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Maximizing precision and accuracy of TIMS Nd isotope measurements for small sample sizes

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The neodymium (Nd) isotope ($^{143}Nd/^{144}Nd$) composition of foraminifera is widely used as a tracer of oceanic mixing on glacial inter-glacial timescales, and of continental weathering on multi-million year timescales.

The availability of foraminifera and its different species in sampled sedimentary materials can limit the precision of Nd isotope measurements accelerating the increasing need to measure high-precision Nd isotope data for small sample sizes (<1 ng Nd). Recent advances in amplifier technology have enabled precise determination of small signals, improving the precision of small sample isotopic measurements [1,2,3,4]. For Nd metal determined by Thermal Ionization Mass Spectrometry (TIMS), precision better than 100 ppm (2 RSD) have been achieved for a 100 pg Nd loads of standard reference materials [1,2] and recent Mediterranean foraminifera with an estimated Nd load < 1 ng. For these measurements, the precision is mainly limited by the counting statistics and hence the Nd ion yield (typically 2–3 %). In comparison, analyzing Nd isotopes in the oxide form (NdO^+) by loading the samples with a tantalum oxide phosphoric acid slurry has been shown to yield much higher yields (>10%; [5]).

In this study we combine the NdO^+ method with the low noise Thermo Scientific 10^{13} Ω amplifiers on a Triton series TIMS to obtain best accuracy and precision. The results demonstrate that high-precision Nd isotope data can be obtained for Nd loadings of <1 ng, opening up the possibility to measure increasingly smaller foraminifera samples.

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