U and Th abundances of crustal rocks in the Japan Arc: Towards better constraints on the geoneutrino flux from the mantle

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It has been widely assumed that the bulk silicate Earth (BSE) has chondritic relative abundances of refractory-lithophile elements. The validity of this long-standing paradigm can be potentially addressed using electron antineutrinos produced within the Earth, the so-called geoneutrinos. The geoneutrinos have been measured with two liquid scintillator detectors at KamLAND in Japan and Borexino in Italy. Once the crustal contribution to the measured total geoneutrino fluxes are well established by determining U and Th distributions around the detectors, the data allow us to determine the absolute U and Th abundances in the mantle with sufficient precision to evaluate the chondritic BSE model, in particular whether highly incompatible refractory-lithophile elements are significantly (~50%) depleted as inferred from an impact-erosion model. Yet, the U and Th distributions in the Japan Arc crust, in particular deep crust, are still poorly constrained.
For better understanding of U-Th distributions in the Japan Arc, we have compiled previously reported U-Th abundance data for crustal rocks in the Japan Arc and further conducted petrology and geochemistry on mafic-ultramafic xenoliths from Oki Dogo. The equilibrium temperatures of two-pyroxenes indicate their derivation from the depth of 25-35 km. By combining the compiled data and newly obtained data, we found that the relative abundances of U and Th of the Japanese deep crust are distinctive from those of the deep crust in cratonic regions. The discrepancy may reflect that the Japan Arc crust was formed under more oxidized conditions as compared to the cratonic deep crust. In the presentation, we will further discuss about a methodology for combining these rock data with seismic data to estimate the U and Th distributions within the deep crust over the wide area.

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