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四川盆地南部地区新生代隆升剥露研究——低温热年代学证据

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Cenozoic uplift and exhumation in southern Sichuan Basin—Evidence from low-temperature thermochronology

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摘要

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摘要

本文通过背斜褶皱变形与低温热年代学年龄(磷灰石和锆石(U-Th)/He、磷灰石裂变径迹)端元模型研究,约束低起伏度、低斜率地貌特征的四川盆地南部地区新生代隆升剥露过程.四川盆地南部沐川和桑木场背斜地区新生代渐新世-中新世发生了相似的快速隆升剥露过程(速率为~0.1 mm/a、现今地表剥蚀厚度1.0~2.0 km),反映出盆地克拉通基底对区域均一性快速抬升冷却过程的控制作用.川南沐川地区磷灰石(U-Th)/He年龄值为~10—28.6 Ma,样品年龄与古深度具有明显的线性关系,揭示新生代~10—30 Ma以速率为0.12±0.02 mm/a的稳态隆升剥露过程.桑木场背斜地区磷灰石裂变径迹年龄为~36—52 Ma,古深度空间上样品AFT年龄变化不明显(~50 Ma)、且具有相似的径迹长度(~12.0 μm).磷灰石裂变径迹热演化史模拟表明桑木场地区经历三个阶段热演化过程:埋深增温阶段(~80 Ma以前)、缓慢抬升冷却阶段(80—20 Ma)和快速隆升剥露阶段(~20 Ma—现今),新生代隆升剥露速率大致分别为~0.025 mm/a和~0.1 mm/a.新生代青藏高原大规模地壳物质东向运动与四川盆地克拉通基底挤压,受板缘边界主断裂带差异性构造特征控制造就了青藏高原东缘不同的边界地貌特征.

关键词 低温热年代学, 隆升剥露, 褶皱变形, 四川盆地, 青藏高原东缘

Abstract:

Based on the model of low-temperature thermochronology (apatite and zircon (U-Th)/He, apatite fission track) and folding in anticlines, we decipher the uplift and exhumation in southern Sichuan basin during Cenozoic time, which is characterized by low-relief and low-slope in topography. The Muchuan and Sangmunchang area underwent rapid uplift and exhumation in Oligocene-Miocene, with a rate of ~0.1 mm/a and a magnitude of 1.0~2.0 km of surface erosion. It indicates that the craton basement has exerted a significant influence on the regional uplift and exhumation. The apatite (U-Th)/He ages range from ~10 Ma to 28.6 Ma in Muchuan anticline, there is a distinct decrease in AHe ages with the increasing depth to show a steady-state uplift and exhumation with a rate of 0.12±0.02 mm/a during this time. However, the apatite fission-track ages range from ~36 Ma to 52 Ma in Sangmunchang anticline, the AFT ages and the track lengths show no distinct change in depth, with a roughly similar value of ~50 Ma in ages and ~12.0 μm in lengths. Temperature-time histories of AFT show that most samples experienced three episodes of evolution. After arriving at the largest depth of subsidence around ~80 Ma, there is a slow uplift and cooling process between 80 Ma to 20 Ma with a rate of ~0.025 mm/a, followed by a rapid uplift and exhumation with a rate of ~0.1 mm/a. The compression between the eastward moving crust in Tibet and the craton basement in Sichuan basin accommodated different kinematic vectors in vertical and horizontal under the control of different boundary faults around the basin. Thus, it had a profound influence on the mount-building in eastern margin of Tibetan plateau and Sichuan basin.

Keywords Low-temperature thermochronology, Uplift and exhumation, Deformation, Sichuan basin, Eastern margin of Tibetan Plateau

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