Silicon isotopes measurement by MC-ICP-MS, a new approach for low concentrations

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Silicon isotopes are a powerful tool for the study of the biological consumption of silicic acid by key organisms such as diatoms, since the lighter isotopes of silicon are preferentially uptaken up. However, the exact fractionation of silicon isotopes during biomineralization, and the biochemical pathway responsible for the fractionation, are unknown. In order to investigate the fractionation during the active uptake of silicon, field or culture studies must be carried out under very low silicic acid concentration (below approximately 10µM) challenging existing methodologies.

Here we show the reproducible measurement of $\delta^{29}Si$ of reference standard solutions from 0.4 to 0.1ppm Si measured by Multi-collector Inductively Coupled Plasma Mass Spectrometry (MC-ICPMS, Finnigan Neptune, Bristol Isotope Group) with new analytical settings. We have used 10^{12} Ω resistors on Faraday cups L3 and C to measure isotopes ^{28}Si and ^{29}Si respectively, followed by a magnet jump to measure ^{24}Mg and ^{25}Mg. Instrumental mass-bias was corrected internally by doping with a magnesium isotopic standard, and externally by standard-sample bracketing. Reproducibility of a biogenic silica standard was improved by using additional gas and careful avoidance of interferences, which were isolated using peak-flatness tests. Our novel method provides a promising new avenue to measuring low Si solutions for applications such as biological culture studies and field studies in oligotrophic surface waters.