Geophysical Research Abstracts
Vol. 12, EGU2010-3427-1, 2010
EGU General Assembly 2010

The growth of facteted spurs at normal fault escarpments : Insights from analog models

Vincent Strak (1), Stéphane Dominguez (2), Carole Petit (1), and Bertrand Meyer (1)

(1) ISTEP, UMR 7193, UPMC Université Paris 6, CNRS, Paris, France (corresponding author : vincent.strak@upmc.fr), (2) Géosciences Montpellier, UMR 5243, Université Montpellier 2, CNRS, Montpellier, France

In extensional tectonic contexts, interactions between crustal deformation, erosion and sedimentation often result in faceted spurs formation along active normal fault scarps. Those geomorphic markers are potentially of great interest to study active fault kinematics and the evolution of landscape morphology. Faceted spurs are generally observed in regions where rainfall rate is large enough to allow for the development of a mature drainage network (Basin and Range, Baikal Rift, Aegean region). Indeed, it seems that, in regions characterized by more arid climatic conditions, faceted spurs are very rare (e.g., several places of the East African Rift).
To better constrain how facets arise and evolve depending on active deformation through time, we developed an approach based on experimental modeling. We constructed a mechanical device reproducing the growth of a single normal fault scarp. Erosion of the model was performed by using a rainfall system composed of 18 sprinklers. The experimental set-up includes a DEM acquisition system based on laser interferometry and allowed computing model topography and the erosion-sedimentation budget at several stages.

A first set of experiments, designed with one rigid tray moving down along the fault plane, succeeded in reproducing the main morphologic features encountered in the field (faceted spurs, drainage basin, drainage network, alluvial fans). Facets grew and their number decreased with time during the experiment due to regressive erosion of the footwall and river valley capture processes.

Nonetheless, the important falling of the base-level due to rigid block motion precluded a meaningful quantitative comparison with natural examples. Indeed, after a large fault offset, facets were sorely conserved because basin subsidence is too important. We performed, then, a second set of experiments including a flexure of the hanging-wall, which reduced the base level fall. This set of experiments showed more realistic facets morphologies (crest lines, facets heights and slopes comparable to natural examples) that were better conserved. We then performed several experiments with varying slip rates in order to understand the impact of this parameter. Our results indicate that the incision rate in fault-perpendicular catchments appears primarily controlled by the fault slip rate, which suggests that the shape of faceted spurs is dominantly controlled by tectonics, as suggested by numerical models (Petit et al., this issue).