



Time scales of polymetamorphism from diffusive alteration of garnet growth zoning (Wölz Complex, Eastern Alps)

M. Bestel, T. Gawronski, and R. Abart

Free University Berlin, Institute for Geological Sciences, Berlin, Germany (abart@zedat.fu-berlin.de)

Garnet prophyroblasts in micaschists from the Wölz crystalline complex (Eastern Alps) typically show two distinct growth zones. The first growth zone is of Permian age and forms the garnet cores. The second growth zone is of Cretaceous age and forms the garnet rims. Both growth zones show pronounced compositional zoning. From garnet isopleth geo thermo-barometry garnet growth at temperatures of 550 to 570°C and pressures of 400 to 500 MPa is inferred for garnet cores and growth at similar temperatures and pressures of 700 to 800 MPa is inferred for garnet rims. In several samples the primary growth zoning of the garnet cores is modified by late stage diffusive alteration along cracks, around mineral inclusions, and at the interface between the first and second garnet growth zone. Two generations of alteration phenomena are discerned. A first generation of alteration phenomena extends over several 100 μm into the pre-existing garnet cores and is ascribed to diffusive exchange with the rock matrix during a long lasting high temperature anneal associated with Permian metamorphism. A second generation of alteration phenomena is restricted to an about 50 μm wide zone along the interface between the two garnet growth zones and around mineral inclusion in the second garnet growth zone. These alteration phenomena are ascribed to diffusion controlled exchange between the first and second garnet growth zones and to late stage exchange between garnet and the rock matrix during Eo-Alpine metamorphism in the Cretaceous. Whereas the time scale obtained for the high temperature stage of the Permian event is on the order of 10 Ma, the time scale obtained for the Cretaceous event is only on the order of 0.2 Ma. This reflects the long lived nature of a stage of elevated heat flux and high geothermal gradient associated with an extensional regime in the Austroalpine realm during the Permian and the lower Triassic. The comparatively short duration of the Cretaceous event reflects rapid exhumation of the Austroalpine lower plate subsequent to the intra continental subduction, which was associated with the Eo-Alpine continent-continent collision.