High precision $^{182}\text{W}/^{183}\text{W}$ isotopic compositions of terrestrial samples

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Tungsten (W) has five isotopes ($M = 180, 182, 183, 184, 186$), and $^{182}\text{W}$ isotope is a beta-decay product of derived from $^{182}\text{Hf}$ with the short half life of 8.9 m.y. Both Hf and W are highly refractory elements and are accumulated in the early stage of the proto-earth. As Hf and W are a lithophile and is a siderophile elements, respectively, $^{182}\text{Hf}^{182}\text{W}$ system could give constraints on metal-silicate (core-mantle) differentiation especially core segregation in the very early Earth system because of its large fractionation between metal-silicate and the short half life of $^{182}\text{Hf}$. Improvement of analytical techniques of W isotope analyses allows us to obtain highly precise $^{182}\text{W}/^{183}\text{W}$ ratios of volcanic rocks, which leads to findings of W isotope anomalies (mostly positive) in old komatiites (2.4 -3.8 Ga) and young volcanic rocks with positive anomalies of 12 Ma Ontong Java Plateau and 6 Ma Baffin Bay (Rizo et al., 2016) and with negative anomalies of those such as the Loihi basalt.

In our study, high-precision W isotope ratio measurement with MC-ICP-MS (Thermo co. Ltd., NEPTUNE PLUS) has been developed. We have measured W standard solution (SRM 3163) and obtained the isotopic compositions with a enough high precision of ±5ppm. However, the standard solution, which separated by cation or anion exchange resin, has systematical $^{183}\text{W}/^{184}\text{W}$ drift of -5ppm. These phenomena was also reported by Willbold et al. (2011). Therefore, we corrected the measured W isotope ratios of samples with the standard solution processed by the same method as that of the samples. This technique leads to the reproducible W isotopic compositions with reproducibility of several ppm. We have obtained the negative $^{182}\text{W}/^{183}\text{W}$ for the basalts with the high $^3\text{He}/^4\text{He}$ isotopic composition from the Loihi, Hawaii, through the developed analytical method. This result is consisten with that of Mundl et al., (2017). As negative anomaly of $^{182}\text{W}/^{183}\text{W}$ could be created by the early earth core segregation, it is probably a signature of core-mantle interaction.

Keywords: core-mantle interaction, W isotope, Ocean island basalt, high-precision isotope analysis