Geophysical Research Abstracts
Vol. 12, EGU2010-13873, 2010
EGU General Assembly 2010

Geomorphologic coupling and decoupling in a Mediterranean mountain catchment under changing environmental conditions as evidenced by sediment fingerprinting

Koen D'Haen (1), Gert Verstraeten (1,2), Patrick Degryse (1,2), Bert Dusar (1), Marc Waelkens (2,3)

(1) Department of Earth and Environmental Sciences, K.U.Leuven, Celestijnenlaan 200E box 2409, B-3001 Heverlee, Belgium (koen.dhaen@ees.kuleuven.be), (2) Centre for Archaeological Science, K.U.Leuven, Belgium, (3) Archaeology Research Unit, K.U.Leuven, Belgium

Soil erosion, sediment deposition and sediment delivery are intimately coupled with human activities. This is also the case for the Mediterranean environment where intense human impact during the classical period (Hellenistic to Roman Period) has caused widespread erosion and alluviation. Many studies, however, have illustrated that this coupling is not always straightforward as it not only depends on the intensity of human impact, but also on the spatial patterns of land use changes and internal geomorphic system controls. As a result, different locations within a landscape may react differently to a single catchment disturbance event. Within this study, the spatial and temporal sediment dynamics for the 264 km^2 large Büğdüz catchment are analysed. This catchment is situated in the western part of the territory of the classical city of Sagalassos, Taurus Mountain range, 100 km north of Antalya. Previous sedimentological studies have shown that especially during the period 900 BCE-600CE human activities triggered intense sedimentation in upland areas, whereas for more recent periods sediment dynamics are more limited and restricted to some alluvial units. It can be questioned what the decrease in (spatial) sediment dynamics in the Büğdüz catchment caused: decreasing human activity, changing spatial patterns of human impact or internal geomorphic processes. Indeed, archaeological surveys have shown that spatial patterns of settlement patterns have changed through time. Therefore, we used a sediment fingerprinting technique in order to elucidate the sediment sources and to get an idea of the connectivity between the various parts of the catchment.
Ninety-four cores were taken within the alluvial plain, and numerous topsoil samples were taken over the entire catchment. All samples were wet sieved into three factions, a gravel (>2 mm), a sand (2>x>63 μm) and a silt/clay fraction (<63 μm). Gravel lithologies were used as primary qualitative provenance indicators, whereas the sand was studied for its heavy mineral composition. On the fine material (silt and clay) aqua regia extractions were applied and several major (Ca, Al, Mg,...) and trace (Cr, Ba, Sr, ...) elements were measured.
The geochemical analyses of subrecent valley sediment (i.e. from the last few hundred years) indicate a significant spatial variation in sediment provenance and highlight the great importance of local sediment sources. These results suggest that there is only a limited coupling between the upstream and more downstream regions of the Büğdüz catchment. However, when comparing the geochemical properties of recent and older sediments, some (but less pronounced) temporal variation in sediment provenance can be observed. This illustrates that in the past, valley sediment deposits not only originated from nearby hillslopes, but that also sediment sources from further away need to be considered. We suggest that changes in intensity and spatial patterns of human impact did influence the coupling of the various geomorphic subsystems in the catchment. During the classical period, anthropogenic land use was so dominant that hillslopes and valleys, as well as up- and lowland areas were coupled. However, when human impact became less intensive after the Roman Period not only hillslopes and channels became largely decoupled, but also alluvial deposition centres in up- and lowland regions were no longer connected. The latter suggests that also fluvial processes have become less dominant.