Pressure-temperature estimates of the lizardite/antigorite transition and FME behaviours in high pressure alpine serpentinites.

STÉPHANE SCHWARTZ [1*], ROMAIN LAFAY [1], STÉPHANE GUILLOT [1], BRUNO REYNARD[2], CHRISTIAN NICOLLET [3]

[1] Institut des Sciences de la Terre, Université Joseph Fourier, CNRS, F-38041 Grenoble, Cedex 9, France
(*correspondance : stephane.schwartz@ujf-grenoble.fr; romain.lafay@ujf-grenoble.fr)

[2], Laboratoire de Science de la Terre, Ecole Normale Supérieure de Lyon, CNRS, F-69634 Lyon cedex 7, France

[3] Laboratoire Magmas et Volcans, Université Blaise Pascal, CNRS, F-63038 Clermont-Ferrand, France

Serpentine minerals in natural samples are chrysotile, lizardite and antigorite. Despite numerous petrological experimental work, stability field of these species remains poorly constrained. In order to understand their stability fields, we investigate natural serpentinites from the Alpine orogenic wedge representing a paleo-subduction zone deformed and exhumed during collision. The serpentinites are derived from similar protoliths, but they experienced different metamorphic conditions related to three different structural levels of the paleo-subduction zone (obducted: Chenaillet ophiolite, accretionary wedge: Queyras Schistes lustrés complex and serpentinite channel: Monviso ophiolite). Metamorphic conditions recorded by these three units are well defined, increasing eastward from sub-greenschist (P <4 kbar, T~200-300°C) to eclogitic facies conditions (P >20 kbar, T > 480°C). The petrological observations coupled with the Raman spectroscopy show that below 300°C, the serpentinization is characterized by the development of mesh texture after olivine according to the reaction olivine + water = lizardite (mesh) + magnetite. Locally, the mesh is crosscut by secondary chrysotile veins. The relationship between mesh textures and chrysotile veins are typically observed during oceanic sea-floor serpentinization. Between 300 and 360°C antigorite appears and crystallizes at the lizardite grain boundaries by mineral replacement coupled with dissolution-precipitation. Between 360 and 390°C antigorite overprinted statically lizardite in the core of the mesh texture. The Raman spectra obtained in this thermal range indicate a fine mixture between lizardite and antigorite corresponding to a solid-state transition. Above 390°C, under high-grade blueschist to eclogites facies conditions, antigorite is the solely stable serpentine mineral. Additionnaly, geochemical bulk rocks and in situ (LA-HR-ICP-MS) analysis on serpentinites were realized. These data reveal different behaviours for the fluid-mobile elements (FME: As, B, Li, Sb) during increasing of metamorphic conditions. We propose that serpentinites act as a trap and-release system for FME in a subduction context.