

## Variation of helium isotopic compositions around Mashu, Japan

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Helium-3 is one of the most sensitive geochemical tracers which reflects addition of mantle-derived components to gas and fluids in volcanic hydrothermal systems, and monitoring of  $^3\text{He}/^4\text{He}$  ratios may provide useful information for assessing temporal change of volcanic activity. Lake Mashu is a caldera lake which formed around 7000 years ago in Hokkaido island, Japan. Igarashi et al. (1992) measured He and Ne isotopes in water of Lake Mashu, and detected mantle-derived He injection due to hot spring activity at the lake bottom. However, He isotope data around Mashu are too scarce to be discussed for assessing change of recent volcanic hydrothermal activity. In order to assess recent volcanic activity around Mashu, we collected water of Lake Mashu in May and September 2017. Water samples were collected using a Go-Flo water sampler at several depths (surface to 210 m) around the deepest point (211 m). Collected samples were immediately transferred into lead-glass containers with vacuum valves at both ends. Subsequently, dissolved gases in water were extracted by the head space method. In May 2017 and December 2018, we collected fumarolic gas and bubbling gas samples into lead-glass containers at Atosanupuri volcano and Wakoto-Roten hot spring which are located about 10 and 20 km west of Lake Mashu, respectively. In Atmosphere and Ocean Research Institute, gas samples were introduced into a purification vacuum line, and He and Ne were purified for isotope analyses.  $^3\text{He}/^4\text{He}$  and  $^4\text{He}/^{20}\text{Ne}$  ratios were measured using Helix-SFT and QMS, respectively. At Lake Mashu, a linear correlation between  $^4\text{He}/^{20}\text{Ne}$  and  $^3\text{He}/^{20}\text{Ne}$  ratios in water samples indicated mixing of two components: injected fluids and the atmosphere. The estimated  $^3\text{He}/^4\text{He}$  ratio of the fluid end member was indistinguishable from the value reported by Igarashi et al. (1992), implying a possibility that there was no significant change in volcanic activity at Lake Mashu in the past 30 years. From 2017 to 2018, no apparent changes of  $^3\text{He}/^4\text{He}$  ratios were detected in Atosanupuri and Wakoto-Roten samples. However  $^3\text{He}/^4\text{He}$  ratios of Wakoto-Roten samples in 2017 and 2018 may be slightly higher than the  $^3\text{He}/^4\text{He}$  ratio observed in 1985 (Sano and Wakita, 1988), which may reflect recent change in the hydrothermal system between Wakoto-Roten and Atosanupuri.