November 20th, 2025

10th Dutch Exploration Day

ebn State Energy Company of the Netherlands

Evaluating the Jurassic play using the GEODE Atlas

Ryazanian (TMS-3) of the Terschelling Basin

Aart-Peter van den Berg van Saparoea (EBN)

ebn TNO GEODE

A sustainable **gas system**

Acknowledgements

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Sjoukje de Vries (EBN)

GEODE Atlas programme

From data to information and knowledge

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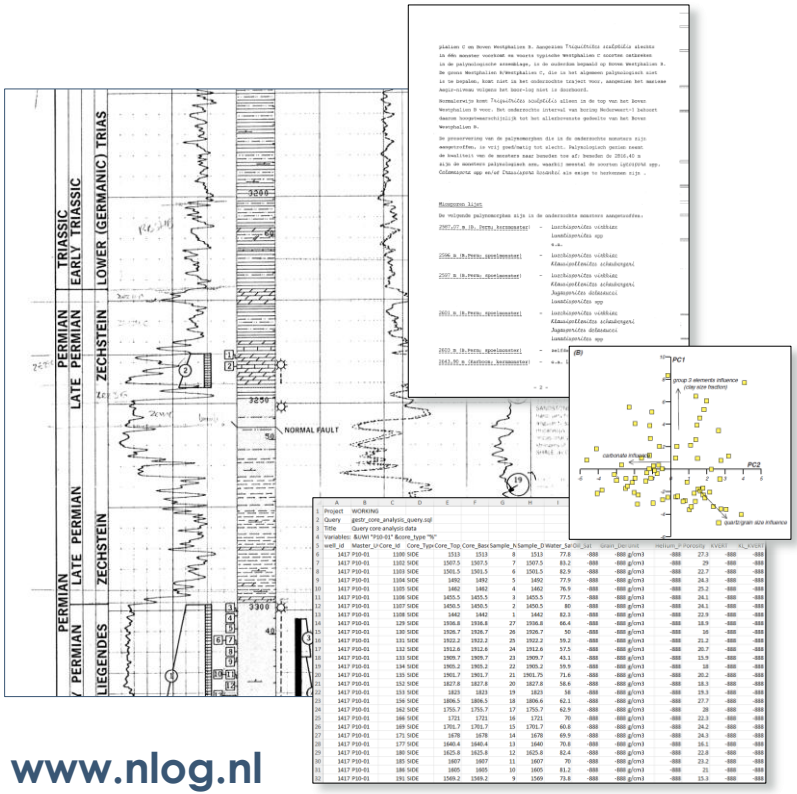


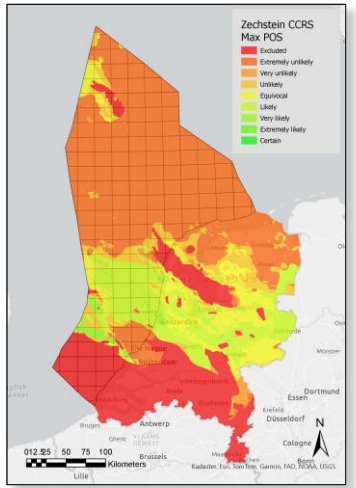
Reservoir screening
> 280 datasets/maps

Seal assessment
> 120 datasets/maps

Faults
> 20 datasets/maps

Nationwide basin model
> 80 datasets/maps

CCRS map



Risk maps
> 150 maps

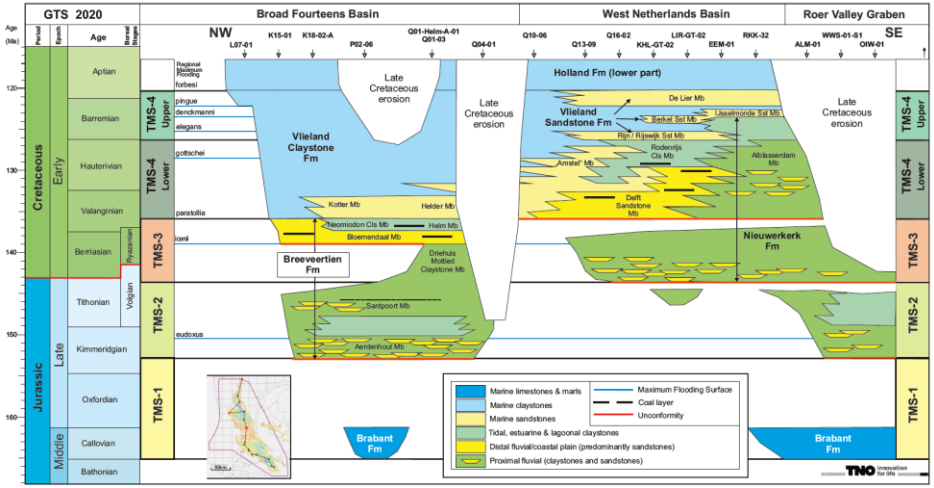
www.nlog.nl

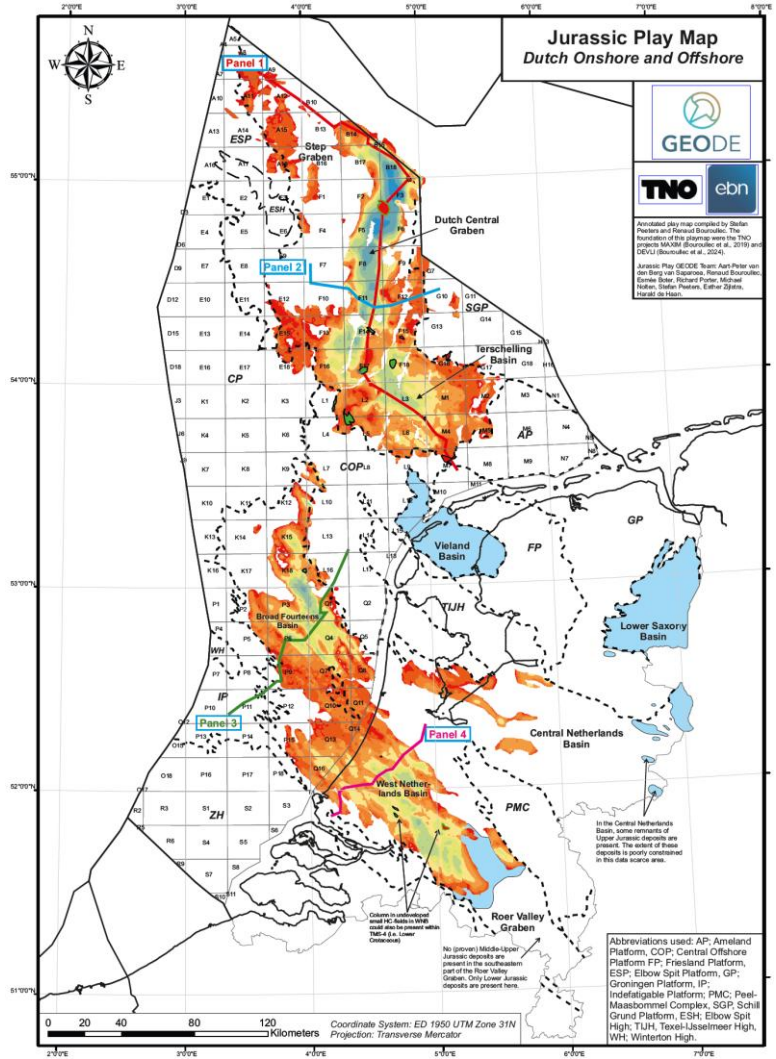
www.geodeatlas.nl

GEODE Jurassic 2025

- Updated and expanded 2021 version

- Includes DeVli study
  - Biostratigraphy
  - Sequence stratigraphic framework
  - Seismic interpretation





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Example use case – where to start

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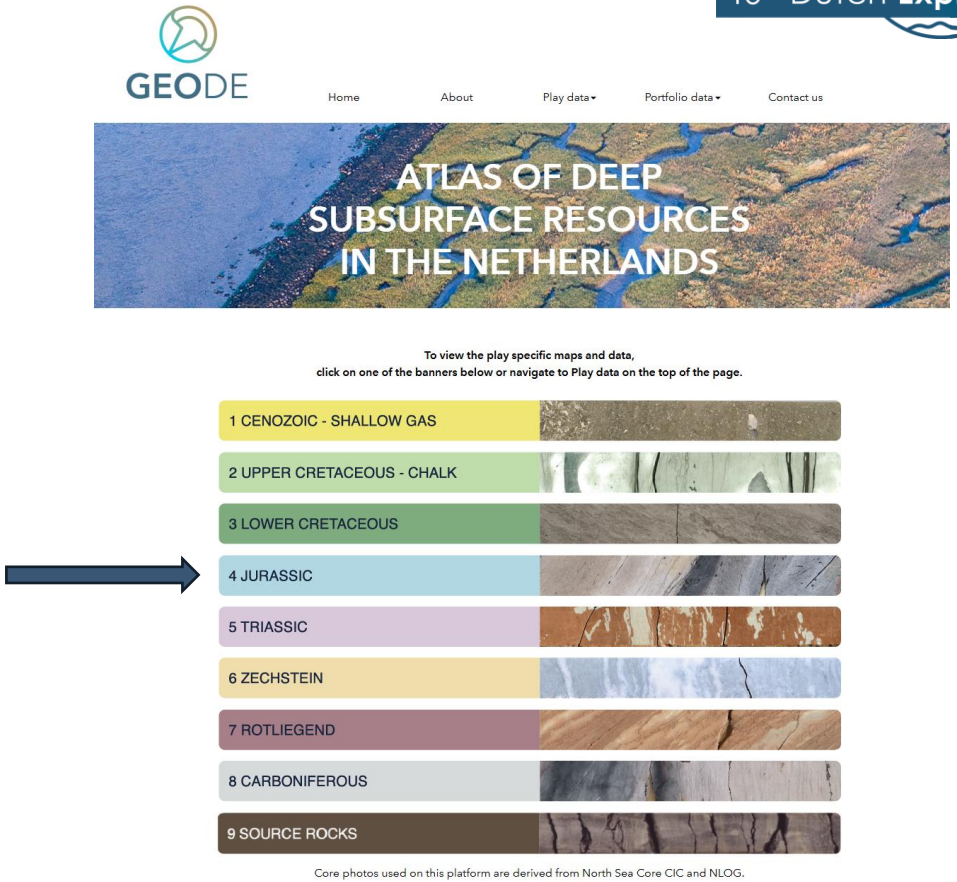

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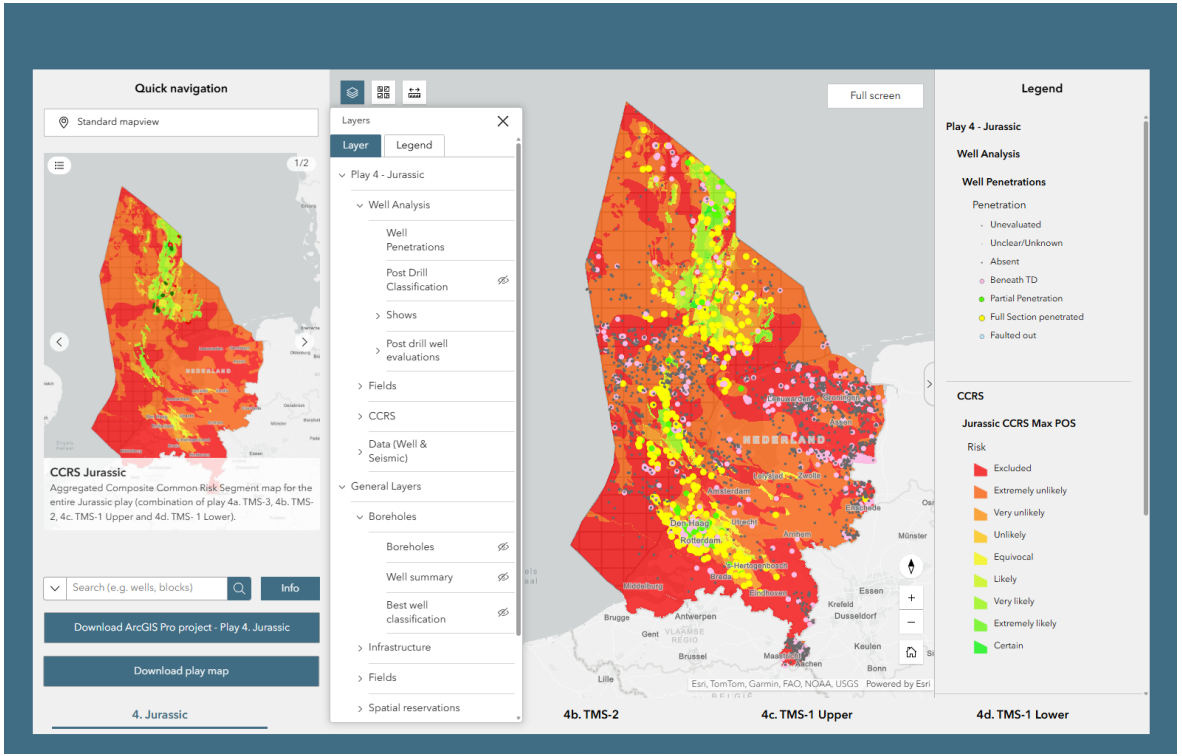
- Interactive map



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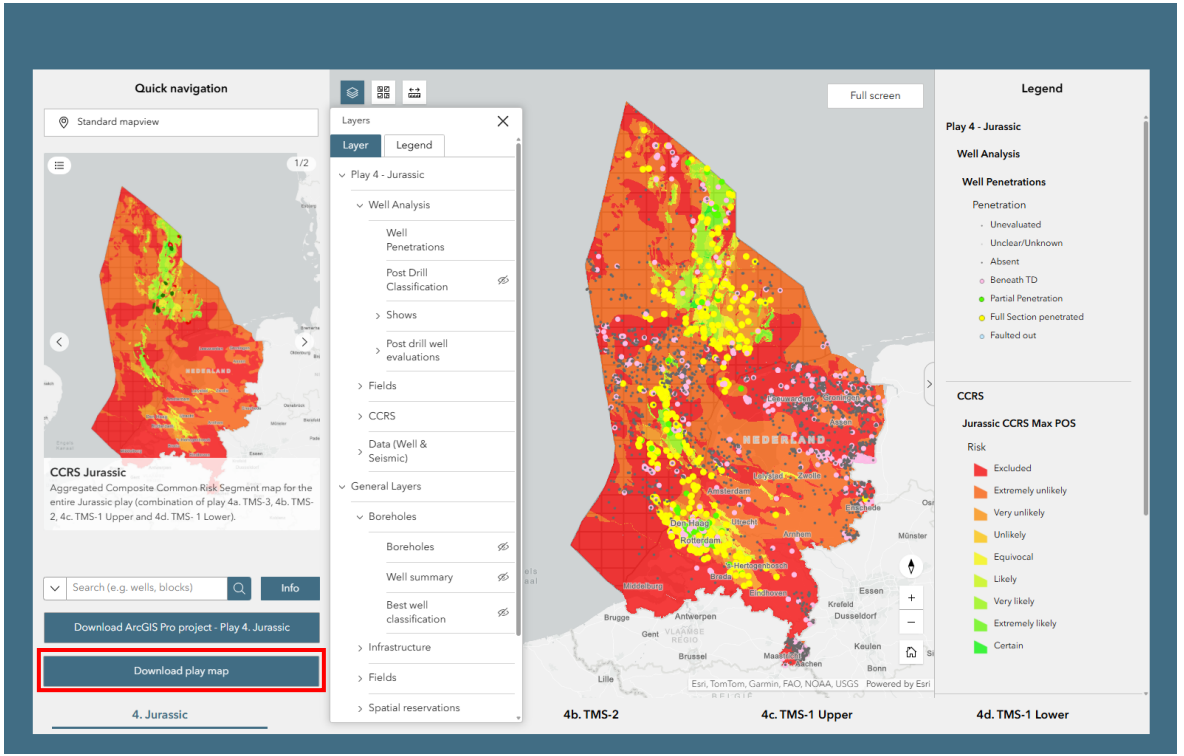
- Interactive map
- Annotated Play Map



Example use case – where to start

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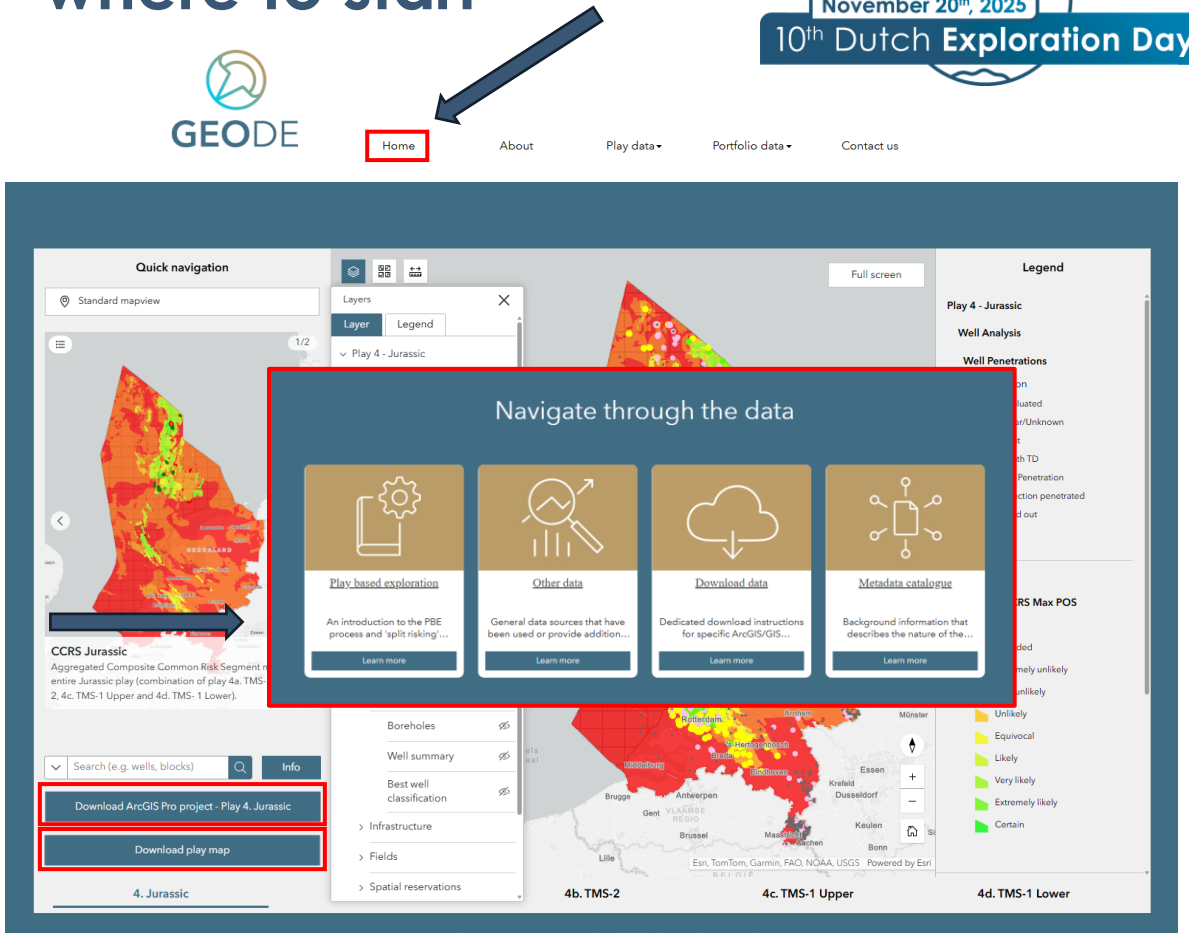
- Interactive map
- Annotated Play Map
- Download GIS data



Annotated play map

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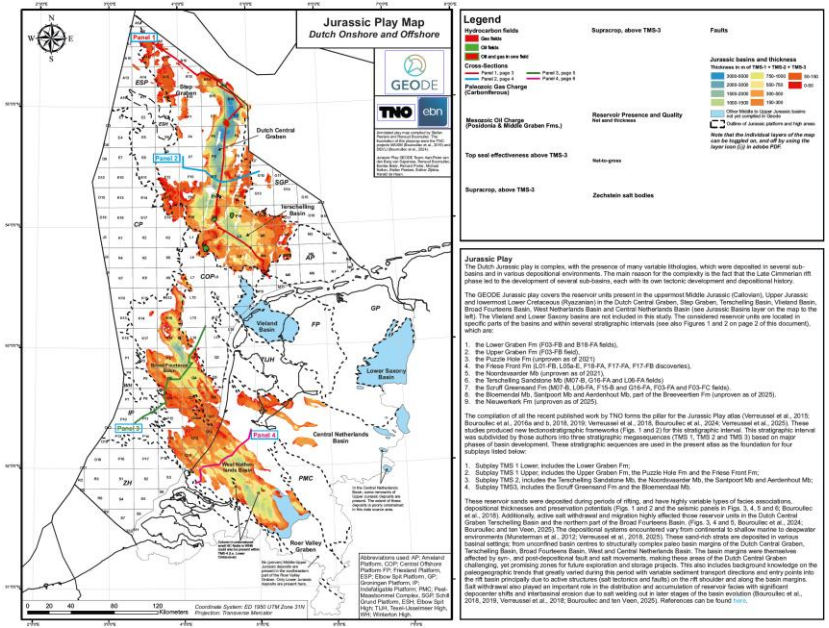
Layered PDF document containing a wealth of information.

- Introduction
- Summary
- Reference



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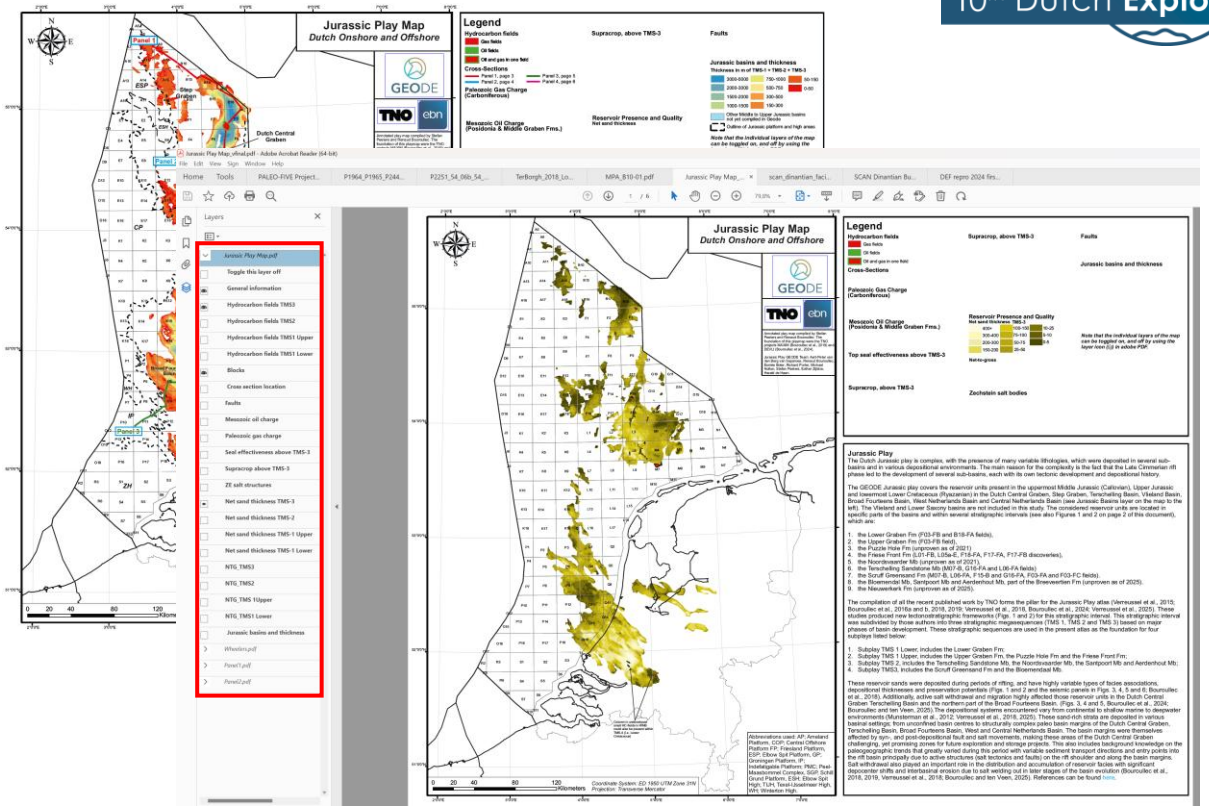

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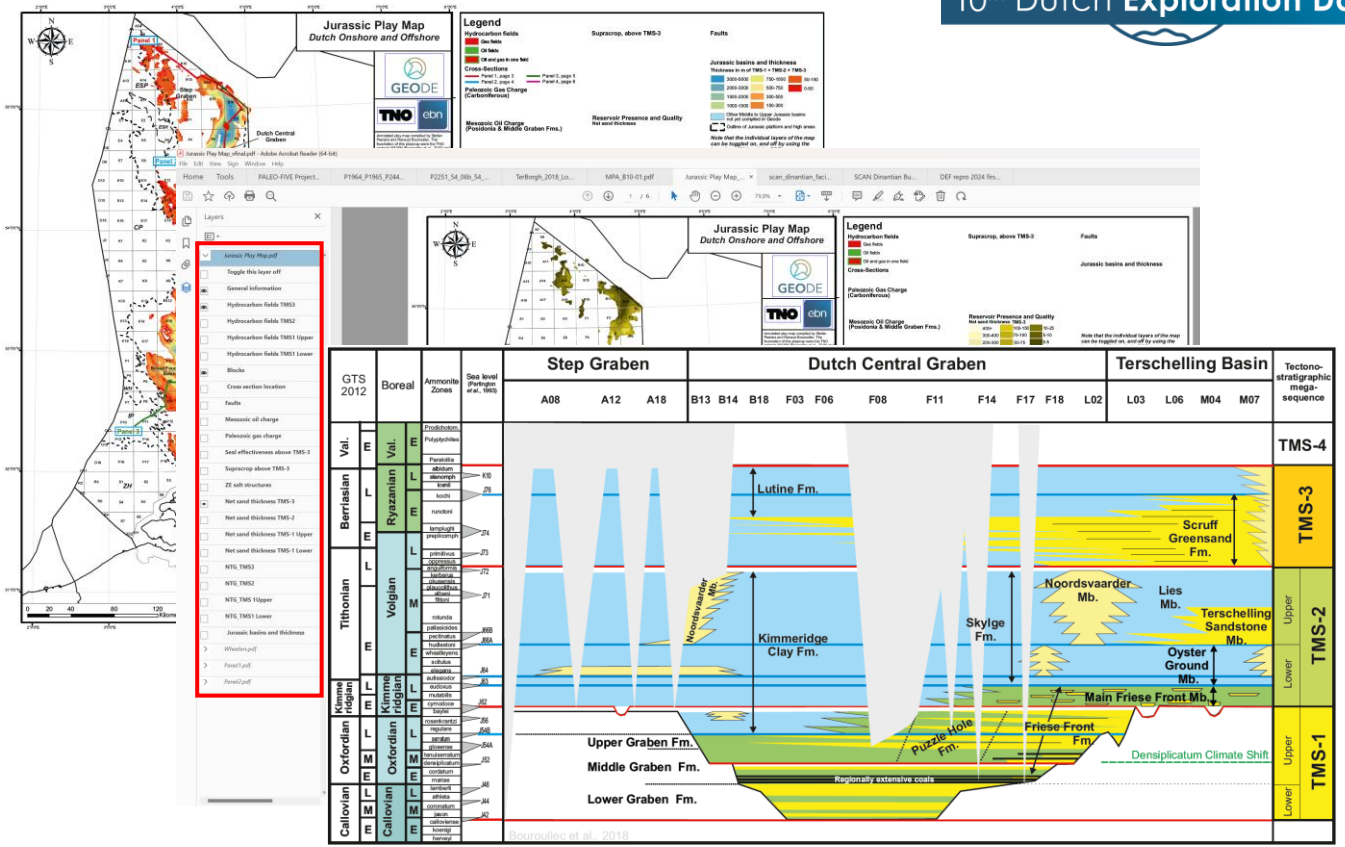

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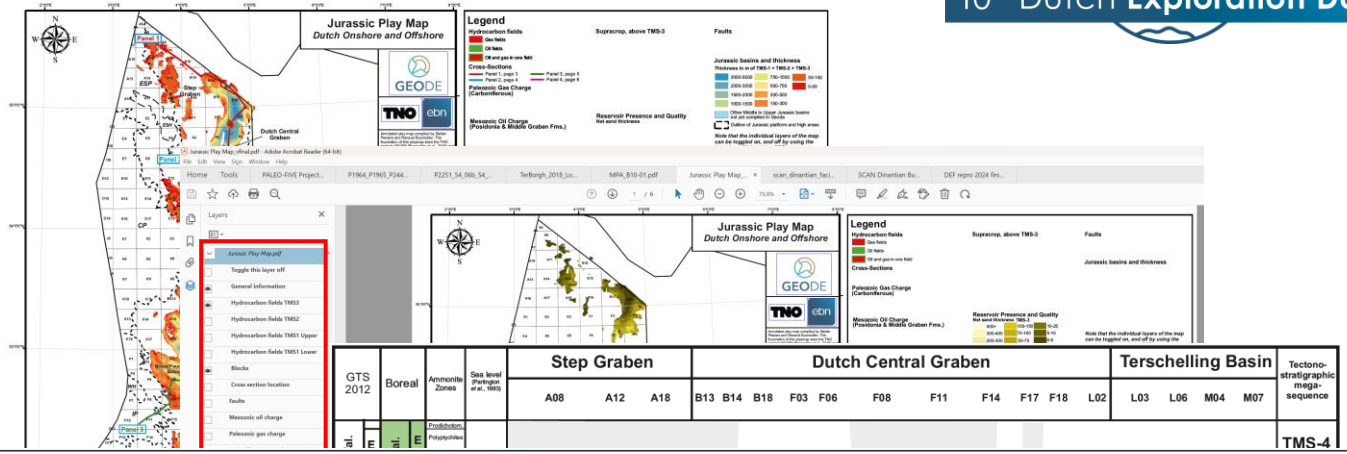

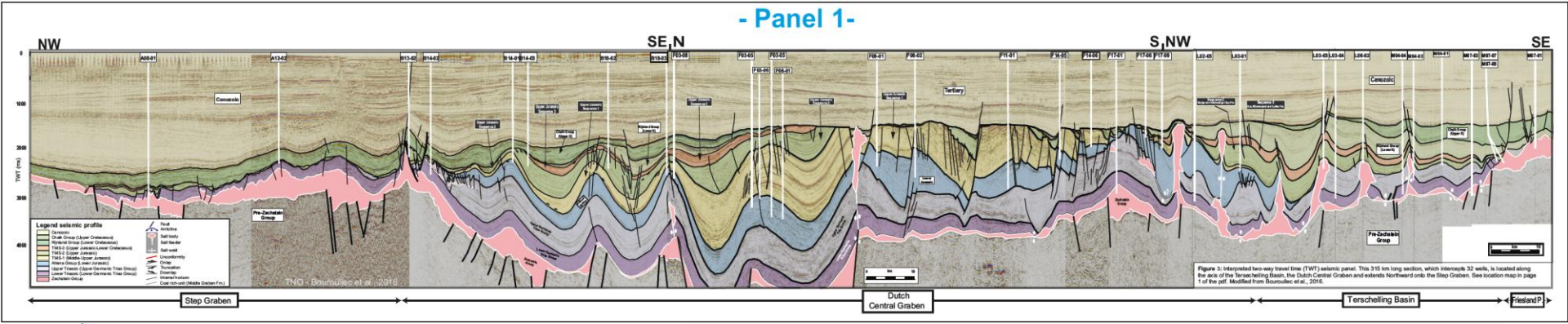

Bouroullec et al. (2018) Tectonostratigraphy of a rift basin affected by salt tectonics…

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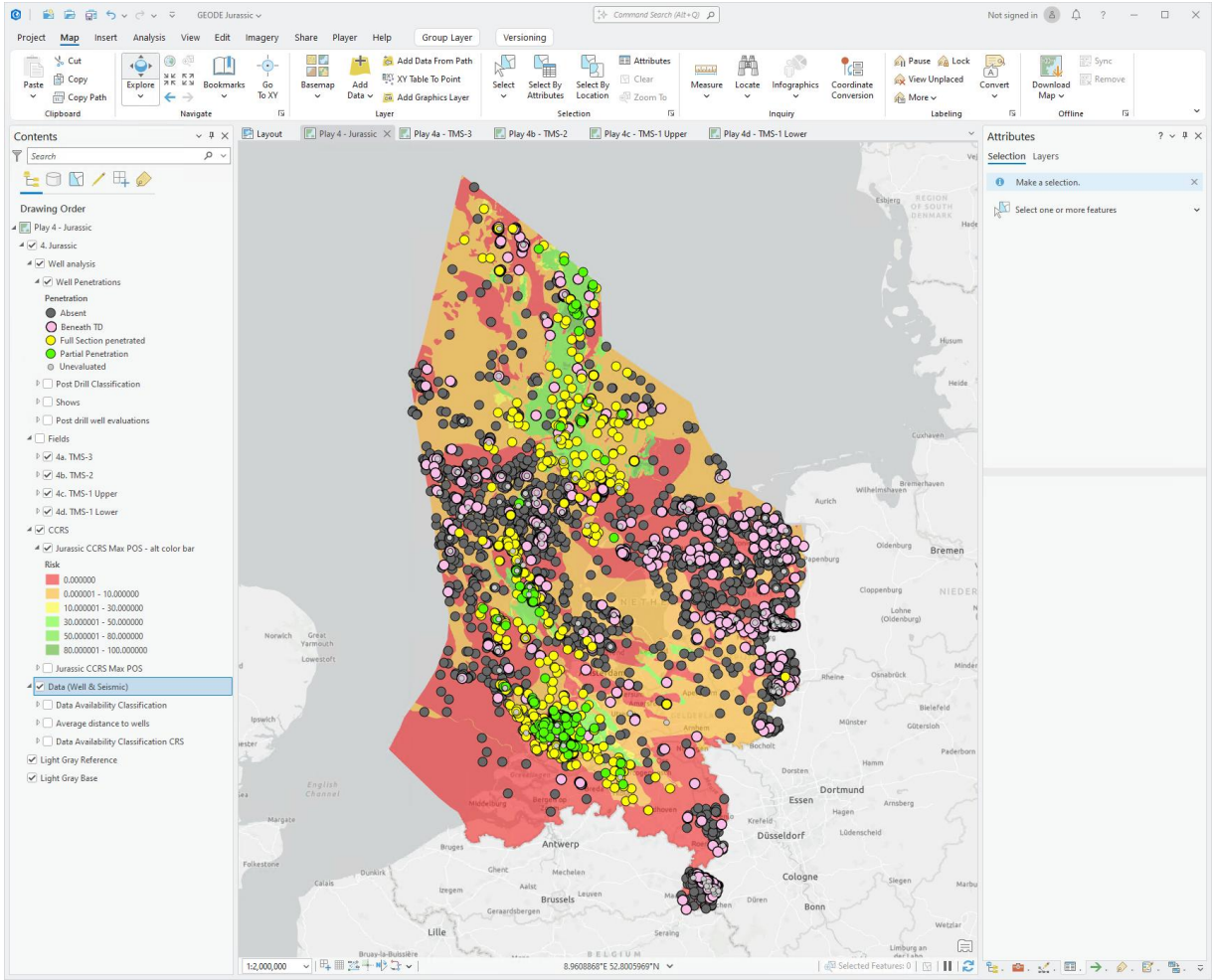
Example use case – GIS project

- Download ready to go **ArcGIS** project or shapefiles for use in **QGIS**, **Petrel** etc.
- Integrate your own data
- Modify as required

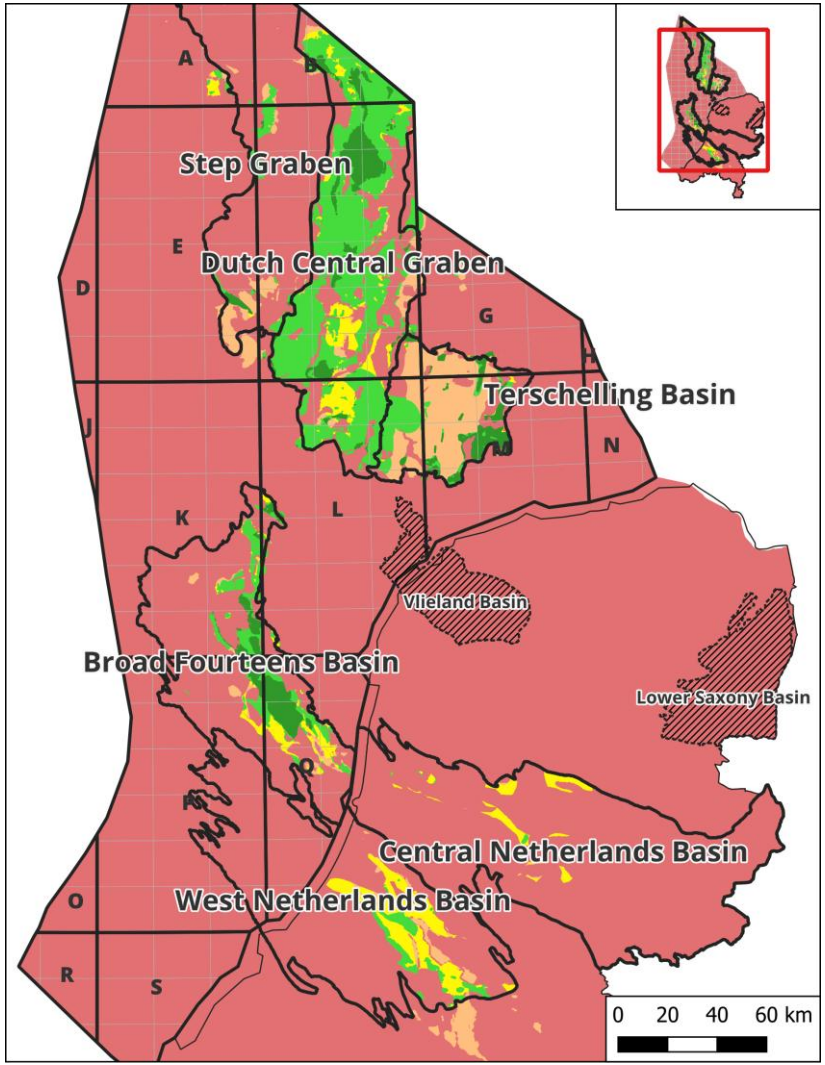


Example use case – CCRS map Jurassic Play

Jurassic rift basins

Composite **C**ommon **R**isk-**S**egment map

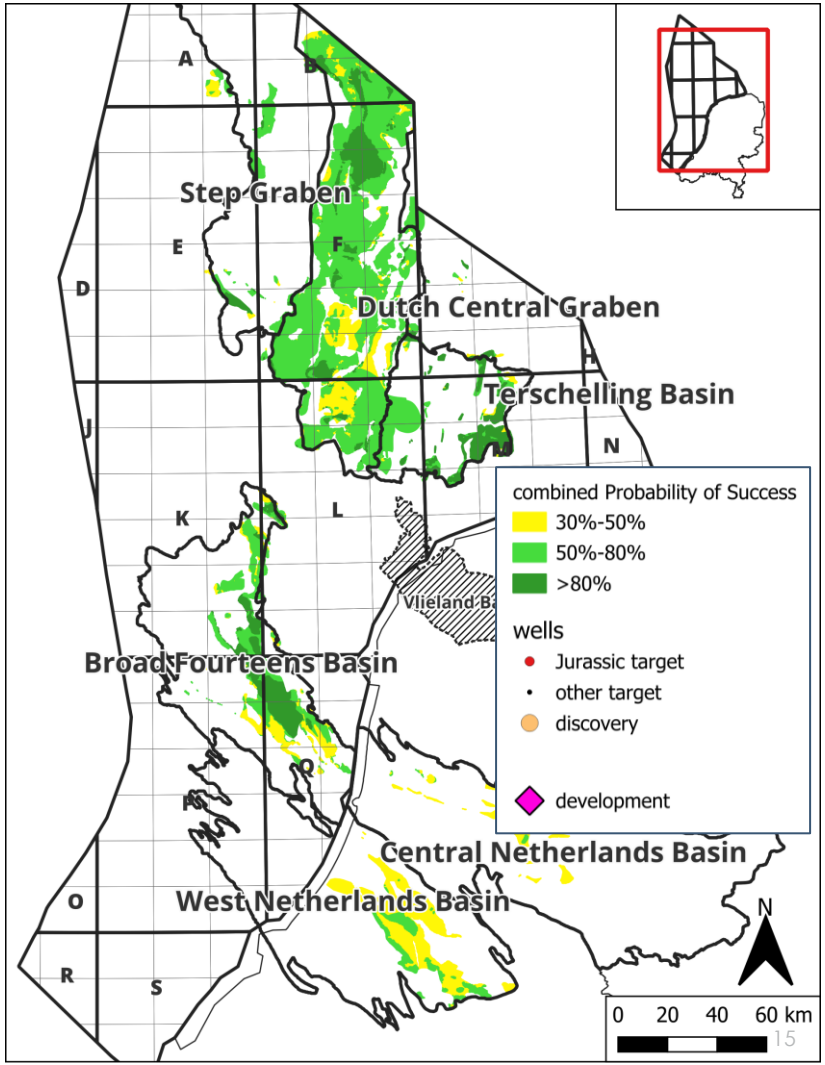
Some onshore basins not included (yet)



combined Probability of Success
- <10%
- 10% - 30%
- 30%-50%
- 50%-80%
- >80%

Example use case –
Exploration history Jurassic Play

- **Dutch Central Graben**: high success rate and many accidental discoveries.
- **Terschelling Basin:** challenging but has seen a few commercial discoveries.
- **Broad Fourteens Basin**: no targeted wells and one discovery. **Underexplored**.
- **West Netherlands Basin:** numerous discoveries but no commercial successes, despite targeted effort.



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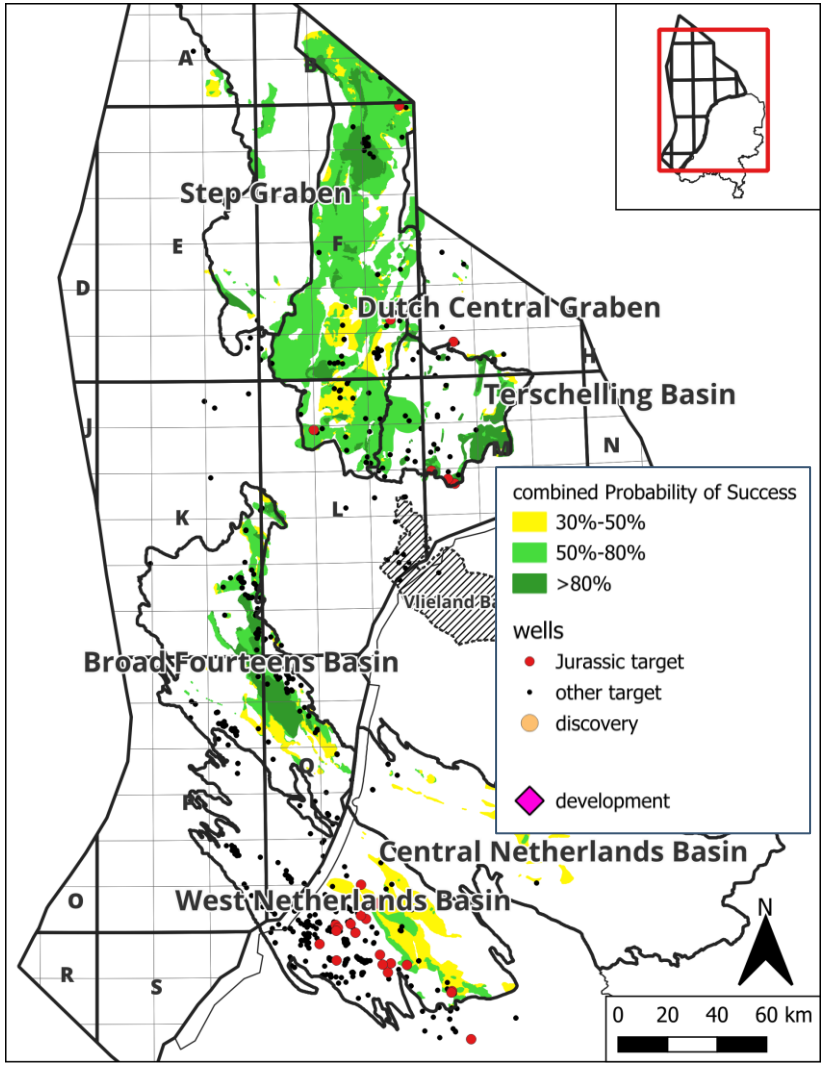

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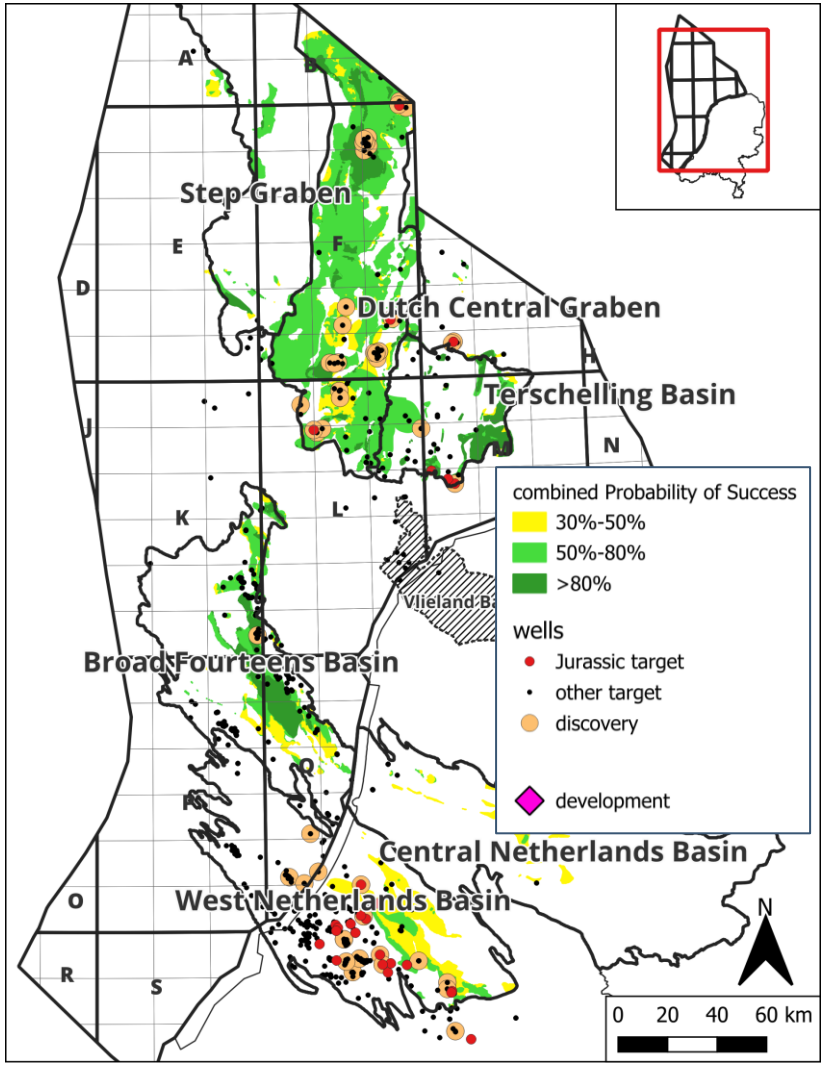

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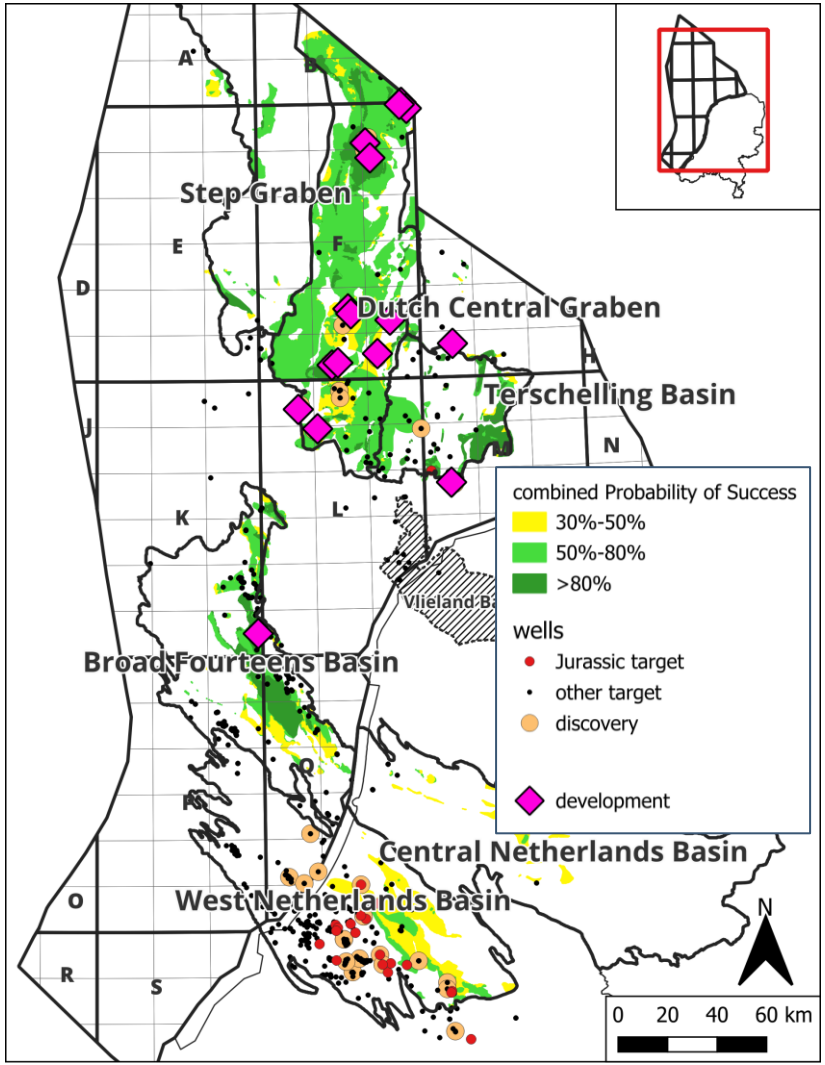

Example use case –
Exploration history Terschelling Basin

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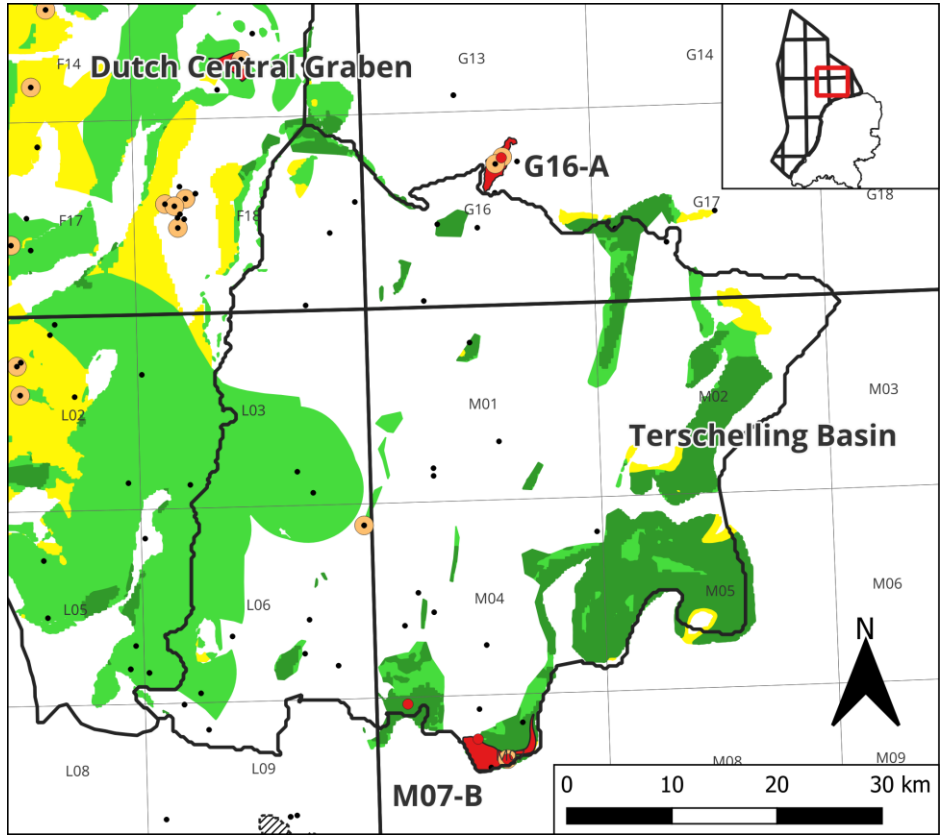
- Terschelling Basin is challenging
- High success rate targeted wells
- Both discoveries developed



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Example use-case: focus on Terschelling Basin, TMS-3

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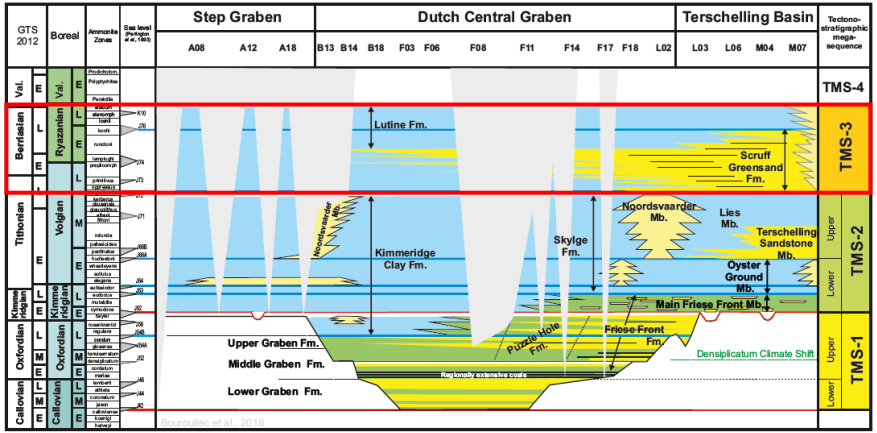
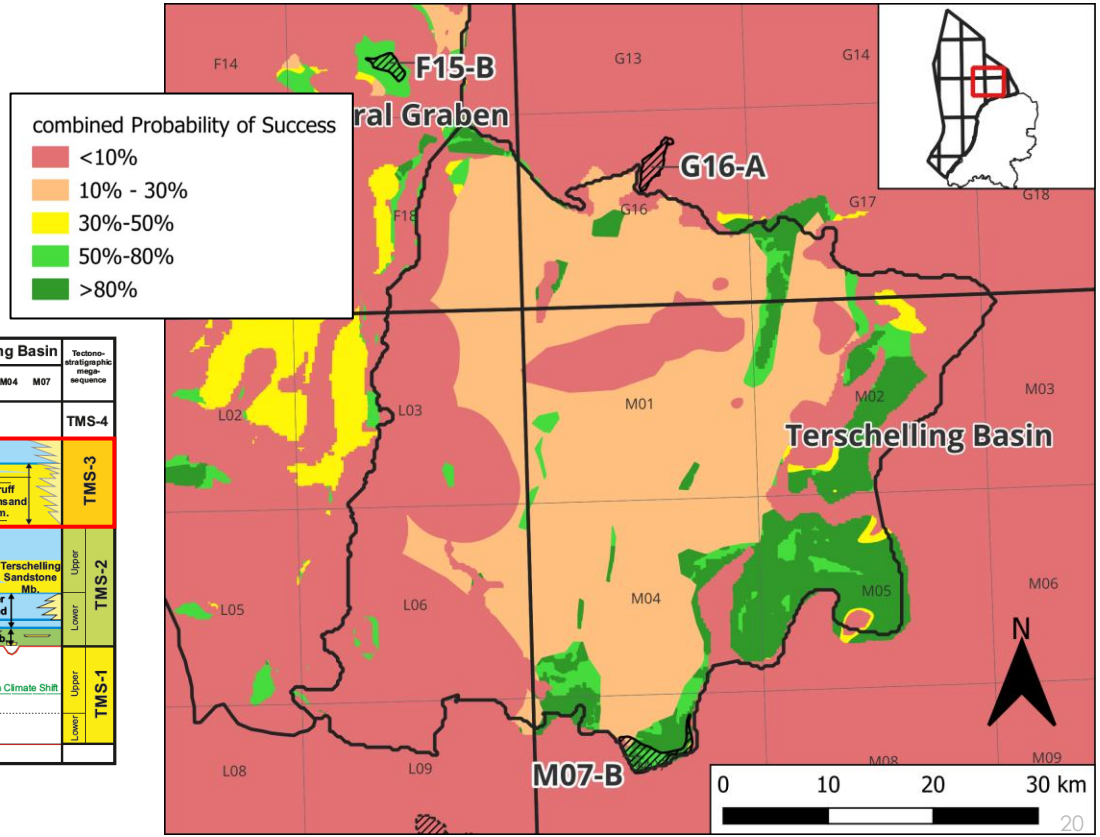
TMS-3, Ryazanian (Lower Cretaceous)

CCRS map





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Example use-case: well results

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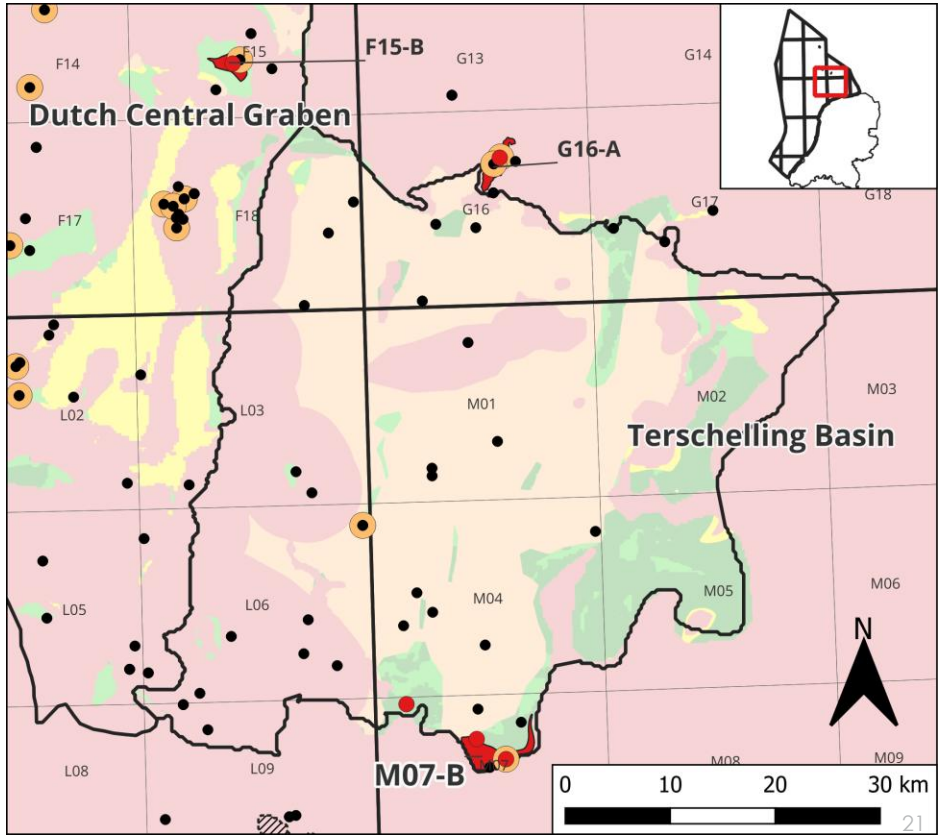
High success rate targeted wells (2/3)

Both discoveries developed



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Example use case – weakest element

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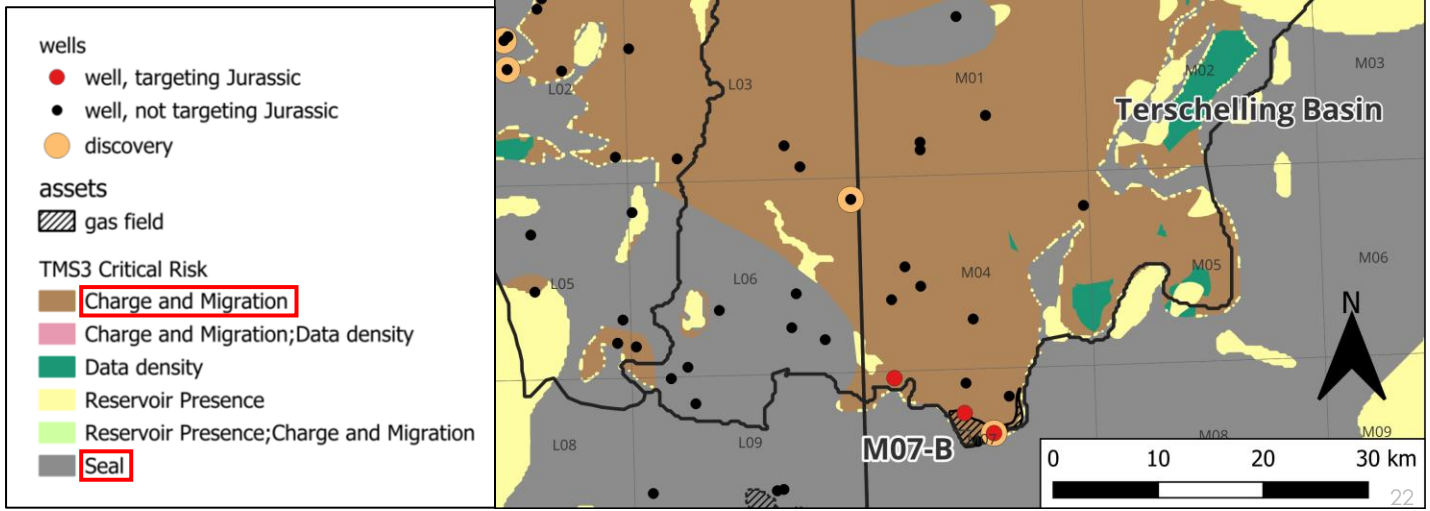
What is the most likely cause of failure?

- Charge and migration
- Top seal



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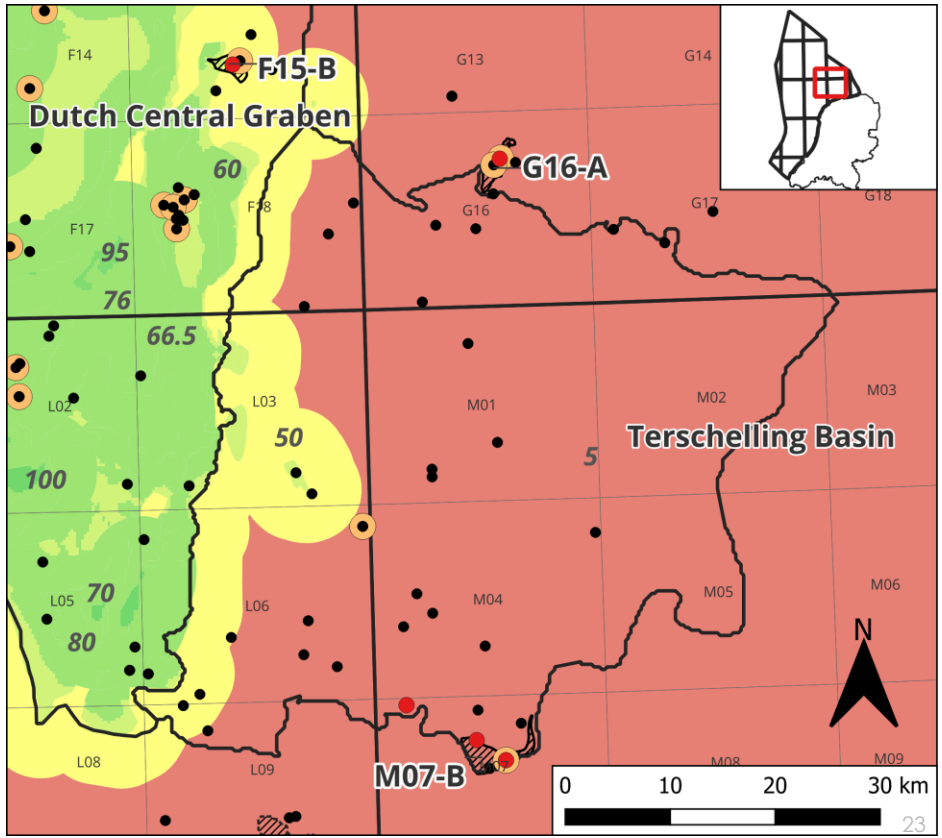
Example use case – charge POS

POS Mesozoic oil/gas expulsion: **5%**



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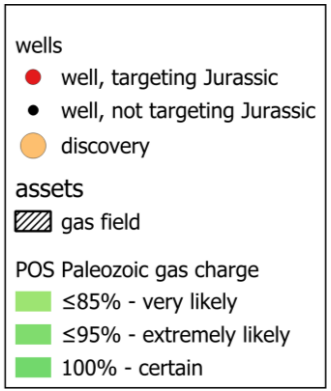
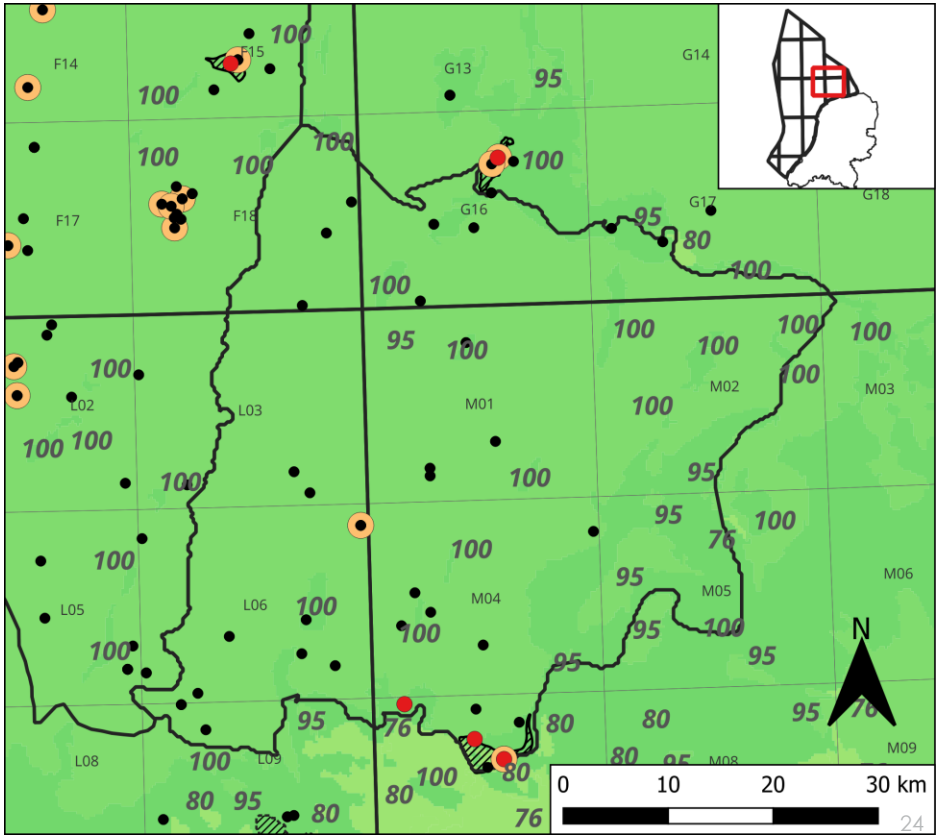
Example use case – charge POS

POS Mesozoic oil/gas expulsion: **5%**

POS Paleozoic gas expulsion: **95%**





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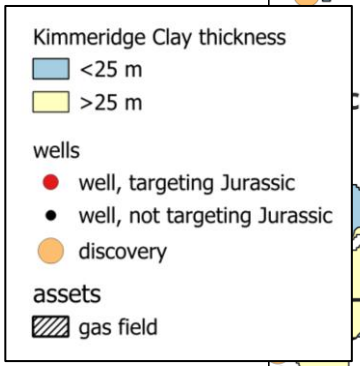

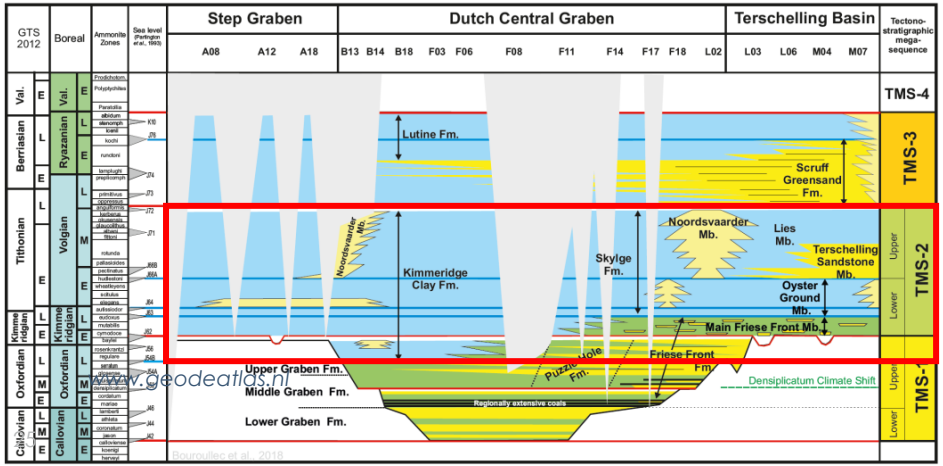

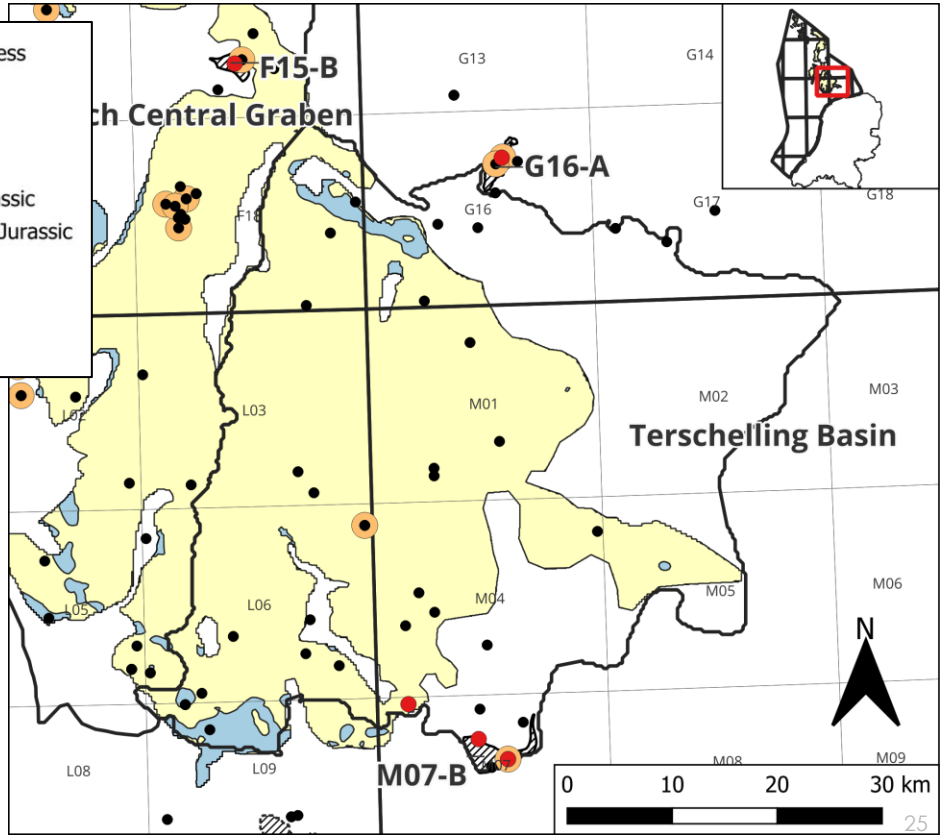

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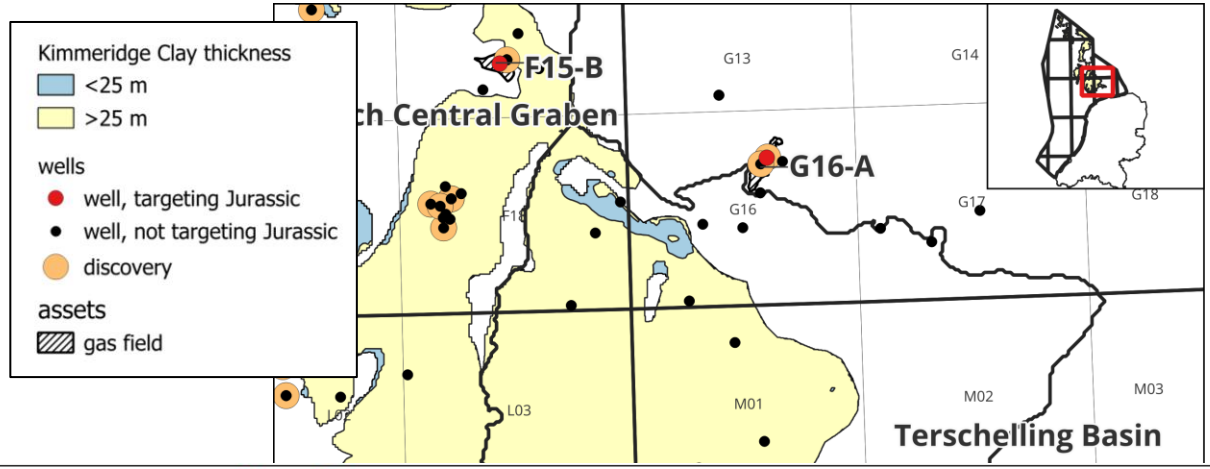

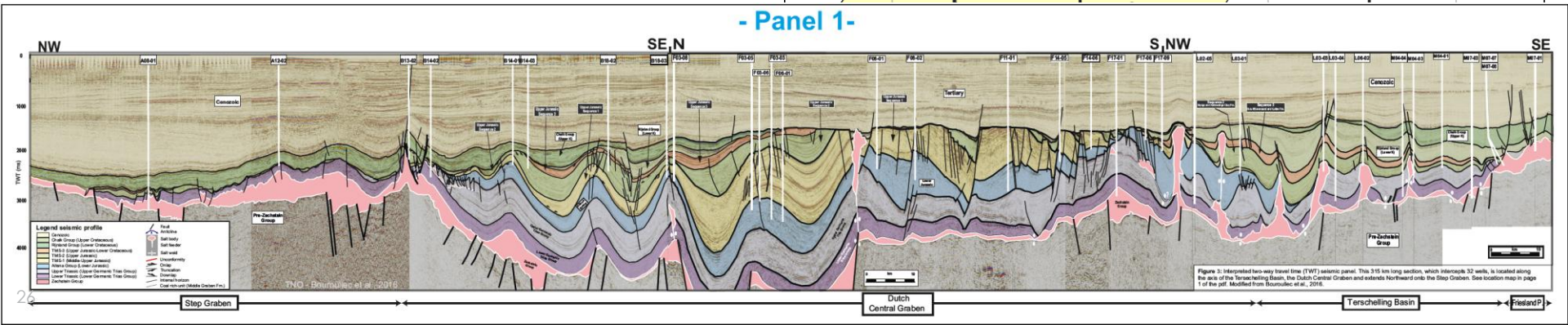

Example use case – charge POS

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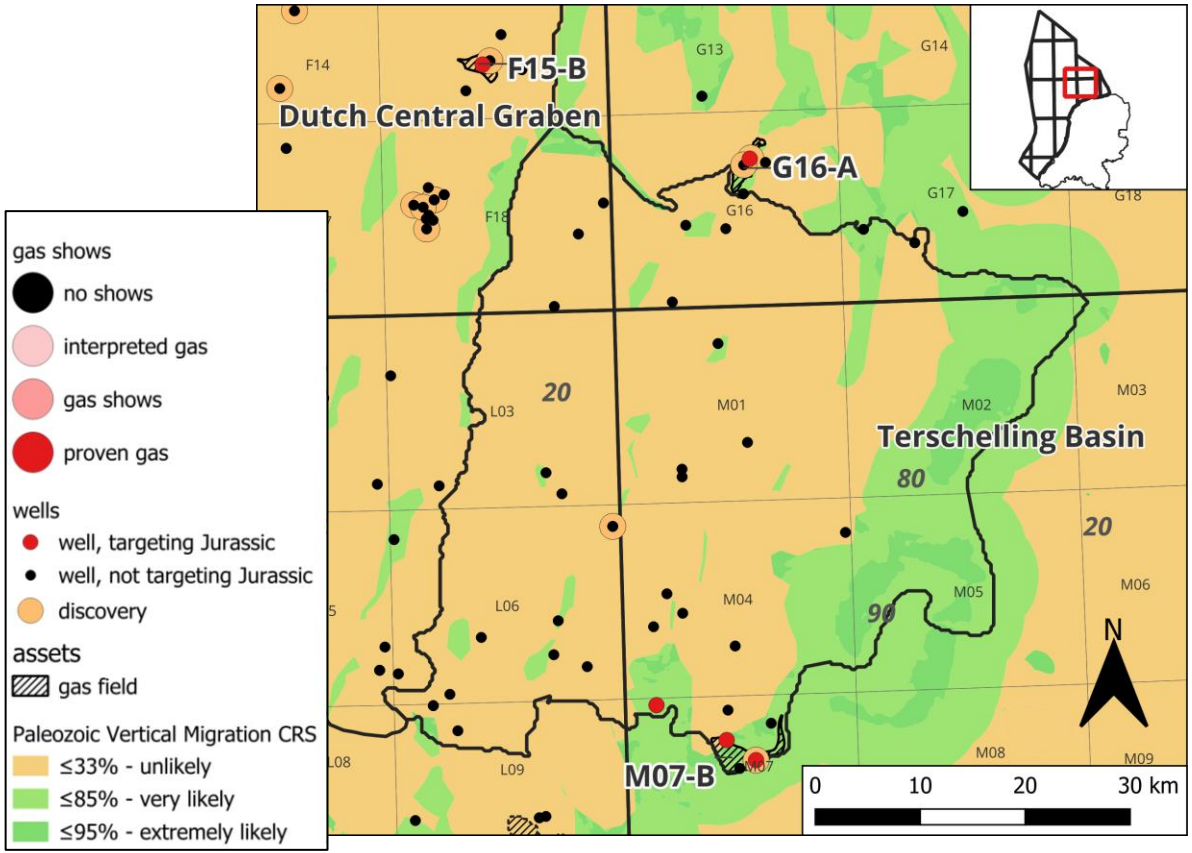
POS Paleozoic gas expulsion: **95%**

POS vertical migration: **20% - 90%**; most significant risk



Example use case – charge POS

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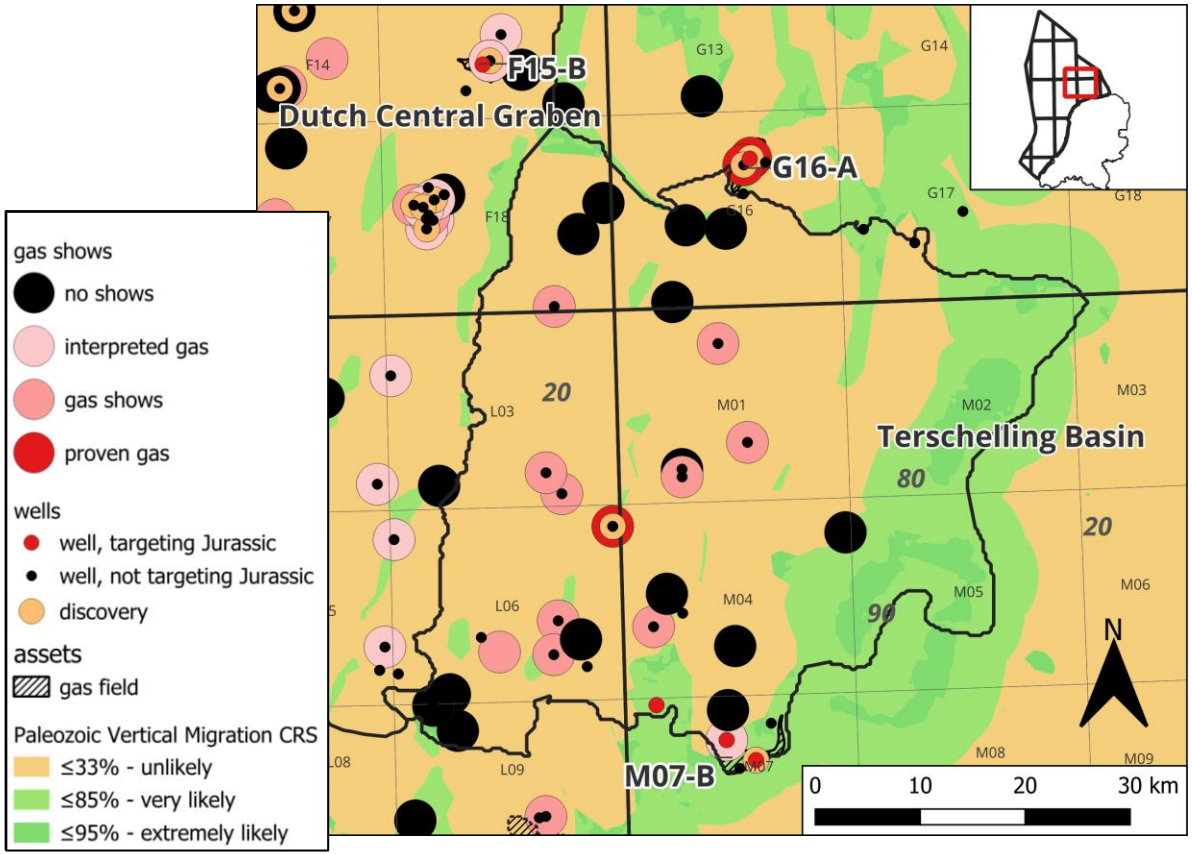
NB: gas shows are for entire Jurassic!



Example use case – seal POS

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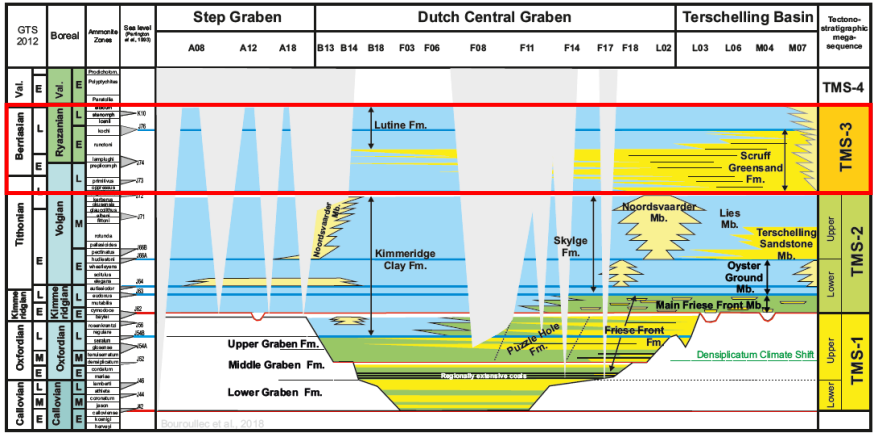
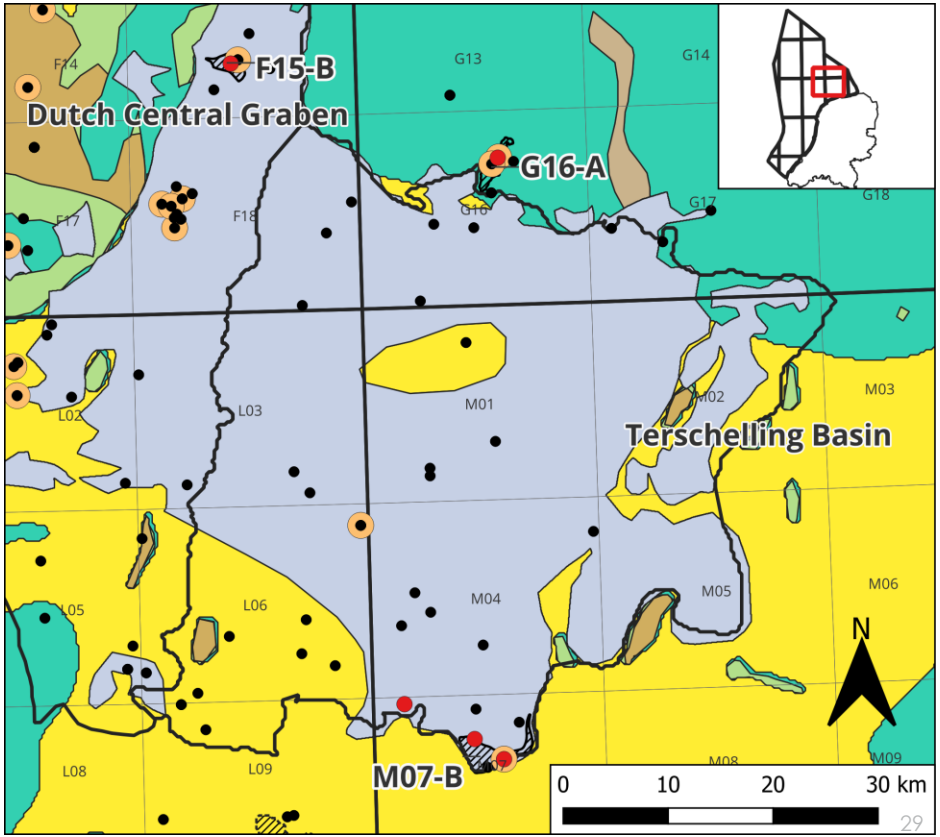
Lutine Formation – POS top seal: **100%**

Kotter/Helder Members – POS top seal: **0%**





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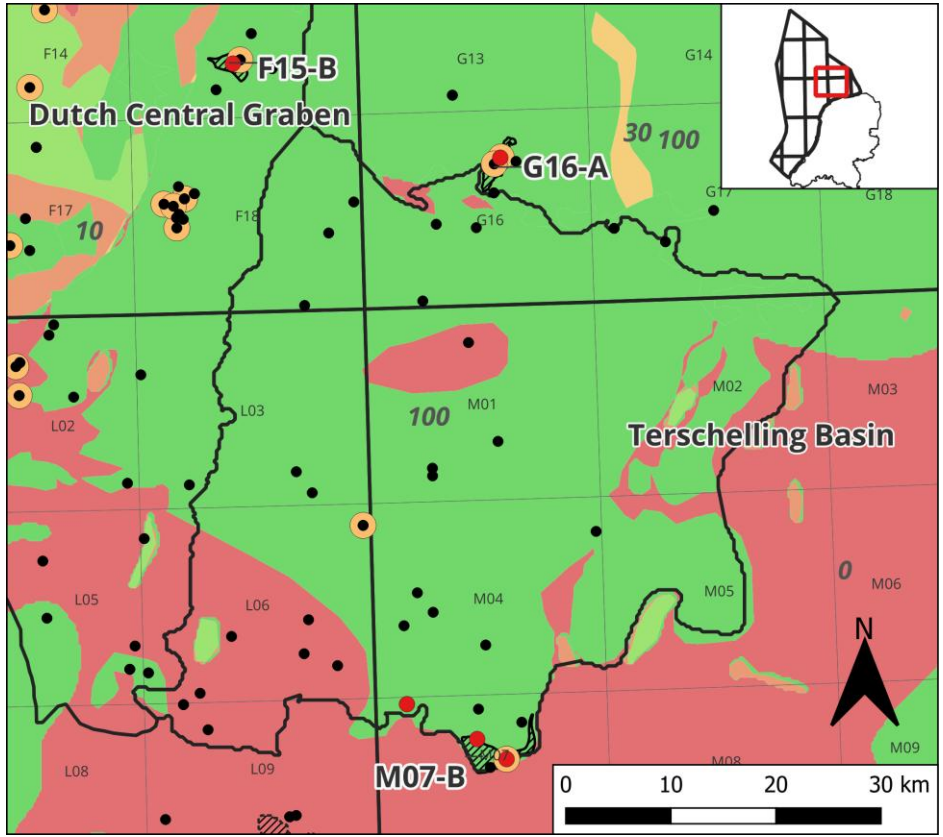


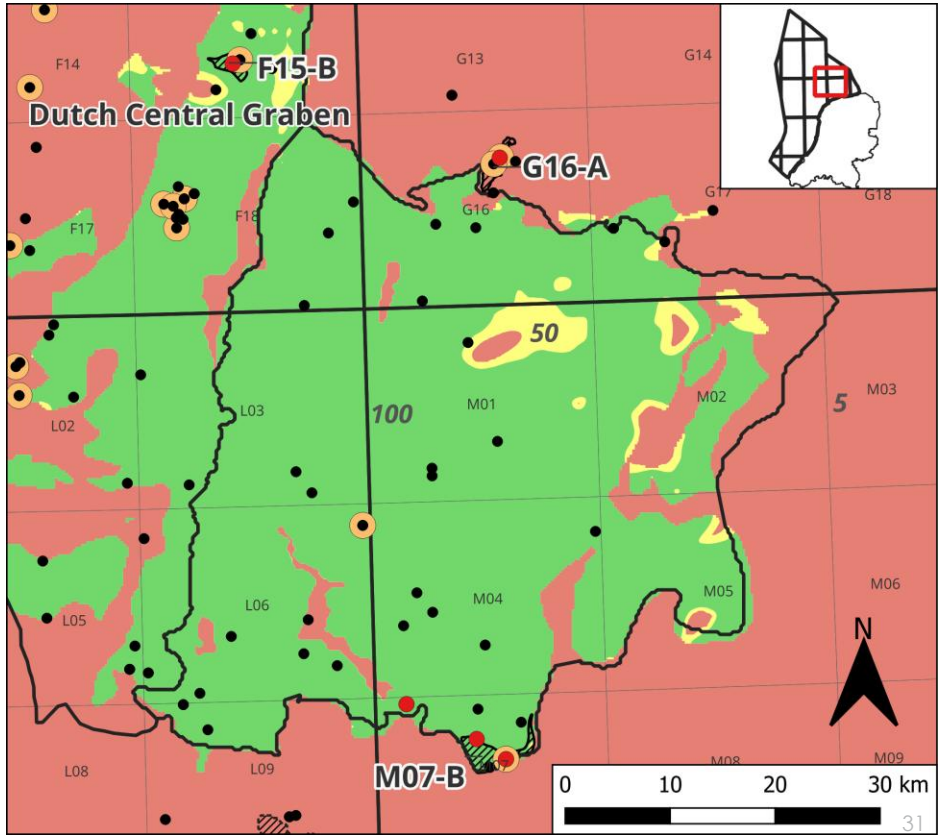
wells
- well, targeting Jurassic
- well, not targeting Jurassic
- discovery

assets
- gas field

POS top seal
- 0 - excluded
- ≤15% - very unlikely
- ≤33% - unlikely
- ≤85% - very likely
- 100% - certain

Example use case – reservoir POS

Reservoir presence POS 100% over most of the Terschelling basin



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Example use case – reservoir POS

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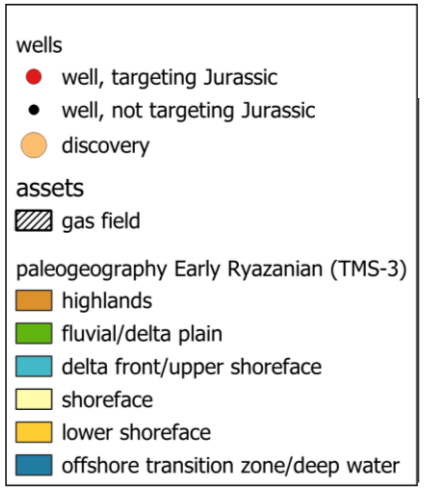
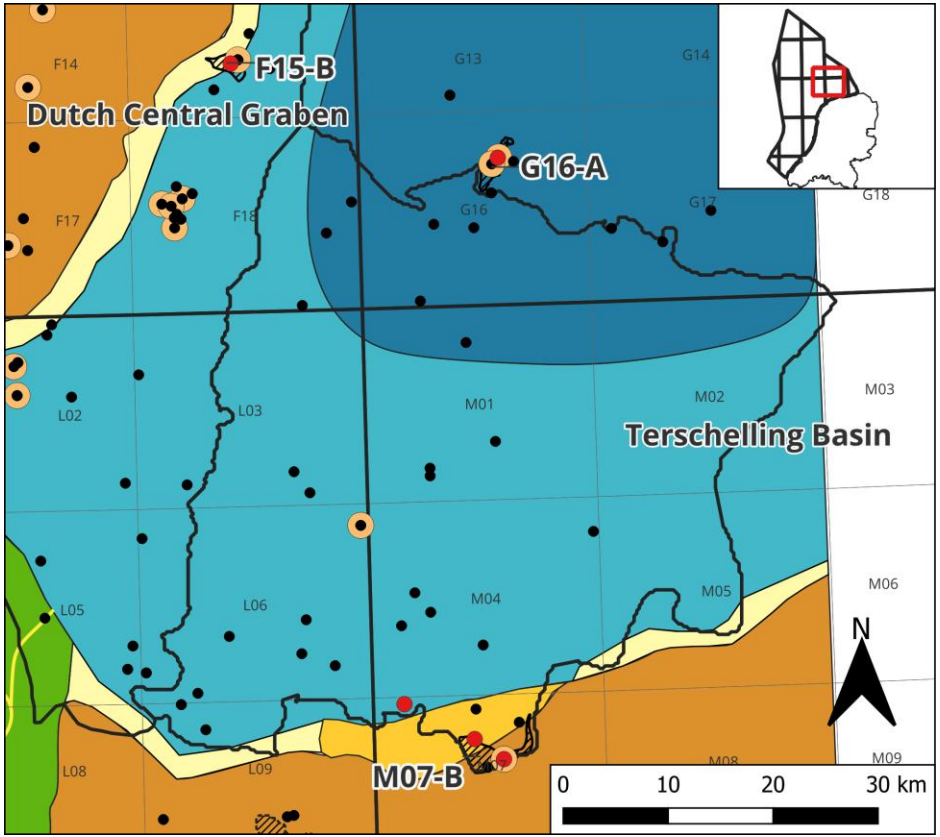
Reservoir presence POS 100% over most of the Terschelling basin

Primarily shallow marine sediments (results from TNO MAXIM study)





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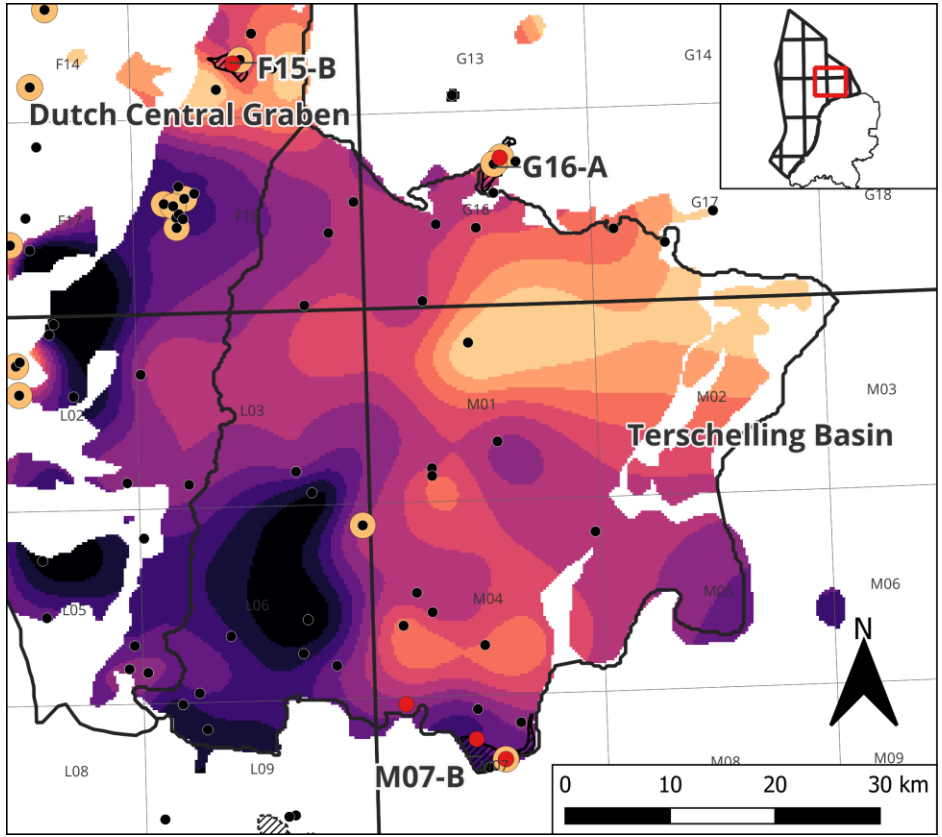

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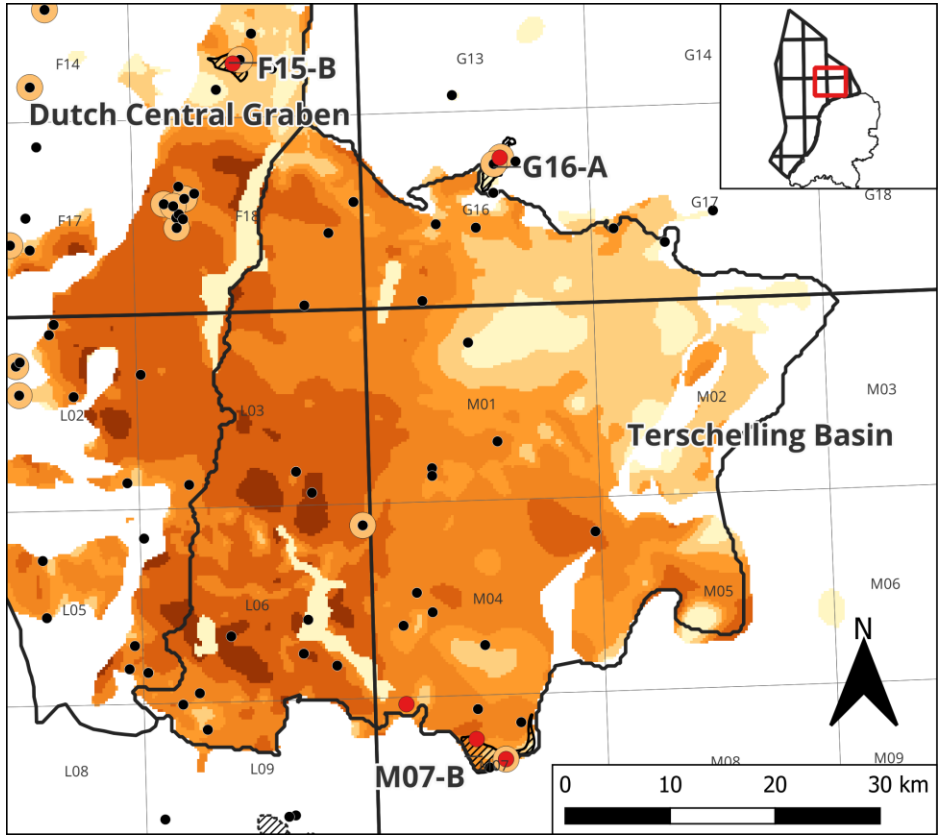
Example use case – reservoir POS

Reservoir presence POS 100% over most of the Terschelling basin

Primarily shallow marine sediments (results from TNO MAXIM study)

Clear proximal-distal trends reservoir quality



wells
- well, targeting Jurassic
- well, not targeting Jurassic
- discovery

assets
- gas field

net sand thickness
- <= 5 m
- 5 - 25 m
- 25 - 50 m
- 50 - 100 m
- 100 - 200 m
- > 200 m

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Example use case – conclusions Terschelling basin

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- Terschelling Basin dominated by Paleozoic **gas**
- **Migration** is a key risk
- **Top seal** absent in some locations, but excellent over most of the basin
- **Reservoir quality** likely to be best in W and SW of the basin **on a regional scale**

Where to focus detailed screening work?

- Local **migration** pathways Paleozoic gas
- Potential **stacked reservoirs** sealed by Lower Cretaceous
- **Reservoir quality** – as exemplified by the **M07-B** field

How to use the GEODE Atlas effectively

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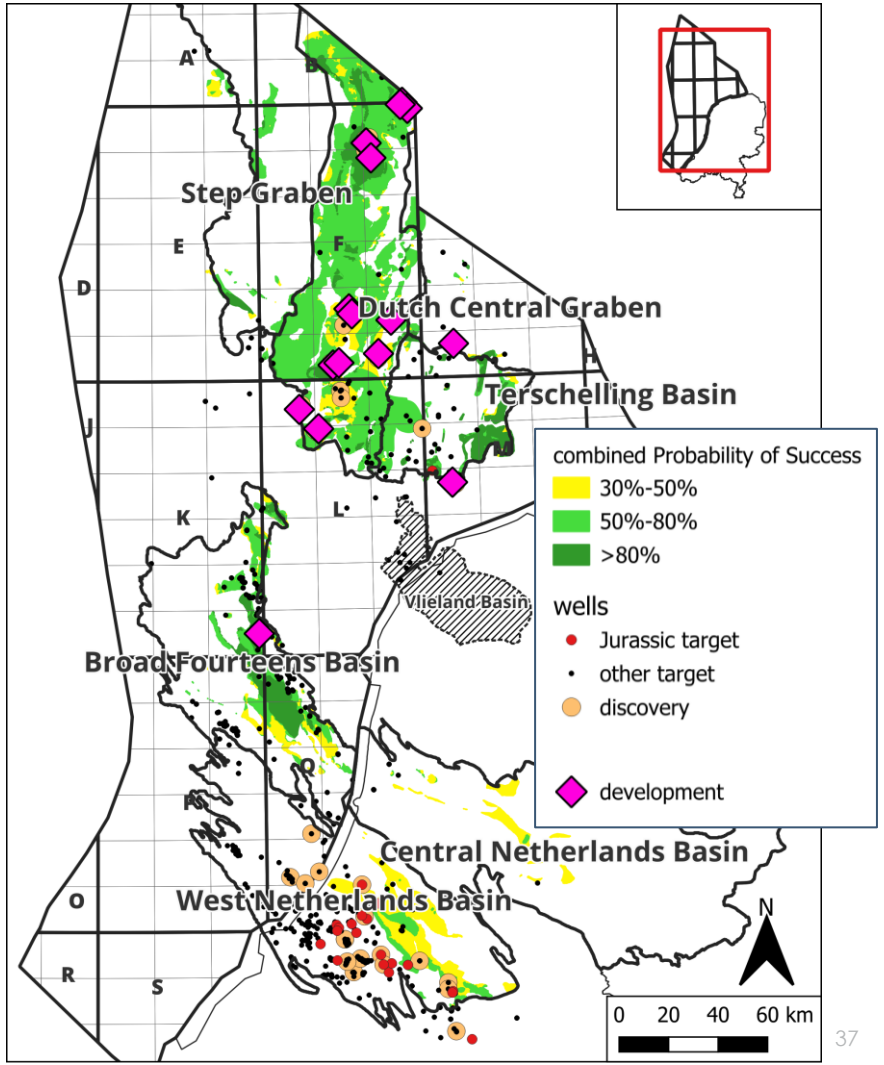
- Download GIS data
- Create your own project, integrate with your own data
- GEODE Atlas is valid on a **regional scale,**
  fit for **screening** and regional **context** of play segments and prospects
- Local details may deviate strongly, prospect evaluation requires
  additional work on much smaller scale

Conclusions Jurassic Play

- **Dutch Central Graben**: high success rate and many accidental discoveries.
- **Terschelling Basin:** challenging but has seen a few commercial discoveries.
- **Broad Fourteens Basin**: no targeted wells and one discovery. **Underexplored**.
- **West Netherlands Basin:** numerous discoveries but no commercial successes, despite targeted effort.



November 20th, 2025

10th Dutch Exploration Day

ebn State Energy Company of the Netherlands

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Thank you for your attention