

Serpentinization in the oceanic lithosphere along the outer-rise faults

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Hydration of oceanic lithosphere can occur along outer-rise faults that relate to the plate bending at close to the trench (Facenda et al. 2009). This contributes an additional source of water into the Earth interior, which might have larger water flux than that transported by hydrated oceanic crust. Recent seismic reflection survey has shown that seismic velocity in the oceanic lithosphere decreases at where bending-related faults are observed (e.g., Ranero et al. 2003; Fujie et al. 2013). Although these seismic data is not enough to image what extent of hydration occurs along the outer-rise faults, we modeled the thickness of serpentinization based on fluid percolation. When the reaction kinetics is much faster than the fluid access to the reaction front, the reaction rate is controlled by permeability through the hydrated layer (Macdonald and Fyfe 1985). Using laboratory measured permeability, the reaction thickness of serpentinization is estimated as thick as 10 km for a period from the initiation of outer-rise fault to the trench axis assuming a plate velocity of 10 cm/year. If outer-rise faults occur 100 km interval, subduction water flux is estimated to be 4.8×10^{12} kg/year by hydrated oceanic lithosphere, which is approximately 4 times larger than that carried by oceanic crust. More detail discussion and implication will be prepared for the meeting.

Keywords: outer-rise fault, oceanic lithosphere, serpentinite