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Tectonics and Geochronology of the Northern Margin of the Zhongba Terrane, Southern Tibet: Implications for the Closure of the Western Yarlung Zangbo Suture Zone

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The Zhongba terrane represents a special tectonic unit sitting between the northern and the southern ophiolitic sub-belt in the western segment of the Yarlung Zangbo Suture Zone (YZSZ), which separates the Indian and the Eurasian continental plates. Thus, the structural characteristics and evolution of this terrane should offer critical clues to understanding tectonic evolution of the YZSZ and the closing processes of the Neo-Tethys. Based on deformation features, the central-east section of the Zhongba terrane can be divided into fault-fold belt, fold belt and fault belt. The fault-fold belt, composed of northward-dipping thrust faults and asymmetric folds in the Carboniferous and late Devonian strata, mainly occurs at the northern margin of the Zhongba terrane. Four stages of deformation (D_1-D_4) can be recognized in this belt. Stage D_1 is recorded by the rolling folds in the Devonian strata in which the residual S_0 can be observed in asymmetric small folds induced by interlayer shear sliding under NS compression. Quartz c-axis fabrics show that the dominant slip system of quartz is basal <a> under transpression and low temperature (~400°C). In the stage D_2, many small folds with axial plane inclined at high angle to the north were formed. The highly inclined C foliation in mylonitic limestones suggests that this belt represents the strain concentration zone during the northward subduction of the Neo-Tethyan lithosphere beneath the Gangdese arc belt. Coaxial progressive deformation is demonstrated by strongly shortened layers and abundant cleavages that are parallel to the axial plane of pre-existing folds in the stage D_3. Mylonitic foliation is replaced by the cleavages plane (S_2) associated with southward thrusts. In the stage D_4, some northward thrusts and relevant cleavage with medium angle replaced early folds.

LA-ICP-MS zircon U-Pb dating was combined with ^{40}Ar-^{39}Ar dating to constrain the above deformation events in the Zhongba terrane. Zircon U–Pb ages found in nearby quartz diorites at Gangdese arc belt yielded 91.8±1.3 Ma. Since these quartz diorites are compositionally similar to island-arc magma from active continental margins, we infer that the northward subduction of the north sub-belt of YZSZ started in the upper Cretaceous. Muscovite separates from representative tectonites within the strain concentration zone and the southward thrust belts yielded $^{40}Ar/^{39}Ar$ age of 71.6±1.1 Ma and 56.5±2.5 Ma, respectively. The former represents the collisional time between the Zhongba terrane and the Gangdese arc, while the latter indicates the final closing time of the Neo-Tethys ocean.

On the basis of structural characteristics and geochronology from the northern margin of the Zhongba Terrane, the tectonic evolution of the research area is summarized as follows: 1) expansion of the Neo-Tethys ocean in the western segment of the YZSZ (~125Ma); 2) northward subduction and subsequent collision of the north belt of the western YZSZ (90–70Ma); 3) closure of the Neo-Tethys ocean and initial collision of the India-Asia (~55 Ma).

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