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Central Mediterranean mantle flow system and the formation of the Pannonian basin

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Upper mantle flows generated by subducting lithospheric slabs in the Alpine-Mediterranean convergence zone have played a fundamental role since the Late Oligocene in the formation and evolution of the Mediterranean backarc basins. Surface geology and geodesy combined with seismic tomography and shear wave anisotropy data offer adequate constraints to reconstruct the subduction history of Mesozoic oceanic lithosphere in the area.

A general feature of the Mediterranean is given by the inferrence that rollback of the subducting slabs was always much faster than the convergence rate. The retreating slab generates an upper mantle circulation system characterised by poloidal and toroidal flows. Numerical and experimental modelling show that the circulation pattern is strongly modified by the presence of slab windows. It has been demonstrated that this flow system has largely controlled the dynamic topography, as well as extension and rotations of the upper plate in the Mediterranean backarc basins.

The so far unexplained, but well known feature of the Pannonian basin is given by the anomalous subsidence and uplift history.In addition, the upper plate above the retreating lithosphere is actually a collage of two distinct crustal wedges extruded from the internal Eastern Alps and the Dinarids. During extension they became juxtaposed after major (70 to 90 degree)counterclockwise and clockwise rotation, resp.

We argue that crustal stresses due to indentation of Adria combined with induced flow around the retreating slab are the main driving force for the development of the Pannonian basin. However, we point out that the presence of a slab window below the northwestern branch of the Dinarides („the Istria window") is vital to explain the initiation of extrusion and opposite rotation of the Alcapa and Tisza-Dacia crustal wedges. Via this slab window mantle material from the sub-Adriatic region has been pumped into the upper mantle above the retreating slab in the Carpathian embayment since the Late Oligocene, when rollback of oceanic lithosphere on both sides of Adria commenced. It is becoming increasingly clear that the Alpine -Mediterranean realm constitute one single interconnected geodynamic system.