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Thermal properties of Tertiary sediments of the Lower Rhine Basin (Germany)

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We study the thermal and hydraulic rock properties of the subsurface in Germany in order to minimize the risk of failure of geothermal installations. In the current project stage, we have been analyzing fresh Tertiary drilling core sediments (clay, silt, sand, lignite) from an exploration well in the centre of the Lower Rhine Basin representative for the sequence of the youngest basin sediments of up to 1000 m depth. Different grades of consolidation and saturation as well as varying mineralogical compositions and grain sizes require different and customized methods for the measurement of rock properties in the laboratory. Beside porosity, matrix and neutron density and saturation, we measured thermal conductivity with an optical scanner and a needle probe. 90 samples from a depth between 44 m and 734 m show porosities predominantly between 35 % and 40 % and matrix densities of 2650 kg m^{-3} for sand, 2550 kg m^{-3} to 2750 kg m^{-3} for clay and 1420 kg m^{-3} for lignite. Thermal conductivity of the moist samples fresh from the borehole vary mainly between 1.4 W m^{-1} K^{-1} and 3.0 W m^{-1} K^{-1}, whereby lignite and clay represent the lower end and sand the upper end of this spectrum. In a subsequent step, the data set combined with logging data and complementary mineralogical analysis will be used to derive a lithological depth profile This, in turn, enables calculating the corresponding thermal conductivity profile. Finally, this approach allows to infer thermal conductivity from wireline data of ten further exploration wells in the Tertiary Lower Rhine Basin and its spatial variations.