

Identification of multiple components of noble gas isotopes in subcontinental lithospheric mantle beneath backarc region of a subduction zone

LENA YOKOKURA¹, DR. HIROCHIKA SUMINO²,
TAKESHI KURITANI¹, YUUKI HAGIWARA³ AND JUNJI
YAMAMOTO⁴

¹Hokkaido University

²University of Tokyo

³Research Institute for Marine Geodynamics, Japan Agency for Marine-Earth Science and Technology

⁴Kyusyu University

Presenting Author: reiar17@icloud.com

We investigated isotope ratios of noble gases ($^3\text{He}/^4\text{He}$ and $^{40}\text{Ar}/^{36}\text{Ar}$) extracted by laser microprobe methods for mantle-derived xenoliths collected from northeast China. The heterogeneous noble gas isotope ratios obtained from the mantle xenoliths by the crushing method in previous studies may reflect local metasomatism induced by multi-components with various origins. Observation of fluid and melt inclusions would be effective in investigating what controls the heterogeneity of noble gas isotope ratios in the xenoliths. On the basis of shape and chemical composition, the inclusions were classified into three types. We performed quantitative verification of the correlation between $^3\text{He}/^4\text{He}$ and the abundance ratio of three types of inclusions in olivine grains in each sample. As a result, it is inferred that type (3) inclusions with negative crystal shape are associated with a relatively high $^3\text{He}/^4\text{He}$, and types (1) and (2) inclusions, the former of which are melt-dominated secondary inclusions and the latter are vermicular in shape and distribute on partly healed cracks, may have a relatively low $^3\text{He}/^4\text{He}$. In order to verify this interpretation and to determine the $^{40}\text{Ar}/^{36}\text{Ar}$ for each type of the inclusions, we carried out laser spot analyses of noble gas isotopes for type (2) and type (3) inclusions. The type (2) inclusions showed relatively low $^3\text{He}/^4\text{He}$ and atmospheric $^{40}\text{Ar}/^{36}\text{Ar}$. In contrast, type (3) inclusions showed relatively high $^3\text{He}/^4\text{He}$ and $^{40}\text{Ar}/^{36}\text{Ar}$, which were similar to typical of subcontinental lithospheric mantle (SCLM) values. Considering the growth stage of inclusion form, type (2) inclusions would be vestiges of melt infiltrated to the upper mantle beneath northeast China later than type (3) inclusions, whose shape represents a matured stage. Taking the tectonic setting of the studied area into account, the coexistence of the inclusions with different noble gas isotopic compositions indicates that the upper mantle with SCLM-like noble gas isotopic compositions was infiltrated by the melt associated with slab-related components.