

雅鲁藏布江蛇绿岩中地幔柱型岩浆作用 ——来自氦、氩同位素的证据

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摘要: 雅鲁藏布江蛇绿岩的氦、氩同位素组成分别是: 蛇绿岩中变质橄榄岩的 $3\text{He}/4\text{He}$ 比值为 $1.104\sim 3.384\text{Ra}$, 平均为 2.383Ra ; 玄武岩的He同位素组成比较均一, $3\text{He}/4\text{He}$ 平均值为 5.359Ra ; 辉绿岩的 $3\text{He}/4\text{He}$ 比值变化较大, 为 $1\sim 5\text{Ra}$ 。由于各岩石样品有不同程度的蚀变, 造成放射性成因He的加入, 因此大多数样品He同位素组成比低于亏损地幔大洋中脊玄武岩(MORB $\approx 8\text{Ra}$), 不能真实反映源区特征。而采自吉定的辉绿岩样品 $3\text{He}/4\text{He}$ 比值平均高达 31.57Ra , 与夏威夷发现的热点地幔源区的样品比值接近; 分步加热法进一步测试, 其高比值的He是在低温区段释放的。这种高 $3\text{He}/4\text{He}$ 比值He的捕获, 表明雅鲁藏布江蛇绿岩形成时, 存在地幔柱型富集地幔岩浆作用。

关键词: 蛇绿岩; 氦同位素组成; 氩同位素组成; 地幔柱型岩浆作用; 雅鲁藏布江

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Plume-type magmatism in the Yarlung Zangbo ophiolites, Tibet

—Evidence from the helium and argon isotopic compositions

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Abstract: The Helium and argon isotopic compositions of the Yarlung Zangbo ophiolites in Tibet have revealed that the $3\text{He}/4\text{He}$ ratios of serpentinites (metaperidotites) in ophiolites vary between 1.104 and 3.384Ra with an average value of 2.383Ra , that the helium isotopic composition of basalts is uniform with an average $3\text{He}/4\text{He}$ ratio of 5.359Ra , and that the $3\text{He}/4\text{He}$ ratios of diabases vary widely between 1 and 5Ra . As different degrees of alteration of all rock samples have resulted in introduction of radiogenic He, the $3\text{He}/4\text{He}$ ratios of most samples are lower than that (MORB $\approx 8\text{Ra}$) of MORB of the depleted mantle and thus cannot truly reflect the characteristics of their original magma source. However, the $3\text{He}/4\text{He}$ ratios of three diabases samples from Jiding are as high as 31.57Ra on the average, relatively close to the previously reported values for the samples from Hawaii hotspots. Stepwise heating measurements have further revealed that He with the highest $3\text{He}/4\text{He}$ ratio was released from the low-temperature area. This suggests that plume magmatism played an important role in forming the Yarlung Zangbo ophiolites.

Key words: ophiolite; helium isotopic composition; argon isotopic composition; plume-type magmatism; Yarlung Zangbo River