Geophysical Research Abstracts, Vol. 8, 08990, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08990

Active tectonics in the Xainza rift (S-Tibet) expressed by multiple generations of fault scarps in Quaternary sediments.

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The late Cenozoic tectonic evolution of the Tibetan plateau is dominated by prominent strike-slip fault systems and kinematically linked N-S trending rifts, accommodating E-directed extrusion and internal constrictional strain. Studies on surface ruptures, global positioning system velocities, fault slips, distribution of epicenters and focal mechanisms undoubtedly confirm ongoing deformation on the Tibetan plateau. Fault scarps are abundant in tectonically active areas and are the surface expression of slip along subsurface faults during major earthquakes (M$>$6.0). Quantitative investigation of fault scarps help improve our understanding of the spatial and temporal distribution of active faults and their kinematic interplay over 10^6 year time scales, especially when systematically combined with longer-term constraints, such as from thermochronometry.

The Xainza rift is located in the central part of the Lhasa block in southern Tibet ca. 300 km west of Lhasa. Like other extensional rift systems in the area (e.g., Yadong-Gulu or Tangra Yum Co), it is characterized by spectacular topography in the uplifted footwall flank and moderate relief in the hanging wall separated by sedimentary basins. To the north, it is kinematically linked to the right-lateral Garing Co strike-slip fault. The northern part of the rift can be subdivided into three arcuate rift segments. Fault scarps in the northern and middle segment are located close to the range front and follow the interface between bedrock and on-lapping basin fill. At the mouth of major drainage valleys, Quaternary fluvial sediments and in some cases lateral moraines are offset by active normal faults. In contrast, active fault scarps in the southern part are

located at a distance from the range front and offset voluminous fluvial terraces, while the range front normal fault appears abandoned. The central part of this $\sim$10 km long structure is defined by a sharp terrace edge formed by a series of closely-spaced scarps with a cumulative offset up to 80 m. To the north and south, multiple fault scarps with surface offsets of less than 10 m that diverge from the main fault strand marking complex fault relay zones. We have identified five distinct terrace levels marked by spectacular terrace risers in multiple drainages. These terrace risers are differentially offset by the normal faults demonstrating that these morphologic features were formed by repeated seismic events followed by development of new terrace levels. Surface offsets range from 1.5-4.5 m on the lower terraces (T1-T3) to 80 m on T5. Small-offset fault scarps offsetting younger fluvial terraces laterally increase cumulative displacement within older terrace surfaces clearly indicating multiple reactivations of fault strands. Cosmogenic nuclide dating of samples from soil pits on five terrace levels (T0, T2, T3, T4, and T5) is currently in progress to constrain fault slip rates on the different fault scarps. Quantification of slip rates and systematic integration with footwall thermochronometric data will allow for a better understanding of fault dynamics within the rift and elucidate the nature of strain transfer from the Garing Co strike-slip fault.