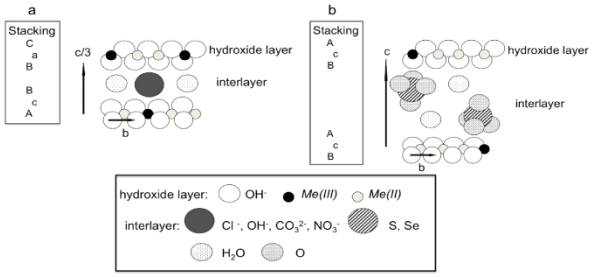
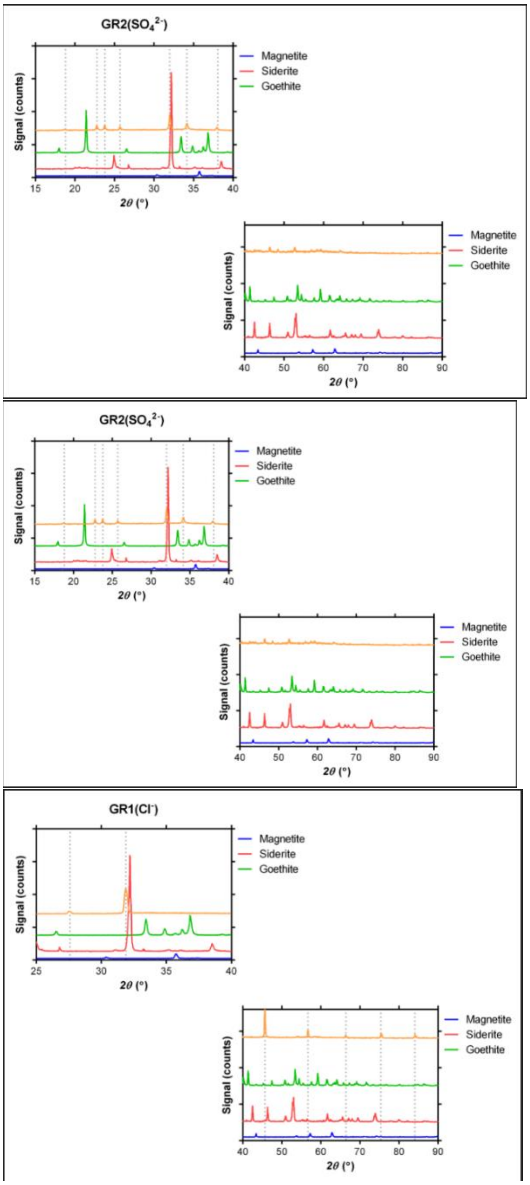
NITRATE REDUCTION IN PREBIOTIC CHEMISTRY. Vincent Aguirre[1], Scott Churchman[1], Marc M. Baum[1], David VanderVelde[2], Laura M. Barge[3,2]. [1]Oak Crest Institute of Science, Monrovia CA. [2]California Institute of Technology, Pasadena CA. [3]NASA/JPL Icy Worlds Team, Pasadena CA.

Introduction: Double-layer, mixed valence iron hydroxide minerals [FeII (1-x)FeIIIx(OH)2]x+ [x/nAn-.m/nH2O]x-, known as "green rusts" (GRs), have been investigated for their ability to reduce anionic species in diverse applications ranging from drug delivery to water treatment. The implication of GR in the prebiotic metabolism of early Earth may have led to the synthesis of organic material while simultaneously acting as an accretionary agent priming conditions for abiogenesis. Although seemingly a straightforward synthesis, GR precipitates rest at a high-energy state, subject to aerobic decomposition into more stable iron minerals such as magnetite and hematite. GR samples synthesized under rigorously anaerobic conditions and precise pH control were characterized by X-ray powder diffraction (XRD), Mossbauer spectroscopy, scanning electron microscopy (SEM), and atomic force microscopy (AFM), providing complementary structural insights. Nitrate reduction to ammonia is a well-studied reaction that occurs via GR intercalation under anaerobic conditions within a narrow pH range. The reduction of nitrogen-containing anions was investigated with different GR types under a range of conditions. The variations in synthesis and storage methods were found to impart significant differences in stability and reactivity in reduction experiments. Methods to measure the concentrations of reduction products and corresponding reaction rates were carried out employing three analytical techniques; 14N NMR spectroscopy, colorimetry, and ion chromatography. The results will lead to a better understanding of the GR-mediated reduction of nitrogen-anions in systems that behave as primitive enzymes in prebiotic metabolism.





References: [1] Hansen, H.C.B.; Koch, C. B.; Guldberg, Susanne; Erbs, Marianne. (2001) *Applied Clay Science*, 18, 81-91. [2] K. Barthélémy, S. Naille, C. Despas, C. Ruby, M. Mallet. (2012) *Journal of Colloid and Interface Science*, Vol 384, Iss. 1, Pg. 121-127. [3] Choi, J.; Batchelor, B.; Won, C.; Chung, J. (2012) *Chemosphere*, 86, 860-865.