The principle working function of the 'benthic weathering engine' indicated by results from benthocosm experiments

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Abstract

The natural dissolution of carbonate minerals in the marine environment increases alkalinity, potentially leading to a draw-down of atmospheric CO_2. Consequently, large-scale manual dispersal of such minerals has been proposed as a potential measure to alleviate rising atmospheric CO_2 levels through ocean alkalinity enhancement (OAE). In the framework of three studies, the effects of biogeochemical processes on alkaline mineral dissolution in surface marine sediments were investigated over time under different geochemical conditions in several different laboratory and benthocosm experiments. These studies have revealed unexpectedly high dissolution and subsequently alkalinisation rates even when bottom waters are oversaturated with respect to calcite.

The 'benthic weathering engine' has previously suggested to foster dissolution of added minerals. It describes the combined interaction of macro-faunal in- and digestion of sediments and added substrates as well as the local impact of ventilation of otherwise anoxic sediments and subsequent oxidation and acidification. We present background information and unpublished data from long-term benthocosm experiments that underpin the potential impact of macrofaunal activity on dissolution rates. Additionally, we present results from a state-of-art 2-D transport-reaction model that aims to quantify key geochemical processes promoting the dissolution of added alkaline minerals.