

Sample-scale compositional variation of the Inada granite, Ibaraki, Japan -toward the reduction of geoneutrino flux estimation errors from the Japanese crust-

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Geoneutrino observed at anti-neutrino observatory "KamLAND" in Kamioka (Hida City, Gifu Prefecture), enables us to directly observe the abundance of radiogenic elements in the deep earth. As crustal rocks exhibit a high concentration of geoneutrino producing radiogenic elements (Uranium and Thorium) than mantle rocks, we have to subtract the contribution of geoneutrino from the Japanese crust from the observation value in Kamioka to estimate geoneutrino flux from core and mantle. For the purpose, we estimated the 3D distribution of uranium and thorium in the Japanese crust by the stochastic modeling using the seismic velocity structure, geological information and geochemical database for the Japanese crustal rock. Geoneutrino flux calculated using the compositional map exhibits a very large error (up to 80%) at present.

We found that information on the compositional heterogeneity (spatial correlation) of various length scale, such as of the single rock suite scale (km to m scale), and sample scale (cm to mm scale) are essential to reduce the estimation error of crustal geoneutrino flux as small as the observation error of the geoneutrino on KamLAND. Therefore, we conducted a grid sampling of the granite of Inada, Ibaraki prefecture, to obtain quantitative knowledge on the small scale compositional heterogeneity. Samples (about 500g) were divided into several centimeter scale split (about 25g). Based on the compositional variations between small splits from one sample, we discuss the small scale sample wise compositional variation. Whole rock chemical composition of each small split was analyzed using XRF. Also, we conducted surface analysis using an ED-XRF to evaluate the spatial distribution of elements in each split. As a result, even within a single sample (about 500g), a compositional variation of about several% at maximum was observed. This result indicates that when conducting the analysis based on the rock chemical composition considering the spatial context, it is necessary to properly evaluate the sample scale heterogeneity, in addition to the tectonic scale, the rock suite scale, and microscopic scale. Also, this result will contribute to the reduction of the estimation error of geoneutrino from the Japanese crust.

Keywords: Geoneutrino, Granite, Rock chemical composition