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# Diffusion creep and fabric development in eclogites - a case of transformation plasticity

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The deformation of eclogites and the processes of their fabric development in subduction zones involve mineral reactions and phase transformations. The identification of their interrelationships has been one of Harry Green′s strong research interests aimed at the determination of deformation rates in subduction zones and in the upper mantle. Most previous studies have suggested dislocation creep to be the principal processes of deformation causing the development of a strong CPO in omphacite.

We tested the viability of this process by studying the chemical zonation of garnet and omphacite as well as the texture and microstructure development of Variscan eclogites from the western Bohemian Massif (Czech Republic). These rocks show elongated garnet and omphacite grain shapes parallel to the rock′s extension direction. A chemical zoning pattern in both minerals is congruent with the elongated shape of the grains and has developed as growth zonation during increasing pressure conditions. A later stage of retrogression observed locally along garnet and omphacite grain boundaries has produced mineral phases with an orientation parallel to that of the prograde fabric orientation. Thus, the elongation direction of the deforming rock has been the same throughout the whole prograde and through part of the retrograde reaction history.

The CPO of garnet is random, whereas that of omphacite shows strong [001] maxima parallel to the extension direction, with incipient girdles of poles to (010) and (100). However, dislocation creep can be excluded in both cases based on the chemical zonation patterns and the lack of dynamic recrystallization. Rather the strong CPO of omphacite is due to an oriented growth of omphacite grains during deformation

The spatial distribution of garnet and omphacite grains is random within the eclogite and with respect to one another, consistent with random nucleation sites of both minerals. Quartz is also randomly distributed in the eclogite, but highly ordered with respect to garnet, indicating preferred nucleation sites in the pressure shadows of garnet.

Such diffusion creep microstructures suggest n-values of 1 to 2 for eclogite deformation. The correlation of mineral reactions with deformation throughout the whole eclogite P,T-history is a clear case of transformation plasticity and thus suggests a transient but long-lasting weakening of mafic rocks during subduction.