

Late Cenozoic cooling history of the central Menderes Massif and the contribution of erosion to rock exhumation during active continental extension

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The Menderes Massif constitutes the western part of the Anatolide belt in western Turkey and experienced a prolonged history of post-orogenic extension. A large amount of the extension was accommodated by the two oppositely dipping Gediz and Büyük Menderes detachment faults, which led to the exhumation of the central Menderes Massif (Gessner et al., 2013). Previous studies proposed a synchronous, bivergent exhumation of the central Menderes Massif since the Miocene (Gessner et al., 2001), although only the evolution of the north-dipping Gediz detachment is well constrained (Buscher et al., 2013). Detailed structural and thermochronological investigations from the south-dipping Büyük Menderes detachment have still been missing. Here we present results from different thermochronometers, which constrain the cooling and exhumation history of footwall and hanging wall rocks of the Büyük Menderes detachment.

Our new zircon and apatite (U-Th)/He and fission track ages of footwall rocks from the Büyük Menderes detachment document two phases of increased cooling and exhumation (Wölfler et al., in revision). The first episode of increased footwall exhumation (~ 0.9 km/Myr) occurred during the middle Miocene, followed by a second phase during latest Miocene and Pliocene (~ 1.0 km/Myr). Apatite fission track ages yield a slip rate for the Pliocene movement along the Büyük Menderes detachment of $3.0 (+1.1/-0.6)$ km/Myr. Thermochronological data of hanging wall units reflect a slow phase of exhumation (~ 0.2 km/Myr) in the late Oligocene and an increased exhumation rate of ~ 1.0 km/Myr during the early to middle Miocene, when hanging wall units cooled below ~ 80 °C. In comparison with the Gediz detachment, our thermochronological data from the Büyük Menderes detachment confirms the concurrent activity of both detachments during the late Miocene and Pliocene. With respect to the relative importance of normal faulting and erosion to rock exhumation, a comparison with ^{10}Be erosion rates from catchments in the exposed footwall of the Büyük Menderes detachment indicates that erosion has contributed 10-40% to the exhumation of metamorphic rocks beneath the detachment. Our finding underlines that the contribution of erosion to rock exhumation cannot be neglected in regions of active continental extension.

References

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