

## Pseudomorphs and silicification of brucite during serpentinization

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serpentinization reaction, in particular in terms of geochemical cycles and hydrogen production as well as for the numerical modelling of the reaction from either a reactive transport modelling or a batch geochemical reaction

Serpentinization is a fundamental mechanism in Earth Sciences playing a major role in energy and mass exchanges between the ocean, the crust, and the upper mantle as well as in the biogeochemical cycling of volatiles. Moreover, these reactions also modify in depth the rheologic, magnetic, geochemical, and thermal structure of the lithosphere.

While the general mechanisms of serpentinization are well known and well constrained from a geochemical perspective, there are still major unknowns in the physicochemical processes transforming a fresh and anhydrous peridotite into a fully hydrated serpentinite. Rates of reaction, volume changes and reaction front propagation are intimately related to the local scale mass transfers during the hydration reaction. These local mass transfers are in turn related to the coupling between the geochemical reaction and the hydrodynamics of the system.

We present batch short duration serpentinization experiments of a fresh natural dunite in artificial seawater at 280°C and 450 bar. Experiments lasted only 1 month allowing to observe the incipient serpentinization of the olivine, orthopyroxene and clinopyroxene grains. Results show that the general geochemical behavior is controlled by local equilibria and short length mass transfers, leading to characteristic features such as pseudomorphic replacement, but also to out-of-equilibrium features. These features exhibit for example contacts between brucite  $\text{Mg}(\text{OH})_2$  and talc  $\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$  demonstrating the importance of silica mobility during serpentinization, and in turn its importance on the transient volume changes, permeability evolution and surface passivation of a peridotite subjected to on-going serpentinization.

These results highlight the importance of taking into account metastable and relative kinetics of the different species involved in the