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New age constraints on the timing of deformation along the right-lateral Karakorum fault (Ladakh).

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The timing and the offset of the Karakorum fault zone (KFZ) in western Tibet have been debated (e.g., Searle and Philips, 2004; Valli et al., 2008). The information is important in better understanding of the role of large strike-slip faults in collisional belts. To further constrain the initiation of the KFZ deformation, we obtained geochronological, microstructural and petrological data of granitoids and leucocratic/pegmatitic dykes in the 8-km wide KFZ in the Tangtse – Darbuk area.

Zircons from 6 granitoids and 8 leucocratic/pegmatitic dykes were dated either with a SHRIMPII (ESS/GSC) or a LA-IC-MS (LMV) and yield ages ranging from 435±5 Ma to 14.2±0.4 Ma, with some samples showing two age populations. Old ages are inherited from the Ladakh and Karakorum batholiths. Thirteen out of 22 age populations are younger than 25.6 Ma. Ages of deformed dykes range between 18.9 Ma (Sample LA28) and 14.2 Ma, whereas those of crosscutting dykes between 16 and 14.5 Ma. Four granitoids show evidences for post 25 Ma magmatism. The syntectonic South Tangtse granite (LA21), which bounds the KFZ to the south, has the age of 18.5±0.2 Ma. These ages suggest the granitic magmatism started before ∼25 Ma, was synchronous with the deformation since at least ∼19 Ma, and lasted until ∼14 Ma. The microstructures of these rocks indicate that the deformation took place during cooling from above ∼550°C to ∼300°C. This cooling history is constrained by 13 new Ar/Ar ages from amphiboles, biotites, muscovites and K-feldspar in 10 samples. Cooling was diachronic across the KFZ: ∼12 Ma in the SW (South Tangtse granite) and ∼8.5 Ma in the NE (Muglib). Deformation changed to brittle faulting after 8 Ma along the Muglib fault bounding the KFZ to the NE.
The magmatic and cooling history obtained during this study is comparable to that in the Ayilari range 200 km along strike to the SE reported by Valli et al. (2007, 2008): granitic magmatism at ∼25-22 Ma was followed by metamorphism and metasomatism until ∼14 Ma, and then by rapid cooling below ∼300°C.

The ages of syntectonic intrusions in the two areas over the strike length of 200 km demonstrate that the deformation of the KFZ started prior to 22.7±0.1 Ma in the North Ayilari (C32, Valli et al., 2007) and ∼18.5 (LA 28 and LA 21, this study). Using the total offset of 200 to 240 km, a slip rate is calculated to be on the order of 11-13 mm/year. If all Miocene granitoids in the KFZ are syntectonic, the slip rate would be 8-9.6 mm/yr. In either case, the data suggest that the KFZ is a major long-lasting structure linked with important magmatism.