[EE] Evening Poster | S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Tectonophysics

[S-IT22]Interaction and Coevolution of the Core and Mantle in the Earth and Planets

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Recent observational and experimental investigations have significantly advanced our understanding of the structure and constituent materials of the deep Earth. Yet, even fundamental properties intimately linked with formation and evolution of the planet, such as details of the chemical heterogeneity in the mantle and light elements dissolved in the core, remained unclear. Seismological evidence has suggested a vigorous convection in the lower mantle, whereas geochemistry has suggested the presence of stable regions there that hold ancient chemical signatures. The amounts of radioactive isotopes that act as heat sources and drive dynamic behaviors of the deep Earth are also still largely unknown. We provide an opportunity to exchange the achievements and ideas, and encourage persons who try to elucidate these unsolved issues of the core-mantle evolution using various methods, including high-pressure and high-temperature experiments, high-precision geochemical and paleomagnetic analyses, high-resolution geophysical observations, geo-neutrino observations, and large-scale numerical simulations. Since this session is co-sponsored by geomagnetism, paleomagnetism and rock magnetism division of the SGEPSS, contributions in geomagnetism and geodynamo simulation are also encouraged.

[SIT22-P27]The evaluation of the compositional variation in a single rock suite revealed by grid sampling toward improving the accuracy of geoneutrino flux

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Geoneutrino, which is emitted in decay of radioactive elements in the earth, was firstly observed on the KamLAND (Kamioka Liquid Scintillator Anti-Neutrino Detector) in 2005 (Araki et al., 2005). In the past decade, the KamLAND has enough observed data to estimate the U-Th abundances in the core or mantle (The KamLAND Collaboration, 2011). Previous estimates of U-Th abundances in the earth were derived based on the refractory element abundances in the chondrites. On the other hand, geoneutrino enables us to conduct direct estimation of the U-Th abundances in the earth. In order to obtain the U-Th abundances with high accuracy based on the geoneutrino data, it is important to estimate the U-Th distributions in the crust near the KamLAND (Enomoto et al., 2007). Takeuchi et al. (in review) showed U-Th distributions in the Japanese crust using the new method, which combines the three-dimensional lithology model inferred from seismic velocity structure and the rock composition model.

The new compositional model enables us to infer the geoneutrino flux from the Japanese crust. However, calculated geoneutrino flux from the Japanese crust has large uncertainties of 70%. One reason of the uncertainty is derived from wide compositional variations of the U-Th concentrations in one geological unit. These wide compositional variations of the U-Th concentrations make it difficult to estimate the uncertainty of the typical U-Th concentration values in one geological unit, which leads to the large uncertainty of geoneutrino flux. If the U-Th distributions in a single rock suite is known, the large uncertainties on geoneutrino flux from the Japanese crust can be reduced to 30% at a maximum.

In order to understand the distributions of element concentrations in a single rock suite or the relationship between sample size and the U-Th concentrations, rock samples were collected in a single rock site. We sampled granitic rocks from Inada granite, Kasama city, Ibaraki prefecture. Inada granite is 60Ma (Arakawa and Takahashi, 1988) medium-grained granite (Takahashi et al., 2011) in the Ryoke Belt (Ishihara, 1977). We conducted grid sampling in two stone quarries. Precise locations were obtained by a high-precision GNSS receiver. Several 2-centimeter cube were cut from one rock sample and each cube was analyzed by XRF utilizing fused glass beads. Compositional variations of rock samples in the single rock suite and the precise sampling points obtained by a high-precision GNSS receiver with the accuracy of 1m degree reveal the relationship between the distance of one sampling point to another and chemical concentration variations. This relationship enables us to constrain on the geoneutrino flux derived from the single rock suite.