Field and experimental investigations of Li behavior-Implications for fluid origin and fluxes in SZ forearcs

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The chemical and isotopic compositions of pore fluids provide important insights on fluid-rock diagenetic or metamorphic reactions, as well as on the subsurface hydrology. Li is one of the most prominent tracers used for these objectives. Like the other alkali elements, it strongly partitions into the fluid-phase, in particular at moderate to high temperatures. The partitioning is strongly temperature dependent. Evidence of large-scale fluid flow, primarily focused along faults, is manifested by widespread seafloor venting. The nature of fluid venting, however, seems to differ at erosional and accretionary subduction zones (SZs). At both, venting sites are primarily associated with faults.

Lithium and δ^7Li data from five well-studied, representative erosional and accretionary SZ forearcs will be presented. Most characteristically, the expelled fluids from forearcs generally have higher Li concentrations and lower δ^7Li values than seawater (SW). These together with other important geochemical characteristics, e.g., Cl dilution, SO_4, Ca and Mg depletions, higher B, Si, Sr, alkalinity, and hydrocarbon concentrations, and often distinctive δ^{18}O, δD, δ^{11}B, and δ^{37}Cl values, provide key insights on the source of the fluid and the temperature at the source. Most importantly, based on recent extrapolated fluid reflux to the ocean at SZ forearcs, these reflux fluids contribute significantly to both, the Li concentration and ^{6}Li in the ocean.

Recent hydrothermal experiments with MORB-SW and smectite-SW, at 35-350 °C at 25 °C steps, and 600 bars, show that Li is released into the fluid throughout the experimental temperature range, with a significant release at ~250 °C.