Development of seawater stable Ba isotope analysis by DS-TIMS technique

*Shigeyuki Wakaki[1], Yuki Tezuka[2], Takashi Miyazaki[3], Keiji Horikawa[2]

1. Kochi Institute for Core Sample Research, JAMSTEC, 2. Univ. of Toyama , 3. Department of Solid Earth Geochemistry, JAMSTEC

Depth profile of Ba in the ocean is characterized by nutrient-type distribution: the surface seawater has low Ba concentrations whereas the bottom water has high Ba concentrations. Barite formation in the ocean surface effectively removes Ba from the surface water. Part of the settling barite particles dissolve during the descent transporting Ba into deeper part of the ocean. The barite precipitation chemistry from seawater accompanies Ba stable isotope fractionation (von Allmen et al., 2010). Therefore, seawater Ba stable isotope composition is heterogeneous and variable in vertical directions (Horner et al., 2015). Also, the stable Ba isotopic composition of surface waters seems to be sensitive to riverine input and thus is a potential tracer of water mass interactions and ocean cycling (Cao et al., 2016).
The variation of stable Ba isotope ratios in the ocean is on the order of sub-permil. Therefore, detection of the seawater Ba isotope ratio changes requires high-precision analytical technique. In this study, we developed a method to analyze seawater Ba stable isotope composition with high- precision and high-accuracy using double-spike thermal ionization mass spectrometry (DS-TIMS). The spike used in this study was ^{134}Ba-^{136}Ba double spike with ^{134}Ba/^{136}Ba ratio of 2.5. Ba isotope ratios were measured with Thermo Triton TIMS in Kochi Core Center. Mass spectrometric conditions as well as conditions of double-spike data analysis were thoroughly optimized by repeated analysis of Ba reagents (NIST SRM3104a and an in-house reference reagent) to obtain the highest precision from a single dataset. With the optimized analytical conditions, the external precision of the $\delta^{138/134}$Ba value of multiple reagent analyses was +/- 0.01 ‰(2SD, n = 6). We will also discuss about the remaining issues for seawater analyses.

Keywords: Ba stable isotopes, double spike technique, seawater

