TECTONIC UNROOFING OF ALPINE ULTRAHIGH-PRESSURE TERRANES

FROITZHEIM, N. [1], JANAK, M. [2], PLEUGER, J. [1] & VRABEC, M. [3]

[1]Geologisches Institut, Universität Bonn, Nussallee 8, 53115, Bonn, Germany
[2]Geological Institute, Slovak Academy of Sciences, Dúbravská 9, 840 05, Bratislava 45, Slovak Republic
[3]Department of Geology, University of Ljubljana, Askerceva 12, 1000, Ljubljana, Slovenia
e-mail: niko.froitzheim@uni-bonn.de

The return of ultrahigh-pressure metamorphic terranes to Earth's surface is mostly discussed in the framework of gravity-driven extrusion from a subduction channel. This implies the simultaneous activity of a thrust fault with foreland-directed shear sense at the base of the UHP terrane and a normal fault with hinterland-directed shear sense at the top. However, the shear zones at the top of UHP terranes in the Alps are generally not normal faults but foreland-directed thrust faults. They were partly reactivated as or cut by hinterland-directed normal faults, but this generally occurred after the main exhumation stage. Therefore, the extrusion model and its variants (e.g., slab break-off, serpentinisation) do not adequately describe the exhumation of UHP terranes in the Alps.

During UHP metamorphism, part of the overburden of any UHP terrane is invariably formed by mantle rocks because the required overburden exceeds the maximum thickness of crust. We show that in the cases of Tertiary UHP rocks in the Adula - Cima Lunga nappe, Central Alps, and of probably Cretaceous UHP rocks in the Pohorje unit, Eastern Alps (JANÁK et al., 2004), these mantle rocks belonged to transient microplates (Briançonnais microplate in the case of Adula, Upper Central Austroalpine microplate in the case of Pohorje) bounded by parallel-dipping subduction zones on two sides, the UHP rocks being buried in the lower and more external subduction zone. This subduction zone was oceanic in the case of Adula but intracontinental in the case of Pohorje. The lower crustal and mantle parts of the microplates are not present any more in the Alps, neither at the surface nor in deep seismic profiles and therefore must have been subducted. In both cases, a dense oceanic slab was attached to the microplates (South Penninic slab in the case of Adula, Meliata slab in the case of Pohorje). We assume that these slabs exerted a pull which caused the downward removal or extraction of the microplates during ongoing plate convergence, leading to the partial unroofing of the UHP rocks (slab extraction model, FROITZHEIM et al., 2003). In this model, the ultimate driving force of exhumation is not the buoyancy of the UHP terrane but the negative buoyancy of the oceanic slab.

References

FROITZHEIM, N., PLEUGER, J., ROLLER, S. & NAGEL, T. (2003): Geology, **31**, 925-928.

JANAK, M., FROITZHEIM, N., LUPTAK, B., VRABEC, M. & RAVNA, E.J.K. (2004): Tectonics, **23**, TC5014.