Basalt Weathering under Controlled Conditions as Influenced by Biota, Temperature, and CO_2

KATERINA DONTSOVA[1]*, SABRINA JUAREZ[2], JEAN-FRANÇOIS LE GALLIARD[2,3], SIMON CHOLLET[2], MATHIEU LLAVATA[2], FLORENT MASSOL[2], PIERRE BARRÉ[4], ALEXANDRE GELABERT[5], DAMIEN DAVAL[6], PETER TROCH[1], GREG BARRON-GAFFORD[1], JOOST VAN HAREN[1], REGIS FERRIÈRE[7]

[1] University of Arizona, Biosphere 2, USA (*correspondence: dontsova@email.arizona.edu)
[2] CNRS, ECOTRON Ile-De-France, France
[3] CNRS, iEES-Paris, France
[4] CNRS, Laboratoire de Géologie de l'ENS, France
[5] IPGP, Géochimie des eaux, France
[6] CNRS, Université de Strasbourg, LHyGeS, France
[7] ENS, IBENS, France

Weathering of primary silicates and photosynthesis by plants are among the mechanisms involved in carbon removal from the atmosphere. Increase in both temperature and amount of CO_2 in the atmosphere characteristic of global warming can increase weathering, impact biological systems, and promote biological weathering creating negative feedback on climate change. The goal of this research was to quantify direct and indirect effects of temperature and elevated CO_2 on basalt weathering and carbon sequestration. We performed mesocosm experiments at Ecotron Ile-de-France where granular basalt was exposed to rainfall at equilibrium with two different CO_2 concentrations in the air, 400 ppm and 800 ppm; and kept at two climate regimes, with ambient and elevated (+ 4°C) temperature. Four biological treatments were superimposed on this design: a plant-free control with native microbial community; *Medicago sativa,* a N-fixing forb, *Prosopis velutina,* a N-fixing woody plant; and *Leptochloa dubia,* a grass that does not form symbiotic relationships with N fixers. Mesocosms were equipped with solution and gas samplers to monitor biogenic and lithogenic weathering product concentrations in solution and measue soil gases. Plant biomass was collected at the end of the experiment to determine dry weight, as well as removal of N and lithogenic elements by the plants. Solid samples were collected to connect the measured weathering fluxes in solution with the mineralogical evolution. Basalt was analysed for organic and inorgnic carbon and total nitrogen before and after the experiemnt. Obtained values for the solution composition, gas fluxes and solid phase changes will be used in multicomponent reactive transport modeling.