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Comparative analogue and numerical modelling of the reactivation of a strike-slip system: a case study of the Derecske trough, Pannonian basin

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This contribution presents a series of analogue and numerical modelling to explore possible reactivation patterns of strike-slip zones. The Pannonian basin is characterized by several strike-slip faults rooting in weakness zones of the pre-Miocene basement, and cutting through the entire Neogene-Quaternary basin fill. These zones show more or less continuous activity from the late Early Miocene time. They originally connected areas of extension in the basin system with areas of coeval collision in the surrounding mountain belts. At the beginning of Pliocene the stress field has changed after the termination of subduction along the Carpathian arc. Our objective was to examine the reactivation pattern of strike-slip fault zones with special regards on the state of the stress field, the orientation and the mechanical parameters of the deforming medium. To do so, analogue and numerical modelling have been carried out. To test the modelling results, the case study of the Derecske trough at the north-eastern part of the Pannonian basin has been selected. This deep pull-apart basin is bordered by two overstepping strike-slip zones with NE-SW strikes. The chosen parameters of the analogue and numerical modelling (dip of the basement fault, orientation of the system, etc.) have been obtained from this area.

The results of sand-box analogue modelling shows that the reactivation pattern critically depends on the orientation of the strike-slip system with respect to the confining stress field, on the material properties of the employed sand (i.e. ratio of the cohesion

of the intact sand and the faults), and on the adaptation of a lubricant layer at the base of the models. This latter was necessary to simulate the presence of overpressure zones often observed at the bottom of the Pannonian basin fill. The reactivation pattern, however, depends much less on the dip angle of the faults. In-situ stress acquisitions have been carried out that provided reliable values for the characterisation of the stress ellipsoid acting in the sandbox models. The geometry and in-situ stress measurements of the analogue models provided input parameters for the numerical modelling. The slip tendency, slip directions and the frictional coefficient were investigated by changing the direction of minimum horizontal stress and the stress ellipsoid orientation with respect to the strike of the system. The two different modelling techniques provide comparable reactivation patterns along the strike-slip systems. Our results show that the strike-slip border zones of the Derecske pull-apart basin, due to their orientation and geometry, are prone to reactivation in the prevailing present day stress field. These results are confirmed by the recent seismic activity observed in the study area.