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浙江龙游沐尘早白垩世石英二长岩体的成因: 镁铁质包体及寄主岩的元素与Sr-Nd同位素地球化学证据

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摘要：

沐尘岩体呈北北东向出露于浙江龙游县沐尘至遂昌县双溪口一带,为早白垩世晚期(112Ma)岩浆活动的产物。岩体主体岩性为石英二长岩,岩体中普遍发育形态多样的暗色镁铁质微粒包体。包体岩性主要为黑云母二长闪长岩,包体多呈椭球形或卵形等塑性形态,大小不一,从几厘米到几十厘米不等。主量元素组成上,寄主石英二长岩具有中酸性、准铝质、富碱、富钾等特征;镁铁质包体则偏基性、贫钾。微量和稀土元素组成上,寄主岩富集Rb、K、Th、U,贫Sr、P、Nb、Ta、Ti,且Zr、Hf含量相对较高,具中-强的铕负异常(Eu/Eu^{*}=0.12~0.60)。镁铁质包体具有相似的微量元素特征,但相对富集Sr、P,贫Zr、Hf,铕负异常中等或不明显(Eu/Eu^{*}=0.43~0.93)。寄主岩及镁铁质包体具有相似的初始Sr、Nd同位素组成,I_{Sr}分别为0.7062~0.7065和0.7058~0.7070,$\varepsilon_{Nd}(t)$值均偏高,分别为-3.19~-2.43和-2.60~0.58。在主量元素氧化物比值相关图解及微量元素与同位素协变图解上,镁铁质包体与寄主岩之间呈现出良好的协变关系,从地球化学角度为成岩过程中存在岩浆混合作用提供了可靠证据。温压计算表明沐尘岩体为温度偏高(797~851℃)的中深成岩体(6~7km)。综合岩石学、元素地球化学与Sr-Nd同位素组成特征,表明沐尘石英二长岩及镁铁质包体最可能是在引张构造背景下,由亏损的地幔组分及其诱发的地壳物质部分熔融形成的长英质岩浆经混合后,并经进一步的分异演化形成。

英文摘要：

The Muchen pluton, outcropped with a NNE-trending around Muchen of Longyou County and Shuangxikou of Suichang County in Zhejiang Province, was generated during the late stage of Early Cretaceous (112Ma). Lithologically, this pluton comprises mainly of quartz monzonites, with abundant mafic microgranular enclaves (MMEs) of different shapes. The MMEs, consisting mainly of biotite monzodiorite, commonly show ellipsoidal or ovoid plastic shape, and vary from a few to several tens of centimeters in size. Geochemically, the host quartz monzonites show intermediate-acidic, metaluminous, alkaline and potassium-rich signatures, whereas the MMEs are relatively poor in silicon and potassium. The host quartz monzonites are enriched in Rb, K, Th, U, and depleted in Sr, P, Nb, Ta, Ti, and display moderately Zr, Hf peaks in the primitive mantle-normalized trace element spidergrams, and moderately to strongly europium depletions (Eu/Eu^{*}=0.12~0.60) in the chondrite-normalized REE distribution patterns. The MMEs share similar trace and rare earth element characteristics to those of the host rocks, but are relatively enriched in Sr, P and more depleted in Zr, Hf, and display weakly to moderately europium depletions (Eu/Eu^{*}=0.43~0.93). The MMEs and host quartz monzonites show similar Sr and Nd isotopic compositions, with I_{Sr} values of 0.7058~0.7070 and 0.7062~0.7065, and $\varepsilon_{Nd}(t)$ values of -2.60~0.58 and -3.19~-2.43, respectively. On the major element oxide ratios and trace elements versus isotopic compositions co-variation diagrams, the MMEs and host quartz monzonites demonstrate a distinctive covariant relationship, providing reliable geochemical evidence that magma mixing had been occurred during their petrogenesis. Using the zircon saturation geothermometer and the Al-in-hornblende geobarometer, the rock-forming temperature and pressure have been estimated. The results have suggested that the pluton was crystallized in high temperatures of 797℃ to 851℃ and at an intermediate depth (emplacement depth of about 6~7 km). The integrated petrology, elemental and isotopic compositions suggest that the MMEs and the host rocks were most likely generated via a process including mixing of depleted mantle-derived mafic magmas and induced felsic magmas by partial melting of crust materials under an extensional setting, and suffered further differentiation during magma ascent.

关键词：镁铁质微粒包体 石英二长岩 地球化学 岩浆混合作用 早白垩世晚期 浙江沐尘岩体

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