Revised stress field evolution of the northern and south-western Pannonian basin from the Mesozoic to Quaternary

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Fault-slip data and stress field analysis represent tools that have been applied since the mid-eighties in the Pannonian Basin, following the pioneer work of Bergerat et al. (1984). Since then a great number of data have been accumulated. In this contribution I present the state-of-the art of this data set and touch some geodynamic conclusions.

Jurassic of the Transdanubian Range (TR) was marked by NNE–SSW extension (D1 phase), which was connected to the opening of the Alpine Tethys (195–142 Ma). N–S to ENE–WSW compression or strike-slip stress field dominated the northern part of the TR, and determined the clastic sedimentation during the early Cretaceous (D2 phase, 142–108 Ma). The TR was folded, imbricated during several episodes of roughly NW–SE compression during the prolonged Albian-Coniacian D3 phase (110 to 87 Ma). This contractional deformation was related to nappe emplacement of the TR as the highest nappe in the Alpine edifice. The Senonian D4 stress field is still enigmatic and probably represents a NE–SW extension. The next D5 phase, an ENE–WSW compression and perpendicular extension has uncertain age (65?–46? Ma), but reactivated E–W sinistral faults in the TR and probably also in the wider area.

The D6 mid-Eocene to early Oligocene stress field had transpressional character with WNW–ESE compression. Syn-sedimentary deformation is connected to the formation of the Paleogene basins. The newly recognized mid-Oligocene D7 phase is connected to the major subsidence in the North Hungarian Paleogene Basin. It is also the time span when Periadriatic magmatism was active along the newly formed Periadriatic-mid-Hungarian shear zone. The Early Miocene (23–19 Ma) could be the classical time of extrusion tectonics of the Alcapa unit during the D8 phase.

The D9 rifting phase of the Pannonian Basin was punctuated by vertical-axis rotations, long time recognized by Márton and Fodor (1995). The first rotation was probably preceded by an early ~N–S extensional event (19–18.5 Ma). This temporal relationship may suggest extensional character for rotational deformation. Major syn-rift extension resulted in the exhumation of mid-crustal rock units in the Tauern window and along the western and southern boundary of the Pannonian basin (Rechnitz window, the Pohorje massif and several metamorphic complexes in the Sava zone Usztasewski et al., 2010). ~E–W extension continued during the late Mid-Miocene (ca. 14–12 Ma). This D10 phase and resulted in major basin subsidence in the NE Pannonian Basin. Extensional direction might have changed from ENE–WSW to ESE–WNW from west to east. Transpressional to strike-slip type stress field dominated the western Pannonian Basin and in the Easternmost Alps, and resulted in variable inversion of some basins. Compression axis of this short D11 phase (12?–11? Ma) changed from N–S to ENE–WSW from west to east. Extensional deformation was re-established in the Late Miocene and locally also in the Early Pliocene (D12 phase). E–W to SE–NW extension represents a deformation superimposed on the regional thermal post-rift subsidence. The D13 neotectonic phase of the Pannonian basin is characterized by temporal and spatial transition from extensional to compressional stress field. The earliest inversion structures occurred at ~8 Ma (Uhrin et al., 2009), but transtension seems to persist up to 4 Ma in the central, up to recent times in the eastern basin segment.

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