Geophysical Research Abstracts, Vol. 9, 04429, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04429

No surface evidence for recent channel flow imprint in Eastern Tibet

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Located west of the Sichuan Basin, the Longmen Shan mountain range constitutes the eastern border of the Tibetan Plateau. Its morphology is characterized by a steep regional gradient, comparable with that observed in the Himalayas. Nevertheless, despite this significant topographic step, no active convergence is detected across that border of the plateau, in particular from geodesy [Chen et al, 2000].

On the ground of those observations several authors have proposed explanations for topography building and sustainment in this area. The most widely advocated model propose the existence of mid-crustal channel flow of low viscosity material from the Plateau interior toward the Sichuan Basin (e.g. Clark et al, [2005]). The flow is supposed to be deviated by the cold rigid Yangtze Craton under the Sichuan Basin, which induces surface uplift in the Longmen Shan and would explain the existence of high topography in this area.

We present here a new set of data from (U-Th)/He thermochronometry, cosmogenic isotope measurements in modern river sands, and quantitative geomorphology. Our data indicates that, (1) the maximum for denudation is not located in the high topographic front of the range, but rather behind this area, and (2) the intensity of denudation processes decreases with time. On this basis we propose that the temporal and spatial evolution of denudation processes for the last 10 Myr can be explained by the propagation of a regressive erosion wave, acting on a tectonically passive inherited topographic step.

The global implications of this hypothesis are tested using a finite element thermo-mechanical model, considering the erosion of a margin without tectonic forcing. The results of our modelling are consistent with the available observations, including heat

flow, geodetic velocities and erosion rates. Furthermore it appears that the action of erosion on the Plateau margin induces large scale crustal deformation, with rates and pattern significantly different from what is proposed in classical channel flow models.