

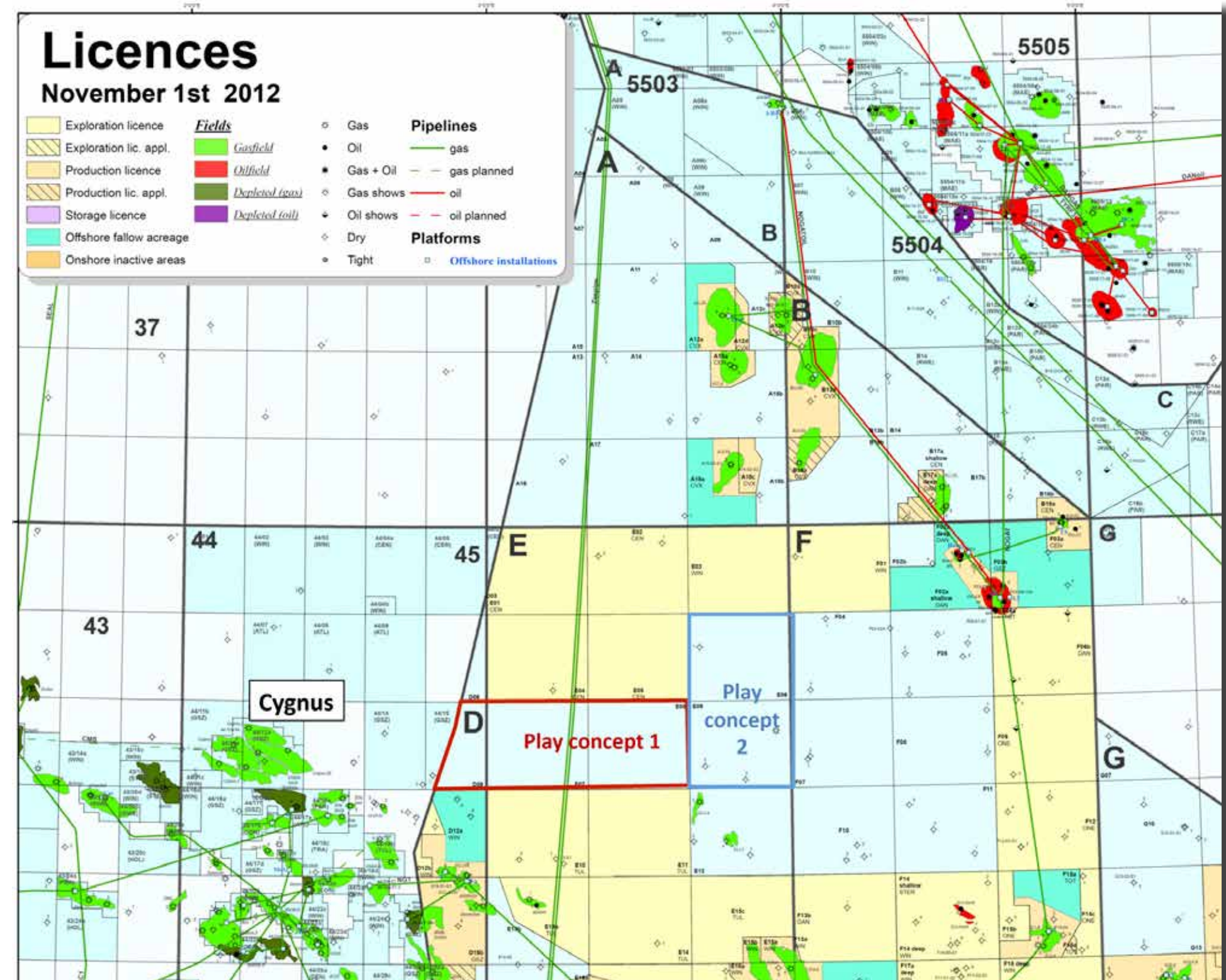
Hydrocarbon Prospectivity in the under-explored Northern Dutch Offshore

Introduction – project DEFAB

EBN is undertaking a large regional review of the Dutch northern offshore, as part of the EBN Roadmap Exploration. Recent long cable 2D lines (TGS) and the 3D DEF survey (Fugro) are being used, among others. All proven and unproven petroleum plays in the area are reviewed regionally. The subsequent prospectivity analyses will focus on unlicensed blocks.

Permian	Zechstein Gp	Base Zechstein (basement rock)	Rotliegend stl sourced from S	F15/E16
	Upper Rotliegend Gp		Rotliegend stl sourced from N	
	Steph / Westphalian D	Step Graben Fm (Bouillon)	Step Graben Fm	S108 Flora field
	Westphalian C	Hospital Ground (Kettin)	Hospital Ground Fm	E113 Epitaph, Chis, Schooner, Kettin
	Westphalian B	Maurite Fm (Westbo)	Maurite Fm	
	Westphalian A	Klaverbank (Murdoch)	Klaverbank Fm	Caster, Murdoch, D12 FA
Namurian	Eper Fm			
Carboniferous		Gawerk Shale Mt.	Milstone Grl Fm	E12 Tulp, E12-Lake
		Silverpit coal		
Dinantian	Yoredale Fm		Fall Sandstone Fm	
	Elleboog Fm		Cementst. Fm	
			Rotliegend Fm	
Old Red Group			Buchan Fm	
Devonian	Kyle Fm			

Map showing licenses, fields, infrastructure and country borders (1 Nov. 2012)

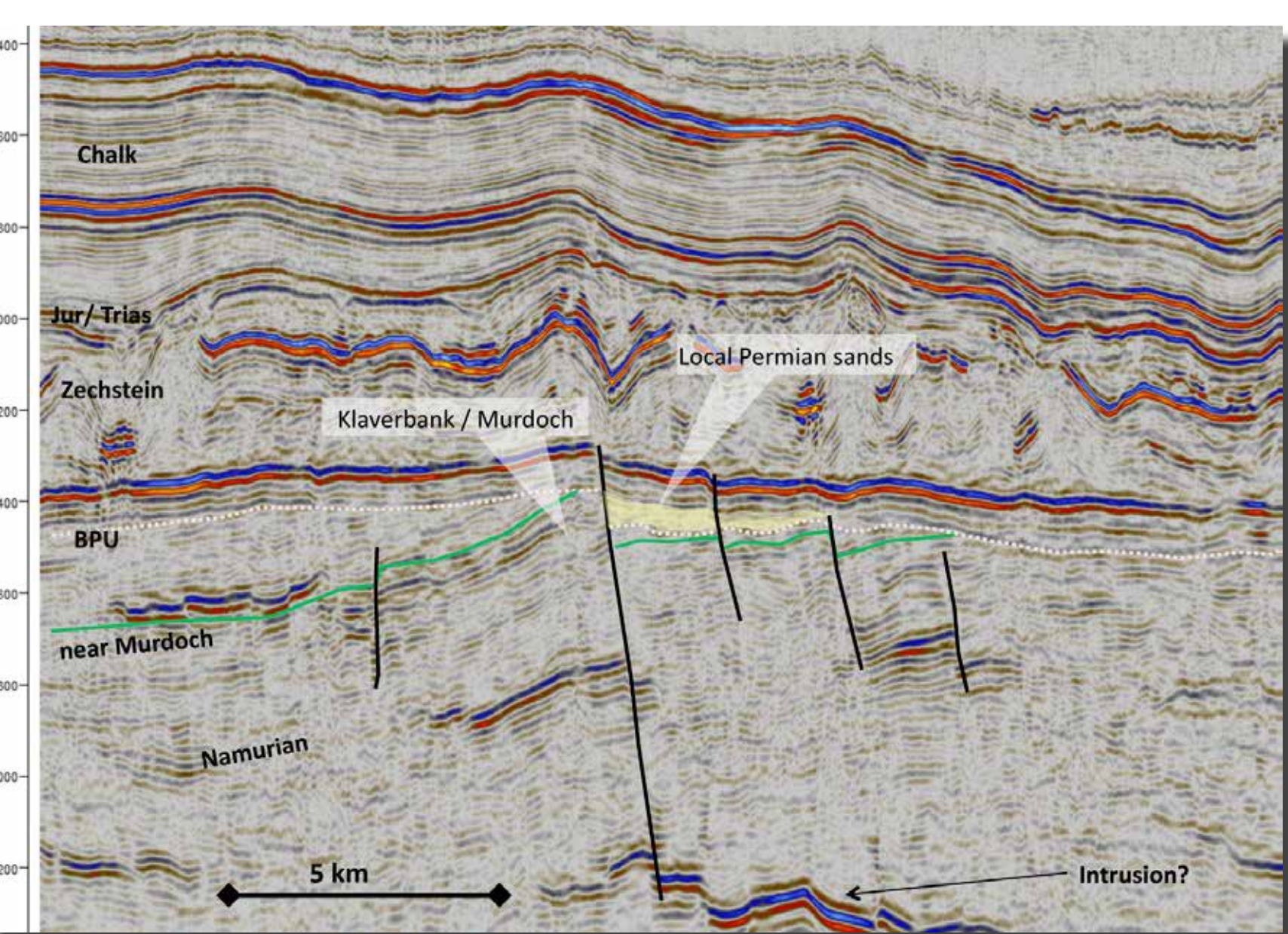
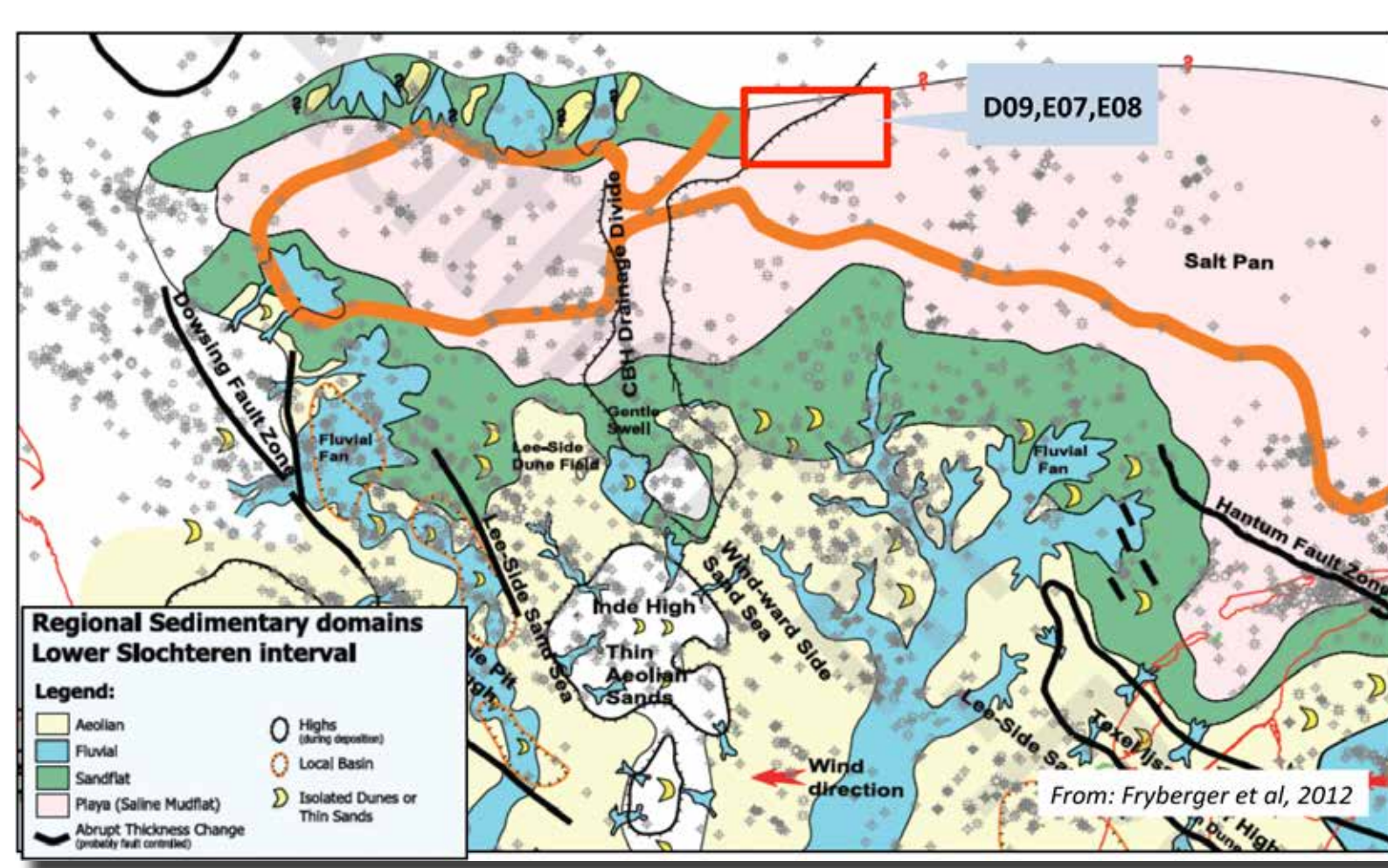


Summary of lithostratigraphy, potential source rock and reservoir intervals in Dutch Northern offshore

Play concept I

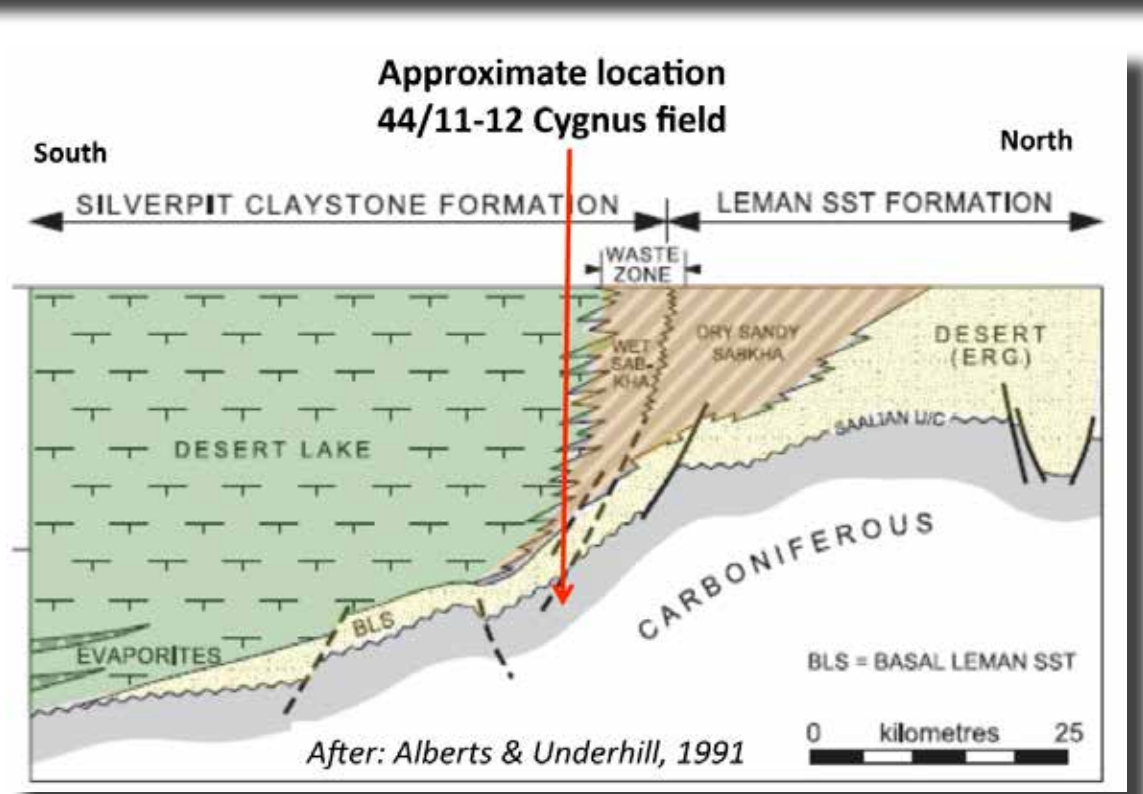
The Cygnus equivalent in blocks D09, E07, E08

Recent developments on the northern fringe of the Permian Basin show the potential of localised basal Rotliegend sand. Extrapolating the 44/11-Cygnus Permian sands along trend east-wards brings us to Dutch blocks D09, E07 and E08. No wells have been drilled in this acreage. Recently acquired 3D seismic shows a number of prospective structures.



Whaletail Lead

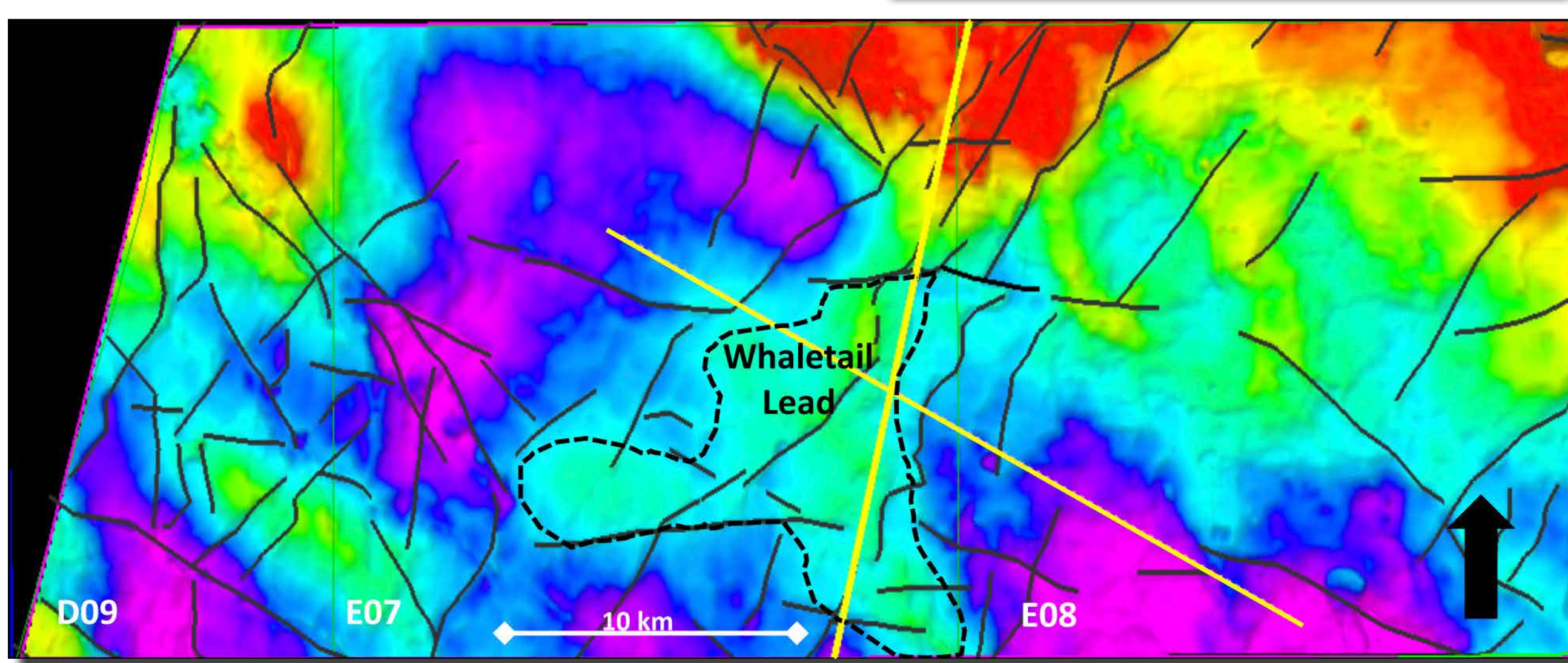
An 80 km² lead has been identified in a NNE-SSW ridge at Base Permian Unconformity (BPU) level in block E07. The north-end of the lead is closed by an EW trending Carboniferous fault.



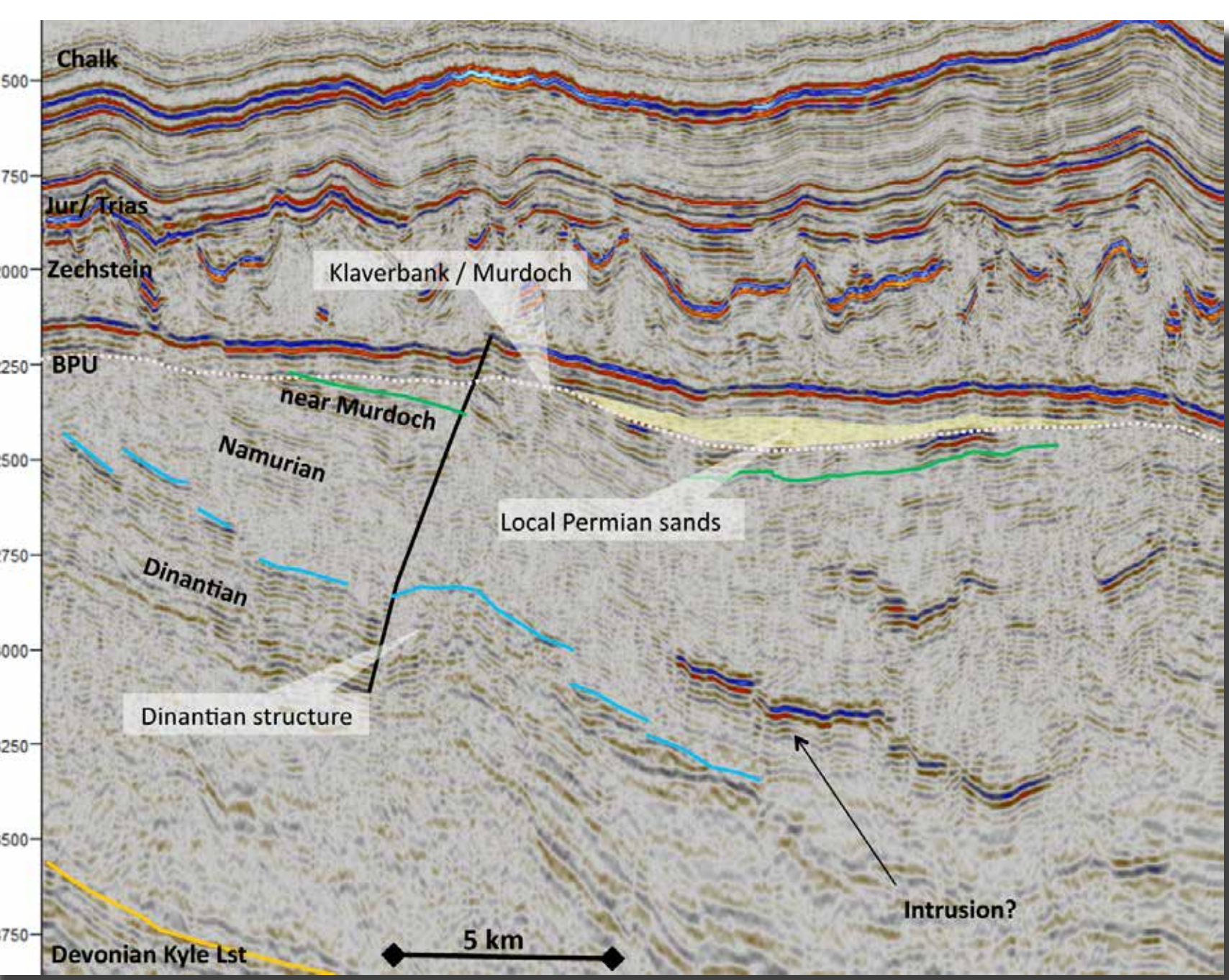
Cygnus-like Permian sands could have developed in this area with sediment supply from the North, preferably along the down-thrown side of Carboniferous faults. The structure can be sealed by Silverpit shales and Zechstein salt which are proven seals.

In addition, Murdoch (Klaverbank) sandstones seem present within closure.

Deeper down a Dinantian high is developed. Both clastic and carbonate reservoirs can be expected in this region with potential sealing Namurian Shales on top. Charge is expected from Namurian and Dinantian shales / coals.



Base Zechstein TWT (2010 DEF survey) showing seismic line locations and the Whaletail lead

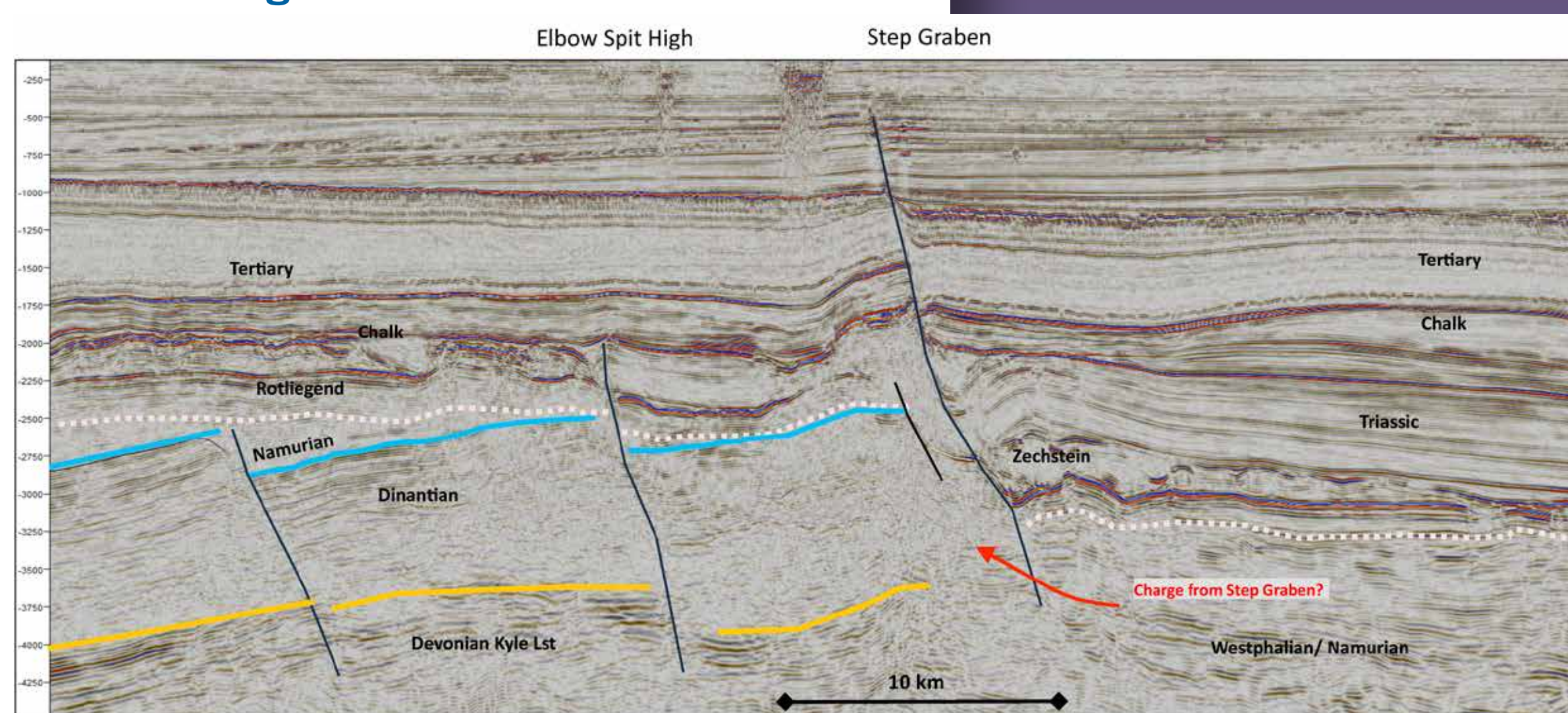


NNE-SSW seismic line

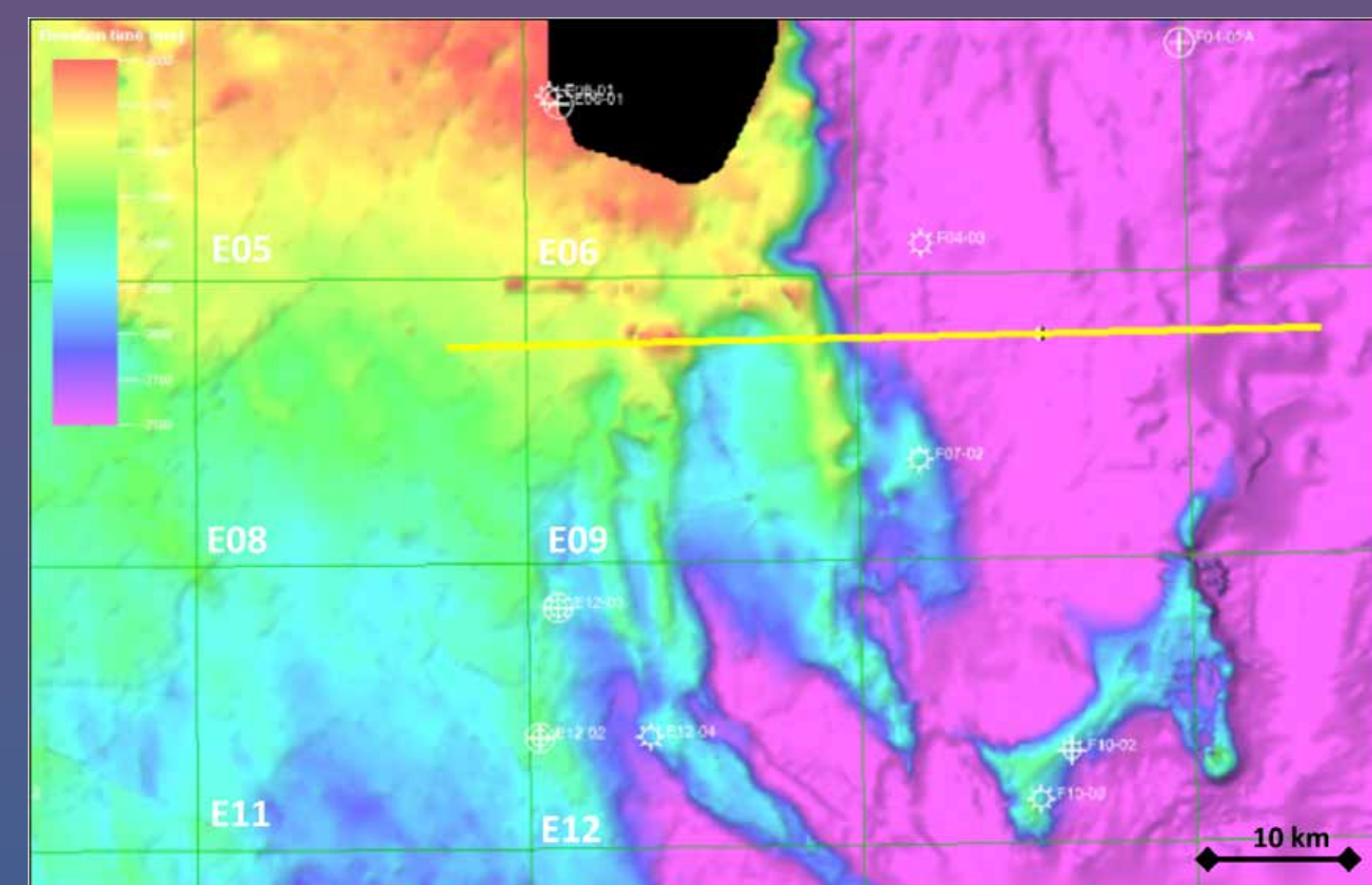
Play concept II

The Dinantian clastics of the Yoredale Fm and Elleboog Fm

The Dinantian clastics have been drilled in a number of wells in the DEAB area and are possibly present in large parts of the DEFAB area. Charge could come from intra-formational coals or from other source rocks via long distance migration. Seal is provided by overlying Namurian shales or Permian units.



WE seismic section from 3D 2010 DEF survey (Fugro)



Base Zechstein TWT (TNO)

Play concept III

The Devonian limestones of the Kyle Gp

The late Middle Devonian carbonates of the Kyle Gp have not been penetrated by any well in the Dutch subsurface so far, however, they are believed to be present over large areas. In parts of the DEFAB area this formation is at medium depth and is clearly imaged in 2D and 3D seismic. The Kyle Gp constitutes a sequence of limestone and mudstone and is known from wells in the southern Central Graben of the UK and Norway, including wells drilled in the Argyll and the Auk field (UK Quad 30).

Way forward

EBN is continuing the prospectivity review of the unlicensed area in the northern offshore. EBN plans to regularly publish results of this review. For more information, please contact EBN : Bastiaan Jaarsma at bastiaan.jaarsma@ebn.nl or Eveline Rosendaal at eveline.rosendaal@ebn.nl



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