安定同位体分析のための環境試料の化学的分離法
Chemical separation of environmental materials for Stable Isotope Analysis

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Stable Isotopes (SI), especially Sr-Nd-Pb isotopes, had been widely used as powerful geochemical tracers in Earth sciences. In recent, these isotope ratios have been applied to the biogeochemical tracer in traceability research. Since its invention, multi-collector ICP-MS (MC-ICP-MS) has been widely used for isotope analysis of metal and metalloids, including Sr and Pb because of their higher ionization efficiency of the ICP ion source, the enhanced sample throughput, and the flexibility of sample introduction. However, the chemical separation is still adapted from those developed for TIMS, and not modified for the use of MC-ICP-MS. The higher ionization efficiency makes almost all introduced component to ionize, causing matrix effect to the analyzed data and deterioration of the machine. Diverse environmental samples, especially organic materials cause a problem during chemical separation that could not expect. It should need that the element for MC-ICP-MS analysis should be clearly separated from matrix component not only cation elements but also organic materials.
The purpose of this study is to describe a newly developed sequential separation of Sr, Pb, and Nd with Sr resin and nitric acid solution reducing the processing time, the amount of acid reagent solution, and evaporation steps.
Two type of separation methods has developed depending on the elements. One is single separation method and the other is multi-separation ones. Single separation method separates a small amount of Sr (~1ug Sr) or Pb (~1ug Pb) only with restricted volume of the resin. This method merits fast recovery of the target element and direct analysis of Sr isotope ratios with MC-ICP-MS. The Pb solution recovered by hydrochloric acid evaporated and dissolved in nitric acid for isotope analysis. Multi-separation method uses a large amount of the resin to separate REE, Sr, and Pb in a row. The REE solution follows further separation of matrix elements with a cation exchange resin to purify rare earth elements. Nd elements purified from REEs with Ln resin.
To reduce organic materials from the Sr resin, a polymeric adsorbent resin is used in the lower layer of the Sr resin. For water samples, it is recommended to use hydrofluoric acid during sample evaporation, because natural water contains silica as a major component and poor separation in the resin. During these methods, the elements recovered up to 95% of Sr and 99 % of Pb of the loaded samples, respectively. The blank levels of Sr and Nd in the separation process were ~10pg and ~20pg, respectively.

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