Geodynamic setting of rocks above and below the Eo-Alpine extrusion wedge (Innsbruck Quartzphyllite Zone, Eastern Alps, Austria)

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In the Austroalpine units of the Eastern Alps, low-grade metapelitic rocks occur structurally above and below the high-metamorphic grade rocks of the Eo-Alpine extrusion wedge (Koralpe-Wölz Nappe System). Information about the P-T-t-D histories of the units above and below the extrusion wedge are currently limited despite their great importance to constrain the geodynamic setting for the Late Cretaceous exhumation of the high-pressure rocks. In this work we investigate the 'Innsbruck Quartzphyllite Zone' north of the Tauern Window, which consists of low-grade metasedimentary sequences. Recent structural mapping and new petrological and geochronological data showed that the Innsbruck Quartzphyllite Zone consists of several tectonic Austroalpine units that are located above and below the Eo-Alpine extrusion wedge: The lowermost Königsleiten Nappe belongs to the Silvretta-Seckau Nappe System (structurally below the Eo-Alpine extrusion wedge), the Windau Nappe and the Uttendorf Nappe both belong to the Tirolic-Noric Nappe System (structurally above the Eo-Alpine extrusion wedge).

Chloritoid-bearing phyllites from the Königsleiten Nappe exhibit a pronounced compositional layering, which is interpreted as an inherited sedimentary compositional heterogeneity, arguing for a simple deformation history. The mineral assemblage interpreted to be stable at the metamorphic peak comprises chloritoid, chlorite, muscovite, paragonite, quartz, ilmenite and allanite. Samples from the Windau Nappe show a polyphase deformation history, indicated by veins concordant to the main foliation that contain intrafolial folds. The assemblage in the phyllitic host rock is characterized by chloritoid, muscovite, quartz, rutile and subordinate Mg-siderite whereas veins contain coarse grained quartz, muscovite, Mg-siderite, dolomite and chlorite. Kyanite is found at the vein-host rock interface, commonly partially replaced by muscovite and kaolinite. Layers at the host rock-vein contact are typically enriched in accessory minerals that comprise rutile, monazite, apatite, xenotime and zircon. Compositional zoning of these phases indicates extensive dissolution and precipitation, probably related to vein formation. Samples from the Uttendorf Nappe comprise chloritic micaschist with several mm-sized chloritoid porphyroblasts. Depending on the bulk chemistry, either rutile or ilmenite is interpreted to be part of the equilibrium assemblage, indicating peak metamorphic conditions close to the rutile to ilmenite transition. Additionally, apatite and allanite commonly overgrown by an epidote rim were found.

Preliminary results from SEM imaging and EMP analyses combined with thermodynamic forward modelling indicate peak conditions of ~470°C and ~7 kbar for the Königsleiten Nappe and slightly lower P-T conditions for the Windau Nappe. Similar conditions are inferred for the Uttendorf Nappe from the rutile to ilmenite transition at ~450°C. We present new results from thermodynamic modelling with an extended model compositional space to account for REE-bearing phases (allanite, monazite, xenotime and apatite) which are suitable targets for U-Th-Pb in-situ dating using laser-ablation ICP-MS. Identifying prograde and retrograde reactions involving these minerals allows a better link of P-T and age data and thus helps resolving the temporal variation of the Cretaceous metamorphic evolution in the different nappes. Our new P-T-t-D data from units structurally above and below the extrusion wedge help to better characterize the overall geodynamics settings of the Eo-Alpine exhumation of high-grade rocks in the Eastern Alps.