WおよびOsの高精度同位体比測定によるコアーマントル共進化解明の展望
High precision analysis of Os and W for early evolution of core-mantle

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Tungsten is one of the highly siderophile and refractory elements. There are 5 stable isotopes of W as 180,182,183,184, and 186. ^{182}W is a decay product of ^{182}Hf ($t_{1/2}$=890 million year) which is extinct at present. Therefore, the amount of ^{182}W can give information on evolution of very early solar system at the timescale from tens of thousands of years to hundreds of thousands of years. Because Hf and W are highly refractory elements, ^{182}W isotope evolution process in the Earth could be same as in chondrites. W and Hf have been considered to be partitioned into metal (core) and silicate (mantle) phases, respectively, which leads to higher Hf/W ratio of mantle. Due to the decay of ^{182}Hf, the amount of ^{182}W should have increased in a planetary mantle 1 billion years after the beginning of the solar system.
In the early stage of applications of the ^{182}Hf-^{182}W isotope system has been used as a chronometer of the Earth's core formation (Lee et al., 1995) to use that iron meteorites possess lower ^{182}W/^{184}W isotope ratios than those of chondrites and Earth's rocks. Variation of this isotope ratio is presented as εvalue using W isotope standard solution (NIST SRM-3163).
High precision isotope analysis of W (< 0.3 ε) was difficult until 2010 even if extremely sensitive and precise mass spectrometers of N-TIMS and MC-ICP-MS were used. Recently, the mass spectrometry in MC-ICP-MS or N-TIMS and chemical separation methods were significantly improved (Touboul et al., 2011), and high precision tungsten isotope analysis of ±5 μ(=0.05ε) is possible at present. These high precision analyses lead to findings of W isotope anomaly in the early Earth's rocks such as komatiite (older than 2.8 billion years). Kostomuksha komatiite has positive anomaly (+20μ) (Touboul et al., 2012). Variation of these W isotope ratios was discussed together with PGE abundance and Os or Nd isotopes of mantle rocks. The PGE and Os isotopes could give constraints on the timing and processes of early mantle evolution such as Late Veneer, the core-mantle or mantle-silicate differentiation.
In our study, we are trying to develop the methodology of extremely high precision measurements of W, Nd and Os isotopes using N-TIMS and MC-ICP-MS and will try to reveal the core mantle coevolution on the early Earth.

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