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## 佛冈高分异I型花岗岩的成因:来自Nb-Ta-Zr-Hf等元素的制约

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### 摘要:

华南南岭地区发育有大面积的与锡钨成矿相关的侏罗纪花岗岩,然而其中有些花岗岩的成因类型却难以确定。本文以佛冈岩体为例结合前人已发表数据,对佛冈花岗岩体中Nb、Ta、Zr和Hf等元素的迁移特征及其原理进行探讨,并对佛冈花岗岩的成因类型进行了厘定。随着分异程度增加,佛冈花岗岩Nb和Ta含量增加,Nb/Ta(3.6~15.3)和Zr/Hf(17.3~38.9)比值降低并发生分异。随着Zr含量的降低,佛冈花岗岩的Zr/Hf比值降低,这一特征表明锆石的分离结晶作用使得佛冈花岗岩的Zr/Hf比值分异。Nb/Ta比值分异可能与角闪石和黑云母的分离结晶作用有关。随着Nb/Ta比值降低,Y/Ho比值增加,这一特征表明佛冈花岗岩Nb/Ta比值的分异也和岩浆演化后期的流体有关。佛冈花岗岩不含原生的富铝矿物,为准铝质到弱过铝质岩石。随着分异程度增加,佛冈花岗岩P<sub>2</sub>O<sub>5</sub>含量降低,表明它不是S型花岗岩。随着Y/Ho比值增加和Nb/Ta和Zr/Hf比值降低,佛冈花岗岩Ga/Al和FeO<sup>T</sup>/MgO比值增加,从典型I型花岗岩特征演化到类似A型花岗岩的地球化学特征。因此,我们认为佛冈花岗岩不是A型花岗岩而是高分异的I型花岗岩。区域上与成矿相关的流体和花岗质岩浆的相互作用和分离结晶作用,使得华南南岭地区的花岗岩地球化学特征复杂,所以其成因类型也变的难以确定。

### 英文摘要:

Jurassic granitoids are widespread in the interior of South China. However, the genetic types of some plutons are still controversial. In this paper, we show an example (Fogang batholith) of how to distinguish I-, S- and A-type granitoids. Fogang batholith is the largest Jurassic granitic pluton, located in the Guangdong Province. With increasing differentiation, the contents of Nb and Ta progressively increase, whereas those of Zr and Hf show gradual decrease. Both Nb/Ta and Zr/Hf ratios show decrease with the fractionation of granitoids (15.3~3.6 and 38.9~17.3 respectively). Fractionation of zircons result in lower Zr/Hf ratio with strongly decreasing Zr concentration. Fractionation of amphibole and biotite produce decreased Nb/Ta ratio with the differentiation of granitoids. The Nb/Ta ratios of the Fogang granites correlate positively with Y/Ho ratios, indicating that the fluid also played a key role in the variation of the contents of Nb and Ta and Nb/Ta ratios in Fogang granitoids. The absence of Al-rich minerals and the negative correlation between Zr and P<sub>2</sub>O<sub>5</sub> preclude the Fogang batholith to be S-type granite. Ga/Al and FeO<sup>T</sup>/MgO ratios correlate positively with the Ta and Nb contents, and Y/Ho and Nb/Ta ratios, implying that the high Ga/Al and FeO<sup>T</sup>/MgO ratios of Fogang granites result from fractionation and fluid-magma interaction. Therefore, the Fogang batholith is deduced to be metaluminous to slightly peraluminous I-type granitoids rather than A-type granites. This work highlights that the fluid-melt/rock interaction makes it difficult to directly define the genetic types of some granitic plutons.

关键词: [Zr/Hf和Nb/Ta](#) [花岗岩](#) [地球化学](#) [岩石成因](#) [华南](#)

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