

**REACTIVITY OF NATURAL AND SYNTHETIC FE-BEARING BRUCITE IN SERPENTINIZING SYSTEMS.** Eric T. Ellison<sup>1</sup> and Alexis S. Templeton<sup>1</sup>, <sup>1</sup>Dept. of Geological Sciences, University of Colorado – Boulder, 2200 Colorado Ave., Boulder, CO 80309 (eric.ellison@colorado.edu; alexis.templeton@colorado.edu).

Brucite ( $\text{Mg,Fe}(\text{OH})_2$ ) is a common secondary mineral product of serpentinization of peridotite. Brucite specifically incorporates reduced Fe(II) which limits  $\text{H}_2$  production during water/rock reaction, since that Fe cannot become oxidized to form magnetite or other Fe(III)-bearing phases. Both the amount of brucite produced and the Fe content of the brucite increase with decreasing reaction temperatures [1]. Brucite has been detected spectroscopically on the surface of Ceres, and it is a likely product of serpentinization on many celestial bodies [2, 3]. Although it has not been found on the surface of Mars, it may persist in the Martian subsurface [4, 5]. Fe-bearing brucite is present in partially serpentinized peridotites in Oman and there is evidence that it is participating in modern low-temperature  $\text{H}_2$  generation occurring there [6, 7]. The long-term stability or reactivity of brucite may therefore influence the production of electron donors that could support microbial life in serpentinizing systems on Earth and elsewhere.

To study the reactivity and hydrogen producing potential of Fe-bearing brucite, we have assembled a suite of natural brucite samples from a variety of locales. Additionally, we have synthesized brucite spanning the  $\text{Fe}(\text{OH})_2$ - $\text{Mg}(\text{OH})_2$  solid solution in the laboratory. These natural and synthetic brucite specimens are suitable for a variety of studies on the reactivity of brucite.

We present preliminary results from experimental low-temperature (100 °C) alteration of Fe-bearing brucite in fluids modeled after those found in serpentinizing peridotite aquifers in Oman. Substantial hydrogen production detected in the headspace gas demonstrates that Fe(II) stored in brucite can become available for hydrogen production during low-temperature mineralogical transformations. Raman spectroscopy reveals the mineral products of brucite reaction, and micro-X-ray absorption spectroscopy details changes in Fe redox and speciation, allowing us to search for likely products of brucite reaction and oxidation in serpentinized peridotite from Oman.

These results indicate that brucite may be an important reactant and source of Fe(II) during low-temperature alteration of brucite-bearing rocks including serpentinized peridotites. Hydrogen generated from the alteration of brucite could potentially fuel an in-situ microbial ecosystem. The potential for Fe-bearing brucite to support  $\text{H}_2$ -based life is an exciting implication

for investigation on Earth and elsewhere in our solar system.

**References:** [1] McCollom T. M. and Bach W. (2009) *Geochim. Cosmochim. Acta* 73, 856–875. [2] Milliken R. E. and Rivkin A. S. (2009) *Nat. Geosci.* 2, 258–261. [3] Holm N. G. et al. (2015) *Astrobiology* 15, 587–600. [4] Ehlmann B. L., Mustard J. F., and Murchie S. L. (2010) *Geophys. Res. Lett.* 37, L06201. [5] Sleep N. H., Bird D. K., and Pope E. C. (2011) *Philos. Trans. R. Soc. B Biol. Sci.* 366, 2857–2869. [6] Miller H. M. et al. (2016) *Geochim. Cosmochim. Acta* 179, 217–241. [7] Miller H. M. et al. (in review) *Geochim. Cosmochim. Acta*.