Towards a spatially and temporally constant Karakorum fault slip rate

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Detailed study of the Karakorum fault (KF), a major intra-continental strike-slip fault, is important to improve our understanding of the present-day kinematic role of large strike-slip faults in the deformation of Tibet. Indeed, fast rates argue in favor of block models and suggest lateral transfer of material along strike-slip faults [e.g. 1-4], while slow rates argue in favor of continuous deformation models and crustal thickening with minor lateral transfer [e.g. 5]. Recent papers [e.g. 6, 7] suggested that existing velocity fields and geologic rates on active faults in Asia are still too sparse and poorly constrained (both spatially and temporally) to discriminate between a wide range of deformation models. Therefore, new slip-rate data at different timescales and locations are essential to better understand the deformation of Tibet.

The range of geodetic and geologic slip-rates is ~0 – 11 mm/yr along this structure. At short timescales, InSAR data suggest a rate of 1±3 mm/yr [8] or 0-6±2 mm/yr [9], and GPS data yield between 3–4 mm/yr [10-12] up to ~11 mm/yr [13]. At the long-term timescale (Ma), using geochronology, the rate is ~5-10 mm/yr [e.g. 14-21], even though some authors [22] suggests that the northern section is inactive in the Quaternary.

In order to constrain slip-rates at the Late Quaternary timescale using tectonic-geomorphology, we studied 29 distinct surfaces (8 alluvial surfaces and 8 lateral moraines) located along the southern half of the KF and along its northernmost tip in the Chinese Pamir, that are offset by the fault by varying amounts from 7 to 1520 m. These surface ages were determined using ^{10}Be surface-exposure dating of ~300 quartz-rich samples. Our data [23-26] suggest that the KF slip-rate does not decrease toward its tips but is constant along strike, at >5 mm/yr on one fault branch or >7 mm/yr across two branches. This rate is on the same order than that determined by the same technique [4±1 mm/yr on one branch, 27]. In addition to being spatially constant, this late Quaternary rate appears to be, within error, in agreement with most studies at various timescales and suggests that at first approximation, no major discrepancy exists between geodetic and geologic rates.

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