Thermophysical reservoir properties of the Hauptdolomit-facies underneath the Viennese basin across fault zones analogues – a reservoir study for the GeoTief EXPLORE project

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The GeoTief EXPLORE project aims to explore the geothermal potential and quantify the geothermal resources of the Vienna Basin (Austria) and the underlying Northern Calcareous Alpine basement. The main target of geothermal interest is the massive and tectonically remolded Hauptdolomite facies that has been identified as potential geothermal reservoir in previous studies. Now, this formation is studied using outcrop analogues for the investigation of their petrophysical characterization and specific thermal properties (thermal conductivity and thermal diffusivity).

Here, we report new measurements on a total of 60 samples from 6 outcrops in and around the area of Vienna applying different methods for the laboratory measurement of thermal and hydraulic rock properties. The petrophysical analysis considers the impact of deformation along and across fault zones, which introduces heterogeneity of storage properties and consequently in the thermophysical properties. Using the standard fault core and damage zone model, outcrop samples were grouped into unfractured and fractured protoliths, as well as in fault rocks, like breccias and cataclasites. Rock samples are then classified by their fracture density (m² fracture surface per m³ rock) and by their matrix content and differences in grain sizes, respectively.

The measured thermal rock properties vary significantly between the selected rock groups. The total range [90 % of values] is between 3.2 and 5.0 W/(mK) for thermal conductivity and between 1.3 and 2.7 mm²/s for thermal diffusivity. The results generally met the expected trend for fractured rocks as conductivity and diffusivity decreases with increasing porosity under unsaturated and saturated conditions. The total porosities are less than 5%. The variability of thermal conductivity under saturated conditions shows complex trends depending on the different rock classifications where fault rocks and highly fractured rocks of the damage zone show lower increase in thermal conductivities.
The new petrophysical characterization will be the base for further numerical investigations of the hydraulic and thermal regime as well as for the analysis of the geothermal resources of the Hauptdolomite.