Depositional and Diagenetic Heterogeneity Control on Aquifer Quality: a Case Study of the Lower Triassic Sandstones in the Southeastern Part of Netherlands

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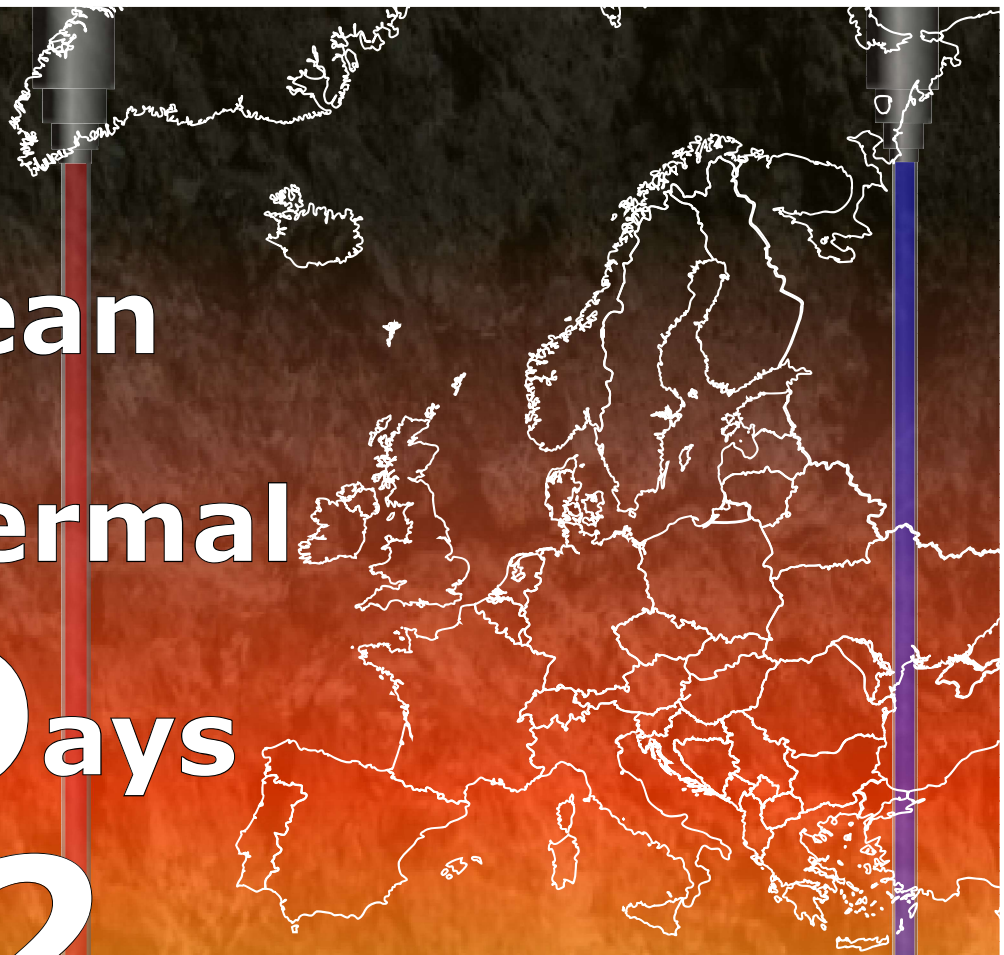

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Depositional and Diagenetic Heterogeneity Control on Aquifer Quality: a Case Study of the Lower Triassic Sandstones in the Southeastern Part of Netherlands

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A combined study of depositional facies and diagenesis variation was carried out to understand the main controls on aquifer quality of the Middle Buntsandstein in the southeastern part of the Netherlands. Heterogeneities in continental sandstone bodies occur at different spatial scales, ranging from micrometers to hundreds of meters. Commonly, such heterogeneities result from the interaction of depositional processes at various spatial and time scales. These processes partially also influence subsequent diagenetic evolution, hence present-day aquifer properties. Understanding the role of the resulting architectural heterogeneities in controlling the dynamic reservoir behavior is key in determining aquifer properties and improving pre-drilling prediction.

The sandstones of the Main Buntsandstein subgroup in the southeastern part of the Netherlands provide an excellent example where different detrital compositions, internal sedimentary architectures, and diverse burial histories have resulted in a wide range of present-day aquifer properties. In the study area, the aquifers are composed of stacked heterogenous alluvial sandstones bodies intercalated with mud-prone intervals deposited in arid to semi-arid conditions. Differences in sediment sources, transport mechanisms, and intrabasinal conditions resulted in a wide distribution of composition and texture. Additionally, the effect of post-depositional burial diagenesis in a basin with complex tectonic history created diverse burial histories across the basin.

The study aims to investigate the variation of present-day aquifer hydraulic parameters about changes in aquifer facies and architecture, detrital composition, as well as compaction and cementation during burial. Core sample analysis unfolded a diverse spectrum of sedimentary facies and lithic fragments, which differ between formations. Thin section analysis provides insights about mechanical compaction, cementations, and authigenic phases. By combining these results with petrophysical data on permeability and porosity of core samples, the major controls on present-day aquifer quality can be assessed.