

Brucite as an important phase in the mantle wedge: evidence from the Sanbagawa belt, SW Japan

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Large parts of the shallow mantle wedge are thought to be hydrated due to release of fluids from the subducting slab and serpentinization of the overlying mantle rocks. If serpentinization proceeds under low SiO₂ activity, brucite can be a major phase in the low temperature (<450°C) part of the serpentinized mantle wedge, but only very few natural examples have been documented. Combined petrological, geochemical and field-based studies show that brucite is widely distributed in the wedge mantle-derived Shiraga metaserpentinite body in the Sanbagawa metamorphic belt of SW Japan. Thermodynamic modeling combined with bulk rock composition and point counting indicates the original fully hydrated shallow parts of the Sanbagawa wedge mantle contained ~10-15 vol.% brucite before the onset of exhumation of the Shiraga body and before peak metamorphic conditions. A distinct zone of brucite-free essentially monomineralic antigorite serpentinite occurs limited to a 100-m thick marginal zone of the body. This supports the idea of a limited degree of Si-metasomatism by slab-derived fluids in the shallow mantle wedge. The presence of brucite may strongly affect the H₂O budget and mechanical properties of serpentinite, these should be taken into consideration when examining the behavior of the shallow wedge mantle.

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