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Evidence for a polymetamorphic evolution of migmatic paragneisses from the southeastern Moldanubian Superunit, Lower Austria

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High grade migmatic paragneisses occur in the the southeastern part of the Modalnubian Superunit which is regarded to be part of the Drosendorf nappe. The rock exhibits the granulite facies mineral assemblage garnet + sillimanite + K-feldspar + biotite + plagioclase + quartz + ilmenite. Within these rocks two generations of garnet can be observed in a matrix composed of large (2mm) K-feldspar and small (<1mm) plagioclase and quartz grains. The first generation of garnet (grt1) forms porphyroblasts with 5–6 mm in diameter with abundant mineral inclusions such as muscovite, kyanite, biotite, rutile, K-feldspar, plagioclase, quartz and ilmenite. This garnet generation displays a prograde zoning pattern seen in a change in chemical composition from Alm68Prp20Grs7Sps6 in the core to Alm68Prp24Grs5Sps2 at the rim. Based on the observed mineral inclusions the first garnet generation was growing at elevated pressures in the presence of kyanite and temperature was increasing during garnet growth beyond the stability field of muscovite. The occurrence of rutile as titanium phase as well as the high Si content of muscovite (3.20 apfu) also indicate elevated pressure conditions for the first garnet generation compared to the granulite facies matrix assemblage. Equilibrium phase diagram calculations point to pressure conditions of 1.4–1.7 GPa at a temperature of 650–750 °C by applying phengite content of muscovite inclusions and nearby garnet compositions.
The second generation of garnet (grt2) is significantly smaller (1–2mm), relatively inclusion free, and chemically different. This garnet generation is more abundant in the rock compared to the first garnet generation. The second garnet generation either occurs as independent small grains in the matrix, or is surrounding the first garnet generation forming an almost continuous “rim” which seems to confine grt1 from the matrix. This kind of garnet does not show any zoning in spessartine component which is very low with Sps1. Remarkable is a strong change in grossular and pyrope and a weak change in almandine contents from Alm66Prp18Grs15 in the core to Alm67Prp25Grs5 at the rim. For the matrix assemblage P–T conditions of 0.7–0.8 GPa at 750–800°C were obtained using the rim composition of grt2 and associated matrix phases.
The results from the granulite facies assemblage is similar to findings for comparable paragneisses (Petrakakis, 1997) and is correlated to thrusting and nappe stacking in the Moldanubian Superunit. The obtained conditions for an initial high pressure stage could be correlated with felsic granulites from the Gföhl nappe (Carswell & O’Brien, 1993). Although pressure conditions of 1.4–1.7 GPa are similar, the postulated temperature of 1000 °C for granulites is much higher compared to 650–750 °C from paragneisses of this study.

Petrakakis K, (1997) Evolution of Moldanubian rocks in Austria: review and synthesis. Jornal of Metamorphic Geology 15: 203–222

Carswell, D. A. & O’Brien, P. J. (1993). Thermobarometry and Geotectonic Significance of High-Pressure Granulites: Examples from the Moldanubian Zone of the Bohemian Massif in Lower Austria. Journal of Petrology 34, 427–459.