Deep crustal deformation, anatexis and rheological significance of the Continental-Scale Chongshan Strike-Slip shear zone on the Southeastern Tibetan Plateau

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Abstract: Anatexis (i.e., partial melting) commonly occurs during crustal thickening, post-collisional collapse or exhumation and tectonic regime transition. It plays a crucial role in the evolution processes of tectono-thermal, rheological, and deformation behavior of the continental crust in orogenic belts. Continental-scale strike-slip shear zones often record significant tectono-magmatism and dynamic deformation processes of the crustal lithosphere. However, the genetic relationships and timing among the anatexis, deformation, and initial shearing along a strike-slip shear zone have not been well defined. The Chongshan shear zone (CS-SZ) is an important hundred-kilometer-long continental scale strike-slip shear zone on the Southeastern Tibetan Plateau. The CS-SZ involved contemporaneous activity with the adjacent sinistral Ailaoshan–Red River shear zone and dextral Gaoligong shear zone during the Cenozoic. In this study, we present a combined result of detailed field, microstructural, zircon U–Pb geochronology, geochemical and EBSD texture analyses of leucogranites and migmatites in the CS-SZ. The results indicate that most migmatites and leucogranites exhibit strong shear deformation and well-developed high-temperature mylonitic microstructures. The quartz aggregated from foliated leucogranites developed dominant high-temperature prism <c> and prism <a> slip systems. The pre- and syn-kinematic crustal anatexis and localized weak zone mainly occurred from 35–29 Ma along the CS-SZ, which is closely related to the post-collisional extension and collapse of overthickened crust. Leucogranites that further experienced fractional crystallization of plagioclase and K-feldspar during melting and subsequent melt migration and emplacement upward along the pre-existing tectonic weak zone. The thinning and weakening of lithospheric crust further facilitated the initial and formation strike-slip displacement along the CS-SZ, which occurred from 29 Ma to 20 Ma or much later to 18 Ma. Finally, we propose that crustal anatexis and upward migrating melts play a key role in controlling the thermal state and rheological strength of the crust, resulting in nucleation and initiation of the localized deep-seated shear zone that accommodates significant displacement for the India–Asia continental forward collision and intracontinental deformation.