Variscan to Eoalpine tectono-metamorphic history of the Austroalpine Units south of the Tauern Window (Kreuzeck Mountains, Eastern Alps, Austria)

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The Austroalpine Units of the Eastern Alps are derived from the continental crust of the northern Adriatic continental margin. They consist of several basement and/or cover nappes, which were affected differently by Phanerozoic tectono-metamorphic events. This work presents new age and PT data from the Kreuzeck Mountains located to the south of the Tauern Window.

The investigated area consists of two nappe systems, namely the Koralpe-Wölz Nappe System (KWNS) in the footwall and the Drauzug-Gurktal Nappe System (DGNS) in the hanging wall. They are separated by the several hundreds of meters wide newly defined Wallner Shear Zone, representing an Eoalpine (Cretaceous) South-dipping normal fault.

The KWNS is composed of monotonous paragneiss with intercalations of mica schist and amphibolite (Prijakt-Polinik Complex). Eoalpine peak conditions reached eclogite-facies further in the North and amphibolite-facies in the study area. Rb/Sr biotite ages indicate cooling below c. 300 °C at 75-80 Ma.

The DGNS consists of 3 complexes, which experienced different metamorphic conditions during the Variscan orogeny. The lowermost Strieden Complex is built up by intensely folded, locally garnet-bearing mica schist and amphibolite recording Variscan upper epidote-amphibolite-facies conditions. Structurally above, the Gaugen Complex is dissected by an EW trending, steep North-dipping thrust fault – the Leßnigbach Shear Zone – which is interpreted to be linked to the Wallner Shear Zone and therefore also Eoalpine in age. The Gaugen Complex comprises mica schist and paragneiss and minor amphibolite. Kyanite and staurolite identified in thin sections suggest amphibolite-facies conditions, which is confirmed by PT-pseudosections revealing peak conditions at 600±50 °C and 0.8±0.1 GPa. Sm/Nd garnet isochron age suggest peak conditions around 306±5 Ma. Rb/Sr biotite ages gave 292±3 Ma and 273±3 Ma in the area to the South of the Leßnigbach Shear Zone and 221±2 Ma to the North of it. These ages are interpreted to reflect Variscan cooling with a Cretaceous thermal overprint, which is very weak in the South and more intense in the northern block reflecting the tectonic history of the northern block, which was exhumed from greater depths during the Late Cretaceous activity of the Wallner and Leßnigbach shear zones. The uppermost Goldeck Complex, in contrast, consists of phyllite and marble, which only reached Variscan greenschist-facies conditions.

Taking all together, the DGNS came in contact with the underlying KWNS along the Wallner Shear Zone during the Eoalpine event in the Late Cretaceous. Within the DGNS the individual complexes show a different Variscan imprint. The Gaugen Complex is divided into two blocks, separated by the Leßnigbach Shear Zone. Both blocks reached amphibolite-facies conditions during the Variscan orogeny, but the northern block was exhumed from greater depth by the activity of two shear zones in the Upper Cretaceous.