Geochemical study on the magmatism at the Southern Mariana spreading ridge

Mitsuteru Kuno[1]; Harue Masuda[2]; Patricia fryer[3]; Minoru Kusakabe[4]; Katsuhiko Furuyama[2]

[1] Biology and Geosciences Sci.,Osaka City Univ; [2] Dept. Geosci., Osaka City Univ.; [3] HIGP, Univ. Hawaii; [4] ISEI, Okayama Univ.

Active volcanism has been known in the spreading ridge on the eastern edge of the southern Mariana Trough. In this report, we report the analytical results of rock samples collected above the unique magma chamber beneath the spreading ridge by SHINKAI 6500 submersible dive (YK05-09 Leg2) in 2005. These rock samples are flesh volcanic rocks including quenched glass rim collected along the spreading ridge crest within length of 4km. Since the quenched glass rim is formed by rapid cooling when the lava erupted on the seafloor, it preserves primary magma components more than the bulk samples.

We analyzed major and trace elements, H2O content, and hydrogen isotope ratio of the quenched glass rims. Hydrogen isotope ratios were analyzed to estimate the origin of water in the magma in this area. These submarine volcanic rocks are basaltic andesite-andesite (SiO2 content 53.7-60.0%). Linearly negative correlations were found between SiO2 vs. TiO2, Al2O3, FeO, MnO, MgO, and CaO contents, while nearly linear positive correlations were found between SiO2 vs. Na2O, K2O, and P2O5 contents. The rocks are depleted Ni and Cr. FeO/MgO ratio is large (2.06-3.59%).The variation of chemical compositions of those rocks is explained by the crystallization differentiation of the magma having same composition. The composition of incompatible elements indicated the almost typical pattern of back arc basin basalt (BABB), however, the contents of Rb and Y were higher than those of BABB and Nb was lower than that of BABB.

The hydrogen isotope ratios of all analyzed samples were within -37–45 permil. These values obviously are higher than those of H2O in MORB (-80permil). The H2O contents in these samples are 1.35-1.96wt%, and the positive correlation was found between the H2O content and hydrogen isotope ratio. Because hydrogen isotope ratio is not varied along with the variation of crystallization differentiation and partial melting, the increase of hydrogen isotope ratios with H2O contents is only caused by direct infiltration of seawater or hydrothermal alteration. Therefore, H2O in quenched glass rim of the studied volcanic rocks is not originated from the mantle. Since there were no hydrothermal alteration in the samples, direct infiltration of seawater to the magma must cause the high hydrogen isotope ratios. This suggests that the seawater in the oceanic crust influences the magma generation in this area.

During the ocean bottom observation from the submersible, spattered, pillow and sheeted lavas were found. We expected clear differences of H2O content in those different shaped lavas. However, we have not obtained such a result until now.