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Constraints on lateral extrusion in the Eastern Alps and the linkage to Mediterranean plate tectonics

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This study comprises a review and discussion of the classical model of lateral extrusion in the Eastern Alps, including the evolution of the confining fault systems in space and time, the evaluation of thermochronological and sedimentary ages as well as the application of seismic data. Accordingly, the kinematic model of lateral extrusion between ca. 30 and 15 Ma has to be modified. We suggest a four stage extrusion scenario for the Eastern Alps and link it to Mediterranean plate tectonics.

(1) During Oligocene times, eastward extrusion of the Cental Austroalpine units was mainly accommodated by displacement along the Inntal Fault, the Defereggen-Antholz-Vals Fault system and the Periadriatic Fault with sinistral sense of shear.
(2) Subsequent unroofing of the eastern Tauern Window (ca. 23 Ma) was achieved by strike-slip along the western segment of the Salzachtal-Ennstal-Mariazell-Puchberg Fault and the Mölltal Fault, as well as normal faulting along the Katschberg fault. The sedimentation within the fault-related pull-apart basins along these strike slip faults initiated significantly later. This is taken as a hint that early faulting was not accompanied with significant exhumation within the eastern Central Austroalpine realm.
(3) Ongoing northward indentation of the Southalpine (Adriatic) Block and related shortening during Early Miocene times ($\sim$ 17-16 Ma) resulted in the lateral escape of Austroalpine units east of the Tauern Window. Strike slip faults propagated eastwards and the kinematic along the Periadriatic lineament changed from sinistral to dextral. Formation of intramontane basins and onset of sedimentation within the Styrian Basin suggest significant exhumation within the Austroalpine and incipient crustal thinning along the Alpine – Pannonian plate margin.
(4) The extrusion wedge, controlled by the shape of the Bohemian promontory in the north, is eastward widening and experienced N-S extension at ca. 15 Ma. Extension-related normal faulting in the internal parts of the Austroalpine wedge resulted in the exhumation of the so called Schladming Block to the east of the Tauern Window and southeastward detachment of the Gurktal Block along the Katschberg - Niedere Tauern Southern Fault System. The eastern termination of the Gurktal Block is defined by the Pöls–Lavanttal Fault System that links the Schladming Block with the coevally exhuming Pohorje Block. The Mid-Miocene Pohorje Pluton is suggested to have formed within the Pöls-Lavanttal Fault.

A combined view on seismic data and plate configuration in the Alpine-Carpathian-Mediterranean realm suggests that the Pöls- Lavanttal fault system defines the junction where European, Adriatic and Pannonian plates intersect. Minor extrusion between ca. 30 and 17 Ma is related to the fact that Austroalpine units are confined by oblique convergence between Adriatic and European plates. Major extrusion between ca. 17 and 6 Ma occurred as soon as Austroalpine units extended to the east of the Dinaric slab now being controlled by overall extension between Dinaric and Carpathian slabs.