

Barium stable isotope fractionation in seawater

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Studies of the stable isotope fractionation of group II elements in seawater are of interest because these elements are important in geochemical and biological processes in the ocean. Previous studies have found significant Mg, Ca and Sr stable isotope fractionation [1], but Ba isotopes yet been extensively studied in the ocean. Unlike the other group II elements, the Ba concentration is not uniform throughout the water columns, but shows a broadly nutrient-type profile. The large gradient in the concentration indicates significant consumption of Ba in the surface seawater and suggests the presence of Ba-isotope variation in the water-column. Such isotope fractionation might elucidate the mechanism for Ba uptake in the modern ocean, and allow a range of sedimentary paleoproxies.

To investigate the Ba stable isotope fractionation in seawater, we have developed a new method using a ¹³⁷Ba-¹³⁵Ba double spike to measure seawater Ba isotopic compositions with TIMS. The lack of Xe interference with TIMS enables us to achieve a higher precision analysis for Ba isotopes than we have been able to achieve by MC-ICP-MS. In this study, Ba isotopic data were normalised to the Ba standard NIST SRM-3104a, and presented as $\delta^{138/134}\text{Ba}$ (‰). Preliminary data show that the surface seawater $\delta^{138/134}\text{Ba}$ is ~ 0.3 higher than that for deep seawater in the South Atlantic. This result is consistent with previous experimental observations that Ba precipitates consume light isotopes and leave heavy isotopes in liquids [2].

We will examine $\delta^{138/134}\text{Ba}$ in seawater samples from the North Atlantic as well as the North Pacific to establish the correlations between Ba stable-isotope fractionation and marine productivity in different oceans. This study provides new constraints on Ba isotope fractionation in seawater, and suggests the use of Ba stable isotopes as a new proxy to investigate marine productivity and Ba cycles in the ocean.

[1] Griffith et al. (2008) *Science* **322**(5908). [2] Von Allmen et al. (2010) *Chem. Geol.* **277**(1-2).