Experimental Setup:

- Two titrators were coupled with a temperature controlling rolling reactor
- CaCl₂ was titrated over a time of 10 min to a Na₂H₂PO₄ solution (1:1).
- Aliquots were taken, filtered (0.2µm), and lyophilized instantly.
- Raman spectra were collected in the 100–1890 cm⁻¹ region with a resolution of 1 cm⁻¹ and an excitation wavelength of 785 nm.

Motivation:

- New exiting tool: In-situ Raman!
- RXN2TM analyzer from Kaiser Optical Systems with a Kaiser MR Probe head
  - In-situ raman allows us to observe the transformation of amorphous to crystalline material in real-time with a temporal resolution of up to 45s/scan.
  - The transformation from amorphous/ nano-material towards crystalline material is accompanied by an increased degree of ordering; i.e., a shift from a broad peak at ~950 cm⁻¹ towards a narrow peak at 960 cm⁻¹.

XRD and Solution Chemistry:

- Transformation occurs after 8 h with a clear peak sharpening recorded by a decreased FWHM from 27.1 cm⁻¹ in the amorphous state (inlet A) to 15.8 cm⁻¹ in the crystalline state (inlet B).

Introduction:

Think Big – Start small:

- Phosphatic sediments record important microbial activity and redox conditions throughout Earth’s history and form economically important deposits.
- Basically two fundamentally different mechanisms lead to the formation of large scale phosphatic sediments:
  1. Microbially mediated (biotic)
  2. Direct precipitation (abiotic)
- In order to evaluate rock samples with respect to formational and diagenetic processes, as well as their temporal sequence/evolution (e.g., preservation of fragile embryo fossils), we aim for a profound understanding of the basic principles underlying apatite (mineral) formation.
- The understanding of complex natural systems requires single component analysis in a minimized experimental setup: Ca²⁺, PO₄³⁻ and H₂O.
- Temperature and initial pH during the experiments are chosen to resemble ocean chemistry during the Cambrian Eon.

Transformation as a function of time.

Different additives (Ca, Mg, Sr, REE,...) will be introduced to simulate a natural environment while the transformation process will be monitored by in-situ raman.

The new insights of the mechanisms controlling hydroxyapatite formation will be applied to natural samples.

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