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塔里木盆地现今地热特征

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Present-day geothermal regime in Tarim basin, northwest China

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摘要

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摘要 地温梯度和大地热流是揭示盆地现今热状态的重要参数,它们对理解盆地的构造-热演化过程及油气资源评价等方面均具有重要意义.利用塔里木盆地约470口井的测井温度资料和941块岩石热导率数据,本文计算了塔里木盆地38个新的大地热流数据,进而揭示了该盆地现今地热分布特征.研究表明,塔里木盆地现今地温梯度变化范围为17~32 °C/km,平均为22.6±3.0 °C/km;大地热流变化范围为26.2~65.4 mW/m²,平均为43.0±8.5 mW/m².与我国其他大中型沉积盆地相比,它表现为低地温、低大地热流的冷盆的热状态,但仍具有与世界上典型克拉通盆地相似的地热背景.整体而言,盆地隆起区地温梯度和热流相对较高,坳陷区地温梯度和热流则偏低.此外,我们还发现塔里木盆地现有的油气田区一般位于高地温梯度区域,这可能与下部热流体的向上运移和聚集有关.影响塔里木盆地现今地热特征的因素包括盆地深部结构、构造演化、岩石热物理性质、盆地基底构造形态和烃类聚集等.

关键词 地温梯度, 热导率, 大地热流, 热状态, 塔里木盆地

Abstract: Geothermal gradient and terrestrial heat flow are key parameters that describe the thermal regime of sedimentary basin, and are so vital for understanding the tectono-thermal evolution and associated hydrocarbon resource potential assessment of oil and gas bearing basin. Here we show the distribution pattern of the updated present-day geothermal gradient and calculate 38 terrestrial heat flow values in the Tarim basin, one of the biggest sedimentary basins in China, based on the formation temperature data from approximately 470 wells and 941 thermal conductivity of rocks within this basin. Our results show that the present-day geothermal gradient of Tarim basin varies between 17~32 °C/km with a mean value of 22.6±3.0 °C/km, and the terrestrial heat flow ranges from 26.2 to 65.4 mW/m² with a mean of 43.0±8.5 mW/m², suggesting a thermal regime of cold basin with low temperature and low heat flow, as compared with other large-middle scale sedimentary basins in China. This low thermal regime also makes Tarim basin to share the similar geothermal characteristics of other typical craton basins in the world. Generally, the geothermal gradient and terrestrial heat flow in uplift areas are usually larger than those in the depressions. We also find that the discovered oil and gas fields in Tarim are usually with relatively large geothermal gradient, the cause for this coincidence is not clear but the upward movement and accumulation of hot fluid below is speculated to account for this positive geothermal anomaly. Finally, we summarize the factors that influence the geothermal distribution of basin as deep structure, tectonic evolution and basement pattern of basin, thermal physical properties of rocks and hydrocarbon accumulation as well.

Keywords Geothermal gradient, Thermal conductivity, Terrestrial heat flow, Geothermal regime, Tarim basin

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