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Quaternary landscape evolution driven by extensional processes in the Central Betics: the case of the Granada basin

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The Granada basin is one of the largest Neogene-Quaternary intramontante basins of the Betic Cordillera in SE Spain. The present-day physiography of this topographic depression mainly results from Guadalquivir river capture in Quaternary times. However, landscape evolution in the Granada basin does not respond to a simple model of headward erosion after river capture. In the NE border of the basin, the most striking geomorphic feature is a prominent mountain front between the metamorphic basement and the sedimentary infilling of the Granada Basin. This mountain front is depicted by normal faults with well preserved fault-scarps developed on dolostones of the basement. A second less prominent mountain front is located between the Tortonian to Plio-Pleistocene sedimentary formations along the NE margin of the Granada Basin and the flat area basinwards, where Upper Pleistocene to Holocene sediments crop out. Despite the lack of well exposed fault-scarps, this mountain front cannot be but tectonic in origin, since little lithological contrast in terms of rock-strength exists here and seismicity of moderate-low depth is observed. The drainage network is highly incised between the both fronts revealing two stages of river development and entrenchment. The first stage is represented by abandoned channels slightly incised into a geomorphic flat surface defined by a calcrete. The second stage corresponds to the present-day drainage network with higher incisions and a well developed pattern of headward erosional. The local base level for this second erosional stage coincides with the flat surface defined by the Pleistocene-Holocene deposits of the central part of the Granada Basin. Two samples from the top of the calcrete were collected and dated by the U/Th method. The resulting dates are 40 ± 4 ka and 38 ± 7 ka. Using these age, we have calculated the incision and erosion rates for the late Pleistocene to present-day time span, yielding high erosion rates around 3 mm/yr. These high erosion rates and the landscape evolution are probably related to differential uplift during the recentmost Quaternary. In this regard, the NE part of the basin seems to have uplifted at higher rates than the central part, probably as a consequence of basin compartmentalization due to active faulting. Actually, NW/SE-oriented normal faults are thought to be the most active structures in this region according to both field geology and seismicity. These normal faults are the northern continuation of a major extension zone that bound the western termination of Sierra Nevada dome, where the highest elevations of the Betic Cordillera occur. We propose that these normal faults are responsible for the differential river incision and drainage evolution in this border of Granada Basin.