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Straw increasing alkalinity production in an enhanced weathering flow-through column experiment

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To mitigate climate change, novel and scalable carbon dioxide removal (CDR) methods are urgently needed. Natural silicate weathering is considered one of the most important natural CO_2 sinks on geological time scales. Accelerating this natural process to capture more CO_2 also on human timescales is known as enhanced rock weathering. This can be done, for example, by spreading rock powder on agricultural soils, where it can sequester CO_2 and have beneficial effects as mineral nutrient fertilizer. Previous studies have shown that certain bacteria, fungi, and earthworms enhance mineral dissolution. How all these components interact and whether this can be optimized through specific mixtures is not yet well understood.

In this study, we test how the addition of biota (bacteria, earthworms, and fungi), to a straw and rock powder impacts total alkalinity (TA) production. The action of biota on low inorganic carbon basanite-straw mixture was studied in a flow-through column set-up lasting for 8 weeks. These columns were irrigated daily. Leachate water was collected and analyzed for TA, dissolved-inorganic and organic carbon, pH, electrical conductivity, anions, and cations to assess mineral dissolution and CO_2 sequestration.

The addition of straw increased the dissolution of the basanite. However, biotic additions to the straw-basanite mixture could not enhance the dissolution during the experimental period. Likely, the CO_2 generated by the decomposition of the straw has provided higher CO_2 partial pressure and was thereby contributing to a lower local pH. These processes elevated the alkalinity production.