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A brittle tectonic history of the Internal Dinarides: an inference based on the paleostress study in the Valjevo area (western Serbia)

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The Internal Dinarides is part of a complex suture zone situated in the central Balkan Peninsula, which present-day tectonic pattern is a result of Late Cretaceous subduction followed by Cenozoic post-collisional and neotectonic phases. Since the Late Miocene, the most important factor controlling regional tectonic processes in this area has been the counterclockwise rotation and northward motion of the Adria plate in respect to the Dinaric orogen. In Serbia, this tectonic process is manifested through constant moderate seismic activity, where stronger earthquakes are recorded mostly along well-known fault systems active in the neotectonic period. However, brittle fault kinematics in this part of the Internal Dinarides is poorly documented. In this research we performed a calculation of the tectonic stress tensors in order to determine brittle tectonic regimes acting in western Serbia (Valjevo mountains range), as well as their relative chronology.

Fault-slip data have been collected in geological units of different age and lithology: Permian, Triassic and Cretaceous limestones and Jurassic peridotites and serpentinites. Slip was determined using linear indicators like "carrot shaped" markings, gouging grain grooves and calcite and magnesite fibres. Relative brittle history was determined using criteria of cross-cutting relationships, fracture mineralization and structural features of the brittle overprint of rocks.

We distinguished four brittle deformation phases. Phase D1 is characterized by N-S compression, which is indicated by thrust faulting of NE- and NW-trending faults. Phases D2 and D3, are both extensional. However, since we had clear indicators that phase D3 overprints all the previous deformation phases, we suppose that the two extensional phases occurred separately, rather than acting as a single radial extension phase. Deformation phase D2 is characterized by N-S to NE-SW extension, while D3 phase is represented by NW-SE (orogen parallel) extension. Strike-slip deformation phase D4, was indicated by sinistral faulting along N- to NE-trending faults, and dextral faulting along generally E-trending faults. This deformation phase is characterized by N-S compression and E-W extension.