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# Deformation of slabs in the deep mantle: constraints from mineral physics and geodynamic implications

Shun-ichiro Karato
Yale University, Geology and Geophysics, New Haven, CT, United States (shun-ichiro.karato@yale.edu)

Temperature dependence of energy dissipation has a decisive control over the rate of convective heat transfer and the thermal evolution of a planet. Deformation of the lithosphere is a key process in mantle convection where a large amount of energy is likely dissipated. The lithosphere is strong and hence large energy dissipation likely occurs by the deformation of the lithosphere. Consequently, it is likely that the nature of thermal evolution of Earth is likely controlled by the temperature dependence of energy dissipation associated with lithosphere deformation. In the previous studies of mantle dynamics and thermal history modelling (Conrad and Hager, 1999a; Conrad and Hager, 1999b; Korenaga, 2003), only deformation of the lithosphere at trenches is considered. However, high-resolution tomographic images show clear evidence of intense deformation of some of the slabs in the deep mantle in and around the mantle transition zone. In this paper, I will review the recent progress in characterizing the plastic properties of the deep mantle minerals including wadsleyite and ringwoodite, combined with a model of grain-size reduction upon a phase transformation. Following the method developed by (Karato et al., 2001). Due to the strong influence of temperature on the grain-size after the phase transformation in the transition zone, the energy dissipation associated with the deep slab deformation may show the sensitivity to temperature that is opposite to the energy dissipation in the ambient mantle.

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