Determination of δ11B in pore water via MC-ICP-MS using matrix effect correction

BI ZHU[1], TAO YANG[2] AND SHAO-YONG JIANG[3]

[1]Institute of Isotope Hydrology, School of Earth Sciences and Engineering, Hohai University, Nanjing 210098, China
[2]State Key Laboratory for Mineral Deposits Research, Department of Earth Sciences, Nanjing University, Nanjing 210093, P.R. China
[3]Faculty of Earth Resources, China University of Geosciences, Wuhan 430074, China

Boron concentration and $\delta^{11}B$ values of sediment pore water at various marine environments have provided important information on fluid migration and can be used to assess the degree of organic matter degradation, water–sediment interaction, and fluid and sources. Determination of $\delta^{11}B$ in pore water usually requires removal of matrix of samples by resin exchange prior to mass spectrometric measurement by either TIMS or MC-ICPMS. However, the resin exchange procedure may introduce boron contamination during sample processing and is complex and time consuming. Moreover, incomplete recovery of boron by resin exchange would cause isotope fractionation and lead to inaccurate results. Alternatively, $\delta^{11}B$ in pore water can be measured by loading untreated samples directly on degassed filaments and measured as BO_2^- on TIMS (e.g. Li and Jiang, 2010). However, for the N-TIMS method, each step should be processed with great caution to minimize the influence of time-dependent in-run mass fractionation and possible interference from organic matter.

In this study, we made an attempt to use a matrix-matching method for rapid determination of $\delta^{11}B$ in pore water without purification. All measurements were performed on a Thermo Scientific multi-collector inductively coupled plasma mass spectrometry (MC-ICPMS). $\delta^{11}B$ in five untreated pore water samples from the northern South China Sea were directly measured using standard-sample bracketing technique (SSB). Seawater was used as standard during the analysis based on considerations that pore water and seawater, have similar metrics and should have similar matrix effects during MC-ICPMS measurement. For comparison, we carried out chemical purification on the same pore water samples following the method of Yan et al. (2012). The $\delta^{11}B$ of the purified samples were then determined using standard-sample bracketing technique, where NIST951 was used as standard. Results showed consistent $\delta^{11}B$ values for the two methods, with differences of less than 0.9‰ for most samples and a relatively higher value of 1.2‰ for 1 sample. The results also showed that the B concentrations in pore water had no obvious influence on the determined $\delta^{11}B$ values.

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