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The adiabatic temperature profile in the mantle

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The temperature at the 410-km discontinuity is reinvestigated using the in situ X-ray diffraction experiment by Katsura et al. [2004] and equation of state of MgO by Tange et al. [2009] (Tange scale). The newly estimated temperature is 1850+-20 K, which is 90 K higher than that by our previous study. The equations of state of the major mantle minerals (olivine, wadsleyite, ringwoodite and perovskite) are recalculated using Tange scale. The adiabatic temperature gradient is calculated using thermal expansion coefficient obtained from these equations of state. The adiabatic temperature gradient decreases with depth in the region without a phase transition, and abruptly increases in association of the phase transitions. The adiabatic temperature gradients are found to be 04~0.5 and 0.3 K/km in the upper and lower parts of the mantle. The temperatures at the depth of 200 km, the bottom of the mantle transition zone, top of the lower mantle and depth of 2700 km are found to be 1720+-20, 2010+-20, 1980+-20, and 2730+-30. The mantle potential temperature is found to be 1610+-15 K.

Keywords: adiabatic geotherm, mantle, thermal expansion coefficient, 410-km discontinuity, olivine-wadsleyite transition, in situ X-ray diffraction