The tectonic contact between the Bundschuh and Murau Nappes (Upper Austroalpine Unit, Stadl an der Mur, Austria)

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The exact position and kinematics of tectonic contacts between different nappe systems within the Upper Austroalpine Unit are still poorly explored. In this work, we investigate the contact between the Bundschuh Nappe (BN, Ötztal-Bundschuh Nappe System) and the Murau Nappe (MN, Drauzug-Gurktal Nappe System) south of Stadl a.d Mur. We documented the lithologies and structures across the contact and investigated the garnet-bearing micaschist and paragneiss from both nappes in order to characterize the exhumation history. The BN is exposed in footwall position and consists of a crystalline basement (paragneiss, micaschist) with transgressive overlying Permo-Mesozoic metasediments (metaconglomerate, quartzite). The MN, in hanging wall position, is comprised of metasediments (micaschist, marble, greenschist) of Palaeozoic age and overlain by Permo-Mesozoic cover rocks (quartzite, marble). The top of the deformed Permo-Mesozoic metasediments of the BN defines the nappe boundary.

In both nappes, four main deformation phases have been identified at outcrop scale and in thin sections. The main layering dips shallowly to N and E in the BN and to NE in the MN (D1). It is deformed by isoclinal folds with NE- to E-dipping fold axes, cleavage domains and microlithons structures (D2). Ductile to brittle-ductile top-to-the-E shearing, indicated by quartz CPO and SPO as well as C'-fabric is interpreted as the expression of an early phase of Eoalpine exhumation (D3). Brittle top-to-the E and NNE shearing with kinking of the earlier fabric corresponds to the late Eoalpine exhumation (D4).

In both nappes, the investigated thin sections have similar characteristics, with a lepidoblastic microstructure and nearly almost similar index minerals (garnet, muscovite, paragonite, chlorite, biotite, ilmenite) and mineral proportions. The only significant difference is the occurrence of chloritoid porphyroblasts in the samples of the BN and the slightly higher biotite content in the MN. In both nappes, orientation of inclusions in garnet indicates garnet growth during phases D1, D2, SEM imaging, and chemical profiles in garnet show a systematic continuous core to rim chemical zoning.

Raman microspectroscopy on carbonaceous material yielded temperatures of 520°C in the BN and slightly below 500°C in the MN. Thermodynamic modelling was carried out for a sample from the BN, showing a garnet-chloritoid-chlorite-muscovite-paragonite-ilmenite equilibrium assemblage interpreted as a peak assemblage. For the analysed bulk rock chemistry, this assemblage correspond to a narrow field located at 510-540°C and 9-11 kbar. The compositions of garnet, chloritoid, chlorite and white mica calculated for this P-T range are in good agreement with the measured ones. These peak conditions are consistent with the results of Raman microspectroscopy. The fact that both units show one phased garnets is a new finding, especially in the BN.