



Vertical-axis block rotations linked to normal faulting: paleomagnetic and structural evidence from Miocene to Recent extensional basins in southern Turkey

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Paleomagnetism provides important constraints on complex patterns of vertical axis rotations in orogens. Where normally paleomagnetism is applied to constrain regional rotations, in the vicinity of fault zones often locally varying rotation patterns occur. Here we provide results of an extensive paleomagnetic survey constraining vertical axis rotation in Neogene extensional continental basins in the Taurides, in the eastern flank of the Isparta Angle (SW Turkey). In total, 437 oriented cores were sampled at 43 sites distributed within Miocene-Pliocene continental sedimentary rocks from the basins at the eastern limb (Ilgın and Altınapa Basins) and also central part (Yalvaç Basin) of the Isparta Angle. Despite the more or less coherent overall strike of the mountain belt and sedimentary basins, our results show different senses and varying amounts of vertical rotation within short distances; the Altınapa Basin has undergone only very minor rotations during and after the Miocene, but the paleomagnetic data from Yalvaç and Ilgın basins show $\sim 50^\circ$ clockwise and $\sim 20^\circ$ counter-clockwise rotation, respectively. Following a long history of shortening and thrusting, our study area has undergone regional extension since the mid-Miocene, which is still active in the present-day as portrayed by active seismicity, earthquake focal mechanisms, field data including fault plane solutions, and GPS measurements. This extension is accommodated along major normal faults that end in relay ramps with overlapping, adjacent normal faults. We show that the paleomagnetically determined rotations are related to such relay ramps, in places superimposed on rigid block rotations, and can be used as a first-order tool to quantify horizontal extension. As such, vertical axis rotations and paleomagnetism unravels important insights in the evolution of deformation in major normal fault zones.