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Geochronogy of leucogranites in Yadong region: constraints on the age of the South Tibetan Detachment System in central-eastern Himalaya

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The South Tibetan Detachment System (STDS) is a series of low-angle normal faults with an extension of more than 2000 km along strike of the Himalaya orogen (Burchfiel et al., 1992). It separates the high-grade rocks of the Greater Himalaya Sequence (GHS) from the generally low-grade metasedimentary rocks of Tethyan Himalaya Sequence (THS) above. Knowing the timing of deformations related to the STDS is critical to understanding the exhumation history of the Himalaya. In central-eastern Himalaya, the STDS is disrupted by a major northeast-trending fault zone that was referred as Yadong Cross Structure (YCS). Exposures of the STDS either side of the YCS have been well determined, and the cessation timing of shearing have been estimated prior to 22∼16 Ma for the western section and younger than 12 Ma for the eastern section (see the review in Leloup et al., 2010). It suggests that the YCS is key region that corresponds to a major timing discontinuity. However, the exposure of STDS in Yadong region and its activity timing has not been well constrained.

Field mapping of the Yadong region reveals that a klippen of Cambrian biotite schist, chlorite schist, calcischists and quartzite, and Ordovician limestones of the THS units was resting on garnet-sillimanite-plagioclase gneisses, augen granitic gneisses and migmatites of the GHS basement (China University of Geosciences, 2005, unpublished). Structural relationships indicate that the contact is a low-angle normal fault, which was termed as Yadong shear zone (Xu et al., 2013). We correlate the Yadong shear zone to the STDS following the broader convention that STDS is defined as the contact between the THS and GHS.

There are two leucogranite plutons within the shear zone, the Dingga pluton to the north and the Gaowu pluton to the south. They intruded into both GHS and THS, with the main bodies are undeformed and isotropic. Furthermore, there are numbers of undeformed dykes crosscut the foliations of the country rocks. Field relations indicate that after intrusion of the leucogranites, there was no significant movement of the shear zone. Monazite from the main body and dykes were analyzed for Th–Pb isotopes to constrain the time of intrusions. Three samples from the main body of Dingga pluton show fairly homogeneous 208Pb/232Th data, with weighted average dates of 19.3 $\pm$ 0.2 Ma, 20.0 $\pm$ 0.3 Ma, and 20.8 $\pm$ 0.1 Ma, respectively. These dates indicate an Early Miocene emplacement and crystallization age of ca. 20 Ma. Dykes structurally adjacent to the main bodies of Dingga pluton and Gaowu pluton gave final crystallization age of 16.4 $\pm$ 0.3 Ma and 16.3 $\pm$ 0.3 Ma, respectively. From monazite geochronology and field relationships, we can conclude that the undeformed Dingga and Gaowu leucogranites crosscuted the boundary between the GHS and THS at ca. 20 Ma and ca. 16 Ma, and constrained the end of motion of the STDS in Yadong region at least prior to 20 Ma.