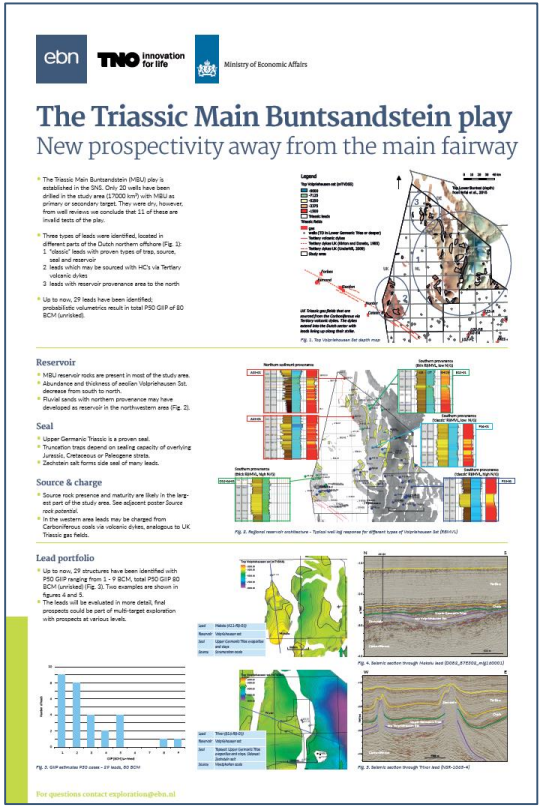
Poster #7



The Triassic Main Buntsandstein play in the Dutch northern offshore

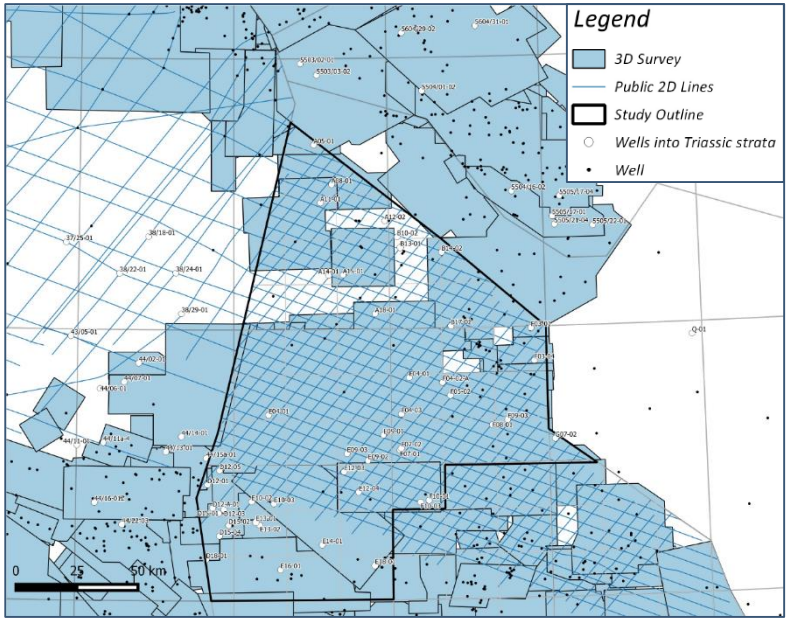
New prospectivity away from the main fairway

Marloes Kortekaas*, Bastiaan Jaarsma, Ulf Böker, Cas van der Kooij and Eveline Rosendaal

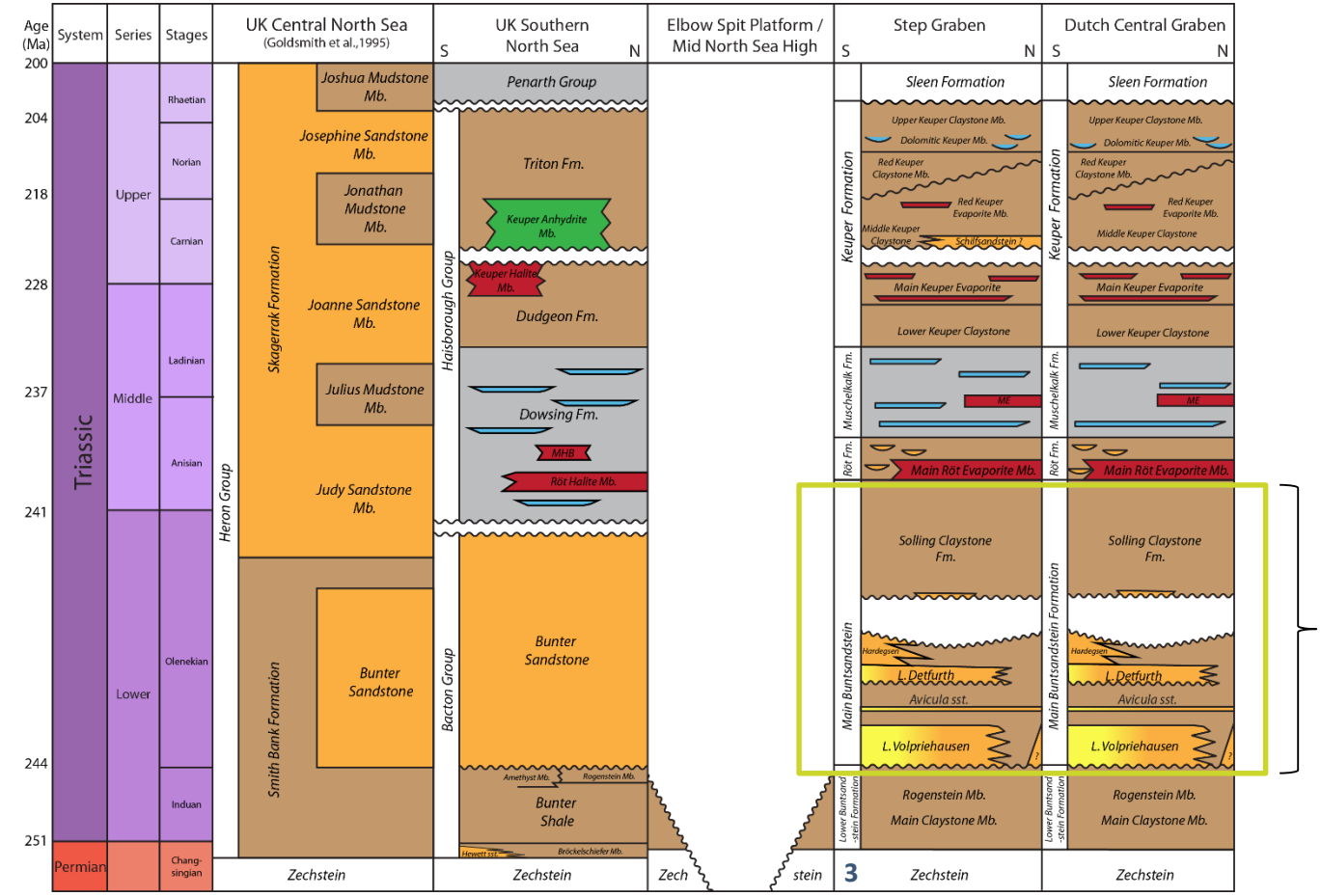
EBN, the Netherlands.
* Corresponding author:
marloes.kortekaas@ebn.nl

Introduction

- Renewed exploration interest in the Mid North Sea area
- New seismic data available (incl. UK)
- The Triassic Main Buntsandstein play is underexplored in the Dutch northern offshore
- Indications for local sediment provenance of Triassic sandstones in DK and UK
- This study shows new Triassic prospectivity away from the main fairway
- Work in progress..



Stratigraphic subdivision of the Triassic



Main Buntsandstein Subgroup (MBU)

Source: van der Kooij, 2016

Early Triassic depositional environment

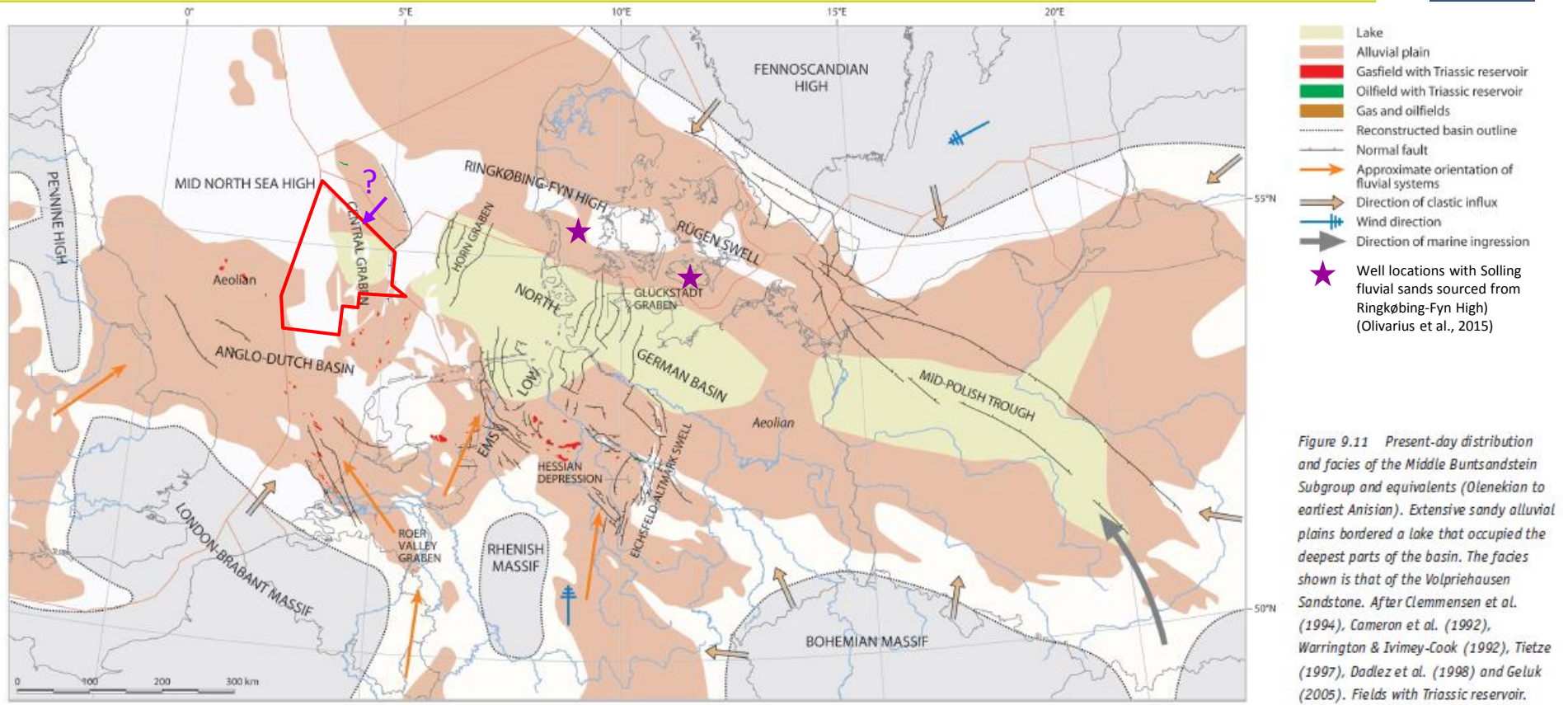
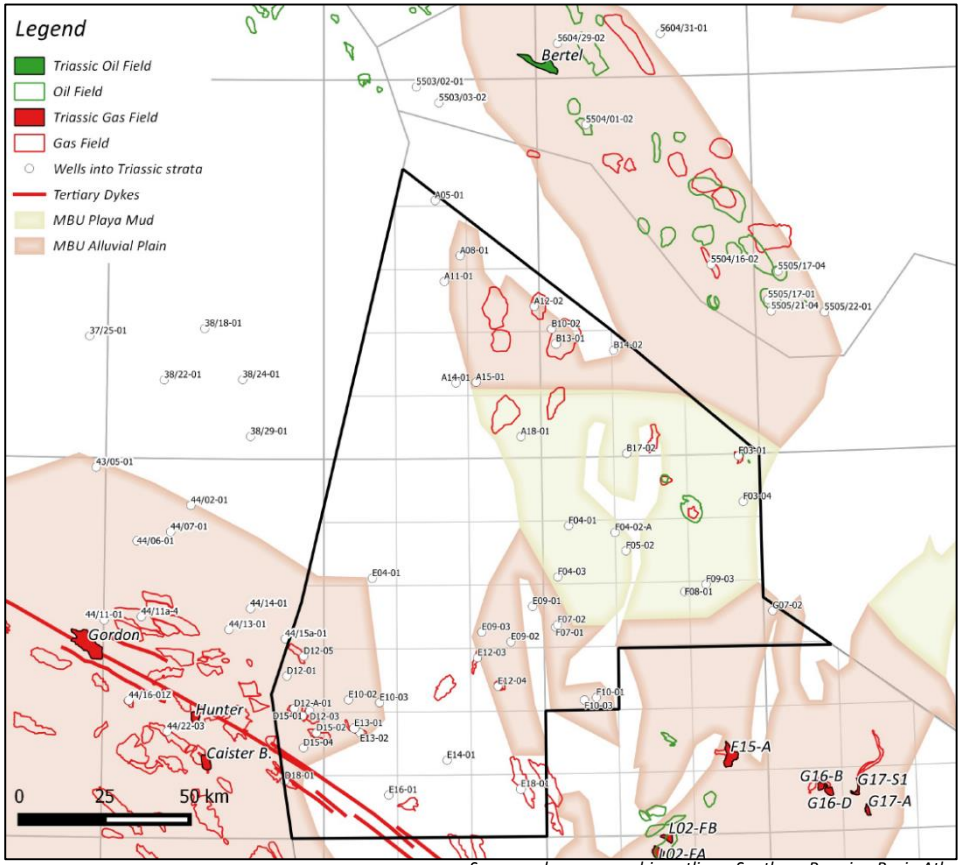


Figure 9.11 Present-day distribution and facies of the Middle Buntsandstein Subgroup and equivalents (Olenekian to earliest Anisian). Extensive sandy alluvial plains bordered a lake that occupied the deepest parts of the basin. The facies shown is that of the Volpriehausen Sandstone. After Clemmensen et al. (1994), Cameron et al. (1992), Warrington & Ivimey-Cook (1992), Tietze (1997), Dadlez et al. (1998) and Geluk (2005). Fields with Triassic reservoir.

Source: Southern Permian Basin Atlas

Exploration history of the Triassic in the DEFAB area



Source palaeogeographic outlines: Southern Permian Basin Atlas

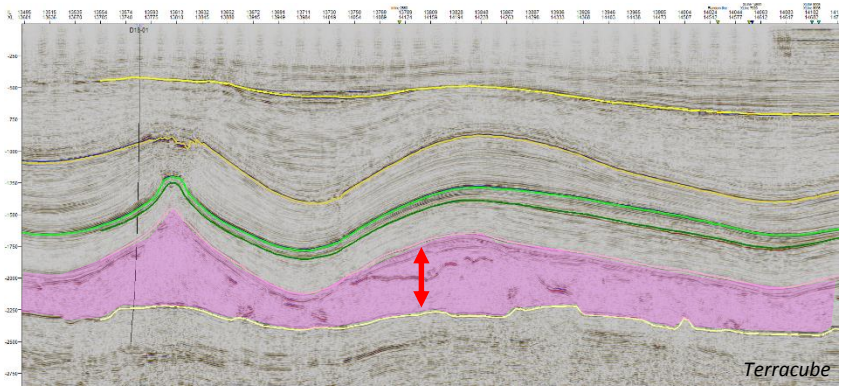
Currently no Triassic fields in DEFAB region

General perception:

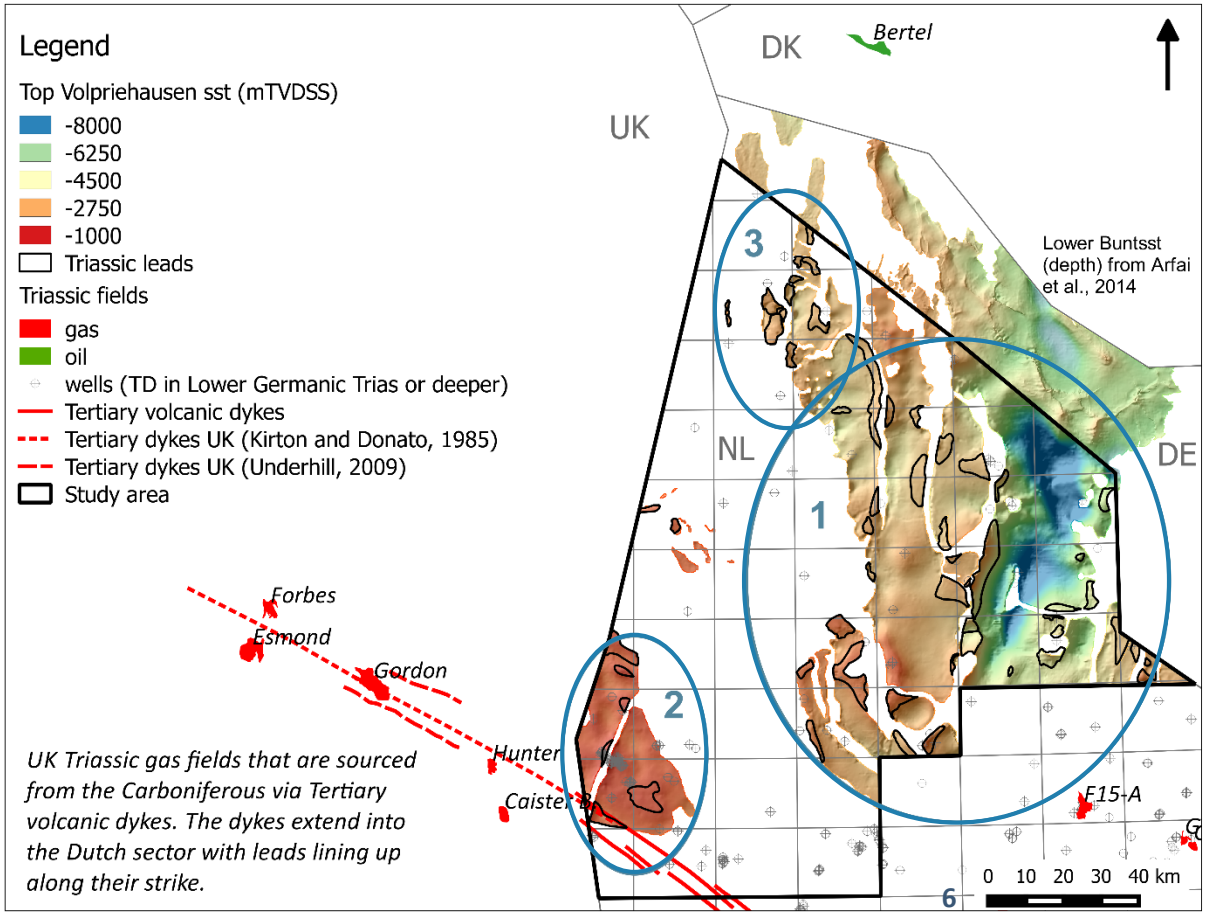
- Thick ZE prevents HC migration into Trias
- Thinning/shaling out of sst packages towards north

Only 20 wells have been drilled in study area (17000 km^2) with MBU as primary/secondary target.

11 of these wells: invalid tests of the play



Top Lower Volpriehausen Sst depth map - Prospectivity



UK Triassic gas fields that are sourced from the Carboniferous via Tertiary volcanic dykes. The dykes extend into the Dutch sector with leads lining up along their strike.

Three types of leads:

1) "classic" leads with proven types of trap, source, seal and reservoir
2) leads which may be sourced with HC's via Tertiary volcanic dykes
3) leads with local reservoir provenance area

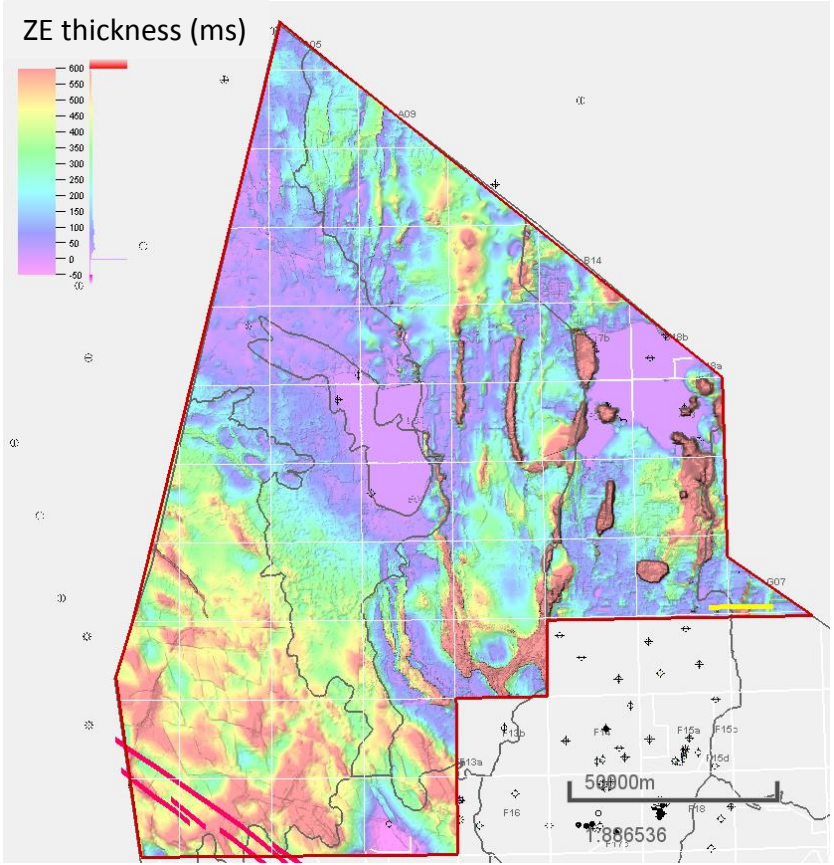
Charge

Source rock presence / maturity discussed in separate poster presentation.

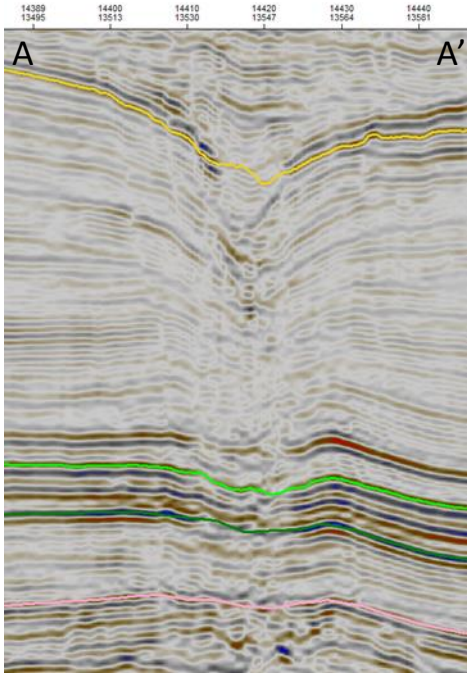
Three charge mechanisms:

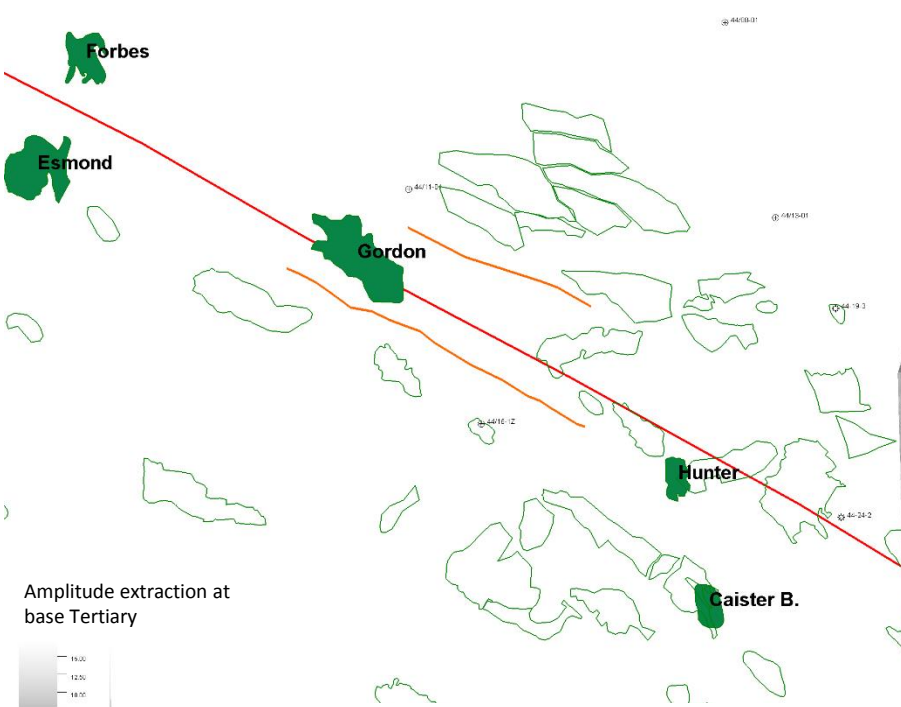
- Salt windows (ZE thickness)
- Volcanic dykes
- Faults

Analysis per lead is required – in progress

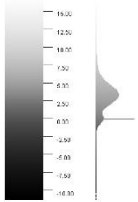


Charge via volcanic dykes





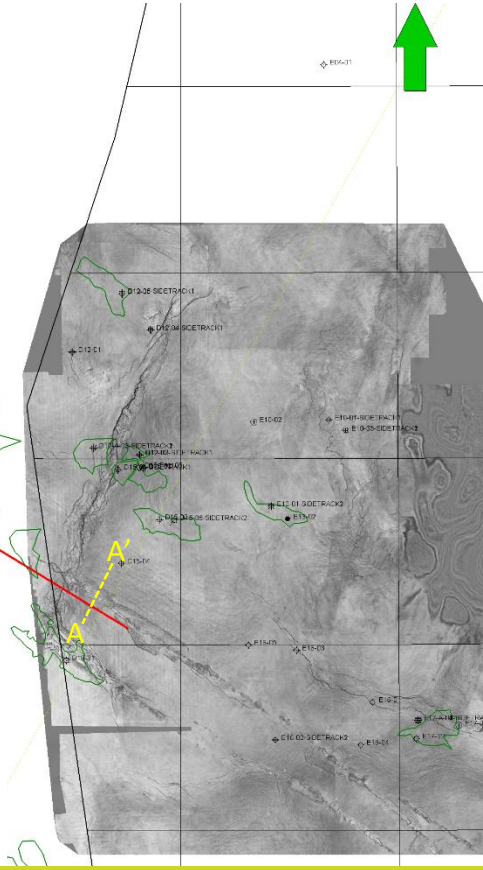
Amplitude extraction at base Tertiary



MBU gas fields UK charged via fractures near volcanic dykes (a.o. Underhill, 2009).

Tertiary dyke trend UK (Kirton and Donato, 1985)

Tertiary dyke trend UK (Underhill, 2009)



Analogue field charged via volcanic dyke

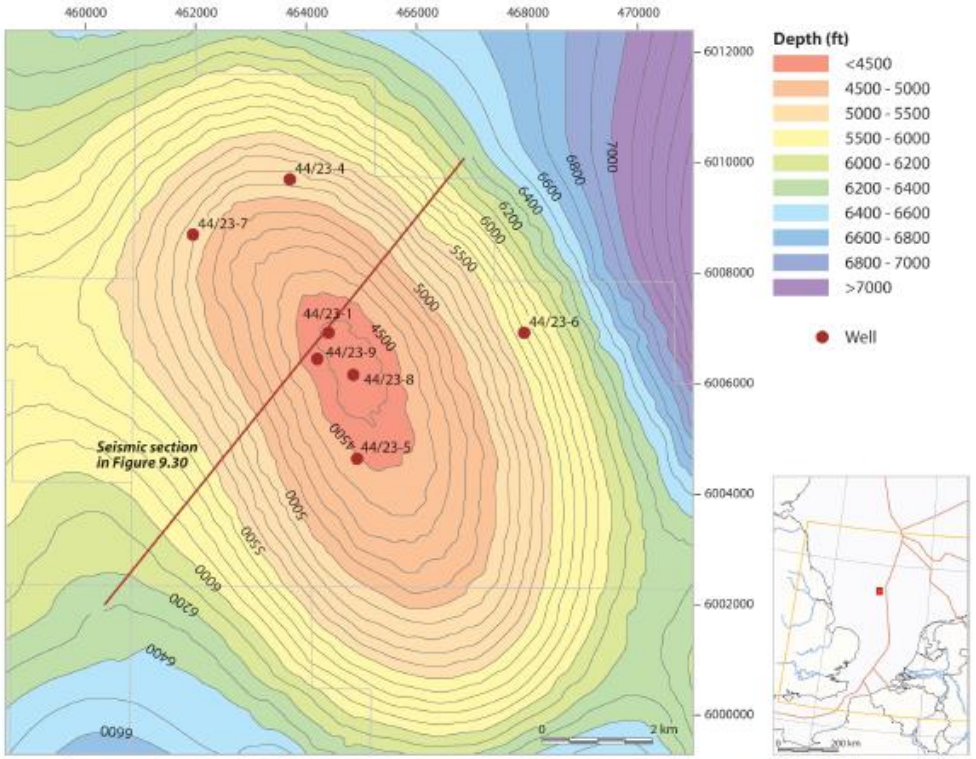
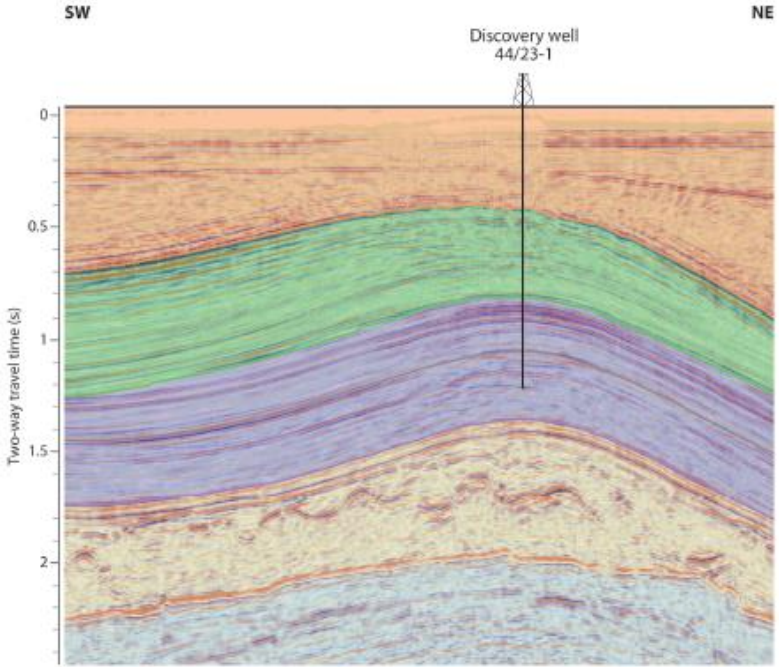


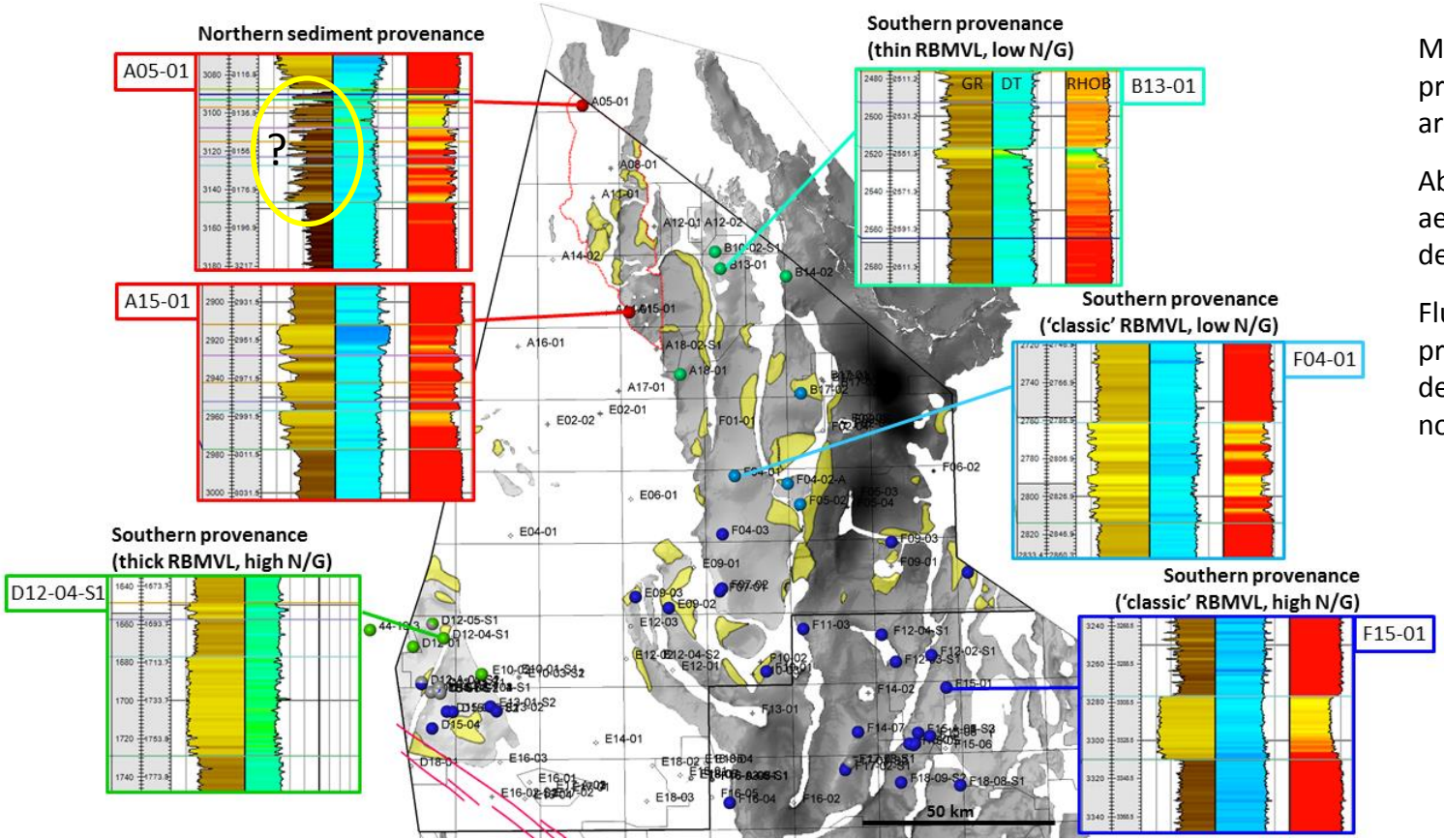
Figure 9.29 Depth-structure to the top of the Bunter Sandstone Formation in the Caister B gasfield, UK southern North Sea. Note that the structural closing contour (~5600 ft) lies much deeper than the gas-water contact (~4600 ft), indicative of underfilling of this structure (courtesy of ConocoPhillips).

- Thick ZE: charge bypassed ZE via volcanic dykes
- Significant lateral HC migration



Source: Southern Permian Basin Atlas

Reservoir: typical well log response of Lower Volpriehausen Sst

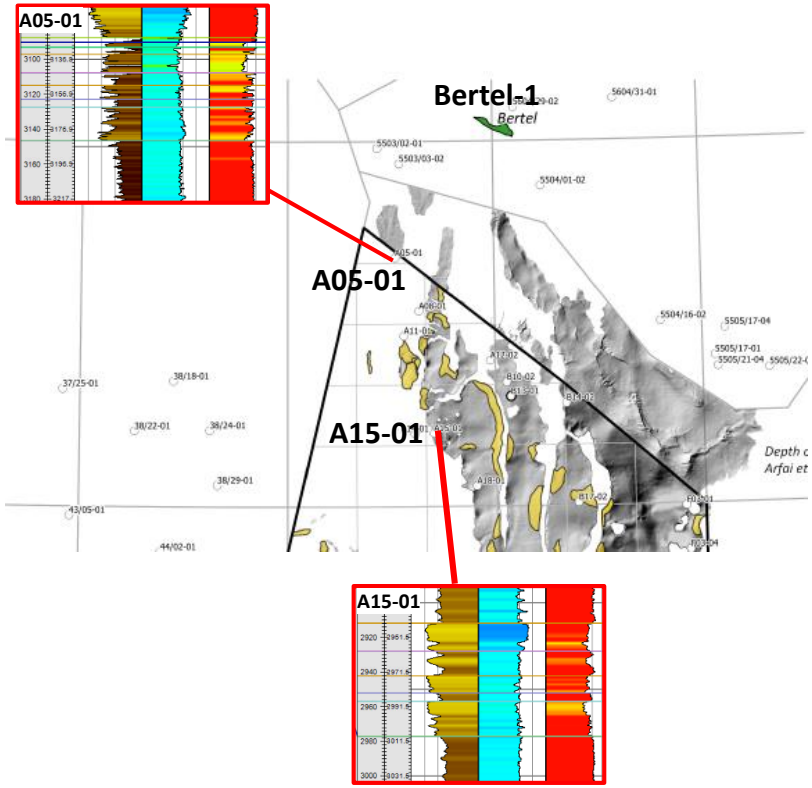


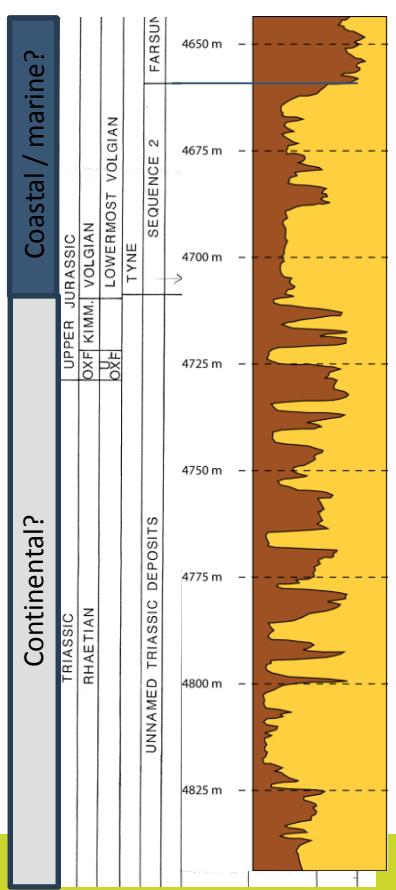
MBU reservoir rocks are present in most of the study area

Abundance and thickness of aeolian Volpriehausen Sst. decrease from south to north.

Fluvial sands with northern provenance may have developed as reservoir in the northwestern area.

A05-01, A15-01, Bertel-1





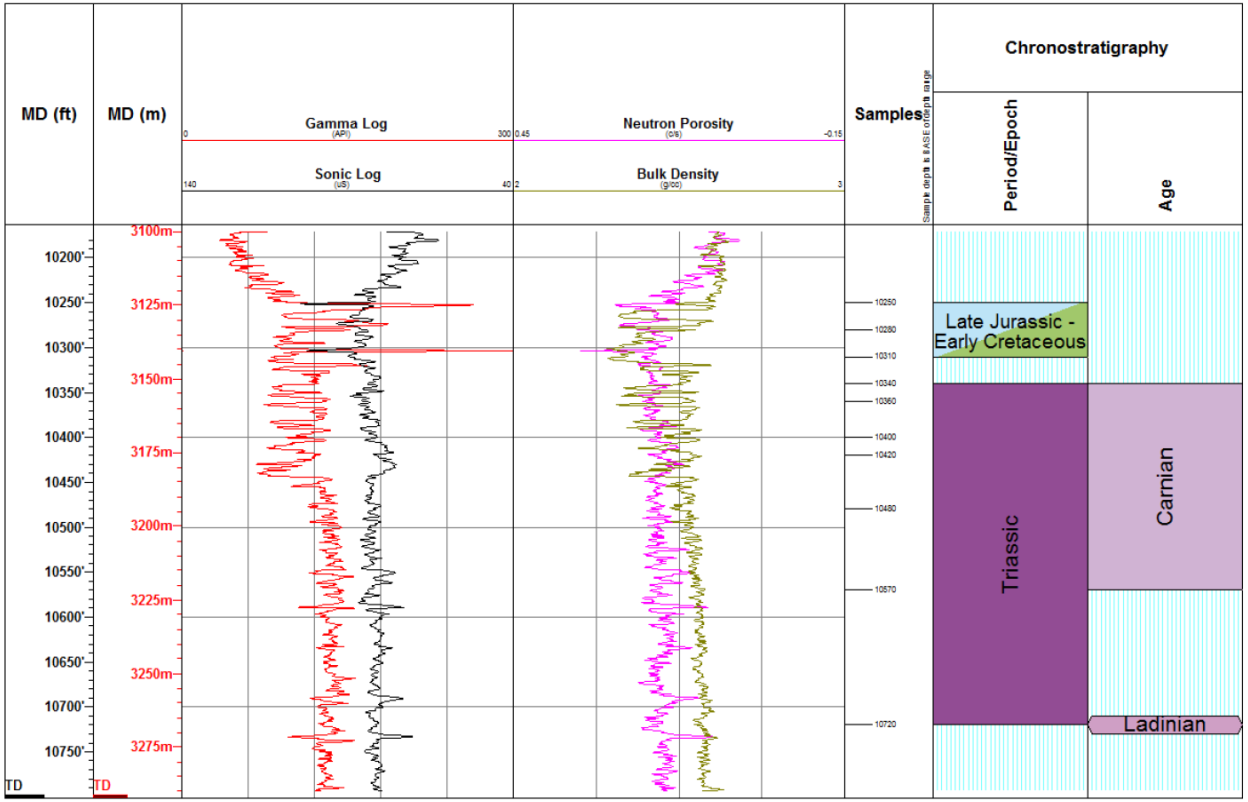
Bertel-01

- Inconsistencies in biostrat. analysis reported
- Trias-/Jurassic boundary doubted
- redbeds in Jurassic… continental?

A05-01

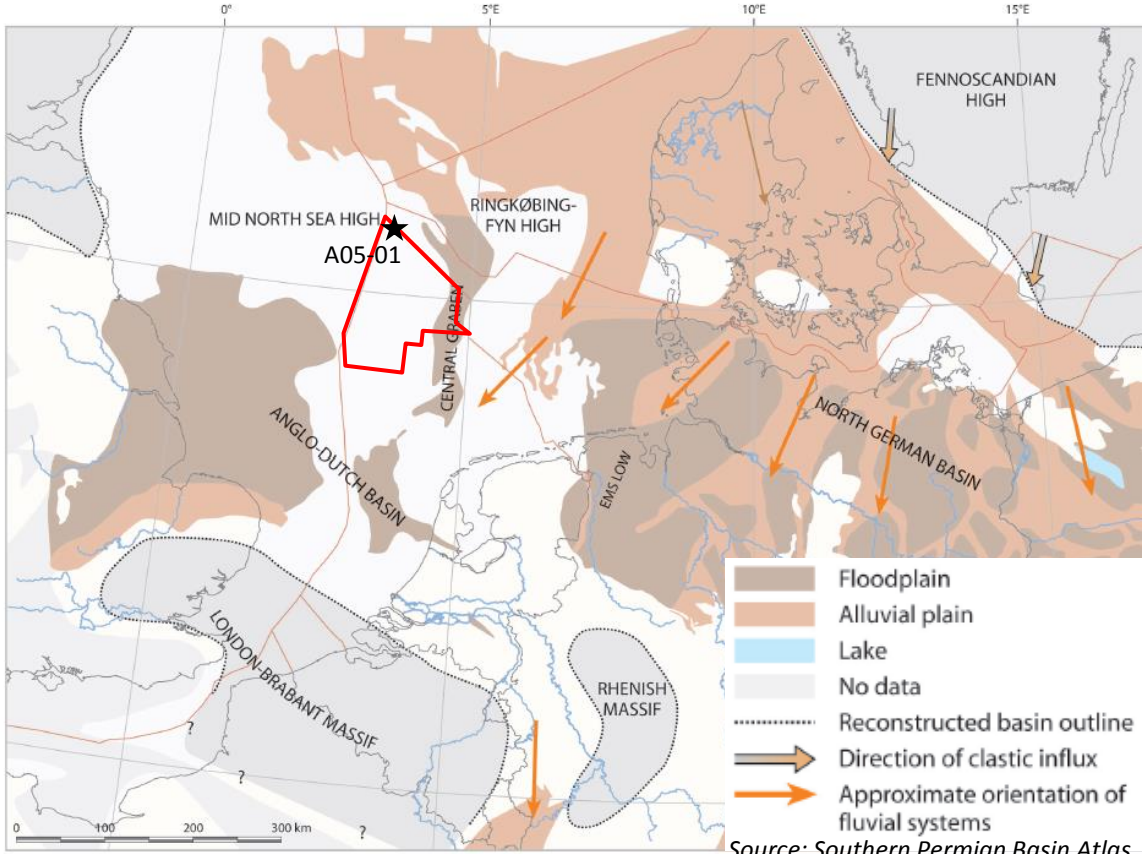
- Limited info on nlog
- 2016: Biostrat analyses by TNO on A05-01

A05-01



- Early Cretaceous – Late Jurassic strata present
- Keuper: Schilfsandstein?

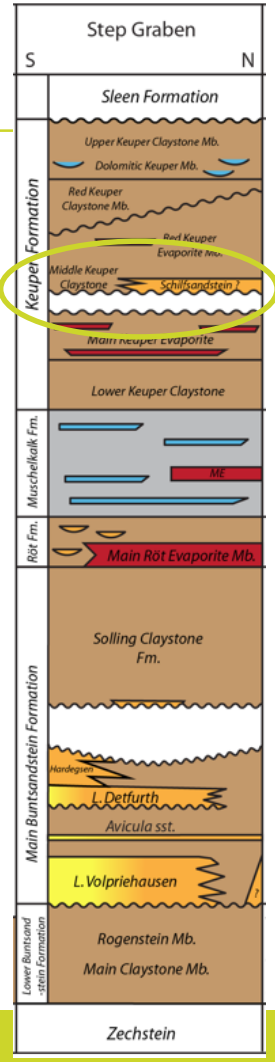
Schilfsandstein



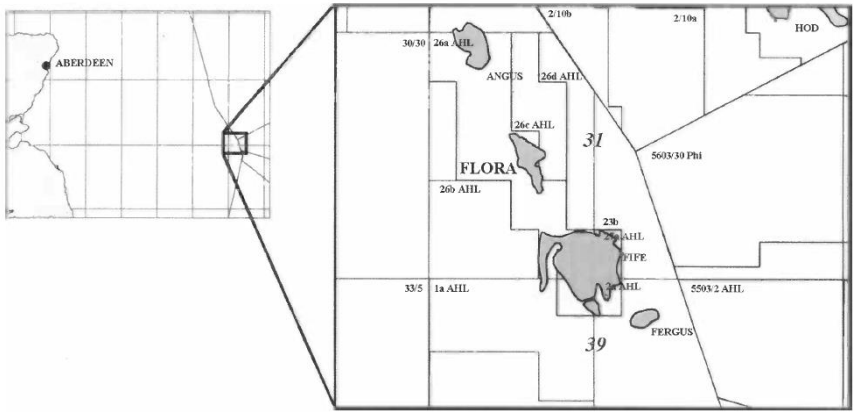
Source: Southern Permian Basin Atlas

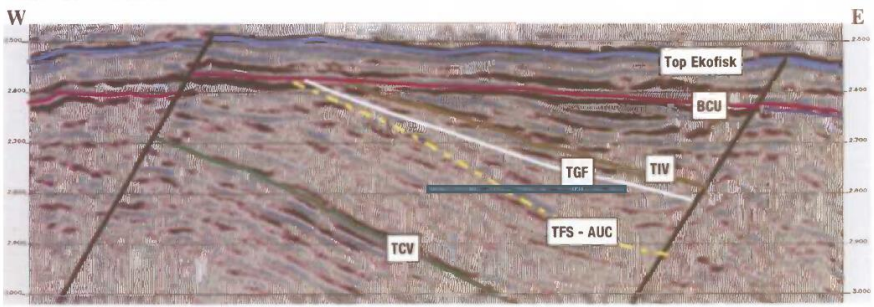
Carnian (Schilfsandstein) present in Dutch northern offshore

Figure 9.25 Present-day distribution and facies of the Stuttgart Formation (Schilfsandstein) and equivalents (Carnian). The main sediment supply originated from an uplifted rift shoulder in the Caledonides of present-day western Scandinavia. After Wurster (1964),

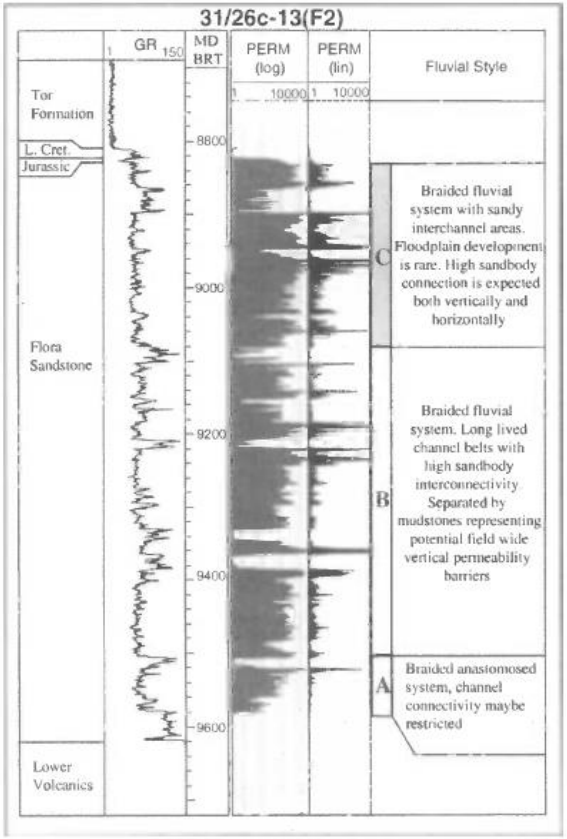


Seal: a thin layer of Jurassic/ Cretaceous shales can seal!





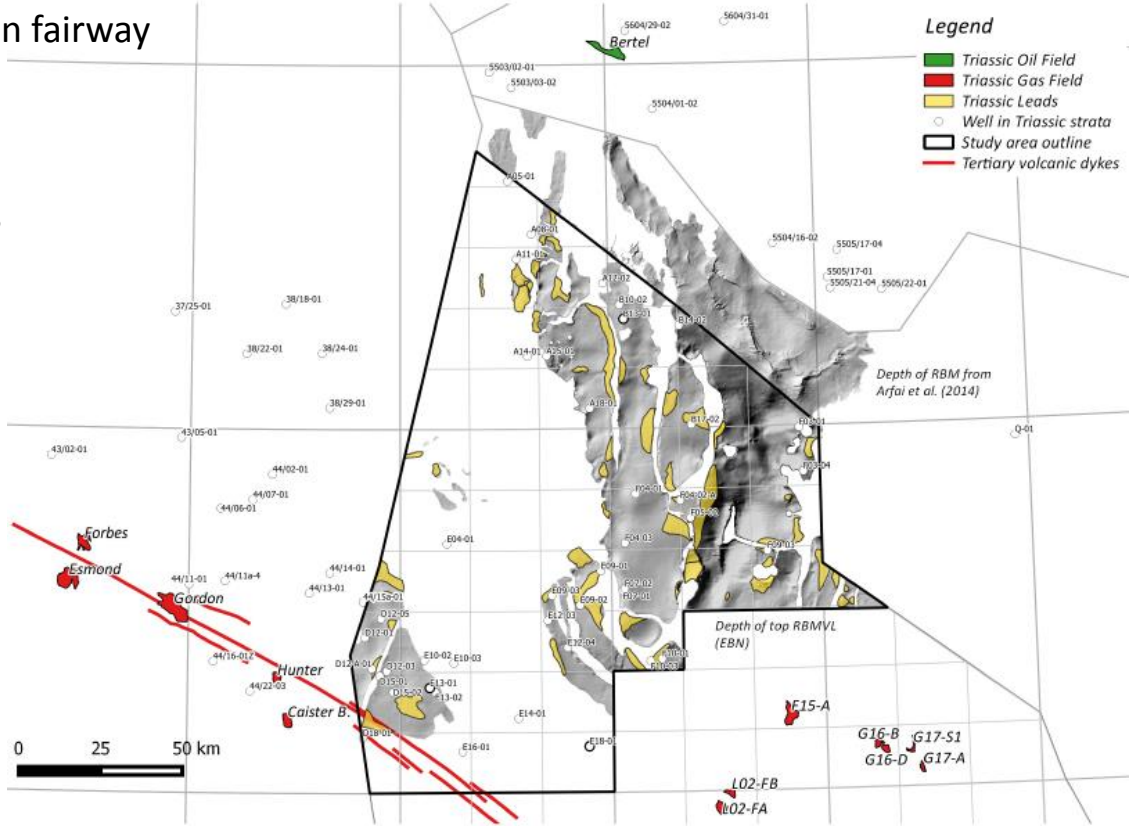
- Flora field (UK) sealed by a thin layer of L Cret. marls (and chalk).
- Way forward: velocity analysis chalk



Source: Hayward et al. (2003)

Conclusions

- New prospectivity away from the main fairway (see poster #7)
- Local reservoir development
- Potential for Upper Triassic reservoirs



Work in progress

Poster #7

- Reservoir development - reports will be available at ebn.nl (August 2016):
  - Cas van der Kooij (UU): Triassic sand development in the northern dutch offshore
  - Gioia Bezemer (UU): Depositional environment (grainsize/clay mineralogy/SEM on core material and cuttings)
  - Aike Vonk (UU): Provenance study (heavy mineral analyses on core material and cuttings)

- Prospect specific evaluations
  - tPOS and Volumetrics

- Presentation at Geol. Soc. Conference: 'Mesozoic Resource Potential in the SPB' (London, Sept 2016):
  The Triassic Main Buntsandstein play – New prospectivity in the Dutch northern offshore. (available at ebn.nl (Sept 2016)

Thank you for your attention

More information? Contact us:

exploration@ebn.nl

Acknowledgements:

Fugro and Spectrum ASA, for giving permission to show data from the DEF survey

EBN Colleagues and Ulf Böker (Panterra, reservoir development)

References:

Southern Permian Basin atlas (2010)

Geology of the Netherlands (2007)

Arfai et al. (2014), Late Palaeozoic to Early Cenozoic geological evolution of the Entenschnabel, NJG

Hayward et al. (2003), The Flora Field, Blocks 31/26a, 31/26c, UK North Sea, Geol. Soc. Memoir

Olivarius et al. (2015), Provenance of the Lower Triassic Bunter Sandstone Formation, Basin Research