

The Rare earth element ‘probe’ : Investigation of the water/solid interfaces and their impact on the rare earth element dissemination

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Due to their unique properties, rare earth elements (REE) are widely used in high-tech products and especially in the Greentech industry. The main consequences are the increase in the amount of extracted REE and produced wastes. Rare earth elements are therefore considered both as critical elements and emerging pollutants. Beyond these considerations, REEs have been used for many years as tracers of sources and waters mixtures. More recently, the entire lanthanide group has demonstrated its ability to trace the processes occurring at the water/solid interface. This tracing property based on the use of the whole lanthanide group (pattern) and on the fractionation resulting from the coherence of their physicochemical properties. Coupled with thermodynamic modeling and X-ray absorption spectroscopy, this fractionation allows to trace the reactivity of the solid surface, i.e. the active functional groups and the complexes formed (i.e. Marsac et al., 2010). This fingerprinting capability has been applied to the study of natural colloids (Catrouillet et al., 2020) as well as anthropogenic nanoparticles (Blanco et al., 2022). In turn, the REE "probe" has shown that the mobility and dissemination of REE in the environment are largely controlled by colloids and in particular by multiphase colloids formed by Fe and organic matter. These results are of major importance as the use of REE for Greentech products increases their concentrations in the environment and as global climate change and agricultural practices release more and more Fe-organic matter colloids into the natural system.

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