Ectomycorrhizae-mediated biotite weathering and K uptake

Z. BALOGH-BRUNSTAD[1]* AND C.K. KELLER[2]

[1]Hartwick College, Oneonta, NY 13820, USA (*correspondence: balogh_brunz@hartwick.edu)

[2]SEES, Washington State Univ., Pullman, WA 64164, USA (ckkeller@wsu.edu)

Fungal and bacterial associates of vascular vegetation play a major role in increased weathering rates and regulation of nutrient uptake. This study investigated biotite dissolution and K uptake from micro- to meso-scales [1, 2, 3]. We hypothesized that dissolution of K bearing silicate minerals was enhanced by ectomycorrhizal activity when no other K sources were available. Two to three times larger K weathering fluxes were found in treatments with ectomycorrhizae and/or bacteria than in abiotic controls in all experiments. The combination of all three — bacteria, ectomycorrhizae and vascular plants — further increased the K weathering fluxes. However, without vascular hosts, loss of K to solution and drainage nearly equalled the weathering fluxes. Microscopy documented surface attachment of fungal hyphae and bacteria to biotite surfaces with a protective biofilm cover (Figure 1).

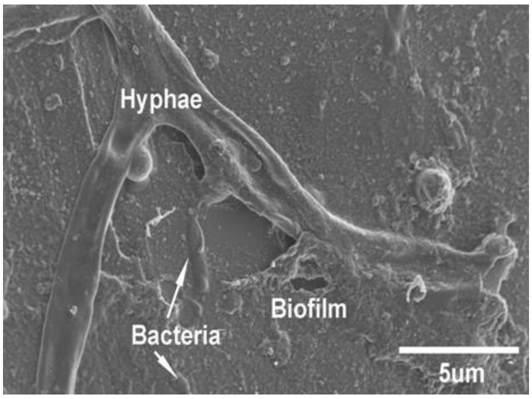

Figure 1: The surface of a biotite particle retrieved from the ectomycorrhizal and bacterial pine treatment of column growth experiments [3]

Our results suggest a 'three-way symbiosis' that enhances weathering under K limitations via biofilms that localize weathering and nutrient uptake through isolation of the root-microbe-mineral interfaces from the bulk soil solution. This idea is under further testing and is consistent with other recent work [4, 5].

[1] Balogh-Brunstad *et al.* (2008) *GBC* **22**, GB1007, doi,10.1029/2007GB002957. [2] Balogh-Brunstad *et al.* (2008) *GCA* **72**, 2601–2618. [3] Balogh-Brunstad *et al.* (2008) *Biogeochem.* **88**, 153–167. [4] Bonneville *et al.* (2009) *Geology* **37**, 615–618. [5] Calvaruso *et al.* (2009) *Soil Sci. Soc. Am. J.* **73**, 331–338.

Preservation of sharp olivine compositional boundaries within olivine-phyric shergottite LAR 06319

J. BRIAN BALTA* AND H. MCSWEEN

Department of Earth and Planetary Sciences, University of Tennessee, Knoxville, TN 37996 (*correspondence: jbalta@utk.edu)

Several olivine crystals in olivine-phyric shergotite LAR 06319 contain sharp compositional boundaries between high and low Mg# olivine. The largest step in composition across a single plane corresponds to a change from Mg# 71 to Mg# 58 over a few μm. These boundaries do not appear to be related to shock, as they are localized within a small portion of the grain and high-Phosphorus bands [1] cut across the same plane without being offset.

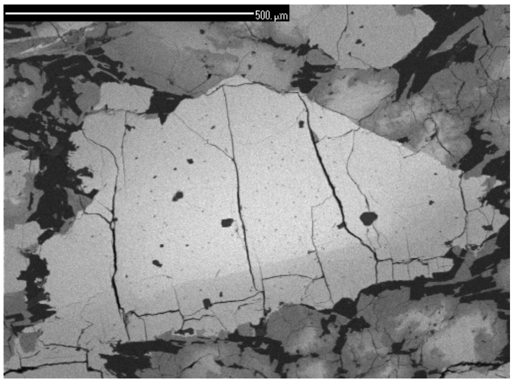

Figure 1: Mg X-Ray map of large olivine crystal..

Whether large crystals in Martian igneous rocks crystallized from or were entrained in the liquids that host them is an open question that may be understood by constraining their cooling histories. Previous estimates for Martian basalt cooling rates have relied on CSD measurements and suggest peak cooling rates of 3-7°C/hr [2]. However, the existence of high-P bands in olivine suggests still higher cooling rates of 15-30°C/hr [1]. The preservation of this boundary suggests that the time between growth of the rim of this grain and final quenching was short, consistent with the presence of high-P banding in the rim. Compositional measurements across these boundaries will allow for estimation of the cooling timescale for the emplacement of LAR 06319 independent of CSD.

[1] Milman-Baris *et al.* (2008) *Contrib. Min. Pet.* **155** 739–765. [2] Lentz & McSween (2005) *Antarct. Met. Res.***18** 66–82.