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Tectono-morphologic evolution of the Jumilla basins, Betics, southeastern Spain (Prov. Murcia)

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The present-day external Betics in the Jumilla area (100 km west of Alicante) are morphologically characterized by elevated remnants of a marine Tortonian peneplain, pointing at significant post-orogenic plateau-like uplift with a magnitude in the order of 1 km. During the Late Tortonian-Recent time interval small intramontane basins developed, which are associated with a deep seated fault structure inherited from the Mesozoic passive margin stage. Two of those basins, La Celia and La Alqueria, became inverted during the Pliocene Pleistocene. In contrast, the Jumilla basin is still actively subsiding. The La Celia and La Alqueria basins are morphologically characterized by fresh, WNW-ESE oriented fault scarps and a tectonically affected drainage network. Paleostress analyses shows that the most recent deformation phase in these basins is transpressive. The fault scarps are therefore interpreted as hanging wall collapse structures of reverse faults. Dating of the fault scarps using numerical landscape evolution modeling assuming different fault event scenarios demonstrate that their age is probably less than 2 Ma. In contrast, the Jumilla basin does not show fault scarps or other geomorphic indicators for deformation, except that it is an endorheic intramontane basin. The La Celia and La Alqueria basins are aligned on top of the NE-SW oriented deep-seated fault. This fault, which can also be identified by thickness and facies changes in the Mesozoic sequences of the surrounding mountains, parallels the well-known Crevillente fault . We propose that the La Celia and La Alqueria basins developed as transtensional basins in Late Tortonian times along this fault structure, and were inverted by transpressive motions during the Quaternary. The transpression also gave rise to formation of salt-anhydrite-gypsum walls, which rise up to the surface. Since there is no stratigraphic- nor morphologic record of the Messinian and Pliocene, motions along the deep-seated fault might have been pure strike-slip during that time-interval. This tectonic evolution implies a rotation of the stress field. The Jumilla basin probably has had a continuous subsiding evolution from Late Tortonian – Recent, which is best-explained assuming an origin as a step-over basin between the deep-seated fault and another strike-slip fault to the south.
Our study implies active tectonic activity in the northeastern part of the Betics, characterized by plateau-uplift and strike-slip deformation. Such deformation was already documented in the eastern Betics to the south and in the Cazorla arch to the west.