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

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Lawsonite is a hydrous Ca–Al silicate mineral which is broadly stable in a typical subduction-zone geotherm after late Neoproterozoic. In order to understand the elemental fractionation and the sources of subducted materials, lawsonite crystals in basaltic and sedimentary lawsonite-eclogites from South Motagua Mélange of Guatemala [1] were investigated using LA-ICPMS and LA-MC-ICPMS. Mass balance calculation using *in-situ* trace element and modal compositions in an eclogite with a low-variance mineral assemblage confirmed that lawsonite hosts most of the LREE, Sr, Pb, Th and U in the bulk rock as has been reported elsewhere. *In-situ* Sr–Pb isotope analyses of the lawsonite crystals revealed isotopic variations reflecting their protoliths. Isotopic zoning is also detected in some crystals. Lawsonite crystals in a phengite-rich metabasaltic eclogite have relatively low $^{87}Sr/^{86}Sr$ = 0.70335–0.70355 with variations in $^{207}Pb/^{206}Pb$ = 0.840–0.851 and $^{208}Pb/^{206}Pb$ = 2.076–2.091. Lawsonite crystals from another metabasaltic eclogite are remarkably zoned. The cores have $^{87}Sr/^{86}Sr$ = 0.70558-0.70601 and the rims have elevated $^{87}Sr/^{86}Sr$ = 0.70636-0.70662. The Pb in the cores has MORB-like compositions $^{207}Pb/^{206}Pb$ = ~0.843–0.844, whereas rims have more enriched $^{207}Pb/^{206}Pb$ = ~0.839–0.841. The radiogenic Sr isotope composition would have been derived from sea-floor alteration before subduction. In fact, lawsonite crystals in a metachert have higher $^{87}Sr/^{86}Sr$ = 0.70697–0.70757 with $^{208}Pb/^{206}Pb$ = ~2.07. However, the isotopically zoned metabasaltic lawsonite crystals with MORB-like core compositions suggest metasomatism by a `external' fluid from sediment protolith occurred during overgrowth of their rims. Our study indicates that lawsonite crystals record both the isotopic composition of the protoliths and fluid metasomatism from different protoliths. The *in-situ* Sr–Pb isotope analysis has a potential to reveal such complicated metamorphic processes.

[1] Tsujimori *et al.* (2006) *GSA Special Paper* **403**, 147-168.