RES-T04: Facies relation and depth dependency of thermo-physical rock properties of the Upper Jurassic geothermal carbonate reservoirs of the Molasse Basin, Germany

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In the early stages of hydrothermal reservoir exploration, the thermo-physical characterization of the reservoir is mainly accomplished by evaluating drilling data and seismic surveys. Especially in carbonate reservoirs the distinction of different facies zones is very complex. For reservoir predictions, permeability, thermal conductivity/diffusivity, and specific heat capacity have to be quantified as precisely as possible. As these parameters show facies related trends, applying a thermofacies classification on the Upper Jurassic limestones is helpful to understand the heterogeneities and to identify production zones. Outcrop analogue studies enable the determination and correlation of facies related thermo-physical parameters and in combination with drilling data the geothermal exploration becomes more precise. The outcrops of the Swabian and Franconian Alb represent the target formations of Upper Jurassic carbonate reservoirs in the adjacent Molasse Basin. The hydraulic conductivity of these limestone formations is mainly controlled by tectonic elements and karstification. The type and grade of karstification is also facies related. A high variation of thermo-physical parameters is recognized within one facies zone. The matrix permeability has only a minor effect on the reservoir’s sustainability except for some grain- and dolostones with higher permeabilities and porosities. Mud- and wackestones show thermal conductivities around 2 (W m-1K-1). Permeabilities range from 10-18 m² to 10-13 m². Mudstones have lower thermal conductivities than wackestones due to their clay content. The permeability range of mud and wackestones is about the same. The thermal conductivities of the rudstone show values of 1.8 to 3.9 (W m-1K-1). Reefal structures show the highest values of thermal conductivity, due to secondary mineralized silicates and dolomites. Most parameters are determined on oven dried samples. The values therefore have to be corrected for water saturated rocks under the according temperature and pressure conditions. To validate these calculated parameters a Thermo-Triax-Cell simulating the temperature and pressure conditions in the reservoir is used. The facies related characterization and prediction of reservoir formations is a powerful tool for the design, operation, extension and quality management of geothermal reservoirs.