Wave-induced H2S flux sustains a chemoautotrophic symbiosis

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ABSTRACT: Symbioses involving sulfur-oxidizing bacteria and invertebrate hosts require a source of reduced sulfur, a source of O_2, and transport mechanisms that ensure them a supply of both. We investigated these mechanisms using the symbiosis between the sessile ciliate *Zoothamnium niveum* (Hemprich and Ehrenberg 1831) and bacteria living on its surface. The stalked colonies of *Z. niveum* grow on peat walls around the openings of centimeter-scale conduits created when mangrove rootlets decompose. Using in situ, time-series measurements with fast-responding amperometric microelectrodes, we found that the conduits were charged with H_2S by diffusion from the decaying rootlets during periods of low boundary-layer flow speed. During these times, the feeding current of the zooids transported oxygenated seawater from outside the peat wall toward the ectobiotic bacteria. During periods of high flow speed, H_2S-rich seawater from the conduits was drawn along the colonies and over the bacteria. We conclude that this symbiosis exploits a combination of two transport mechanisms: (1) venting of H_2S-rich seawater due to pulsating boundary-layer current over ciliate groups and (2) the continuous and rapid feeding current generated by the host□s cilia. This discovery raises the possibility that other systems in which pockets of decay are exposed to pulsating flow could support similar symbioses.