Bioturbation as an essential process for Carbon Dioxide Removal Techniques

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To limit the effects of global warming, policymakers worldwide have pledged to keep the global temperature increase below 2○C above pre-industrial levels. To achieve this, CO2 removal techniques are crucial. A widely accepted CO2 removal method is enhanced silicate weathering (ESW). By introducing fine-grained, fast-weathering silicate minerals into sediments in coastal areas, a CO2 sink could be created via artificial enhancement of the seawater alkalinity. It has recently been proposed that faunal activity could increase the dissolution rate of silicate minerals due to bioturbation and ingestion. To investigate the effect of bioturbation on silicate mineral weathering rates, we are performing long-running sediment mesocosm incubation where the deep-burrowing lugworm *Arenicola marina* is exposed to different concentrations and grain sizes of the fast-weathering mineral olivine. Initially, the sedimentary alkalinity release was significantly higher in mesocosms with than without added olivine. Additionally, significantly higher alkalinity fluxes in incubations with lugworms compared to non-bioturbated sediments have been observed throughout the experiment, revealing that bioturbation is essential for the sedimentary alkalinity release into the surface water. On the other hand, the treatment with small-grained (10-63 μm) olivine resulted in a decrease in the adult lugworm population and an increase in juveniles. To better understand the impact of additional silicate on macrofaunal activity in our mesocosms experiment. Our measurements provide a clear evidence that bioturbation is an important source of alkalinity for the tidal flats, and that the addition of olivine has multiple effects on macrofaunal activates and thus on alkalinity fluxes.

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