

Thermal Properties of West Siberian Sediments in Application to Basin and Petroleum Systems Modeling

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Quality of heat flow and rock thermal property data is the crucial question in basin and petroleum system modeling. A number of significant deviations in thermal conductivity values were observed during our integral geothermal study of West Siberian platform reporting that the corrections should be carried out in basin models. The experimental data including thermal anisotropy and heterogeneity measurements were obtained along of more than 15 000 core samples and about 4 500 core plugs. The measurements were performed in 1993–2015 with the optical scanning technique within the Continental Super-Deep Drilling Program (Russia) for scientific super-deep well Tyumenskaya SG-6, parametric super-deep well Yen-Yakhinskaya, and deep well Yarudeyskaya-38 as well as for 13 oil and gas fields in the West Siberia. Variations of the thermal conductivity tensor components in parallel and perpendicular direction to the layer stratification (assessed for 2D anisotropy model of the rock studied), volumetric heat capacity and thermal anisotropy coefficient values and average values of the thermal properties were the subject of statistical analysis for the uppermost deposits aged by: T₃-J₂ (200–165 Ma); J₂-J₃ (165–150 Ma); J₃ (150–145 Ma); K₁ (145–136 Ma); K₁-K₂ (125–94 Ma); K₂-Pg+Ng+Q (94–0 Ma). Uncertainties caused by deviations of thermal conductivity data from its average values were found to be as high as 45 % leading to unexpected errors in the basin heat flow determinations.

Also, the essential spatial-temporal variations in the thermal rock properties in the study area is proposed to be taken into account in thermo-hydrodynamic modeling of hydrocarbon recovery with thermal methods.

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