## P-T-t constraints for the Variscan history of the Gaugen Complex (Kreuzeck Mountains, Austria, Eastern Alps)

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In the Eastern Alps pre-Alpine metamorphic and plutonic Austroalpine and Subpenninic basement units cover a wide area. Large portions of these units were penetratively overprinted by Cretaceous to Cenozoic deformation and metamorphism, which tended to erase the pre-Alpine features. Consequently, there are only a few areas where the pre-Alpine history of basement units can be studied in detail.

The Gaugen Complex is part of the Drauzug-Gurktal Nappe System (Austroalpine) and covers large parts of the SE Kreuzeck Mountains, south of the Tauern Window. In the Gaugen Complex the Variscan amphibolite-facies metamorphic assemblages are well preserved due to the limited Eoalpine overprint in lower greenschist-facies conditions. The most common lithology is paragneiss with transitions to mica schist. In these lithologies garnet is microscopically abundant and can reach sizes of 1 cm in particular layers. Locally, staurolite and rarely kyanite occur in equilibrium with garnet, indicating amphibolite-facies conditions. A three point Sm-Nd isochron age yielded a late Variscan age of 306 ± 5 Ma (2 garnet fractions, one whole rock fraction). This relatively young age is interpreted as a garnet growth age.

The Gaugen Complex is divided by a large E-W striking Eoalpine shear zone with a north side up sense of shear. One representative sample from each side of the shear zone was chosen for bulk rock and mineral chemical analyses as well as equilibrium phase diagram calculations with the Theriak-Domino software package (NCKMnFMASHT system with excess $SiO_2$ and $H_2O$). In the sample of the southern block, the observed equilibrium assemblage Grt-Bt-Ms-Pl-Ilm corresponds to a relatively wide pentavariant field located in the range 570-670°C and 5.5-8.5 kbar. The measured composition of garnet, biotite, plagioclase and muscovite indicates that the observed recorded conditions are at approximately 570°C - 6.5 kbar, which are situated at the low temperature boundary of the Grt-Bt-Ms-Pl-Ilm field. In the sample of the northern block, the observed equilibrium assemblage Grt-Ky-St-Bt-Ms-Pl-Ilm corresponds to a narrow trivariant field located around 640°C - 6.5 kbar. The chemical compositions of garnet, biotite, plagioclase and muscovite calculated at 640°C - 6.5 kbar are in good agreement with their measured counterparts.

Microstructural arguments and equilibrium phase diagrams indicate that the studied parageneses correspond to the metamorphic peak conditions. The blocks to both sides of the shear zone record different peak temperatures (~570°C in the southern block, ~640°C in the northern block) but similar peak pressure (~6.5 kbar). We suggest that these peak conditions were reached in the late Carboniferous according to the garnet age.