Major element composition of the missing reservoir and the early Earth differentiation

NOZOMI KONDO[1]*, TAKASHI YOSHINO[2], KYOKO MATSUKAGE[3], KENTA YOSHIDA[4] AND TETSU KOGISO[1]

[1]Graduate School of Human and Environmental Studies, Kyoto University, Kyoto, Japan(*correspondence: kondo.nozomi.75x@st.kyoto-u.ac.jp)

[2]Institute for Sutudy of the Earth's Interior, Okayama University, Tottori, Japan

[3]Graduate School of Science, Kobe University, Hyogo, Japan

[4]Graduate School of Science, Kyoto University, Kyoto, Japan

The notably higher $^{142}Nd/^{144}Nd$ of the accessible silicate Earth (ASE) than that of chondrites can be the result of the formation of a low $^{146}Sm/^{144}Nd$ reservoir in the early Earth and the isolation of the reservoir until now (missing reservoir). The reservoir is considered to have formed as melt, and various models for the formation and fate of the reservoir have been proposed. However, these models have not estimated the major element composition of the reservoir, although the major element composition controls its density and fate, whether the reservoir sunk or ascended in the early mantle. In this study, we experimentally determined the major element composition of the missing reservoir and estimated its density.

The difference in $^{142}Nd/^{144}Nd$ between the ASE and chondrites suggests that the low $^{146}Sm/^{142}Nd$ reservoir had been formed at quite small degrees of melting at upper mantle pressures, possibly before the last giant impact. Then we determined the major element composition of the small degree melt of the primitive peridotite at 7 GPa with the method of MISE (Modified Iterative Sandwich Experiment, [1]), assuming that the reservoir formed at high temperature and high pressure in the early Earth. The solidus melt composition is Fe-rich komatiitic, with 44.3% SiO_2, 14.4% FeO, and 24.2% MgO. The density of the near-solidus melt is smaller than that of the primitive peridotite. Thus, the low $^{146}Sm/^{142}Nd$ reservoir could have ascended in the mantle to form the crust and spattered into the space at some impact collision.

[1] Hirschmann & Dasgupta (2007) *Contrib. Mineral. Petrol.* **154,** 635-645