Bubble-mediated transport mechanism: process parametrisation and effects on the pelagic methanotrophic community

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Marine sediments and overlying water are interconnected by various exchange mechanisms like submarine groundwater discharge and resuspension. These transport benthic microorganisms into the water column, impacting biogeochemical cycles and the pelagic food web. Recent studies show that gas bubbles can transfer methanotrophs from sediments into the water column at methane seep sites. However, transport efficiency and the effect on pelagic microbial communities remain unknown.

Benthic methanotroph transport at two different seep sites in the Coal Oil Point (COP) seep field (California, USA) were studied to identify underlying parameters and estimate the contribution to the local methanotrophic community. The COP seep field however is characterized by extreme heterogeneity in gas bubble seepage over a vast area, challenging estimations. We also studied the contribution to the water column methanotroph community by gas bubble seepage from a borehole in the North Sea. We sampled along transects orthogonal to the currents, both before and after passing the borehole to quantify the methanotrophs injected. We found that (1) benthic methanotrophs were transported from all sampled vent holes into the water column and (2) that the bentho-pelagic transport efficiency is determined by volumetric gas flow. Apart from this process parametrization, we discuss the contribution of this transport process to the local water column methanotrophic community and compare the sediment and water column communities based on molecular biological analysis.