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New U/Pb zircon ages demonstrating Karakorum shear zone activity prior to 18 Ma

Emmanuelle Boutonnet (1), Philippe Hervé Leloup (2), William Davis (3), and Keiko Hattori (4)

(1) L.S.T. UMR CNRS 5570, Université de Lyon 1, France (emmanuelle.boutonnet@ens-lyon.fr), (2) L.S.T. UMR CNRS 5570, Université de Lyon 1, France (herve.leloup@univ-lyon1.fr), (3) ESS/GSC-CNCB/GSC-CC/GEOCHRON, Geological Survey of Canada (Bill.Davis@NRCan-RNCan.gc.ca), (4) Department of Earth Sciences, University of Ottawa, Canada (khattori@uOttawa.ca)

In western Tibet, the timing and total offset of the Karakorum fault zone (KFZ) have been debated. This has important bearing on the long-term slip rate of the fault and the general significance of large-slip faults in collision belts. Valli et al (2008) proposed a minimum age of 22 Ma for fault initiation based on the age of syntectonic dykes in the Ayilari range. On the other hand, Searle and Phillips (2004) , based on work in the Tangtse area more than 200 km away to the NW, asserted that right-lateral ductile deformation occurred between 15.7±0.5 Ma and 13.7±0.3 Ma. This assertion is based on the interpretation of most granitoids within the shear zone to be pre-kinematic to the right-lateral shear.

To further constrain the initiation of the KFZ deformation, we dated zircon grains from the South Tangtse granite in the western extension of the Tangste gorge. The granite, which has never been described in details, shows an undeformed body with a typical granite mineralogy (Q + orthose megacryst + biotite), and is intruded by undeformed leucocratic dykes. Towards the NE the granite exhibits a faint NW-SE magmatic foliation that progressively develops into a mylonitic fabric close to the Tangtse strand of the KFZ. These field relationships show that the South Tangtse granite was emplaced synkinematically to right-lateral shear in the KFZ. Zircon from undeformed granite (sample LA21) show inherited Paleozoic cores mantled by younger rims dated at 18,5 ± 0,2 Ma (12 meas., MSWD = 2,07). Zircon from a contiguous dyke (sample LA20) have a crystallization age of 18.6±0.2 Ma (11 meas., MSWD = 2.18). The rim ages are interpreted as the age of granite and dyke crystallisation and thus give a ∼18 Ma lower bound for the timing of initial right-lateral shear along the KFZ.

Within the Tangtse strand of the KFZ, leucogranite dykes crosscut the right-lateral schistosity, but are affected by ductile to brittle right-lateral shear parallel to that schistosity. One of these leucogranites (LA60) yielded zircon showing uraninite exsolution and very high U contents (≥ 2900 ppm). Seven Shrimp 207Pb-corrected 206U/238Pb ages of these zircon span from 16.3 to 18.9 Ma. It has been shown that matrix effects related to high uranium content (>2000 ppm) systematically bias the Pb/U measurement to higher values and older apparent ages. Six of the seven measurements show a clear correlation between 206U/238Pb age and 238U/196Zr2O (U content), that can be used to infer a single corrected age of 16.0 ± 0.6 Ma (6 meas., MSWD = 2,6 - 6 grains). This age is interpreted as the timing of crystallisation of the late dyke and demonstrates that right-lateral ductile deformation occurred prior to ∼16 Ma in this area.
Leucogranites, including pegmatitic dykes, and granites from within the Karakorum shear zone show emplacement ages between 13.7 ± 0.2 and 20.8±0.4 Ma ages (this study; Jain and Singh, 2008; Phillips et al., 2004; Ravikant et al., 2009; Reichardt et al., in press). Most of these granites, at least all younger than 18.5 Ma, are syntectonic. It implies that magmatism during syn-strike-slip shearing is important and confirms that the KFZ is at least ∼18.5 Ma old and cannot be considered as a transient secondary structure.