1 Applicant

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2 Project title

"Geomorphology and landscape evolution of the Parroquia-Zarzilla region, southeast Spain".

3 Abstract

Desertification is one of the biggest problems facing European Mediterranean countries. Understanding how landscapes are affected by degradation will broaden our knowledge in order to reduce human impact on land. The study area is located in the catchment of the Guadalentín River in the eastern Betics, a key region for desertification studies. The geology of the eastern Betic Cordillera offers an interesting research setting in the convergence zone of the African and Eurasian plates. The research area has not yet been subject to other studies and forms a key area in understanding the landscape evolution of the region.

The objective of this thesis is to reconstruct the landscape evolution of the Parroquia-Zarzilla region since the late Pliocene. This study evaluates the following research questions: 1. What can we learn about the evolution of the landscape from the present geomorphologic features? 2. Do the lithological and sedimentological findings match with findings of other research conducted in the same region and which new ideas can be deduced? 3. How do climate fluctuations influence the evolution of the landscape? 4. Considering the evolution of the landscape in a broader sense, what can be said about geological and neo-tectonical drivers of the evolution?

In order to answer these questions the area was investigated through the generation of a geomorphological map and geomorphological cross sections on-site. Prior to the field work, a literature research was conducted and a GIS database with satellite images, topographical, geological and soil maps was created. After fieldwork drawn field maps were digitized to visualize the findings in a geomorphological map on a scale of 1:5,000. The results were compared to other studies conducted in the region. Finally, the map was transferred into a 3D-model in ArcScene to draw regional conclusions about the landscape evolution.

The result of this master thesis is a geomorphological map that contains a fluvio-lacustrine landscape in the northwest, an alluvial fan in the southwest and a range with bedrock and pediment dominated landscape in the north and south, as well as a lacustrine landscape in the southeast. The range has been cut by two rivers which developed a steeper v-valley in the north and a less steep valley with highly eroded terraces in the south. The generation of pediments is controlled by phases of neo-tectonic uplift and neo-tectonic stability. Strong earthquakes or localized high magnitude rainfall events possibly triggered mass movement processes that blocked the Luchena and created a lacustrine environment in the northwest. When the blockage was overcome through erosion, the paleo-lake emptied suddenly, and a fluvial dominated landscape

developed. This blocking/deblocking process happened several times, as three limnic terrace levels (10 m, 30 m, 50 m height above floodplain) are observed nowadays.

Comparison to other research shows similar internal dynamics, where the Guadalentín River was blocked creating a paleo-lake to the east, but does not allow a satisfactory correlation to climatic conditions. This suggests that the landscape evolution rather is driven by its internal dynamics in form of two subsiding basins in west and east and a uplifting neo-tectonically active range in between (relatively to each other). The basins are characterized by an alternation of erosion and sedimentation processes depending on adjustments to changing base levels through the blocking/deblocking dynamics, whereas the range has been continuously under the influence of erosional processes as adjustment to the ongoing uplift. Through this uplift also the southern river got cut off and changed its direction to connect with the downstream located Guadalentín Basin via the Luchena.

Finally a rough sequence of events is proposed: 1. Formation of eastern Betic bedrock (Cretaceous-Neogene); 2. Development of basin and range morphology with a large western basin and a smaller eastern basin (Neogene); 3. Development of alluvial fan in subsiding basin, drainage in southern valley (Pliocene-Pleistocene); 4. Uplift of bedrock ranges, pediment formation, calcrete development, cut-off southern river (Pliocene-Pleistocene); 5. Luchena blockage, development of 50 m and 30 m terraces (Lower Pleistocene); 6. Last 4.5 m of eastern basin fill (after 19,500 BP); 7. Two phases of uplift (19,500-2,500 BP); 8. Development of paleo-lake east (17,000-13,800 BP); 9. Lorca fan aggradation (7,900-4,200 BP); 10. Deposition of limnic L_2 terraces east (2,000-1,870 BP); 11. Development of fluvial and limnic 10 m, 5 m terraces & current floodplains (1,870-1,300 BP and/or 485-50 BP).

Due to difficulties in classifying the temporal events of the landscape evolution precisely, it is strongly advised to conduct further research in the area with regard to dating of terraces and pediment surfaces, measurement of sedimentation rates and effects of human impact.