Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.38291

Using REE geochemistry and stable Nd isotopes to understand REE enrichment within clay-rich horizons: Mt Weld, Western Australia

SAMANTHA C RUSSO[1,2], IGNACIO GONZÁLEZ-ÁLVAREZ[3,4], HELEN MCCOY-WEST[1] AND DR. ALEX J MCCOY-WEST, PHD[1,2]

[1]Economic Geology Research Centre, James Cook University, Townsville

[2]IsoTropics Geochemistry Laboratory, James Cook University, Townsville

[3]Commonwealth Scientific and Industrial Research Organisation (CSIRO)

[4]Centre for Exploration Targeting, University of Western Australia

With increasing demand for rare earth elements (REE) comes the necessity to improve our understanding and exploration for REE in high- and low-temperature systems. Low-temperature deposits, and more specifically REE ion adsorption clay deposits (IACD) [1], have received heightened global interest regarding more efficient and effective REE extractions, relative to other REE deposits (e.g. carbonatites). More efficient and effective REE extraction in IACD is attributed to the easily exchangeable nature of REE sorption to clay minerals (e.g., kaolinite), permitting the use of weak reagent salts (e.g., ammonium sulfate). Despite the metallurgical benefits, IACD have significantly lower grades than supergene REE deposits associated with carbonatites.

Carbonatites are the most significant REE mineral resources globally. Examples of carbonatites include Bayan Obo, China, Mountain Pass, USA, and Mt Weld, Western Australia. Rare earth element enrichment within carbonatites is facilitated by high- (i.e., magmatic and/or hydrothermal) and/or low-temperature (i.e., lateritic weathering) processes. At Mt Weld, lateritic weathering significantly upgraded REE within the system, resulting in a REO resource of 109.6 Mt at an average grade of 4.24 wt.% REO (where REO refers to rare earth oxides; [2]). The current resource exploited at Mt Weld is contained within secondary (alumino)phosphates hosted within the high-grade regolith, which is underlain by carbonatite and overlain by caprock and lacustrine and alluvial clays.

In response to the economic interest of (alumino)phosphates in the regolith, limited research has been conducted on REE-clay associations, nor has Mt Weld's IAC potential been explored. Here, we present whole-rock and sequential extraction data on clay-rich horizons at Mt Weld to understand the REE budget across the exchangeable, carbonate, Fe oxide, phosphate, and residual (silicate) mineral fractions. Additionally, we present novel stable Nd isotope data as a weathering and REE mobility tracer, providing insight into the bonding environment of REE onto clay minerals.

[1] Russo, S. C., González-Álvarez, I., Cocker, H. A., & McCoy-West, A. J. (2025). The fundamentals of rare earth element ion adsorption clay deposits: A mineral systems approach for exploration. *Journal of Geochemical Exploration*, *278*, 107845.

[2] Lynas Rare Earths, 2025. Appendix 4E and 2025 Annual Report. Date: 28 August 2025. https://lynasrareearths.com/investors-media/reporting-centre/annual-reports/