Reconstructing subduction zone fluid compositions from minerals using an element partitioning approach

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The principal material fluxes from the surface into the deep Earth take place at subduction zones. Models of element cycling therefore critically hinge on accurate estimates of these fluxes and of the recycling of material by fluids and melts from the dehydrating slab. Knowledge of element partitioning between minerals and fluids at subduction zone conditions is one avenue to constrain the element release from the slab, both by forward modelling and by directly reconstructing fluid compositions from preserved blueschist and eclogite minerals. Although this approach has great potential, it is currently limited by a scarcity of experimentally-determined partition coefficients at relevant conditions, and apparent discrepancies in D-values among studies.

Here, we review the partitioning approach as a method to constrain element fluxes in subduction zones and address the impact of accessory phases, and the influence of element speciation and concentration on partition coefficients. We show that partitioning is highly systematic, obeying Lattice-Strain Theory predictions, and that apparent discrepancies are mostly the result of differences in element speciation.