

## Helium isotope variations around Ontake volcano

# Yuji Sano[1]; Kaoru Kiyota[2]; Naoto Takahata[3]; Yoshiro Nishio[4]

[1] Ocean Res. Inst. Univ. Tokyo; [2] Center for Advanced Marine Research, ORI, Univ. of Tokyo; [3] ORI, Univ. Tokyo; [4] KOCHI/JAMSTEC

Fifty one gas and fluid samples were collected from hot and mineral springs associated with Ontake volcano in central Honshu, Japan from June 1996 to June 2007. The chemical compositions, He, Ar, C and N isotopic ratios of twenty three samples collected between 1996 and 2000 were measured using a gas chromatography, noble gas and stable isotope mass spectrometers, respectively. The  $^3\text{He}/^4\text{He}$  ratio decreased with increasing distance from the central cone of the volcano to the sampling site, while  $\delta^{13}\text{C}$  value of  $\text{CO}_2$  increased with the distance. Such trends are consistent with those observed from November 1981 to June 1993 in the literature (Sano et al., 1984; Sano et al., 1998), suggesting that source of magmatic helium and carbon is located beneath the volcanic cone and they are continuously emitted into surroundings. The  $\delta^{15}\text{N}$  value of  $\text{N}_2$  increased with the distance while most  $^{40}\text{Ar}/^{36}\text{Ar}$  ratios were similar to the atmospheric value. Magmatic nitrogen may also be carried by a fluid flowing through the volcanic edifice and diluted by crustal nitrogen.

Significant increase of  $^3\text{He}/^4\text{He}$  ratio from 1996 to 2000 was observed at the site close to the fault formed by a M6.8 earthquake that occurred in September 1984, which agrees well with the  $^3\text{He}/^4\text{He}$  change from November 1981 to June 1993 (Sano et al., 1986). The  $^3\text{He}/^4\text{He}$  ratios of recent twenty eight samples between 2003 and 2007 were measured by a noble gas mass spectrometer. Significant decrease of the  $^3\text{He}/^4\text{He}$  ratio was observed in Shirakawa, Kakehashi, and Shojima sites located at southeastern foot of Ontake volcano. On the other hand, increase of the ratio was found in Nigorigo and Yuya sites, situated at northwest. These observations may suggest the recent movement of magmatic fluids in the region.

Sano et al., 1984. *Science* 224, 150-151.

Sano et al., 1986. *J. Geophys. Res.* 91, 12291-12295.

Sano et al., 1998. *J. Geophys. Res.* 103, 23863-23873.