

From orogenic buildup to extensional unroofing: the evolution of the Adria - Europe collisional zone in the Medvenica Mountains of Croatia

Van Gelder, I.E.¹, Beniést, A.¹, Matenco, L.¹, Willingshofer, E.¹, Andriessen, P.A.M.², Gruic, A.³ & Tomljenovic, B.³

¹ Utrecht University, Faculty of Geosciences, Utrecht, The Netherlands
(i.e.vangelder@hotmail.com)

² VU University Amsterdam, Faculty of Earth and Life Sciences, Amsterdam, The Netherlands

³ University of Zagreb, Institute of Geology and Geological Engineering, Zagreb, Croatia

Quantifying the kinematics of the Miocene extension in the Pannonian Basin is of critical importance for understanding the evolution of Adria-Europe collision in particular in the transitional zone from the Alps to the Dinarides. Recent studies have demonstrated that large-scale extensional unroofing along low-angle detachments have affected the Europe-Adria contact in the Dinarides during Miocene times. The relationship between this extensional exhumation of Adriatic units in the Medvednica Mountains (Croatia), the roughly coeval Miocene extension affecting the Alpine-derived units during E-ward extrusion and the formation of the Pannonian Basin is still unknown and the focus of this study.

The Medvednica Mountains, a NE-SW striking mountain range within the internal Dinarides, has been the focus of a field kinematic study, complementary low-temperature thermochronology (apatite fission track), metamorphic petrology, isotope dating (Rb-Sr measurements) and microstructural analysis. The observations indicate that the mountains consist of two units, reflecting distinct Adriatic paleogeographical positions. The upper unit contains Paleozoic mostly fine-grained clastic sequence metamorphosed in sub-greenschist facies, overlain by a proximal Adriatic facies consisting of Triassic shallow water carbonates. The lower unit is made up by a volcanic sequence overlain by Triassic carbonates metamorphosed in greenschists facies that bears a strong resemblance to the Triassic break-up volcanism and subsequent sedimentation affecting the distal Adriatic units observed elsewhere in the Jadar-Kopaonik unit of the Dinarides. The strong contrast between the Middle-Upper Triassic facies of the Medvednica Mountains suggests large scale thrusting during Cretaceous nappe stacking.

Subsequently, the studied area has been affected by significant extensional deformation creating the present-day turtleback geometry. This resulted in the formation of brittle normal faults in both units, locally tilted by the uplift of the mountain core, which indicate mostly NE-SW extension. The lower unit is affected by a pervasive deformation characterized by a wide mylonitic shear zone with stretching lineations indicating consistently top-NE to E sense of shear. Low-temperature thermochronology and absolute age dating (in progress) will clarify the exact ages of nappe-stacking and subsequent extensional exhumation.

The present-day geometry of the mountains was established during the Pliocene-Quaternary inversion.

Furthermore, the results demonstrate that the extensional geometry and sense of shear is typical for the Miocene extensional exhumation and basin formation that affected the Adria-Europe contact elsewhere in the Dinarids, e.g. Kozara-Prosara-Motajica and Fruska Gora extensional structures. By comparing similar extensional features observed in for instance the Rechnitz and Pohorje extensional structures, the combined study potentially demonstrates that the Miocene mechanism of extension and sense of shear is structurally coherent at the scale of the entire Dinaridic and Alpine margins.