Temperature dependence of Fe-Mg partitioning between (Mg,Fe)SiO3-perovskite and magnesiowüstite

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The Earth""s lower mantle is considered to be composed mainly of (Mg,Fe)SiO3 perovskite and magnesiowüstite, and the iron contents influence their densities and phase relations. Therefore, it is very important to determine the iron contents of these phases in understanding structure and dynamics in the lower mantle. Several workers have studied Fe-Mg partitioning between (Mg,Fe)SiO3 perovskite and magnesiowüstite, but temperature dependence on the partitioning has not been well understood. In this study, we have experimentally determined the partitioning of iron between these two phases and its temperature dependence.

We conducted high-pressure experiments using a Kawai type high-pressure apparatus at ~24 GPa, and at 1673-2273K. We used San Carlos olivine with a composition of (Mg0.91Fe0.09)2SiO4 as starting material. After the high presser and temperature runs, the products were examined using SEM, EDS and X-ray diffraction techniques to observe the microstructures, to measure the chemical composition and to identify the phase present, respectively.

The Fe-Mg partitioning attained chemical equilibrium after heating of 90 minutes above 1673K.The partition coefficient defined as K=(Fe/Mg)Pv/ (Fe/Mg)Mw increased from 0.19 to 0.34, with increasing temperature from 1673K to 2273K, witch are significantly larger than reported by Ito et al. (1984), Wood et al. (1996), Martinez et al. (1997).