Lawsonite oxygen isotope and trace element records of subduction fluids

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Lawsonite is abundant in subducted oceanic crust and sediments and is an important carrier of water and trace elements to subarc depths. It is, however, rarely preserved in exhumed high pressure/low temperature (HP/LT) rocks, particularly in eclogite, so the few occurrences of fresh lawsonite in eclogite and blueschist provide an opportunity to evaluate fluid-rock reaction during subduction metamorphism and exhumation.

We have determined the oxygen isotope and trace element composition of lawsonite in HP/LT rocks from mélange (Franciscan/USA; Dominican Republic) and from structurally coherent terranes (Sivrihisar/Turkey; Corsica/France; BC/Canada). In mélange, lawsonite $\delta^{18}O$ ranges from 7.47-10.47‰, which is greater than that of MORB (5.7‰) but within the expected range for a low-T, hydrothermally-altered basaltic protolith or a metabasalt that interacted with high $\delta^{18}O$ fluid. The latter is supported by textural and geochemical evidence such as lawsonite with high $\delta^{18}O$ in calcite veins and the occurrence of Cr oscillatory zoning, which may indicate a fluid-mediated process. Lawsonite from the coherent HP/LT terranes analysed differ in $\delta^{18}O$ from mélange lawsonite and from each other: Sivrihisar/Turkey and BC/Canada record heavier $\delta^{18}O$ (11.52-14.83‰) and Corsica has lower $\delta^{18}O$ (3.72-4.32‰), likely indicating extensive interaction with sediment- and serpentinite-derived fluid, respectively.