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# Contemporaneous versus diachronous rapid exhumation in the Tauern Window - new perspectives from in-situ 40Ar/39Ar laser-probe ages of white mica (Eastern Alps)

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The Tauern Window is a late-orogenic structure that exposes nappes derived from the lower plate (Penninic- and Subpenninc units) of the Alpine Orogen. The exhumation is greatest where two domes with post-nappe folds and Barrovian-type amphibolite-facies metamorphism are exposed in the footwalls of Neogene extensional shear zones at the window's western and eastern margin: the Brenner- and Katschberg shear zone systems (BSZS, KSZS). The conjugate geometry of these post-nappe structures suggests that all parts of the Tauern Window exhumed contemporaneously in response to northward indentation of the Adriatic microplate. However, new 40Ar/39Ar laser-probe ages of white mica in combination with existing thermochronological data and thermal modeling suggest that rapid exhumation may have been diachronous.

Rapid exhumation (> 1mm/a) in the western part of the Tauern Window began no later than 20Ma (von Blanckenburg et al. 1989, Fügenschuh et al. 1997) and coincided with the onset of sinistral strike-slip faulting along the Guidicarie Belt (south of the BSZS) that accommodated indentation of the Eastern Alps by the Adriatic indenter. Rapid cooling (> 25°C/Ma) from c. 550° to 270°C in the footwall of the BSZS began at about 18Ma. However, in the eastern part of the Tauern Window the single grain ages from white micas that overgrow the main foliation of the KSZS constrain rapid exhumation in the footwall of the KSZS to have begun before 20Ma and to have ended no later than 17Ma ago. Together with literature data from other thermochronological methods, our new 40Ar/39Ar data indicates that rapid cooling of this same area from 525° to 270°C began at 21Ma or even earlier.

Taken at face value, the data suggest that rapid exhumation of the western part of the Tauern Window may have begun simultaneously with or slightly later than the onset of rapid exhumation in the eastern part, and that rapid cooling in the west started at least 3Ma later than in the east. If rapid exhumation at both ends of the Tauern Window was contemporaneous, then the delay between the onset of rapid exhumation and rapid cooling was much shorter in the east ($\leq$ 1Ma) than in the west (2Ma). A possible explanation is that erosional denudation was greater in the west due to the prominent role of high-amplitude post-nappe folding, whereas tectonic denudation due to extensional shearing was more important in the east. On the other hand, if rapid exhumation began significantly earlier in the east (>21Ma), then northward indentation of the Adriatic microplate accommodated by sinistral motion along the Guidicarie Belt is unlikely to have been the sole cause of rapid exhumation in the entire Tauern Window. Possibly, earlier rapid exhumation in the east reflects the counterclockwise rotation and subduction of Adriatic lithosphere. The rotation about a pole located in the western Po Plain would have lead to earlier NNW-directed subduction and indentation beneath the eastern Tauern Window. This is consistent with tomographic images in which the north-dipping slab anomaly beneath the Eastern Alps trends obliquely to Neogene structures in Tauern Window (Lippitsch et al. 2003).