MARINE SCIENCE INSTITUTE

THE UNIVERSITY OF TEXAS AT AUSTIN

750 Channelview Drive • Port Aransas, Texas 78373 • Phone (512) 749-6711 • Fax (512) 749-6777

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Final Technical Report

Project title: Mechanisms of dissolved organic carbon cycling in an ocean margin

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PI: Ronald Benner

Dissolved organic carbon (DOC) is the largest reservoir of organic carbon in the ocean, and the objectives of this project were to investigate the mechanisms and pathways of DOC formation and consumption in seawater. Carbohydrates are the most abundant form of DOC, and this project included measurements of dissolved carbohydrates as well as DOC to help delineate the cycling of DOC. Many of the methods and approaches for investigating DOC production were developed as part of this project, and those methods are detailed in the two manuscripts (see Publications) resulting from this project.

The relative roles of phytoplankton, protozoa, dinoflagellates and copepods in DOC production were investigated in a series of laboratory studies conducted in collaboration with Drs. Suzanne Strom and Mike Dagg (see Strom et al. 1997). DOC production during grazing of phytoplankton was relatively high and resulted in the release of 16-37% of algal C content. For comparison, DOC production from phytoplankton alone ranged from 3-7% of algal C content. Dissolved carbohydrates were a major component (22-30%) of the DOC released by phytoplankton and during grazing. These studies indicated that planktonic grazers were a potentially major source of carbohydrate-rich DOC in the marine environment.

A field study of the distribution of DOC and dissolved carbohydrates was undertaken to gain further insights to the cycling of DOC in the ocean (See Skoog and Benner 1997).

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Concentrations of DOC and carbohydrates were generally highest in surface waters (≤ 100 m), suggesting that phytoplankton were the ultimate source of this material. A new method for the molecular-level characterization of the aldose fraction of carbohydrates was developed to trace the mechanisms and pathways of carbohydrate and DOC consumption. The fraction of total C as carbohydrate (aldose) was found to be a robust indicator of the diagenetic state of organic matter. Analysis of particulate, high-molecular-weight DOC or colloidal material, and low-molecular-weight DOC indicated a clear diagenetic sequence from large and reactive particles to small refractory molecules. The aldose compositions of these different size fractions of organic matter were also determined. The DOC was found to be rich in deoxy sugars and galactose compared to the particulate fraction. Differences in aldose compositions could arise from diagenetic alteration or variability in the initial compositions of particulate and dissolved organic matter.

Publications resulting from this grant:

Strom, S., R. Benner, S. Ziegler, and M. Dagg. 1997. Planktonic grazers are a potentially important source of marine dissolved organic carbon. **Limnol. Oceanogr.**, in press.

Skoog, A., and R. Benner. 1997. Aldoses in various size fractions of marine organic matter: implications for carbon cycling. **Limnol. Oceanogr.**, in press.

Final Report prepared by Ronald Benner

Ronald Benner, Ph.D.

Associate Professor of Marine Science

University of Texas at Austin