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Determination of thermal and hydraulic Properties for different Lithologies of Southern Germany

R. Jorand (1), R. Pechnig (2), D. Mottaghy (2), A. Koch (1), C. Clauser (1)

(1) RWTH Aachen University, Germany (r.jorand@geophysik.rwth-aachen.de / Fax: +49 241-8092132 / Phone: +49 241-8094835), (2) Geophysica Beratungsgesellschaft mbH, Germany (r.pechnig@geophysica.de / Phone: +49 241-18992916)

A better prediction of thermal and hydraulic properties would allow reducing the cost of geothermic exploitation. However, the thermal rock properties can be varying which can not completely constrain thermal characteristics at a specific site. Indeed, they are controlled not only by intrinsic parameters of the rock such as porosity, mineralogy and rock morphology, but also by external properties such as pressure and temperature. To improve this situation, this project will provide statistically relevant data of thermal and hydraulic properties for the subsurface of Germany. In the first stage, a large number of Mesozoic rock samples from the South-West German Molasse basin was chosen. About 280 core samples were tested by thermal and petrophysical core scanning yielding high resolution information on thermal conductivity, density, porosity and sonic velocity of the rocks in dry and saturated conditions. In addition, 100 core plugs were taken for measurements of specific heat capacity and hydraulic permeability and of XRD and XRF analyses. Thus, thermal properties could be related to the petrophysical characteristics and to the mineralogical and chemical rock composition. The geometric mixing law was confirmed as a fast and robust estimator for thermal conductivity, especially for limestones and dolomites regardless of their stratigraphic age and genetic origin. In a more sophisticated approach, the data were further used to compare and to calibrate theoretical models for thermal conductivity prediction. Rock type specific parameters were determined describing the relationship between rock matrix, porosity, rock morphology, and the effective thermal conductivity. These relations can further be combined with logging data in order to identify various lithologies. This grouping by rock type and rock generation allows an enhanced prediction of thermal properties of the Mesozoic strata of German sedimentary basins.