Interaction of metamorphic and deformation processes in the Hohl eclogite body (Koralpe, Eastern Alps, Austria)

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In this contribution, we present petrographical, chemical and microstructural data from a series of eclogite samples derived from low Mg-high Ti gabbro collected at the Hohl eclogite body in the Koralpe Range (Eastern Alps, Austria). Our investigations suggest a strong interaction between chemical (i.e. metamorphism) and mechanical (i.e. deformation) processes operating at eclogite facies conditions. The rocks are characterized by a pronounced foliation defined by the shape preferred orientation of the major minerals (omphacite, amphibole, epidote and garnet). Minor euhedral quartz grains are present. Overall, grains show rather uniform extinction which is well in line with a low internal distortion detected by electron backscatter diffraction mapping. These features are interpreted as evidence of fluid-triggered syn-tectonic diffusion dominated eclogitization. Thermodynamic forward modelling indicates that eclogitization occurred under fluid saturated conditions at about 1.8 GPa and 640 °C. Continuous prograde metamorphism is resulting in dehydration of eclogite, consequently increasing the pore-fluid pressure and causing brittle failure of the eclogite. Fractures are subsequently sites of re-precipitation with a similar paragenesis as the host eclogite. However, the veins that formed by this process are enriched in quartz and epidote, depleted in garnet and show overall a coarser grain size. Deflection of the host-rock adjacent to veins indicates a ductile reactivation as flanking structures localizing the deformation. The reactivated veins are characterized by undulatory extinction, twinning and subgrain formation, all being indicative of dislocation creep. The investigated samples testify how metamorphic reactions dictate the style of deformation in the eclogite body. While fluid-supported eclogitization initially allows for the accommodation of ductile strain via diffusion-dominated processes, posteclogitization dehydration triggers brittle deformation. Finally, quartz and epidote enriched veins can deform by dislocation creep.