



Focused exhumation in the Eastern Alps vs. distributed exhumation in the Western/Central Alps: a response to lower-crustal architecture

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A compilation of apatite and zircon fission track ages of the Alpine chain points to markedly different patterns of cooling and exhumation of the Eastern Alps compared to the Central and Western Alps. The site of exhumation and shortening in the Western Alps progressively migrated towards the northwestern foreland of the orogen during the Tertiary, whereas it was rather stationary in the Eastern Alps. As a result, a narrow metamorphic belt, coinciding with an orogen-scale upright antiform of large amplitude formed in the Eastern Alps (Tauern Window) and a wide metamorphic belt characterised by two orogen-scale antiforms of smaller amplitude formed in the Western and Central Alps (internal and external massifs). This difference is expressed at the surface by the disappearance of the external massifs in the Eastern Alps.

We estimate that the amount of Neogene shortening in the Eastern Alps, along the TRANSALP section, varies between 109 and 124 km. This value is comparable to the 119 km constrained for the Central Alps, along the NFP 20 transect (Schmid et al. 1996), suggesting that the different modes of exhumation and deformation (distributed vs localised) are not due to different amounts of shortening.

The deep structure of these two parts of the orogen is also clearly different. Lower crustal wedges overthrusting the European lower crust are imaged by seismic interpretation in the Central and Western Alps, whereas they are lacking in the Eastern Alps (Schmid et al., 2004; Kissling et al., 2006). Alternative interpretations do show an incipient lower crustal Adriatic wedge (TRANSALP working group, 2002; Lüschen et al., 2004) in the Eastern Alps, however its lateral extent is limited, terminating below the southern boundary of the Tauern Window (Lüschen et al., 2004). Moreover, the inferred basal detachment of this wedge is much steeper than in the Western Alps, resulting in the overthrusting of upper instead of lower European crust. Whatever interpretation is favoured, no significant doubling and northward displacement of the lower crust can be inferred in the Eastern Alps. The northern terminations of the west-Alpine lower crustal wedges are located close to the termination of the most external thrusts of the external massifs, where the youngest exhumation of European basement took place. We interpret the formation and displacement of these lower crustal wedges as the cause for the northward shift of deformation and exhumation towards the foreland of the orogen. The absence, or the very limited extent of such a wedge in the Eastern Alps explains the long-term localization of shortening and exhumation in one and the same area, namely the axial zone of the orogen.

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