

## Reactivity of Ferrihydrite

JASMINE J. ERBS<sup>1</sup>, THELMA BERQUØ<sup>2</sup>,  
SUBIR K. BANERJEE<sup>3</sup>, GEGORY V. LOWRY<sup>4</sup>,  
BRIAN C. REINSCH<sup>4</sup>, BEN GILBERT<sup>5</sup> AND R. LEE PENN<sup>6</sup>

<sup>1</sup>University of Minnesota, Department of Chemistry 207  
Pleasant St. SE, Minneapolis, MN 55455  
(erbsj@uwplatt.edu)

<sup>2</sup>University of Minnesota, Institute for Rock Magnetism, 100  
Union Street SE, Minneapolis, MN 55455  
(berquo013@umn.edu)

<sup>3</sup>University of Minnesota, Department of Geology and  
Geophysics, 310 Pillsbury Drive SE, Minneapolis, MN  
55455 (banerjee@umn.edu)

<sup>4</sup>Civil & Environmental Engineering, Carnegie Mellon  
University, 119 Porter Hall, Pittsburgh, PA 15213  
(glowry@andrew.cmu.edu, breinsch@andrew.cmu.edu)

<sup>5</sup>Lawrence Berkeley National Laboratory, Earth Sciences  
Division, 1 Cyclotron Rd., MS 90-1116, Berkeley, CA  
94720 (bgilbert@lbl.gov)

<sup>6</sup>University of Minnesota, Department of Chemistry 207  
Pleasant St. SE, Minneapolis, MN 55455  
(rleepenn@umn.edu)

Iron oxide nanoparticles are a major source of reactive surface in many natural systems. Ferrihydrite is a naturally-occurring iron oxide that typically occurs as nanoparticles in the 3-10 nm size range. This material is dynamic from the perspectives of size, phase, morphology, reactivity, and aggregation-state. Quantitative results tracking reactivity as a function of particle size, arsenic loading, and storage method will be presented. One major result is that dried ferrihydrites are substantially less reactive than never-dried materials. A second result is that the method of arsenic incorporation (e.g. co-precipitated or adsorbed to pre-existing ferrihydrite nanoparticles) is a strong predictor of arsenic release during reductive dissolution. Results from characterization by transmission electron microscopy, X-ray diffraction, small angle X-ray scattering, X-ray absorption, and magnetic methods will be presented.

## A conceptual model for foraminiferal proxy incorporation based on their biomineralization mechanism

JONATHAN EREZ

Institute of Earth Sciences, the Hebrew University of  
Jerusalem 91904, Israel (erez@vms.huji.ac.il)

Based on recent observations it has been demonstrated that the fluid from which perforate foraminifera precipitate their secondary calcite is modified seawater. The seawater is supplied by endocytosis of large vacuoles which are modified within the cell and then are exocytosed into a privileged space where biomineralization occurs. Based on the dynamics of vacuole supply the residence time of the fluids in the biomineralization site is estimated to be short (few to tenths of minutes). Both trace elements and isotopes are incorporated into the secondary calcite by Rayleigh type fractionation processes. The main factor which controls the degree depletion of the calcification reservoir is the supply of  $\text{CO}_3^{2-}$  ion to the privileged space. A carbon concentrating mechanism (CCM) can be demonstrated both in the vacuoles and in the privileged space. The CCM is based on the diffusion and accumulation of  $\text{CO}_2$  (aq) originating in acidic seawater vesicles and from respiration into the alkaline seawater vacuoles which eventually arrive to the privileged space. Environmental parameters in the original seawater such as DIC, pH and/or  $\text{CO}_3^{2-}$  may influence the CCM and thus control the Rayleigh processes involved in the proxies incorporation into the shell. However, different ions and isotopes need to be examined individually to be explained with this mechanism. New confocal microscope observations and experiments of these processes leading to this conceptual model will be demonstrated and discussed.