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Investigation of biogeochemical activities at the deepest known *Calyptogena* habitat associated with a subduction-type cold seep in the Japan Trench

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The remarkable abundance of specialized invertebrates such as giant tube worms or bivalves is one of the most striking features of seep communities and one of the best "indicators" of fluid emission at the seafloor. The biogeochemical processes fueled by the seepage of methane and sulfide provide the habitat for rich and complex ecosystems. They provide the carbon and energy sources for abundant chemosynthesis-based communities, like bacterial mats but also epifaunal assemblages of clams that derive their nutrition from symbiotic relationships with sulfide- or methane-oxidizing bacteria. The free living and symbiotic microbial communities associated with some invertebrates (*vesicomyid* clams, *vestimentiferan* tubeworms, *mytilid* mussels) are thereby nourished by the chemical energy rising from the basis of cold seep ecosystems. These invertebrates often form dense and endemic benthic communities, which are sustained by the high production of organic carbon.

At the oxic-anoxic interfaces but also in the anoxic zone a variety of biogeochemical processes are relevant for the turnover of organic and inorganic molecules. Microbial catalyzed anaerobic transformations, e.g. AOM, hydrogenotrophic methanogenesis, acetoclastic methanogenesis, homoacetogenesis, sulfate reduction, aerobic oxidation of methane may contribute significantly to the overall reaction depending on the environmental conditions.

Here we present in situ measurements of the deepest known cold seep system in the Japan Trench. Microprofiler and benthic chamber investigations were performed at *Calyptogena* colonies at 5300 and 6400m water depth. Combined with ex situ measurements of methane oxidation and sulfate reduction we tracked the most important

processes. Our investigation indicates that the upward flux of sulfide is spatially limited to the areas of *Calyptogena* colonies. Nevertheless, the availability of reduced compounds appears to be constant over longer periods of time as indicated by the sizes of colonies. Our measurements show that seeping is highly patchy at the investigated deep sea trench sites and can be a source of methane to the hydrosphere.