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胶北~2.5Ga岩浆热事件的锆石Hf同位素特征及其对地壳演化的指示意义

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摘要:

位于华北克拉通东缘的胶北地体,被普遍认为是胶-辽-吉带的西南组成部分,经历了多期岩浆-变质热事件,而晚太古宙末期约2.5Ga的岩浆事件是该区最强的岩浆事件;为了确定该期岩浆热事件的性质,本文选取2件形成于约2.5Ga的英云闪长质片麻岩及花岗质片麻岩开展锆石Hf同位素测试分析;总计69个锆石Hf同位素分析点的结果显示,它们均具有正的 $\epsilon_{\text{Hf}}(t)$ 值,在10.71到3.0之间,平均为6.02,两阶段锆石Hf模式年龄主要分布于2.6~2.9Ga之间,平均为2747Ma,明显大于锆石的 $^{207}\text{Pb}/^{206}\text{Pb}$ 年龄,表明约2.5Ga的TTG及花岗质片麻岩主要源于2.6~2.9Ga新生地壳的重熔或再造;另外,一些锆石具有极正的 $\epsilon_{\text{Hf}}(t)$ 值,它们的锆石Hf模式年龄与U-Pb年龄相近,这暗示在约2.5Ga有亏损地幔物质加入地壳,并发生了即时重熔;根据本次研究获得的锆石Hf同位素数据,结合前人的Nd同位素结果,我们认为胶北地体内约2.5Ga的岩浆活动可能主要表现为与地幔岩浆低侵作用有关的新生地壳的重熔或再造,约2.9Ga和2.7~2.8Ga是胶北地体地壳生长的两个时期,并且与华北克拉通大部分地区一样,2.7~2.8Ga是胶北地体新生地壳形成最重要的时期。

英文摘要:

The Jiaobei terrane located in the eastern margin of the North China Craton (NCC), is commonly regarded as the southwestern segment of the Jiao-Liao-Jiao belt, and underwent polyphase magmatic and metamorphic events during Early Precambrian. In order to confirm the nature of the ~2.5Ga magmatic event which is the most significant magmatic event in the Jiaobei terrane, as well as in the NCC, in this study, two representative tonalitic and granitic gneiss samples with zircon U-Pb ages of ~2.5Ga are performed in zircon Hf isotopic analysis. The results of total 69 zircon Hf isotopic analyses show that they have positive $\epsilon_{\text{Hf}}(t)$ values ranging from 10.71 to 3.0 with an average of 6.02; Their two-stage Hf model ages (t_{DM2}) mainly range from 2.6Ga to 2.9Ga (an average of 2747Ma), and older than their zircon $^{207}\text{Pb}/^{206}\text{Pb}$ ages of ~2.5Ga, suggest that the ~2.5Ga TTG and granitic rocks were mainly derived from remelting or reworking of juvenile crusts forming during 2.6~2.9Ga. In addition, a few zircons from the gneisses have strongly positive $\epsilon_{\text{Hf}}(t)$ values of 7.03 to 10.71, and their zircon Hf model ages are close to zircon U-Pb ages representing the timing of zircon growth, indicative of new addition of coeval depleted mantle material to crust. Based on the results of zircon Hf isotopic analyses presented in this study and available Nd isotopic data published in previous studies, we suggest that the ~2.5Ga magmatic event in the Jiaobei terrane represents the remelting or reworking of juvenile crust, which is linked to the underplating of large amounts of mantle-derived magmas, and ~2.9Ga and 2.7~2.8Ga are two periods of crustal growth, especially, 2.7~2.8Ga is the most significant period of crustal growth in the Jiaobei terrane, as well as other areas in the NCC.

关键词: [锆石Hf同位素](#) [~2.5Ga岩浆热事件](#) [地壳演化](#) [胶北地体](#) [华北克拉通](#)

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