QUANTIFICATION OF GALLIUM, INDIUM AND THALLIUM IN METEORITES AND OTHER GEOLOGICAL MATERIALS BY GRAPHITE FURNACE ATOMIC ABSORPTION SPECTROMETRY

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ABSTRACT

Methods of solvent extraction have been developed for the determination of gallium, indium, and thallium in meteorites and other geological materials. The extraction of gallium is based on forming a chloro complex in HCl solution and extraction into MIBK. Indium was extracted into the same solvent as an iodo complex in an HBr + KI medium to which KOH had been added. Thallium was also extracted as an iodo complex from a H_2SO_4 + KI medium with addition of K_2HPO_4 as a salting out agent. Serious interference from iron(III) was eliminated by adding KI to reduce this element to its divalent state that was not extractable into the organic phase.

Graphite furnace atomic absorption spectrometric techniques were employed to determine these three elements in the MIBK phase after extraction from the aqueous phase. Very low limits of detection (l.o.d.) were obtained with these methods. It was possible to lower the l.o.d for these elements either by increasing the aqueous/organic phase ratio before extraction, or by multiple loading injections.

Using the developed methodology, gallium, indium, and thallium were quantified in iron and chondritic meteorites as well as in Cretaceous/Tertiary boundary clays, and some volcanic emissions.

The data for thallium abundances in 49 iron meteorites were the first ever recorded for this type of meteorite and allowed for taxonomic separation of the various groups of irons.

Indium abundances were only recorded in six chondrites because of the very low concentrations in iron meteorites.

My data for thallium and other elements were used to classify the previously non-studied Manitouwabing iron meteorite.

All three Group IIIA elements were determined in Cretaceous/Tertiary boundary clays and it was shown that these and other chalcophile elements have an abundance greater than that which would have been expected from either a volcanic or impact-derived source. Possible sources of this enrichment are discussed.

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