Critical considerations for Precise Determination of Stable Strontium Isotopic Compositions by MC-ICP-MS

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The investigation of variations within the non-traditional stable Sr isotope composition in various natural system gained a broader interest in recent years. Although significant improvements in analytical precision for isotopic ratio analysis has been obtained in the recent decade, accurate determination of stable Sr isotopic ratios is still a challenge nowadays. We here show the key controlling factors affecting precise determination of stable Sr isotopic ratios using Neptune Plus MC-ICP-MS, including internal standard correction, nebulizer fractionation effect and matrix effect. Further, a novel tactic in the Sr purification using Sr-spec® resin increasing the recovery rates to > 98.5% is presented. In this work, the mass bias effects between $^{92}Zr/^{90}Zr$ and $^{88}Sr/^{86}Sr$ were investigated and compared, and a 3~5-fold improvement in precision of determination of $^{88}Sr/^{86}Sr$ was obtained compared to that based on only the standard-sample-bracketing technique. Moreover, nebulizer fractionation was illustrated using an in-house standard solution Alfa Sr and the seawater standard IAPSO. As for matrix effect, residual Ca in purified Sr fraction was evaluated and showed insignificant influence. Overall, A practical, high-efficient procedure for stable Sr separation and analysis was set up basing on our study. The seawater standard IAPSO yielded $\delta^{88/86}Sr$ = 0.374 ± 0.028 ‰ (2SD, n = 23) in agreement with reported data. The long-term reproducibility for rock standard materials, BCR-2 and BHVO-2, yielded $\delta^{88/86}Sr$ = 0.232 ± 0.015 ‰ (2SD, n = 10), $\delta^{88/86}Sr$ = 0.249 ± 0.017 ‰ (2SD, n = 10), respectively, which agree well with the published values. The in-house standard solution Alfa Sr was produced to check for the long-term reproducibility of the method and yielded a comparable value of 0.113± 0.039 ‰ (2SD, n = 46) over 6 months.