

# Clay hosted REE deposits: early characterisation for economics assessment

*H.M. Lampinen<sup>1</sup>, N. Reid<sup>2</sup>, A. Davis<sup>3</sup>, R. Thorne<sup>4</sup>, and M. Iglesias-Martinez<sup>5</sup>*

1. Research Engineer, Mineral Resources, Discovery Program, CSIRO, Kensington WA 6151. Email: heta.lampinen@csiro.au
2. Senior Research Scientist, Mineral Resources, Discovery Program, CSIRO, Kensington WA 6151. Email: nathan.reid@csiro.au
3. Principal Research Scientist / Team Leader, Mineral Resources, Discovery Program, CSIRO, Kensington WA 6151. Email: aaron.davis@csiro.au
4. Research Scientist / Team Leader, Mineral Resources, Discovery Program, CSIRO, Kensington WA 6151. Email: robert.thorne@csiro.au
5. Research Scientist, Mineral Resources, Discovery Program, CSIRO, Kensington WA 6151. Email: mario.inglesias-martinez@csiro.au

Keywords: REE, clay hosted, kaolinite crystallinity, electrical conductivity, AEM, infrared reflectance spectroscopy, geochemistry, microscopy, partial leaching, sequential leaching, recovery, mineralogical domaining.

## ABSTRACT

Rare earth elements (REE) are critical for new and emerging technologies used for the carbon-free energy transition. Some REE occurrences are concentrated to economically viable grades within clay horizons that have developed over weathered REE-rich parental rocks, for example, granites. The extraction economics for clay-hosted REE are directly related to the specific REE that are present and how these exist in clay deposits. From most economically viable to more challenging, the REE can occur as ionically adsorbed, chemisorbed, or as colloid particles on the clay surface, and in relict minerals inherited from the clay protolith. Further, REE can be found as a combination of the above types in various degrees adding to their complexity. They can occur at different stratigraphic depths of the clay deposit within both in-situ and transported horizons that display vertical and lateral changes in extent and thickness. CSIRO Mineral Resources and industry partners are currently investigating several Australian clay-hosted REE prospects using multiscale and multidisciplinary approaches involving synthesis of metallurgical analysis for recovery with various microscopy analysis techniques, geochemistry, geophysics, infrared reflectance spectroscopy (colloquially hyperspectral), hydrogeochemistry, and regolith landform evolution analysis combined with advanced computer analytics. With the early-stage synthesis of existing data, we aim to delineate the prospects and to outline the mineralogical properties of the ore domains within the clay deposit stratigraphy. Specifically, we are looking for features that are salient to the beneficiation processes in order to aid the industry partners in their economic assessment of their prospects. We will present early findings from multidisciplinary characterisation of clay-hosted REE deposits in southwestern West Australia and discuss the pros and cons of various methods that were applied in the process of characterisation.