Sr^{2+} uptake during precipitation of $CaCO_3$ in constant composition experiments with variable ion ratios

MIKALA BEIG[1], TSIGABU GEBREHIWET[2]*,
YOSHIKO FUJITA[3], GEORGE REDDEN[3]
AND ROBERT W. SMITH[2]

[1]Mikala Beig, 7963 Grasmere Dr.Boulder, CO 80301(mbeig@alumni.rice.edu)
[2]University of Idaho, 1776 Science Center Dr, Idaho Falls,ID, 83402(*correspondence: tgebrehiwet@uidaho.edu) (smithbob@uidaho.edu)
[3]Idaho National Laboratory, MS 2208,Idaho Falls, ID 83415 (Yoshiko.Fujitia@inl.gov, George.Redden@inl.gov)

Engineered precipitation of calcium carbonate, which can co-precipitate trace metal contaminants, is a proposed strategy for remediating toxic or radioactive metals in subsurface environments. Although, extensive research has been conducted on $CaCO_3$ (s) precipitation mechanisms, few of these studies have investigated trace metal partitioning under saturation states and ion ratios that are likely to occur in engineered systems. Under these conditions, where rapid treatment is an important objective, supersaturation states with steep ion concentration gradients may be generated. In support of the development of engineered calcite precipitation schemes, we have conducted experiments on $CaCO_3$ precipitation kinetics under constant composition conditions where the supersaturation state (Ω) with respect to calcite is held constant at 12.8, but the ion activity ratio ($Ca^{2+}:CO_3^{2-}$) is varied. The objective is to examine the effect of the ion ratio on the mineral precipitation rate and the distribution coefficient for coprecipitated Sr (D_{exSr}). Our results to date show that: 1) precipitation rates vary by a factor of two with the maximum rate occurring at a non-equimolar carbonate to calcium ratio, and 2) Although the variation in the range of values for D_{exSr} is similar to the range for the calcite precipitation rate, we found no correlation between strontium distribution coefficients and precipitation rates.

Liesegang pyrite bands in sapropel sediments

R. BEKTURSUNOVA* AND I. L'HEUREUX

University of Ottawa, 150 Louis Pasteur, Ottawa, K1N6N5, Canada (*correspondence: rbekt101@uottawa.ca)

Liesegang precipitation patterns are encountered in some geological systems [1]. For example, pyrite Liesegang bands are observed in marine sediments of the Eastern Mediterranean in close vicinity to organic matter-rich anaerobic layers (sapropel) [2].

We study the formation of Liesegang pyrite bands in aging sapropel sediments by means of early diagenetic reaction-transport modelling [3] coupled with pyrite precipitation kinetics that incorporates nucleation, growth and ripening [4].

The model reproduces the essential features of banded authigenic pyritization observed in sapropel sediments [2]. The results show that the main factors controlling the formation of distinct precipitation bands, their number and distribution over the sediment layer are: availability of organic matter and sulfate, as well as the source of reactive iron and pH.

Sediment properties that promote the formation of pyrite Liesegang patterns are considered (Fig.1). The dependence of the pyrite pattern on the time-dependent boundary conditions that characterize the sapropel system may be used to interpret the paleoclimatic environment at the time of deposition.

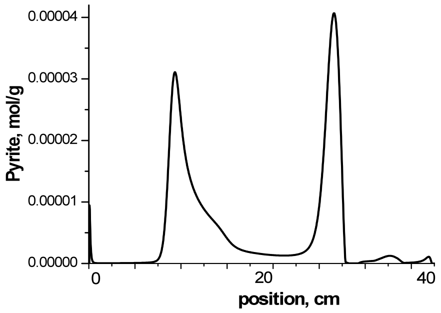

Figure 1: Pyrite steady-state concentration profile in a sapropel system.

[1] L'Heureux & Bektursunova (2010) in, *Precipitation patterns in reaction-diffusion systems* (Lagzi, Ed.) Research Signpost. [2] Passier *et al*. (1996) *GCA* **60**, 751–763. [3] Boudreau (1997) *Diagenetic models & their implementation,* Springer-Verlag. [4] L'Heureux (2008) *Phys. Lett. A* **372**, 3001–3009.