

## **Nucleation of Th-rich cerianite on halloysite surface in a regolith-hosted rare earth elements deposit in South China**

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### **ABSTRACT**

The ion-adsorption rare earth element (REE) deposit, a valuable type of REE deposit, has been thought to be derived from the release and enrichment of REE during granite weathering. Understanding the REE occurrence in regolith-hosted deposits is crucial for more efficient extraction. We investigated a weathering granite profile of a regolith-hosted REE deposit located in South China. X-ray diffraction (XRD) and X-ray absorption near edge structure (XANES) analysis of the clay fractions reveal that the highest Ce(IV) content located in intensely weathered layers and cerianite nanoparticles (CeNPs) can be observed, besides invisible adsorbed REEs. Interestingly, most of the CeNPs scatter on halloysite basal surface and exhibit preferred orientation. Detailed analysis demonstrates that the diagonal plane of cerianite matches with the exposed basal surfaces (Si-O tetrahedron) of halloysite. Such a lattice match may contribute to the nucleation and growth of CeNPs after oxidation of the adsorbed Ce(III), which results in great REE enrichment by clays. The findings provide new insight into the mechanism of Ce precipitation and REE mineralization during granite weathering.

**Keywords:** Nucleation, halloysite, lattice match, cerianite, ion-adsorption rare earth element deposit, South China