Enhanced Rock Weathering in Agroecosystem Field Trials, Illinois, USA

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Enhanced Weathering (EW) of silicate rocks is a geoengineering strategy that seeks to accelerate rates of chemical weathering and ultimately, atmospheric carbon dioxide (CO_2) sequestration, through the application of powdered rock to the land and/or ocean. Models suggest that EW could draw down meaningful quantities of atmospheric CO_2 over relatively short timescales, and therefore help combat anthropogenic climate change [1, 2]. However, at present, the majority of research into EW has focused on model or laboratory studies [e.g., 3, 4].

Here, we present the first chemical weathering data from a large-scale field trial of EW in two agroecosystems in Illinois, USA. Powered basalt (10 – 500 μm) was applied to two 3.8 ha plots of corn and miscanthus at the Energy Farm, University of Illinois Urbana-Champaign. Basalt application occurred prior to the start of the growing season at a rate of 5 kg/m^2. Two adjacent 3.8 ha plots of corn and miscanthus that were untreated with basalt were also monitored as controls. Discharge from each plot was sampled throughout 2017 from tile drainage systems installed below ground. To quantify the extent of chemical weathering, as well as the sources of dissolved cations from each plot, we measured discharge alkalinity, cation and anion concentrations, dissolved inorganic and organic carbon concentrations, and $^{87}Sr/^{86}Sr$ values. To constrain the chemical budget, we present data on the ion concentrations and $^{87}Sr/^{86}Sr$ values of soil exchangeable leachates, basalt powder, precipitation, and plant biomass. Considered together, these data provide the first estimates of the efficacy of EW as a climate geoengineering method under natural conditions.

[1] Moosdorf et al. (2014) Environ. Sci. Technol. **48**, 4809 – 4816. [2] Taylor et al. (2016) Nat. Clim. Change **6**, 402 – 406. [3] Montserrat et al. (2017) Environ. Sci. Technol. **51**, 3960 – 3972. [4] Renforth et al. (2015) Appl. Geochem. **61**, 109 – 118.