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Large-scale lithospheric folding controlling active deformation and topography development in the Pannonian basin: insights from analogue modelling

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The ongoing positive structural inversion of the Pannonian basin and its related topography development has been addressed by a series of analogue models. Gradual transition of stresses in the area can be inferred both from numerical modelling results and field observations. This change from extensional to compressional style is directly due to the continuous indentation of the Adriatic microplate, and indirectly to the cessation of the subduction in the Carpathian orogen. The syn-rift phase of the basin evolution is characterised by intense extension leading to a considerable weakening of the lithosphere. As a result, relatively low compressional stresses can induce/trigger deformation during subsequent inversion. The characteristic spatial distribution of the subsiding and uplifting areas inside the basin has invoked the idea of multi-wavelength lithospheric/crustal deformation, which has been interpreted as folding of the lithosphere. Several recent neotectonic structural studies in the area have evidenced this deformation pattern and highlighted the importance of the link between deep earth and surface processes.

Primary target of the models was to study folding of the hot and weak Pannonian lithosphere as well as to examine the first-order signals of topography development. In accordance with available rheological and seismotectonic data, the basin system was represented as a two-layer model with thin (ca. 10-15 km) brittle upper crust. The

lower crust and the mantle were considered as one unit with an average thickness of 45 km. Applied strain rates were adjusted according to the latest data of GPS velocity measurements. Scenarios of complex geometric boundaries were also tested.

The following results of the analogue experiments are presented and discussed: (i) timing and modes of stress propagation in the Pannonian lithosphere, (ii) quantification of the lithospheric buckling, and its wavelength and amplitude, (iii) reconstruction of the related recent vertical surface motions and comparison with observations and (iv) role of initial crustal thickness variations and complex geometries in the models.

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