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Can earthworms enhance mineral weathering and thereby increase carbon sequestration?

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Negative Emission Technologies (NETs) are urgently needed if we want to keep global temperature increase below 1.5 °C. Enhanced Silicate Weathering (ESW) is a NET with as yet unknown potential to mitigate climate change. There are indications that ESW rates can be amplified by biotic activity, including that of earthworms. Earlier studies have suggested various pathways through which earthworms might enhance weathering rates, including the grinding of minerals in their gizzard, the stimulation of microbial communities in their gut, as well as the production of mucus rich in organic acids and digestive enzymes. Within this research, we aim to unravel the mechanisms through which earthworms increase mineral weathering rates, and ultimately to develop a bio-reactor in which these processes are optimized. As a first step, we carried out two experiments to determine the suitability of two earthworm species and to establish the optimal conditions for earthworms and mineral weathering in a small bio-reactor. The first study tested the potential of two endogeic earthworm species, *Aporrectodea caliginosa* and *Allolobophora chlorotica*, in a system with two types of rock flours (dunite and basalt) and three organic sources (hay, straw and co-digestate solid). The results showed that both earthworm species can thrive and remain active in the bio-reactor in the presence of basalt mixed with either co-digestate or straw. In the second study we tested the tolerance of the same two earthworm species to two temperatures exceeding earthworms ambient levels (20°C and 25°C) and two flow rates (50 ml/day and 80 ml/day) in a system with basalt and straw. The results showed that both earthworm species can survive and remain active at the highest temperature level and the highest flow rate. Our findings demonstrate that earthworms are suitable for use in a bio-reactor and can tolerate physical conditions which are known to stimulate weathering. Future studies will elucidate to what extent earthworms can enhance weathering.