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Alkaline minerals as a tool to mitigate ocean acidification and facilitate CO2 uptake from the atmosphere

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Over the last century, anthropogenic carbon dioxide (CO_2) emissions steadily increased. The carbon clock is ticking to meet the two-degree target, to avoid the climate change to produce irreversible damage. The ocean takes up 25% of CO_2 from the atmosphere both chemically and biologically. However, if more CO_2 is entering the ocean, the water will acidify, a phenomenon known as ocean acidification, and problematic to marine biodiversity and biogeochemistry. Oceanic CO_2 uptake can, however, be amplified using alkaline minerals which buffer the ocean's pH, thereby counteracting ocean acidification, and facilitate the chemical and biological carbon pumps at the same time.

We have investigated the potential of various alkaline minerals to stabilize seawater pH over time on a small scale. Those alkaline minerals were predicted being appropriate for ocean alkalinity enhancement and can offer a toolset to increase CO_2 uptake from the atmosphere. Specifically, we have examined how Chalk, Calcite, Dolomite, Limestone, and Olivine affect seawater pH and total alkalinity (TA) on timescales of several months. Thereby, we could identify two promising minerals, Dolomite and Olivine, and develop a strategy for mineral additions to buffer the seawater pH. Importantly, limestone which is often proposed as a suitable mineral, had an unexpected opposite effect and lowered the seawater pH over a timescale of 100 days. Using our strategy, we explored how additions of Dolomite, Limestone, and Olivine affect marine primary producers. The results from the study add an important knowledge layer on how the chemical and biological carbon pumps will react to the addition of alkaline minerals.