



## **Pressure-temperature paths, fluid flow and metasomatism above subduction zones**

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We have modeled the thermal and chemical behavior of dehydration fluids with dissolved constituents generated in and above subduction zones. Silica solubility has been used as a proxy (e.g., Gerya et al. 2005. *Eur. J. Mineral.* 17:269-283). We assume a 100 km thick oceanic lithosphere (= subducted slab), hydrated rocks represent the top 6–15 km of the slab (5–9 km of hydrated silica-saturated mafic & pelitic rocks 1–5 km of hydrated peridotite). The mantle wedge is modeled as forsterite+enstatite, or coesite eclogite. Distinct enrichment/depletion patterns occur depending on fluid flow path through the thermal structure above the subduction zone, either as a vertical path from the top of the slab (where the rising fluid or melt would be rapidly heated to the local mantle  $T$ ), or back up along the mantle-slab interface (where the rising fluid would not heat).

A vertical section through a subduction zone has an S-shaped  $T$  profile. Aqueous fluids leaving coesite- or quartz-bearing rocks vertically in the depth range 300 to 150 km at 800 to 1000 °C with concentrations of 0.05 to 0.20 mSiO<sub>2</sub>, will encounter mantle rocks whose buffered silica values would be about one tenth of these values. This extreme silica difference would result in continuous conversion of forsterite to enstatite. The length of the enstatized column would correspond to the amount of silica (and H<sub>2</sub>O) released. In thermal models of subduction for NE Japan (e.g., Furukawa, 1993; Helffrich, G., 1996) the vertical distance from the top of the slab to the wet mantle solidus (1000 to 1180 °C) between 100 to 200 km depth is just a few km (~0.1 GPa above the slab). Here wet melting would limit the depth of mantle metasomatism. In general, the thickness of the metasomatic zone above the slab depends on the subduction  $PT$  structure as this determines the amount of dissolved silica transported by H<sub>2</sub>O released from the slab.