	0,57	0,20	0,21	1,32	3,78	1,69	1,27
Probability of Success											
Prospect	Target	Segment	Reservoir		Seal		Source	Trap	Charge	POsg	POS
			Play	Overall	Play	Overall					
Pianosa	Kobbe	2- North	100 %	90 %	100 %	90 %	40 %	80 %	60 %	16 %	17 %
Pianosa	Kobbe	1- South	100 %	90 %	100 %	90 %	40 %	80 %	55 %	14 %	12 %
GE West	Kobbe	1	100 %	90 %	100 %	90 %	40 %	50 %	50 %	8 %	8 %
Giglio	Klappmyss	1	100 %	85 %	100 %	75 %	40 %	75 %	45 %	9 %	9 %

The play and local risk associated to the prospects have been estimated using PAPA++ (Vår Energi's in-house risk assessment tool). For all prospects: Pianosa, Goliat Eye West and Giglio, the reservoir and seal chances are 100% at play level. The Lower Kobbe source rock is proven in the Hammerfest Basin. However, the charging route of all prospects requires a long-distance migration. Based on the conducted PSM study and nearby well results this aspect has been evaluated as the most negative in the play.

At local level, the main risk is the trap due to the fact that leaking along fault planes during several reactivation phases may have occurred. Concerning top seal, there is no evidence on the seismic data for the presence of thief sandstones.

Overall, the probability of success is 16% and 14% for Pianosa (two segments), 8% for Goliat Eye West and 9% for Giglio; while utilizing the DHI matrix the values for Pianosa become 17% and 12% for the two segments, respectively.

Upside potential in PL900 is identified in a Jurassic target lead and in a deeper Permian target of the Giglio prospect (Fig. 4.1).

Economics, based on the above illustrated volumetric and risk assessment assumptions, have been fully developed and led to negative results.



6 Conclusions

Vår Energi has updated and improved the geological and technical evaluation and understanding of PL900 since the award in 2017. The work commitment in the licence has been fulfilled with the acquisition/purchase of 3D seismic data. Based on the results of the conducted work, the prospects in PL900 show limited hydrocarbon potential. Therefore, the JV (Vår Energi AS and Concedo ASA) took the decision to do not continue further. The licence has been fully surrendered and SMIL submitted on 05th February 2019.



7 References

Eni Norge-APT (2006). Well 7122/7-3, Biostratigraphic Report. Eni Norge, internal study.

Eni Norge - Exploration well Evaluation Report, wells: 7122/7-1, 7122/7-2, 7122/7-3, 7122-7-4S, 7122/7-5, 7122/7-5A, 7122/7-6 & 7122/10-1S.

Eni Norge - Hammerfest Basin Regional Petroleum System Study.

Gudlaugsson, S.T., Faleide J.I., Johansen, S.E., and Breivik, A.J. (1998). Late Paleozoic structural development of the south-western Barents Sea. *Marine and Petroleum Geology*. 15, p. 73–102.

Gernigon, L., Brönnert, M., Roberts, D., Olesen, O., Nasuti, A., and Yamasaki, T. (2014). Crustal and basin evolution of the southwestern Barents Sea: from Caledonian orogeny to continental breakup. *Tectonics*, v. 33, doi: 10.1002/2013TC003439.

Eni Norge APA 2016 Application (Goliat Eye West, Block 7121/12 part).