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What is the upper limit of the benthic microbial methane filter?

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The microbial methane filter of the ocean floors globally retains approximately 80-90% of the ascending greenhouse gas methane through anaerobic oxidation of methane (AOM). However natural and catastrophic fluctuations of methane fluxes (caused e.g. by gas hydrate melting, earthquakes, slope failure) can challenge the capability of this greenhouse gas sink. We ask: How efficient can the methanotrophic community adapt its activity to methane flux changes, what is its response time and where is its ultimate limit?

To answer these questions, a new sediment-flow-through-system was developed. The system holds intact sediment cores and simulates natural condition of seepage with a diffusive supply of sulfate from the top and an advective transport of methane from the bottom. Sampling holes allow monitoring the key parameters (sulfate, sulfide, pH, Redox, Total Alkalinity) over the entire sediment depth.

For our experiments, sediment from three different methane-rich environments were used: (1) gassy sediments from Eckernförde Bay (German Baltic) without naturally occurring advective fluid transport, (2) sediments with high advective transport from a methane seep within an oxygen minimum zone on the continental margin (Quepos Slide, Costa Rica), and (3) methane-seep sediments from the center of a mud volcano (North Alex Mud Volcano, Eastern Mediterranean Sea). Two different advective methane flow rates (15.3 and 153 mmol CH4 cm-^{2}yr-1, fluid flow 10.9 and 109 cm yr-1) were applied for replicate sediment cores (upper 20cm) of the respective environments.

The poster will present first results of the flow-through experiments (turnover rates, geochemical gradients) and compare the response of the different sediment types to the varying methane and fluid flow rates.