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Modern Carbon Cycle Dynamics: Unraveling Petrographic Organic Carbon Cycling in Arctic Riverine and Marine Sediments

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The carbon cycle is driven by interactions between the biosphere, atmosphere, hydrosphere, and geosphere. Photosynthetic organisms convert CO_2 into O_2 and organic carbon (OC), with the burial of OC influencing atmospheric composition over time [1]. When OC is re-exposed to weathering as petrographic carbon, the efficiency of weathering should depend on a variety of factors, including the concentration of atmospheric oxygen. Thus, as O_2 levels drop, an increasing amount of unweathered petrographic OC accumulates in marine sediments, making OC recycling a potential indicator of past atmospheric O_2 levels [2]. In modern times, it has been demonstrated that much petrographic OC escapes oxidation and is recycled into marine sediments after being weathered [3]. However, quantifying petrographic OC recycling into modern sediments, and distinguishing it from recently formed OC, is challenging. This project investigates the oxidation and recycling efficiency of petrographic OC in Svalbard as a key to understand the role of petrographic OC recycling in the modern carbon cycle.

Firstly, a method for extracting petrographic carbon from modern sediments is being developed. Key steps are decarbonization, density separation, milling, and microwave digestion with hydrofluoric acid. Subsequently, the concentrations of petrographic carbon can be quantified and its maturity can be analysed by Raman spectroscopy with minimal thermal alteration [4].

This method is applied to explore the recycling of petrographic carbon from rocks and sediments from outcrops, riverbeds and fjords in Svalbard. Our Raman data is supplemented with ^{14}C dating to compare and contrast alternative methods for exploring petrographic carbon recycling.

This approach offers key insights into the carbon cycle in the past and present, while also enhancing the accuracy of climate change models.

Literature

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