Geophysical Research Abstracts
Vol. 12, EGU2010-3514, 2010
EGU General Assembly 2010

Unravelling Late Pleistocene and Holocene landscape dynamics: The Upper Guadalentín Basin, SE Spain

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Landscapes in South-eastern Spain have developed in response to tectonics, climate fluctuations and, more recently, human activity. Fluvial and colluvial sediments such as river terraces and slope deposits found in the valleys reflect a complex interplay between landscape forming processes. Investigating these sediment archives, we reconstructed Late Pleistocene and Holocene landscape evolution for the Upper Guadalentín Basin, SE Spain. Driving forces of sedimentation and erosion can be external (e.g. tectonics, climate) or internal (e.g. complex response) and have a regional or more local character. By correlating episodes of sedimentation and erosion to past climate fluctuations and human impact on the land, insight can be gained of the relative influence of both on landscape dynamics. Research is conducted along the Guadalentín river and three of its tributaries. For chronological control, sediments were dated using Optically Stimulated Luminescence (OSL; 13 samples) and radiocarbon dating (AMS; 9 samples). Both river terrace sediments and finely layered, varve-type sediments, deposited directly over coarse gravels, were encountered in the study area. The latter are interpreted as having been deposited in a (palaeo) lake, formed as a consequence of a sudden blockage of the Guadalentín river between ~17 and ~13.8 ka. Differences in relative height above the floodplain and age between the river terraces of parts of the Guadalentín river indicate that they have not been in equilibrium at least for some time. Deposition of river terraces along the upstream part of the river is recorded at ~13 and ~9.5 ka, whereas no evidence of deposition is found for that period along the lower part of the river. There, episodes of sedimentation occur at ~7.5 – 5 ka, ~3.4, ~1.6, ~0.7 and ~0.4 ka. This discrepancy is explained by the palaeo-lake and its influence on erosion and sedimentation processes through base level changes. During its existence, sediments accumulated in the lower parts of the lake and a delta was being built further upstream, while downstream of the blockage clean water caused erosion. After failure of the blockage, the upstream effects are rapid incision into the accumulated sediments, while downstream the effect is increased sediment loads as the accumulated lake sediments are gradually, but incompletely, removed.

These processes are combined in a proposed schematic model of Late Pleistocene and Holocene landscape evolution for the area. From the model we can conclude that i) the influence of the palaeo-lake on deposition and erosion processes both upstream and downstream is evident; and for the younger river terraces that ii) episodes of deposition seem to coincide in time, but iii) episodes of erosion in between terrace level aggradation do not coincide and neither do terrace level heights and iv) no evidence of deposition is found for the upstream part of the river.

Correlation of erosion and sedimentation episodes with climate change and human impact is discussed. Although some correlations can be made, there is strong evidence that climate was not the main driver of landscape processes. Besides the mentioned asynchrony of erosion episodes in the lower parts of the river and the absence of younger terraces in the upstream parts, no sediments for the Late Glacial – Holocene transition were found. If climate would have been the most important driver, synchronous and spatially homogeneous deposition and erosion episodes should be expected. Thus, we suggest that internal river dynamics and local processes are more important drivers for landscape dynamics in the Upper Guadalentín Basin than external and regional factors.