Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.8991

The solubility and speciation of Nd in carbonate-bearing hydrothermal fluids

HAYLEA NISBET[1], ARTACHES MIGDISSOV, PHD[1], VINCENT VAN HINSBERG[2] AND ANTHONY WILLIAMS-JONES[2]

[1]Los Alamos National Laboratory
[2]McGill University
Presenting Author: haylea.nisbet@mail.mcgill.ca

Neodymium is one of the most highly sought-after Rare Earth Elements (REE), owing to its vital use in permanent magnets. In nature, concentrated quantities of Nd, and other REE, are frequently associated with hydrothermal fluids. Consequently, in the last decade, a multitude of studies have been carried out to investigate the solubility and speciation of these elements at hydrothermal conditions. However, a major gap that hinders our ability to predict the mobility of Nd in natural systems is its behavior in carbonate-bearing hydrothermal fluids- to which there is currently no information.

In this study, we determine the speciation of Nd in carbonate-bearing fluids at elevated temperature (175-250°C) by the autoclave solubility technique [1] using synthesized Nd-hydroxylbastnäsite as the reference phase. We demonstrate that the predominant aqueous complex at these conditions is the $NdCO_3OH_{aq}$ complex, formed by the congruent dissolution of the solid phase. This suggests that the speciation of Nd in alkaline solutions is controlled by mixed-ligand complexes, and is significantly different from its predicted behavior in earlier evaluations. The concentration of such complexes, and thus, the ability for a fluid to transport Nd will, therefore, depend on multiple factors- namely, the concentration of HCO_3- and pH.

[1] Migdisov et al. (2009) Geochim. Cosmochim. Acta 73, 7087-7109