Scientific Paper:

Aquatic Geochemistry, 12, 1-19, 2006

# Benthic Oxygen Consumption and Organic Matter Turnover in Organic-poor, Permeable Shelf Sands

ANTJE RUSCH[1,3,*], MARKUS HUETTEL[1,4], CHRISTIAN WILD[5] and CLARE E. REIMERS[2]
[1]Max Planck Institute for Marine Microbiology, Celsiusstr. 1, D-28359 Bremen, Germany
[2]Hatfield Marine Science Center, Oregon State University, 2030 South Marine Science Drive, Newport OR 97365,U.S.A.
[3]Present address: Department of Geology and Geophysics, University of Hawaii at Manoa, 1680 East-West Road, Honolulu HI 96822, U.S.A.
[4]Present address: Department of Oceanography, Florida State University, Tallahassee FL 32306, U.S.A.
[5]Present address: GeoBio-Center, Ludwig-Maximilians-Universität, Richard-Wagner-Str. 10, 80333 München, Germany

**Abstract:**

The high permeability of sediments and strong near-bottom currents cause seawater to infiltrate the surface layers of Middle Atlantic Bight shelf deposits. In this study, sandy sediment cores from 11 to 12 m water depth were percolated with filtered seawater on shipboard. Sedimentary oxygen consumption (SOC) increased non-linearly with pore water flow, approaching maximum rates of 120 mmol $m^{-2}$ $d^{-1}$ (May 2001) or 75 mmol $m^{-2}$ $d^{-1}$ (July 2001). The addition of acetate to the inflowing water promptly enhanced the release of dissolved inorganic carbon (DIC) from the cores. DIC production rates were a linear function of acetate concentration, ranging from 100 to 300 mmol $m^{-2}$ $d^{-1}$ without substrate addition to 572 mmol $m^{-2}$ $d^{-1}$ with 100 mM acetate. The sediments also hydrolyzed a glucose pseudopolymer, and the liberated glucose prompted an increase of SOC. Our results suggest that decomposition rates of organic matter in permeable sands can exceed those of fine-grained, organic-rich deposits, when water currents cause advective interstitial flow, supplying the subsurface microbial community with degradable material and electron acceptors. We conclude that the highly permeable sand beds of the Middle Atlantic Bight are responsive within minutes to hours and efficiently operate as biocatalytical filters.

Key-words: Benthic mineralization, pore water flow, biocatalytical filter,oxygen, DOM, DIC, permeable sediment, shelf sands