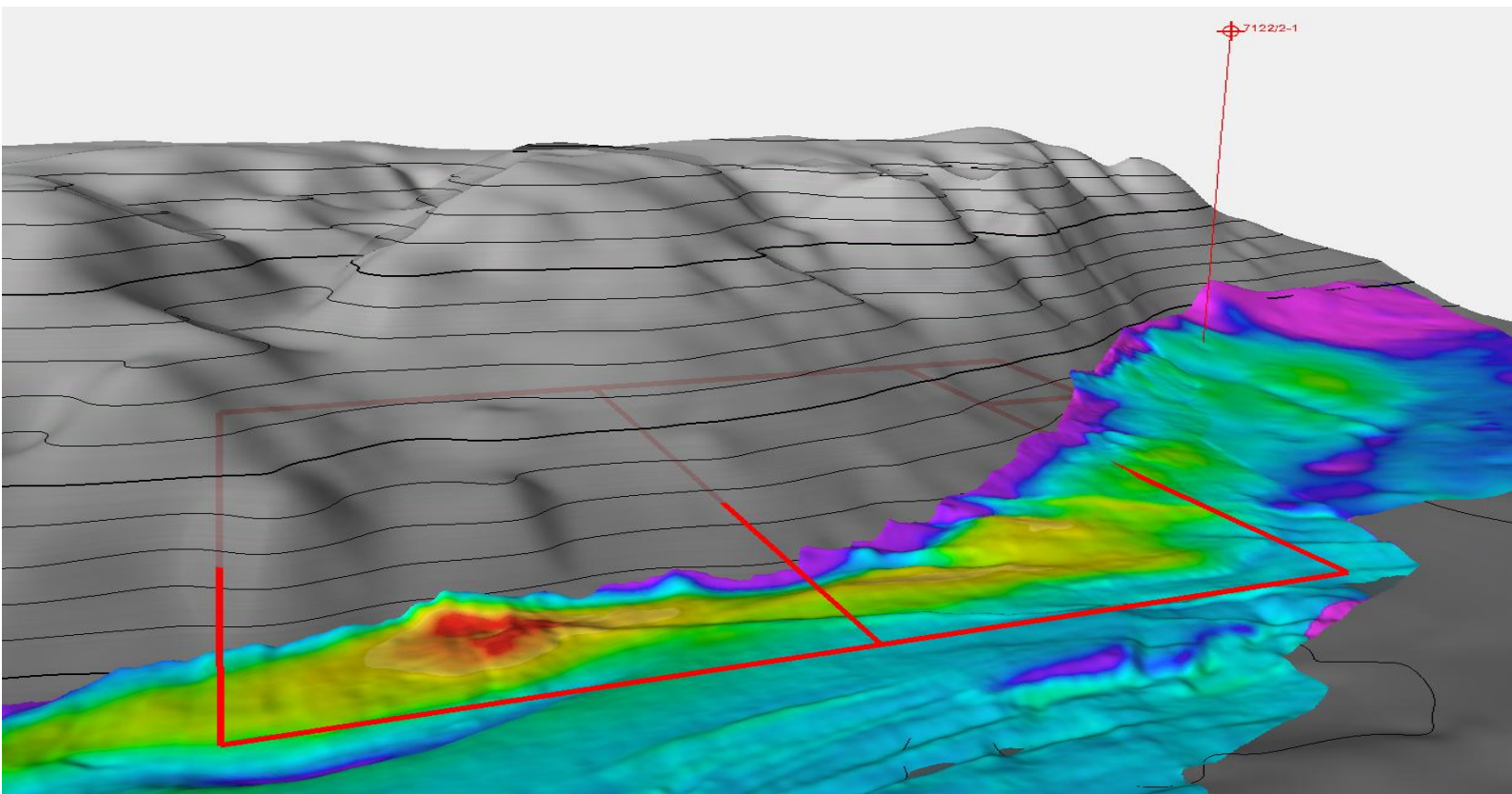


RELINQUISHMENT REPORT FOR PRODUCTION LICENCE 449

BLOCK 7121/3, 7122/1 & 7122/2 (Part)



March, 2011
Confidential



Prepared by:

Date: 28/03/11

Approved by:

Date: 28/07/11

Relinquishment Report

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1 EXECUTIVE SUMMARY

OMV (Norge) AS, as operator of production license 449, has relinquished this license after the initial 3-year period, effective date June 15th 2010. All license commitments have been fulfilled.

Production license 449 is located on the Barents Sea, approximately 150 km north of Hammerfest and was awarded on June 15th 2007 in the APA2006 licensing round. Licensees to the this permit were OMV (Norge) AS (operator & 50%), Front Exploration AS (formerly Discover Petroleum, 30%) and SAGEX Petroleum ASA (20%). The work commitment for the initial period of the licence was to acquire a minimum of 200 sqkm of 3D seismic.

At the time of application, on the basis of 2D seismic interpretation, it was seen that depositional mechanisms could create combined structural-stratigraphic traps in an area to the south of the Loppa High in areas of thickening Lower Cretaceous Knurr Formation, sourced from the Loppa High. In the area of production license 449, one lead was defined defined by this thickening along the basin margin.

In addition Triassic potential to the north of the production license was identified prior to the award. Triassic Snadd and Kobbe Formation were interpreted to be contained in faulted structural traps.

Detailed interpretation on the basis of extensive 3D coverage support the initial interpretation of thickening of Knurr Formation, interpreted to be indicative of increased chance of reservoir presence, but no trapping mechanism could be identified at this level. The Triassic faulted structural closures were found to be of limited extent and carry a very high risk of failure with regards to reservoir presence.

2 DATABASE AND GEOLOGICAL SETTING

2.1 Database

2.1.1 Seismic Database

The work programme of the first phase of the initial period was to acquire a minimum of 200 sq km of 3D seismic data in production licence 449. This commitment has been fulfilled with data acquisition in 2008 (survey OMV0802). The 3D survey was acquired between July and September 2008 using the PGS vessel Ocean Explorer. Seismic processing was undertaken by Fugro Seismic Imaging between October 2008 and March 2009.

The full-fold dataset owned by production licence 449 covers 669 sq km. This modern 3D dataset was the basis for the licence specific evaluation. Through trade and as the operator of production licence 439, OMV (Norge) AS has also access to the production licence 439 3D seismic survey together with traded data from production licence 491 and multiclient data from PGS to the south (Fig. 2.1). These 3D datasets were complemented by all publicly released datasets and additional traded data sets to provide full 3D data coverage along the northern edge of the Hammerfest Basin. Overall OMV (Norge) has access to more than 2500 sq km of 3D seismic data in the area of interest (Fig. 2.2).

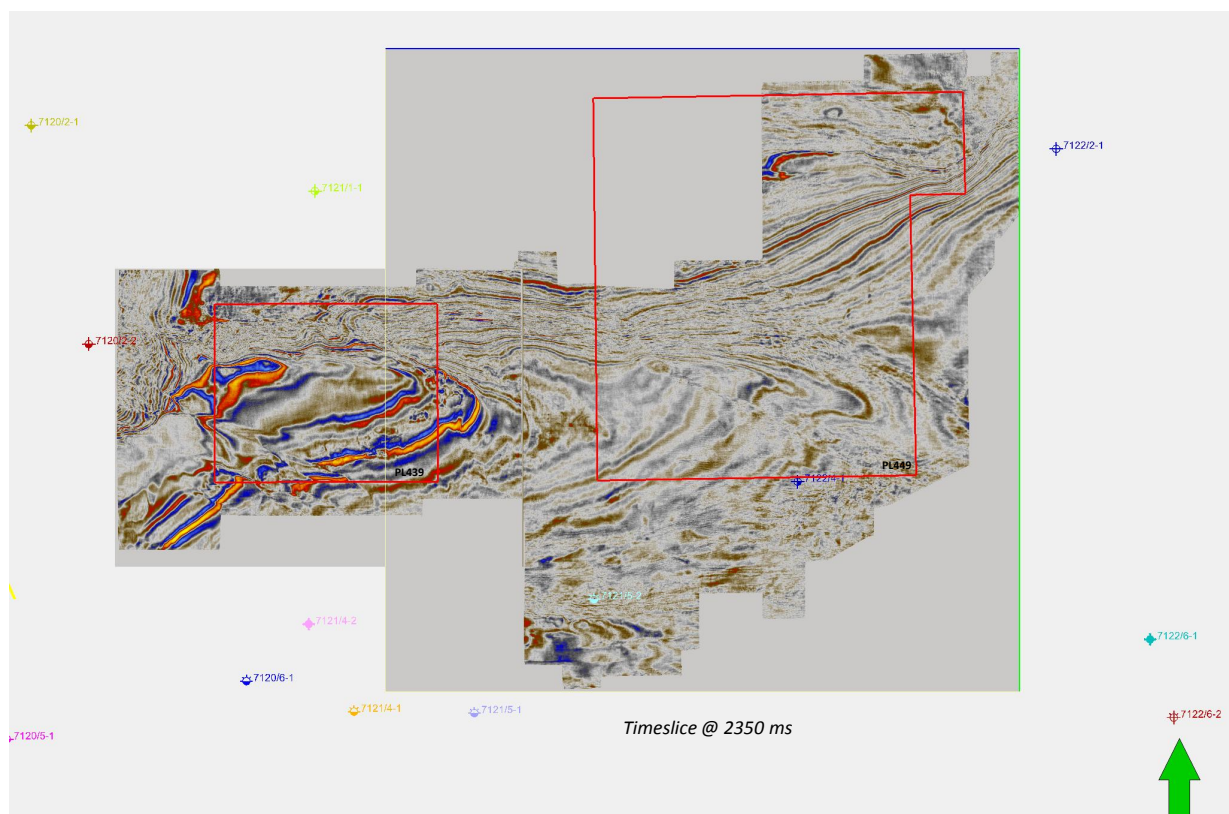


Fig. 2.1 3D Dataset PL439 - PL449

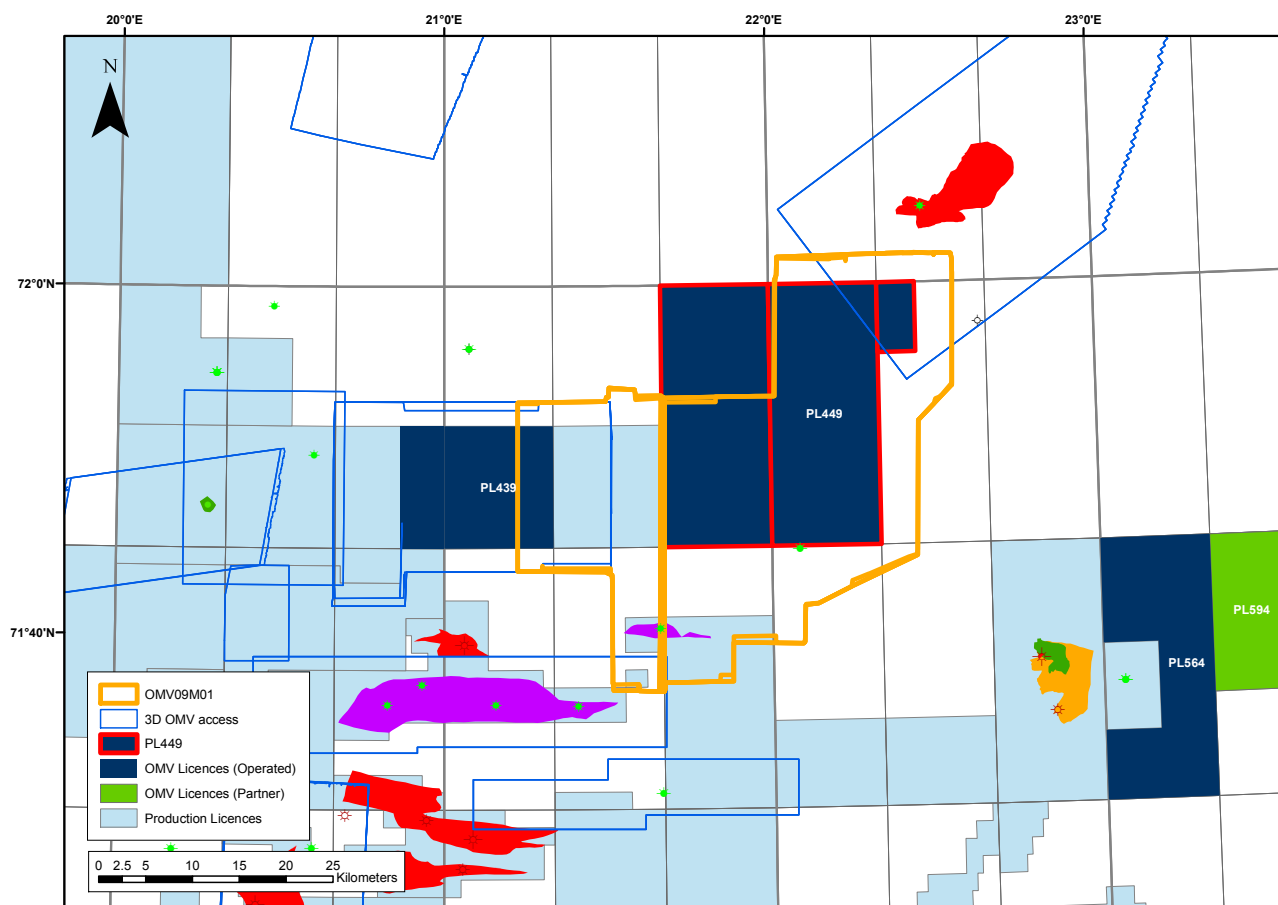


Fig. 2.2 Access to 3D Seismic

2.1.2 Well Database

More than 25 wells have been drilled within a distance of 50 km from the production licence 449 (highlighted in Fig. 2.3). The majority of these wells were drilled in the greater Snøvhit area to the south, towards the centre of the Hammerfest Basin. Five of these wells were drilled on the Loppa High. Well 7120/1-2 was drilled on the northern edge of the Hammerfest Basin but on a down-thrown fault block from the Loppa High. Well 7122/2-1, immediately to the east of production licence 449, is of particular relevance as it encountered a similar play as targeted by production licence 449.

In addition to information that has been released by the operators, the partnership undertook reservoir studies to enhance the understanding for reservoir presence and quality utilising the main wells 7120/1-2, 7120/2-2, 7122/2-1, 7122/4-1, along the northern edge of the Hammerfest Basin and the Loppa High (Fig. 2.3). The principal aim of the report was to de-risk the uncertainty of reservoir presence and quality. It included core analyses, facies analysis, petrography, core to log calibration and formation evaluation. In-house CPIs were performed for wells 7120/1-2 & 7122/2-1 .

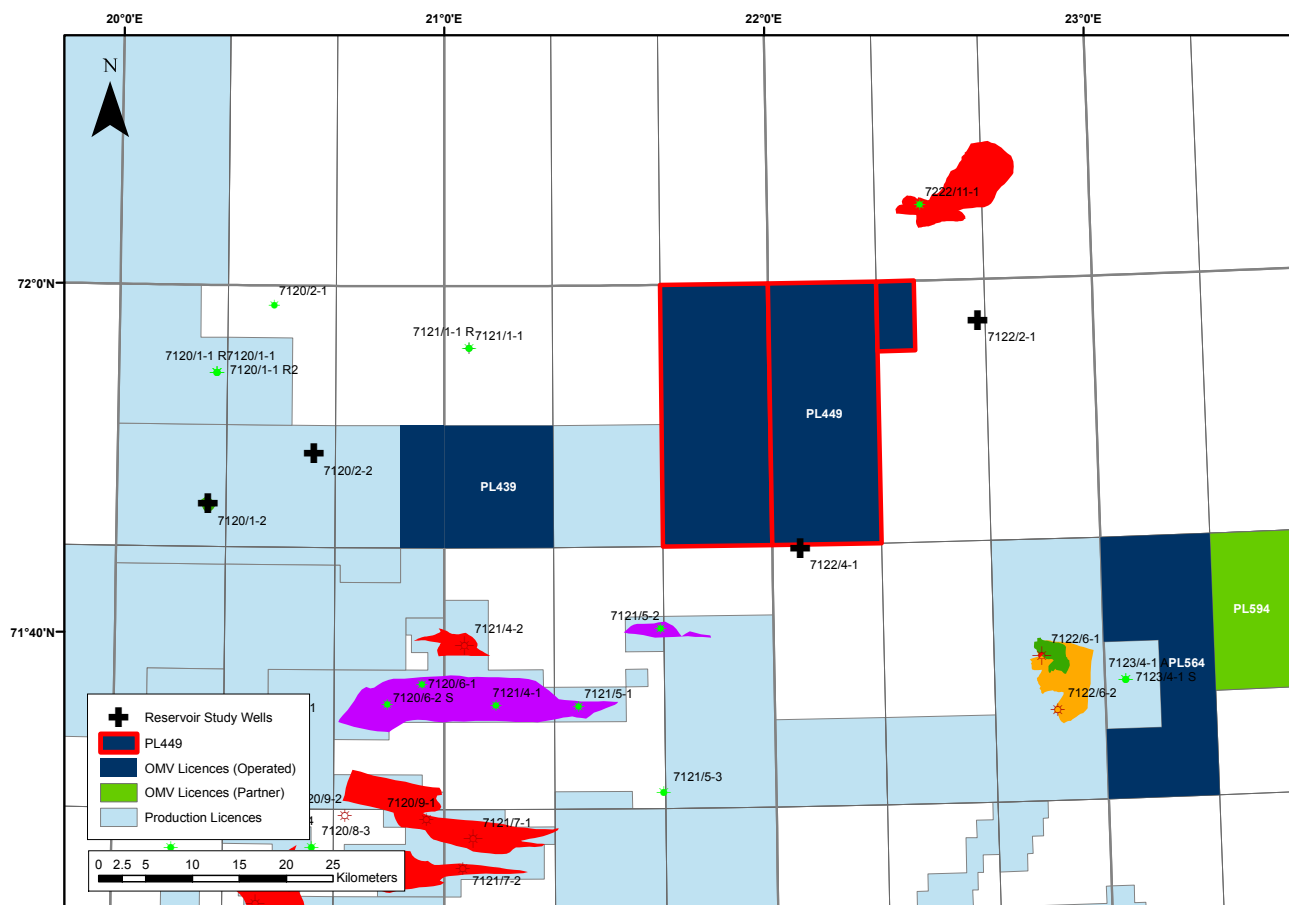


Fig. 2.3 Well Overview

2.1.3 Studies

The specific G&G studies commissioned by production licence 449 are listed in Appendix A

2.2 Geological Setting

2.2.1 Structural Setting

Structural Framework

Production licence 449 is situated in the northernmost part of the Hammerfest Basin. The Loppa High is situated in the northern part of the licence and the southern part lies within the Hammerfest Basin. The two are separated by the Asterias fault complex (Fig. 2.4).

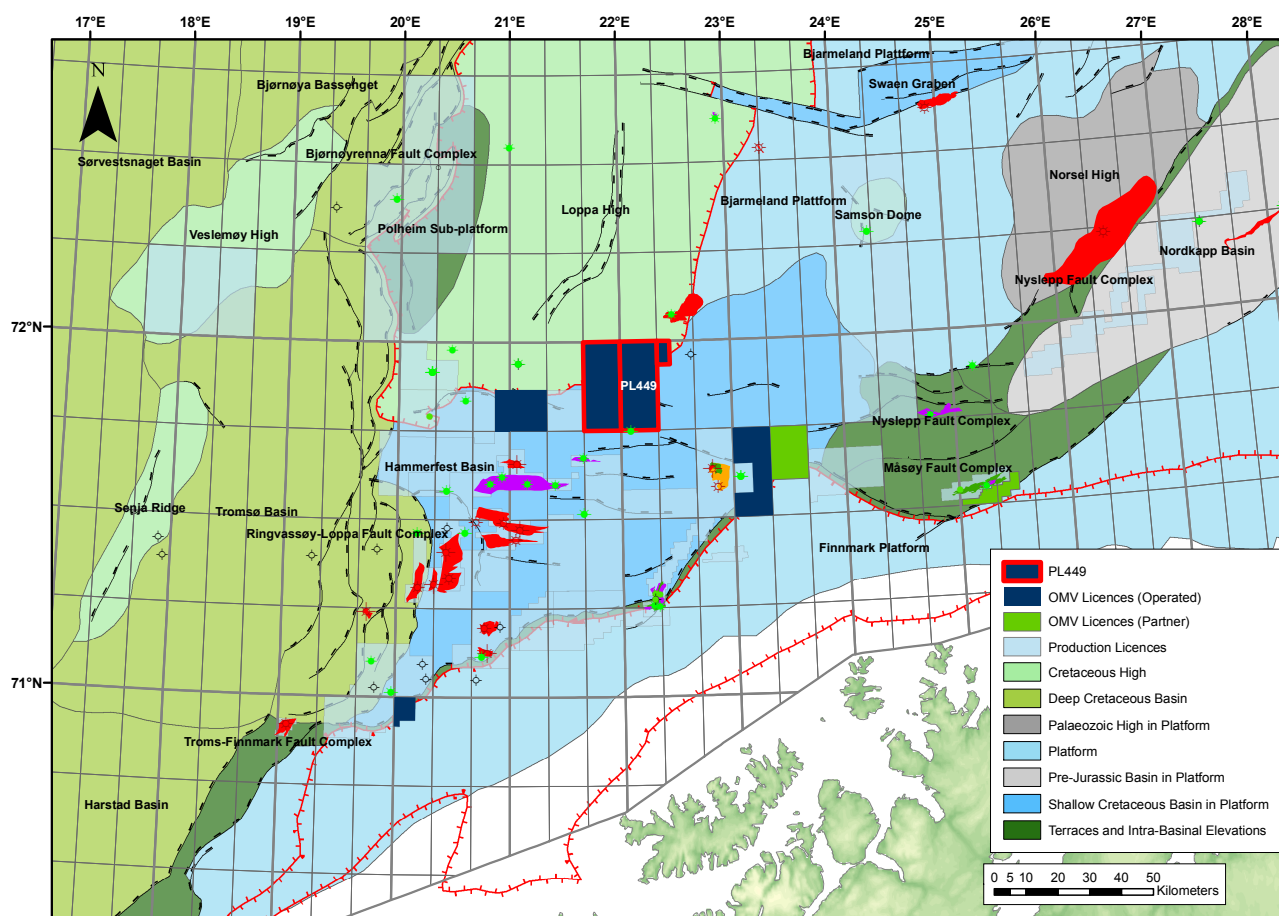


Fig. 2.4 Regional Tectonic Setting

Cretaceous, Jurassic and Triassic fill is well preserved in the Hammerfest Basin where numerous hydrocarbon discoveries are present, but the Jurassic and Cretaceous are mostly eroded or absent on the Loppa High. The rationale for the acquisition of production licence 449 was based on a Cretaceous play model which had the Knurr Formation sandstone as the main reservoir target. The petroleum system model for the Lower Cretaceous play has been proven with a few small discoveries and shows (wells 7019/1-1 and 7120/1-2). Moreover, several wells have demonstrated reservoir presence at this stratigraphic level in the basin.

The present day structural elements of the Barents Sea are shown in Fig. 2.4. The Permian and Triassic were dominated by the general subsidence of the whole Barents Sea area, except for a rift episode in the western margins during the Early Triassic. By Mid Jurassic times, sediment supply surpassed subsidence and sand deposition was widespread. In the Mid to Late Jurassic, extensional tectonics reactivated Caledonian and Carboniferous lineaments and rifting was active in the SW region of the Barents Sea. During the Cretaceous, extensional tectonic pulses and strike-slip movements influenced the structuring of the Barents Sea shelf area. Opening of the Norwegian-Greenland Sea began in the southern areas as a sheared margin in the Eocene, the associated thermal and compressional tectonic forces caused uplift and erosion of the western margin of the Barents Sea in the Palaeogene. This uplift, together with the glacial unloading in the Plio-Pleistocene, had severe effects on the petroleum systems of the Barents Sea.

2.2.2 Stratigraphy

Stratigraphic and Sedimentological Framework

The geological evaluation presented in this report focuses on the nature and development of the Lower Cretaceous, Lower to Middle Jurassic and Triassic in the area of production licence 449. The stratigraphic nomenclature (Fig. 2.5) applied in this part of the Barents Sea is based on NPD Bulletin No 4 (Dalland, Worsley and Ofstad, 1988).

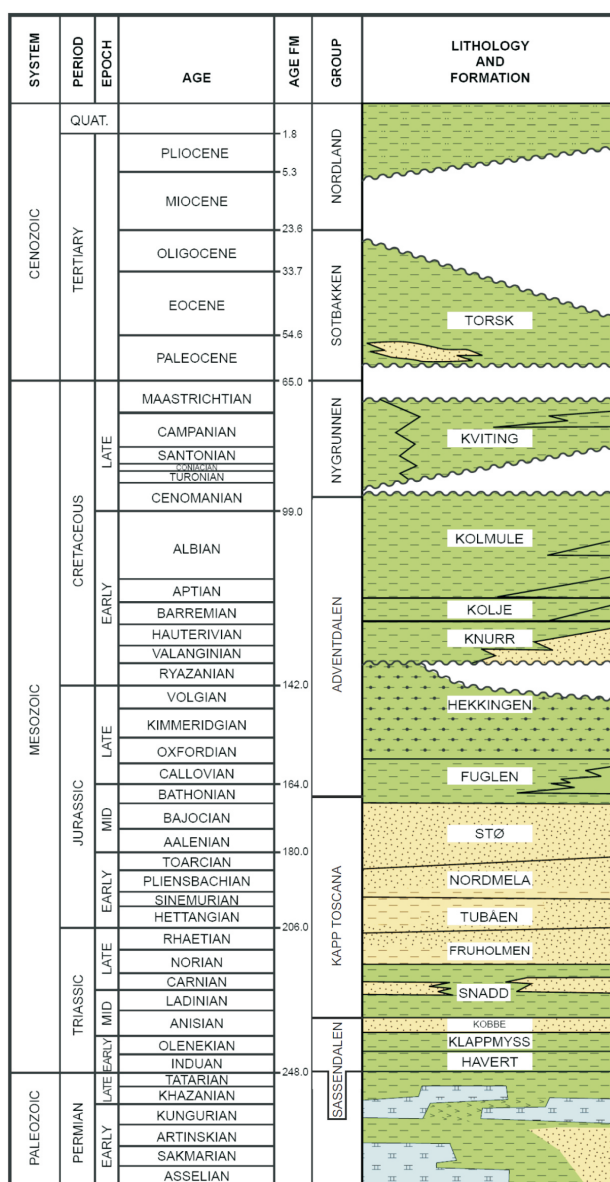


Fig. 2.5 Southern Barents Sea Stratigraphy

Lower Cretaceous Knurr Formation Depositional System

The Valanginian to Hauterivian age Knurr Formation reservoir forms the main target in the production licence 449 area. The Knurr sands exhibit their best development along the margins of the Hammerfest Basin and were deposited as a response to the Late Jurassic/Early Cretaceous rifting. Subsidence of the basinal areas and uplift of the rift margins (Loppa High and Finnmark Platform) resulted in considerable sub-aerial erosion and re-sedimentation into a deep marine setting. The regional Knurr Formation isochron illustrating its distribution is shown in Fig. 2.6.

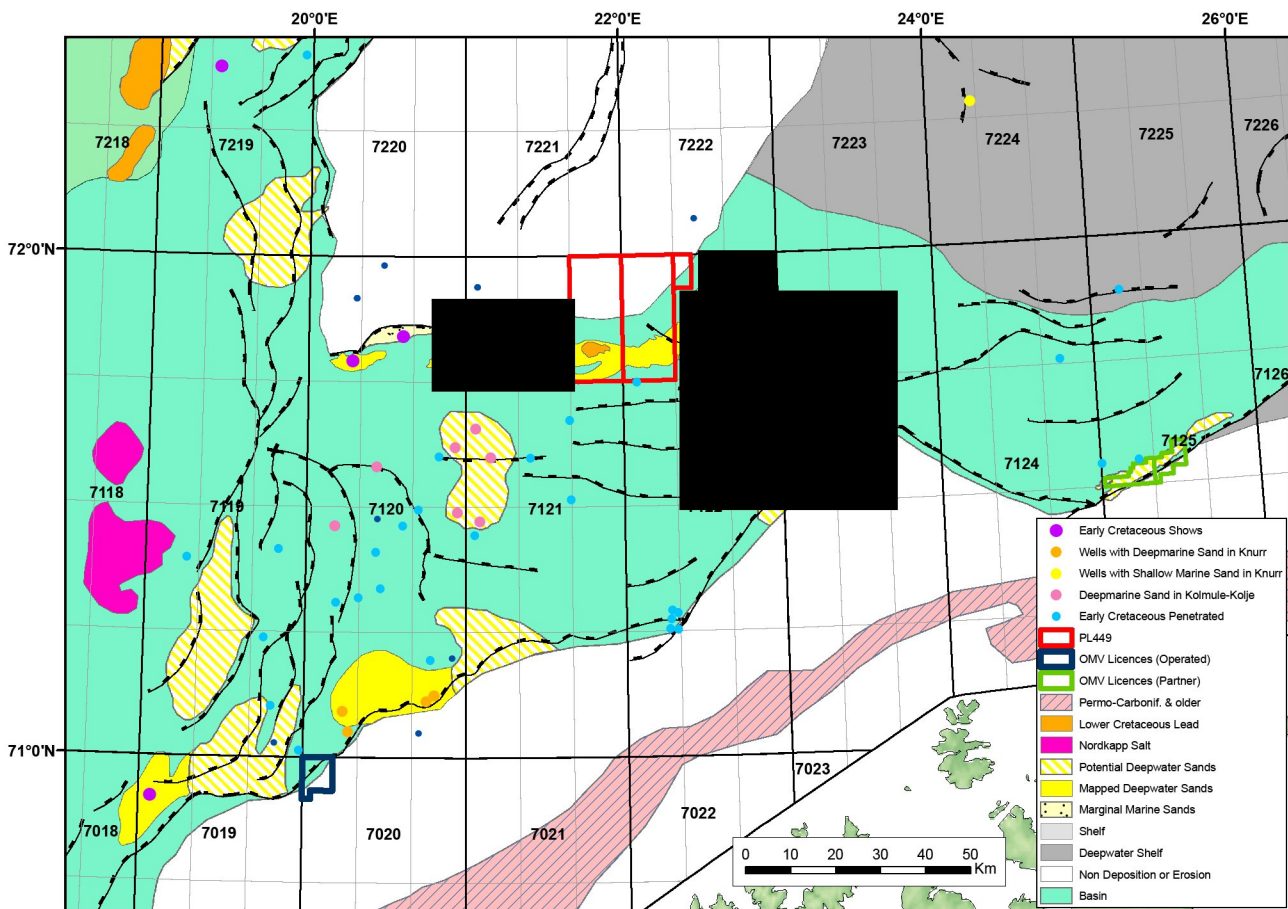


Fig. 2.6 Lower Cretaceous Knurr Formation Play Map. Knurr Formation beyond a certain isochron highlighted in yellow.

The mid and upper Cretaceous section in the Barents Sea is predominantly a mud-rich deepwater depositional system, to a large degree dominated by tectonic quiescence and the overall Cretaceous transgression. Minor and poorly developed sandstones are also proven in the Kolje Formation (e.g. well 7121/5-2), but these are not considered to be a viable reservoir unit. Sandstones with shows were encountered in the Upper Cretaceous Kviting Formation in well 7125/4-1.

Jurassic Realgrunnen Depositional System

The Jurassic members of the Lower to Middle Jurassic Realgrunnen Subgroup are eroded or were not deposited on the Loppa High but have been penetrated in the basin.

Triassic Snadd Formation Depositional System

The Snadd Formation was deposited during the Ladinian, through Carnian, to early Norian times. The depositional model for the Snadd Formation is shown in Fig. 2.7 and Fig. 2.8. The gross depositional setting is interpreted as a muddy coastal plain traversed by fluvial channels, which drained into a coastal embayment. The drainage pattern in the Hammerfest Basin area was probably from the Finnmark Platform in the south towards the north or northwest. The Snadd Formation contains a significantly higher proportion of fluvial channels than the older Kobbe Formation, which probably is indicative of a northerly progradation of the depositional system during deposition of the Snadd Formation.

Triassic Kobbe Formation Depositional System

No wells have penetrated the Kobbe Formation in the northern or central parts of the Hammerfest Basin. However, the nature and character of the depositional system is better known from the 'platform' areas where it has been drilled by wells 7222/6-1S, 7223/5-1, and 7224/7-1. The regional depositional model for the Kobbe Formation is that of a WNW prograding slope with shelf deltas. The best reservoir facies is predicted along a NNE to SSW trending shoreface belt but in the area of production licence 449, a muddy shelf is thought to have existed during Kobbe times.

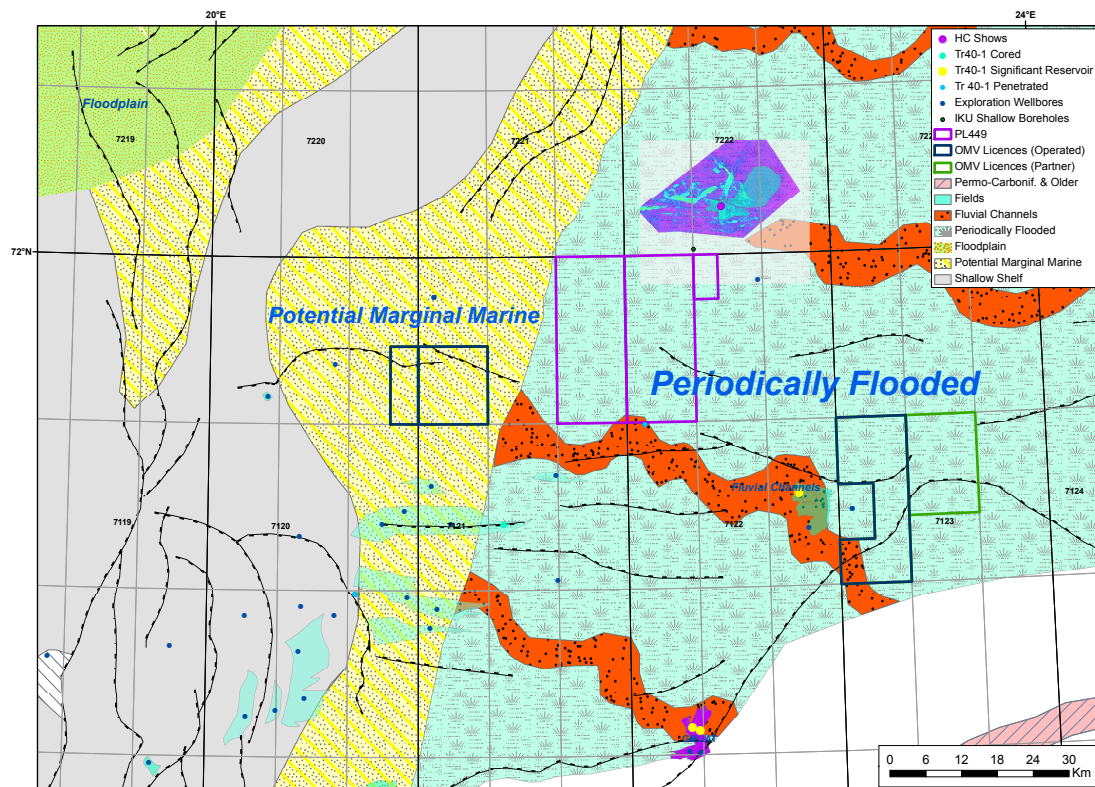


Fig. 2.7 Triassic Early Carnian GDE Map. Upper Snadd Formation (Tr40-1)

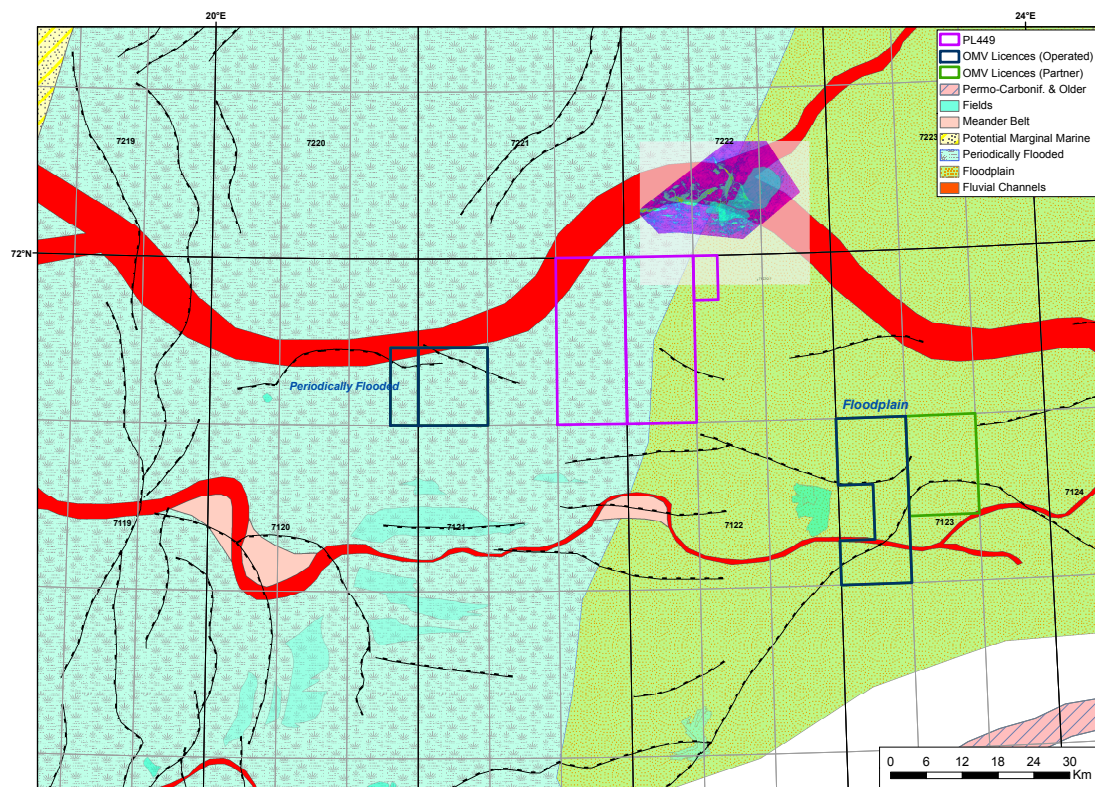


Fig. 2.8 Triassic Late Carnian GDE Map. Upper Snadd Formation (Tr40-2)

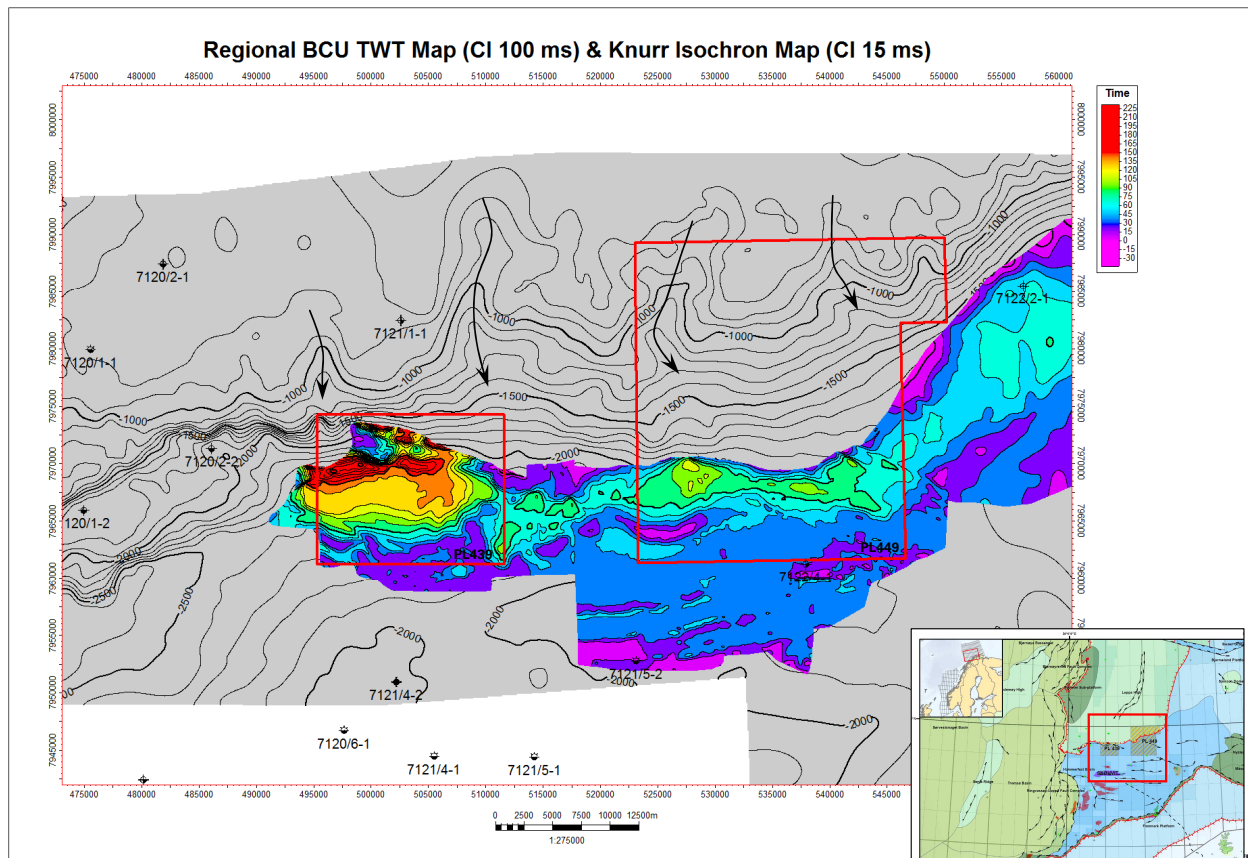


Fig. 2.10 BCU TWT & Knurr Formation Isochron (CI 15 ms). BCU TWT in grey, Knurr isochron colored. Sediment input routes from Loppa High into PL 439 (W) and PL 449 (W) indicated by arrows along edge of Hammerfest Basin.

Production licence 449 is located in a particular focus area of Knurr Formation sedimentation where a total thickness of up to 200 m is mapped. While no direct evidence for sandstone presence can be drawn from Knurr Formation thickness, it is believed that the erosion of sand-prone Jurassic strata (Kapp Toscana Group) on the juxtaposed Loppa High has provided a coarse siliciclastic input into the Hammerfest Basin. Wells further to the south have encountered the Knurr Formation in a shale-prone facies. The expected sand-prone Knurr Formation is therefore interpreted to be deposited closer to the Asterias fault complex and represented as areas of thick section.

Based on core studies along the northern margin of the Hammerfest Basin, the general depositional environment of the Lower Cretaceous can be interpreted as a shallow near shore to shelf environment co-existing with mass flow and density flow environments in more distal settings at the toe-of-slope and in the basin. The Knurr sandstone was encountered in wells 7120/1-2 and 7122/2-1 at the northern edge of the Hammerfest Basin. Biostratigraphic analyses showed that the sand bodies encountered in these wells are not age equivalent and as such not genetically related (Fig. 2.11). They appear as localised point-sourced sand accumulations and not as one linear sand body along the margin of the Loppa High. Reservoir quality varies significantly along the Loppa High margin with the best reservoirs in mass flow and density flow deposits as seen in well 7122/2-1 (Fig. 2.12). Over 100 m of high net-to-gross Knurr Formation were encountered in this well (Fig. 2.13).

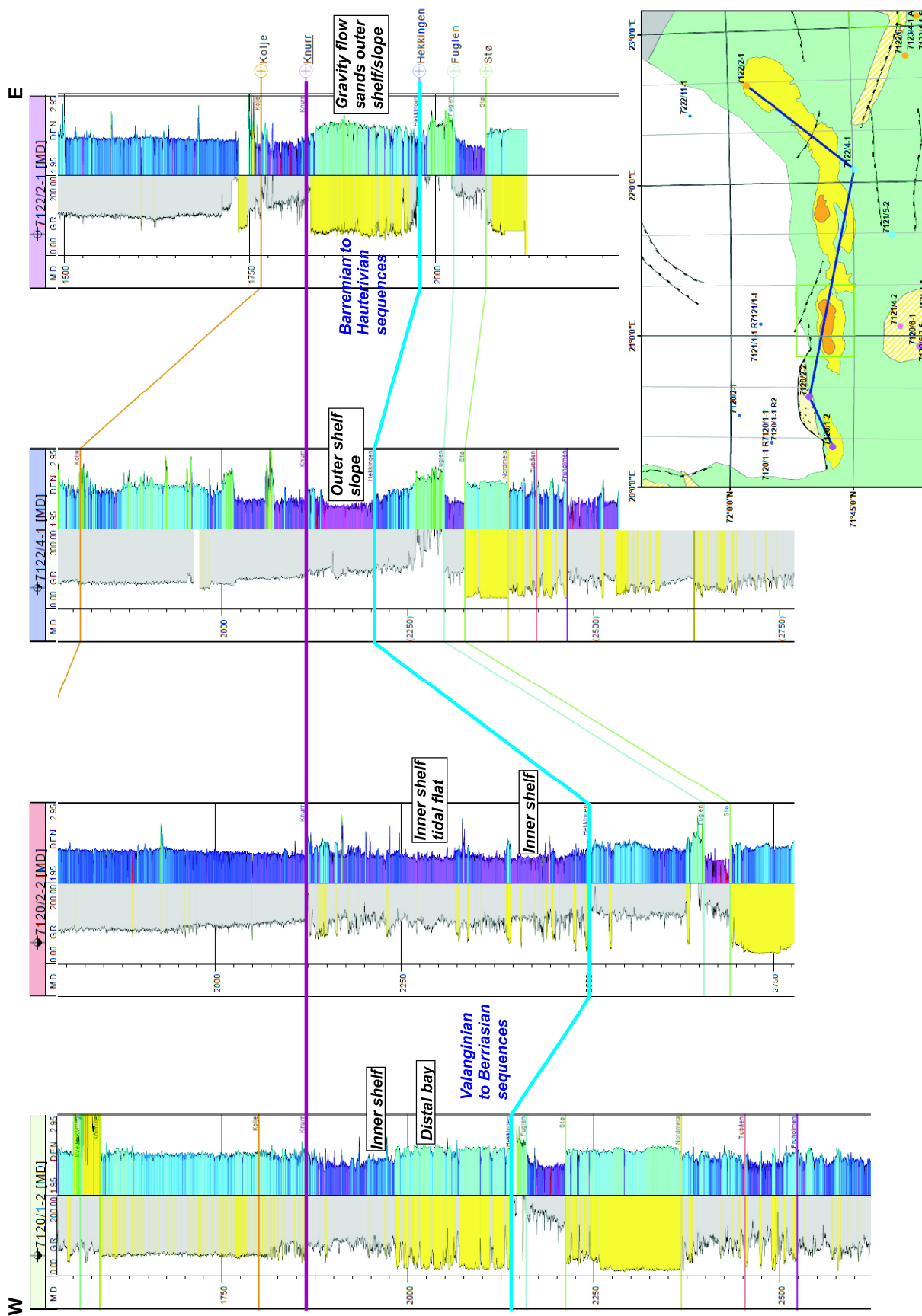


Fig. 2.11 Correlation Hung on the Top Knurr Formation North Hammerfest Basin.

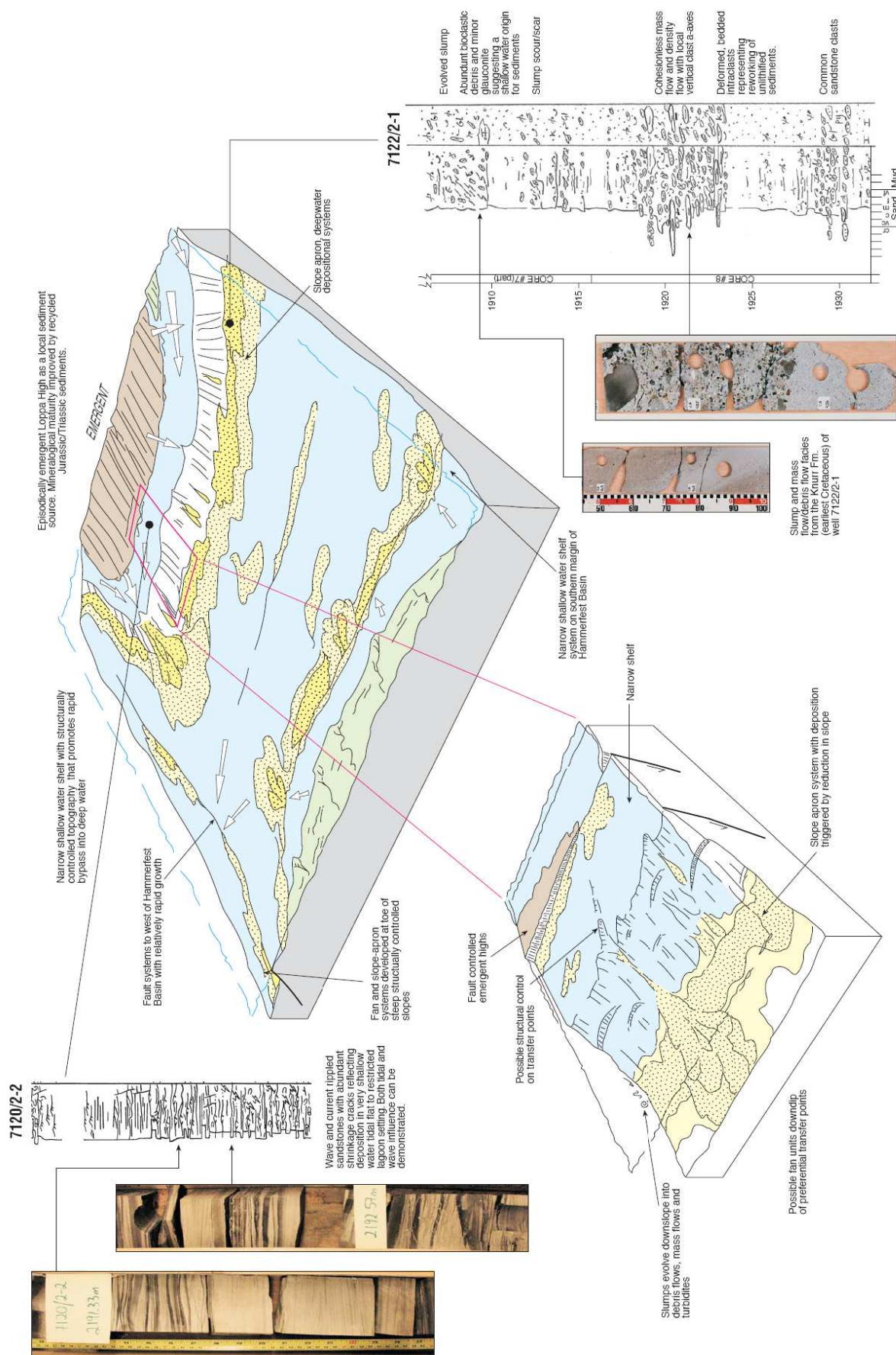


Fig. 2.12 Depositional Model For Lower Cretaceous Reservoirs. Based on core studies carried out by Fugro Robertson for OMV operated licenses PL439 and PL449.

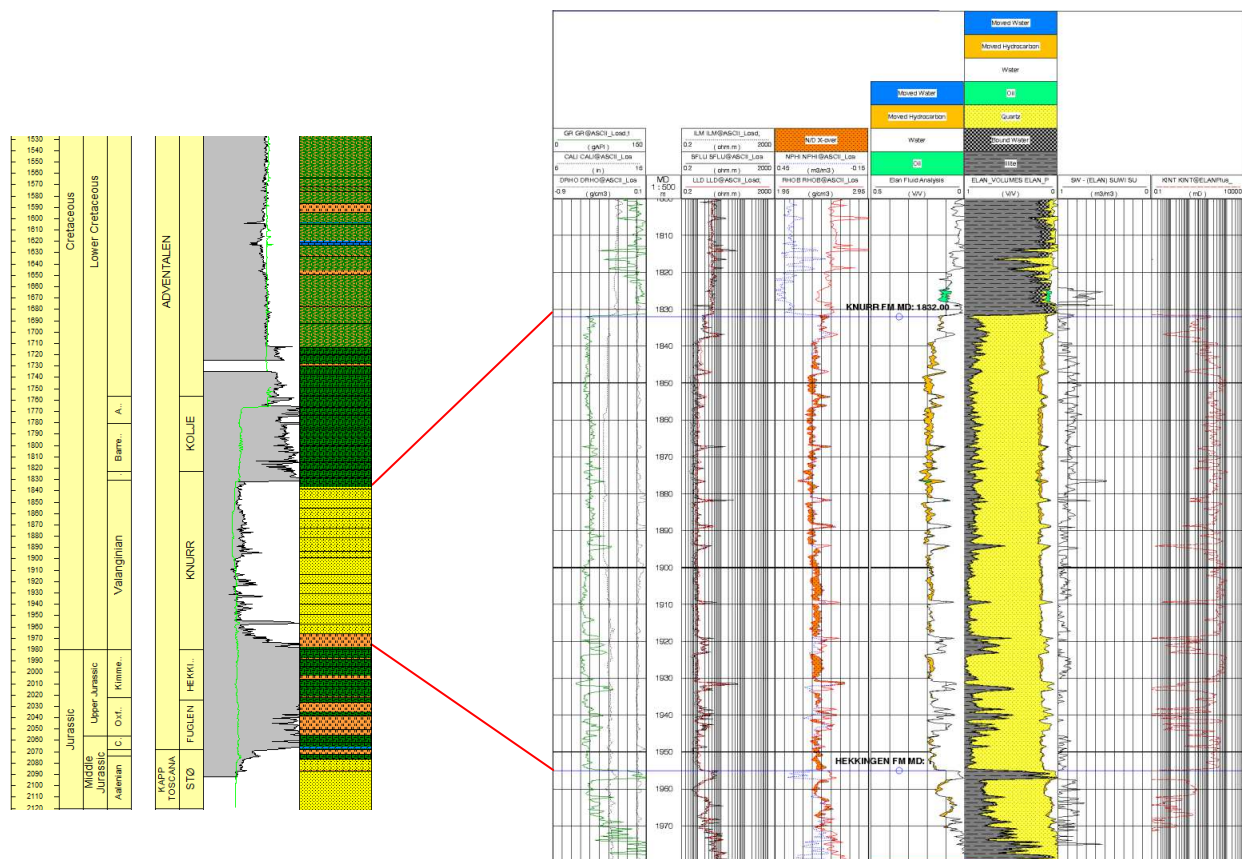


Fig. 2.13 CPI 7122/2-1 Knurr Interval

The original interpretation of the Knurr Formation in this area, which at the time of the application was based on sparse 2D seismic grid, concluded that the structural shape of the Top Knurr reflector was an indicator for turbidite deposits. Based on a consistent 3D interpretation along the margin, this interpretation had to be revised. It becomes evident that the Knurr Formation has undergone severe post-depositional incision which has had a major effect on the structural configuration. The area to the west of production licence 449 exhibits deep east-west orientated incisions eroding into the Knurr Formation. Within the Knurr, continuous internal reflectors can be traced on both sides of the incisions, illustrating their erosional nature.

Fans of variable sizes are associated with these feeder systems. The Knurr Formation sandstone units vary significantly in thickness and facies from thin and heterolithic to thick and massive. The thicker sequences commonly display near blocky, aggradational patterns, suggesting infill rather than progradation. Sandy gravity flows were deposited in bathymetric lows that were also depocentres for thick Lower Cretaceous mudstones. Only a few wells have penetrated these palaeo-bathymetric lows as exploration activity targeted Jurassic reservoirs on tilted fault blocks which were topographic highs during the Lower Cretaceous. Well data show that most of the sandstones are found in the thickest Knurr Formation sections, as in the most prominent example, well 7122/2-1 (118 m gross sand) which was drilled on the south eastern flank of the Loppa High. However, well 7122/4-1, drilled in the centre of the Hammerfest Basin, exhibits a 113 m thick Knurr Formation shale section without any sandstone and underlines the difficulty of utilising the Knurr Formation thickness to directly predict Knurr reservoir sandstones.

2.3.2 Basin Modelling

A petroleum systems analysis was undertaken jointly for the area of production licences 439 and 449 to evaluate the source rock potential and migration efficiencies. The advantage of this combined approach was to enable the use of a wider range of input grids based on most up-to-date 3D mapping.

There are several possible source rock intervals in the Barents Sea but the Late Jurassic Hekkingen Formation is the only well developed source rock proven by sample analysis in the study area.

Analysis of vitrinite reflectance as a indicator of maturity shows that the Top Hekkingen Formation is early to late oil mature at present within production licence 439 (Fig. 2.14).

Maturity modelling concluded that the oil expulsion in this area started between 50 - 60 million years ago and ceased at the onset of Tertiary uplift (Fig. 2.15). The 3D basin modelling shows that especially in the western part of the study area, a significant amount of oil has been expelled (Fig. 2.16).

The 3D basin modelling assumes the presence of sandstone in the thicker portion of the Knurr Formation along the margin of the Hammerfest Basin which can act as a carrier bed for hydrocarbon migration.

The study indicates that moving eastwards from the main area of hydrocarbon generation, long distance migration is required to charge structures within the Knurr sandstone of production licence 449. The significant distance to the main source kitchen might also be a valid reason for failure of the dry well 7122/2-1.

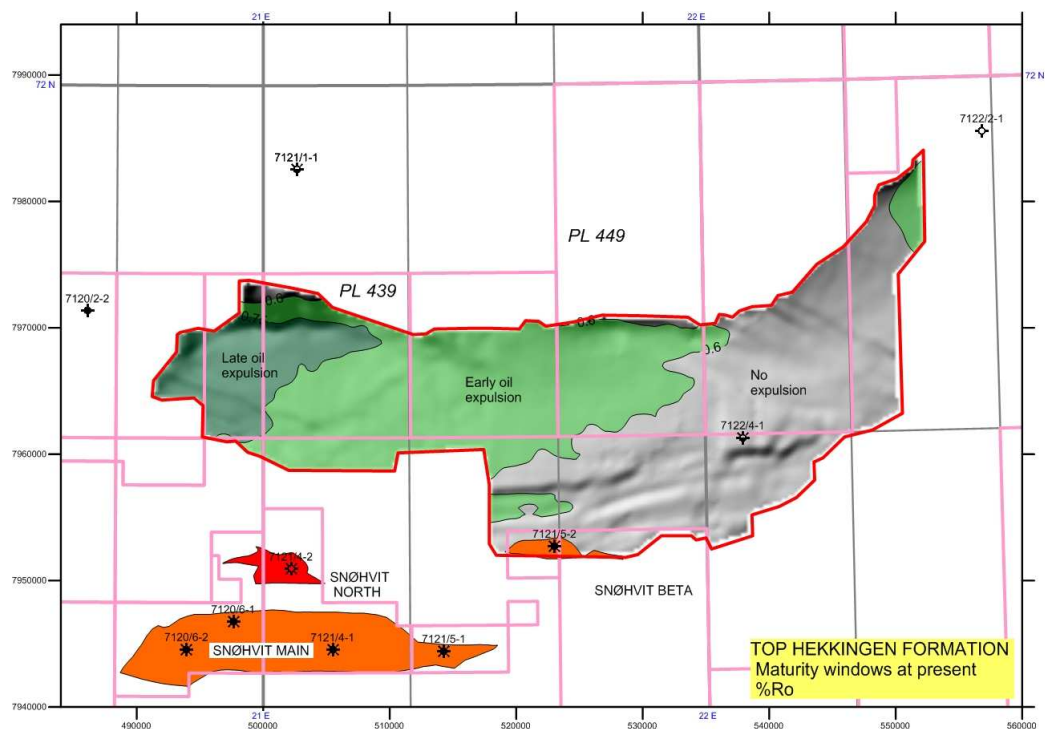


Fig. 2.14 Basin Modelling - Maturity Window Top Hekkingen Present

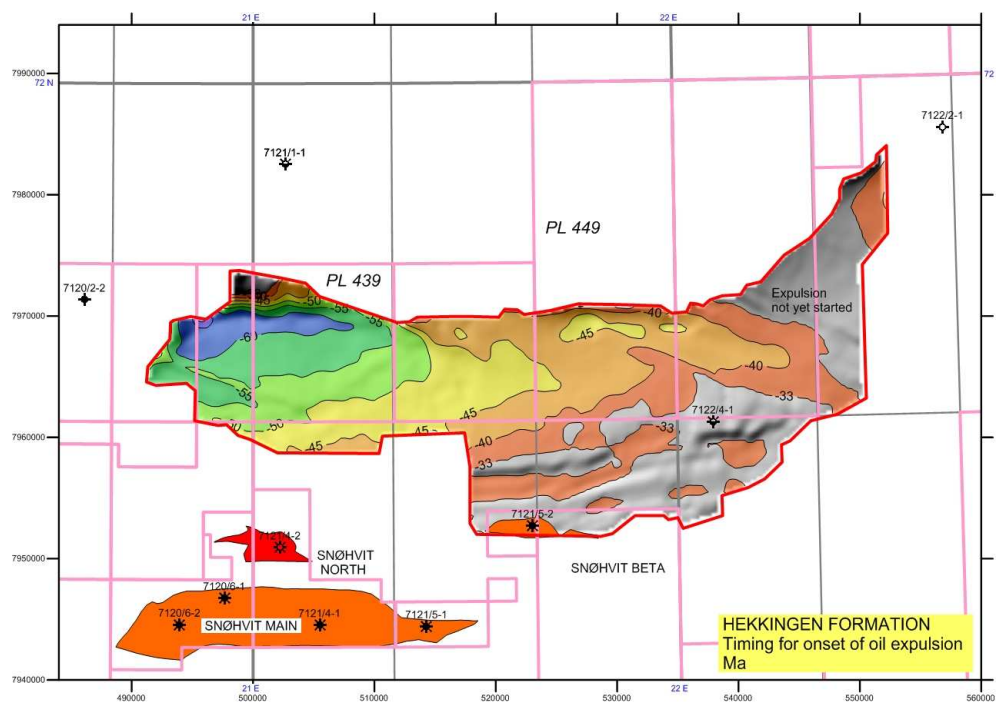


Fig. 2.15 Basin Modelling - Timing Onset Oil Expulsion Hekkingen Formation

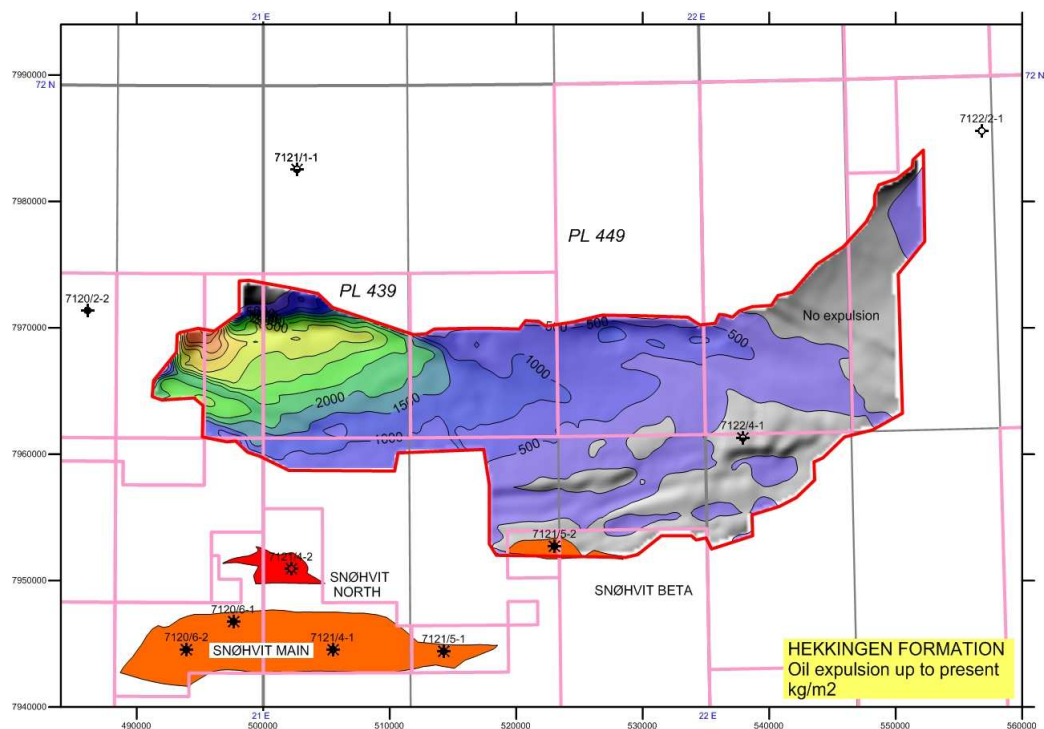


Fig. 2.16 Basin Modelling - Oil Expulsion Hekkingen Up To Present

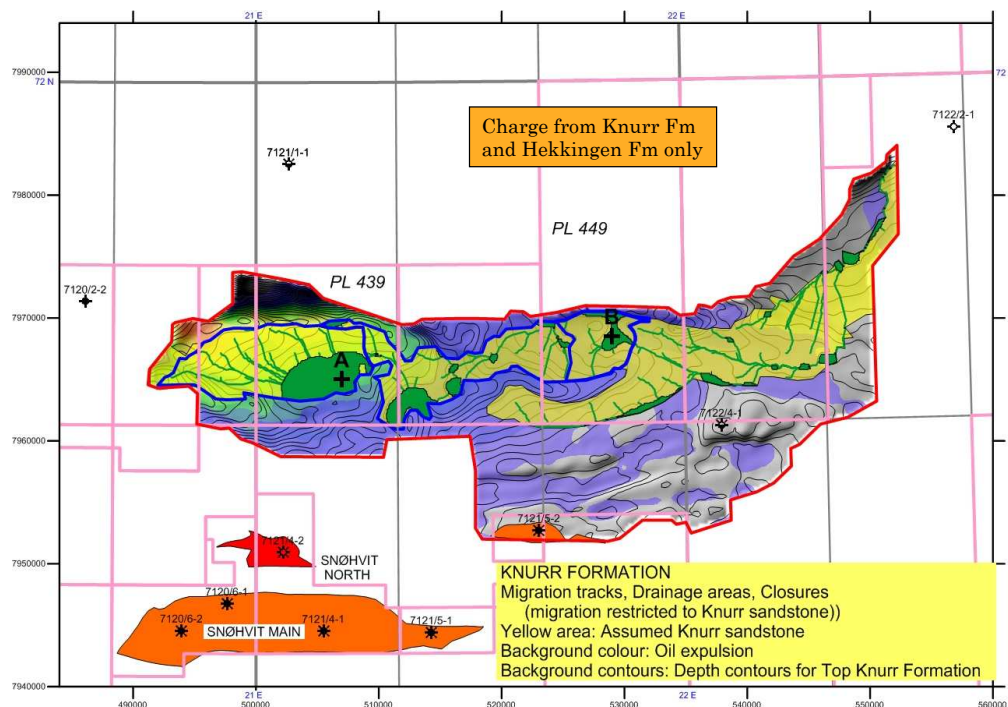


Fig. 2.17 Basin Modelling - Modelled HC Migration in Knurr Formation

3 GEOLOGICAL AND GEOPHYSICAL EVALUATION

3.1 Seismic Interpretation

3.1.1 Seismic Mapping

The mapped key horizons are listed in the table below. Top Kveite to Top Fuglen were mapped in the Hammerfest Basin part of the license, while Top Snadd, Top Kobbe and Top Klappmyss were mapped in the northernmost portion of production licence 449.

Table 3.1 Mapped Horizons. Including pick quality and polarity

Seismic Event	Pick Quality	Polarity
Seabed	Excellent	Peak (positive amplitude)
Kveite	Excellent	Peak (positive amplitude)
Kolje	Good	Peak (positive amplitude)
Knurr	Excellent	Peak (positive amplitude)
BCU	Good	Trough (negative amplitude)
Fuglen	Excellent	Peak (positive amplitude)
Snadd	Good	Peak (positive amplitude)
Kobbe	Good	Peak (positive amplitude)
Kobbe Internal	Good	Peak (positive amplitude)
Klappmyss	Good	Trough (negative amplitude)

Well ties were created to all wells of relevance (wells 7120/1-2, 7122/2-1, 7121/4-1, 7121/5-2, 7222/11-1) integrating the available 3D surveys and where necessary across regional 2D lines. The synthetic seismogramme for well 7122/2-1 is presented in Fig. 3.1. A very high correlation to the 2D line NBR07-134654 is achieved. The main picks (Knurr, BCU, Fuglen) for the Hammerfest Basin are highlighted.

Fig. 3.2 and Fig. 3.3 are illustrating the main horizons of interpretation in the Hammerfest Basin portion of production licence 449 on representative E-W and N-S lines. The extent of production licence 449 is outlined by the arrow.

Fig. 3.4 and Fig. 3.5 show ties to wells of significance for the interpretation of the Triassic portion in production licence 449 (wells 7222/11-1, 7224/7-1). Fig. 3.4 illustrates the main Triassic horizons that were interpreted in the northern part of production licence 449.



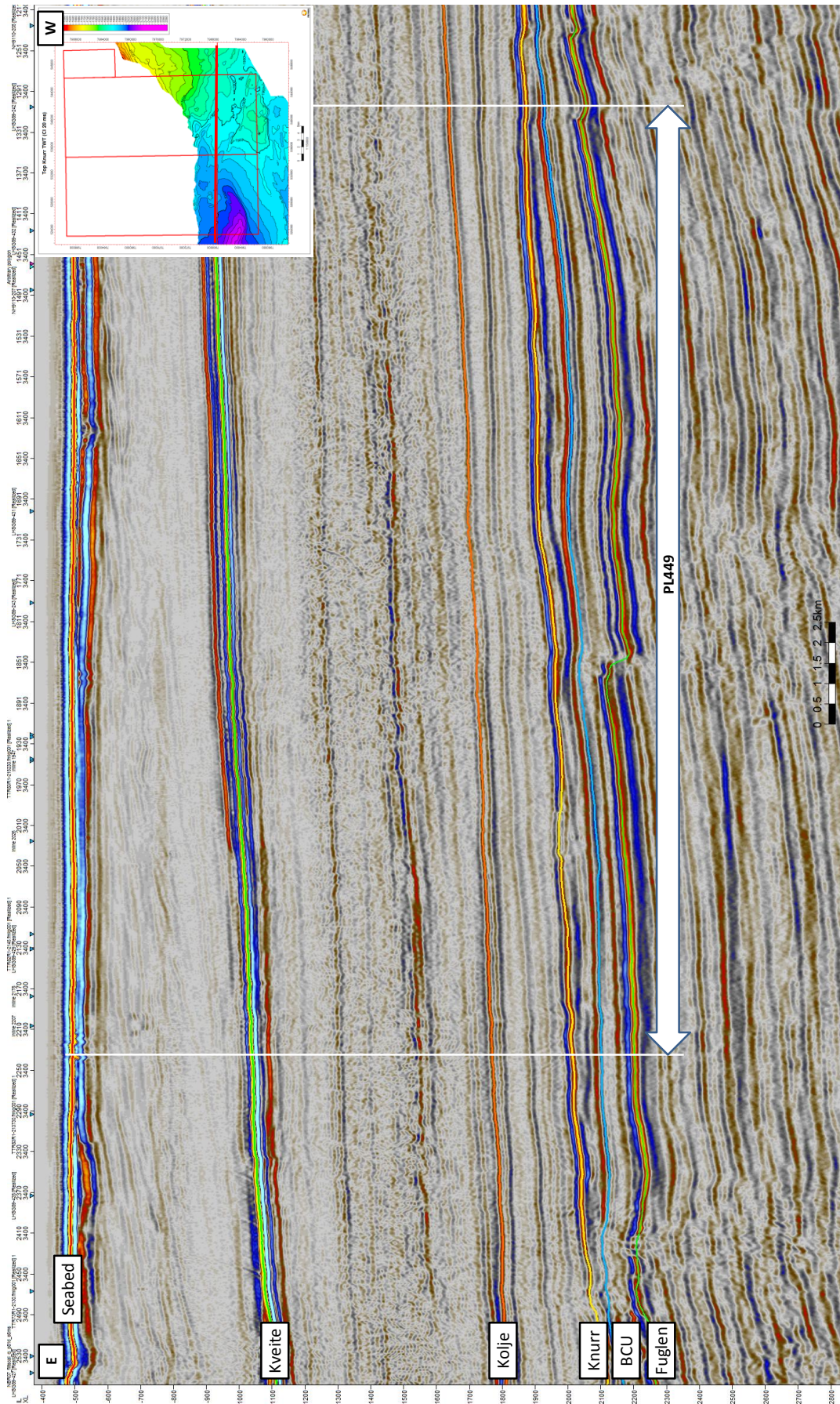


Fig. 3.2 Representative E-W Line - Hammerfest Basin.

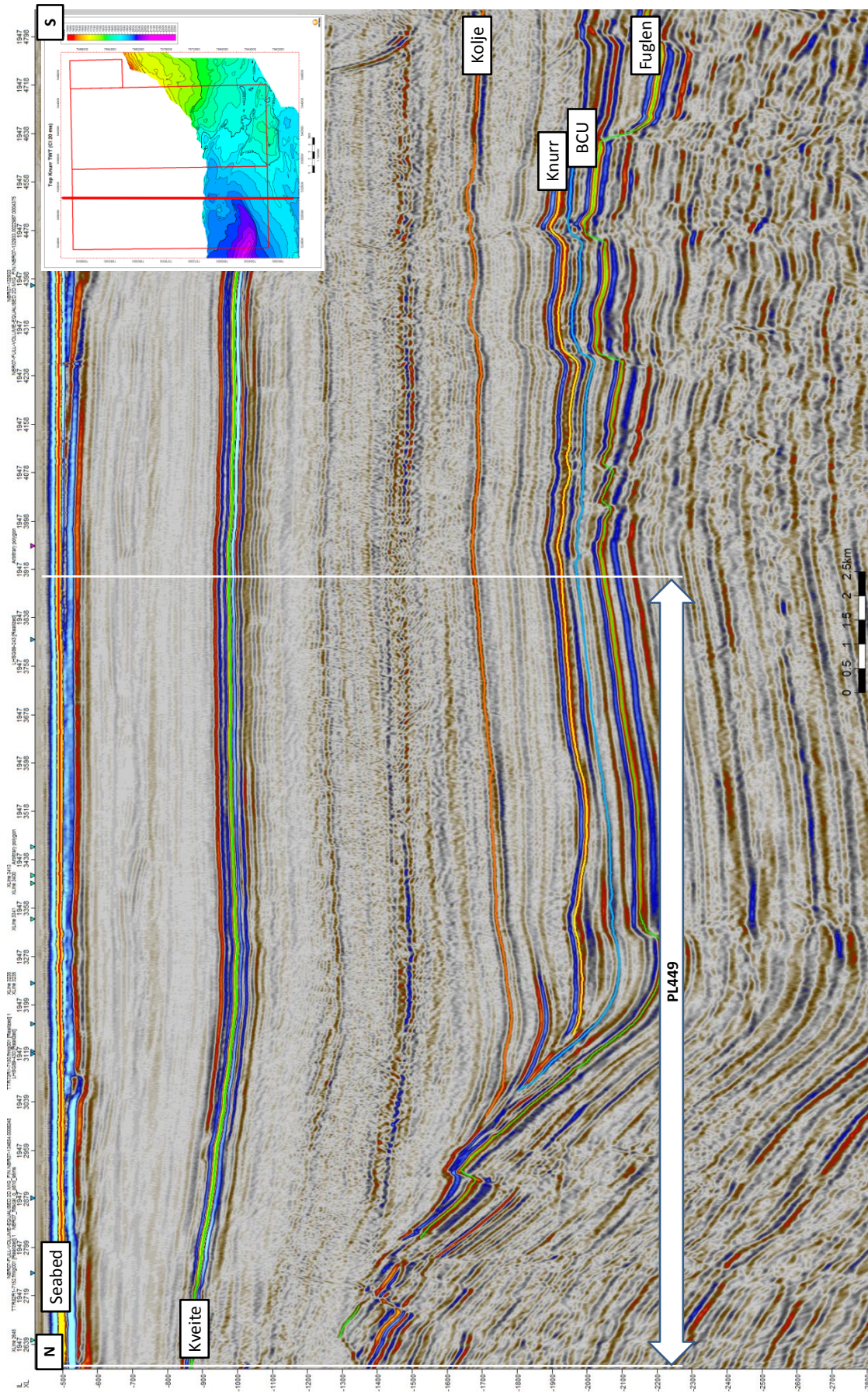


Fig. 3.3 Representative N-S Line - Hammerfest Basin.

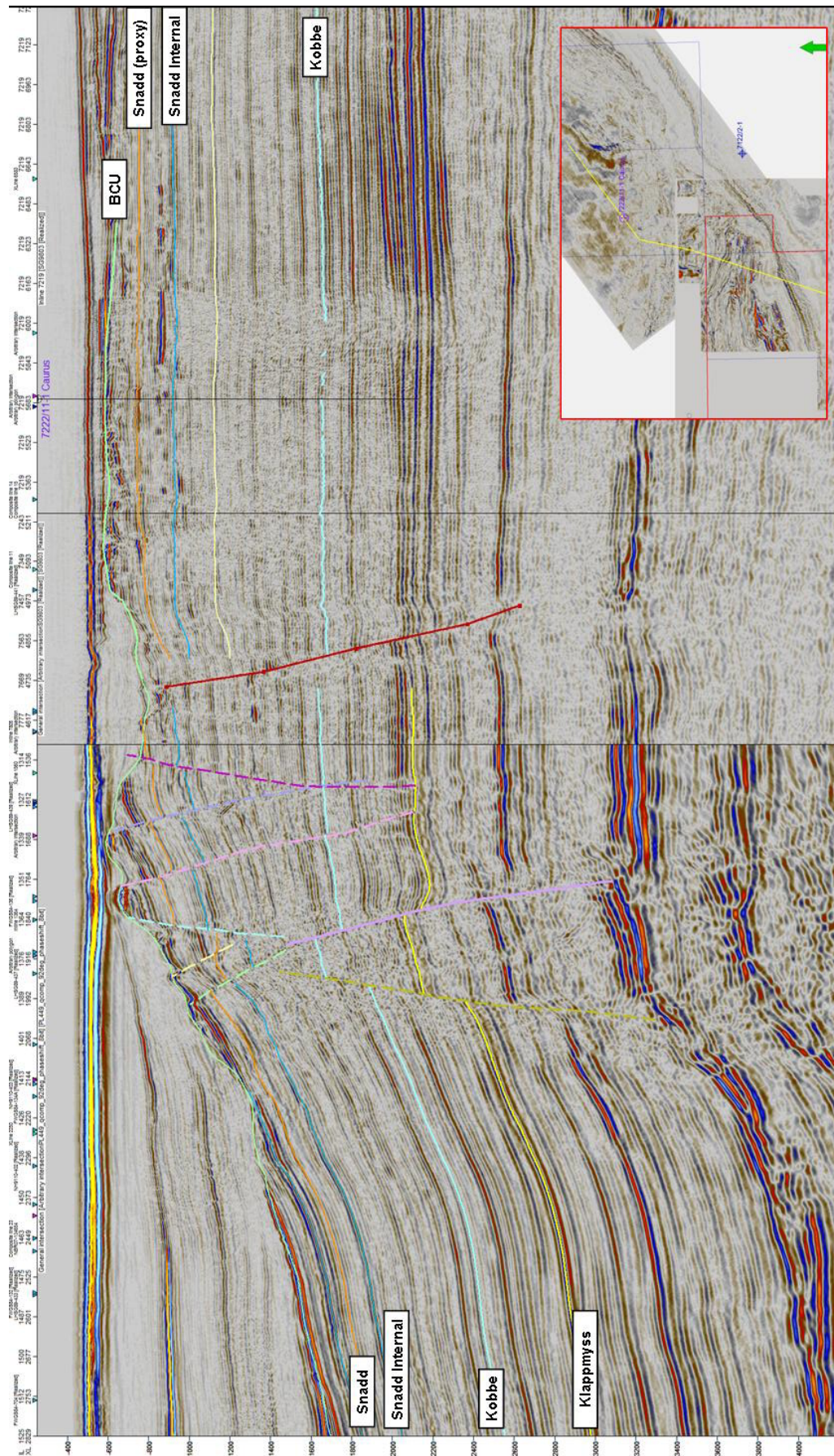


Fig. 3.4 PL449 Area Tie Line to Caurus Well.

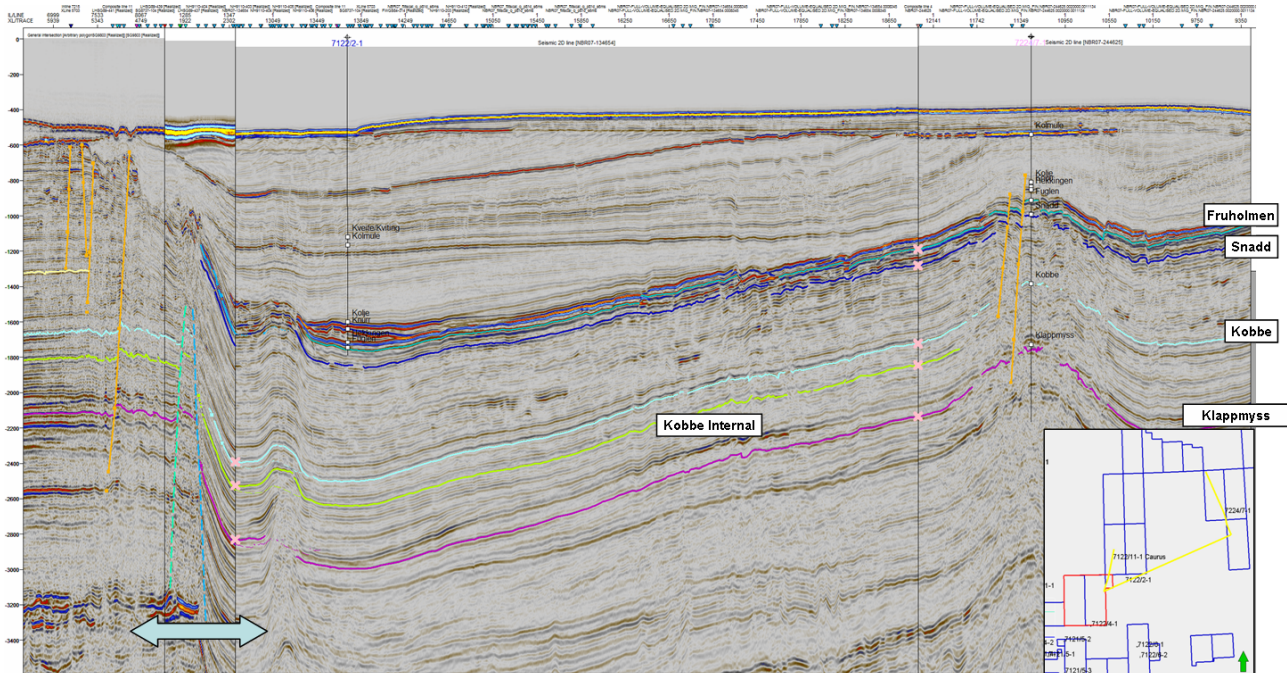


Fig. 3.5 Triassic Tie Line

3.1.2 Time Maps

The time maps covering the Hammerfest Basin portion of production licence 449 are presented in the following figures:

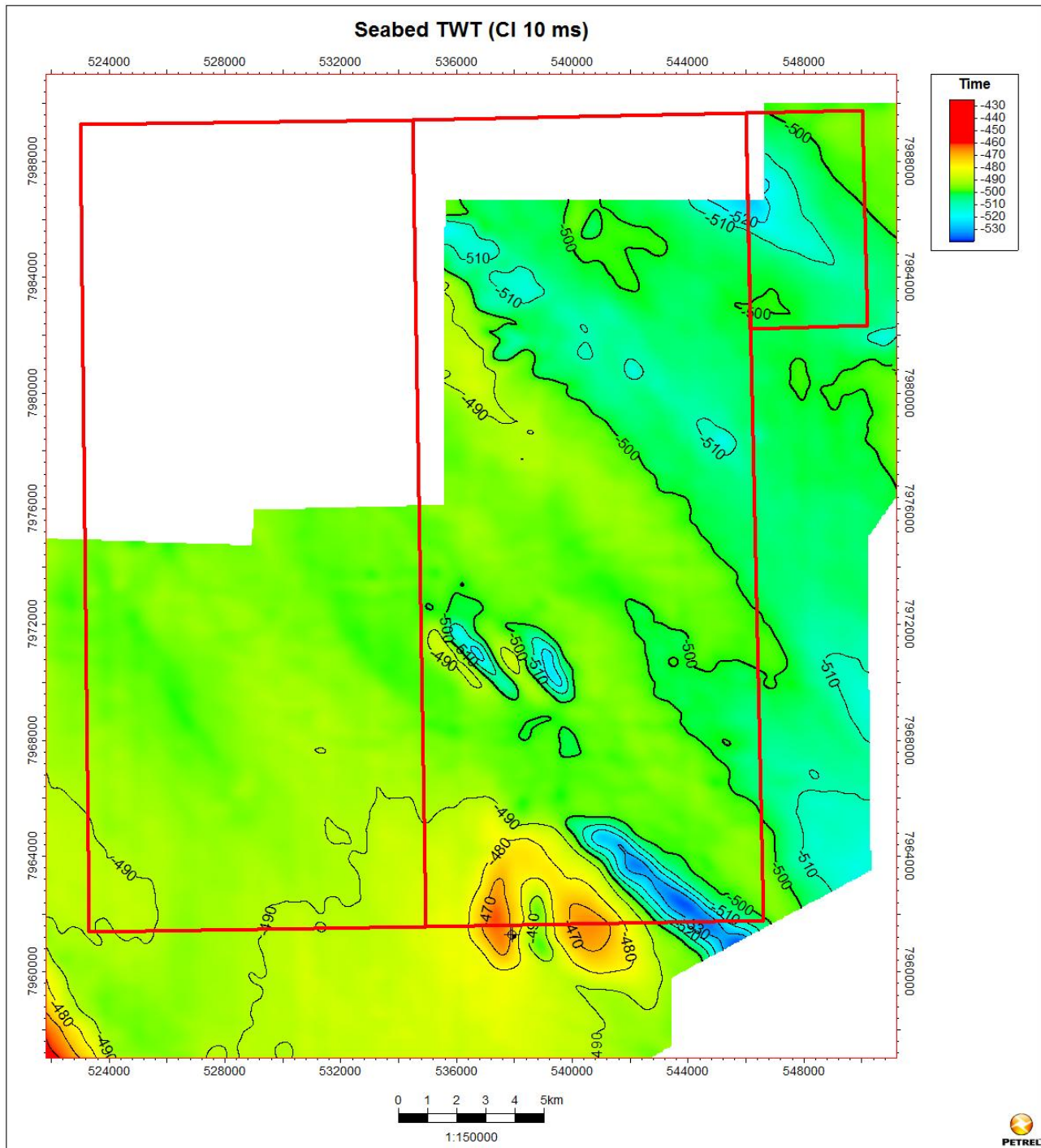


Fig. 3.6 Seabed Time Map (TWT)

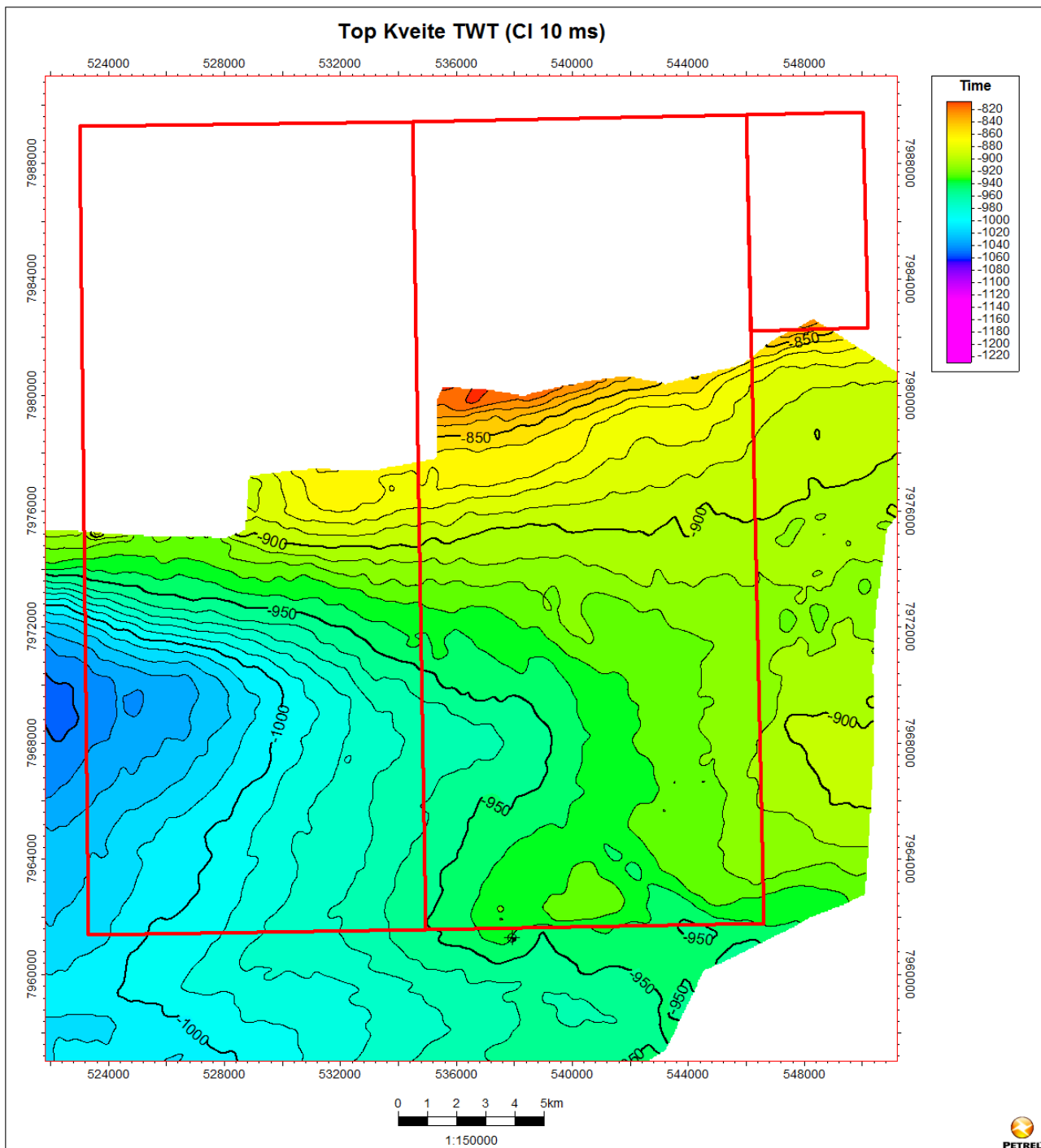


Fig. 3.7 Top Kveite Time Map (TWT)

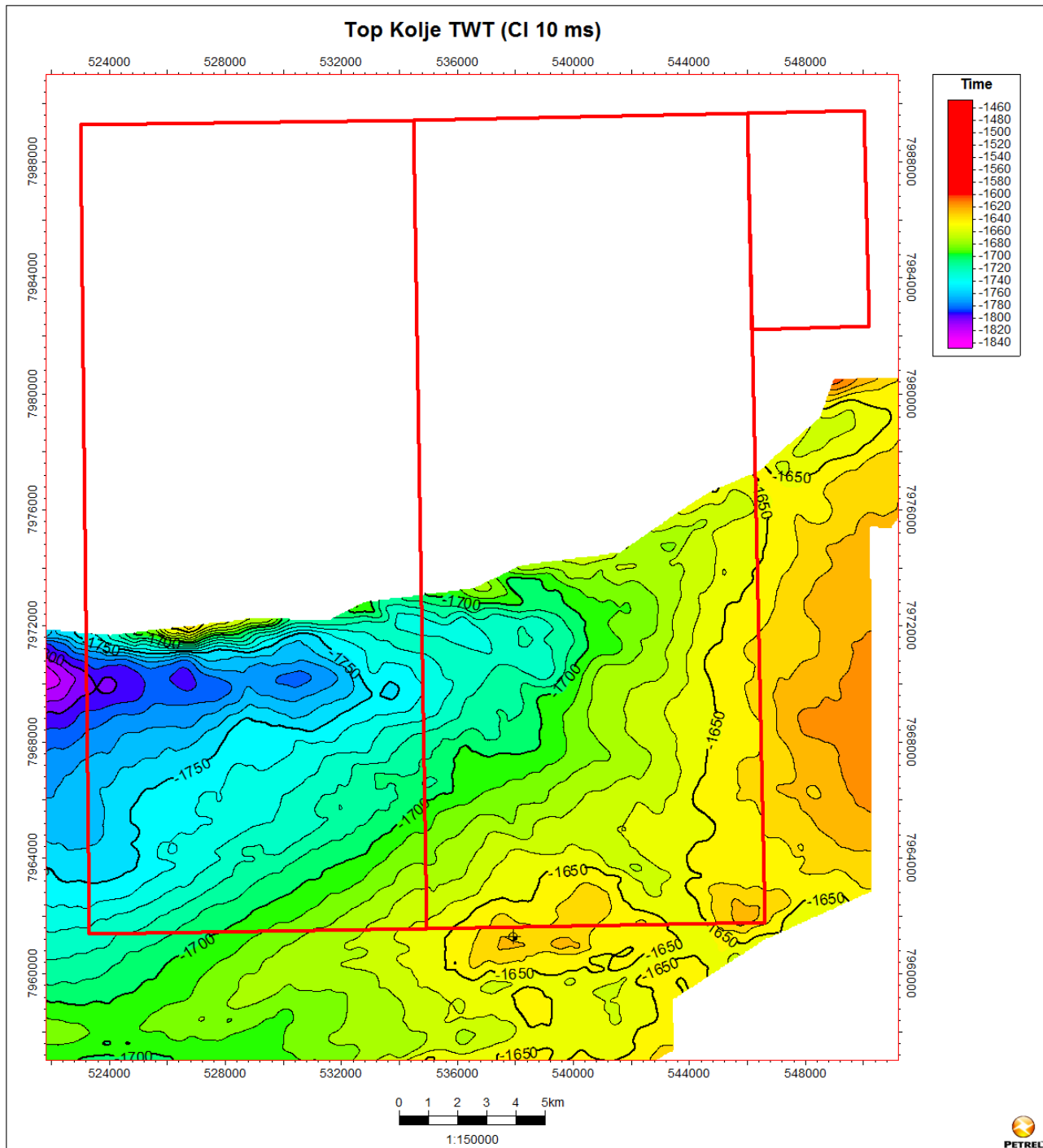


Fig. 3.8 Top Kolje Time Map (TWT)

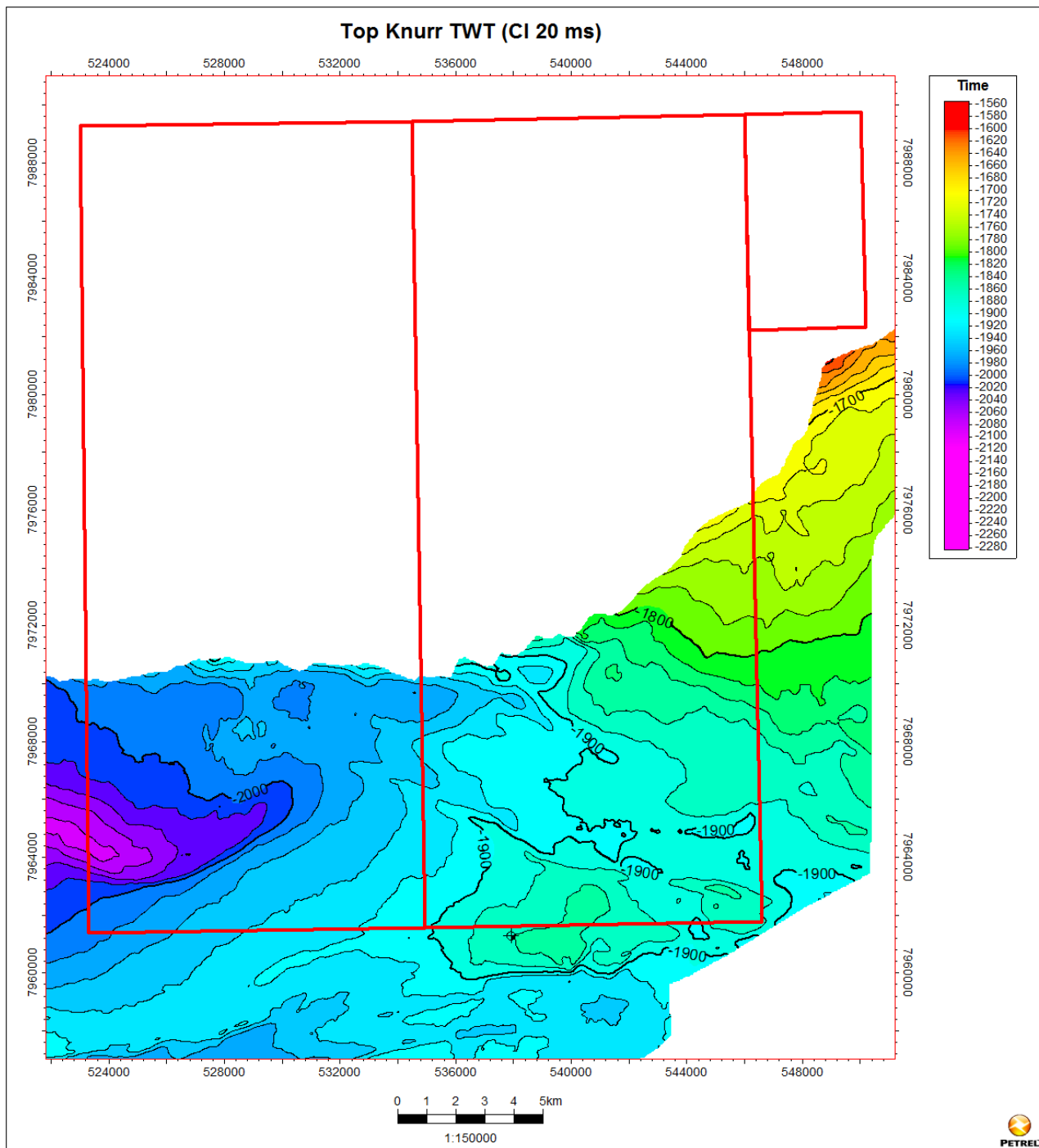


Fig. 3.9 Top Knurr Time Map (TWT)

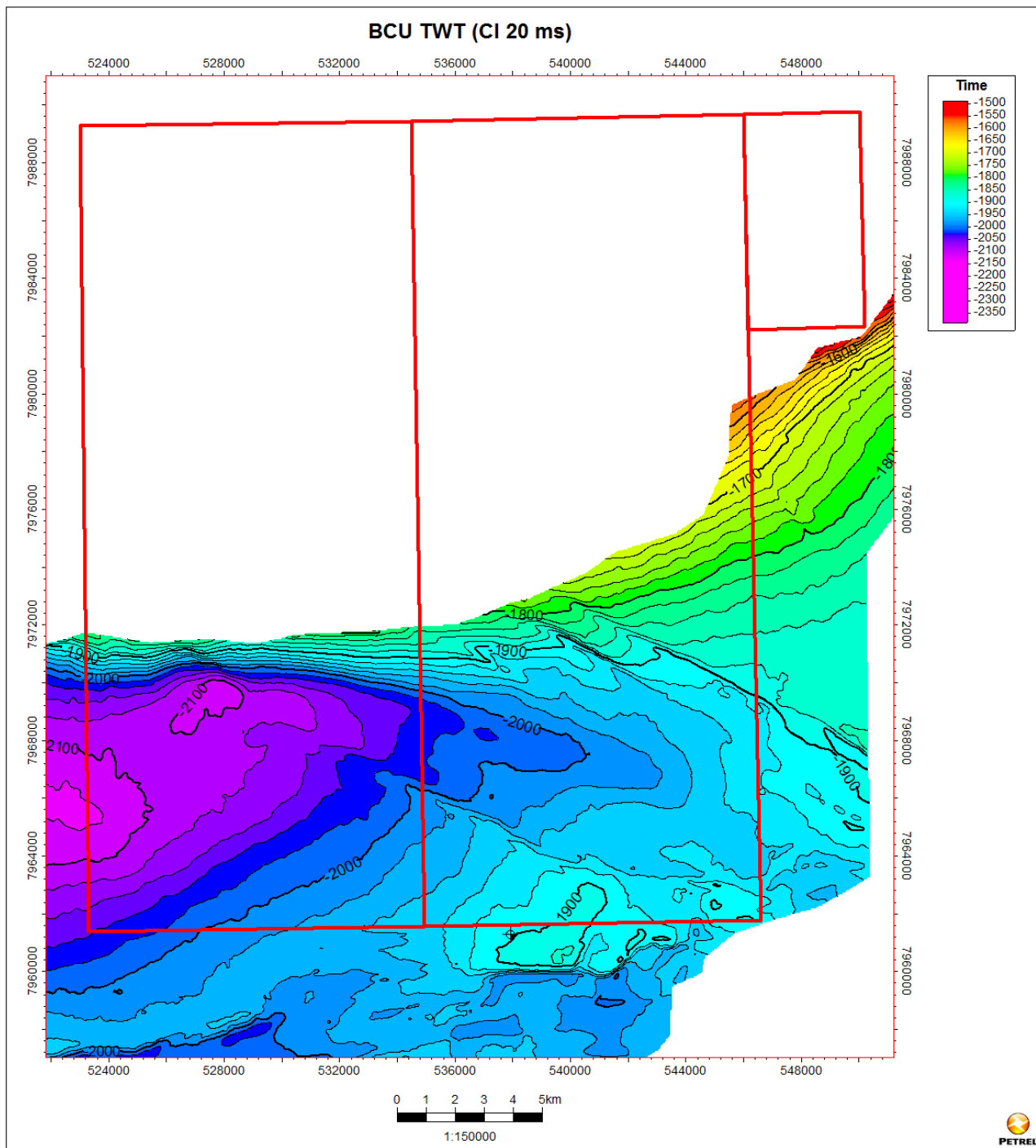


Fig. 3.10 BCU Time Map (TWT)

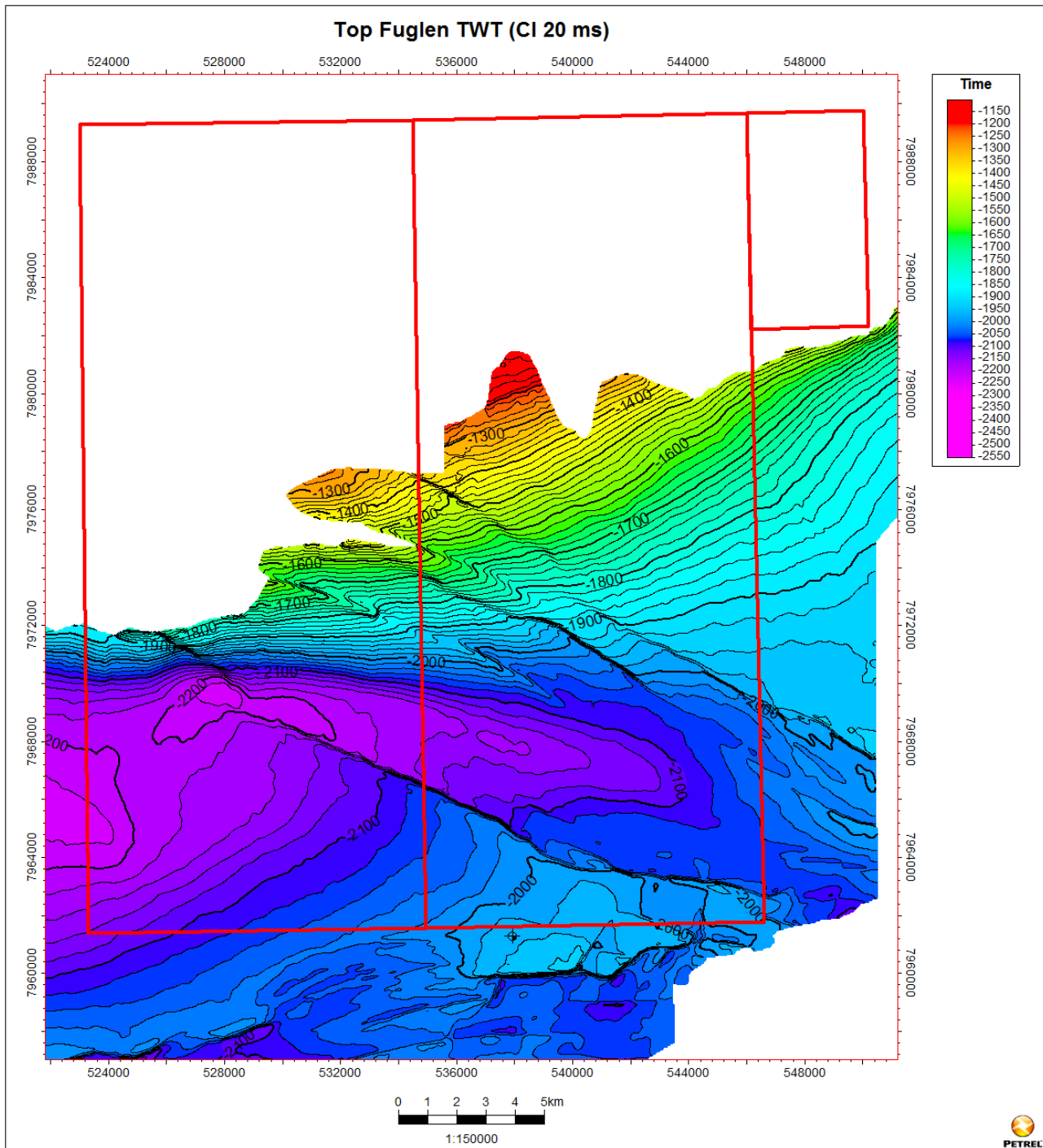


Fig. 3.11 Top Fuglen Time Map (TWT)

The following time maps have been created on the northern Loppa High portion of production licence 449:

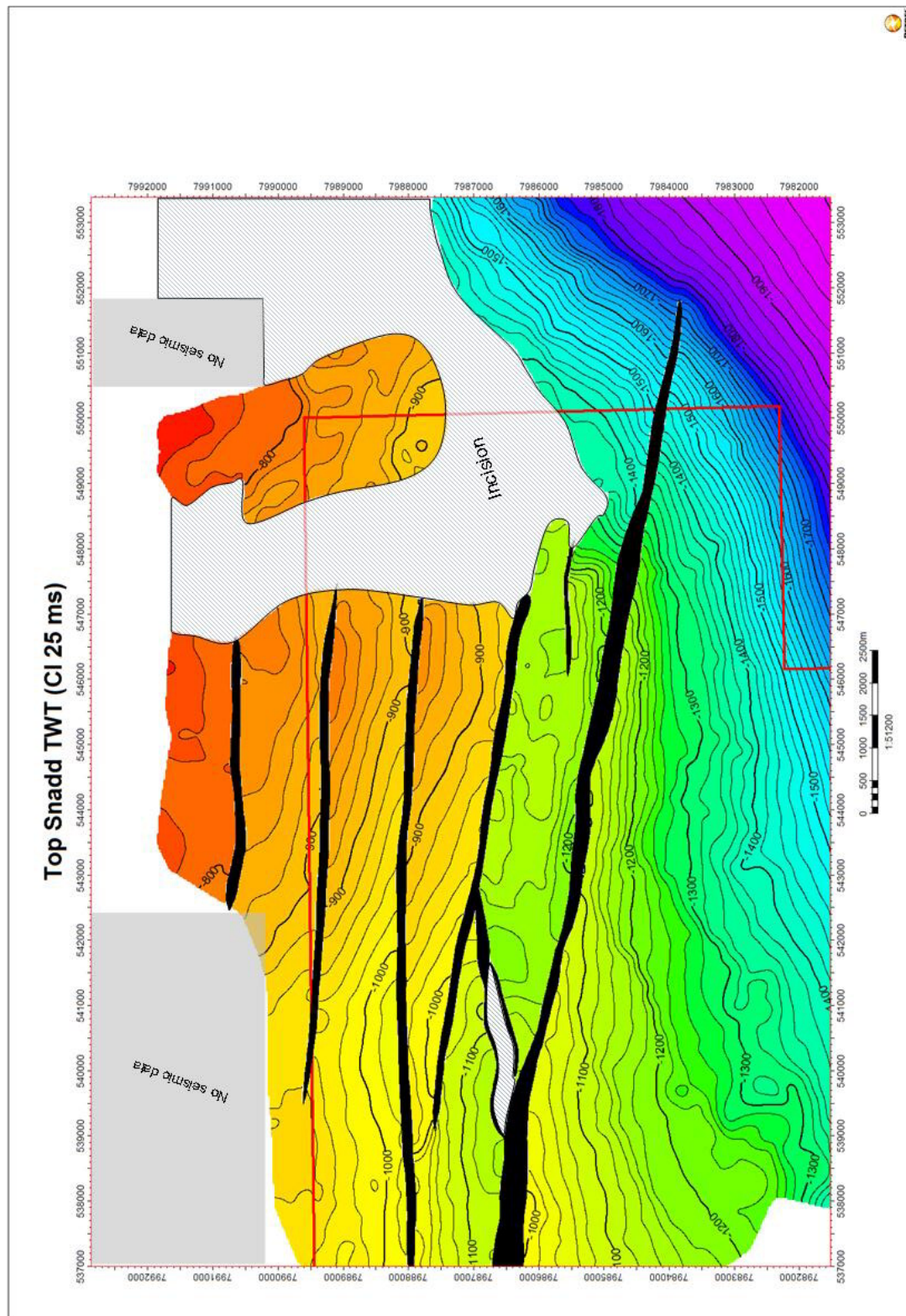


Fig. 3.12 Top Snadd Time Map (TWT)

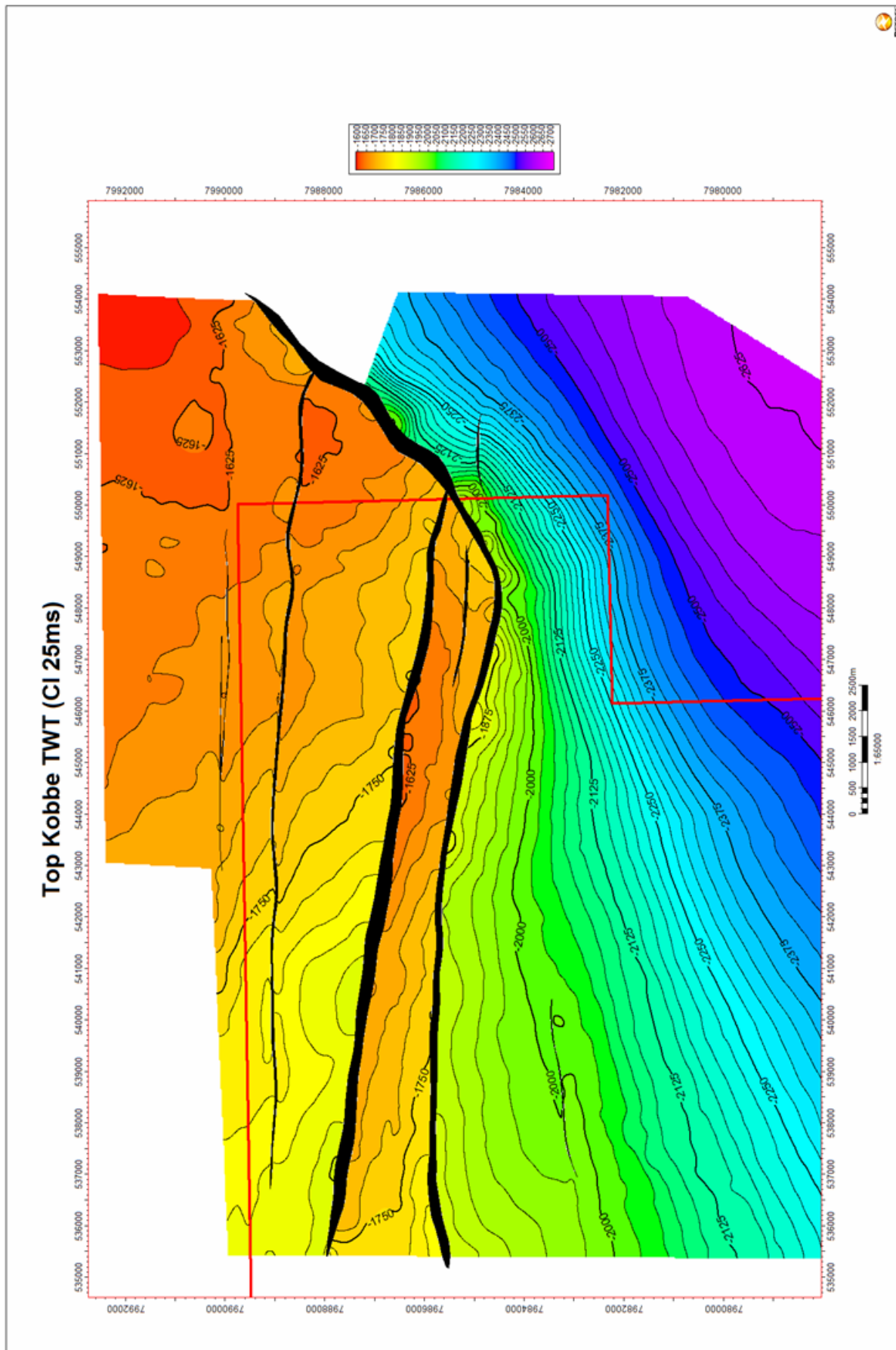


Fig. 3.13 Top Kobbe Time Map (TWT).

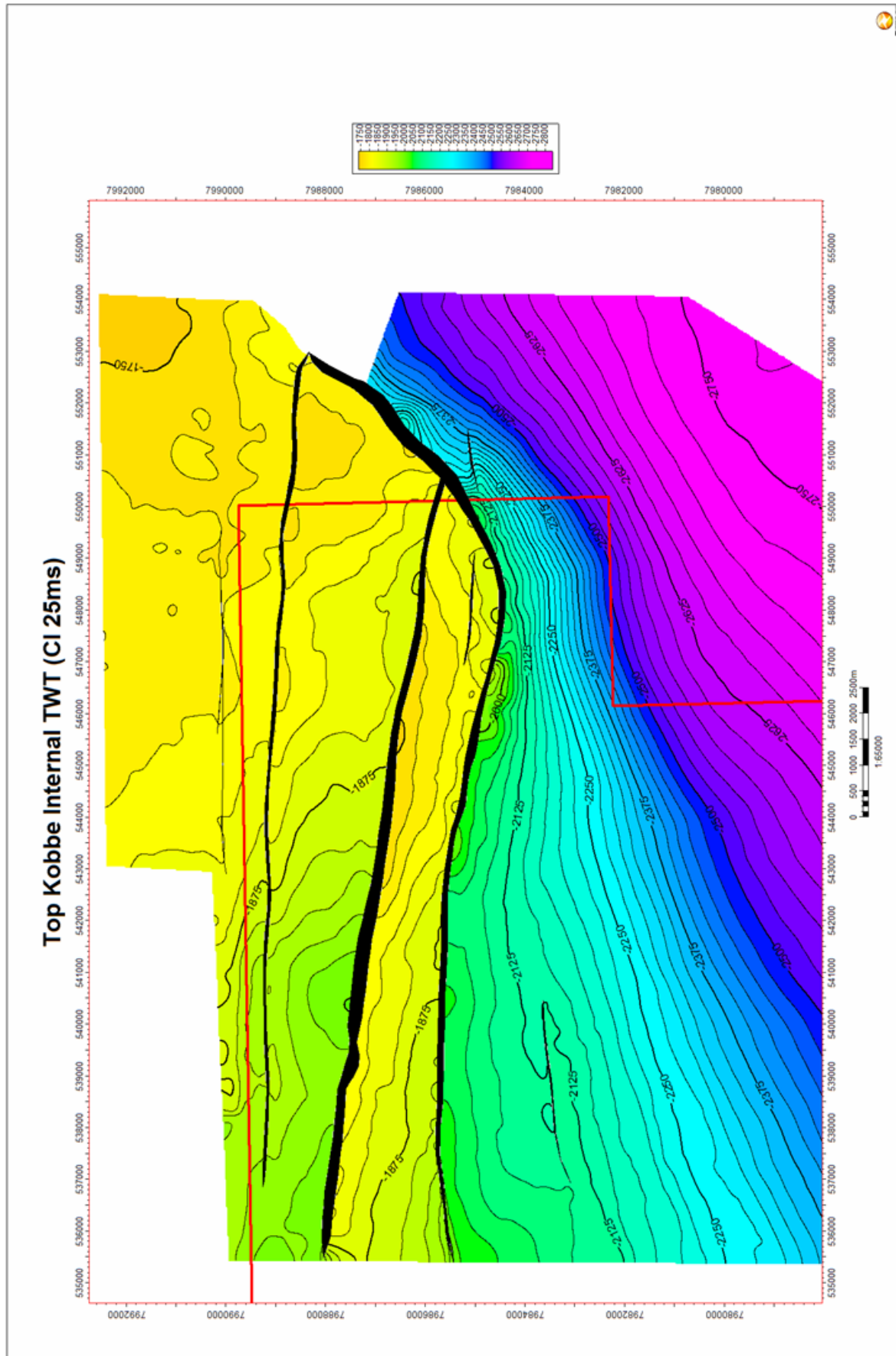


Fig. 3.14 Intra Kobbe Time Map (TWT).

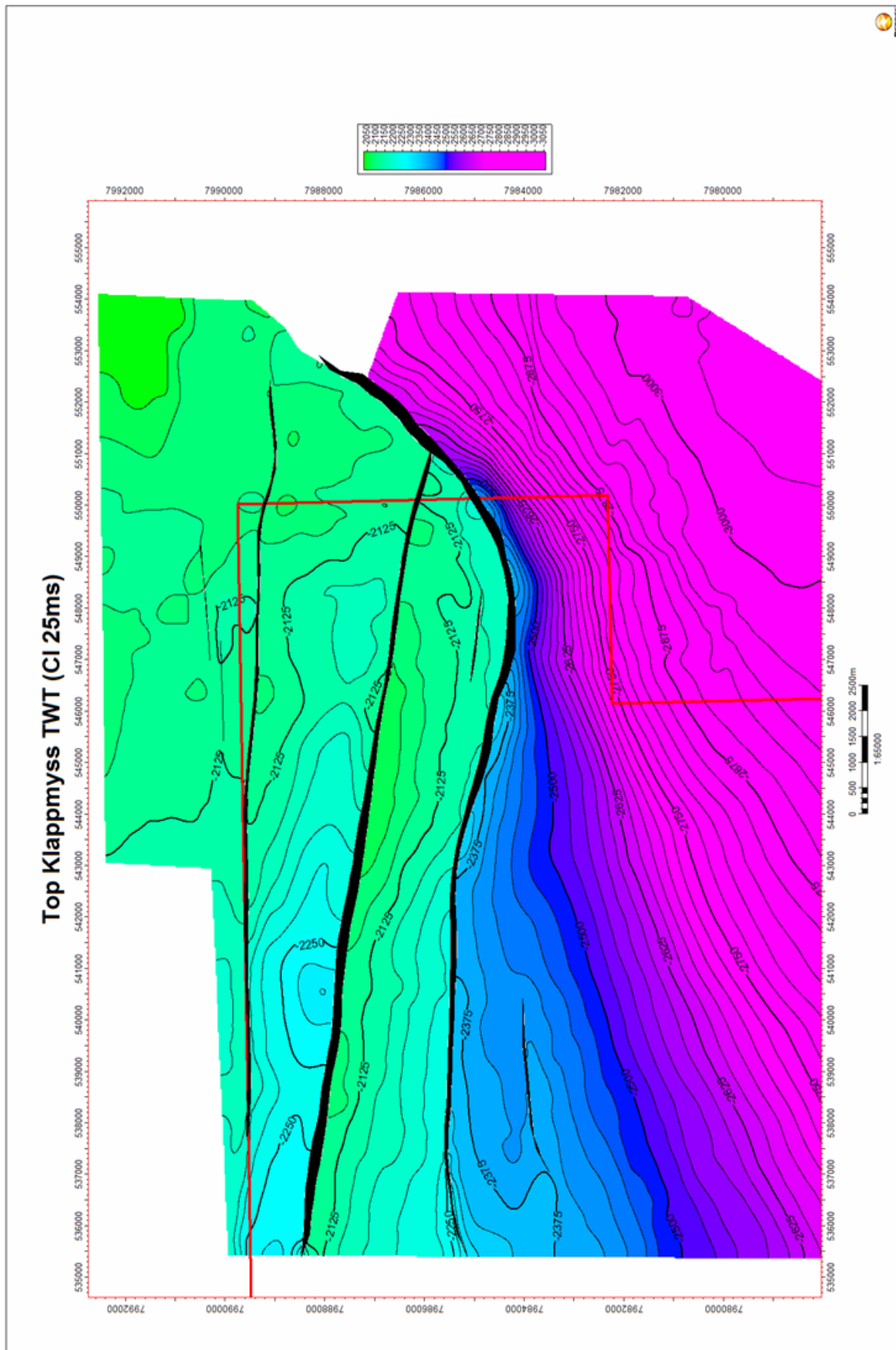


Fig. 3.15 Top Klappmyss Time Map (TWT).

3.2 Prospectivity Evaluation

3.2.1 Knurr Formation

Through access to the a wider merged 3D dataset (Fig. 2.1) the operator had the opportunity to interpret the horizons of interest along the northern margin of the Hammerfest Basin. This enabled a regional approach to the interpretation of the Knurr Formation development south of the Loppa High (Fig. 3.16). It can be noted that the structure is dipping to the west, with the depocentre to the west in production licence 439. Especially in the western portion of production licence 449 and to the west of the license, incisions have contributed to the overall structural configuration. These incisions have an impact on the shaping of the top of the Knurr Formation and partly represent thinning of the package (Fig. 3.17).

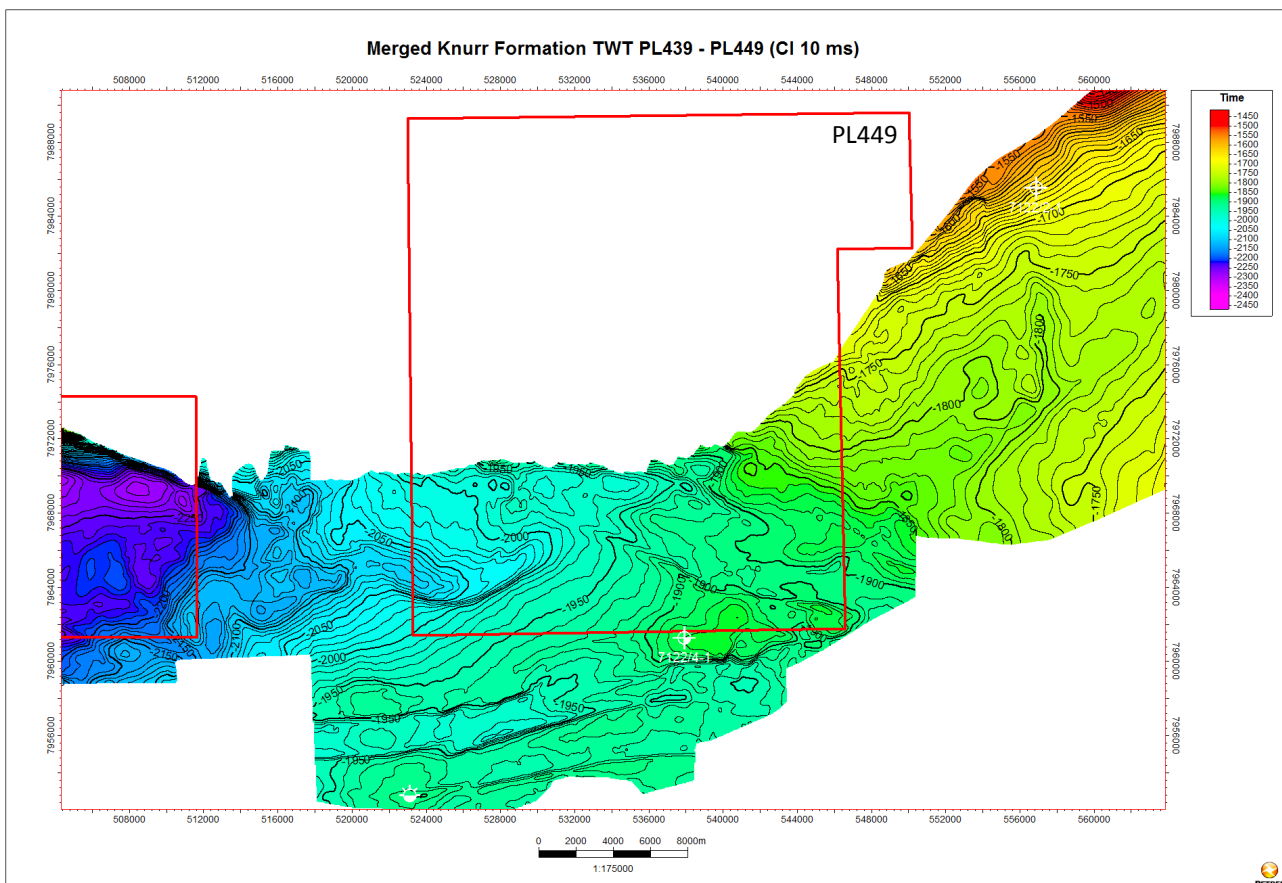


Fig. 3.16 Merged Knurr Formation Time Map (TWT)

The Knurr Formation time map is not exhibiting any structural closures of significant extent. Red circles in Fig. 3.18 are highlighting the small structural closures which can be identified. There is an evident structural closure around well 7122/4-1 to the south of production licence 449 but this well has encountered the Knurr Formation in a non-reservoir facies. As previously outlined it is assumed that Knurr Formation in reservoir facies is deposited along the northern margin of the Hammerfest

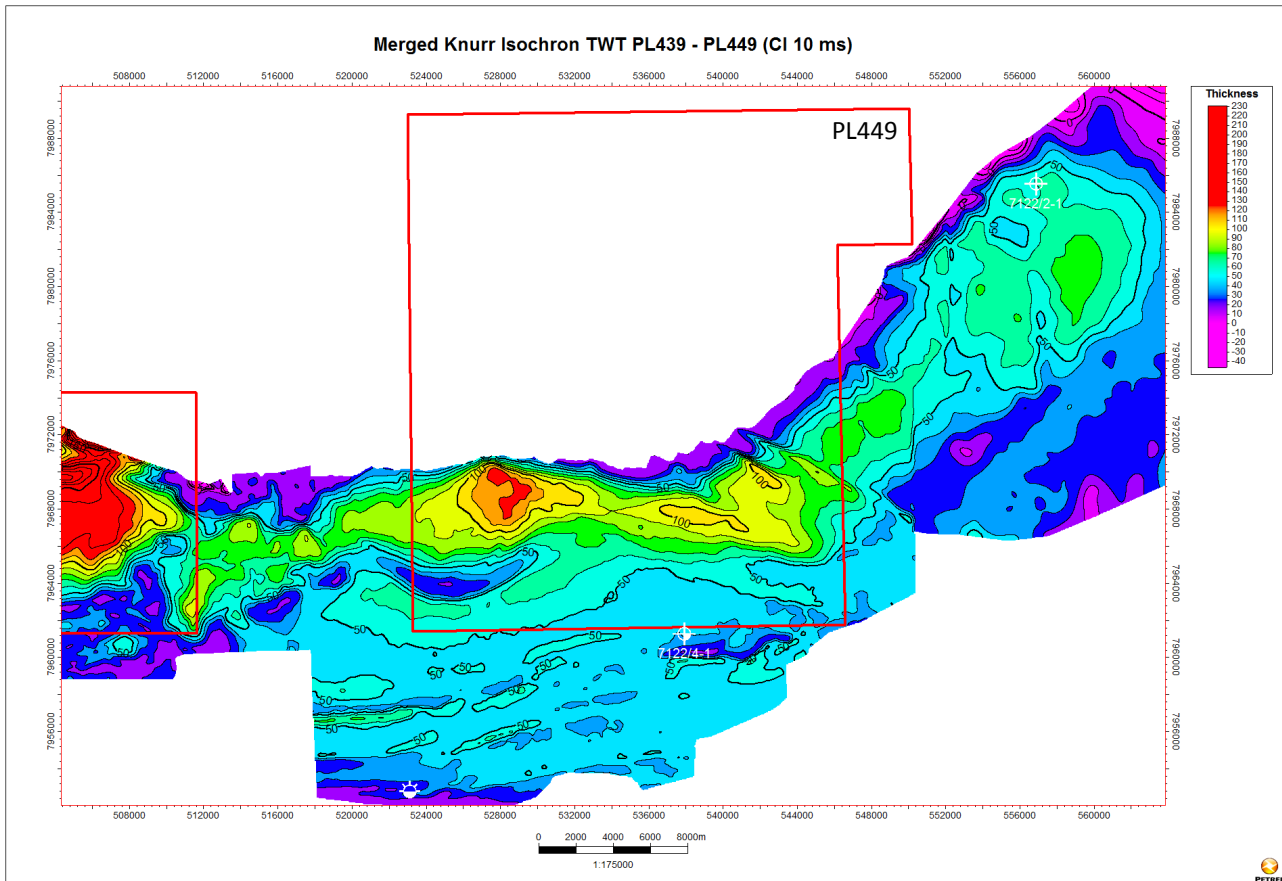


Fig. 3.17 Merged Knurr Isochron (TWT)

Basin and this deposition is interpreted to find its expression in increased thickness (Fig. 3.17). Fig. 3.19 shows two example lines that highlight the onlap of the Knurr package onto the north. In addition the rugose internal seismic facies can be identified which is interpreted to be another indicator for reservoir prone facies.

Due to the lack of structural closures it requires a combined structural-stratigraphic trapping component to confine a potential hydrocarbon accumulation in this interval of thicker Knurr Formation. Stratigraphic thinning, either through incisions or depositional thinning, is seen to the south and the north. Structural trapping along the belt of increased thickness needs to be provided by faulting as the prevailing updip direction is to the east, indicated by arrows in Fig. 3.20. As it is evident in Fig. 3.21 that faults are still active until Cretaceous times and at BCU level an offset can be interpreted. This faulting is also affecting the thickness of the overlying package due to syndepositional movement at the base and creation of additional accommodation space. However faulting ceases during the deposition of the Knurr Formation and no effective offset can be recognized at the top Knurr level. This has a direct impact on the sealing potential and the structural offset across faults is not considered sufficient to provide any sealing across this interpreted sand-to-sand juxtaposition.

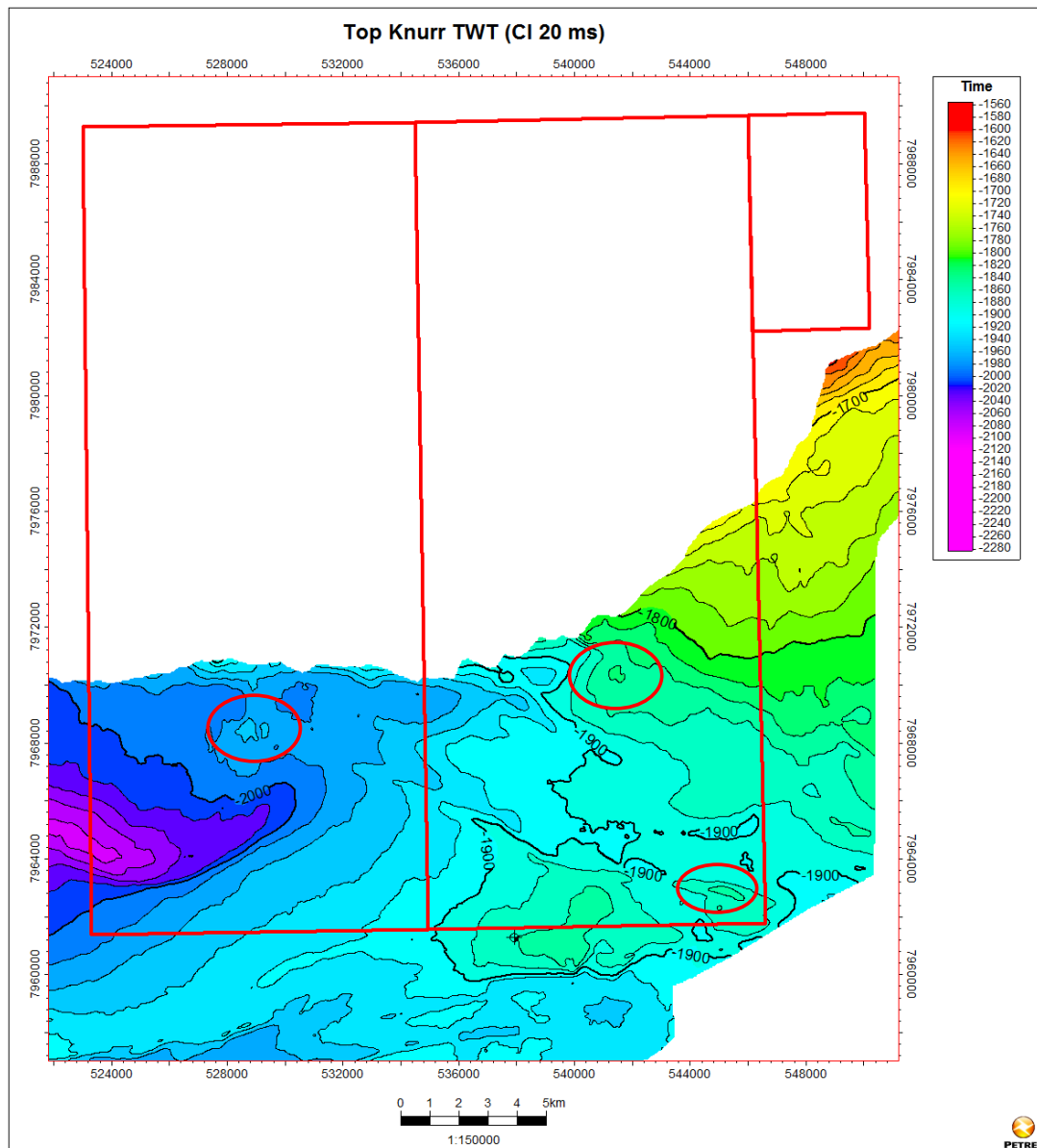


Fig. 3.18 Top Knurr Time Map (TWT) - Structural Closures

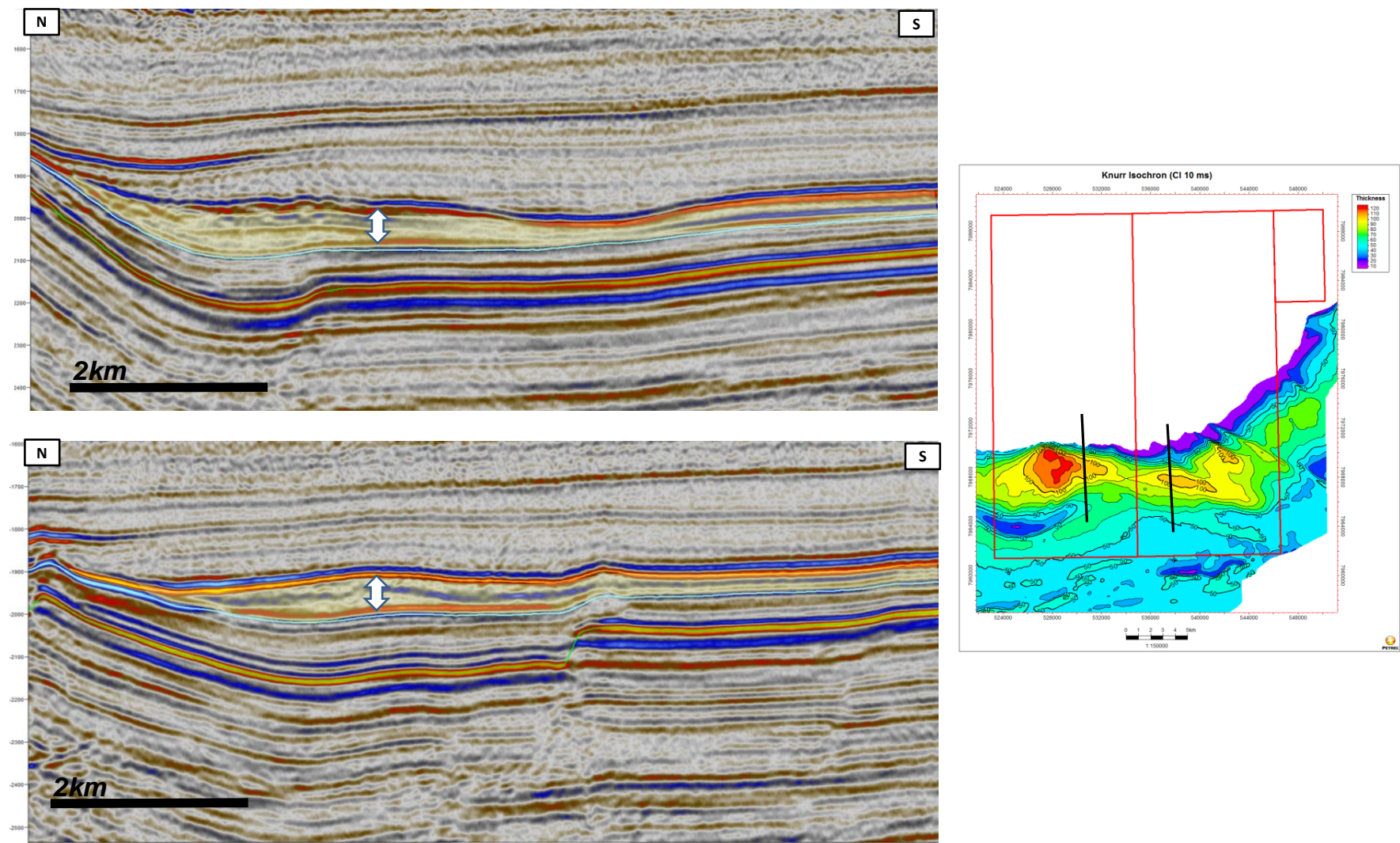


Fig. 3.19 Knurr Formation - Internal Seismic Facies.

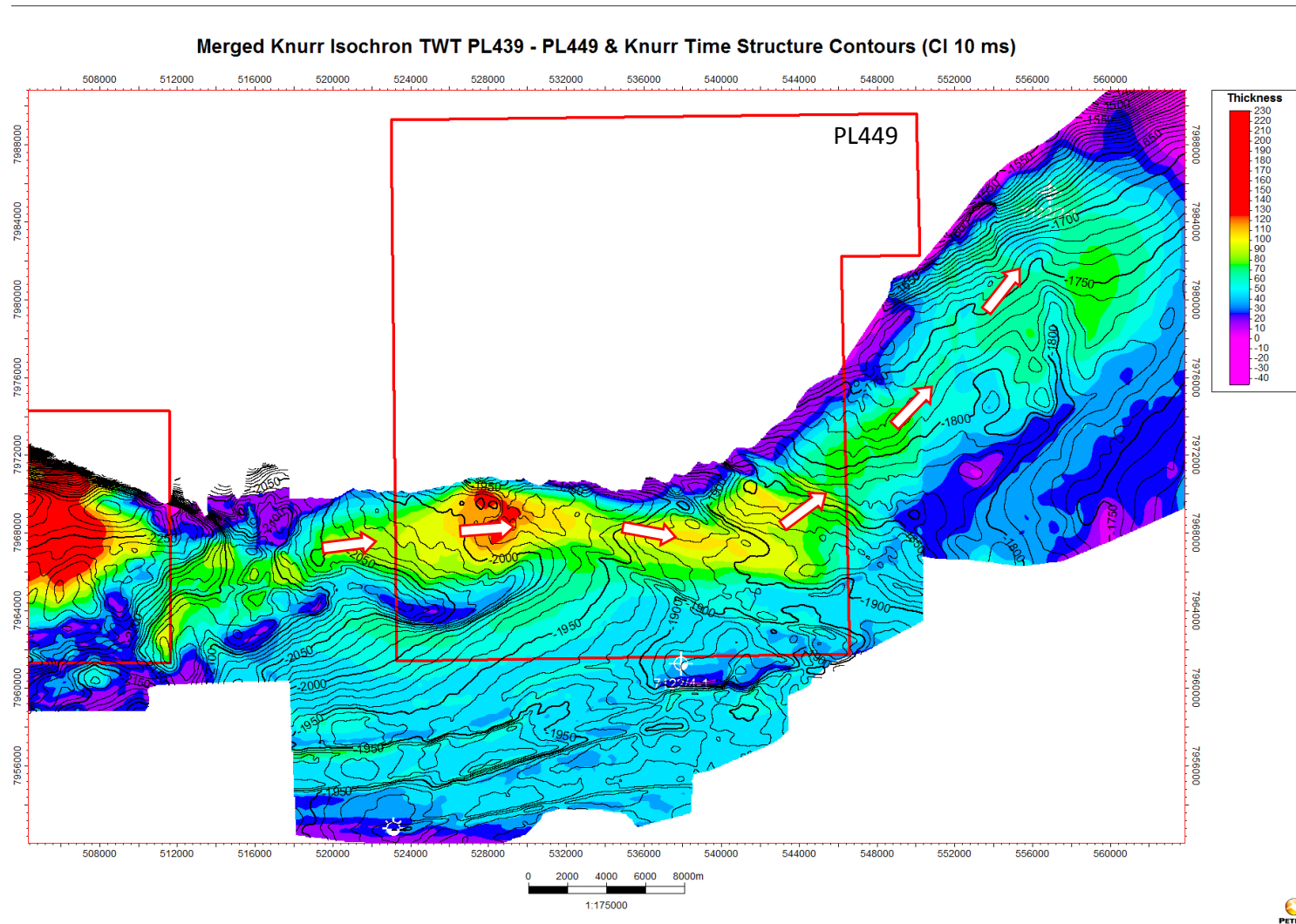


Fig. 3.20 Knurr Isochron (colors) & Structural Contours (TWT). Arrows indicating updip direction

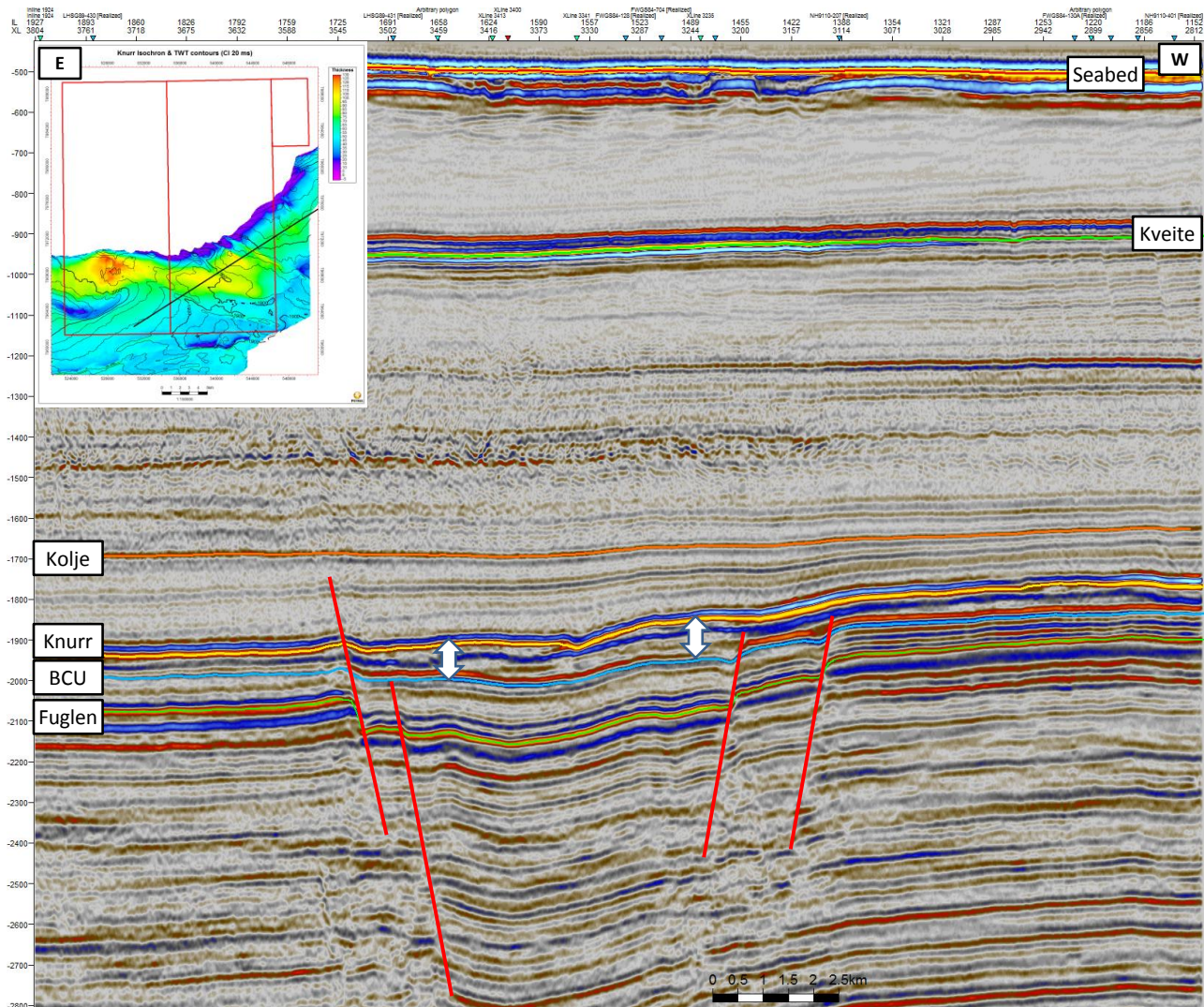


Fig. 3.21 Knurr Formation - Internal Structural Seals

Additional detailed mapping of internal reflector of the Knurr interval does not reveal any subtle trapping mechanism. Due to the fact that no structural closures could be identified in addition to a lack of stratigraphic trapping mechanisms and limited fault seal potential, it has to be concluded that the Knurr Formation in license production licence 449 exhibits no prospectivity which justifies further exploration.

3.2.2 Triassic Snadd and Kobbe Formations

Snadd Level Prospectivity

A composite line through the 3D coverage (Fig. 3.22) illustrates the general structure of the northern portion of production licence 449. The Snadd Formation is near seabed on the Loppa High and is broken up by E-W faulting at the southern margin of this major structural feature. In the basin, the Snadd level exhibits near monoclinial dip. Detailed mapping (Fig. 3.23) has shown a series of down-thrown fault-blocks and a small horst-like feature with only limited structural closure. Furthermore, there is a possibility of leakage to the west. A representative line is shown in

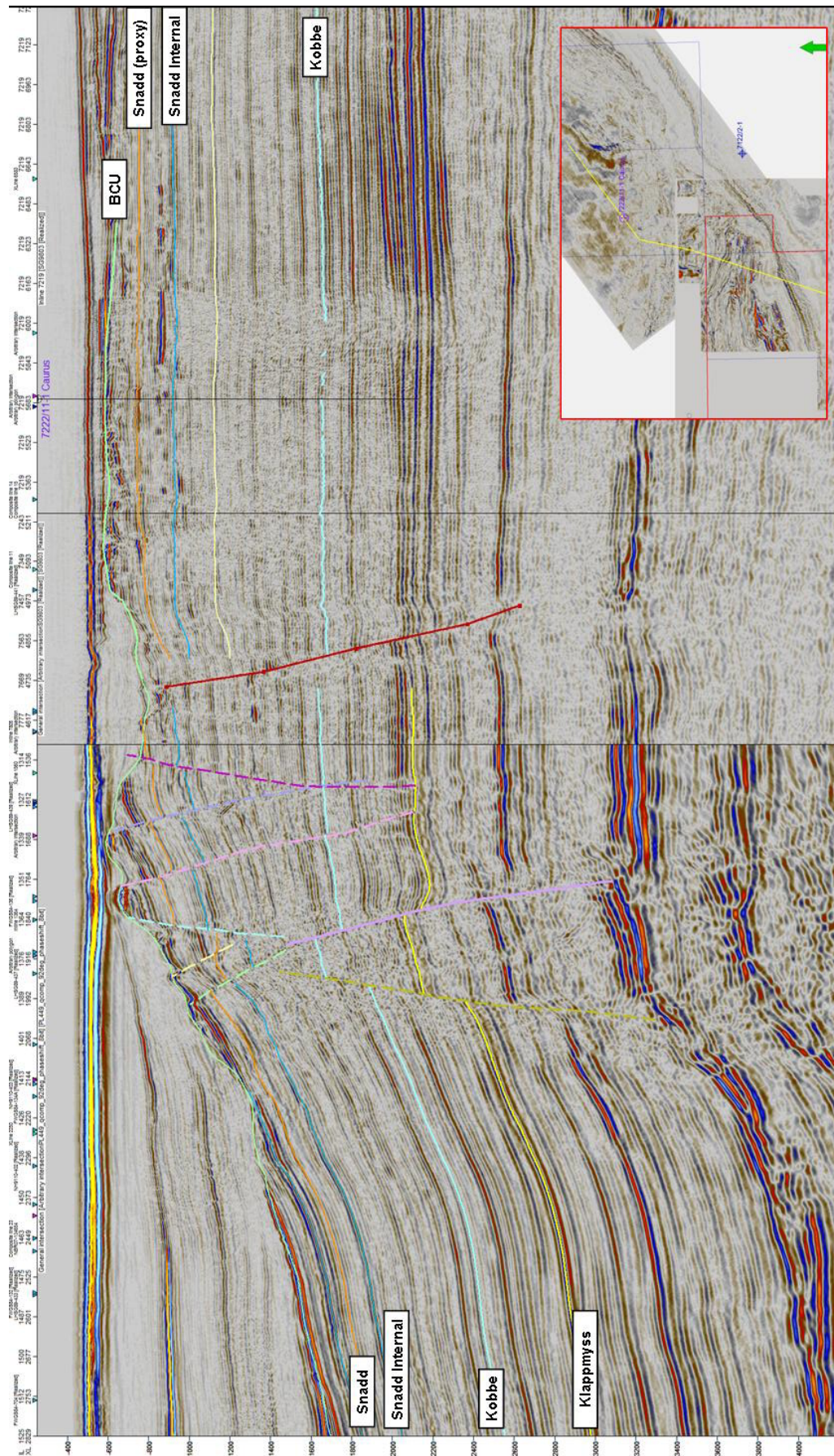


Fig. 3.22 PL449 Area Tie Line to Caurus Well.

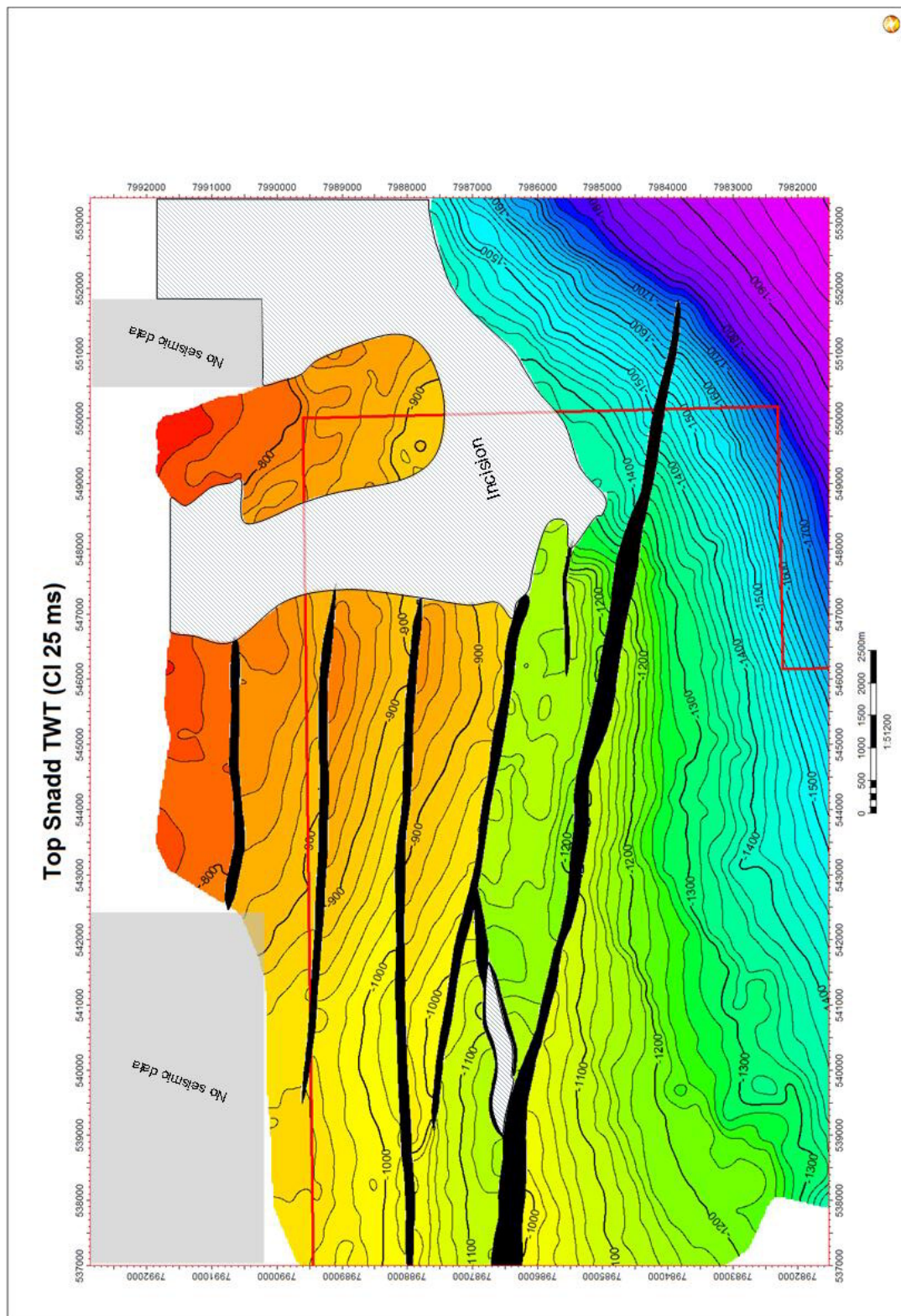


Fig. 3.23 Top Snadd Time Map (TWT)

Fig. 3.24. Moreover, the Snadd level is truncated or eroded by significant incision in several areas (Fig. 3.25) and no recognisable fluvial channel patterns can be demonstrated in the production licence 449 area on time-slice data. For the reasons outlined above, the Snadd level in production licence 449 is not considered to have any significant prospectivity.

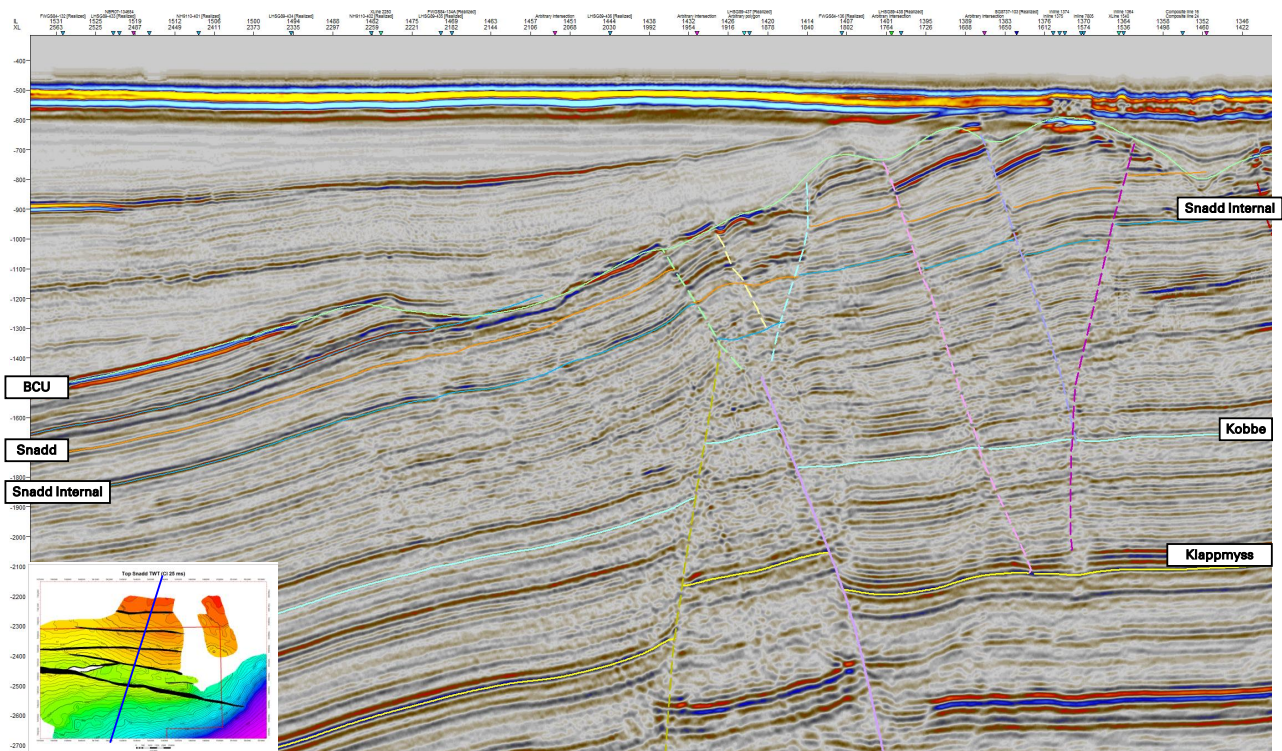


Fig. 3.24 3D Seismic Dip Line SG9803

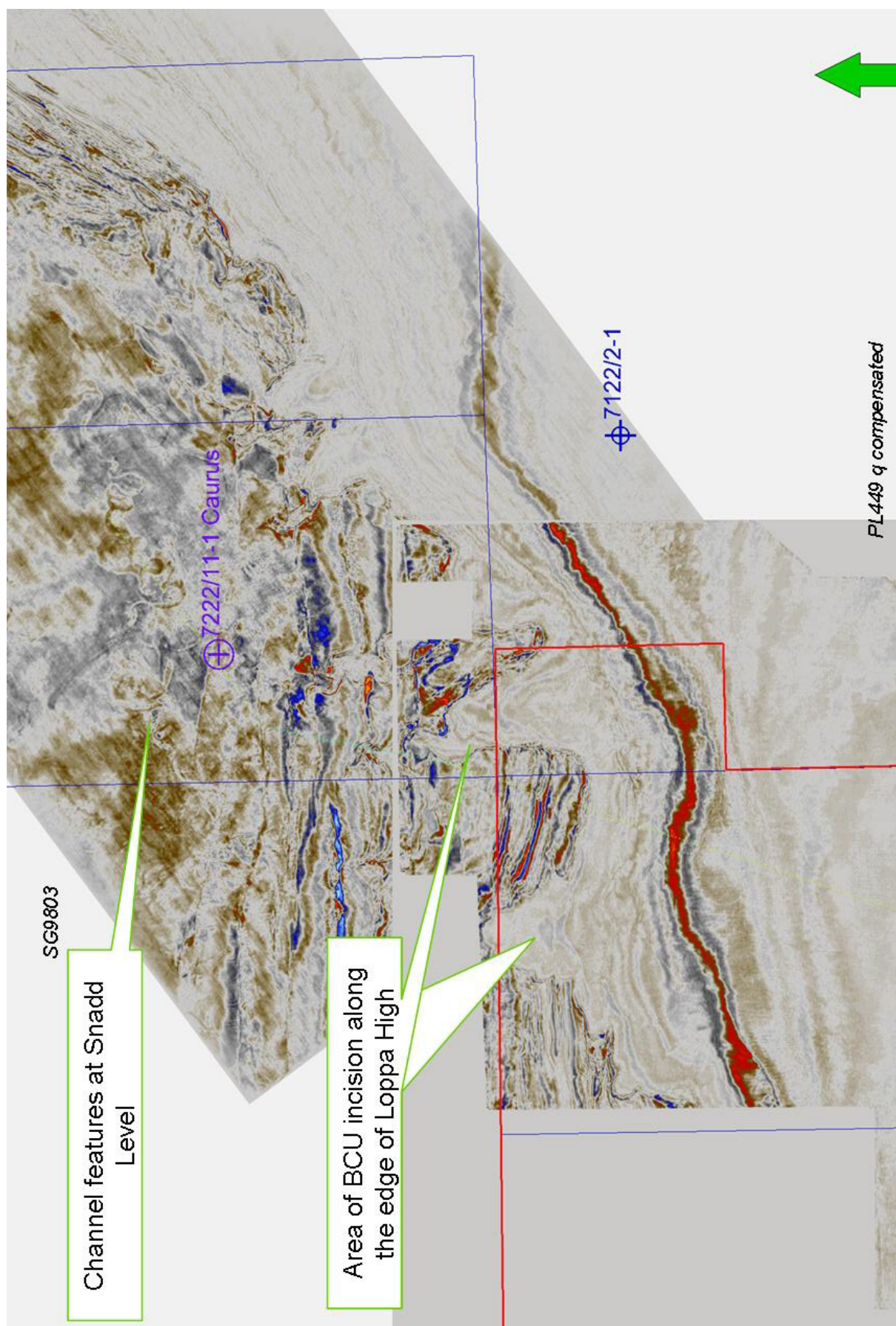


Fig. 3.25 PL449 Triassic Snadd Level Timeslice. (OMV09M01 & SG9803)

Kobbe Level Prospectivity

Detailed mapping at Top Kobbe level (Fig. 3.26) has also shown the presence of a horst-like feature (refer to representative seismic lines as for Snadd level) within production licence 449. However, the structure is very narrow in the eastern portions of the licence and is only partially delineated by 3D seismic data giving rise to some uncertainty in the interpretation. Reservoir potential within the Kobbe Formation in this area is considered problematic and high risk as it is believed to have been deposited in a muddy outer-shelf environment. In addition, the OMV mean reserve case has a hydrocarbon column height of only 130m making the GRV relatively small. Furthermore, using net to gross ratios from surrounding well control it is considered highly unlikely that there will be sufficient net reservoir in the structure to provide economic reserve potential. For these reasons the Kobbe level structure is not considered a viable prospect.

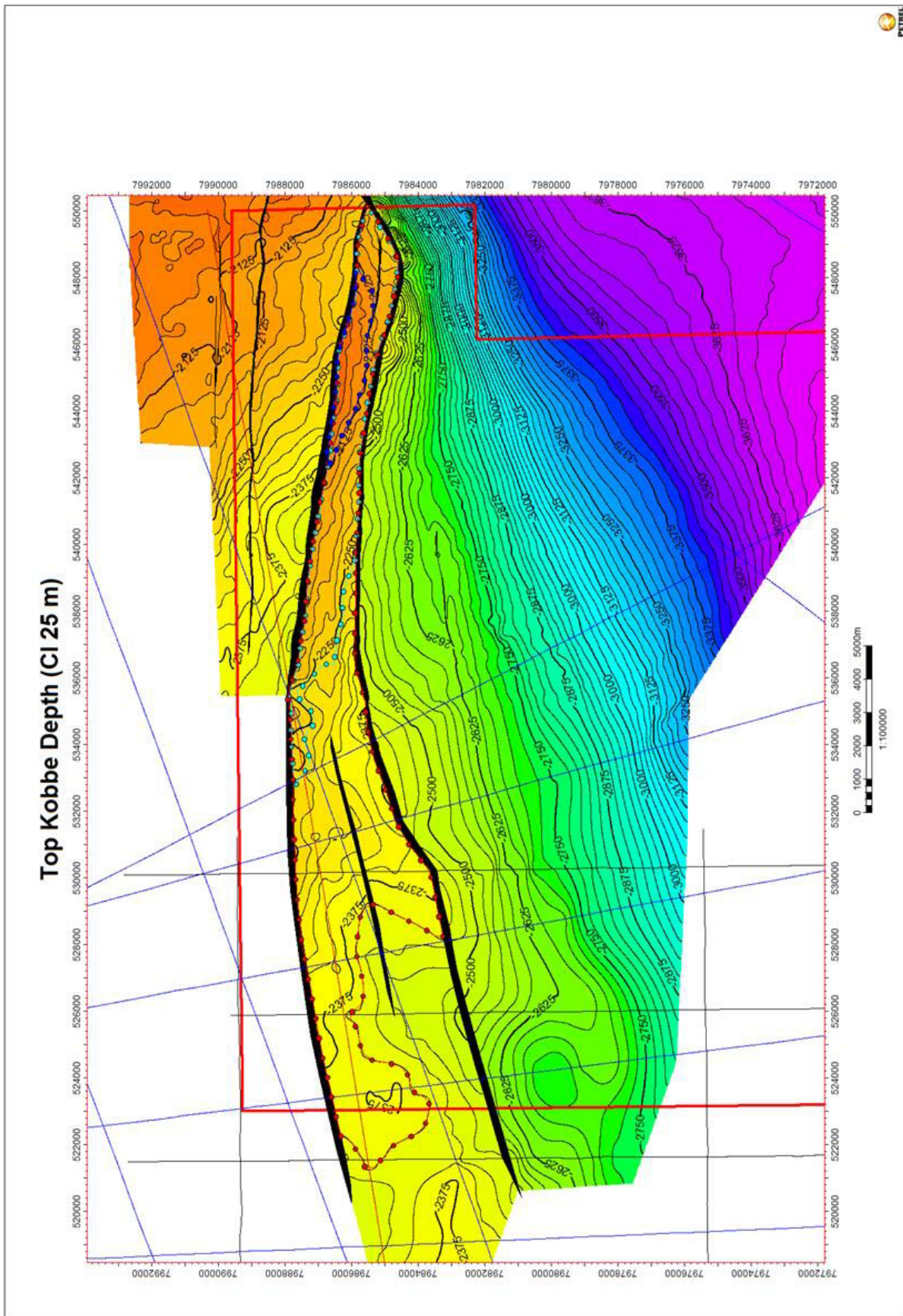


Fig. 3.26 PL449 Top Kobbe Depth Map Showing Areas of Closure.

Appendix A

Specific G&G studies commissioned by production licence 449

Seismic Acquisition

3D Seismic Acquisition Design, Production Licence 449. OMV Internal report. 2007

Seismic Acquisition, Production Licence 449. Mapping of marine resources. DNV Energy 2008.

Barents Sea Production Licence 449. 3D seismic Survey. Quality Assurance Report. Exploration Partners International 2008

Production Licence 449 3D Barents Sea. Acquisition Report. PGS Geophysical 2008

Seismic Processing

Seismic Data Processing Report. OMV Production Licence 449. Fugro Seismic Imaging Pty Ltd. 2009

Production Licence 449 3D Seismic Inversion. OMV Internal Report 2009.

Geological Reports

Barents Sea Wells 7120/1-2 and 7122/2-1 Log Analysis. OMV Internal Report 2008.

Reservoir Geological Study of Lower Cretaceous Knurr Formation, SW Barents Sea. Fugro Robertson Limited 2008

Geological Reservoir Characterisation Study of the Triassic Formations, SW Barents Sea. Fugro Robertson Limited 2009.

Petroleum Systems Analysis of the Production Licence 439 & Production Licence 449 areas in the Hammerfest Basin. Torena 2009.