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Methane seeps at the gas hydrate stability boundary off West Spitzbergen: Geochemistry, microbial methane turnover, and chemosynthetic communities at the seafloor

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In 2008, a large area with several hundred methane plumes were discovered along the West Spitzbergen continental margin at water depths between 150 and 400 m (Westbrook et al. 2009). Many of the observed plumes were located at the boundary of gas hydrate stability (∼400 m water depth). It was speculated that the methane escape at this depth was correlated to gas hydrate destabilization caused by recent increases in water temperatures recorded in this region. Here, we report about the biogeochemical characteristics of the methane seeps found at the seafloor at water depth between 240 and 400 m, which were studied during the RV Merian expedition MSM 21-4 in August/September 2012. The area was investigated visually by the submersible "JAGO". Sediment and porewater samples were collected from push cores, gravity cores, and "peepers". Our dives with JAGO confirmed active methane vent sites at the sea floor. Most vent sites were characterized by massive platforms of authigenic carbonates and chemosynthetic communities, i.e. filamentous sulfur bacteria and siboglinid tubeworms. Concentrations of hydrogen sulfide were up to 11 mM in surface sediments. Methane concentrations measured ex situ often reached levels above atmospheric saturation level. Porewater profiles of methane, sulfate, sulfide, and total alkalinity of a sediment core (total length 210 cm) taken at 394 m water depth pointed to non-steady state conditions with respect to methane fluxes. Besides sediment porewater data, this presentation will also report microbial methane turnover rates in sediments around methane seepage as well as geochemical characteristics of recovered authigenic carbonates. Finally, implications of the observed seep characteristics for postulated temperature-related environmental changes in this area will be addressed.

Reference

Westbrook, G.K., et al., Escape of methane gas from the seabed along the West Spitsbergen continental margin. Geophys. Res. Let., 2009. 36: p. doi:10.1029/2009GL039191.