Geophysical Research Abstracts
Vol. 13, EGU2011-11278, 2011
EGU General Assembly 2011

Late Neogene landforms as indicators of neotectonic movements in the Katutau - Altynemel Range (Tien Shan, Kazakhstan)

Nadine Seib, Jonas Kley, Thomas Voigt, and Martin Kober
Jena University, Institute for Geosciences, Jena, Germany (Jonas.Kley@uni-jena.de)

The Tien Shan is an intraplate mountain chain marking the boundary between the Kazakh shield and Tarim basin. It is about 2500 km long in E-W direction and up to 250 km wide. High topography and strong seismicity of the region indicate active orogeny. GPS measurements also show active, roughly N-S shortening of the Tien Shan by 22mm/year. The modern topography results from rapid deformation and uplift in the Tien Shan since Miocene time, much later than the initial India-Asia collision some 50 Ma ago. Paleoclimate reconstructions show climate fluctuations from arid (warm-dry) to pluvial (cool-wet) during the last 7000 years. The Katutau is a low mountain range in the northern Tien Shan foreland, situated between the higher Altynemel range in the north and the large Ili river in the south. A system of partly deformed pediment surfaces and river terraces characterizes the southern slopes of the Katutau.

The drainage network is a particularly sensitive indicator of tectonic movements and climate change. Surface uplift and varying discharge initiate the creation of river terraces. Nevertheless, the analysis of terrace and pediment surfaces provides the possibility to estimate uplift by comparing relative elevations of the geomorphic surfaces.

Terrace and pediment surfaces of presumably Quaternary age can be readily separated from outcrops of Neogene bedrock on satellite images. However, discerning different Quaternary landforms requires more advanced processing of the data. A specific problem is to compare the order and elevations of terrace levels from different rivers.

Here we present a method which uses processing of Landsat and SRTM satellite data as a basis for enhanced mapping of geomorphic surfaces. The processed Landsat data reveal the outlines and extent of individual Quaternary landforms and associated deposits, such as terraces, alluvial fans and pediments. Processing of SRTM data allows to separate different terrace levels based on relative elevation and other features and to analyse their relations.

Most terraces of the Katutau′s southern slopes are of degradational type. A distinctive feature of many reserved terrace remnants is armoring by calcretes or gravel which erode much slower than the Neogene deposits. Where such armoring layers are breached by erosion, rapid headward incision of deep channels into the Neogene sediments begins.

Field work and analysis of the satellite data suggest active uplift of our study area. Differential uplift of the areas west and east of the Usek river, a large south-flowing tributary of the Ili river, is indicated by different depths of erosion: the eastern area has a continuous Quaternary cover but stands higher than the western one where outcrops of Neogene rocks are widespread. This may indicate a reversal in relative elevation and a covered fault along the Usek river.

The young, generally gently sloping pediments south of the Katutau locally steepen across one continuous, linear feature. We interpret this as a fold scarp overlying an active blind thrust fault.

Another prominent knick line east of the Usek river may either represent a thrust trace or an old terrace belonging to an earlier Usek valley of different orientation.

The method presented here provided a possibility to analyse the spatial and relative temporal relationships of landforms over a large area with a limited amount of ground truthing.