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Thermal regime of Tarim basin, northwest China

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Geothermal regime of sedimentary basin is important for understanding basin (de)formation geodynamics, and also holds key position in hydrocarbon generation and evaluation. Tarim basin is the largest intermountain basin in China that located in the Precambrian craton block, previous knowledge of thermal regime of this basin is from limited oil exploration borehole temperature, and controversies exist due to its data accuracy. Here we reported our latest state temperature logging results in this basin and discuss its thermal regime.

10 temperature loggings are conducted in the northern Tarim basin where the present major oil and gas fields are discovered. All the boreholes for temperature logging are non-production wells and shut in at least more than 2$\sim$3 years, ensuring the temperature equilibrium after drilling. The present geothermal gradient varies from 20.2 to 26.1°/km, with a mean of 22.0°/km. High gradients(26.1°/km of S4 well and 25.2°/km of S6 well) both occur in the Yakela gas field, larger than gradients in other oil fields, indicating higher thermal regime of gas field than oil field. In addition, some previous reported gradients in this area are obviously lower than our results, for instance, the previous gradient of THN2 well is 13.2°/km but 23.2°/km in this time, and not enough equilibrium time in previous logging accounts for this discrepancy.

Combined with measured thermal conductivity data, heat flow is also estimated, and the heat flow is between 38mW/m^2 and 52mW/m^2, with a mean of 43 mW/m^2. Generally, heat flow pattern in this basin is mainly controlled by the base topography, showing large heat flow in the uplift areas and low in the depression; other factors also influence this pattern locally, and large heat flow is also found in the area with salts, showing the effect of thermophysical properties.

As presented above, the Tarim basin is of low geothermal regime, compared with other Meso-Cenozoic rift basins in the east China, but shares the similar thermal settings with those typical Precambrian craton basins in the world, such as the Michigan and Siberia basin.