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New Insights into Growth and Physiology of Different ANME Communities

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The anaerobic oxidation of methane (AOM) is one of the most important sinks for the greenhouse gas methane in marine ecosystems. AOM is known to be mediated by at least two phylogenetically different groups of Archaea, ANME-I and ANME-II. So far, no pure cultures of these microorganisms have been obtained. However, using naturally enriched environmental samples from Hydrate Ridge, dominated by ANME-II, and the Black Sea and Gulf of Mexico, both dominated by ANME-I, we established in-vitro experimental systems to investigate the physiology of AOM. Increasing rates of methane dependent sulfate reduction in subsequent incubation periods indicated growth of responsible microorganisms. This effect was 5-10 fold more pronounced under elevated methane partial pressures (1.35 MPa). The increase in AOM-dependent biomass was investigated by stable isotope labeling and further confirmed by cell counts. Using 15N-labeled ammonium as sole N-source, a significant and methane-dependent increase of 15N in the biomass was detected. Further experiments were carried out to attribute this isotopic enrichment to an increase in biomass and more specifically to ANME-populations. Cell counts demonstrated for different samples an 5-10 fold increase of ANME-microorganisms over time, thus confirming the substantial enrichment of AOM-dependent biomass. Changes in microbial community composition during the enrichments were studied by 16S rDNA and functional gene-based DGGE analysis.