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Coupled serpentine dehydration and high-pressure serpentinization

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Serpentinites in subduction zones play an important role in deep geochemical cycling and redox processes as they may release substantial amounts of aqueous fluids. The main discharge of water is expected with the antigorite breakdown around 600-700 °C (80-120 Km depth). Nonetheless, around 400 °C (40- 80 Km depth) a significant amount of water could be potentially released through progressive transformation of antigorite+brucite assemblage to form metamorphic olivine. At these conditions lizardite stability may be extended to higher temperatures by high aluminum contents so that both lizardite and antigorite can be the stable polysomes to participate in the reaction. These reactions have long been invoked to explain water production and circulations in metamorphic rocks. However, the incipient stages of water migration from partial serpentine dehydration remain little studied.

In this study, we investigated the potential interaction of aqueous fluids released by partial serpentine dehydration reactions with nearby metastable peridotite relicts. We studied partially serpentinized peridotite from the Monte Maggiore peridotite body, Alpine Corsica, which experienced a metamorphic peak at blueschist facies conditions, at $P > 1$GPa and T of about 400-450 °C. Microstructural relationships indicate the presence of two, spatially related serpentine populations characterized by partial conversion of Al-Liz into M-Ol and Atg, and growth of antigorite at the expense of primary mantle olivine. Trace analysis highlights different distinctive concentrations in REEs and FME between the two populations.Preliminary In-situ B analyses suggest a potential source-to-sink relationship between the two populations.

The collected data suggest that the second serpentine generation may have formed in response to the release of water from partial Liz dehydration, and the interaction of these fluids with olivine relicts.

The identification of this process at the larger scale could provide information on alternative pathways of water recycling at depths and on the redox state of subduction zone fluids.

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