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Bubble Shuttle: A bubble-mediated bentho-pelagic transport mechanism of methanotrophs and a first study at the Coal Oil Point seep field to identify the controlling parameters

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In marine habitats, the water body and underlying sediment are strongly interlinked by various exchange mechanisms like submarine groundwater discharge and resuspension. Benthic microorganisms, which are transported into the water column this way, are thought to impact biogeochemical cycles and the pelagic food web. Recent investigations showed that methanotrophs can be transferred from the sediment into the water column via gas bubbles at methane seep sites. The authors suggested that such a transport process inoculates the overlying water column with methanotrophs, which then contribute to the local methane turnover in the dissolved methane plume. However, these investigations were limited to only one gas vent and the parameters controlling the transport efficiency are still unknown.

In our recent study in the Coal Oil Point (COP) seep field (California, USA), we examined the transport of benthic methanotrophs at six vent sites characterized by different gas flux intensities. We found that (1) the abundance of methanotrophs was highest in the upper sediment layer at all sites, (2) methanotrophs accounted for about 1 % of the total cell counts in the overlying water column, and (3) benthic methanotrophs were transported from all sampled vent holes into our bubble-collecting device. These results allowed us to discuss the effect of vent density, gas flux intensity, and bubble size/surface on the bubble-mediated transport of methanotrophs.