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Determination of rare earth elements, uranium and thorium in geological samples by ICP-MS, using an automatic fusion machine as an alkaline digestion tool.

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At the present time, rare earth elements deposits have became in strategic resources for extraction of raw materials in order to manufacture high tech devices (computers, LCD, cell phones, batteries for hybrid vehicles, fiber optics and wind turbines) (1).The appropriate analytical determination of the REE (rare earth elements) in sediment and rock samples , is important to find potential deposits and to recognize geological environments for identifying possible alterations and mineral occurrences.

The alkaline fusion, which aim is to move the entire sample from solid to liquid state by forming water soluble complexes of boron and lithium, as a previous procedure for the determination of these elements, usually takes a lot of time due to the complexity of the analysis phase and by the addition of other reagents (Tm and HF) (2) to compensate the lack of strict temperature control.

The objective of this work is to develop an efficient alternative to alkaline digestion using an electrical fusion machine, which allows to create temperature programs with advanced process control and supports up to 5 samples simultaneously, which generates a reproducibility of the method and results during the melting step. Additionally, this new method permits the processing of a larger number of samples in a shorter time.

The samples analyzed in this method were weighed into porcelain crucibles and subjected to calcination for 4 hours at 950 ° C in order to determine the Lost on Ignition (LOI) , that serves to adjust the analytical results and to preserve the shelf life of the platinum ware.

Subsequently, a fraction of the calcined sample was weighed into platinum crucibles and mixed with ultrapure lithium metaborate (flux) 1:4 . The crucible was then placed in the fusion machine, which was programmed to take the sample from room temperature to 950 ° C in five minutes, make a small ramp to 970 ° C maintain that temperature for five minutes and download the melt in a 10 % v / v nitric acid solution . After an incorporation time, a fraction of this sample was then diluted 20 times in ultrapure deionized water (resistivity greater 18.2 megohms / cm). The diluted sample was analized in the ICP- MS, which was setted in high sensitivity mode.

The results were compared through cross samples (the same samples tested in the laboratory were sent to another international laboratory, which works under accreditation ISO 17025) and no major deviations (5%) was obtained by making comparisons between the two laboratories.

When comparing the results and evaluated the development of the art, it is concluded that this is an alternative that allows performing samples up to 50 alkaline fusions per day with great accuracy, saving resources and time.

References:
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