

Noble gas study on fluid inclusions in mantle-derived xenoliths from Eastern China

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Noble gas abundances and isotopic compositions were measured for understanding the characteristic noble gases in mantle-derived xenoliths in Cenozoic basalts from Eastern China. Samples were collected at more than 10 sites from the northernmost Heilongjiang province to the southernmost Hainan province, covering almost the whole Eastern China area.

The occurrence, type and composition of fluid inclusions, which developed in minerals of xenoliths (Ol, Cpx and Opx) are strongly dependent on localities. Two generations of fluid inclusions have been found in most samples; one is CO₂-rich primary fluid and another secondary melting. They seem to have affected abundance and composition of noble gases to some extent. Results obtained by the two-pyroxene geothermometer indicate that the mantle xenoliths formed at a temperature ranging from 810 to 1,060°C.

For noble gas analysis, Ol, Cpx and Opx were separated from the xenoliths, and heating and crushing methods were applied to degas noble gases. For noble gases extracted by the heating method, it has been revealed that noble gas isotopes were greatly affected by cosmic ray on the surface. However, the data from the crushing method show obvious differences among samples depending on localities. The ³He/⁴He ratios range from 0.31Ra to 9.67 Ra (where Ra is the atmospheric helium isotope ratio). Xenoliths having the forming temperature of more than 1000°C show relatively uniform ³He/⁴He ratios at each site, while ³He/⁴He ratios for those of less than 1000°C are variable. When we eliminate the effects of interaction between xenolith and basalt magma, the mantle-derived xenoliths indicate the ³He/⁴He ratios of the MORB-like value (8Ra), which is higher compared to the reported averaged value of mantle xenoliths from the continental area (e.g., Gautheron, C. et al., 2002). Most of ⁴⁰Ar/³⁶Ar ratios obtained with the crushing method are less than 1000, though the highest one is 7600. The neon isotopic data show that most of them are indistinguishable from the atmospheric neon, but some of them obviously indicate the addition of nucleogenic ²¹Ne.

References

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Reactive gaseous mercury formation in the North Pacific ocean's marine boundary layer: A potential role of halogen chemistry

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Global mercury models have identified wet and dry particle deposition and evasion of dissolved gaseous mercury from the ocean and from land as key controls over global mercury cycling. Recent ocean studies however, have indicated that estimated mercury evasion rates from the ocean substantially exceed estimated deposition. Oxidized reactive gaseous mercury species (RGHg) are now known to play a major role in the global mercury cycle. RGHg species are water-soluble, exhibit a much shorter atmospheric lifetime than elemental mercury, and contribute largely to atmospheric mercury deposition. Although recent global mercury models have accounted for the dry deposition of RGHg derived from point source emissions, the formation and deposition of RGHg in remote areas have not been incorporated. Reactive gaseous mercury (RGHg), atmospheric elemental mercury (Hg⁰) and ozone (O₃) along with other ancillary parameters have been measured simultaneously in the marine boundary layer (MBL) over the North Pacific Ocean during the 2002-IOC cruise. Our result strongly suggest in situ formation of RGHg with increasing concentrations in the tropical regions concomitant to a dramatic decrease in O₃ mixing ratio. A distinct diurnal variation in RGHg concentrations with maxima during periods of highest UV irradiation suggests a photochemically driven oxidation of marine boundary layer Hg⁰. In the tropical area, enhanced RGHg formation and daily variation in O₃ could both be related to reactive halogen chemistry. Deposition velocity and flux calculations emphasize the role of RGHg and the importance of tropical marine boundary layer in the global mercury cycle.