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The upper part of the Eo-Alpine extrusion wedge: insights from the tectonic window of Oberhof (Carinthia, Austria)

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During the Eo-Alpine collisional event, eclogite-bearing nappes were exhumed in the core of an extrusion wedge that is part of the Upper-Austroalpine Unit of the Eastern Alps. Towards the foot- and hanging wall of the wedge, the metamorphic field gradient decreases. While the E-W trending high-pressure belt is well characterized, lower grade metamorphic units were largely neglected so far. As there is no modern P-T-t-D data available, their geodynamic significance during burial and exhumation is not well constrained. A key area for targeting this open question is the tectonic window of Oberhof (Carinthia, Austria), since the transition between high/medium-grade and low-grade units is exposed.

In this contribution we present structural and petrological data for units exposed within the Oberhof window. In the core of the window Late Ordovician orthogneiss and Triassic dolomite marble corresponding to the Ötztal-Bundschuh (ÖB) Nappe System are overlain by conspicuous garnet-chloritoid bearing graphite schists with a suspected Pennsylvanian protolith age. Garnet- and hornblende-bearing schists corresponding to the Koralpe-Wölz (KW) Nappe System are found structurally above. These units are overthrusted by mica schists and phyllites of basal units of the Drauzug-Gurktal Nappe System. Unlike elsewhere in the Upper-Austroalpine Unit, units assigned to the KW Nappe System are exposed structurally above the ÖB Nappe System. Based on field- and microstructural observations, the several deformation events result in the following (micro)structures: (D1) ductile top-E shearing in the upper part of the section, (D2) tight folds with strong scattering axes roughly trending E-W to SE-NW and (D3) shallow-dipping, top-E/ESE normal faults at brittle-ductile conditions. Folding (D2) results in the most pervasive imprint and occurred closely after metamorphic peak conditions. Since it overprints older boundaries related to nappe-stacking (D0) no kinematic indicators of nappe-stacking are preserved and transitions between units. Cross-cutting relationships of D1, D2 and D3 are not always obvious, probably owed to the contemporaneous nature of the events in the frame of N-S shortening and E-W extension.

In the garnet-chloritoid bearing mica schist the metamorphic peak assemblage is best preserved showing neglectable retrograde overprint. Simple zoned garnets exhibiting slight decrease of Mn indicates single-phase metamorphism. From pseudosection modeling, peak conditions at 530°C and ∼9 kbar are inferred. Towards structurally shallower units the metamorphic field gradient apparently decreases as recorded by progressive disappearance of garnet. However, peak temperatures varying around 520°C throughout all units derived from Raman microspectroscopy of carbonaceous material and microstructural observations (chlorite pseudomorphs after garnet, dynamically recrystallized feldspar) indicate similar peak conditions for the whole succession. We suspect that fluid-driven retrogression related to the D3 top-E shearing event is responsible for the retrogression gradient of peak assemblages. Rb-Sr cooling ages of biotite around 75 Ma imply a minimum age for this event. Due to the common post-peak history observed in the structurally deeper units, we suggest out-of-sequence thrusting during nappe stacking predating peak temperature conditions to account for the reversed position of the KW and ÖB nappe systems.