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SEA FLOOR CYCLING OF ORGANIC MATTER IN THE CONTINENTAL MARGIN OF THE MID-ATLANTIC BIGHT

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2

FINAL REPORT

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Principal Investigator

Richard A. Jahnke

Skidaway Institute of Oceanography

10 Ocean Science Circle

Savannah, Georgia 31411

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The objective of this project was to examine quantitatively the cycling of organic matter at the sea floor of the mid-Atlantic Bight continental margin. This information would be used to better understand sedimentary geochemical processes and, when used in conjunction with other measurements made within the DOE Ocean Margins Program, would be used to constrain the off-shore and surface-to-deep water transport of organic carbon in this region. The latter information is critical in assessing the role of continental margins in the sequestration of anthropogenic carbon dioxide, the dominant greenhouse gas, in the deep ocean. Because the build-up of greenhouse gases in the atmosphere may cause significant changes in climate, this project had major societal importance.

To achieve the overall objective, *in situ* benthic flux chamber incubations were conducted on the continental shelf, slope and rise in the Cape Hatteras region. Flux chamber measurements provide a strategy to directly measure the rate at which solutes are directly exchanged across the sediment - water interface. Because solute fluxes are directly linked to particle deposition rates and subsequent degradation and remineralization reactions, such measurements provide quantitative assessments of the particle flux to the sediments. These measurements are particularly critical in topographically rugged regions, such as the North Carolina continental slope, where other measurement strategies, such as the deployment of sediment traps, may not yield accurate results.

During the field campaign of the Ocean Margins Program, a series of benthic flux chamber measurements were successfully completed along the North Carolina continental margin. Because of the extremely rugged topography of the continental slope in this region, instruments

deployed from surface vessels proved to frequently not provide enclosed incubations. In addition, these results were difficult to interpret because the exact character of the sea floor at the deployment site was unknown. The final two expeditions and six benthic chamber incubations were performed using manned submersibles, capable of placing the benthic flux chamber instruments at specifically designated and characterized sites.

While some interpretation and synthesis of the results remain to be completed, much of the results are in various stages of publication. Publications to date supported by this project are:

Jahnke, R. A. and G. B. Shimmield (1995) Particle Flux and Its Conversion to the Sediment Record: Coastal Ocean Upwelling Systems, in Upwelling in the Oceans: Modern Processes and Ancient Records, C. P. Summerhayes, K.-C. Emeis, M. V. Angel, R. L. Smith and B. Zeitschel, eds. John Wiley & Sons, pp. 83-100.

Shimmield, C. B. and R. A. Jahnke (1995) Particle Flux and Its Conversion to the Sediment Record: Open Ocean Upwelling Systems, C. P. Summerhayes, K.-C. Emeis, M. V. Angel, R. L. Smith and B. Zeitschel, eds. John Wiley & Sons. pp. 171-192.

Nixon, S. W., J. W. Ammerman, L. P. Atkinson, V. M. Berounsky, G. Billen, W. C. Boicourt, W. R. Boynton, T. M. Church, D. M. DiTorro, R. Elmgren, J. H. Garber, A. E. Giblin, R. A. Jahnke, N. J. P. Owens, M. E. Q. Pilson, and S. P.

Seitzinger (1996) The fate of nitrogen and phosphorus at the land margin of the North Atlantic Ocean. Biogeochem. 35: 141-180.

Michaels, A. F., D. Olson, J. L. Sarmiento, J. W. Ammerman, K. Fanning, R. Jahnke, A. H. Knap, F. Lipschultz, and J. M. Prospero (1996) Inputs, losses and transformations of nitrogen and phosphorus in the pelagic North Atlantic Ocean. Biogeochem. 35: 181-226.

Jahnke, R. A. and L. H. Knight (1997) A gravity-driven, hydraulically-damped multiple piston corer for sampling fine-grained sediments. Deep-Sea Res. 44: 713-718.

In addition, two manuscripts are in final stages of preparation and are appended to this report.

Preprints — removed for separate processing