Three steps of serpentinization of an eclogitized oceanic serpentinization front (Massif of Lanzo – Western Alps)

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Serpentinites are an important component of the oceanic crust generated in slow to ultraslow spreading settings. In this context, the Moho could correspond to a serpentinization front affecting the mantle. The peridotitic massif of Lanzo (Western Alps) is surrounded by a serpentinized envelope of several kilometers. This one can be bordered by ophicalcites which testify that serpentinization begins during the oceanisation (~165Ma). This is confirmed by the presence of early lizardite in the peridotites. The petrographic analysis shows the presence of two other generations of serpentine. During the subduction (~50Ma), a prograde antigorite replaces the lizardite and the primary minerals of the peridotite. This testifies that serpentinization continues during subduction. Locally, this episode is followed by the deserpentinization of antigorite at the peak P/T (estimated in eclogitized metagabbros at P=2-2,5GPa and T=610-660°C): it is marked by the crystallization of a secondary olivine associated with antigorite and chlorite, and of metamorphic clinopyroxene, tremolite and chlorite assemblages. During the exhumation, the previous textures are completely obliterated by the crystallization of retrograde antigorite in the serpentinites. The geochemical analysis shows that the serpentinization of Lanzo massif took place in a relatively closed system for most trace elements. The successive episodes of serpentinization remobilize mineral phases preserved in an intra-oceanic context. It results from a progressive homogenization of serpentine composition from slightly serpentinized peridotites to the serpentinites. If we accept the model of progressive serpentinization towards depth during the oceanisation, the successive episodes of serpentinization could affect this zone preferentially: there, the important deformation and the circulation of fluids would make the transformations easier and would explain the sharp transition of the front of serpentinization. Because the transition lizardite -> antigorite is dehydrating, it provided the water necessary of the late transformations and it removes the requirement for a new influx of water during the subduction.

Keywords: Serpentinization front, Subduction, Lizardite, antigorite, deserpentinization microstructures, trace element.