強親鉄性元素のカンラン岩中での在処とマントル存在度
Highly siderophile elements in the mantle: residence in natural peridotites and the composition of primitive mantle

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Concentrations of highly siderophile elements (HSE: Ru, Rh, Pd, Re, Os, Ir, Pt and Au) in the Earth's mantle are controlled by differentiation processes involving metal and sulfide phases, and therefore give us key insights into the history of core-mantle interaction. The HSE abundances for a hypothetical primitive mantle composition have been estimated on the basis of HSE concentration data for fertile lherzolite samples and covariations of HSE with some melt extraction indicators, such as Al2O3. However, main causes of the covariation of HSE with other elements in mantle peridotites are not well understood yet, resulting in a large uncertainty in the estimated values of the primitive mantle HSE composition. Concentrations of HSE in mantle peridotites are controlled by mainly two processes: partial melting and metasomatism, but it is generally difficult to distinguish the effects of these two processes, because it is not clear how and to what extent HSE are mobilized with silicate melt and aqueous-carbonaceous fluid phases. Recent submicrometer-scale analyses of HSE in natural peridotites have revealed that HSE are mainly hosted by base-metal sulfides (BMS) and platinum-group minerals (PGM) in peridotite. High-temperature/high-pressure experimental works have also revealed that BMS are likely to be molten along a normal mantle geotherm whereas some PGM phases (Ir-Os alloy) persist in residual solids. These studies predict that peridotites with residual signatures would show HSE abundance patterns highly depleted in "incompatible" HSE like Pt, Pd and Re. However, HSE patterns of natural peridotite samples do not always show clear correlations with melt extraction indicators. On the other hand, submicrometer-scale description studies of peridotites have been revealing that carbonaceous melt could mobilize incompatible HSE together with some of "compatible" HSE like Ir. These observations suggest that the behavior of HSE in melting and metasomatic processes of carbon-bearing peridotite systems should be considered in estimating the HSE abundances in the primitive mantle.

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