Organic matter degradation and nutrient remobilization in permeable coastal sands

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Large volumes of water are pumped by bottom currents through the permeable sediments that blanket the shallow shelf, transporting organic matter and oxygen through the pores of the sand. These pores are lined with biofilms that absorb and degrade organic matter filtered through the sediment, thereby functioning as disassembly lines for complex organic matter molecules. The microbial community inhabiting the sands responds instantly to organic substrates filtered into the bed and converts organic matter to biomass, inorganic nutrients and CO_2. The biological and biogeochemical reactions associated with the large specific surface area of the porous sand matrix cause high decomposition rates reflected in oxygen consumption rates reaching hundreds of mmol per square meter per day. The sandy shallow shelf thus functions as an effective filter system removing a large fraction of the organic matter from the water. Anthropogenic activities can alter the effectiveness of this sand filter which may lead to the deterioration of coastal water quality and reduced primary production.

Recycling of matter in tropical and subtropical coastal sands

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Oligotrophic conditions and high light intensities at the sediment surface are typical for many tropical and subtropical coastal environments; and availability of nutrients and dissolved inorganic carbon becomes a limiting factor for primary production. Sediments play a key role in the recycling of carbon and nutrients in the shallow nearshore environment, and sandy sea beds are typical for exposed shores and lagoon environments. Despite similar appearance the biogeochemical characteristics of tropical carbonate sands can be substantially different from those in sands of temperate environments. In this presentation we report results from our studies that address the role of sandy sediments for the recycling of nutrients in tropical and subtropical exposed shores. We combined laboratory experiments and field measurements to investigate the spatial and temporal dynamics of the metabolic processes in nearshore sands exposed to waves and intense pore water flushing. The results demonstrate the immediate response of the benthic system to changes in hydrodynamics and water column composition and emphasize the role of the coastal sands as sites for rapid nutrient regeneration.