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Tungsten and lead isotopic compositions of Ocean Island Basalts in South Polynesian : in search for the Core-Mantle interaction

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Mantle convection and outer core convection discharge heat from the center of the earth into space. The two convections contact at the core mantle boundary (CMB) and influence each other. The CMB can be an important place for the material transfer between outer core and mantle.

Recently, several isotope tracers, Os, W, Ag and Tl, have been used to investigate the chemical interaction at CMB. Among the tracers, we used 182Hf (half life; 9Myr) -182W system for the investigation. Since both Hf and W are refractory elements, no fractionation occurred during accretion of the Earth. Hf is lithophile, whereas W is the siderophile. Thus large fractionation occurred during core formation. The difference in 182W/183W ratio between terrestrial material and chondrite, (terrestrial samples are 2 epsilon unit more radiogenic), suggests that the core formation in the earth took place within 30Myr after the beginning of the solar system. In addition, we can expect the 182W/183W of the core material is less radiogenic than mantle. The difference is estimated around 2 epsilon unit.

Since abundance of tungsten in the core is much higher than that in the mantle, small addition of the core material to mantle should lead to negative 182W/183W. If a mantle plume contains contribution from the Earth's core, the plume could contain tungsten with lower 182W/183W isotope ratio than the rest of the silicate Earth. Tungsten should therefore be sensitive tracer of core contribution in the source of mantle melt.

Although negative anomalies of W were reported for kimberlites from South Africa, and the possibility of the core mantle interaction was suggested (Collerson et al.; 2002), re-examination by Schersten et al. (2004) found no anomaly for the samples. So far no tungsten anomaly by core mantle interaction has been verified in terrestrial samples. The samples of picrites from Hawaii, which shows 186Os/188Os isotope anomaly, has no 182W/183W anomaly. The discrepancy led Schersten et al. to conclude that the 186Os/188Os isotope anomaly resulted from addition of Mn-crust recycled to CMB not from core-mantle interaction. Nielsen et al. (2006) tried to solve this problem with thallium isotope of Hawaiian picrites. But they could not conclude if the core-mantle interaction is present or not.

In this study we analyzed the W isotope ratio of Ocean Island Basalts using multi-collector inductivity coupled plasma mass spectrometry (MC-ICP-MS) to search for material proof of chemical interaction at CMB.

We have chosen the sample of OIBs from the islands of Rarotonga, Mangaia, Rurutu, and Tubuai in South Polynesia. The seismic tomography by Zhao (2000) indicates that the root of the plume in the area is rising from near CMB.

First, we measured Pb isotope compositions of the OIBs. The results of Pb isotope analyses show that Mangaia and Tubuai are closely related to High-MU Mantle source (HIMU), while Rarotonga is to Enriched Mantle 2 (EM2). The samples from Rurutu were plotted between HIMU and EM2.

We have started the W isotope analyses on the OIBs. Tungsten was separated with a method of Sahoo et al. (2006). We will report the results of W isotope analyses.