Quantifying the Flux of Hydrogen from Serpentinzing Ultramafic Rocks

TOM MCCOLLOM[1]*, FRIEDER KLEIN[2], TORI HOEHLER[3] AND ALEXIS TEMPLETON[1]

[1]University of Colorado, Boulder, CO
(*correspondence: mccollom@lasp.colorado.edu)
[2]Woods Hole Oceanographic Institution, Woods Hole, MA
[3]NASA Ames Researh Center, Mountain View, CA

The flux of hydrogen (H_2) generated during serpentinization of ultramafic rocks places major constraints on the capicty for serpentinites to support biological activity and the synthesis of abiotic organic compounds. We will present results of initial models that predict the flux of H_2 during incipient serpntinization of ultramafic rocks, and examine the effect of factors such as temperature, fluid:rock ratio, and rock composition on H_2 generation. Rates of H_2 generation in these models are constrained to first-order by recent experimental results by ourselves and others to measure production of H_2 during serpentinization, and to correlate this production with changes in the composition of mineral reaction products. One prediction of the current models is that H_2 production during low temperature (25-50 °C) serpentinization is extremely slow, requiring many hundreds to many thousands of years to accumulate the H_2 levels observed in found in many low temperature subareal serpentinites, which appears to be in conflict with some ideas about how rapidly serpentinization produces H_2 in near- surface environments. A major source of uncertainty in these predictions at this time, however, is a large discrepancy between the H_2 production rates observed in low temperature (<100 °C) and high temperature (>200 °C) laboratory experiments involving reaction of olivine or ultramafic rocks, where the production rates at low temperatures exceed the rates expected by extrapolation of higher temperature results by several orders of magnitude. Resolution of this discrepancy will help to clarify the source of H_2 in low temperature serpentinizing rocks.