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(U-Th)/He年龄在沉积盆地构造—热演化研究中的应用——以塔里木盆地KQ1井为例

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Application of the (U-Th)/He thermochronometry to the tectono-thermal evolution of sedimentary basin——A case history of Well KQ1 in the Tarim Basin

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摘要

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摘要 (U-Th)/He热定年技术是近年来用于沉积盆地热史研究的新技术, 目前主要是利用磷灰石和锆石的He年龄来揭示地层的构造抬升和热历史. 本文依据塔里木盆地钻井样品的实测磷灰石和锆石(U-Th)/He年龄数据, 初步得出了该地区磷灰石(U-Th)/He年龄的封闭温度为85℃, 并建立了深度/温度—年龄演化模式; 锆石则未达到其较高的封闭温度. 综合利用本次实测的He年龄数据结合磷灰石裂变径迹和等效镜质组反射率等古温标, 模拟计算了塔里木盆地孔雀1井(KQ1)自奥陶纪末期以来的热历史. 模拟结果表明, 孔雀1井区奥陶纪末期的地温梯度可达35.5℃/km, 志留纪—泥盆纪时期的地温梯度为33.3~34.5℃/km, 白垩纪末期地温梯度27.6℃/km左右. 因此, (U-Th)/He年龄结合其他古温标综合模拟的方法可以很好地揭示沉积盆地的热历史. 特别是该技术为缺乏常规古温标的塔里木盆地地下古生界碳酸盐岩层系所经受热史的恢复提供了新的方法.

关键词 (U-Th)/He年龄, 磷灰石, 锆石, 裂变径迹, 孔雀河地区

Abstract: The (U-Th)/He thermochronometry of apatite or zircon has been used as a new technique to study the structural uplift and thermal history of sedimentary basins in recent years. Based on the tested apatite and zircon He ages data from drilling wells samples, an evolution model of apatite He ages with depth and/or temperature is built, which illustrates that the He closure temperature in apatite is about 85℃ in the Tarim basin. However, the zircon He ages reveals that these samples hadn't undergone its higher closure temperature. The thermal history since Ordovician in Well KQ1 has been modeled by using the He ages, AFT and R_0 data. The modeling result shows that the thermal gradient was about 35.5℃/km in the end of Ordovician, and 33.3~34.5℃/km during the period of Silurian to Devonian, and it decreased to 27.6℃/km in the end of Cretaceous. Therefore, the (U-Th)/He ages may provide a newly tool to rebuilt the thermal history of sedimentary basins, especially to the Low Paleozoic carbonate stratum in Tarim basin which is lack of normal thermal indicators.

Keywords (U-Th)/He thermochronometry, Apatite, Zircon, Fission track, Kongquehe Area

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