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Reagent-Associated Offset from JNdi-1 in Nd Isotope Ratio Measurements Using Internal and External Normalization by MC-ICP-MS

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High-precision measurements of stable Nd isotope ratios by MC-ICP-MS and TIMS require robust mass bias correction to achieve external reproducibility at the ≤0.05‰ level [1-6]. The $^{146}Nd/^{144}Nd$ ratio (0.7219) has traditionally been assumed invariant for internal normalization; however, the choice of correction strategy (standard–sample–standard bracketing versus dopant-based normalization) can introduce systematic bias. In particular, reagent-related effects associated with the JNdi-1 reference solution remain insufficiently evaluated. Here we assess multiple mass bias correction approaches, including standard–sample–standard (SSB) bracketing, Sm-dopant normalization, and Eu-dopant normalization, for high-precision stable Nd isotope analysis by MC-ICP-MS. Analytical performance was evaluated through repeated measurements of JNdi-1 and to assess reproducibility and stability. Dopant-based normalization improves short-term precision relative to SSB bracketing; however, reproducible systematic offsets are observed between normalization schemes. These offsets cannot be explained by instrumental drift, matrix effects, or unresolved interferences, indicating potential reagent-dependent mass fractionation effects. The magnitude of the offset is comparable to, or larger than, the external reproducibility commonly reported for stable Nd isotope measurements, underscoring the need for careful inter-laboratory comparability. Our results demonstrate that while internal normalization enhances analytical precision, it may affect accuracy if reagent-specific effects are not properly accounted for. Practical recommendations are provided for minimizing systematic bias in routine high-precision Nd isotope analyses and improving data comparability across laboratories.

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