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Stratigraphic Framework of the Delfland and Vlieland Subgroups across the West Netherland and Broad Fourteen Basins

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Dieters, S. , Boter, E. (EBN)

Content

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- Middle Jurassic - Lower Cretaceous - Geode Atlas context
- 2024 Devli Project Scope
- New chrono-stratigraphic framework
- Results: Tectonostratigraphy and rift dymamics

Acknowledgements

EBN for the support and collaboration.
Simona Bottero (TNO) and Marloes Kortekaas (EBN) for the project management.

Bas van Es, Harald de Haan, Daan den Hartog, Aart-Peter van den Berg van Saparoea, Sjoukje de Vries, Michael Nolten, Sabine Korevaar, Nico Janssen, Sander Houben, Jeroen van der Molen and Richard Porter.

Context

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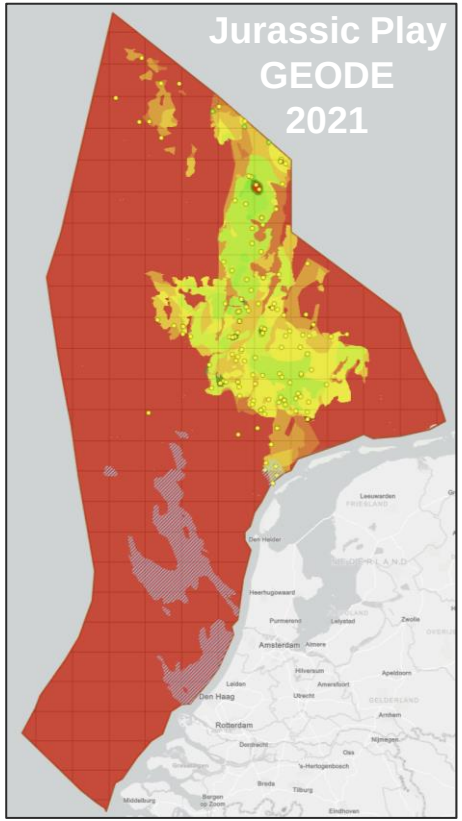
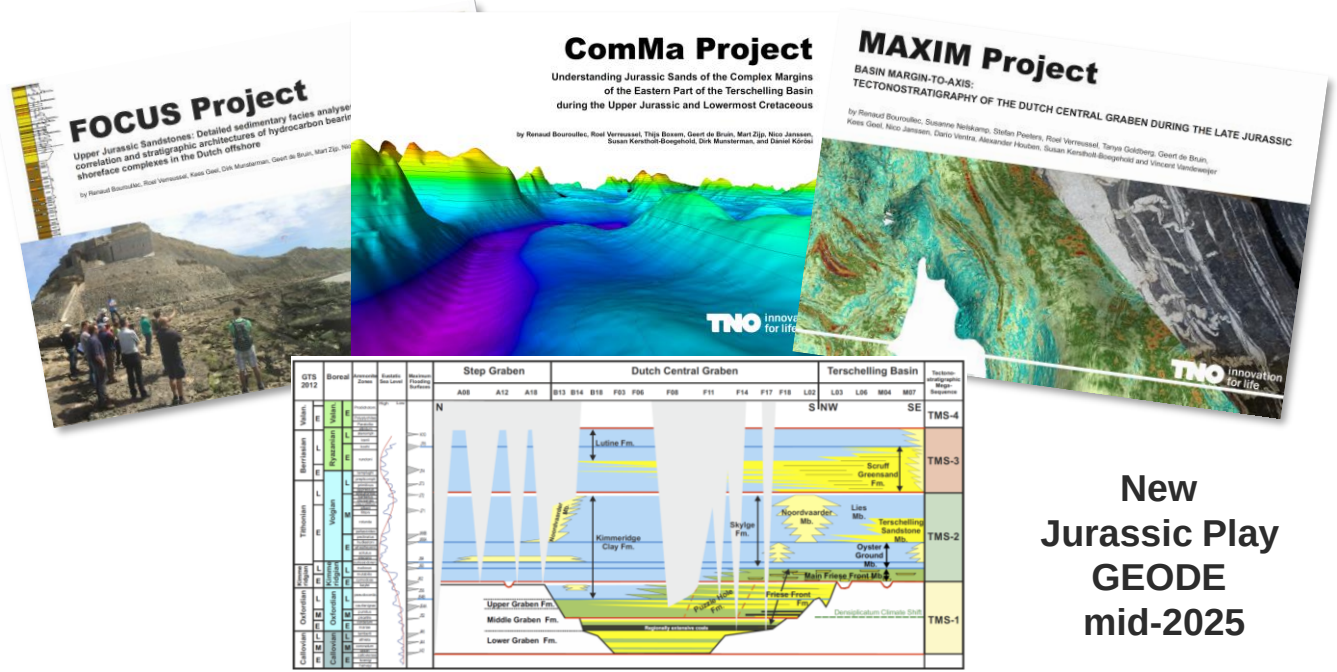
2021 Jurassic Play Project – the 1st GEODE project



Mesozoic Resource Potential in the Southern Permian Basin . Geological Society, London, Special Publications, 469

- Verreussel, et al., 2018, Stepwise basin evolution of the Middle Jurassic–Early Cretaceous rift phase in the Central Graben area of Denmark, Germany and the Netherlands. https://doi.org/10.1144/SP469.23
- Bouroullec et al.. 2018, Tectonostratigraphy of a rift basin affected by salt tectonics: synrift Middle Jurassic - Lower Cretaceous in the Dutch Central Graben, Terschelling Basin and neighbouring platforms, Dutch offshore. https://doi.org/10.1144/SP469.22

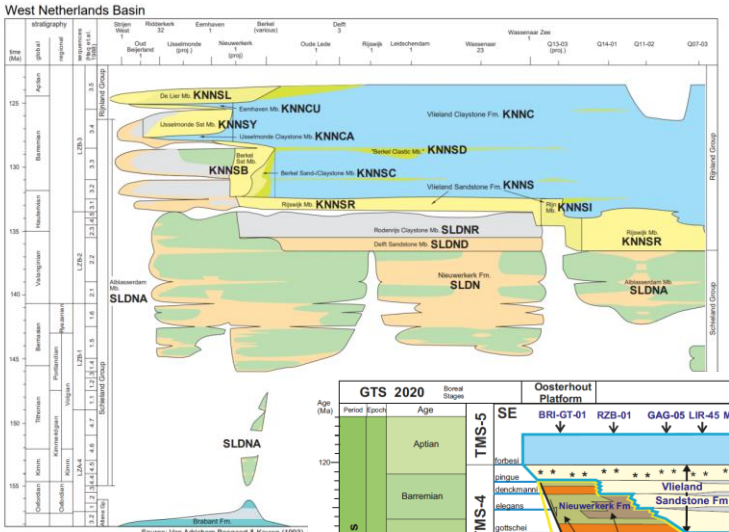


New Jurassic Play GEODE mid-2025

Context

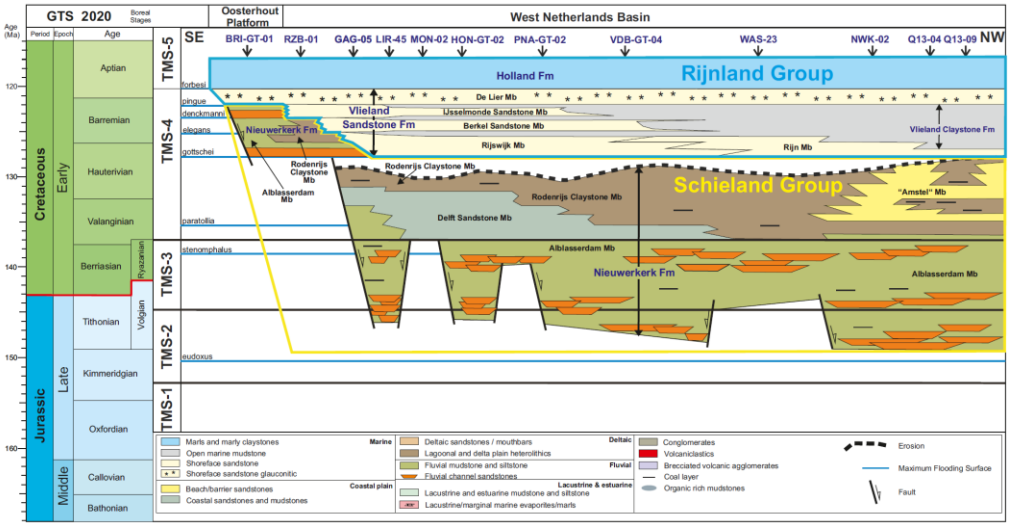
WNB Middle Jurassic – Early Cretaceous chronostratigraphy

- A very good foundation for exploration with already an undertone of sequence stratigraphy with retrograding Valanginian to Aptian depositional systems
- Clear evolution from continental facies (green and orange) to predominantly marine facies (yellow and blue).
- Issues arise when dealing with lithostratigraphic units (e.g. Ablasserdam Mb.) that are time equivalent of (too many) other members and formations, hence a difficult unit to put into the complex basinal context (rift).



Van Adrichem Boogaert & Kouwe (1993)

Verreussel et al., in press



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DEVLI Project (2024)

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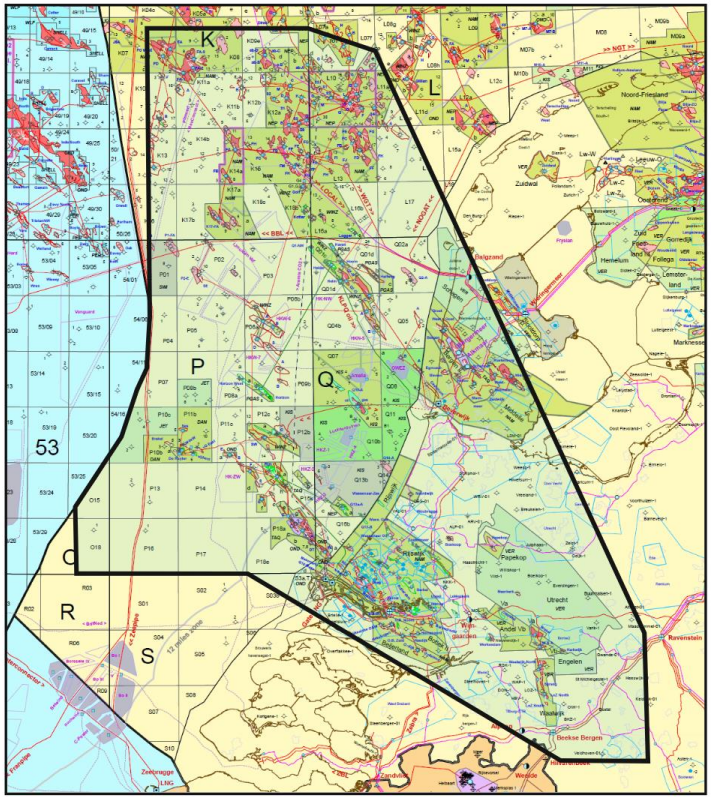
Scope



DeVli: Standing for **De**lfland and **Vli**eland subgroups.

To update on the stratigraphy and tectonostratigraphy of the Upper Jurassic to Lower Cretaceous in southern part of the Dutch Offshore and in the western part of the Dutch onshore.

To support the **EBN/TNO GEODE Jurassic Play update project (2024-2025)**

To provide new stratigraphic and structural insights on the geology of the southern Dutch rift system with potential application for multiple resources.

Devli Project (2024)

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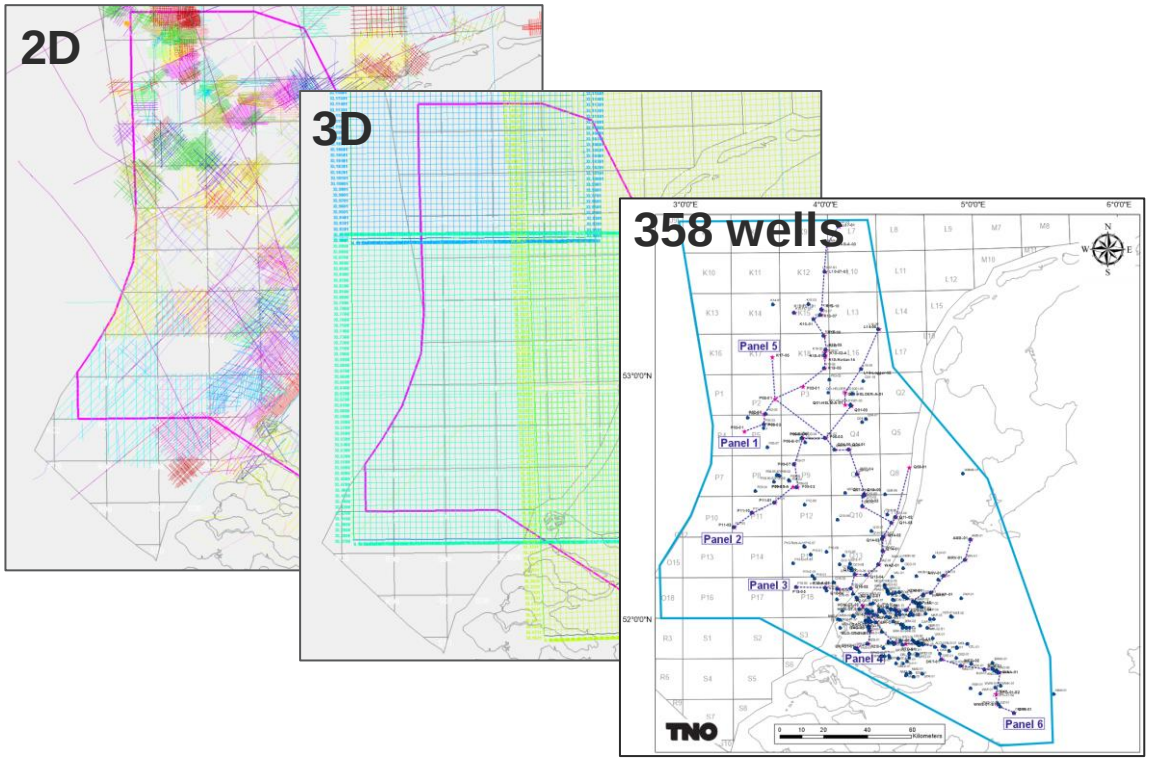
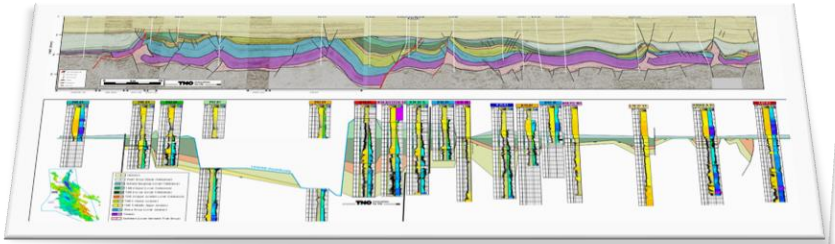
Data and methods

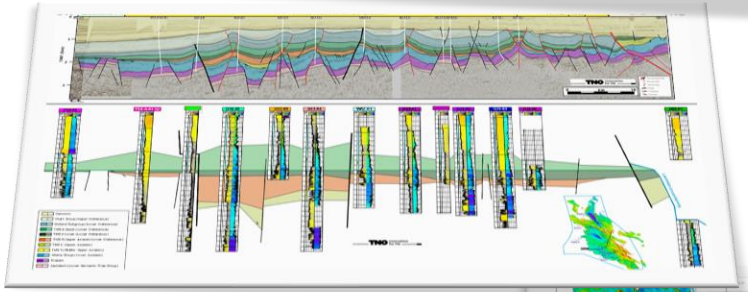


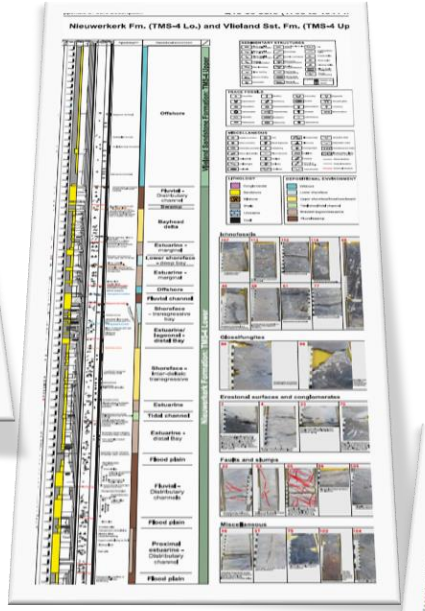
1. **Data mining** NLOG and other sources for **age assessments**.
2. **CORE description** of selected wells.
3. **New palynological analyses** of selected wells.
4. Integrate the stratigraphy with a **new seismic interpretation** effort.
5. **Establish lithostratigraphic subdivisions** (TMSs) for each well.
6. Construct **new Wheeler diagrams**.
7. Construct **well and seismic panels** along and across main basins (WNB and BFB).
8. Construct **time thickness maps** (soon converted for Geode) for each tectonostratigraphic unit (TMS-1 to -5). s
9. Integrate the tectonostratigraphic results.

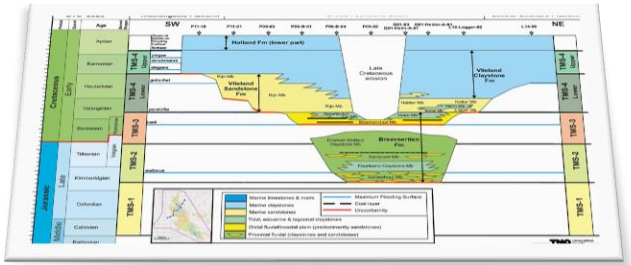
Devli Project (2024)

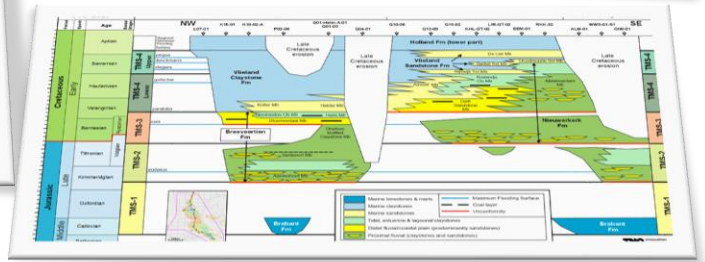
Research output

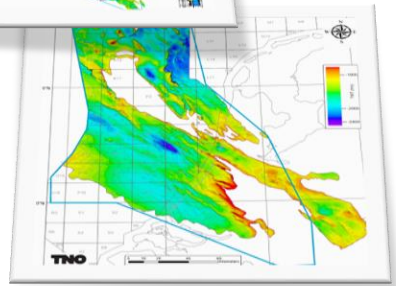


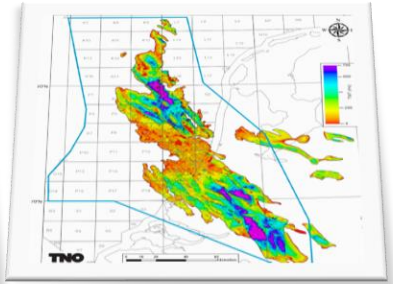


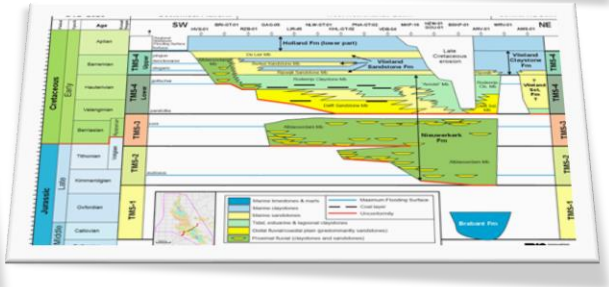












- 3 Wheeler diagrams
- 5 core descriptions
- 6 regional panels
- 16 maps + interpretations

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New chrono-stratigraphic framework

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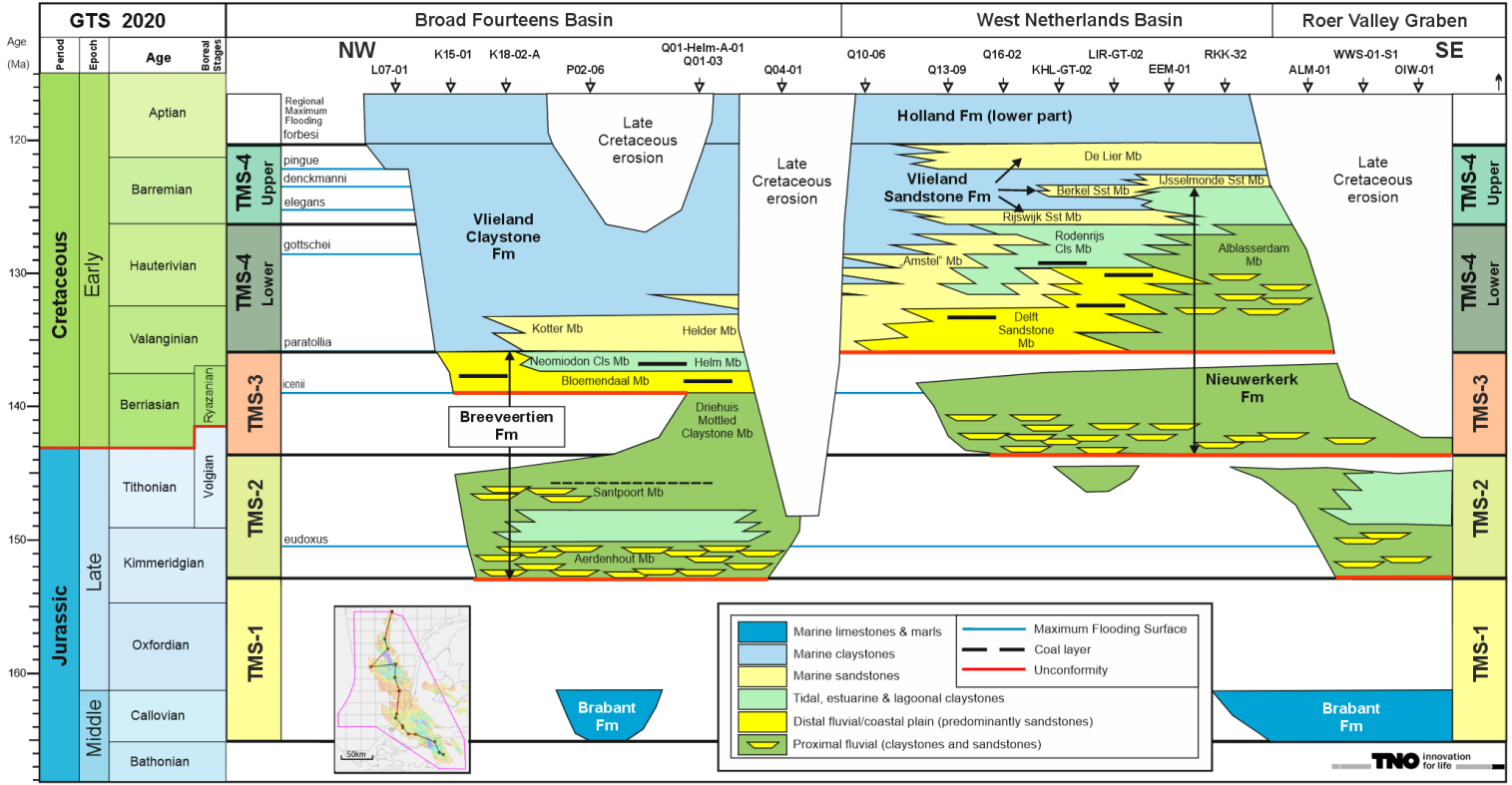
Wheeler diagram along the rift axis



New chrono-stratigraphic framework

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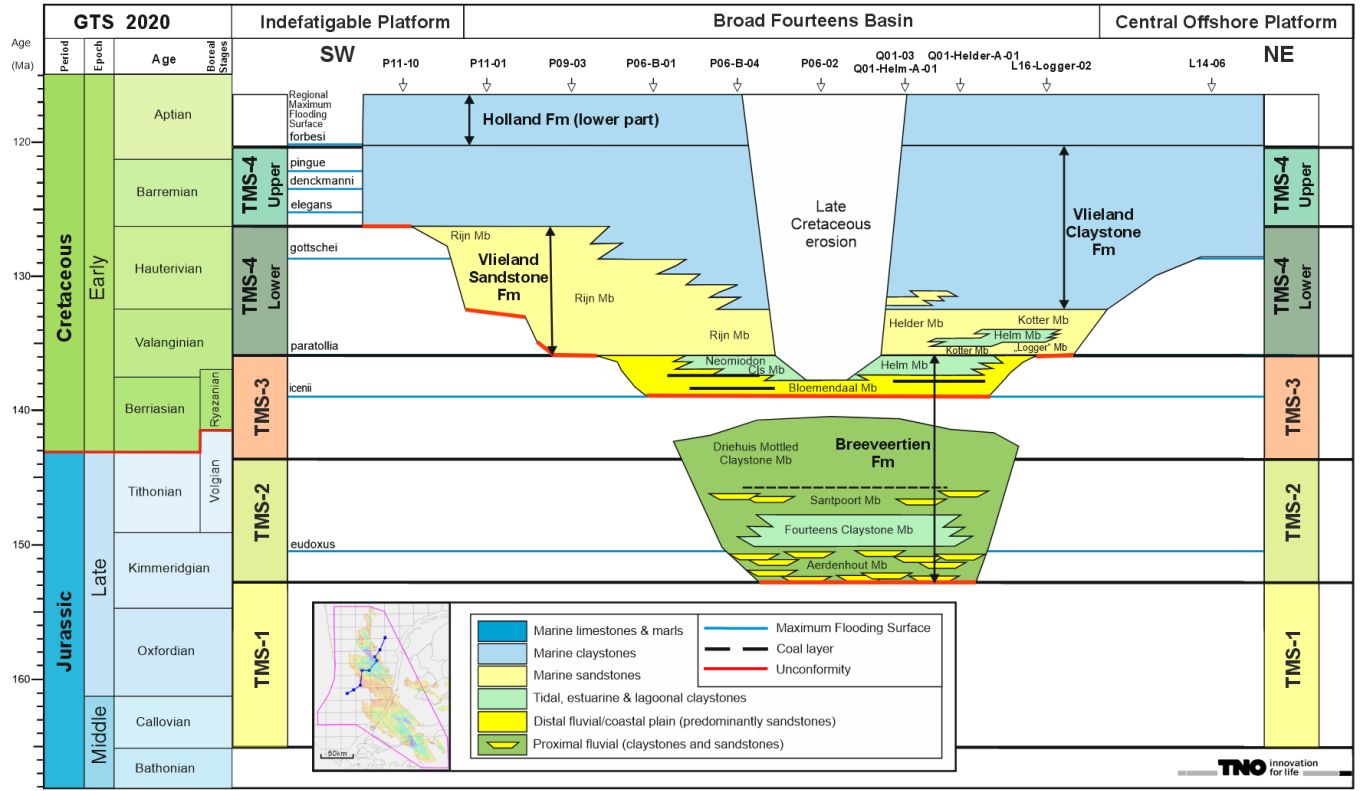
Wheeler diagram across the rift axis (BFB)



Tectonostratigraphy

Time thickness maps for TMS-2 and TMS-3

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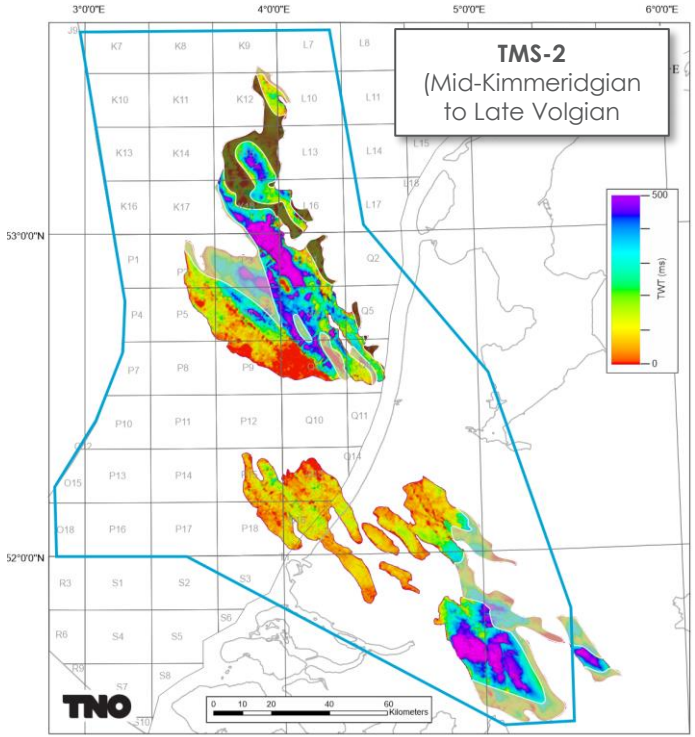
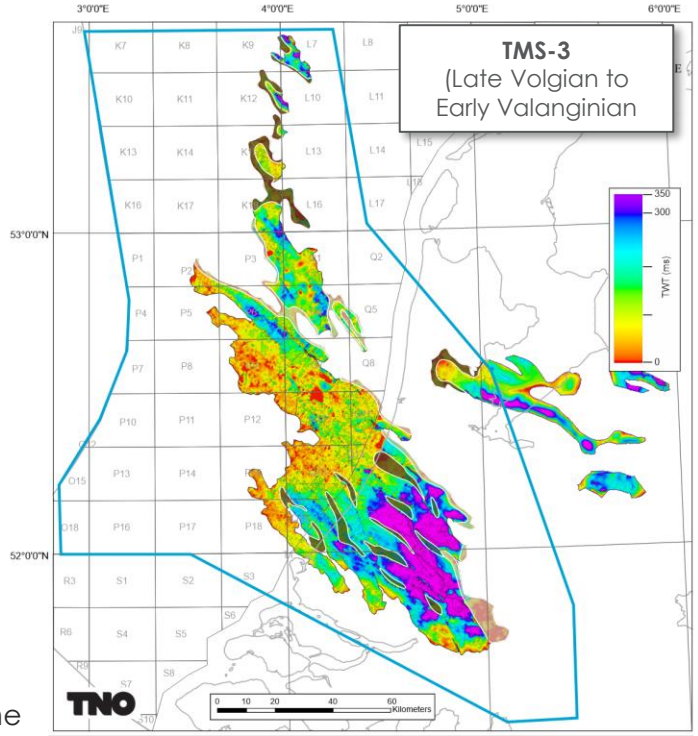


TMS-2 no connected between the WNB and BFB. Present in small grabens on the NW side of the WNB, and deepening toward the SW.

TMS-3 connected between the basins. Thinner in the transitional zone. Grabens are still active but are connected, with some erosion of the horsts.



Light grey polygons are Upper Cretaceous/ Laramide unconformities and dark grey polygons intra-Upper Jurassic or intra-Lower Cretaceous unconformities.

Tectonostratigraphy

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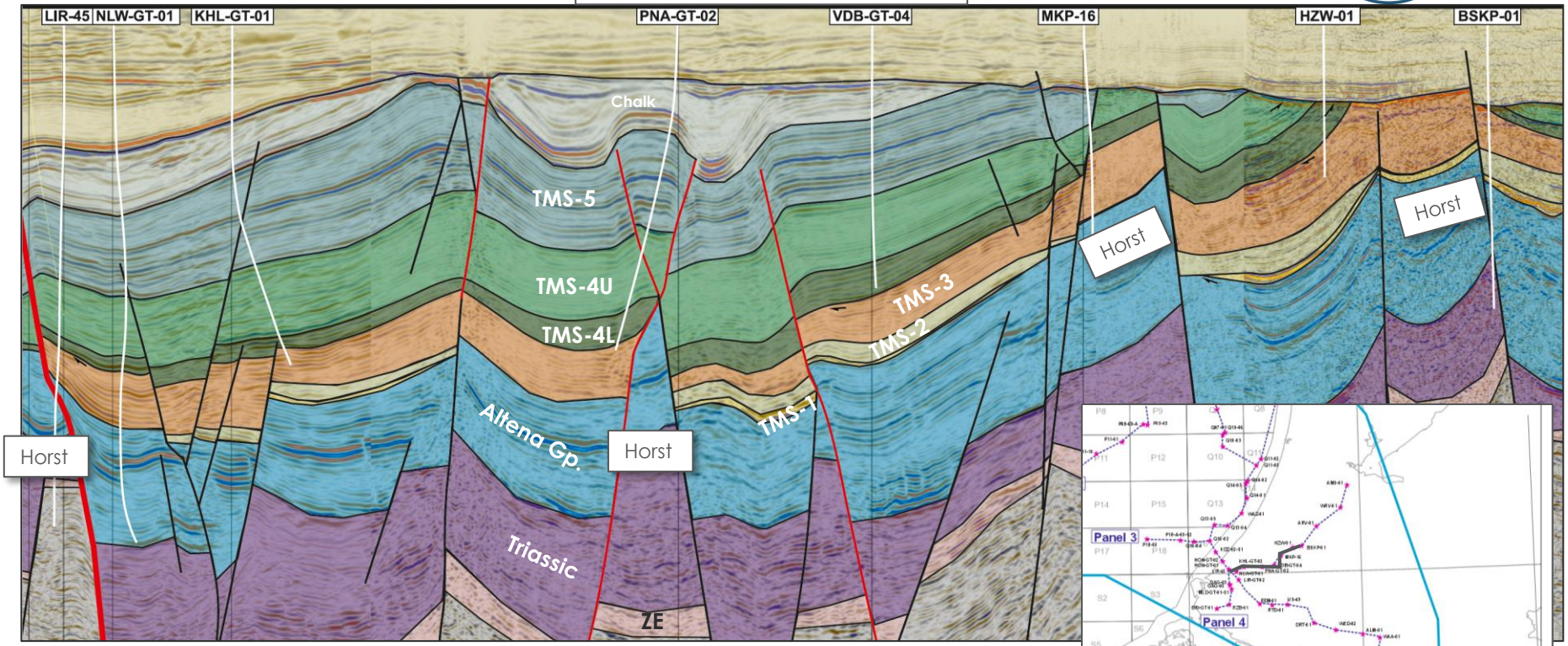
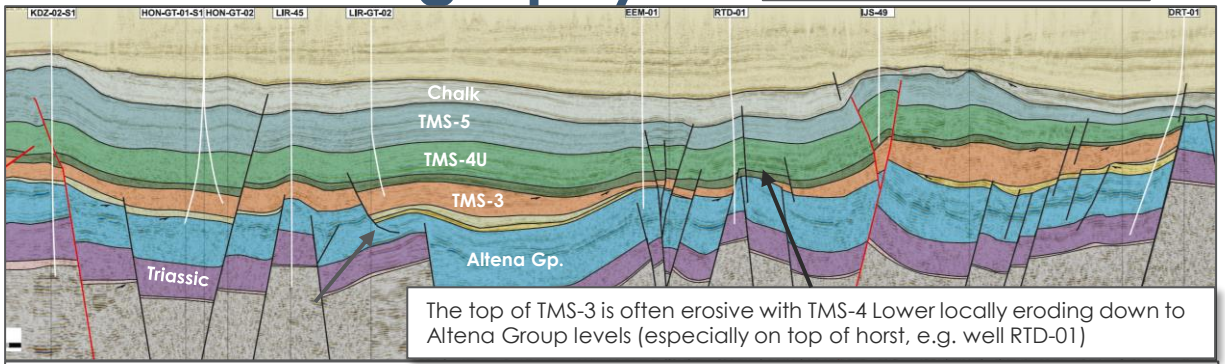
Central part of Panel 4

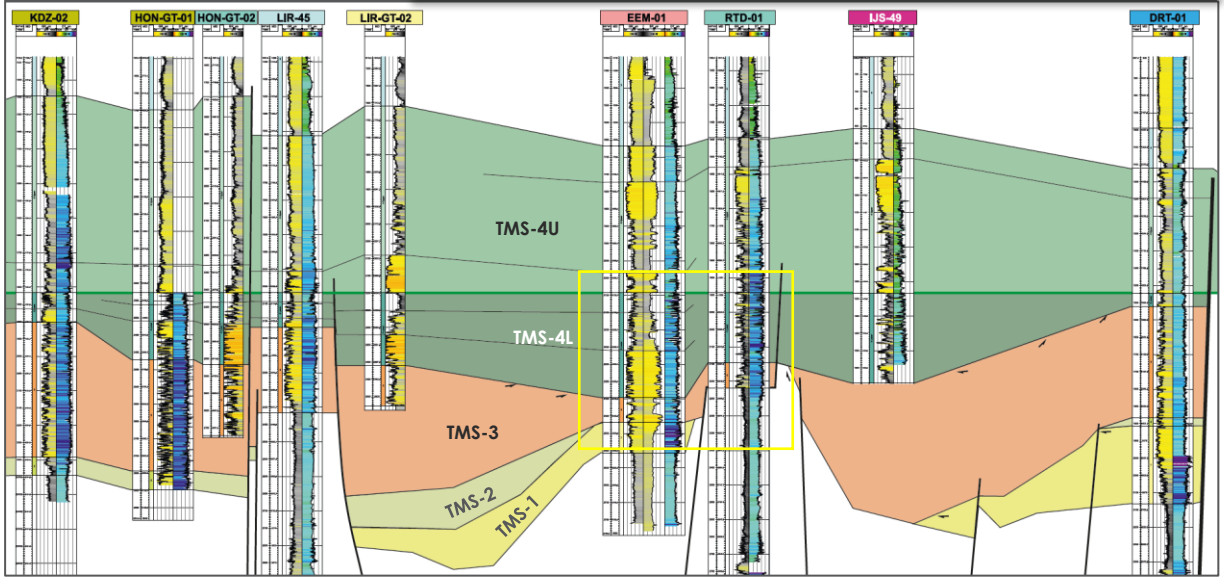


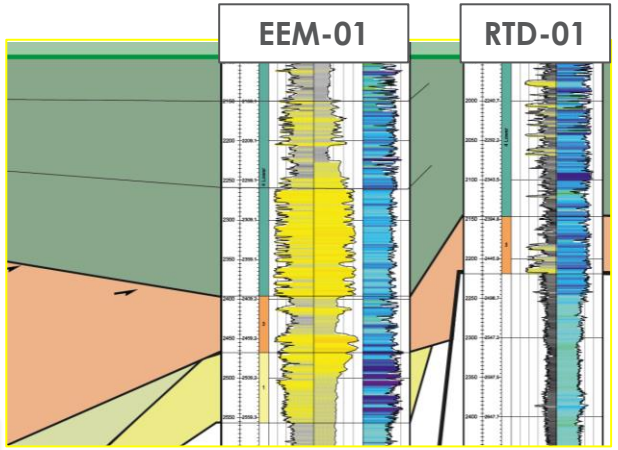
Tectonostratigraphy

NW part of Panel 6

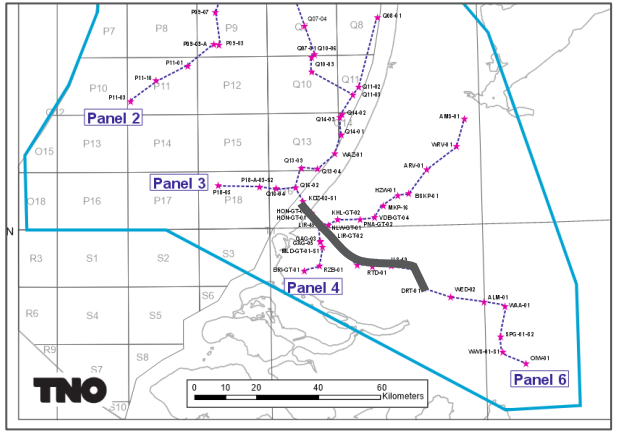


The top of TMS-3 is often erosive with TMS-4 Lower locally eroding down to Altena Group levels (especially on top of horst, e.g. well RTD-01)





Note that the Delft Sandstone Mb. (equiv,) is very thick (140m) in well EEM-01, eroding down into a large part of TMS-3 at this location. This may indicate that Delft Sandstone Mb. sediment sources may be here very local (alluvial fans ?).



Rift dynamics

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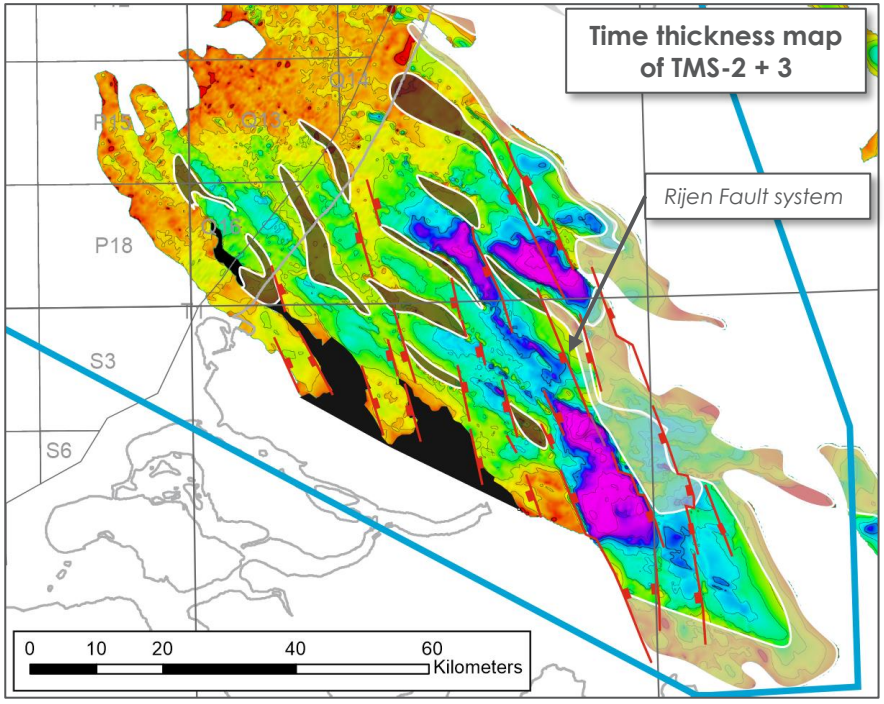
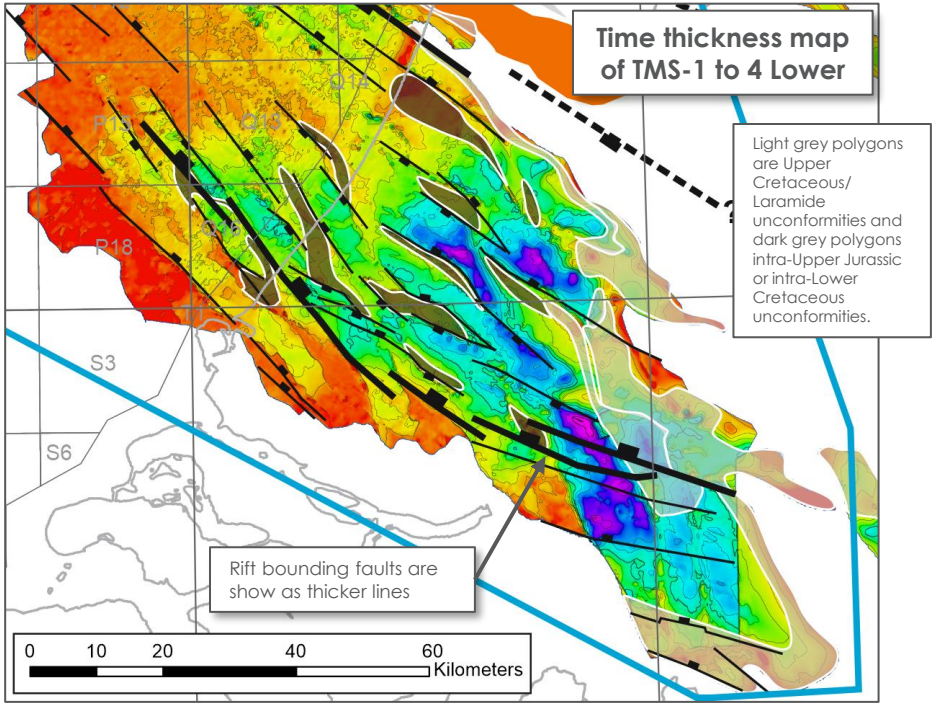
Relative erosion of intra-basinal paleo-structural highs

Faults active during the deposition of TMS-2 and lower part of TMS-3 (Mid-Kimmeridgian to Late Volgian) are oriented NNW-SSE (**red faults below**) while faults active during the depositional time of TMS-3 and 4 Lower (Late Volgian to Hauterivian) are oriented NW-SE (**black faults below**). These two trends explain the sigmoidal geometries of the intrabasinal high (horsts) and lows (grabens).





Rift dynamics

Strike slip, but what kind?

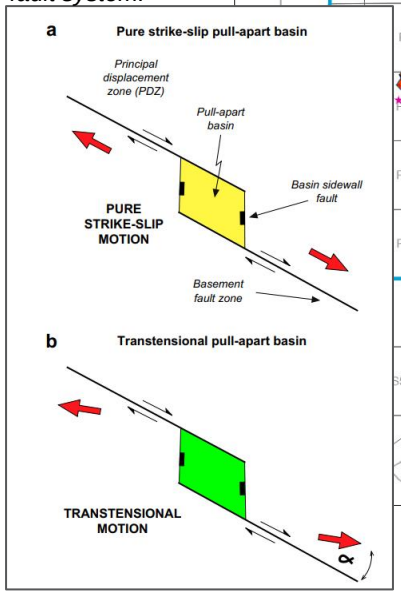
• The WNB itself has an **overall sigmoidal geometry**. In the case of the BFB it is less clear due to central part and entire NW side of the basin being eroded.

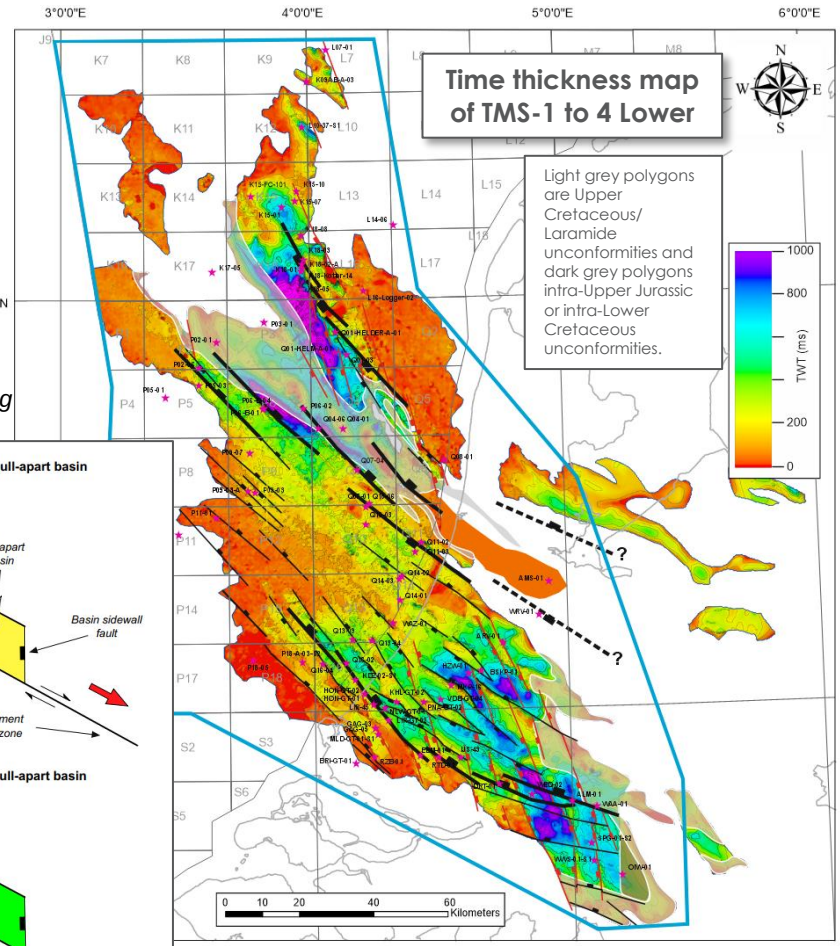
• All rift-bounding faults (thick black lines on the map) are **en-echelon basin sidewall faults**, which indicate **strike slip tectonics with a dextral (right-lateral) motion**.

• The oblique **en-echelon basin sidewall faults** link with a **Principal Displacement Zone** (PDZ) at depth (e.g. Burchfiel and Stewart, 1966; Crowell, 1974), which accounts for greatest proportion of accumulated strain.

• En-echelon geometry indicate **a transtensional pull-apart** basin configuration rather than a pure strike-slip pull-apart basin configuration (Garfunkel, Z., 1981; Wu et al., 2009). Such strike slip system form lower aspect ratio rift basin (wider basins than pure strike slip cases).

General characteristics of a pull-apart basin in a dextral side-stepping fault system.



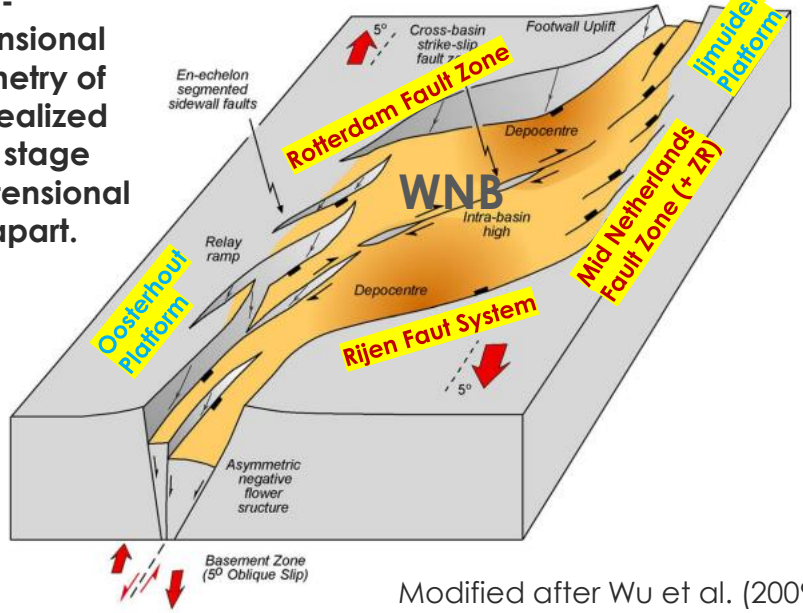


Rift dynamics

Transtentional pull-apart model- Dutch southern rift system

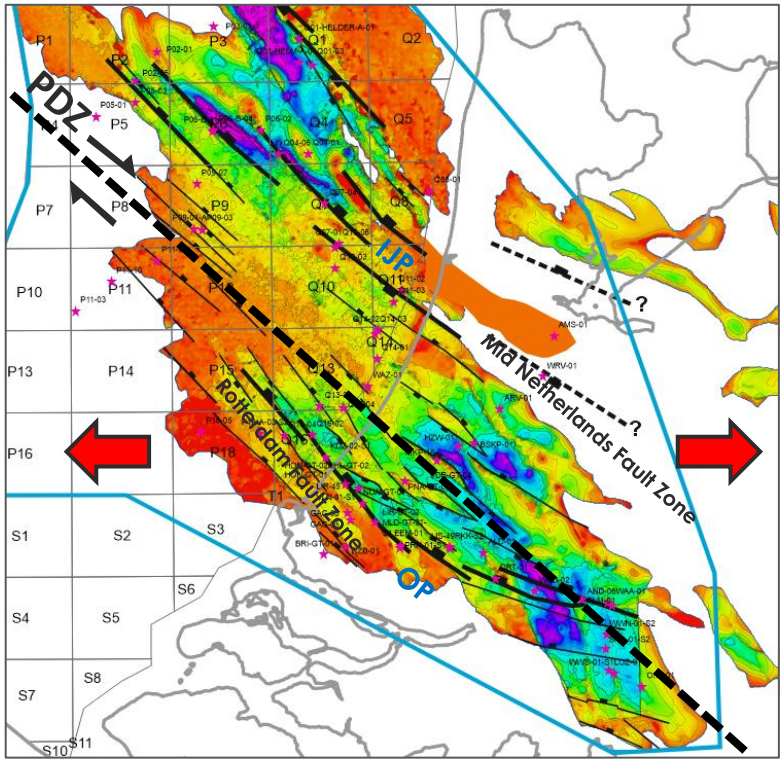
Model explains the complexity of the WNB during the Late Jurassic-Early Cretaceous while involving a constant direction of extension. The position of the PDZ that linked main bounding faults to a deep detachment, likely inherited from the Paleozoic (Devonian?).

Three-dimensional geometry of an idealized early stage transtensional pull-apart.



Modified after Wu et al. (2009)

Time thickness TMS-1 to 4 Lower



Dissemination

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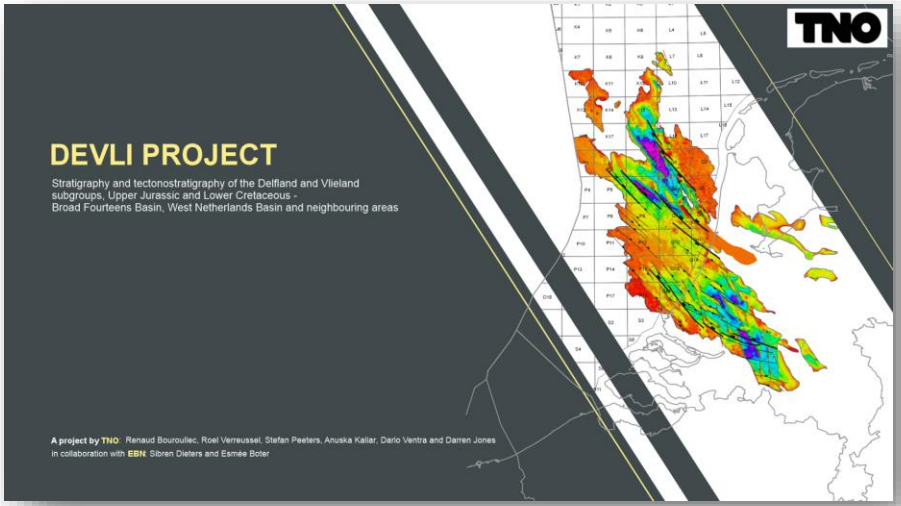
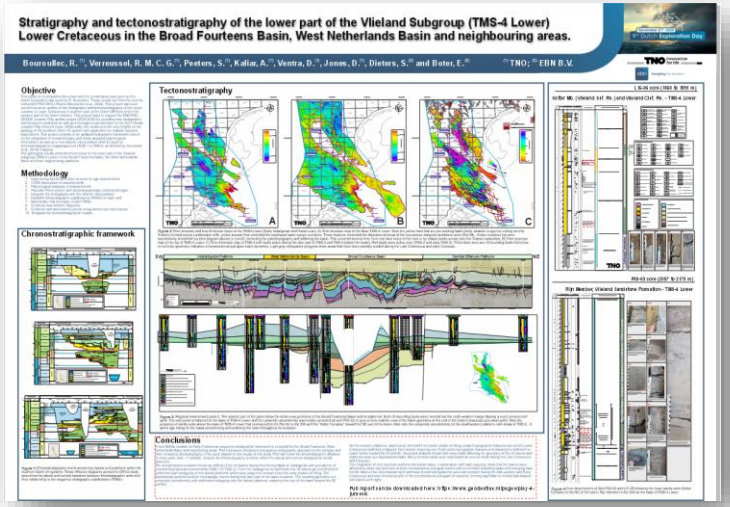


DEVLI Project report is available today on the GEODE website (for free)



DEVLI poster today

Poster of the TMS-4 Lower unit (Alblasserdam, Delft Sandstone, Rodenrijs, "Amstel", Helder, Kotter, Helm, Logger members).

Updated GEODE Jurassic Play project coming mid-2025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Thank you for your attention