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Geodynamical Models of the Rotation and Extension of Alcapa and Tisza Blocks in the Pannonian Basin of Central Europe

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The two major crustal blocks of the Pannonian basin, Alcapa (Alpine-Carpathian Pannonian) and Tisza, underwent a complex process of rotation and extension of variable magnitude during the Tertiary. The northward push of the Adriatic Block initiated the eastward displacement and rotation of both the Alcapa and Tisza blocks. Emplacement was accompanied by substantial strike-slip movements, together with shortening and possible extension across the Mid-Hungarian Line, which now separates the two domains. Anti-clockwise rotations of variable amplitude occurred during the Early Miocene in the Alcapa unit, and clockwise rotations of the Tisza block occurred between Late Cretaceous and Late Miocene. The opposite rotations of the two plates led to NW-SE convergence and NE-SW extension in the space between the two Intra-Carpathian terranes. Subsequently both domains underwent extension dominantly in the NE-SW direction. We have constructed geodynamical models of the rotation and extension of the two Pannonian blocks. We decompose this complex process into two stages. We aim to show how the two plates deformed under the influence of a NW push by the Adriatic block, a NE pull from a retreating subduction zone on the eastern Carpathians, and the internal buoyancy forces arising from crustal thickness variations. We consider only 2D aspects of the problem, using an idealised thin viscous sheet model of the continental lithosphere. The deformation of the lithosphere is described by a non-linear viscous constitutive relationship. Our approach is based on the finite element method, and we consider several distinct models of initial geometry, boundary conditions, and constitutive parameters. Rotation and distortion vary across both blocks, with clockwise rotation occurring in the Alcapa plate, and anticlockwise rotation in the Tisza block. For a fixed exponent in the non-linear stress vs strain-rate law, increasing the viscosity coefficients of the blocks relative to the surrounding domain has a distinct impact on the distribution of rotation and deformation within the two blocks.