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Constraints for the extrusion tectonics and back-arc extension in the Pannonian basin: a state of the art

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Recent advances in various fields of geosciences led to a better understanding of the structural evolution of the Pannonian Basin and surrounding orogenic belt. In the presentation we review constraints which are important for the timing and kinematics of the two distinct crustal wedges (Alcapa and Tisza-Dacia units) which were emplaced into the Carpathian embayment.

1) Dextral slip along the Periadriatic line (PL) and its eastern continuation, the Mid-Hungarian Shear Zone (MHZ) at the southern margin of the Alcapa unit started in the late Early Oligocene. Basin stratigraphy indicates subsidence in the middle Oligocene (ca. 30-28 Ma) and widespread magmatism along the PL-MHZ and also in the Sava zone of the Dinarides. Paleogeographic connection between the Hungarian and Slovenian Paleogene basins do not allow major separation before ca. 30Ma. Thus ∼30 Ma can be considered as the onset of strike-slip deformation. Structural data suggest transpressional deformation with compression perpendicular or slightly oblique to basin axis (N-S in original position).

2) Major extension (∼22-16 Ma) in the Eastern Alps resulted in the exhumation of mid-crustal rock units in the Tauern window. Along the western and southern boundary of the Pannonian basin a similar process led to the formation of the Rechnitz window, the Pohorje massif and several metamorphic complexes in the Sava zone. As an expression of extension, dextral slip continued along the PL-MHZ up to the onset of late Early Miocene sedimentation (19 Ma). Extensional collapse of the Pannonian basin proper (syn-rift sedimentation) took place in the 19 to 11.5 Ma time interval.

3) The most essential elements of this extensional collapse were the coeval opposed rotations of the Alcapa (counterclockwise) and Tisza-Dacia (clockwise) units of up to 90°. This rotation is extremely well-constrained in the Alcapa unit, where it occurred between 18 and 14.5 Ma. Restoration of Alcapa and Tisza-Dacia units and reconstruction of the paleostress fields suggest a quite homogeneous, originally E-W oriented extensional stress field, which developed further during rotation. This suggests that rotational deformation was driven by the same mechanism as extension.

4) The rotational deformation modified the geometry of the extruded blocks and juxtaposed Alcapa, and the Tisza-Dacia units. Their further history during the 11.5 and 5 Ma time interval (post-rift phase) was characterised by minor extension and major subsidence and sedimentary upfill.

5) The earliest phase of extension was associated with silisic magmatism (19-17 Ma). These rhyolite-andesite suite suffered brittle extensional deformation. The granodiorite of the Pohorje (18,6 Ma) suffered ductile to brittle extensional deformation corresponding to intrusion depth. This timing and the geochemical data indicate that magma generation was connected with crustal extension and melting. Subsequent voluminous calc-alkaline magmatism took place in the central and eastern Pannonian Basin (17-12 Ma) and has continued until recent times in the south-estern region of the Tisza-Dacia unit (12-0 Ma).

6) The 5-0 Ma time interval of the Pannonian basin is characterised by a transition from extensional to compressional stress field, evidenced in the compressional or transpressional inversion of numerous normal faults.