VLIZ pioneer in marine science

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The microcosm research facility

Investigating the potential for CO_2 drawdown in coastal environments.

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Enhanced silicate weathering (ESW) is a negative emissions technology (NET) that mimics the natural process of silicate rock weathering. On geological time scales natural silicate weathering is capable to initiate atmospheric CO_2 drawdown by the release of alkalinity. However, this natural process takes a long time (i.e., centuries) before significant amount of atmospheric CO_2 is captured. Considering the fact that NET approaches need to be applied soon, ESW aims to speed up this natural process by the selection of fast weathering silicates, increasing their surface area, and distributing them in environments where dissolution rates are expected to be high.

SCAN ME

Coastal-carbon.eu

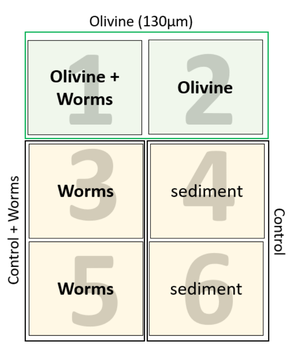
Where is it?

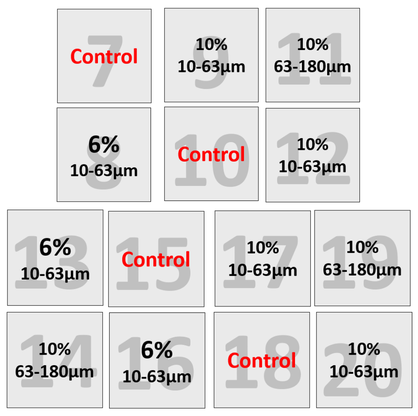
At the Marine Station Ostend (MSO), the University of Antwerp and Flanders Marine Institute (VLIZ) operate an internationally **unique microcosm facility**. The microcosm approach allows to mimic semi-natural conditions and study the effects of natural processes such as bioturbation on silicate weathering rates and the CO_2 uptake.

Marine Station Oostende (MSO)
Slipwaykaai 1
8400 Oostende

What's in there?

The experimental setup consists of **20 tanks**, each replicating one square meter of North Sea sediment. Six blue tanks are already running from 2014 and fourteen additional, gray, tanks run since 2022. Each tank contains **600 L of seawater** on top of a **40 cm layer of North Sea sediment**. Different concentrations and grain sizes of the fast-weathering silicate **olivine** were mixed with the top 10 cm layer of the sediment. Seventeen of the tanks are stocked with bioturbating **lugworms** (*Arenicola marina*). They allow identification of the differences in carbon dynamics between a bioturbated and non – bioturbated benthic environment.



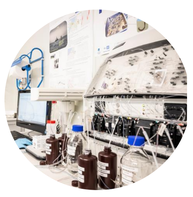


Olivine

***Arenicola marina*, lugworm**

Alkalinity sampling

Dissolved inorganic carbon sampling

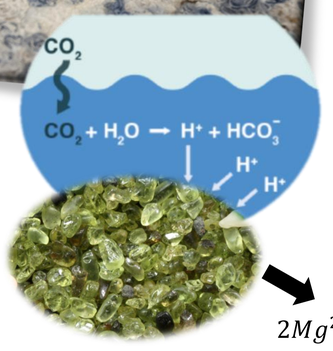


Nutrient measurement with Quaatro39

DIC measurement with AIRICA

What happens here?

Over a period of five weeks (one session), **overlaying water is sampled** weekly to accurately monitor a wide range of multiple variables, including alkalinity, dissolved inorganic carbon, pH, nutrients and trace metal accumulation, over time. Regular **porewater sampling and sediment sampling** enables monitoring of geochemical conditions within the sediment and single grain visualization of olivine weathering over time. Environment parameters, like temperature and humidity are followed up as well.

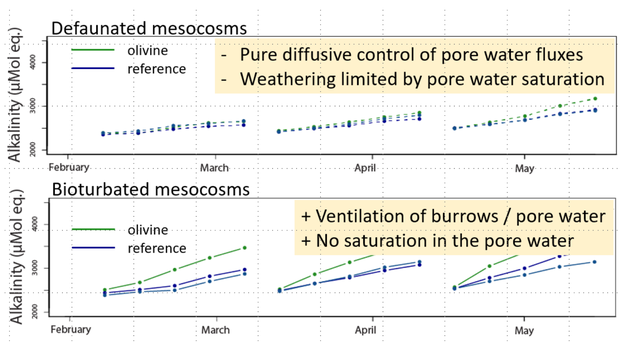


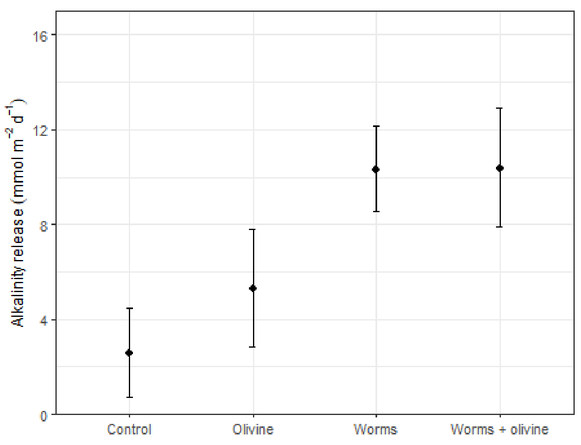
$2Mg^{2+} + 4HCO_3^- + H_4SiO_4$

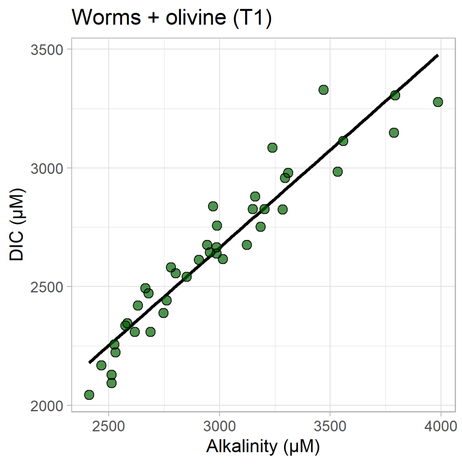
Dissolved magnesium | Dissolved carbon | Dissolved silica

Preliminary results

From the first few sessions in the 6 longest running blue tanks, we can conclude that **bioturbation is essential** for the sedimentary alkalinity release into the overlaying water, and thus for the rate of ESW. The impact of olivine on alkalinity fluxes is not clear yet. Further investigation is nessesary. Therefore, we expanded the microcosm setup with 14 additional, gray, tanks.







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