Generation of high fluid pressure at the base of the shallow mantle wedge—evidence from serpentinite of the Sanbagawa belt, SW Japan

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Serpentinite units derived from the mantle wedge in the Sanbagawa subduction-type metamorphic belt record interaction between the shallow mantle-wedge and the flow of SiO2-bearing fluids at two different depths in the paleo subduction zone. The mineralogy and geochemistry of two units indicate there was a major increase in the fluid flow perpendicular to the subduction boundary with decreasing pressure. The rate of flow can be related to the presence or absence of a thick shear zone. Estimates of fluid flux from subducted slabs combined with experimentally determined permeability of serpentinite suggests that the presence of a zone of gently dipping strongly foliated serpentinite is a key component of developing high fluid pressures at depths of 30–50 km in subduction zones—a key requirement for the development of slow earthquakes. Most of the SiO2 in these subduction fluids will be absorbed in the serpentinite and is unlikely to be available for precipitation and formation of an impermeable cap at higher levels in the system.

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