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On the formation and evolution of the Pannonian basin: constraints derived from the orogenic collapse recorded at the junction between Carpathians and Dinarides

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Formation and evolution of back-arc basins is related to the evolution of subduction zones, resulting geometries being dependent on the interplay between the velocity of retreating slabs and boundary conditions that often limit rapid subduction systems. Classical models of evolution in the Alps-Carpathians-Dinaridic domain assume that the formation of the Pannonian back-arc basin is related to the rapid roll-back of an European slab and the invasion of Tisza-Dacia and ALCAPA upper plate blocks into the so-called Carpathians embayment starting at $\sim$20Ma. The general mechanism assumes a gradual evolution, an initial mechanical phase of extensional detachments being recognized near the transition between the Alps and the Pannonian basin was subsequently followed by upper crustal normal faulting and a thermal phase during the Middle-late Miocene times that affected the central part of the Pannonian basin. A key area of the entire system often neglected by kinematic studies is the connection between South Carpathians and Dinarides. Here, regional seismic lines traversing the entire Serbian part of the Pannonian basin were calibrated with well data in order to derive an evolutionary model. The deformation is dominantly expressed by the formation of extensional (half-)grabens that are the brittle expression of large-scale extensional detachments. In contrast with previous interpretation restricting the syn-rift phase to the Middle Miocene, the geometry of normal faults and the associated syn-kinematic sedimentation allows the definition of a continuous Early to Late Miocene extensional evolution that was followed by the formation of isolated uplifted areas during the subsequent Pliocene – Quaternary inversion. The orientation of these (half-)grabens changes gradually from W-E to NW-SE and then to N-S, suggesting that the present-day strike of faults is the effect of a clockwise rotational mechanism of South Carpathians and Apuseni Mountains in respect to Dinarides. The S-ward prolongation of the large scale extension in an area that is adjacent across Carpathians to the Moesian platform suggests that the roll-back of the Carpathians is not the only mechanism that is responsible for the formation of the Pannonian basin. The correlation with similar extensional structures superposed over the orogenic chain located S-wards strongly points towards a component of Pannonian collapse driven by a Middle Miocene roll-back of a Dinaridic slab. The study provides critical constraints for the pre-Neogene evolution of an area where there major crustal blocks (i.e. Tisza, Dacia and Dinarides) are juxtaposed together with their partly overlying obducted ophiolitic sequences against the major oceanic suture of Dinarides, the Sava zone.