Tungsten Isotopic Analysis on Six Geochemical Reference Materials using Multiple Collector-ICP-Mass Spectrometry Coupled with Rhenium-External Correction Technique

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Introduction

Recent studies have revealed that natural stable isotope fractionations of many elements heavier than S (e.g. Ca, Fe, Cu, Zn or Tl) are common on the Earth.[1] Among the heavier elements, W is particularly important, because the isotopic composition of W provides chronologic data as ^{182}Hf-^{182}W isotopic chronometer.[2-4] In this study, we have developed a new correction technique for the mass discrimination effect using Re, which enables us to detect possible isotopic fractionation in nature.

Result and Discussion

In order to detect the mass dependent isotopic fractionation of W in a sample, great care must be given in the isotopic fractionation of W during the chemical decomposition and separation procedure. To overcome this, we have developed a new chemical separation procedure using ion chromatography. The total recovery of W through the chemical decomposition and separation procedures was 98.4 $\pm$ 6.5% (n=5) based on repeated analysis of W abundance from geochemical reference material (JR-1).

No significant variation in ^{182}W/^{183}W due to radioactive decay of ^{182}Hf could be found for all of the samples analysed in this study. In contrast, the resulting ^{182}W/^{183}W, ^{184}W/^{183}W and ^{186}W/^{183}W ratios for W reagents and geochemical reference materials revealed that W suffered from mass dependent isotopic fractionation through the sample formation. The W isotopic ratios for igneous rocks (JB-3, JA-3 and JR-1) did not vary measurably through high-temperature processes for the formation of igneous rocks. However, the resulting W isotopic ratios for sediments (JMn-1 and HSD) displayed a large range of isotopic fractionation (>0.05 ‰/amu). This indicates clearly that W isotope can be used as a new tool for stable isotope geochemistry.

References

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