Across-arc variation of 238U-230Th-226Ra disequilibrum in Izu arc

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238U-230Th-226Ra radioactivity disequilibrium phenomenon is used to estimate the time scale of various processes from the generation of the arc magma to the eruption. This research considered heterogeneity of the mantle component and the slab fluid which became important information in the accurate age interpretation.

It is thought that the fluid generated by the dehydration on the subducted slab lowers the solidus of mantle wedge peridotite and causes the partial melting. The state of disequilibrium of 238U-excess and 226Ra-excess might be observed in the lava which erupts in the subduction zone, and it is thought that this reflects a chemical character that U and Ra distribute the fluid easily from Th. However, 238U-230Th disequilibrium will return to equilibrium in 35 ka, and 230Th-226Ra disequilibrium will return to equilibrium in 8000 years. Each shown ages differ and it has argue about the disagreement of these age value (Turner et al. (2000), Sigmarsson et al. (2002)), and this disequilibrium interpretation has not become settled. This problem might be caused for 238U-230Th-226Ra disequilibrium heterogeneity of the slab fluid, and it is necessary to examine it. In addition, the influence that 238U-230Th-226Ra system receives by the assimilation of the subduted sediment and oceanic crust component in mantle cannot be disregarded. Then, in this research, it was examined whether there were changes in equilibrium or disequilibrium of the mantle component and the slab fluid depending on the distance from the volcanic front and on the depth to the slab.

238U-230Th-226Ra disequilibrium was measured by isotope dilution analysis using in-house spikes. Uranium spike was the depleted uranium regent, thorium spike was purified from a reagent uranium solution, and radium spike was purified from a reagent thorium solution. The rock samples were used about 300mg, and were digested sequentially by HF/HClO4 and HCl /H3BO3. Uranium and thorium were purified with AG1X8 anion exchange resin, radium was purified with 50WX5 cation exchange resin and Sr spec resin, and these isotope ratios of three elements were measured by MC-ICPMS.

We analyzed 238U-230Th-226Ra disequilibrium about the lava sample of Fuji, Oshima, Miyakajima, Niijima, and Teishi Knoll in Izu arc. Consequently, 238U-excess [(238U/230Th)=1.05-1.56] and 226Ra-excess [(226Ra/230Th)=2.0-6.0] was observed. These results were similar to Tonga-Kermadec, Mariana, etc. However, there is no correlation in the degree of two disequilibria and it cannot explain this result by adding a homogeneous fluid. It is suggested that the state of 238U-230Th-226Ra disequilibrium of the slab fluid which related to the generation of the arc magma is different depending on the generation depth of the fluid from the depth to Wadati-Benioff zone in each volcano different. Moreover, the area of each volcano plotted on (238U/232Th) - (230Th/232Th) diagram was different, it was not easy to think that these magmas generated from the same mantle, and it was suggested mantle heterogeneity.