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Composition of subduction zone fluids: comparison of experimental data and thermodynamic models

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Aqueous fluids in subduction zones are responsible for mass transfer between individual lithologies and across the slab-mantle interface. We evaluate performance of three available datasets using the Helgeson-Kirkham-Flowers model for aqueous species against experimental mineral solubilities. The DEW dataset [1,2] substantially improves reproducibility of aqueous Si and Al concentrations, although it reproduces poorly alkali- and alkali-earth-Al complexing or equilibria in saline fluids. Our predictive simulations along the subduction PT gradient show that Si-Al, Mg and Na-Ca species dictate remarkably distinct acid-base properties. Fluids in equilibrium with Si,Al-dominated lithologies (e.g., subducting sediments) have the strongest reactivity and metasomatic potential leading to leaching of lithophile elements. Fluids in equilibrium with eclogites are preferentially reactive with Ca-poor peridotites in the mantle wedge.

[1] Sverjensky D., Harrison B. & Azzolini D. (2014) GCA 129, 125–145. [2] Huang F. & Sverjensky D.A. (2019) GCA 254, 192–230.

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