Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18756

# Development of a sequential ion exchange chromatography method to separate geochemically important tracers for isotope measurements

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To carry out precise isotope measurements by TIMS and MC-ICP-MS, it is important to isolate the desired element in the purest form while reducing matrix elements to avoid interferences and matrix effects. This is generally achieved by ion exchange chromatography and most of these procedures were developed to isolate a single element. Developing a sequential ion exchange element separation technique capable of separating multiple elements has the advantage of enabling an investigation of the relationships between multiple isotope systems in the same fraction, which is especially important when the sample amount is limited.

In this study, we developed a sequential separation method for multiple elements, including transition elements (Ti, V, Cr, Fe, Ni, Cu, Zn, Cd, W ± Mo), Mg and Ca. The method also can be extended to separate the rare earth elements (REEs), which are important for geochemistry and cosmochemistry. For the separation techniques anion exchange resin (AG1X8), cation exchange resin (AG50WX8) and DGA resin were used. Oxalic acid was the only organic acid used throughout the procedure and other reagents used were commonly available inorganic acids. Resin volumes were kept minimal (maximum 1 ml), but can be modified accordingly.

The effectiveness of Ni, Cr and Ca separation was evaluated using geological samples having a wide variety of matrices including ultramafic, mafic and felsic samples and it was found that the ratio between impurities and the desired element in the purified sample is <0.2 for Ni [1] and <1 for Ca and Cr. Furthermore, the impurities at these levels were found to not influence the accuracy of isotopic measurement. Recovery yields were >90% and the total procedural blanks were <1 ng for all three elements. The isolation techniques developed were applied for the analysis of the Ryugu asteroid samples returned by the “Hayabusa 2” mission [2] where sub-milligram levels of samples were consumed for isotope analysis.

References

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[2] E. Nakamura et al., Proc. Japan Acad. Ser. B Phys. Biol. Sci. 98 (2022) 227–282.