Worms and mud in estuaries : a CO2 game-changer ? The role of bioturbators, sediment fining and organic matter enrichment in sediment alkalinity generation

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The ocean is the largest sink for atmospheric CO2 and takes up a third of anthropogenic CO2 emissions[1]. The seawater's ability to store CO2 is controlled by its alkalinity content[2], of which nearly half is generated by geochemical processes in the seafloor[3][1] . Bioturbation has been suggested to greatly influence alkalinity generation pathways in sediments[5,6]. Through their feeding and burrowing behaviour, bioturbators redistribute organic matter and sediment particles and ventilate deeper anoxic layers of the sediment. As a consequence, organic matter mineralization pathways and carbonate chemistry reactions are altered. However, the change in the dominant processes and their actual rates remain understudied. At the same time, estuaries and coastal areas, which are home to dynamic macrofaunal communities with strong bioturbators, are rapidly changing. Human activities, such as sediment dredging and offshore windfarm construction, can enrich the seafloor with fine organic matter. Sediment fining is expected to alter bioturbator behaviour and impact the sediment's ability to sequester carbon and generate alkalinity[7].

Here, we present the results of a laboratory experiment in which we assessed how bioturbation, sediment fining and organic matter enrichment affect sedimentary processes such as alkalinity generation. By mixing sandy and muddy sediment from Zwin intertidal mudflats, we created a gradient of sediment types to simulate fining and organic matter enrichment. The sediment was subsequently incubated with low or high bioturbation intensity, and key metabolic and geochemical parameters regarding alkalinity generation were compared between treatments. Preliminary results show very clear differences in the biogeochemical behaviour of the system between treatments. This work potentially unveils mechanisms of natural variability in alkalinity generation in coastal sediment and CO2 sequestration potential.

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Keywords
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