Zircon U-Pb age and petrogenesis of the middle-Permian highly fractionated granite in Ludian, northwestern Yunnan, China

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The Sanjiang orogenic belt located in the east of the Eastern Syntax, is an important part of the Tethyan tectonic domain. The Jingshajiang suture zone represented one of the Paleo-Tethyan branch in the Sanjiang area, which was open during early Carboniferous to middle Permian, and started to subduction in late Permian, finally collision at late Triassic. The western subduction of the Jingshajiang oceanic plate formed the Jiangda-Weixi arc belt. Ludian batholith located in the southern segment of the Jiangda-Weixi arc belt. This research focused on the geochronology, petrogenesis and magmatic evolution of the Ludian granite. Zircons from Ludian granite sample were used for LA-ICP-MS U-Pb analysis and show weighted mean age of 271.0±2.8 Ma. Combined with previous researches, which show the Ludian granites formed in the late Triassic, the Ludian batholith magmatism lasted from middle Permian to late Triassic. The middle Permian granite show high SiO_2 (73.07~73.89 wt.%), high Na_2O+K_2O (6.50~6.53 wt.%), high differentiation index (85~86), and significant negative Eu anomalies (Eu/Eu*= 0.58~0.62), and strong depletion of Nb, Ta, Ti, Sr, similar to I-type granite. Their zircon $\varepsilon_{Hf}(t)$ range from -5.01~0.58, with an average of -1.40, which indicated the significant mantle material contribution to the magma source. We suggest that the Ludian middle Permian granite was formed under volcanic arc setting related to the western subduction of the Jingshajiang oceanic plate. Our study provides direct magmatism evidence for the middle Permian subduction of the Jingshajiang Tethyan ocean.