Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37465

Trace metal composition and mineralogy of calcium oxalate as a function of time

DIMITRA ATHANASIADOU[1], MR. ARNAUD BOUISSONNIÉ, PHD[1], JEAN-MICHEL BRAZIER[1], PEDRO ALVAREZ-LLORET[2] AND VASILEIOS MAVROMATIS[1]

[1]University of Bern
[2]UNIVERSITY OF OVIEDO

Calcium oxalate (CaOx) precipitation plays an important role in biomineralization including human kidney stone disease (urolithiasis) and low-temperature geochemical systems, yet its long-term stability and trace metal partitioning behavior remain poorly constrained. We conducted time-resolved batch experiments (30 min to 12 weeks) to investigate CaOx precipitation and aging in the presence of Zn, Cu, and Ba, elements of biological and environmental relevance that commonly associate with Ca-bearing minerals. Solid phases were characterized by X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FTIR), while aqueous Ca, Zn, Cu, and Ba concentrations were measured by inductively coupled plasma-optical emission spectrometry (ICP-OES). XRD patterns indicate rapid CaOx nucleation within the first hours of reaction, followed by progressive structural ordering during aging. FTIR spectra show progressive band sharpening and subtle changes in relative band intensities, consistent with increasing crystallinity and structural reorganization up to 12 weeks. No major secondary phases were detected suggesting that Zn, Cu and Ba are either incorporated in the crystal lattices or adsorbed on the surface of CaOx. A rapid decrease in Zn, Cu, Ba and Ca concentrations in solution is observed during the initial precipitation stage (≤3 h). This trend is followed by a gradual increase of Zn, Cu and Ba in the solution during aging, indicating release or redistribution during (re-)crystallization. Collectively, these results show that CaOx is a dynamic, time-dependent trace-metal host. The coupling between evolving crystallinity and changing aqueous metal concentrations underscores the importance of reaction duration when predicting metal sequestration in biological and environmental CaOx systems. This has important implications for kidney-stone trace-element signatures and likely isotope composition, as well as for metal retention in oxalate-forming biota and soils.