

Accounting for Migration Lags in Comparing Redundant CDR Measurements between Soil Elemental Mass Balance and Leachate-Collected Alkalinity

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Recently, significant progress has been made towards quantifying carbon dioxide removal (CDR) impacts associated with enhanced rock weathering [1,2,3]. Within the framework of monitoring, reporting, and verification (MRV) approaches, the field requires convergence of redundant measurements to constrain claimed CDR [4,5]. In this study, we test a technique to reconcile CDR quantified through elemental mass balances and sequestered alkalinity titration. Results from a recently published soil column experiment[6] were complemented with total-fusion ICP-MS analyses supported by Eion.

Here, we highlight that initial weathering rates as determined by soil elemental mass balance approaches (through tracking immobile and mobile weathering products) can only be compared with flushed alkalinity titrations if a migration lag is accounted for. We observe that this lag in the initial two months of study may indicate that up to 98% of the released base cations are bound within the soil matrix during this time. Further investigation using 0.1 M BaCl₂ extractions of retained base cations shows that only a small portion of these bound base cations can be attributed to weak, sorption-like interactions within the soil. Though we expect base cation interactions with the soil complex to yield transient retardation effects, further work is required to define the dominant binding and precipitation mechanisms controlling this process. Testing this lag correction factor for soil column experiments amended with olivine, wollastonite, and albite, the authors present herein a framework by which redundant measurements between soil- and liquid-phase MRV approaches can be reconciled.

References:

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