Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37227

10–100 pg NdO Isotope Ratios Achieved Using TE-Controlled Faraday Detection on a Nu TIMS

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Picogram-level neodymium isotope measurements are increasingly required for sample-limited geochemical studies, experimental petrology, and high-resolution temporal reconstructions. Here we present new NdO analytical performance on the Nu TIMS, combining molecular oxide-ion measurement with switchable 10^{13} Ω amplifiers and a static Faraday array to obtain high-precision $^{143}Nd/^{144}Nd$ data from 10–100 pg JNdi loads.

Measuring Nd as NdO provides a substantial increase in ion yield relative to metal-mode operation, with 15–27% NdO ion efficiency (typically ~21% for 100 pg), enabling stable beams at intensities far below conventional Nd^+ capability. To support low-intensity measurement, we developed a Total-Evaporation (TE) PID-controlled emission ramp that regulates filament output and maintains stable ionisation throughout the evaporation sequence. Combined with Active Tau Correction, accurate Faraday performance is preserved at integration times down to 2 s, significantly improving stability, noise behaviour, and analytical throughput at ultra-small sample sizes.

External reproducibility of approximately 33 ppm (100 pg), 101 ppm (25 pg), and 130 ppm (10 pg $^{143}Nd/^{144}Nd$) was achieved. Equivalent metal-mode analyses demonstrate markedly lower performance due to an 8–9× reduction in ion yield, underscoring the analytical advantages of NdO formation for small-load isotope measurement.

These developments demonstrate that sub-100 ppm Nd isotope precision at the picogram level is achievable on the Nu TIMS. The combination of NdO ion measurement, TE-stabilised emission control, switchable low-noise amplifiers, and static Faraday multicollection enables accurate and reproducible Nd isotope ratios from previously inaccessible sample sizes, opening new opportunities for high-resolution geochemistry across natural and experimental systems.