

Fluid-rock reaction mechanisms, generation of permeability and its consequences for mass transport and texture formation.

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It is well-established that the mechanism of mineral alteration at temperatures where the spatial scale of solid-state diffusion is restricted to intra-crystalline processes, is by dissolution-transport-precipitation. When the dissolution and precipitation steps are spatially coupled, pseudomorphic mineral replacement, in the absence of deformation, is a common observation in both nature and experiment. External stress appears to uncouple the dissolution and precipitation steps, inevitably leading to mass transport and dissolution-precipitation creep as the dominant deformation mechanism. The precipitation process involves nucleation and, in deforming rocks, the minimisation of surface energy leads towards textural equilibration and metamorphic differentiation. The overall process can be considered as a sequence of recrystallisation steps that lead to minimisation of chemical and textural components of the overall free energy. Examples will be given from metamorphic reactions, diagenesis and sub-solidus texture formation in rocks.