The Gaugen Complex in time (Kreuzeck Mountains, Austria)

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In the Eastern Alps only a few lithostratigraphic complexes exist, where the pre-Alpine history of Austroalpine basement units can be studied in detail. This arises from Cretaceous and Cenozoic deformation and metamorphism that variously overprinted most of these units and obscured pre-Alpine features.
One example is the Gaugen Complex forming parts of the Drauzug-Gurktal Nappe System in the Kreuzeck and Goldeck Mountains, south of the eastern Tauern Window. The most common lithology is paragneiss with transitions to micaschist. Additionally, minor amphibolite, orthogneiss and quartzite bodies also occur. The different types of orthogneiss are commonly peraluminous and show volcanic arc signatures. Their age is assumed to be Cambrian or Ordovician. Marble layers appear in the upper part of the Complex and suggest sedimentation at least until the Devonian based on Sr-isotopic ratios.
In the metapelites, locally staurolite and rarely kyanite occur in equilibrium with garnet, indicating amphibolite-facies conditions. A three point Sm-Nd isochron age on garnet yields a late Variscan age of 306 ±5 Ma (two garnet fractions and whole rock), which is interpreted as crystallization age close to the metamorphic peak.
The Gaugen Complex is divided by the E-W striking Lessnigbach Shear Zone. It initiated in Jurassic and/or Early Cretaceous times and was reactivated in the late Cretaceous with a north side up sense of shear. From both sides of the shear zone, 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) were carried out on representative samples. South of the shear zone, the observed equilibrium assemblage Grt-Bt-Ms-Pl-Ilm together with the measured composition of garnet, biotite, plagioclase and muscovite indicates metamorphic conditions of approximately 570°C - 6.5 kbar. The observed equilibrium assemblage Grt-Ky-St-Bt-Ms-Pl-Ilm from the north of the shear zone corresponds to a narrow trivariant field around 640°C - 6.5 kbar, which is confirmed by the chemical compositions of garnet, biotite, plagioclase and muscovite.
Rb-Sr biotite ages are about 280 Ma to the south of the shear zone, whereas to the north of it an age of ~220 Ma were determined. These ages are interpreted to reflect late Variscan cooling below 300±50°C and a slight rejuvenation during the Eoalpine (Cretaceous) lower greenschist-facies overprint, which was more intense to the north of the shear zone.
The Gaugen Complex records different peak temperatures (~570°C in the southern block, ~640°C in the northern block), but similar peak pressure (~6.5 kbar) to both sides of the Lessnigbach Shear Zone. Furthermore, cooling ages in the northern block are younger than in the south. The distribution of the data can be explained by the late Cretaceous north side up sense of shear along the Lessnigbach Shear Zone.