Geophysical Research Abstracts
Vol. 14, EGU2012-7978, 2012
EGU General Assembly 2012

Synkinematic magmatism, heterogeneous deformation, and progressive strain localization in a strike-slip shear zone. The case of the right-lateral Karakorum fault.

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The Pangong range is an 8km wide shear zone corresponding to the exhumed root of the central Karakorum fault zone (KFZ), one of the great continental strike-slip faults of the India-Asia collision zone. Ductile deformation is the most intense in the Tangtse and Muglib strands which bracket the shear zone to the SW and NE respectively. Structural and microstructural data show that deformation was at least partly synchronous with partial melting and the intrusion of granitic bodies and dykes. New U/Pb SHRIMPII and LA-ICP-MS ages for 24 zircons populations, from 5 gneiss and mylonites as well as 10 leucocratic dykes, span in age from 105.1±1.1 Ma to 14.2±0.1 Ma. Old ages are inherited from the surrounding Cretaceous Ladakh and Karakorum batholiths, while 13 ages are younger than 25.6 Ma and reflect Miocene partial melting. The oldest dyke that can be shown to be syntectonic to the KFZ is 18.8±0.4 Ma old, suggesting that strike slip deformation started in the Tangtse strand at least at ∼19 Ma. Other published U/Pb ages imply that deformation lasted until at least ∼13.5 Ma. The absolute ages of dykes that are deformed or crosscut the foliation demonstrate that deformation was heterogeneous in space and time.
24 new Ar/Ar ages, together with published ones, allow reconstructing the shear zone cooling history. Cooling was diachronic across strike and ductile deformation (∼300°C) stopped earlier in the SW than in the NE: at ∼16 Ma in the south Tangtse granite, ∼11 Ma in the Tangtse strand, ∼9Ma in the Pangong range, and ∼ 8Ma in the Muglib Strand. Deformation thus appears to have migrated / localized from the whole shear zone to the Muglib strand, the only locus showing evidence for brittle deformation and active faulting. Taking into account data previously collected along the KFZ, and a finite offset of 200 to 240 km, it appears that the fault has been active for at least 22 Ma, with a slip rate of 0.84 to 1.3 cm/yr in its central section.
Stain rates measured in quartz ribbon with the QSR method from 5 samples across the Tangtse shear zone are higher in the two mylonitic strands than in the surrounding rocks. The corresponding integrated shear rate is on the order of 5.7 E-14 s-1, which would corresponds to an integrated fault rate on the order of 1.45 cm yr-1. Such rate is close to, but somewhat higher, than the fault rate deduced from geological constraints.
This study conducted in the frontal part of the Himalayan orogen shows that large continental strike-slip faults can be linked with magmatism and be stable for more than 20 Ma, even in the hottest part of the orogen where strain localization is supposed to be at a minimum. While de fault zone propagates along strike, deformation also migrates across-strike within the ∼8km wide shear zone.