

Geochemical connection between the Granitic plutons and the rhyolitic volcanics: A case of the Cretaceous granitic magmatism in the central Sulu orogen, eastern China

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There was a early Cretaceous felsic LIPs developed in the central Sulu orogen. It contains multi-stage granitic pluton and andesitic-dacitic-rhyolitic volcanism. The crystal-poor rhyolitic ignimbrite in Lingshan island has been proved not to be derived from the intermediate igneous rock. This research focuses on constructing the geochemical connection between the eruptive rhyolite and the plutonic granite.

The granitic pluton is a suit of I-A type association represented by alkali granite (A-type) and syengranite (I-type). The Zircon U-Pb dating results give the ages of the rhyolite, the A-type granite and the I-type granite are 121.6 ± 1.3 Ma, 120.7 ± 1.8 Ma and 116.8 ± 1.1 Ma respectively. The I-type and the rhyolites show similar geochemical characteristics with extremely high SiO₂(75~79%), low MgO content(0.1~0.2%) and strong Eu anomaly (0.3~0.4), but the I-type ones have lower REEs contents. These suggest the rhyolite is not derived from the I-type granite although the rhyolites are plotted in I&S&M area in the X-1000Ga/Al diagrams. The rhyolite is likely formed by removing mineral assemblages of (0.77Fsp + 0.125Plag + 0.05Bt + 0.033Am + 0.006Ap + 0.025Mag) through 35%-45% fractional crystallization, from the A-type granite (the relatively parental magma with SiO₂ 69~74%). The relatively depleted in some incompatible elements related to minerals of the rhyolites than the granites ($Sr_{\text{rhyolite}}/Sr_{\text{Atype}} \approx 0.7$, $Ba_{\text{rhyolite}}/Ba_{\text{Atype}} \approx 0.5$, $Ce_{\text{rhyolite}}/Ce_{\text{Atype}} \approx 0.3$) also prove that the fractional crystallization occurred during the extraction of the High-SiO₂ rhyolitic melt from the A-type granitic crystal mushes underlying. The intermediate enclaves (SiO₂ 59% , FeOt 5.6%, MgO 2.32%) in the I-type granite indicate the magma mixing during its formation. It was caused by a magma mixing event between the felsic magma and a latter basic recharging magma, and then underwent highly fractionated crystallization processes.

The evolution of the granitic magmatism not only uncovers the inner relationships but also implies the root-delamination and the asthenosphere upwelling at ≈ 120 Ma.