

Supplementary Material

The stable isotope fractionation of Neodymium on Ferrihydrite revisited

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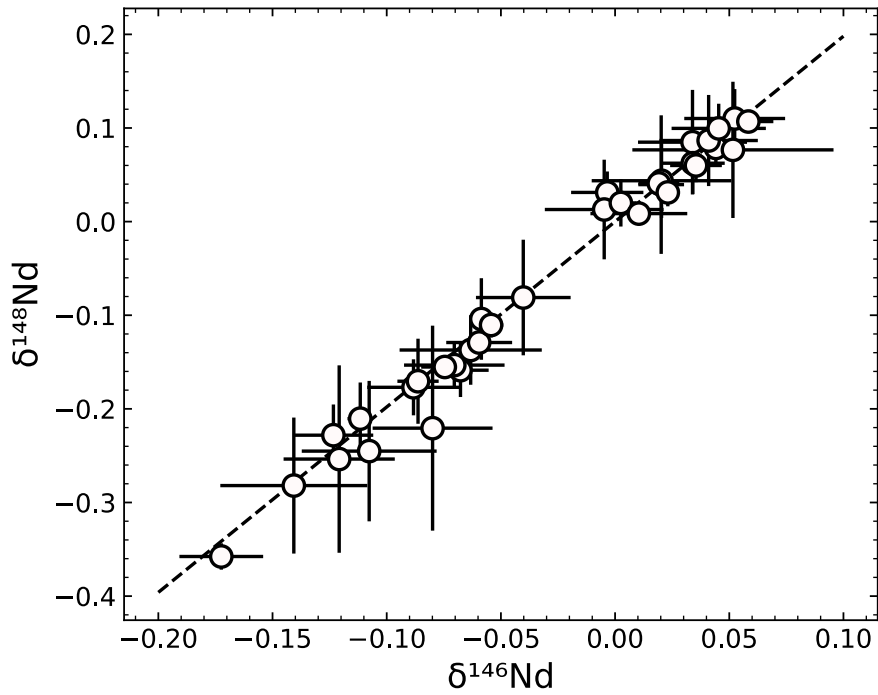


Figure S1: Plot of $\delta^{146}\text{Nd}$ versus $\delta^{148}\text{Nd}$ for analysed experiments ($n=36$), with all samples exhibiting mass-dependent behaviour. Dashed line represents the mass dependent fractionation line. $\delta^{148}\text{Nd}$ is calculated outside of double spike deconvolution as described in McCoy-West et al. (2020).

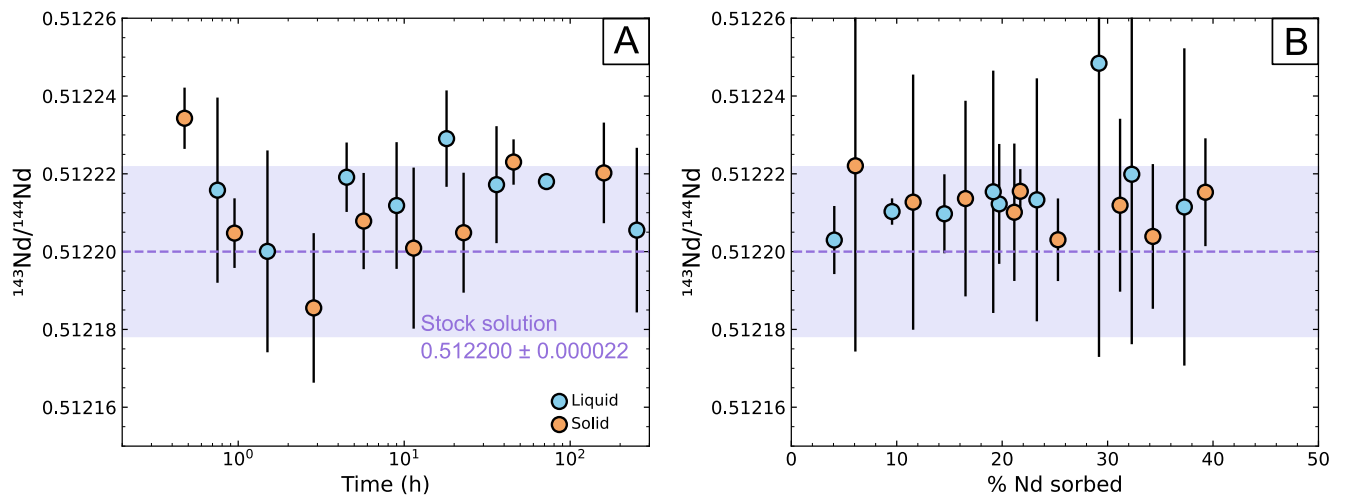


Figure S2: $^{143}\text{Nd}/^{144}\text{Nd}$ compositions of the adsorption experiments agree well with the HPS Nd dopant (Kaufmann and McCoy-West, 2025). Data are shown separately for (a) Time series experiments, and (b) Experiments with variable adsorption in equilibrium.

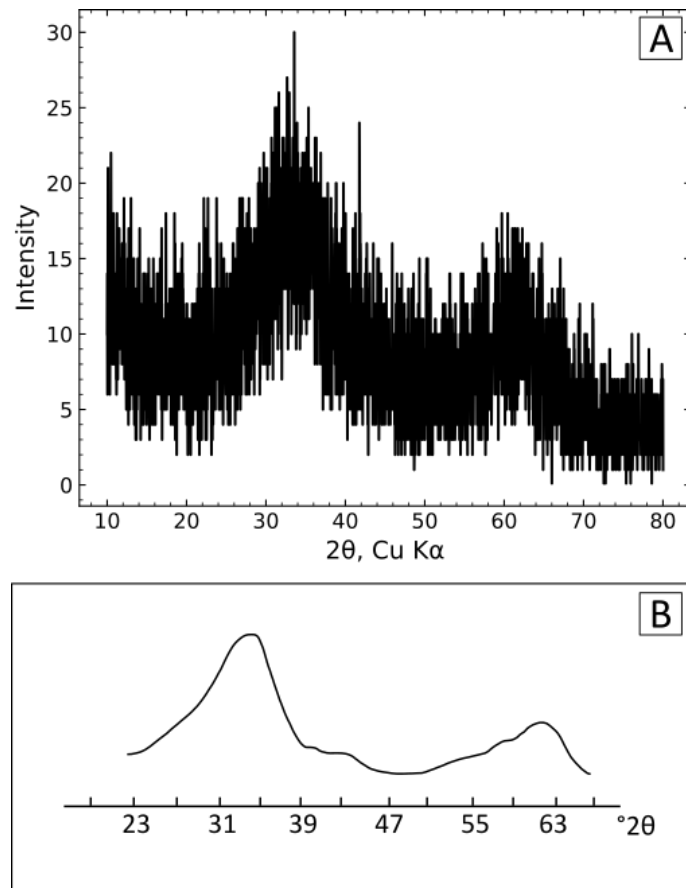


Figure S3: (a) XRD pattern of synthesized ferrihydrite. The peaks at 35° and $62^\circ 2\theta$ are characteristic for 2-line ferrihydrite. (b) Reference diagram after Drits et al. (1993).

Table S1: Calibration standards used for trace element analysis.

Standard	Nd (ppb)	Fe (ppb)
1	0.62	9.07
2	6.36	92.58
3	32.44	472.48

Table S2: Solution parameters used for PHREEQC simulations. Concentrations of the simplified seawater were taken from Diehl and Bach (2020).

Parameter	Experiment	Seawater
pH	5.5	8
Temp (°C)	25	25
Nd (molL ⁻¹)	8.32×10^{-7}	2.30×10^{-11}
Na (molL ⁻¹)	0.01	0.46
Mg (molL ⁻¹)		0.053
Ca (molL ⁻¹)		0.01
K (molL ⁻¹)		0.01
Cl (molL ⁻¹)	0.01	0.54
F (molL ⁻¹)		0.000066
SO ₄ (molL ⁻¹)		0.028
CO ₂ (molL ⁻¹)		0.0023

References

- Diehl, A., Bach, W., 2020. MARHYS (MARine HYdrothermal Solutions) Database: A Global Compilation of Marine Hydrothermal Vent Fluid, End Member, and Seawater Compositions. *Geochemistry, Geophysics, Geosystems* 21(12). doi.org/10.1029/2020gc009385.
- Drits, V., Sakharov, B., Salyn, A., Manceau, A., 1993. Structural model for ferrihydrite. *Clay Minerals* 28(2), 185-207. doi.org/10.1180/claymin.1993.028.2.02.
- Kaufmann, A.K., McCoy-West, A.J., 2025. Combined Stable and Radiogenic Nd Isotope Characterisation of Sedimentary and Iron Formation Reference Materials by Double Spike MC-ICP-MS. *Geostandards and Geoanalytical Research*. doi.org/10.1111/ggr.70020.
- McCoy-West, A.J., Millet, M.-A., Nowell, G.M., Nebel, O., Burton, K.W., 2020. Simultaneous measurement of neodymium stable and radiogenic isotopes from a single aliquot using a double spike. *Journal of Analytical Atomic Spectrometry* 35(2), 388-402. doi.org/10.1039/c9ja00308h.