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Chemoautotrophy at the Hakon Mosby Mud Volcano: in-situ rates and active Bacteria.

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We for the first time measured in situ chemoautotrophy rates and studied active Bacteria at the extensive Beggiatoa mats found around the center of the Hakon Mosby Mud Volcano (HMMV). The INSINC system was used to incubate cores labeled with 13C-bicarbonate on the sea floor and after 2 days of incubation cores were brought up and sliced at a high depth resolution to a depth of 3 centimeters. Dark carbon fixation by chemoautotrophic Bacteria was determined by measuring 13C-labeling in PLFA biomarkers, which yields both rate data and an indication of active organisms. To characterize sediment biogeochemistry, we also recorded in-situ microelectrode porewater profiles of oxygen, sulfide, pH, ORP, and temperature.

Most chemoautotrophic activity could be linked to sulfide oxidation. High rates of chemosynthetic carbon fixation were detected in the top 0-2 mm of the sediment and activity decreased quickly although some activity could be detected to a depth of 10-15 mm. PLFA labeling could not be detected below 10 to 15 mm depth in the zone where free sulfide accumulated due to anaerobic methane oxidation. The depth integrated chemoautotrophy rate was 7.7 $\pm$ 3.6 mmol biomass-C/m2/d (AVG $\pm$ SE), which is in agreement with the sulfide fluxes (14 mmol/m2/d) assuming a typical growth yield for sulfur oxidizing bacteria of 0.33-0.66 (C/S).

Label distribution in PLFA suggested that there was a clear shift in active bacterial community with depth. In the top 4 mm of the sediment, PLFA labeling patterns were similar to the known composition of Beggiatoa at the HMMV. Deeper in the sediment there was a clear shift in 13C-labeling to PLFA found in sulfate reducers associated with anaerobic methane oxidation. The results will be discussed in relation to the biogeochemistry and microbiology of the HMMV. This is one of the first studies to determine in-situ sediment rates of chemoautotrophy at a deep-sea extreme environment.