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Zircon U-Pb Age and Geochemistry of Rhyolite in Jianshui, Yunnan and Its Geological Implications

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A series of complete basalt- andesite- dacite- rhyolite sequence outcrop in Jianshui area, southwest part of Shizong-Mile belt. The form the background for this set of rock series is full of controversy. Some researcher think it as part of the Emeishan volcanic rocks (He bin et al., 2003); and another part of the scholars think that the rocks formed in active continental margin (Dong Yunpeng et al., 1999; Xie Jing et al., 2006). Few research on volcanic high-precision chronology in this area has been done since the volcanic rocks were identified to form in the Permian according to features of the fossil assemblage from biolithite intercalations in conjunction with its stratigraphic position by Yunnan Geology and Mineral Bureau (1990). Through to the rhyolite in zircon U - Pb chronology and geochemical study, The author find early cretaceous volcanic rocks formed in rift environment for the first time. Most of Zircons which picked out from the samples of rhyolite are columnar. In the cathodoluminescence(CL) images, the zircons show good crystal morphology and clear oscillatory zoning, as is the case of magmatic zircon. This article come to the age $115.6 \pm 1.0\text{Ma}$ (MSWD = 0.21) of rhyolite by zircon LA-ICP-MS U-Pb dating, which shows the age of the ejected rhyolite is early Cretaceous. We found the early cretaceous volcanic rocks in the area for the first time. Geochemically, the SiO_2 content of 73.47%~74.63% indicates an acidic characteristic, while total alkali ($\text{K}_2\text{O}+\text{Na}_2\text{O}$) ranges from 4.4% to 7.1% with Rittman index (δ) of 0.08~ 0.10 which reveals calc-alkaline in lithology. The entire samples plot in rhyolite field in the TAS vs. $\text{Nb/Y-Zr/TiO}_2 \times 10^{-4}$ discrimination diagram. Aluminum saturation index (A/CNK) values of 1.12~2.05, greater than 1.1, suggest that the rocks are strong peraluminous. The Characteristics of low $\text{Fe}_2\text{O}_3\text{T}$ (3.13%~3.72%), low MgO (0.15%~0.64%) and low $\text{Mg}^\#$

(8.42~25.5) are quite similar to those of A type granites. TiO_2 content of the rhyolite in Jianshui varied between 0.29%~0.37%, significantly lower than Emeishan volcanic rocks with TiO_2 content of 2.4%~4.29% in adjacent areas (Wang Yunliang et al., 1987), while the former has relatively high total REE content ($109\mu\text{g/g}$ ~ $185\mu\text{g/g}$), 33-56 times of the chondrite ($3.3\mu\text{g/g}$), significantly lower than the latter with total rare earth elements of $278\mu\text{g/g}$ ~ $315\mu\text{g/g}$ (Wang Fangzheng et al., 1997). Chondrite-normalized REE patterns show the relative enrichment of light rare earth elements and $(\text{La/Yb})_N$ ratios between 4.16~6.70 implicate a general level of light and heavy REE fractionation. There is a certain degree of negative Eu anomalies ($\delta\text{Eu} = 0.59\text{-}0.65$), indicating the presence of plagioclase fractional crystallization. Primitive mantle normalized spider diagram shows that the overall samples are enriched in large ion lithophile elements (Rb, Ba) and high field strength elements (Th, Ta, Zr, Hf), and has a high content of Pb ($10.27\mu\text{g/g}$ ~ $18.45\mu\text{g/g}$), flatter depleted in Nb, Sr, Eu. Rhyolites in Jianshui are stable in Zr/Hf (34.8-36.1), and Nb content of $17.06\mu\text{g/g}$ ~ $18.00\mu\text{g/g}$. These features make rhyolites in Jianshui significantly different from the island arc and mid-ocean ridge volcanics, and have excellent similarity with the upper continental crust's. A-type granites are divided into A_1 and A_2 type by Eby (1992) based on their geochemical characteristics. Rhyolites in the study area are plotted in A_2 type granites area in the Nb-Y-Ce discrimination diagrams, which originated from the continental crust or the lower crust within the plate and formed mainly in the extensional tectonic environment. In Rb-Y+Nb and Nb-Y diagrams, samples between WPG and syn-COLG, which further confirmed the rhyolite forming in extensional environment. In summary, the rhyolite in Jianshui may be the partial melting product of continental crust, and not be part of the Emeishan large igneous province. Combining geochronology with geochemistry, rhyolite in Jianshui

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formed in extensional tectonic environment in the Early Cretaceous. Therefore, Jianshui area, southwest part of Shizong-Mile belt is probably continental-rift environment in the Early Cretaceous along with volcanic activities occurring.

Key words: Jianshui, Yunnan; rhyolite; U-Pb age; geochemistry; extensional environment

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