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福建太武山花岗岩体成因: 锆石U-Pb年代学与Hf同位素制约

作者	单位	E-mail
<a href="#">赵姣龙</a>	<a href="#">南京大学内生金属矿床成矿机制研究国家重点实验室, 地球科学与工程学院, 南京 210093</a>	
<a href="#">邱检生</a>	<a href="#">南京大学内生金属矿床成矿机制研究国家重点实验室, 地球科学与工程学院, 南京 210093</a>	<a href="mailto:jsqiu@nju.edu.cn">jsqiu@nju.edu.cn</a>
<a href="#">李真</a>	<a href="#">南京大学内生金属矿床成矿机制研究国家重点实验室, 地球科学与工程学院, 南京 210093</a>	
<a href="#">刘亮</a>	<a href="#">南京大学内生金属矿床成矿机制研究国家重点实验室, 地球科学与工程学院, 南京 210093</a>	
<a href="#">李友连</a>	<a href="#">南京大学内生金属矿床成矿机制研究国家重点实验室, 地球科学与工程学院, 南京 210093</a>	

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摘要:

太武山岩体位于福建东南沿海, 为一大致呈北东向延伸的不规则状岩株体, 出露面积约40km<sup>2</sup>。岩体主体岩性为中细粒花岗岩, 环岩体北部边缘尚发育有似斑状黑云母花岗岩。锆石LA-ICP-MS U-Pb定年表明, 岩体的形成年龄为 $96.9 \pm 1.3\text{Ma}$  (MSWD=1.09,  $2\sigma$ ), 属晚白垩世早期岩浆活动产物。化学组成上, 该岩体富硅, 碱含量中等, 弱过铝, 铝饱和指数(A/NKC值)为1.01~1.04, 碱铝指数(AKI值)为0.73~0.92, 贫钙、镁、铁, 属亚碱弱过铝质花岗岩类。微量和稀土元素组成上, 岩体富Cs、Rb、U、Th、Pb和轻稀土, 贫Ba、Sr、P、Ti, Rb/Sr比值高, 具中到强的铕负异常( $\text{Eu}/\text{Eu}^* = 0.85 \sim 0.04$ ), 其Zr、Nb、Ce、Y等高场强元素均较之典型A型花岗岩偏低, 锆石饱和温度也较低(726~809℃)。综合地质地球化学资料指示该岩体应属高分异的I型花岗岩。太武山花岗岩的锆石 $\epsilon_{\text{Hf}}(t)$ 值散布于正值与负值之间(-1.44~2.78),  $t_{\text{DM2}}$ 值偏低(0.98~1.25Ga, 平均值为1.06Ga), 指示成岩过程中应有显著的亏损地幔组分参与。综合分析表明, 岩体的形成首先经历了幔源岩浆与其诱发地壳物质熔融产生的长英质岩浆在地壳深部混合, 随后这一混合岩浆又经进一步分异演化的二阶段成岩过程。

英文摘要:

The Taiwushan granite pluton, with an outcropped area of about 40 km<sup>2</sup>, is roughly elongated NE-trending as an irregular stock in the coastal region of SE Fujian Province. Lithologically, this pluton consists mainly of medium to fine-grained granites, with minor porphyrocytic biotite granites surrounding the north marginal parts. Zircon LA-ICP-MS U-Pb dating yields an age of  $96.9 \pm 1.3\text{Ma}$  (MSWD=1.09,  $2\sigma$ ), indicating that this pluton was generated in the initial stage of Late Cretaceous. Chemically, the Taiwushan granites are enriched in silicon, and depleted in calcium, magnesium and iron. They also have moderately alkaline contents and show weakly peraluminous signature with A/NKC values of 1.01~1.04 and AKI values of 0.73~0.92, thus can be grouped into subalkaline and weakly peraluminous granitoids. On trace and REE aspects, the granites are enriched in Cs, Rb, U, Th, Pb and LREE, depleted in Ba, Sr, P, Ti, and show high Rb/Sr ratios and moderately to strongly negative europium anomalies ( $\text{Eu}/\text{Eu}^* = 0.85 \sim 0.04$ ). They also have lower Zr, Nb, Ce, Y concentrations and lower zircon saturation temperatures (726~809℃) relative to that of the typical A-type granites. Integrated geological and geochemical data suggest that the Taiwushan pluton should be genetically ascribed to highly fractionated I-type granites. Zircon Hf isotopic compositions of the granites are variable, with  $\epsilon_{\text{Hf}}(t)$  values ranging from negative to positive (-1.44~2.78). Correspondingly, they show younger two-stage Hf model ages ranging from 0.98Ga to 1.25Ga with a mean value of 1.06Ga, indicating that large amounts of depleted mantle materials had been involved in magma genesis. Based on a synthesis of geology, geochronology, elemental and isotopic geochemistry, we suggest that the Taiwushan granites were most likely generated via a two-stage process including formation of parental magma by mixing of a depleted mantle-derived magma and an induced crustal-melted felsic magma in the deep crust, and then suffered further differentiation during magma ascent.

关键词: [高分异I型花岗岩](#) [锆石U-Pb定年](#) [Hf同位素组成](#) [岩石成因](#) [福建太武山岩体](#)

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