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Simulate the Beach: The Influence of Rock Properties and Mineral Composition on Ocean Alkalinity

The ocean plays an important role in regulating CO₂ in the earth system by buffering it as bicarbonate. However, this mechanism is unable to keep up with the rapid increase in atmospheric CO₂ concentrations. One proposed approach to mitigating this issue is to enhance the ocean's alkalinity. This is induced by enhanced weathering of alkaline rock feedstock. Many strategies of atmospheric CO₂ removal are now being researched. However, the role of enhanced weathering in the beach-ocean interface has received comparably little attention. Our focus on coastal processes is based on their greater potential feasibility and the interaction between weathered rock, seawater, and the atmosphere. Therefore, during the past year, we aimed to simulate ocean alkalinity enhancement in a beach setting on a laboratory scale. This was achieved using a custom-built overhead shaker to induce constant motion in a mixture of seawater and rock material. Via frequent monitoring and measurement of key components, such as ionic composition, the effect of rock weathering on sea water alkalinity is assessed. As our expectations are met, mineralogical composition as well as grain size influenced the alkalinity enhancement potential. To quantify this, samples of basalt, andesite and glacial sediments have been compared at two grain sizes. We can see a larger alkalinity enhancement for smaller grain sizes due to larger surface area. The mineralogical composition is still being evaluated in more detail to complement our understanding regarding the influence on ocean alkalinity enhancement, and specifically the minor deviations we could find. This study evaluates the proposed option to reduce a future peak in atmospheric CO₂ concentration and aims to increase the understanding of beach-ocean interfaces.