

In-situ Sr-Pb isotope geochemistry of lawsonite: A new method to investigate slab fluids

*Tomomi Hara¹, Tatsuki Tsujimori¹, Qing Chang², Jun-Ichi Kimura²

1. Tohoku University, 2. JAMSTEC

Lawsonite is a hydrous Ca-Al silicate mineral which is broadly stable in a typical subduction-zone geotherm since late Neoproterozoic. Because lawsonite behaves as a reservoir of trace elements, especially of LREEs, Sr, Pb, Th and U, lawsonite can be a proxy of these elements of a bulk subducting slab, especially of crustal lithologies. In order to understand the elemental behavior of subducting crustal materials, lawsonites in lawsonite-eclogite facies metabasalts and metachert from the South Motagua Mélangé, Guatemala, were investigated by a new technique of *in-situ* LA-MC-ICPMS spot isotope analyses. *In-situ* Sr-Pb isotope determination for eclogite facies lawsonite revealed isotope variations reflecting their protoliths and isotope zoning in some lawsonite crystals. Lawsonite in a phengite-rich metabasaltic eclogite have relatively 'low' $^{87}\text{Sr}/^{86}\text{Sr}$ ratios (0.70335-0.70355) with some Pb isotope variations $^{207}\text{Pb}/^{206}\text{Pb} = 0.8401\text{-}0.8512$ and $^{208}\text{Pb}/^{206}\text{Pb} = 2.0757\text{-}2.0911$. On the other hand, lawsonite from another metabasaltic eclogite is zoned. The cores have $^{87}\text{Sr}/^{86}\text{Sr} = 0.70558\text{-}0.70601$ and the ratios increase at the rims ($^{87}\text{Sr}/^{86}\text{Sr} = 0.70636\text{-}0.70662$); the cores with a MORB-like affinity ($^{207}\text{Pb}/^{206}\text{Pb} = \sim 0.843\text{-}0.844$) are overgrown by the rims with $^{207}\text{Pb}/^{206}\text{Pb} = \sim 0.839\text{-}0.841$. Lawsonite in a metachert has 'higher' Sr isotope ratios (0.70697-0.70757) with $^{208}\text{Pb}/^{206}\text{Pb} = \sim 2.07$. In isotope spaces $^{208}\text{Pb}/^{204}\text{Pb}$ versus $^{206}\text{Pb}/^{204}\text{Pb}$ and $^{87}\text{Sr}/^{86}\text{Sr}$ versus $^{206}\text{Pb}/^{204}\text{Pb}$, lawsonite isotopes are scattered mainly in DMM (depleted MORB mantle) and some EMI and EMII fields, respectively. All the age-corrected isotope ratios were not significantly different from non-corrected values. The bulk-rock compositions and lawsonite Sr-Pb isotope suggest that sediment-like 'external' fluids have incorporated into the metabasaltic system during the second stage eclogite-facies recrystallization in a mélangé of slab-mantle interface. Isotope-zoned lawsonite also supports the presence of sediment-like 'external' fluids.

Keywords: lawsonite, *in-situ* Sr-Pb isotopes, LA-MC-ICPMS, secular change, subduction zone, external fluid