Be isotopic systematics in island-arc volcanic rocks from the North-East Japan including Hokkaido area

AKIKO SHIMAOKA[1] MINEO IMAMURA[2] AND ICHIRO KANEOKA[1]

[1]Earthquake Research Institute, University of Tokyo, Bunkyo-ku, Tokyo 113-0032, Japan (shimaoka@eri.u-tokyo.ac.jp, kaneoka@eri.u-tokyo.ac.jp)
[2]National Museum of Japanese History, 117 Jonai-cho, Sakura, Chiba Pref. 285-8502, Japan (imamura@rekihaku.ac.jp)

The cosmogenic ^{10}Be in volcanic rocks at a convergent margin works as a quite useful tracer of sediment recycling. We examined the Be isotopic ratio (^{10}Be/^{9}Be) for about 50 volcanic rocks from 17 volcanoes with different geological and tectonic settings in the North-East Japan including Hokkaido area (NEJH).

Although Be isotopic ratios in these volcanic rocks show much lower values than those from the other arcs, they are significantly higher than those of the control samples (a Loihi basalt and a Tertiary basalt from this arc). This supports a possibility for the incorporation of subducted sediments into the arc magma in this area.

Several kinds of Be isotopic variations have been observed among different volcanoes located along and across arc. Some volcanoes at the volcanic front show relatively large variations in the Be isotopic ratios among different lava flows, though there are no significant differences in ratios within the same lava, and the degree of variation is different on a regional scale. Such regional Be isotopic variations among different volcanoes at the volcanic front might reflect the regional differences in the tectonic and geological circumstances.

A rough decreasing trend of the Be isotopic ratio in the across-arc direction could be explained by the decay of radiogenic ^{10}Be in the subducted sediments, though a possibility of incorporation of sediments with different degrees is not excluded.

This work has revealed the occurrence of regional Be isotopic variations in NEJH, due to different degrees of incorporation of subducted oceanic sediments into the arc magma and different conditions during magma ascent to the surface.

Noble gas behavior during subduction process in the Izu-Ogasawara arc, Japan

A. SHIMIZU, H. SUMINO, K. NAGAO AND K. NOTSU

Laboratory for Earthquake Chemistry, Graduate School of Science, University of Tokyo, Tokyo, Japan (aya@eqchem.s.u-tokyo.ac.jp)

Noble gases are considered to be ideal geochemical tracers to trace volatile behavior during subduction processes because of their chemical inertness and isotopic difference in several reservoirs in the Earth, such as upper mantle, atmosphere and continental crust.

The Izu-Ogasawara arc is located along the boundary of two oceanic plates, the Pacific plate and the Philippine Sea plate, parallel to the Izu-Ogasawara trench in the Pacific Ocean. This arc is suitable to investigate the recycling of volatile materials concurrent with subduction process, because the contribution of continental components in arc magma can be negligible. Here we report noble gas isotopic compositions of gas samples (hot spring gases, hot spring waters and steams) and volcanic rocks collected from the volcanic front and back-arc regions in the northern part of the Izu-Ogasawara arc.

The gas samples have different maximum ^{3}He/^{4}He ratio between in the volcanic front (6.3-7.0R_A, where R_A denotes the atmospheric ratio, 1.4×10^{-6}) and back-arc regions (7.0-8.0R_A), while olivines in rock samples have similar ^{3}He/^{4}He ratio of about 8.0R_A in both regions, which is in the range of the MORB value. Therefore, the low ^{3}He/^{4}He ratios of gas samples from the volcanic front region are probably due to contamination by crustal helium on the way to the ground surface. The ^{40}Ar/^{36}Ar ratios of olivines from the back-arc region range from 400 to 620, whereas those from the volcanic front region is about 320 at highest. Both ratios are significantly lower than the MORB value (up to 40000) indicating that the contribution of slab-derived atmospheric component is very large in the mantle wedge.

Based on these features, a model of noble gas behavior during subduction process in the Izu-Ogasawara arc is proposed. Helium transported with subducting materials (including sediments and altered oceanic crust) is degassed from subducting plate at shallow depths in the fore-arc region, and so the magma chamber beneath the volcanic front is not influenced by the subducting helium. While heavy noble gases (Ar, Kr, Xe and probably Ne) subduct with subducting materials to a greater depth than helium, and degassed with dehydration of subducting materials. Therefore, heavy noble gases in the magma beneath the volcanic front are severely influenced by those gases from subducting materials. Based on ^{40}Ar/^{36}Ar difference of rock samples between the volcanic front and back-arc regions, it is suggested that the contribution of heavy noble gases from subducting materials in the back-arc side is smaller than that in the volcanic front.