Determination of stable B and Cl isotopic compositions in pore waters using N-TIMS and P-TIMS

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The concentrations and isotopic compositions of B and Cl isotopes in pore waters are unique geochemical tracers that have been extensively used to constrain fluid advection, fluid-rock interaction and diagenesis. In our lab, both N-TIMS and P-TIMS methods for pore water boron isotope measurement are established. The N-TIMS method is easy and simple, with very small amounts of boron (<0.05 μg B), and the pore water samples can be directly loaded onto the Ta filament without any pre-treatment of chemical columns, but the analytical precision is relative large at ~1.0‰. The P-TIMS methods need careful chemical column chemistry to separate boron from other matrix elements, with larger amounts of boron (1-2 μg B), but the analytical precision is significantly improved at ~0.2‰. Recently, two high-precision methods of determining chlorine isotopes have been developed: IRMS method and P-TIMS method, both having an analytical precision of 0.2‰. Generally speaking, the IRMS method requires relatively large quantities of chlorine (>1 mg Cl), precluding the investigation of materials with trace quantities or materials in limited supply. The P-TIMS method is both precise and sensitive and allows the analysis of microgram quantities of chlorine (<2 μg Cl). In our lab, we have established a P-TIMS method of $CsCl^+$, because this method has the smallest mass dependent fractionation, high sensitivity and low filament bank. We use Ba^{2+}-form, H^+-form and Cs^+-form cation resin mini-columns to separate Cl from other matrix ions such as SO_4, and transfer Cl into CsCl form. The CsCl solution is then loaded with high-purity graphite on the Ta filament and $^{35}Cl/^{37}Cl$ ratios are measured in a Finnigan Triton thermal ionization mass spectrometry coupled with multiple Faraday cups. Analyses of a NaCl standard and several pore water samples from sediments in the South China Sea produced an analytical precision of <0.2‰ for our established method. This study is financially supported by Ministry of Education (grant no. 306007).