Revising the Marine Carbon Cycle: **Introducing the Marine Dissolved Organic Matter Reactivity Continuum Concept**

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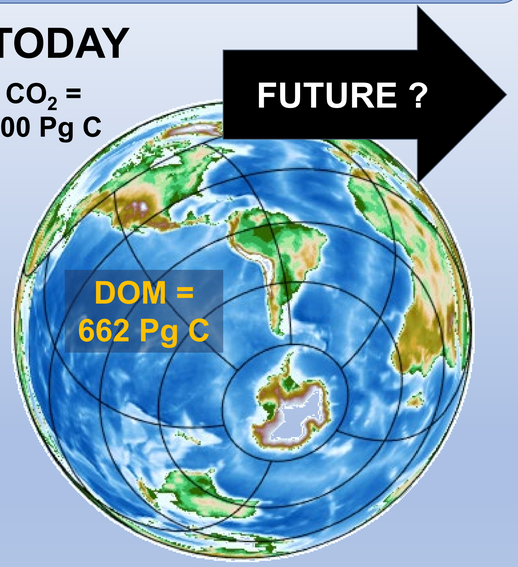
Transformative Idea & Vision

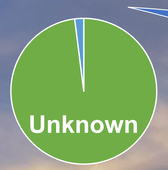


Marine dissolved organic matter (**DOM**) is the least understood and arguably most dynamic carbon pool on Earth. What if the current age estimates for deep ocean DOM of 5,000-6,000 years are wrong and the turnover of this large carbon pool is only 100's but not 1000's of years? If this is the case, the ocean might not sequester carbon as effectively as we currently assume. Defining **the marine DOM reactivity continuum** by structurally elucidating organic molecules that accumulate in the deep ocean (and determining their half-life) and establishing kinetic data will improve DOM and global carbon cycle models.

UN Challenge Addressed

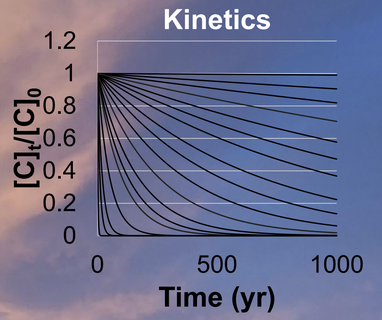
Challenge 5: Enhance understanding of the ocean-climate nexus and generate knowledge and solutions to mitigate, adapt and build resilience to the effects of climate change across all geographies and at all scales, and to improve services including predictions for the ocean, climate and weather.

Current Understanding:
Marine DOM Composition and Reactivity



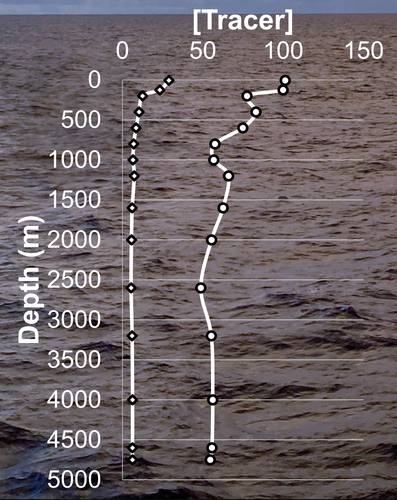
Proposed Framework

Elucidate Structures



Tracer quantification in the ocean

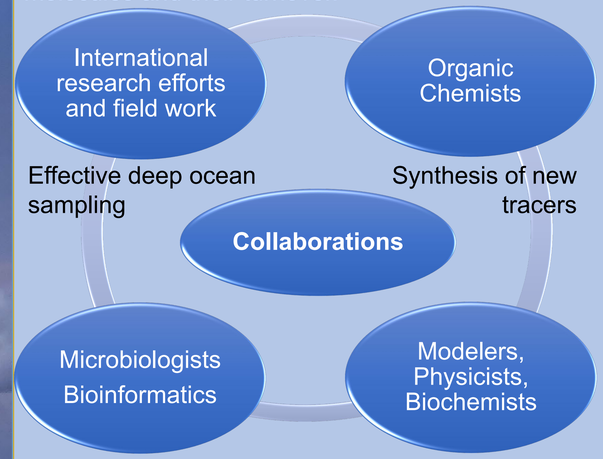
Determine degradation kinetics



Revised Understanding:
Marine DOM Composition and Reactivity (Turnover)

Connections & Partnerships

To date, significant progress has been made by several research groups, which have taken on the challenge to structurally elucidate deep-ocean tracer molecules. These molecules include degradation products of chromophores and metabolites, and other biosignatures. To truly establish reasonably robust marine DOM reactivity kinetics, organic and analytical chemists, microbiologists, physicists, modelers and biogeochemists would need to work closely together to establish a suite of tracer molecules and their turnover.



Global Opportunities

There is a global need for accurate carbon cycling modeling. The synthesis approach between sophisticated organic and analytical chemistry, microbiology and biogeochemistry at large will generate opportunities to mentor next generation scientists in becoming skilled in synthesizing data across disciplines and to extract critical information to address the current controversy of marine DOM reactivity and age. The proposed study will create a new breed of scientists breaking down the boundaries of traditional disciplines.