

Distribution of the helium isotope ratios in northeastern Japan

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The geographical distribution of $^3\text{He}/^4\text{He}$ ratios is characterized by high values of 4 to $8R_A$ along the volcanic front and in the back-arc region and low values less than $1R_A$ in the forearc region (e.g., Sano and Wakita, 1985). We perform the helium isotope ratio analysis in northeastern Japan with a dense and uniform sampling and discuss in detail the distribution of $^3\text{He}/^4\text{He}$ ratios comparing with the seismotectonics and the structure of the crust and upper mantle which are well studied.

We have collected 35 samples of water or gas from hot springs and deep wells distributing mainly in the forearc region where few $^3\text{He}/^4\text{He}$ ratio data were reported. $^3\text{He}/^4\text{He}$ and $^4\text{He}/^{20}\text{Ne}$ ratios were measured by using noble gas mass spectrometers of ORI, Univ. of Tokyo (Helix and VG5400). The latter is used to evaluate air contamination in the samples.

Main features of the results of the present analysis are as follows: 1) $^3\text{He}/^4\text{He}$ ratios in the forearc region are below $0.1R_A$ (where R_A is the atmospheric $^3\text{He}/^4\text{He}$ ratio of 1.39×10^{-6}). This is dissimilar to those in the Chugoku-Shikoku district, where the value of $^3\text{He}/^4\text{He}$ ratios above $1R_A$ are found in the forearc region. 2) The $^3\text{He}/^4\text{He}$ ratios vary along the volcanic front. In Miyagi prefecture [38-39N], the ratios range from 2 to $5R_A$. On the other hand, the ratios are below $1R_A$ in and around the southern boundary of Iwate and Akita prefectures[39-39.5N]. More data are needed to interpret the features of the geographical distribution of the $^3\text{He}/^4\text{He}$ ratios in northeastern Japan by comparing with geophysical and geological data.