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Structural deformation-metamorphism and exhumation processes of Yuanmou metamorphic complex, Yunnan, China

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Within orogenic zone and continental extensional area, it often developed metamorphic complex or metamorphic gneiss dome that widely exposed continental mid-lower crustal rocks, which is an ideal place to study exhumation processes of deep-seated metamorphic complex and rheology. The Yuanmou metamorphic complex is located in the south-central part of the "Kangdian Axis" in the western margin of Qiangtang Block and Yangtze Block, which is a part of the anticline of the Sichuan-Yunnan platform. Many research works mainly focus on the discussion of intrusion ages, aeromagnetic anomalies, and polymetallic deposits. However, the exhumation process and mechanism of the Yuanmou metamorphic complex are rarely discussed and still unclear. This study, based on detailed field geological observations, optical microscopy (OM), cathodoluminescence (CL), electron backscatter diffraction (EBSD) and electron probe (EMPA) were performed to illustrate the geological structure features, deformation-metamorphic evolution process and its tectonic significance of Yuanmou metamorphic complex during the exhumation process. All these analysis results indicate that the Yuanmou metamorphic complex generally exhibits a dome structure with deep metamorphic rocks and deformed rocks of varying degrees widely developed. Mylonitic gneiss and granitic intrusions are located in the footwall of the Yuanmou, which have suffered high-temperature shearing. The mylonitic fabrics and mineral stretching lineations in the deformed rock are strongly developed, forming typical S-L or L-shaped structural features. The high-temperature ductile deformation-metamorphism environment is high amphibolite facies, that is, the temperature range is between 620 ~ 690 °C and the pressure is between 0.8 ~ 0.95 Gpa. In the deformed rocks closed to the detachment fault, some of the mylonite fabric features are retained, but most of them have experienced a strongly overprinted retrogression metamorphism and deformation. At the top of the detachment fault zone, it is mainly composed of cataclasites and fault gouge. The comprehensive macro- and microstructural characteristics, geometry, kinematics, and mineral (amphibole, quartz and calcite) EBSD textures indicate that the Yuanmou metamorphic complex has undergone a progressive exhumation process during regional extension, obvious high-temperature plastic deformation-metamorphism in the early stage, and superimposed of low-temperature plastic-brittle and brittle deformation in the subsequent stage, which is also accompanied by strong fluid activities during the exhumation process.