The tectonic window of Oberhof (Carinthia, Austria): A key area to understand the tectono-metamorphic evolution of the upper part of the Eo-Alpine nappe stack

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The Upper Austroalpine Unit in the Eastern Alps represents a nappe-stack that formed during the Eo-Alpine (Cretaceous) event. It is dominated by crystalline rocks that experienced several metamorphic imprints, specifically during the Variscian, Permo-Triassic, Eo-Alpine and Neo-Alpine events. While the central eclogite-bearing nappes (Koralpe-Wölz Nappe System) are well studied, a good understanding of the upper parts (Ötztal-Bundschuh and Drauzug-Gurktal Nappe Systems) is still missing. The tectonic window of Oberhof represents a key area to study the structure and evolution of the upper part of the Eo-Alpine nappe stack since the succession extends over units corresponding to three nappe systems.

In this contribution, we present a revised lithotectonic map of the Oberhof window. The core of the window is occupied by the middle-grained Late Ordovician “Oberhof orthogneiss” which is overlain by dolomite marble, both representing the easternmost outcrop of the Bundschuh Nappe. The overlying unit is composed of garnet bearing quartzite and garnet-chloritoid-bearing graphite schist. Commonly referred to as metasediments of Pennsylvanian age, their tectonic affiliation is still a matter of debate. These units are overthrusted by garnet-micaschist, amphibolite, hornblende-garbenschist, calc-micaschist, interpreted as the uppermost parts of the Koralpe-Wölz Nappe System. The uppermost units are comprised of micaschist, phyllite and quartzite corresponding to basal nappes of the Drauzug-Gurktal Nappe System. A unique feature compared to the rest of the Upper Austroalpine Unit is the reversed position of parts corresponding to the Koralpe-Wölz Nappe System overlying the Bundschuh Nappe.

From structural field observations and petrographic analysis of thin-sections we can distinguish four deformation events. The first one is preserved in relict isoclinal folds of quartz layers. It is postdated by ductile, top-to-the-E shearing, visible only in the upper parts of the section. The most dominant imprint all over the profile caused flattening and is represented by tight folds with E-W/SE-NW trending fold-axes. A corresponding axial plane schistosity is shallowly dipping to the N/NW. It becomes the dominant schistosity especially in the lower part and obscures the previous deformation events. As the latest deformation event at the brittle-ductile transition shallow eastwards dipping normal faults with top E/SE kinematics are identified. Biotite Rb/Sr ages varying around 75 Ma suggest a Late Cretaceous cooling and imply a maximum age for the latest brittle-ductile shearing event.

To constrain the metamorphic history, peak Temperatures are derived from Raman spectroscopy on the carbonaceous material, which vary around 520°C in the lower units. This indicates epidote-amphibolite facies peak conditions which is in accordance with P-T information gained from thermodynamic modelling using pseudosections. Based on petrographic observations the metamorphic grade decreases to middle greenschist facies conditions towards the higher structural part of the section. Microstructural relations allow correlation of the P-T path with the deformation events, proposing a tectono-metamorphic evolution history of this region.