The Association of Extracellular Enzymes with Aggregates and the Resultant Effects for Carbon Remineralization in Marine Communities

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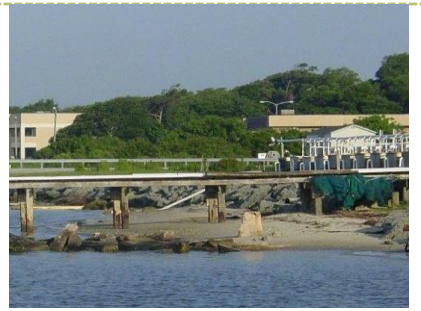
Background and Goals

Microorganisms in the ocean significantly affect the **global carbon cycle** as they remineralize photosynthetically produced **dissolved organic matter (OM) into CO_2** . The most active of these microbes are likely incorporated into macroscopic particles known as marine snow. Enzyme activity in the water surrounding these **aggregates** is primarily due to **hydrolytic, extracellular enzymes** released by aggregate-associated microorganisms.



Site of water sampling at IMS

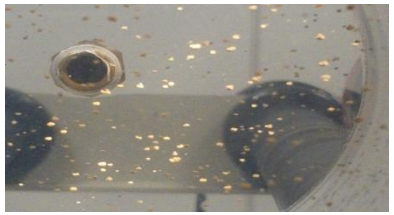
Dr. Ziervogel filtering seawater

Bogue Sound

This project obtained enzymatic hydrolysis rates of a commercially available polysaccharide (*laminarin*) and three phytoplankton-derived organic matter extracts from *Spirulina, Isochrysis* and *Thalassiosira* in order to determine the capabilities of microorganisms, either attached to marine snow or not, to access and degrade high molecular weight OM in the ocean.

Enzymatic activity was measured in whole seawater and water surrounding aggregates formed with seawater collected from Bogue Sound at the Institute for Marine Science in Morehead City, North Carolina.



The Results

• **All four substrates were hydrolyzed** in both the roller and bench bottles although at different times: **enzyme activities in aggregate-surrounding water were higher and somewhat faster than in whole sea water,** suggesting **high hydrolytic activities of aggregate-associated microorganisms and hence, production and release of extracellular enzymes into the surrounding water.**

→ **This would support the hypothesis that aggregate formation considerably enhances hydrolytic activity in the water column. The presence and/or absence of aggregates might explain spatial variations in enzyme activities in pelagic ecosystems.**

Aggregate-associated water on the roller table

Whole sea water incubated on the bench