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Thermomechanical 2D model for a lithosphere transect of North Iberia: reconciling theories of its Cenozoic geodynamic evolution.

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We investigate the influence of the rheology of the lithosphere and inherited weak zones on the transmission of stresses in a N-S oriented transect for the Iberian Peninsula crossing the Central System, Duero Basin and the Cantabrian Range. The Iberian Peninsula was an independent microplate that has been deformed by the convergence between the Eurasian and African plates for the last 65 My. During this tectonic compression, the intraplate mountain range Central System uplifted. Previous studies suggest distinct ways of stress transmission in intraplate deformation such us lithosphere folding or mid-crustal detachment levels. The controversy comes on the distribution of the crustal shortenings in the different areas of the transect and how the crustal deformation accommodates according to those shortenings. Another enigma is the high overall elevation of the Iberian Peninsula compared to the mean topography of Europe. In this study, we perform some thermomechanical models varying rheologies and including weak parts inherited from the Variscan orogeny. We aim to explain the different shortenings, geostructural interpretation and lithosphere asthenosphere boundary from previous studies, by numerical modeling. The transect incorporates a 30 My old oceanic crust in the Bay of Biscay, a weak zone down into the upper mantle on the continental and oceanic transition part, and two faults with a different angle at both sides of the Central System which is a granitoid block. The adopted rheology consists of a power law creep, including diffusion and dislocation, in which viscosities decrease due to a plastic criterion that follows the Byerlee's law. To simulate deformation, we use Underworld-II, a particle-in-cell finite element code applied to large-scale geodynamics simulations. Results show the importance of inherited weak zones to explain the grown of the Central system as a pop-up structure and for mid-lower crustal subduction below the Cantabrian Range. They show the relevance of a mid-detachment level transferring strain rate to the Central System. Our models present high mean absolute topography comparable to the actual Iberian relief in the transect of our study as a result of the density distribution applied.

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