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Curling into the hole: drainage evolution at the edge of a sinking slab (Guadalhorce River, westernmost Mediterranean)

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Dynamic topography related to mantle processes is an important factor controlling landscape and drainage network evolution. Dense slabs induce an upper mantle flow that deflects the topography downward above them. Topographic anomalies caused by these mechanisms have a long-wavelength and normally remain masked by other tectonic mechanisms that deform the surface at smaller wavelengths. Therefore, the geomorphic evidence of these mantle mechanisms are not so frequent in active orogens. In the central Betics (westernmost Mediterranean), sharp differences in crustal thickness do not match with topographic gradients, thus necessitating support by mantle-related mechanisms. In this work we analyzed the topographic and drainage network evolution of the Guadalhorce drainage basin, located in the central Betics. The northern part of this basin was captured in Pleistocene times following a very distinctive radial pattern. The main channels in the north deviate into the Malaga basin depicting sharp U-turns. High-resolution crustal imaging by P-receiver functions allows us to identify a bend of the Iberian Moho at the top of the Alboran sinking slab. Different topography filters at different wavelengths show a long-scale topographic depression that lies above the Iberian Moho bend. The central and middle part of the basin lies over this depression and the drainage network flows orthogonal to the main gradient of the Iberian Moho. Therefore, the Alboran sinking slab produces a negative dynamic topography that is curling the drainage network towards it.