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# Synthesis of Cretaceous-Cenozoic paleostress data from the Pannonian Basin: refinement from time constraints, tilt test and paleomagnetism

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Brittle deformation of the Pannonian Basin was extensively studied by field observations and measurements during the last two decades. The deformation phases were characterised by paleostress calculations mainly based on the method and software of Angelier (1984). The first syntheses of paleostress data used increasing number of data and separated more tectonic phases (Bergerat et al. 1984, Csontos et al. 1991, Fodor et al. 1999). During the last decade, additional data put the Pannonian Basin as having one of the densest data sets concerning paleostress. In the presentation I briefly show the present status of the data base, but rather concentrate on the methodological advances: how structural and other data permit a better resolution of paleostress fields both in time and space. I will concentrate on the following topics: use of syn-sedimentary and syn-burial structures for time constraint of the deformation, the effectiveness of tilt test in the separation of phases or episodes and the role of vertical-axis rotation constrained by paleomagnetism.
13 different paleostress fields were reconstructed for the Jurassic-Quaternary period in the study area. All the data were (re)interpreted using the same method minimizing bias due to varying approaches of different interpreters.
Syn-sedimentary structures, like outcrop-scale faults, dykes, bioperforated fault planes gave good constraints for timing of a given stress state, but axes remained poorly constrained. New findings of syn-kinematic calcite in clastic dykes have the advantage of both constraining stress axes direction and age. Deformation bands, fractured pebbles, soft striae were formed during the burial of sediments and render additional constraints for timing of stress fields.
Tilt test effectively separated deformation phases or episodes within the same phase with respect to a given tilting event: examples are shown from the mid-Cretaceous folding, latest Miocene folding of the Sava folds, and the Miocene rifting of the Mura Basin (Slovenia).
Vertical axis rotations result in the multiplication of the observed stress fields. In fact, rotations mostly induce apparent changes in stress axes (Márton, Fodor 2003) therefore the integration of paleomagnetic data is a must for paleostress studies of regional aspects. In the study area we combined the two independent methods and were able to demonstrate not only large (40-50°) but even small rotations (25-30°), around the resolution of both paleomagnetic and stress analysis. The combined paleomagnetic–paleostress dataset was extensively used for tectonic reconstructions of the study area.

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