Influence of simulated bivalve biodeposition and microphytobenthos on sediment nitrogen dynamics: A laboratory study

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ABSTRACT: Suspension-feeding eastern oysters, *Crassostrea virginica*, were once abundant in Chesapeake Bay and may then have exerted top-down control on phytoplankton and also reduced turbidities, thereby increasing light available to benthic plants. Alternatively, oysters may have simply recycled inorganic nutrients rapidly back to the water column, with no long-lasting reduction in phytoplankton biomass resulting from oyster feeding activity. To help distinguish between these scenarios, we explored changes in nitrogen fluxes and denitrification in laboratory incubations of sediment cores held under oxic and anoxic conditions in response to loading by pelletized phytoplankton cells, an experimental analog for oyster feces and pseudofeces. When organics were regenerated under aerobic conditions, typical of those associated with oyster habitat, coupled nitrification-denitrification was promoted, resulting in denitrification of ~20% of the total added nitrogen. In contrast, under anoxic conditions, typical of current summertime conditions in main-stem Chesapeake Bay where phytoplankton is microbially degraded beneath the pycnocline, nitrogen was released solely as ammonium from the added organics. We postulate that denitrification of particulate nitrogen remaining in oyster feces and pseudofeces may enhance nitrogen removal from estuaries. In aerobic incubations with sufficient light (70 µmol m^{-2} s^{-1}), a benthic microalgal/cyanobacterial community grew that not only absorbed the inorganic nitrogen released from the added organics but also fixed N_2. This result suggests that an ecosystem dominated by benthic primary production may develop in shallow waters when reduced turbidity associated with bivalve feeding increases light penetration to a level that can sustain benthic microalgal production.

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