

Kinematics and timing of convergence between the Tisza block and the internal Dinarides along the Sava-Zone: from Mid-Eocene collision to Mid-Miocene exhumation

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This structural and geochronological study aims at defining kinematics and timing of convergence between the Tisza block and the internal Dinarides along the so-called "Sava Zone", situated at the south-western margin of the Pannonian Basin. The Sava Zone remained open until Mid-Eocene collision between the Dinarides and the northerly adjacent Tisza block and was interpreted to represent a Late Cretaceous to Early Palaeogene volcanic (back)-arc basin (Pamic et al. 2002). This supposed suture zone underwent Early Tertiary regional metamorphism related to its closure. The Sava Zone is considered as to represent a remnant of the Vardar ocean as well as a continuation of the Solnok flysch basin. Thus, it occupies the position of a suture that is of particular importance in unravelling the assembly of tectonic units in the Dinaric-Pannonian-Carpathian domain. Apart from bimodal volcanics of Late Cretaceous age, the Sava Zone is dominated by mostly terrigenous, often volcano-detritic flysch series of Turonian to Mid-Eocene age (Sparica et al. 1984) that were deposited in an accretionary prism forming in the collision zone. The area investigated is situated in northernmost Bosnia-Herzegovina, where outcrops of pre-Neogene rocks are restricted to a few isolated hills (Figure 1). Metamorphic overprint in the flysch series increases towards the N from diagenetic to upper greenschist-facies conditions. Four deformation phases (D1 to D4) can be distinguished in the mount Motajica area.

D1, most likely concomitant with regional metamorphism, produced the main foliation. Top-to-the-S directed transport directions in garnet-bearing mica-schists are presumably related to thrusting of Tisza onto the internal Dinarides and progressive closure of the flysch basin of the Sava Zone. Quartz-mylonites with a pronounced shape-preferred orientation reveal dynamic recrystallisation by grain boundary migration, indicative of upper greenschist facies conditions. D1 structures as well as the isograds of regional metamorphism are crosscut by an S-type granitic intrusion. U-Pb dating of monazites from the granite yielded a $^{207}\text{Pb}/^{235}\text{U}$ age of c. 27 Ma. This result casts severe doubts on earlier reported Rb-Sr whole rock isochron ages of 48 Ma (Lanphere & Pamic 1992), which may possibly reflect mixing with older crustal components in the anatectic granitic melts. We therefore suggest that the magmatism previously considered as syncollisional (Lanphere & Pamic 1992) should be reconsidered as post-collisional. Contact metamorphism is only observed within c. 100 m around the pluton by (a) static growth of large white mica porphyroblasts that overgrew a main foliation in low-grade phyllites and (b) annealing of mylonitic quartz textures.

D2 postdates the intrusion of the pluton, as it produced a foliation in both granite and dikes that discordantly cut regionally metamorphosed series. Occasionally, granitic dikes are found to be folded around WNW-ESE-trending fold axes. Also, the D1

foliation is seen to be overprinted by an axial plane cleavage associated with WNW-ESE-trending, N-facing folds. These observations suggest that N-S shortening prevailed throughout D2.

D3 is manifested by boudinage of granitic dikes and an “upwarping” of the foliation with increasing proximity to the pluton. Associated stretching lineations are WNW-ESE-trending (i.e. parallel to the general strike) and indicate transport directions away from the pluton center (i.e. top-to-the-W and top-to-the-E west and east of the pluton, respectively). Chloritisation of pre-kinematic garnet and growth of chlorite in shear bands at the expense of biotite, together with the lack of dynamically recrystallised quartz, indicate that D3 is related to the exhumation and concomitant cooling of the pluton. K-Ar-ages obtained from Bt-concentrates from granitic samples (Lanphere & Pamić 1992) indicate that cooling below c. 300°C occurred at around 18 Ma. In combination with apatite fission track ages of around 16.5 Ma, this illustrates that the timing of exhumation is coeval with the Eggenburgian to Karpatian synrift phase of the Pannonian Basin. This documents a major change from convergence to extension in the previously collisional Sava Zone. It is speculated that exhumation could have been achieved by isostatic footwall uplift below a WNW-ESE-trending, northerly dipping detachment fault that delineates the Sava depression immediately to the N of Motajica, where subsidence prevailed well into Pannonian times. Finally, D4 led to the formation of metric-scale, open folds in low-grade metamorphosed sandstones and phyllites. They re-fold an older axial plane cleavage associated with E-W-trending crenulations and N-S-oriented bedding-slip lineations. D4 is most likely related to the Post-Pannonian compressional inversion of the Sava depression (Tari & Pamić 1998).

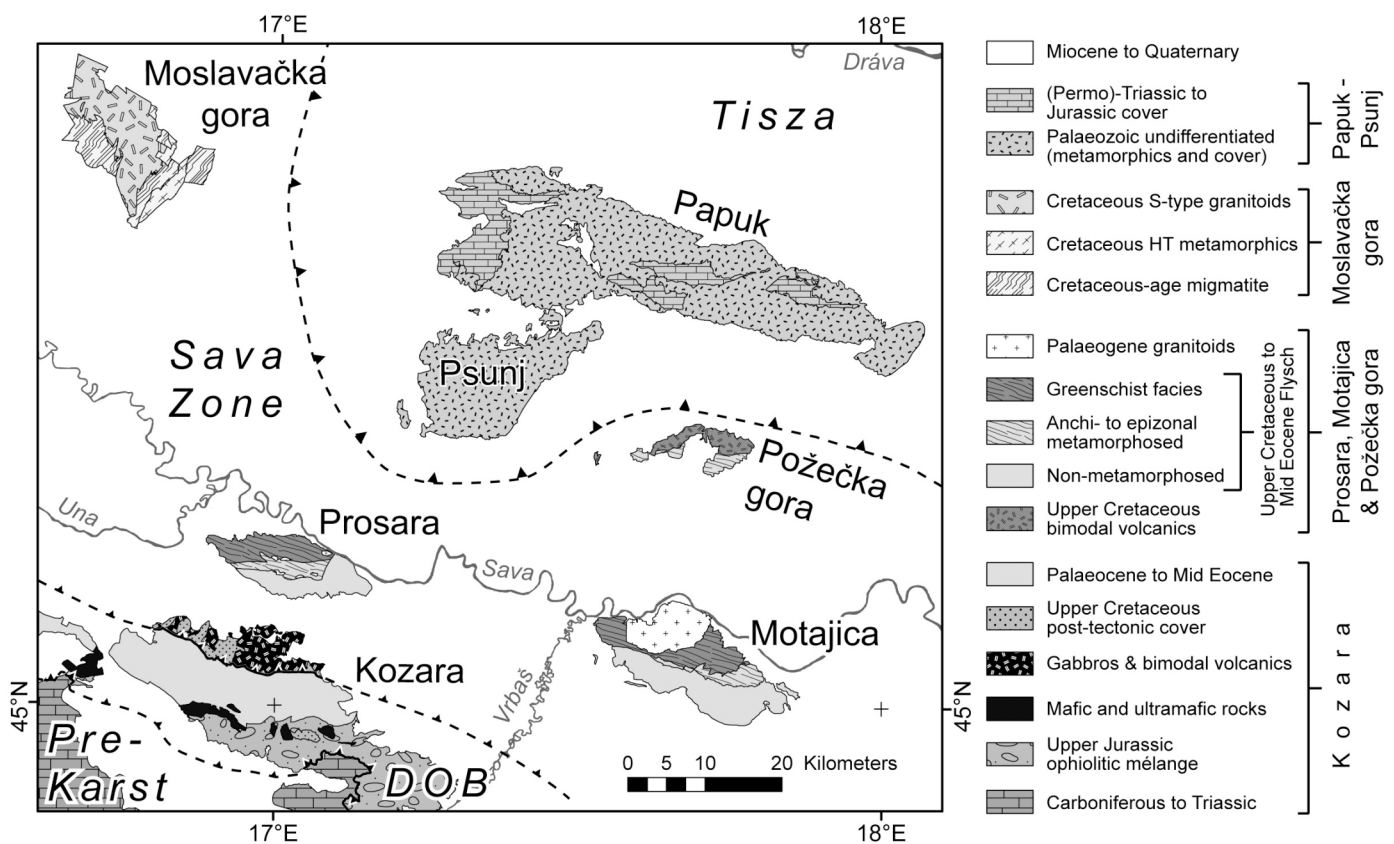


Figure 1. simplified geologic-tectonic map of the inselbergs at the southwestern margin of the Pannonian Basin (based on numerous 1:100.000 map sheets of Former Yugoslavia). Only the Palaeogene tectonic contacts delimiting the major tectonic units (in Italics) are shown. DOB = Dinaric ophiolite belt.

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