Interphase partitioning of minor elements in the transition zone and uppermost lower mantle

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Interphase partitioning of minor elements was studied experimentally upon partial melting of model pyrolite [1] with addition of 2 wt % H_2O, 10, and 15 wt % of multicomponent carbonate at 22–24 GPa and 1300–2200°C. The concentrations of minor elements were analyzed on an Agilent 7500a mass spectrometer. Phase associations included quenched melt (L), bridgmanite (Brd), $CaSiO_3$-perovskite (CaPrv), ringwoodite (Rwd), ferropericlase (Fp), and majoritic garnet (Maj). The sequence of phase assemblages in our runs is consistent to that reported in [2] for melting of anhydrous pyrolite at 24 GPa: Fp+L, Fp+Maj+Brd(Rwd)+L, Fp+Maj+Brd(Rwd)+CaPrv.

Most of minor elements, except for Sc, Cr, and Ni, are incompatible for Brd and show slight increase in partitioning coefficients from LREEs to HREEs in the H_2O-bearing system. Pyrolite with carbonate is characterized by slightly higher LREE partitioning coefficients. Monovalent elements (Li, K, Cs, Rb), as well as Sr and Pb, are strongly incompatible for Brd in all systems. The similar features are observed for Fp enriched in HREEs and depleted in LREEs; all minor elements show redistribution into Fp with pressure. CaPrv is enriched in LREEs and depleted in HREEs.

We applied the lattice strain model [3] for interpretation of the analytical data, which allowed us to study the behavior of minor elements as a function of P-T parameters. Our data and some previous results [4] were used for estimation of the composition of melts in equilibrium with inclusions in diamonds from the transition zone and lower mantle.

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[1] Ringwood (1966) *Adv. Earth Sci*, 287–356. [2] Litasov & Ohtani (2007) *Adv. High-Pressure* **421,** 115–156. [3] Blundy & Wood (1994) *Nature* **372,** 452–454. [4] Liebske *et al.* (2005) *CMP* **149,** 113–128.