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Towards understanding the crustal response of slab tearing and detachment: inferences from the Dinarides-Hellenides transition

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Convergence zones are often characterized by numerous subduction- to collision-related dynamics in many orogenic areas worldwide. Processes such as continental indentation, extrusion and slab roll-back can occur simultaneously along orogens as a consequence of different rates of convergence. Such along-strike variability across the orogen can lead to migration of deformation from partly detached slab to the still active oceanic or continental subduction. These conditions create slab tearing often followed by rotation, rapid roll-back of the attached slab and/or exhumation of previously buried crust in the upper plate above the already detached slab. The main mechanism that explains transition from slabs with contrasting kinematics to the crustal level strain partitioning is still not fully understood.

One very good example of strain partitioning associated with indentation, slab-detachment and slab-tearing is the junction between the Dinarides and Hellenides in southeastern Europe. Following the Jurassic – Eocene closure of the Neotethys Ocean and subsequent Adria – Europe collision, the Dinarides - Hellenides orogen has recorded a significant extensional deformation. This extension was driven by the Oligocene – early Miocene slab detachment of the Dinarides slab, while the Hellenides segment continued its evolution until the present day.

We have performed a field kinematic and structural study in the less understood area of Montenegro near Dinarides - Hellenides transition to determine the influence of Oligocene – early Miocene deformation on Dinarides composite nappes. The results imply that Oligocene – early Miocene slab detachment followed by slab tearing was accommodated in crustal domain by bi-directional extension associated with the exhumation of mid-crustal levels in the footwall of both orogen-parallel and orogen-perpendicular faults, reactivation of inherited Cretaceous-Paleogene nappe contacts and formation of extensional klippen.