

Reservoir potential of the Upper Jurassic

Upper Jurassic shallow marine sandstones in the northern Dutch offshore

- Three fields with Upper Jurassic shallow marine sandstone reservoirs, 30 km from Dutch border: Fife & Fergus (UK), A6-A (DE) (Fig. 1).
- Kimmeridgian to Volgian (Late Jurassic) shallow marine sandstones that form the reservoir of the UK Fife field are underexplored in the Netherlands.
- Fife-equivalent sandstones are likely to be present along the edges of the Central Graben. In the Netherlands these are part of the Noordvaarder Member.
- Sandstones from this interval with favourable reservoir characteristics have been encountered in at least two Dutch wells (figs. 1-4).
- A petrophysical analysis of the interval in Dutch well B13-02 shows a N/G of 0.93 and an average porosity of 21% (Fig. 3).
- Core plug measurements show permeabilities of up to 150 mD (Fig. 4).

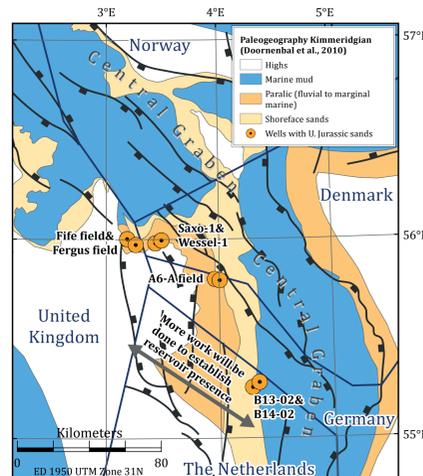


Fig. 1: Occurrence of shallow marine Kimmeridgian-Volgian sandstone reservoirs in the five country area. Dutch wells B13-02 and B14-02 show that these sands are present as far east as the B quad. Paleogeographic reconstructions of their extent vary significantly; compare the figure to the left to the one below.

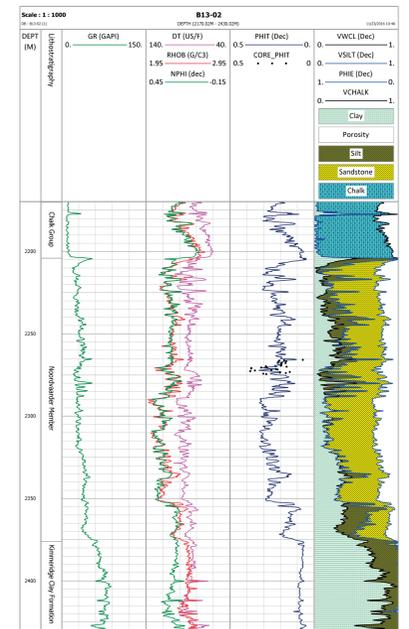
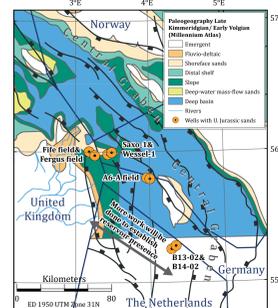


Fig. 3: Petrophysical analysis of the Noordvaarder Member interval in NL well B13-02.

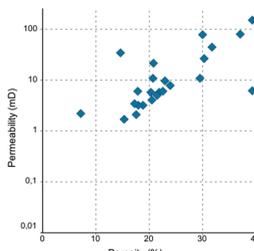


Fig. 4: Core plug measurements from the Noordvaarder Member in NL well B13-02.

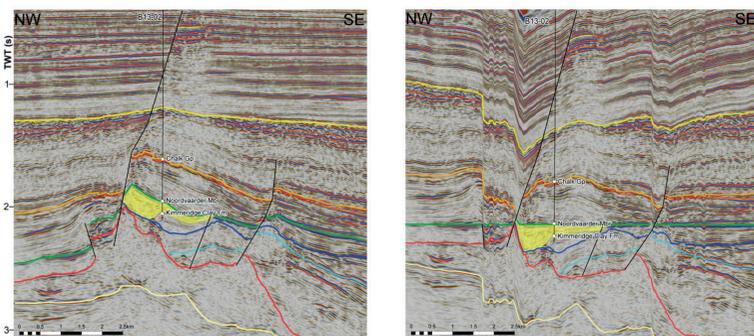
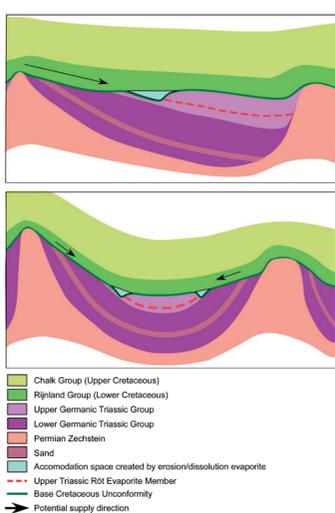


Fig. 2: A) Shallow marine sandstones (Noordvaarder Mb) in well B13-02. B) section flattened at base Chalk.

A new play type in the G&M quadrants

Due to erosion and dissolution of subcropping evaporites of Triassic age at the Mid Cimmerian unconformity a potential new play type for offshore the Netherlands has been identified. The gullies that originated at the eroded Röt surfaces are filled with Upper Jurassic to Lower Cretaceous sediments. An example is the "De Wijk" field, located onshore that produces from the Vlieland sandstone that deposited in a depression formed due to erosion and dissolution of Upper Triassic evaporites. Main uncertainty of the play is the nature (sand or shale) of the infill sediments. The Vlieland Sand-

stone may have not been deposited this far North, however other sand sources can be the Lower Triassic sands that are likely eroded at the same time as the formation of the accommodation space (figure 6a and 6b). We are currently working on a cross-border article with the BGR (Federal Institute for Geoscience and Natural Resources Germany), since the Gullies extend into Germany. The article is expected to be published next year in the Special publication on Mesozoic Resource Potential in the Southern Permian Basin by the Geological Society of London.



Figures 6a, b above illustrate the hypothesis on the infill. Due to halotectonics the Lower Triassic sands and Upper Triassic clays and evaporites are uplifted and eroded, at the same time gullies are formed and possibly filled with erosion material during the Jurassic. The other hypothesis is that the gullies are filled with clay deposited during the Lower Cretaceous.

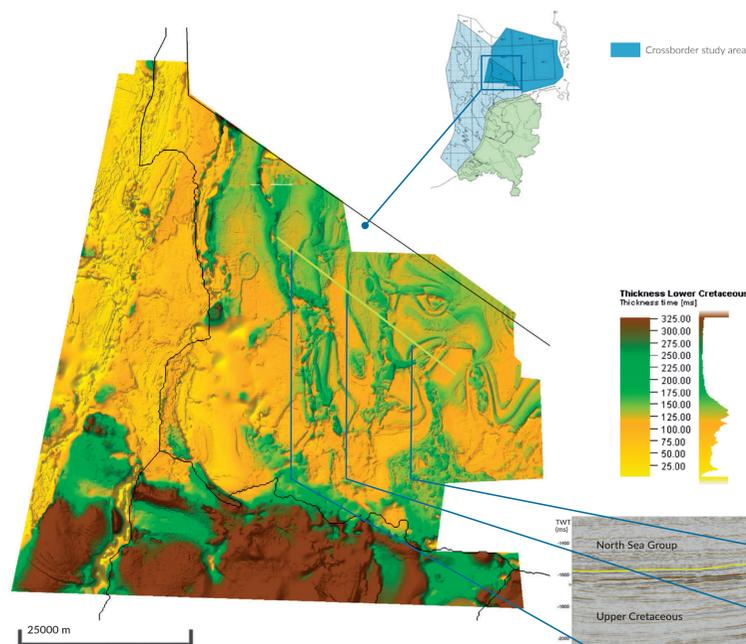


Fig. 7: Thickness map of the Lower Cretaceous Schieland group (between light and dark green interpretations on figure 8). Where gullies are present the Lower Cretaceous is showing thick elongated features.

The MAXIM project – new potential plays in the Upper Jurassic of the Dutch Central Graben

Within the Dutch government funded Upstream Gas research programme (TKI), the Jurassic research project MAXIM is scheduled to start in early 2017. This research will be conducted by the Basin Analysis Team of the Netherlands Organisation for Applied Scientific Research (TNO), in close collaboration with EBN and several other industry partners. The MAXIM Project aims at defining new potential plays in the Upper Jurassic along the Dutch Central Graben basin margins and basin axis. The project will leverage from years of experience in the Dutch subsurface, combined with an impressive dataset that includes more than 100 wells, almost full 3D seismic coverage and a wealth of previous basin, biostratigraphic and sedimentological studies. The applied multi-disciplinary approach will include palynological and stable isotope analyses, 3D seismic mapping, amplitude mapping, 2D structural restorations and more (Fig. 5).

More information?

TNO and TKI welcome industry partners to join the project either as paying or in-kind contributor. If you are you interested to know more about this project, please contact Friso Veenstra (friso.veenstra@tno.nl).

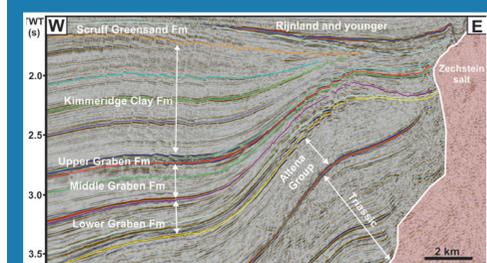


Fig. 5: Seismic cross-section through the Dutch Central Graben basin margin. Seismic mapping and amplitude mapping will be conducted in close harmony with biostratigraphical and stable isotope analyses.

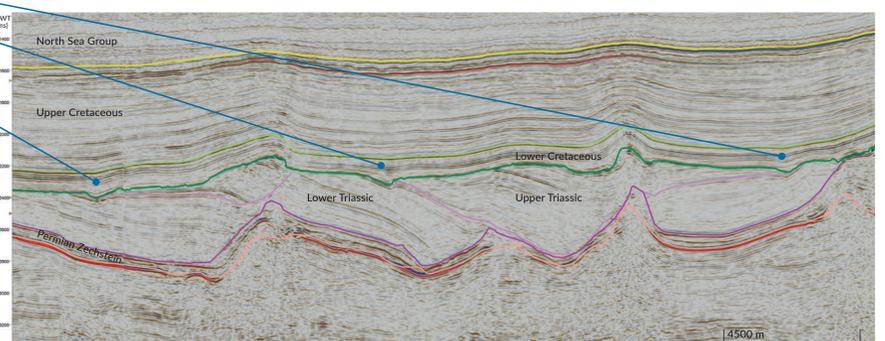


Fig. 8: Cross-section as indicated in fig. 7. Gullies are visible and located where Röt Evaporites are eroded or dissolved.