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Thermal-transport properties of Cenozoic and Mesozoic geological formations in the Northeast German Basin

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Thermal properties of sedimentary formations are first-order controls on the thermal structure of basins. In order to overcome the limiting factor of the availability of drill core samples along the borehole profile and provide continuous thermal-conductivity profiles, standard petrophysical wireline logs and high-precision temperature logs can be used. As part of this approach, thermal conductivity was measured in the laboratory on Mesozoic sandstones from eight wells (predominantly geothermal boreholes) of the Northeast German Basin (NEGB). The measurements were made on drill core using the optical scanning method. Bulk thermal conductivities of sandstones, corrected for in situ thermal conditions, range between 2.1 and 3.8 W/m/K. In general, the Mesozoic sandstones show a large effective porosity typically ranging between 16 % and 30 %. Matrix thermal conductivity ranges from 3.4 to 7.4 W/m/K. The higher values are a reflection of large quartz content in some of the sandstones. Based on the in situ thermal conductivity and corresponding interval temperature gradient, obtained from high-precision temperature logs measured under thermal borehole equilibrium, interval heat-flow values were computed for two borehole locations in the Middle Buntsandstein section of the Stralsund area, at a depth between 1405 and 1521 m. The heat flow at that depth averages to 74 mW/m^2 (Gt Ss 1/85 borehole) and 78 mW/m^2 (Gt Ss 2/85 borehole), which is in good correspondence with previously reported heat-flow values for the NEGB. Based on the interval heat flow and a temperature gradient log, thermal conductivity was indirectly calculated for those parts of the section lacking measured laboratory values. Thus the Cenozoic and Mesozoic section of the Stralsund area, near the northern basin margin, show formation thermal conductivities between 1.5 and 3.8 W/m/K. Further work has to verify whether these values also qualify for other locations in the NEGB.