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An integrated geological evaluation of the Lower Triassic Main Buntsandstein sandstones for deep geothermal applications in the southern Netherlands – HotTrias project

Cecchetti, Emilio; Martinius, Allard W.; Felder, Marita; Donselaar, Marinus E.; Bender, Annelies; Bertotti, Giovanni; Bruna, Pierre-Olivier; Abels, Hemmo A.

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Presenter's first name	Emilio
Presenter's last name	Cecchetti
Names of collaborators	Allard W. Martinius, Marita Felder, Marinus E. Donselaar, Annelies Bender, Giovanni Bertotti, Pierre O. Bruna, Hemmo A. Abels
PhD Student affiliation	Delft University of Technology
Country	The Netherlands
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Title of Abstract	An integrated geological evaluation of the Lower Triassic Main Buntsandstein sandstones for deep geothermal applications in the southern Netherlands – HotTrias project
Abstract (up to 300 words)	Sandstones from the Main Buntsandstein Subgroup represent a promising deep geothermal target in the subsurface of the Netherlands considering their widespread distribution and temperatures locally reaching 140-150 °C at depths of ~ 3 to 5 km. The Main Buntsandstein Subgroup is a sand-prone interval, but the reservoir quality of these sandstones is known to be heterogeneous as result of an interplay between depositional and diagenetic processes. This makes the Buntsandstein sediments an uncertain and risky geothermal play. In this project, we assess the syn- and post-depositional history of these sediments. The aim is to define structural, sedimentary, and diagenetic heterogeneities within the Main Buntsandstein sediments and assess their impact on reservoir quality. This will help reduce uncertainties for geothermal operations in the Triassic in the southern Netherlands and beyond. The structural analysis of the study area using seismic and well data reveals that the Main Buntsandstein sediments represent an early syn-rift sequence and that their present-day distribution is strongly controlled by faulting. In parallel, the study of the sedimentology and stratigraphy conducted on core and wireline data indicates that the depositional environment evolves through the Buntsandstein stratigraphy, resulting in the development of different reservoir architectures. Diagenesis has largely altered the primary relationship between sedimentary facies and porosity and permeability. Overall cementation seems to have a larger impact on reducing reservoir quality than compaction, with quartz, dolomite, and illite representing the most abundant types of cement. The analysis of fractures using core and image logs suggests that the fracture density is driven by the lithological variability within the Main Buntsandstein and that fracture joints and stylolites locally may contribute to enhancing the system permeability. The integrated assessment of the results allows the development of prospect play maps for the Buntsandstein in the southern Netherlands, addressing uncertainties and providing future recommendations for further exploration and optimizing geothermal operations in the Triassic.