AN OPTIMIZED PROCEDURE FOR BORON SEPARATION AND POSITIVE MASS SPECTROMETRY ANALYSIS

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Among the analytical techniques available for the determination of boron isotopic ratios in natural samples, the PTIMS (Positive Thermal Ionization Mass Spectrometry) using Cs$_2$BO$_2^+$ is the most precise and reproducible method with uncertainties in the order of 0.2 ‰ ($\pm 2\sigma$). Nevertheless, this technique suffers from a lack of sensitivity compared to the negative technique while a typical mass of 1 µg of boron remains required for precise isotopic determination. Additionally, boron isotopic determinations are hampered by the presence of organic matter in natural water samples compromising the signal intensity and leading to an isobaric interference at mass corresponding to the $^{10}$B isotope. A number of procedures have been investigated for removing the organic matter but none was entirely satisfactory (U.V. irradiation, organic specific resins, ultra-filtration, hydrogen peroxide or activated carbon).

We have improved the sensitivity for boron analysis using Cs$_2$BO$_2^+$ technique with graphite and mannitol allowing to load a mass of 250 ng of boron with a typical current intensity of $5 \times 10^{-12}$ A using a single Faraday cup coupled to a $10^{11}$ Ω resistor. We have also developed a new chemical procedure for boron extraction from organic rich media. Based on the use of the boron specific resin Amberlite IRA 743 and the property of boron to sublime (see Gaillardet et al., 2000), this procedure is especially efficient in separating boron from river waters where boron concentration can be as low as 1 ppb. No in-run isotopic fractionation is observed and the external reproducibility for standards as well as for samples is typically 0.3 ‰ ($\pm 2\sigma$). With this precision, a slight, but quite reproducible isotopic fractionation of 0.4 ‰ is observed for standards processed through the whole chemical procedure.

References