Fast and simple preparation of geological materials for analysis by high sensitivity ICP-QMS

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The rising demand for rare earth elements (REEs) in the fields of user electronics, catalysis, optical displays, high-performance magnets, batteries, aerospace manufacturing and medical applications has resulted in the need for reliable trace analysis procedures of REEs in the assessment of potential mining sites, process control solutions and quality control of high-purity materials.

For the quantification of REEs, it is important that complete digestion of the sample is achieved. When acid mixtures containing hydrofluoric acid (HF) are used, insoluble fluorides of REEs may remain in the precipitate. In fact, refractory minerals such as zircon, tourmaline, chromite, rutile, garnet, spinel and corundum are incompletely decomposed by an acid attack. Decomposition by lithium metaborate and tetraborate fusion provides a complete decomposition of silicate phases and accessory minerals, however, results in a higher amount of total dissolved solids (TDS). Since ICP-MS is typically limited to TDS levels of less than 0.2%w/v, the fusion decomposition requires additional dilution prior to analysis.

For several types of geological matrices, sintering with Na2O2 is a very attractive analytical decomposition procedure because it is highly effective in decomposing minerals rapidly and the resulting sinter residue is easily dissolved.

This contribution will describe the preparation of ten different certified geological materials by a Na_2O_2 sintering method and subsequent analysis by high sensitivity ICP-QMS for the trace elemental analysis of rare earth elements. The Z-score parameter was adopted to evaluate the analytical quality of measured values and were found to fall within the z-score threshold of ±2, demonstrating the accuracy of the applied method.