

REE mobility in subduction fluids: An example from Franciscan eclogite

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Although rare earth elements (REE) are thought to be relatively immobile in fluids, increasing evidence suggests that REE are in fact fluid-mobile under some circumstances relevant to subduction. We have determined major and trace element concentrations for matrix garnets (2-4 mm) and one garnetite vein in an eclogite-facies block from the Ring Mountain locality of the Franciscan Complex, Tiburon Peninsula, CA. The garnetite vein (1.8 cm wide) is nearly monomineralic, composed of inclusion-poor garnet (5-70 μ m) and trace amphibole (~1%). Inclusion-rich matrix garnet cores display chondrite-normalized REE patterns enriched in heavy (H)REE, consistent with fractionation during prograde metamorphism. Inclusion-poor matrix garnet rims show enrichment in middle (M)REE relative to HREE, perhaps indicative of infiltration by an amphibole-derived fluid late in the prograde metamorphic interval. Vein garnet REE patterns also display enriched MREE relative to HREE, suggesting a shared fluid source for garnetite veins and matrix garnet rims. The vein garnet is Mn-rich relative to matrix garnet cores and rims. The enrichment of Mn in the vein garnet suggests the involvement of an external fluid. We propose a two-fluid model for garnet precipitation in which 1) an internally derived fluid, likely the result of amphibole breakdown during prograde metamorphism, supplied MREE to matrix garnet rims and vein garnet, and 2) an external fluid, likely derived from mélangé serpentinite or a chlorite-bearing selvage, contributed Mn to the garnetite vein. This relationship between vein garnet and matrix garnet rims is evidence for fluid mixing and mass transport of major elements and REEs between high-grade blocks and matrix mélangé within the subduction zone.

Precipitation kinetics of cerussite and hydrocerussite in the presence of biogenic carbonates

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Lead is one of the most important heavy metal pollutants. Biogenic carbonates have been shown to have a great uptake capacity for this metal [1], with sorption taking place by precipitation of both cerussite (PbCO₃) and hydrocerussite (Pb₃(CO₃)₂(OH)₂). Quantifying the conditions at which each carbonate precipitates is a prerequisite for a better understanding of lead mobility in the environment

We have performed mixed-flow experiments where lead solutions were brought in contact with ground biogenic carbonate (mussel) at different supersaturation conditions, in presence of various gases as well as in presence of other metals (Cd, Zn and Fe). The computer code Phreeqc [2] was used to model the temporal evolution of the experiments (Fig. 1). Together with AFM imaging this modelling approach allows to accurately predict the experimental conditions necessary to induce critical supersaturation and at the same time quantify precipitation kinetics of cerussite or hydrocerussite.

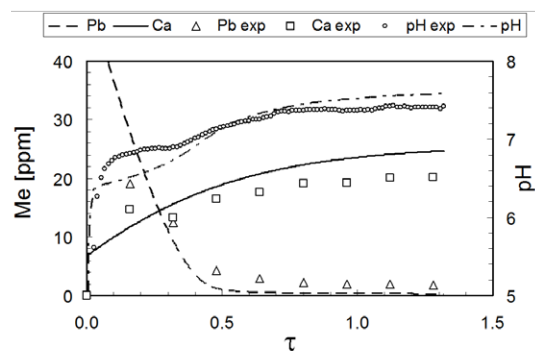


Figure 1: Experimental and modelled Ca and Pb concentrations, as well as pH, as a function of τ (volume/volume passed through the reactor).

[1] Köhler *et al.* (2007) *ES&T* **41**, 112–118. [2] Parkhurst (1998) USGS WRIT 99–4259.